GOVERNMENT OF TAMILNADU
DIRECTORATE OF TECHNICAL EDUCATION
CHENNAI – 600 025

STATE PROJECT COORDINATION UNIT

Diploma in Civil Engineering

Course Code: 1010

M – Scheme

e-TEXTBOOK
on
ESTIMATING AND COSTING-I
for
IV Semester DCE

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(Note: These course materials are not exhaustive. For in depth information students may please refer standard text books / reference books)

31044 ESTIMATING AND COSTING – I

DETAILED SYLLABUS

UNIT – I

I. 1.1. INTRODUCTION

Estimation – Definition of Estimate- Necessity of Estimates – Importance of fair estimation – Duties and requirements of a good Quantity Surveyor - Types of estimates - Approximate and Detailed estimates - Main and Sub Estimates – Revised Estimates - Supplementary Estimates – Maintenance/ Repair Estimates – Taking off Quantities - Trade and Group systems - Merits of Trade/Group systems - Stages in Detailed estimation – Units of measurements for materials and works - Degree of accuracy in measurements – Measurements Books – Deduction for openings in masonry/plastering/colour washing works – Painting Coefficients – Categories of Labourers – Material requirements for different items of works - Labour requirement for different items of works - Standard Data Book – Task or Out turn of labourers – Cost of materials and wages of labour – Schedule of rates – Revision of rates - Market Rates – Lead – Cost of conveyance – Handling charges – Lump sum and Contingency provisions in Estimates – Abstract Estimates.

1.2 APPROXIMATE ESTIMATES

Necessity of Approximate Estimates - Types – Service Unit method – Plinth Area method – Carpet Area method - Cubical Content method – Typical Bay method – Rough Quantity method – Examples for each method - Problems on preparation of Preliminary/Approximate Estimates for buildings projects.

II. 2.1 AREAS AND VOLUMES

Areas of regular and irregular sections – Computation of Areas of Irregular figures - End Ordinate rule, Mid Ordinate rule, Average Ordinate rule, Trapezoidal rule, Simpson’s rule - Problems – Volumes of regular and irregular solids – Computation of volumes of irregular solids - End Area rule, Mid Area rule, Average area or Mean area rule, Trapezoidal rule, Simpson’s or Prismoidal rule.

2.2 EMBANKMENTS AND CUTTINGS

Areas of cross sections of embankments of roads, tank bunds etc – Level section and Two level section – Areas of cross sections of cuttings of canals, drains etc – Level Section and Two level section - Determination of Volume of Earth work in Embankment / Cutting with level sections of varying heights/ depths or with two level sections of uniform height/depth.

III ANALYSIS OF RATES

Analysis of Rates of preparation OF Data for the following Building works using Standard data book :

1) Cement / Lime mortars; 2)Plain cement concrete in Foundation / Leveling course; 3) Flooring with cement concrete plastered with cement mortar;

4) Flooring with PCC Finishing with ellis pattern cement concrete surface; 5) flooring with cuddapa slabs; 6) Mosaic / ceramic tiles flooring; 7) brickwork in cement mortar in foundation; 8) Brick work in CM in super structure; 9) Brickwork in CM in partition with plastering; 10) Random rubble masonry in CM ; 11) Coursed rubble masonry in CM; 12) Lime – surki concrete in weathering course finished with pressed tiles in CM ; 13) Reinforced cement concrete in slabs (Per unit volume / Unit area) ; 14) R.C.C in Beams ;15) R.C.C in columns; 16) R.C.C in sunshades;17) Plastering brick masonry with CM;18)Pointing stone masonry with cement mortar ; 19) Painting the wood work ; 20) Painting steel work ; 21) White / colour washing the plastered surfaces; 22) Form works (Strutting, centering, shuttering etc) for Slabs / Beams / Coumns; 23) Fabrication of steel Reinforcement; 24) A.C Sheet roofing ; 25) Supplying and fixing Rain water pipes – Exercises.

IV TAKING OFF QUANTITIES BY TRADE SYSTEM

General - methods of taking off quantities individual wall method – Centre line method – Examples –Entering the dimensions – Standard forms for entering Detailed measurements and Abstract estimates – Rounding of quantities.

Preparing Detailed Estimate using Trade System and Take off quantities for all items of works in the following types of buildings.

A small residential building with Two/Three rooms with RCC flat roof

A small residential building with Two/Three rooms with RCC sloped roof

A Two Storied Commercial Building (frames structure) with RCC flat roof

A community with RCC columns and T-Beams

A small Industrial building with AC/GI sheet roof on Steel Trusses

V TAKING OFF QUANTITIES BY GROUP SYSTEM

General – Standard method of measurement – Taking off and Recording the dimensions – Order of Taking off – Dimension Paper – Entering dimension paper – Spacing dimensions – Descriptions – Cancellation of Dimensions – Squaring Dimensions – Method of Squaring – Checking the Squaring – Casting up the dimensions – Abstracting and Billing – Function of abstract – Use of Abstract sheets – Order of Abstracting – Preparing the Abstract – Checking the Abstract – Casting and Reducing the Abstract – Writing the bill – Method of writing the bill – Checking the Bill.

Preparing Detailed Estimate using Group System and Take off quantities for all items of works in the following types of buildings.

A small Residential building with Two / Three rooms with RCC flat roof.

A small Residential building with Two / Three rooms with RCC sloped roof.

A community hall with RCC columns and T-beams

(Note : The same drawings of Unit 4 may be practiced and quantities compared)

Reference Book :

1. Rangwala 'Estimating & Costing ' Charotar publishing.
2. Estimating & Costing by Prof. B.N.Dutta.
3. Bridie " Estimating & Costing"
4. Project administration Handbook for Civil Engineering works 2010 on line edition.

UNIT-I

ESTIMAING AND COSTING-I

1.1 INTRODUCTION

1.1.1 ESTIMATION

- Estimation is the method of process of determining the probable cost of a construction before the work is started.
- It involves the predetermination of the quality and quantity of material required, labour required etc.,

1.1.2 DEFINITION OF ESTIMATE

- An Estimate of a project is a fore-cost of its probable cost.
- It may also be defined as the process of calculating the quantities and cost of various items of proposed work.
- It depends on plan, elevation and section.

1.1.3 NECESSITY OF ESTIMATES

1. To work out the quantity of materials and labour requirements.
2. To prepare bills for the project.
3. To calculate the actual cost of construction.
4. To prepare construction schedule.
5. To frame tender document and arrange the type of contract.
6. To control the expenditure of a project.
7. To arrange for labour required for a building
8. To get permission for the construction of building by local authorities.
9. To get bank loan.
10. To buy or sell a building.

1.1.4 IMPORTANCE OF FAIR ESTIMATION

Fair estimation is prepared based on actual quantity of various items of work and the actual cost of the materials and the labour in that local authority. It also gives nearly the actual cost of the building it is very important for purchasing and selling a building at the actual cost in the locality.

1.1.5 DUTIES AND REQUIREMENTS OF A GOOD QUANTITY SURVEYOR

A qualified or experienced person who does the mentioned works (taking off, squaring , abstracting and billing) is called a quantity surveyor.

The following are the qualities of a good surveyor:

- He must have good knowledge of measuring and billing.
- He must have thorough knowledge of construction methods and procedure, materials of construction, labour problem, specifications and local customs.
- He must have knowledge in reading and interrupt drawing and accurately and efficiently.
- He must posses accuracy in calculations and cost.
- He must have common sense, skill, experience, initiative, foresight, good judgment and patience.

1.1.5.1 DUTIES OF GOOD QUANTITIY SURVEYOR

- Preparation of bill of quantities.(taking off, squaring , abstracting and billing)
- Preparing bill for part payment at intervals during the execution of works.
- Preparing the bill of adjusting in case of variations ordered during the execution of works.
- Giving legal advice in case of court proceedings.
- After complication of works bills are prepared for final payment.

1.1.5.2 REQUIREMENTS OF A GOOD QUANTITY SURVEYOR

- Quantity surveyor should have a good knowledge in construction procedure.
- He should be able to read the drawing correctly and bill the quantities accurately.
- He should be able to write the description of works in a simple and clear language.
- He should have good knowledge in legal proceedings of building works.
- He should be able to prepare schedule to be priced by tenderor.
- He should be able to value all variations under the contract.
- He should have good knowledge in execution.

1.1.6 TYPES OF ESTIMATES

Estimate may be divided into the following categories.

1. Approximate estimate
2. Detailed estimate
3. Main and Sub Estimate
4. Revised Estimate
5. Supplementary Estimate
6. Maintenance estimate
7. Repair Estimate

1.1.6.1 APPROXIMATE ESTIMATE

The estimate which is prepared using any rough method to get the approximate cost of construction is called an approximate or rough or preliminary estimate.

- This is prepared to decide approximately the financial aspect, policy and give an idea of the cost of the project.
- This estimate shows the cost of land, cost of building, cost of roads, cost of sanitary works, electrification etc.,
- It should be submitted with site plan and with the details showing how the costs of the separate items have been arrived.
- It is the normal practice to work out the approximate estimate of the structure before detailed estimate is done.

1.1.6.2 DETAILED ESTIMATE

The estimate which provides the item wise quantities of works, items wise unit rates and items wise expenditure in the construction project is called detailed estimate.

- It provides an amount which is very near to the final amount of the structures.
- After getting administrative approval on rough cost estimate, detailed estimates are prepared.
- The dimension such as length, breath and height of each items is taken out correctly form the drawing of the project.
- The quantities of each item of work are calculated.
- Finally the abstract or billing is prepared.

1.1.6.3 MAIN AND SUB ESTIMATE

The estimate which is prepared at the initial stage before execution of works is called **main estimate**.

It consist the following:

1. General report
2. Specification report
3. Lead statement
4. Data
5. Detailed estimate
6. Abstract estimate
7. Drawings, etc.,

A large work are project may consist of several buildings are small works. The Detailed estimate of each sub works is known as **sub estimate**.

For examples: A collage building project may consist of

1. Administrative building
2. Auditorium
3. Class rooms
4. Canteen building
5. Student Hostel
6. Laboratory etc.,

1.1.6.4 REVISED ESTIMATE

A revised estimate is a detailed estimate for the revised quantities and rates of original estimate.

It is necessary for the following reasons:

1. When the sanctioned estimate of the work exceeds by more than 10% of the administration approval.

2. When the estimated cost exceeds by more than 15% during execution due to increase in material cost, labour cost are due to alteration in the works.

3. When the sanctioned estimate is more than the actual requirements.

1.1.6.5 SUPPLIMANTARY ESTIMATE

The fresh detailed estimate in addition to the original sanctioned estimate is called supplementary estimate.

It is prepared when additional works are found necessary during the progress of the project, to supplement to the original works.

1.1.6.6 MAINTENANCE ESTIMATE

In order to keep the building and roads in perfect condition, annual maintenance should be carried out and annual maintenance estimates should be prepared for the following cases:

- In case of the building
  - White washing
  - Colour washing
  - Painting
  - Repairing etc.,
- In case of roads , bridges and culverts etc.,filling patches renewals, repairs etc.,

In no case, this estimate amount should increase more than 11/2 % to 2% of the capital cost of the building.

1.1.6.7 REPAIR ESTIMATE

If the work cannot be carried out by the annual repair funds due to certain reasons resulting in the genuine increase in cost, then special repairs estimate is to be prepared. The reasons of increase in cost may be,

- In case of building opening of new doors, change of floors, re-plastering walls etc.,

- In case of roads: if the whole surface is full of corrugations and patches, the total surface is to repaired. The old metal is taken out reconsolidated by adding more new metal and top surface is repaired.

1.1.7 TAKING OFF QUANTITIES

The procedure by which the the quantities of the various items in a particular structure are worked out is known as the taking off quantities.

- The quantities are obtained by studying in detail the drawings of the structures.
- The quantities of various items of works involved in a construction are Volume, Area, running-metre are per metre length, Nos, etc.,
- Examples
    1. Volume(m^3)- earth work excavation, concrete etc.,(Multiplying Length, breadth and depth)
    2. Area (m^2)- Painting , flooring etc.,(Multiplying Length, breadth)
    3. Running metre – Laying of pipe lines
    4. Numbers – Supply if basins, closets.etc.,

In our country P.W.D method of taking off quantities is follows

The process involved in this method is

(1) Taking off (2) Grouping (3) Billing

SYSTEMS

The method of computing the quantities of various items of works is called system. This system normally adopted in estimation is

(i) Trade system
(ii) Group system

1.1.7.1 TRADE AND GROUP SYSTEMS

TRADE SYSTEM

In trade system all the measurement are recorded trade by trade. In this system the measurements for some work at various places of the construction are the recorded under a particular trade. Deductions or additions are done then and there.

For examples

In Earthwork excavation all measurements of earthwork excavation located at various places of the building is measured at the same time.

- The measurements are recorded are final quantity is computed.
- Following the same procedure for other items of works are computed.
- Deduction such as doors, windows openings are made then and there.

This system is followed in Tamil Nadu public work department (P.W.D)

GROUP SYSTEM

In this system, the measurements of all trades are involved in a particular work. This system is followed in central public work department. (C.P.W.D)

For Examples

For the calculation of water tank the trades involved are as follows

(1) Brick work (2) Plastering (3) Flooring (4) White washing

(5) Plumbing (6) Roof covering etc.,

The quantities of above items of work are computed. Hence it is easy for calculating the cost of work. This method of taking measurement is easy and helps in avoiding any measurements.

1.1.7.2 MERITS OF TRADE/GROUP SYSTEMS

S.no	Trade system	Group system
1.	Measurements are being taken by seeing the drawing thoroughly	Measurements are taken easily
2.	Deductions for opening have to be done in each trade	It is convenient to make deduction at some time.
3	Lot of time is lost in searing dimensions of a particular trade	Saving of time
4.	Alterations are complicated	Alterations are easy
5.	More chances of missing measurements	Less chances of missing measurements

ADVANTAGES OF GROUP SYSTEM OVER TRADE SYSTEM

1. In trade system, measurements are being taken, by searching a certain item from foundation to roof, whereas, in group system, measurements are being taken for small section of work (group) concentrated in particular area.

2. In trade system lot of time is lost in searching dimensions of connected items again and again for each work, whereas in group system saving of time, is achieving by concentrating on a particular section for all works at the same time.
3. For deductions in brick works, plastering, colour washing etc, for openings, lintels etc., in trade system deduction for openings have to be done when dealing with each trade whereas in group system, it is convenient to make deductions at the same time.
4. In trade system, the taking off can be entrusted to only one Quantity Surveyor, whereas in group system the taking off can be entrusted to number of surveyors, to expenditure the process.
5. In case of trade system, the measurements for each trade is to be completed, before taking the next trade. The work of carcase and adjustment of openings must be done by the same surveyor.
6. In case of variations ordered in the work, the group system is more advantageous. In the group system the adjustment ends with a small section of the work. Whereas in the trade system, the surveyor has to search for all the items which have been affected by the variations, ordered.
7. Group system is more advantageous, in determining the requirements of resources, stage be stage, which leads to optimization of resources.

1.1.8 STAGES IN DETAILED ESTIMATION

1. **Detailed estimate** – Calculation of quantities of various items of work in the building. Ex:- Earth work excavation, Masonry, RCC works, Plastering etc.,
2. **Data:-** Calculation of cost per unit of item of work based on the cost of materials, lead charges, labour chages etc.
3. **Abstract estimate:-** Calculation cost of every item of work and finally total cost of the building.

1.1.9 UNITS OF MEASUREMENTS FOR MATERIALS AND WORKS

The measurement of the work done or supplies made is done accurately in units decided by I.S.I for making payments.

a. Building works

No.	Name of items	Units of measurements
1	Earthwork excavation for foundations in ordinary soft soil, hard soil	Cu.m. or m^3
2	Earth filling under floors, sand filling including ramming and watering	Cu.m. or m^3
3.	Earthwork for repair work	Cu.m. or m^3
4.	Compensation of earthwork taken from	Cu.m. or m^3
	Concrete	
1	Plain cement concrete 1:2:4	Cu.m
2	Lime concrete in foundation	Cu.m. or m^3
3	Cement concrete 1: 1.5: 3, 1:2:4, 1:4:8	Cu.m. or m^3
4.	Reinforced cement concrete beams, slabs and lintels (1:2:4) etc.	Cu.m. or m^3
5.	Damp proof course of cement concrete 4cm thick, 1:2:4 mix with one coat of bitumen	Sq.m

6.	Pre-cast cement concrete	Cu.m. or m^3
7.	Pre-case Jali work (thickness specified)	Sq.m
8.	Washing ballast	Cu.m. or m^3
	Brick work	
1	Ist class burnt brick in C.M 1:6 in foundation, plinth and super structure etc.,	Cu.m or m^3
2.	Cornice one brick laid in CM1:5	m
3.	Brick Jali work	Sq.m
4.	Brick bats	m^3
5.	Hlaf brick thick partition wall	m2
6.	Honey-comb brick work in CM 1:4	Sq.m
7.	Square or circular pillars	Cu.m
8.	Corbelling around almirah	m
9.	First class B.B masonry in well steining	Cu.m
10.	R.R. masonry in lime mortar (1:2) in (a) Foundations, plinth and super structure (b) R.R Masonry in cement mortar (1:6)	 Cu.m Cu.m
	Roofing	
1	R.C.C slab roofing	Cu.m. or m^3
2	Jack arch roofing	Cu.m
3.	Corrugated galvanized iron roofing, 24 gauge fixed in position	Sq.m
4	Rain water pipes of cast iron 10cm dia	m

Wood Work		
1	Wood work wrought, framed and fixed in position	Cu.m
2	Wood work paneled or glazed doors and windows	Sq.m
3.	Supplying & fixing glass panes, ply wood etc.,	Sq.m
4	Curtain rod	m
5	Sawing of timber	Sq.m
Steel work		
1.	Rolling shutters including hoisting, fixing in position and painting 3 coats	Quintal or sq.m
2	Bending, binding of steel reinforcement	Quintal
3	Collapsible steel shutter complete with fittings	Sq.m
4	Gusset plate, bolts and nuts	Kg
5	Hold fasts	Kg or pairs
6	Iron grill in windows	Kg
7	Barbed wire fencing	m
8	G.I sheets	Sq.m
9	Iron doors, windows	Sq.m or kg
Finishing		
1	Cement plaster 12.5mm thick with C.M1:4, 1:5 mix	Sq.m or m^2
2	Lime plaster, 12.5mm thick	Sq.m or m^2
2a	Plastering under side of ceiling	Sq.m or m^2

3	Cement pointing (deep)with C.M 1:2 mix	Sq.m or m^2
4	Cement pointing (flush) with C.M 1:2, 1:3 mix	Sq.m or m^2
5	Dado or Glazed tiles (thickness and type specified)	Sq.m or m^2
6	White washing 2 coats, 3 coats Colour washing 2 coats, 3 coats Distemper, snow cem 2 coats	Sq.m or m^2
	Painting	
1.	Painting doors and windows (2 coats, 3 coats)	Sq.m
2	Varnishing – 2 coats	Sq.m
3	Removing of paint or varnish	Sq.m
	Miscellaneous	
1	Ornamental cornice	m
2	Jungle clearance	Sq.m
3	Ornamental pillar caps, base etc.	Nos
4	Laying pipe in sanitary works	m
5	Silt clearance	m3
6	Fixing doors and windows	No.
7	Glazing (fixing and glasses)	Sq.m
8	Glass panes (supply)	Sq.m
9	Renewing glass panes	No.
10.	Fixing of glass panes	No.
11.	Pile foundation	m

12.	Well sinking	m
13.	Electricity fittings	Points
14.	Water closet	Nos
15.	Wash basin	Nos.
16.	Intercepting trap, bib cock, stop cock, bell cock, ferrule, water metre, urinal pot, flushing cistern, gate valve, P.V connection, traps, bend, man hole cover, S.W pipe, pillar cock.	Nos.
17.	C.I pipe, G.I pipe, A.C pipe	m
18.	Hinges	Nos.
	Roads	
1	Earth work in embankment including watering, rolling and dressing slopes of banks	Cu.m
2	Preparation of sub grade for soling coat	Sq.m
3	Collection of bricks for soiling coat including stacking, laying and consolidation with 25cm thick layer of good clay, rolling etc.	Cu.m
4	Bricks on end edging on both sides with bricks and labour complete	m
5	Collection of stone metal including stacking, screening, spreading and consolidating properly	Cu.m
6	Collection of bitumen or tar at site	Tonnes
7	Water allowance for road (where water is not available)	Km
8	Surfacing treatment including heating tar and spraying it with sprayer	Sq.m

9	Providing km stone, boundary stone, road signs, traffic diversion	Each
10	Arboriculture	Km
C. Supply of materials		
1.	Supply of bricks	1000 Nos.
2.	cement	Bags/tone/qunital
3.	Steel	Quintal/Tonne
4.	Tiles	1000Nos.
5.	Surkhi, sand, stone ballast, lime-slacked	Cu.m
6.	Timber, brick bats	Cu.m
7	Ply wood, glass panes	Sq.m
8	Lime unslaked	Quintal
9	Coal, Bitumen	Tonnes
10	G.I sheets	Quintal
11	A.C.sheets	Sq.m
12	Switches, plugs, ceiling roses, bulbes, calling bell, brackets	each
13.	Varnish, ready mix paint, stiff paint	Litres
14	Electric wires	m

1.1.10 DEGREE OF ACCURACY IN MEASUREMENTS

- Degree of accuracy is required in computation of the quantity of any item.
- It depends upon its unit of measurements, item of work and its rate.

- IS 1200 recommends tolerances in measurements for each item of work.

IS CODE 1200 ref. SP 27-1987	Work	Degree of accuracy
Part- I	Earth work	Linear dimension upto 25m- nearest 0.01m More than 25m – nearest 0.1m Areas - $0.01m^2$ Volume - $0.01m^3$
Part-2	Concrete works	Linear dimensions - 0.01m Thickness of slab – 0.005m Areas - $0.01m^2$ Volume - $0.01m^3$
Part-3	Brick Work	Linear dimension – 0.01m Areas - $0.01m^2$ Volume - $0.01m^3$
Part-4	StoneMasonry	
Part 23	Foundation	
Part 5	Form work	Linear dimension – 0.01m Areas - $0.01m^2$
Part-21	Wood work and joinery	Length – 0.01m Width – 0.002m Thickness – 0.002 m or 2mm Areas – $0.01\ m^2$ Volume – $0.001m^3$
Part-8	Steel work abd iron work	Linear dimension except cross section and thickness – 0.001m. Reinforcement – 0.005m Areas – $0.001m^2$ Weight – worked out to nearest 1kg

Part 14	Glazing	Linear dimension – 0.01m Areas - $0.01m^2$
Part 11	Paving, flooring, finishes etc	Linear dimension – 0.01m Areas - $0.01m^2$
Part 9	Roof covering	Linear dimension – 0.01m Areas - $0.01m^2$
Part 10	Ceiling and lining	Linear dimension – 0.01m Areas - $0.01m^2$
Part 12	Plastering and pointing	Linear dimension – 0.01m Areas - $0.01m^2$
Part 13	White washing, colour washing, distempering etc	Linear dimension – 0.01m Areas - $0.01m^2$
Part 15	Painting, polishing, varnishing etc	Linear dimension – 0.01m Areas - $0.01m^2$
Part 19	Water supply, Plumbing and drains	Linear dimension – 0.01m
Part 17	Road work	Length and width – 0.01m Thickness – 0.005m Areas – $0.01\ m^2$ Volume – $0.01m^3$

1.1.11 MEASUREMENTS BOOKS

Measurement book is an important book used in departments, for the entry of measurements of all works done and supplies made. It is the original record of actual measurement. It is the basis of all accounts such as work done by the contractor, materials supplied and labour employed by the contractor, materials purchased by the department.

Measurement book must be considered as a very important record and should be kept in safe custody because sometimes it has be produced as evidence in a court of law.

Instructions for recording measurements in Measurement Books are printed on all M. Books.

1.1.11.1 Rules for recording measurements in M Book or entries.

In recording measurements the following rules are to be adopted.

1. Each set of measurement should begin with the following entries. These entries should be on the top of the page of M.Book in which measurements are recorded.
    a. Name of the work as in the estimate
    b. Location of the work
    c. Name of the contractor
    d. Number and date of contract agreement
    e. Date of order to start work
    f. Date of completion of work.
    g. Date of measurement.

1.1.11.2 Rules for entering measurements

- The entry should be made in ink only.
- Actual measurements only should be entered.
- No page or line should be left blank
- There should be no erasures or overwriting.
- On the left hand side the measurements and quantity should be entered.
- On the right hand side the rate and total value should be entered.

After taking measurements the engineer should sign at the right hand side bottom with designation and date. Also the contractor should sign for acceptance of measurements.

All the measurement books are numbered and maintained in the divisional office. The form of measurement book is shown below.

S. no	Description of work	Measurements of work in m					Rate		Total value up to date		Deduct previous measurements		Since last measurements		
		No	L	B	D	contents	Rs	P	Rs	P	page	quantity	Quantity	Rs.	P

Assistant Engg.signature
Designation & Date

1.1.12 DEDUCTION FOR OPENINGS IN MASONRY / PLASTERING COLOR WASHING WORKS.

In Masonry works

1. No deduction is made for openings of area less than 0.1 m^2
2. No deduction is made for bearings of beams, rafters, wall plates, purlins, trusses etc.
3. No deduction is made for the bearing of slab where the thickness does not exceed 100 mm and the bearing does not extend over the full thickness of wall.
4. No deduction is made for small segmental portions of openings.
5. For semi- circular openings deductions are made only for an area equal to 1.5 r^2.
6. The actual volume of lintels over openings is deducted from the masonry.

In plastering / white washing area.

1. No deduction is made for openings of area less than 0.5 m^2.
2. Deductions are made for one side only for openings of area exceeding 0.5 m^2 but

   Less than 3 m^2. In the above two cases no additions are made for the jambs, soffits and sills of the openings.

3. Deductions are made for both sides for openings of area greater than 3 m^2 and areas of jambs, soffits and sills are measured and added.

1.1.13 PAINTING COEFFICIENTS

When measuring the area of doors and windows for painting, the clear area between walls (flat) is measured on one side and is multiplied by a constant called painting coefficient to allow for both faces including the sides of frames, grooves, projections etc. The painting co-efficients for a few cases are given below. (From Taminadu Building Practice).

1.	Fully paneled, braced, ledged or battened doors and windows	-	2.6
2.	Fully glazed doors and windows	-	1.6
3.	Partly paneled and partly glazed doors and windows	-	2.0
4.	Flush doors	-	2.4
5.	Venetian doors and windows or louvred joinery	-	3.6
6.	Iron grills in windows, grill gates, gratings	-	1 x clear area between frames
7.	Steel roller shutters (without top cover)	-	2.2
8.	Plain sheet steel doors and windows	-	2.2
9.	Collapsible gates	-	3.0

1.1.14 CATEGORIES OF LABOURERS

Labour

1. Mason I class
2. Mason II class
3. Mazdoor I class
4. Mazdoor II class
5. Carpenter
6. Operator
7. Machine attendant
8. Vibrator operator
9. Painter

10. Tile layer
11. Labour for centering work of beam, column, lintels,etc
12. Labour for placing concrete including curing
13. Labour for bending, binding, cutting and placing reinforcement.

1.1.15 MATERIAL REQUIREMENTS FOR DIFFERENT ITEMS OF WORKS

An engineer or estimator should prepare the material and labour requirements for a building or structure.

Materials requirements is the process of arriving materials, no of labour and materials such as quantity of cement , sand , coarse aggregate, brick, steel etc., for the quantity of all items involved in a work.

The following are the advantages in preparing the material requirements.

1. To know about the requirements of materials at each stage of construction.
2. To make the owner aware of the expenses at each stage of the work.
3. This will facilitate him to be prepared ready to meet the expenses.
4. Purchase of materials in required quantity at required time will make the work to progress continuously.
5. This reduces over stocking of material.
6. Purchase of materials according to the specifications.
7. Control over the usage of materials.

Material requirements for different work using thumb rules.

1.1.15. a) Cement Mortar 1:2 – 1 m^3

The ingredients are cement and sand

Cement	=	1 Part
Sand	=	2 Part
Total quantity	=	$2m^3$
Quantity of cement	=	$\frac{1}{2} = 0.5m^3$

Quantity of sand = $\frac{2}{2} = 1\ m^3$

$1m^3$ of cement = 1440 kg.

Cement = 1440 x 0.5 = 720 kg

One bag of cement = 50kg

There for Cement = 720/50 = 14.4 bags

Answer :-

Cement = 720kg

Sand = 1 m^3

1.1.15 a 1) **Cement mortar – 1:3 - 1 m^3**

The ingredients are cement and sand

Cement = 1 Part

Sand = 3 Part

Total quantity (max) = $3m^3$

Quantity of cement = $\frac{1}{3} = 0.33m^3$

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

($1m^3$ of cement = 1440 kg.)

Cement = 1440 x 0.33 = 480 kg

One bag of cement = 50kg

There for Cement = 480/50 = 9.6 bags

Ans :-

Cement = 480 kg

Sand = 1 m^3

Similarly

Mix	Cement	Sand
C:M 1:2	0.5 m^3 (or) 720 kg	1 m^3
C:M 1:3	0.33 m^3 (or) 480 kg	1 m^3
C:M 1:4	0.25 m^3 (or) 360 kg	1 m^3
C:M 1:5	0.20 m^3 (or) 288 kg	1 m^3
C:M 1:6	0.16 m^3 (or) 240 kg	1 m^3

1.1.15 b) Lime Morate 1: 1 $\frac{1}{2}$

The ingredients are lime and sand.

Lime = 1 Part

Sand = 1.5 Part

Total quantity = 1.5 m^3

Lime = $\frac{1}{1.5}$ = 0.667 m^3

Sand = $\frac{1.5}{1.5}$ = 1 m^3

Ans :

Lime = 0.667 m^3

Sand = 1 m^3

1.1.15 b1) Lime mortar 1 :2

The ingredients are lime and sand.

Lime = 1 Part

Sand = 2 Part

Total quantity = 2 m^3

Lime = $\frac{1}{2}$ = 0.5 m^3

Sand = $\frac{2}{2}$ = 1 m^3

Ans :

Lime = 0.5 m^3
Sand = 1 m^3

1.1.15 c) Surki mortar 1 : $\frac{1}{2}$: 1

For Surki mortar 1 : $\frac{1}{2}$: 1 (Lime :surki : sand) - 1 m^3

Lime	=	1 Part
Surki	=	$\frac{1}{2}$ Part
Sand	=	1 Part
Total volume	=	$1 + \frac{1}{2}$ = 1.5 m^3
Volume of Lime	=	$\frac{1}{1.5}$ = 0.667 m^3
Volume of surki	=	$\frac{0.5}{1.5}$ = 0.333 m^3
Volume of sand	=	$\frac{1}{1.5}$ = 0.667 m^3

Ans :

Lime : surki : sand = 0.667 : 0.333 : 0.667

1.1.15 c 1) Surki mortar 1: $\frac{1}{2}$: 1 $\frac{1}{2}$

For Surki mortar 1: $\frac{1}{2}$: 1 (Lime :surki : sand)

Lime	=	1 Part
Surki	=	$\frac{1}{2}$ Part
Sand	=	$1\frac{1}{2}$ Part
Total volume	=	1/2 + 1 ½ = 0.5 + 1.5 = 2 m^3

Volume of Lime	=	$\frac{1}{2}$ = 0.5 m^3
Volume of surki	=	$\frac{0.5}{2}$ = 0.25 m^3
Volume of sand	=	$\frac{1.5}{2}$ = 0.75 m^3

Ans :

Lime : surki : sand = 0.5 : 0.25 : 0.75

1.1.15. d. Cement concrete

The ingredient of the cement concrete is cement, sand, and aggregate. By using thumb rule, the materials may be determined approximately. By field experience it is found that to prepare **1 m^3** of wet concrete with **20 mm** size of coarse aggregate, the required total volume of dry ingredients is **1.57 m^3,** when **40 mm** size of coarse aggregate is used it is found to be **1.52 m^3** if dry ingredients for 1 m^3 of wet concrete.

1.1.15.d 1) Cement concrete 1 : 1 $\frac{1}{2}$: 3 - 1 m^3 using 20 mm aggregate

Cement Concrete	=	1: 1 $\frac{1}{2}$: 3	
Cement	=	1 part	
Sand	=	1.5 Part	
Aggregate	=	3 Part	
Total Parts	=	(1 + 1.5 + 3)	
	=	5.5 Parts	
Total volume of ingredients (20 mm agg)	=	1.57 m^3	
Total volume of cement required	=	(1 / 5.5) x 1.57	
	=	0.285 m^3	
	=	0.285 x 1440 = 411 kg	
Volume of Sand	=	(1.5 / 5.5) x 1.57	= 0.428 m^3
Volume of aggregate	=	(3 / 5.5) x 1.57	= 0.856 m^3

Ans :

Cement	**= 0.285 m^3**	**= 411 kg**
Sand		**= 0.428 m^3**
Aggregate		**= 0.856 m^3**

1.1.15.d 2) Cement concrete 1 : 2 : 4 - 1 m^3 using 20 mm aggregate

Cement Concrete	=	1: 2: 4
Cement	=	1 Part
Sand	=	2 Part
Aggregate	=	4 Part
Total Parts	=	(1 + 2 + 4)
	=	7 Parts
Total volume of ingredients (20 mm agg)	=	1.57 m^3
Total volume of cement required	=	(1 / 7) x 1.57
	=	0.224 m^3
	=	0.224 x 1440 = 324 kg
Volume of Sand	=	(2/7) x 1.57 = 0.449 m^3
Volume of aggregate	=	(4/7) x 1.57 = 0.897 m^3

Ans :

Cement	**= 0.224 m^3**	**= 324 kg**
Sand		**= 0.449 m^3**
Aggregate		**= 0.897 m^3**

1.1.15.d 3) Cement concrete 1 : 4 : 8 - 1 m^3 using 40 mm aggregate

Cement Concrete	=	1 : 4 : 8
Cement	=	1 Part
Sand	=	4 Part
Aggregate	=	8 Part

Total Parts	=	(1 + 4 + 8) = 13 Parts
Total volume of ingredients (40 mm agg)	=	1.52 m^3
Total volume of cement required	=	(1 / 13) x 1.52
	=	0.116 m^3
	=	0.116 x 1440 = 167 kg
Volume of Sand	=	(4/13) x 1.52 = 0.467 m^3
Volume of aggregate	=	(8/13) x 1.52 = 0.935 m^3

Ans :

Cement	**= 0.116 m^3**	**= 167 kg**
Sand		**= 0.467 m^3**
Aggregate		**= 0.935 m^3**

1.1.15. d 4) Cement concrete 1 : 5 : 10 - 1 m^3 using 40 mm aggregate

Cement concrete	=	1: 5: 10
Cement	=	1 Part
Sand	=	5 Part
Aggregate	=	10 Part
Total Parts	=	(1 + 5 + 10)
	=	16 Parts
Total volume of ingredients (40 mm agg)	=	1.52 m^3
Total volume of cement required	=	(1 / 16) x 1.52
	=	0.095 m^3
	=	0.095 x 1440
	=	137 kg
Volume of Sand	=	(5/16) x 1.52
	=	0.475 m^3
Volume of aggregate	=	(10/13) x 1.52
	=	0.95 m^3

Ans:

Cement	**= 0.095 m^3**	**= 137 kg , Sand = 0.475 m^3**
Aggregate		**= 0.95 m^3**

Materials required for cement concrete of different proportion

proportions	Cement	Sand	Coarse aggregate	Total Volume	Size of aggregate
1:11/2 :3	0.285 m^3	0.428 m^3	0.856 m^3	1.57 m^3	20 mm
1:2:4	0.224 m^3	0.449 m^3	0.897 m^3	1.57 m^3	20 mm
1:3:6	0.157 m^3	0.471 m^3	0.942 m^3	1.57 m^3	20 mm
1:4:8	0.116 m^3	0.468 m^3	0.935 m^3	1.52 m^3	40 mm
1:5:10	0.095 m^3	0.475 m^3	0.95 m^3	1.52 m^3	40 mm

1.1.15.e. Brick work in cement mortar

The ingredients are bricks and cement mortar. The number of bricks and quantity of cement mortar is calculated depending on the size of bricks and mortar mix.

1.1.15. e 1)Brick work in C.M 1:4 using I st class bricks - 1 m^3

I st class bricks = 1 m^3

Size of first class bricks = 19 x 9 x 9 cm

Assume the mortar thickness = 1 cm

So,

Size of brick including mortar thickness = 20 x 10 x 10 cm

Volume of brick (0.2 m x 0.1 m x 0.1 m) = 0.002 m^3

No of bricks = (1 / 0.002) = 500 Nos

Quantity of cement mortar = 1 – Actual volume of bricks

Actual volume of bricks = 0.19 x 0.09 x 0.09 x 500

= 0.7695 m^3

Qty of cement mortar (1 – 0.7695)	=	0.2305 m^3
So, Volume of cement mortar	=	0.23 m^3
Cement mortar	=	1:4
Volume of cement	=	0.25 m^3 x 0.23
	=	0.0575 m^3 = 83 kg
Sand	=	0.23 m^3

Ans :

Bricks	**=**	**500 Nos**
Cement	**=**	**83 kg**
Sand	**=**	**0.23 m^3**

1.1.15.e 2)Brick work in C.M 1:5 using II nd class bricks - 1 m^3

II nd class bricks	=	1 m^3
Size of Second class bricks	=	19 x 9 x 5.7 cm
Assume the mortar thickness	=	1 cm
So,		
size of brick including mortar thickness	=	20 x 10 x 6.7 cm
Volume of brick (0.2 m x 0.1 m x 0.067 m)	=	0.00134 m^3
No of bricks = (1 / 0.00134)	=	746 Nos = 750 nos (approx.)
Quantity of cement mortar	=	1 – Actual volume of bricks
Actual volume of bricks	=	0.19 x 0.09 x 0.057 x 750
	=	0.7310 m^3
Qty of cement mortar (1 – 0.7310)	=	0.269 m^3
So, Volume of cement mortar	=	0.269 m^3
Volume of cement	=	0.288 m^3 x 0.269 = 78 kg
Volume of Sand	=	0.269 m^3

Ans :

Bricks	**=**	**750 Nos**
Cement	**=**	**78 kg**
Sand	**=**	**0.269 m^3**

1.1.15.e 3)Random rubble masonry in C.M 1: 6 - 1 m^3

The materials used in Random rubble masonry are rubble stones, sand and cement. The rubble stones are in irregular shape, hence dressing is necessary. Therefore add 10 % extra. The quantity of mortar required for stone masonry is 0.34 m^3

Volume of R.R masonry	=	1 m^3		
10 % extra for dressing	=	0.1 m^3		
Quantity of rubble stone required	=	1.1 m^3		
Quantity of cement mortar				
required for 1 m^3 of masonry	=	0.34 m^3		
Qunatity of Sand				
required for 0.34 m^3 of cement mortar	=	0.34 m^3		
Cement required	=	0.34 x 240	=	81.6 kg
Approximately say	=	82 kg		

Answer :

Rubble stone	**=**	**1.1 m^3**
Sand	**=**	**0.34 m^3**
Cement	**=**	**82 kg**

1.1.15.e 4) Plastering with C.M 1:4, 12 mm thick – 10 m^2

Plastering area	=	10 m^2	
Thickness of cement mortar	=	12mm	
Qty of cement mortar (area x thickness)	=	10 x 0.012	= 0.12 m^3

For wastage add 12 %

Wastage quantity	=	(12 / 100) x 0.12
	=	0.0144
Total qty of mortar(0.12 + 0.014)	=	0.1344 m^3
Quantity of cement = (0.1344 x 360)	=	48.38 kg
Quantity if Sand	=	0.1344 m^3

Answer:

Quantity of cement	**=**	**48.38 kg**
Quantity if Sand	**=**	**0.1344 m^3**

1.1.15.e 5) Flat tiles of size 200 x 200 x 20 mm size for flooring - 10 m^2

Area of tile = (0.2 x 0.2) = 0.04 m^2

No of tiles required for 10 m^2 = $\frac{\text{Area of flooring}}{\text{Area of one tile}}$

= (10 / 0.04) = 250 Nos

Answer :

No of tiles required = 250 Nos.

1.1.15. f) Reinforcement details for R.C.C work

For R.C.C Column	=	1.5 to 2 % (120 to 160 kg / m^3)
For R.C.C Beams	=	1.0 to 1.5 % (80 to 120 kg / m^3)
For R.C.C Slab	=	0.5 to 1.0 % (40 to 80 kg / m^3)
For R.C.C Footings	=	0.5 % (40 kg / m^3)

1.1.15. f 1) R.C.C Column of size 300 x 450 mm for 1 m long

Volume of concrete = 0.3 x 0.45 x 1 = 0.135 m^3

Assuming 150 kg of steel per m^3 of concrete

Quantity of steel required = 0.135 x 150 = 20.25 kg

Answer :

Quantity of steel required = 20.25 kg

1.1.15.f 2) R.C.C slab thickness 120 mm for a half of size 4 m x 6 m

Volume of concrete	=	4 x 6 x 0.12	=	2.8 m^3

Assuming 70 kg of steel per m^3 of concrete

Quantity of steel required	=	2.8 x 70	=	196 kg

Answer :

$\boxed{\textbf{Quantity of steel required = 196 kg}}$

1.1.15.f 3) R.C.C beam of size 300 mm x 600 mm for 3.1 m long

Volume of concrete	=	0.3 x 0.6 x 3.1	= 0.558 m^3

Assuming 100 kg of steel per m^3 of concrete

Quantity of steel required	=	100 x 0.558	= 55.80 kg

Answer:

Quantity of steel required = 55.80 kg

1.1.16 LABOUR REQUIREMENT FOR DIFFERENT ITEMS OF WORKS

1. Earth work excavation for foundation

I st class	=	3 Nos
II nd class	=	3 Nos

2. Sand filling in plinth

Mason I st class	=	2 nos
Mason II nd class	=	2 Nos
Bhistic	=	0.5 Nos

3. Plain cement concrete 1:5:10 below the foundation

Mason I st class	=	1.80 Nos
Mazdoor I st class	=	17.70 Nos
Mazdoor II nd class	=	14.10 Nos

4. Random Rubble Masonry in C.M 1:6

Mason I st class	=	7.1 Nos
Mason II nd class	=	10.6 Nos
Mazdoor I st class	=	14.1 Nos
Mazdoor II nd class	=	14.1 Nos

5. Brickwork in C.M 1:5 using first class bricks – 10 m^3

Mason I st class	=	3.5 Nos
Mason II nd class	=	10.60 Nos
Mazdoor I st class	=	7.10 Nos

Mazdoor II nd class = 21.20 Nos

6. **R.C.C Roof slab 120 mm thick of mix 1 :1.5 : 3 using 20 mm broken jelly - 1 m ^{3}**

Mason II nd class = 3.50 Nos

Mazdoor I st class = 21.20 Nos

Mazdoor II nd class = 35.30 Nos

7. **Plastering the walls in C.M 1:3**

12 mm thick = 10 m ^{2}

Mason I st class = 1.10

Mazdoor I st class = 1.10

Mazdoor II nd class = 1.10

8. **Pointing with C.M 1:4 for**

Random rubble masonry - 10 m ^{2}

Mason I st class - 1.60 Nos

Mazdoor I st class - 0.50 Nos

Mazdoor II nd class - 1.10 Nos

9. **White washing 2 coats - 10 m ^{2}**

Mason I st class - 1.60 Nos

Mazdoor I st class - 0.50 Nos

Mazdoor II nd class - 2.70 Nos

10. **Flooring with amrbonite tiles - 10 m ^{2}**

Mason I st class - 1.2 Nos

Mason II nd class - 1 No

Mazdoor II nd class - 1 No

Stone cutter - 0.5 No

1.1.17 STANDARD DATA BOOK

Government Engineering Department have published data book of their own but standard data book published by PWD Tamil Nadu Government only is used for preparing estimates of various structures by all departments. This given materials and labour required for all item of works in a building. It also gives lump sum provisions and petty charges etc., These values have been arrived form expenditure.

1.1.18 TASK OR OUT TURN OF LABOURERS

The quantity of work that can be done by a labour in a one day (8 hours) in normal working condition is termed as the 'task' or ' out-turn' of the labour. The out-turn varies depending on the nature, size, height, location, climatic condition, techniques adopted, equipments used and the experience of the labour. The approximate task of labours for some important items of works is given below:

(i) Out-turn of a mason:

Cement concrete in foundation	-	4.5 to 5m^3
Lime concrete in foundation	-	5 to 6 m^3
Brick work in foundation	-	1.4 to 1.5m^3
Brickwork in superstructure	-	1.2 to 1.4 m^3
Brickwork in arch work	-	1.0 to 1.2 m^3
Half brickwork in partition	-	4.5 to 5m^2
R.R masonry in foundation	-	1.0 to 1.2 m^3
R.R masonry in superstructure	-	0.9 to 1.0 m^3
20mm thick D.P.C in cement mortar	-	10 to 12 m^2
Plastering B.W in cement mortar, 12mm thick	-	10 to 12 m^2
Plastering B.W in cement mortar, 15mm thick	-	8 to 10 m^2
Plastering ceiling in cement mortar, 6mm thick	-	8 to 10 m^2
Plastering B.W in lime mortar, 2 coats	-	4 to 5 m^2
Pointing R.R masonry with cement mortar	-	6 to 8 m^2
White washing one coat	-	100 m^2
White washing, two coat	-	60 to 70 m^2
Cement concrete flooring	-	10 to 12 m^2
R.C.C roofing	-	3 to 4 m^2
Mangalore tiled roofing set in lime mortar	-	10 to 12 m^2
Dry packing of revetments with rough stone	-	3 to 4 m^3

(ii) Out turn of a carpenter:

Panelled doors and windows (with frames)	-	0.4 to 0.5 m^2
Glazed window shutters	-	0.6 to 0.8 m^2
Venetianed window shutters	-	0.3 to 0.4 m^2
Centering work with timber planks	-	3 to 4 m^2
G.I sheet roofing (rafters & purlins)	-	10 to 12 m^2
Mangalore tiled roofing (rafter & reepers)	-	2.0 to 2.4 m^2

(iii) Out-turn of a painter:

Painting plastering surface with cement paint, 2 coats	-	20 to 25 m^2
Painting primer coat over new wood/steel work	-	40 to 45 m^2
Painting/Varnishing, 2 coats on new wood work	-	18 to 20 m^2
Painting 2 coats on old wood work	-	25 to 30 m^2
Painting 2 coats on old steel work	-	30 to 40 m^2

(iv) Out-turn of a Bar bender:

- Fabrication of reinforcement for slabs (upto 10 dia) - 80 Kg
- Fabrication of reinforcement for columns, beams (above 12 dia) - 100kg

(v) Out-turn of a Mazdoor:

- Earthwork excavation in loose soil - 3 m^3
- Earthwork excavation in hard soil - 2 m^3
- Excavation in soft rock - 0.5 to 1 m^3
- Sand filling in basement - 4 to 5 m^3
- Breaking brick jelly from over burnt and half bricks - 1 to 1.2 m^3

1.1.19 COST OF MATERIALS AND WAGES OF LABOUR

Cost of materials and wages for labour is given in the S.S.R.B (Standard Schedule of a Rate Book) Published by PWD department. Thus the prices of materials are variable from place to place and from time to time as they depends on the prevailing market condition. Standard schedule of rates is published by Tamil Nadu Highways Department by concerned superintending engineers of various circle in the state. The rates are revised and reviewed every year by concerned SE.

1.1.20 SCHEDULE OF RATES

1. Schedule of rates is an important booklet for the preparation of estimate or analysis of rate.
2. It is treated as a confidential document made available only to all Engineering departments, quantity surveyors, engineers and the construction agencies.
3. **This** booklet consists of
   a. Quantity ofmaterials
   b. The rates for several items of works normally executed in construction activity.
   c. Prevailing rates of wages of different classes of labour – skilled, unskilled.
   d. Unit rates for materials commonly used in consruction.
   e. Quarry details
   f. Lead particulars
   g. Handling charges (loading, unloading etc)

4. Depending upon the availability of labour and materials (bricks, sand, aggregates etc) the rates may vary from place to place and also from time to time.
5. It is prepared yearly once and updated according to the variation in cost of labour and materials. Hence the Schedule of rates is prepared for each district separately.
6. The Superintending engineer P.W.D is responsible for fixing the schedule of rates for the district.
7. He conducts the conference of engineers of all other department who are involved in construction activity for deciding the rates.

1.1.21 REVISION OF RATES

The rates given in SSRB are valid only for one financial year. The rates are revised every year depending upon the rates in the market. Sometimes due to technical and constructional difficulties rates are revised as a special case. Extra percentage is allowed to materials in some remote places in district. This is given by a special order.

1.1.22 MARKET RATES

The rate of an item at the store from the public market at a given time is known as market rate. The market rate shall include taxes, incidential charges, depreuation and a reasonable provision of wastage. It indicates the cost per unit, i.e., per meters, per sqm, per cum or per kg.

1.1.23 LEAD

Lead statement is prepared by in addition to the cost of materials used for various items of work, cost of conveyance and handling charges (loading and unloading the materials). The cost of conveyance of different materials per km lead is worked on the basis of the distance of source, mode of transport used, hire charges of vehicles, speed of the vehicle etc. The above particulars are tabulated in the following form and is called the lead statement.

Example

LEAD STATEMENT

Sl.No	Materials	Rate Rs	Lead-unit	Lead(km)	Rate (km)	Handling Charges (Rs)	Total cost
1	Brick I st class	2000	1000 nos	12	5	10	2000+(12 x 5) + 10 = 2070
2	Sand	150	m^3	10	6	8	150 + (10 x 6) + 8 = 218
3	Broken stone	200	m^3	5	5	5	200 + (5x5) + 5 = 230

1.1.24 COST OF CONVEYANCE

The cost of conveyance (rate per kilometer) of different materials per Km. Lead is worked out based on the distance of source mode transport used, hire charges or vehicles, speed of vehicle etc. In addition to the cost handling charges i.e., loading, unloading and stacking the materials are to be also added.

1.1.25 HANDLING CHARGES

All building materials should be loaded at the source or quarry and unloaded at the work site. For this labour charge is given. This loading and unloading charges are called handling charges.

1.1.26 LUMP SUM AND CONTINGENCY PROVISIONS IN ESTIMATES

Lump sum and sundries

In data, the amount can be rounded off to a sensible value. The quantities which are added to round off is called sundries.

In certain works some of the quantities cannot be quantified in data or detailed estimate. For such items a lump sum amount will be provided.

Example for Lump sum provisions

1. Laying of water supply lines and sanitary arrangements
2. Electrification works

3. The work of site cleaning
4. Site dressing
5. Dewatering from a tube well
6. Removing roots of a tree etc

Contingency provisions in Estimates

They are the miscellaneous incidental expenses which cannot appropriately be classified under any distinct sub head, yet relate to the work as a whole. Certain percentage of the estimated cost is added for miscellaneous petty items, unforeseen items etc, as contingencies. (This varies from 2 to 5 %)

1.1.27 ABSTRACT ESTIMATES

- It is next part of the detailed estimate.
- The cost of every items of work is calculated by multiplying the quantity and specified rate in a tabular form.
- After that certain percentages of unforeseen expenditure, supervising charges are added.
- Finally the total cost of construction is worked out.
- Unforseen expenditure
- Supervision charges
- Contractor's Profit

TABULATION FOR ABSTRACT ESTIMATE

Sl.No.	Quantity	Description	Rate	Unit	Amount

Example :

Quantity	Description	Rate	Unit	Amount (Rs)
1 m^3	Concrete broken stone 1:4:8	2718.15	m^3	2718.15
10 m^2	Plastering with CM 15mm thick	1523.94	10 m^2	1523.94
		Rate for 10 m^2	-	4242.

1.2 APPROXIMATE ESTIMATES

Approximate estimate is a rough estimate prepared to decide financial aspect and policy and gives an idea of the cost of the project to the competent sanctioning authority.

This estimate shows the cost of land, cost of building, cost of roads, cost of sanitary works, electrification etc., separately.

The estimate is prepared from practical knowledge and cost of similar work. The following documents to be attached. Detailed report, site plan of the proposal, Land acquisition and provision of electricity, water supply etc.

1.2.1 Necessity of approximate estimates.

1. preliminary studies of the projects.
2. investment to study the feasibility of a project.
3. Financial aspect to prepare finance in advance.
4. To frame tax schedule.
5. Insurance.

1.2.2 Types of approximate estimate.

The approximate cost of a building can be found out by the following methods.

1. Service unit method or unit cost method
2. Plinth area method.
3. Carpet area method
4. Cubical content method
5. Typical bay method.
6. Rough quantity method.

1.2.3 Service unit (or) unit rate method

In this method, the cost of a project is prepared by multiplying the cost per unit by the number of units in the structure.

For example,

- Per class room for school building
- Per bed for hospital
- Per litre for water tank
- Per kilometer for a high way
- Per seat for a auditorium

Example: 1

The expenditure incurred in the construction of a school building with 12 class rooms was Rs. 5,79,000/- about 3 years back. The increase in the cost of materials and labour in these three years is approximately 30 %. Estimate the approximate amount required for constructing a similar school building with 15 class rooms.

Given Data :

For Construction of 12 class rooms Expenditure is = Rs.5, 79,000/-(3years back)

Increase in the cost of materials and labour = 30 %

To Find :

To Estimate the approximate amount required for constructing a similar school building with 15 class rooms.

Solution :

Total expenditure of the existing building	=	Rs 5.79 lakhs
No of class rooms	=	12 Nos

Unit rate of the existing building	= (5, 79,000 / 12) = Rs 48,250/-
Increase in the cost of materials and labour	= (30 % increased)
	= (30 / 100) x 48,250)
	= Rs 14,475
So approximate unit rate at present	= Rs 48,250 + 14,475
	= Rs 62,725
No of class rooms in new building	= 15 nos

Approximate total cost for proposed building	= 15 x 62,725
	= Rs 9,40,875

Result :

Approximate amount required is Rs 9,40,875.

Example :2

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

Given Data :

cost of construction of a polytechnic building of

yearly intake of 120 students = Rs. 20.8 lakhs

Increase in the cost of materials and labours, = 10 %

To Find :

To Determine the probable expenditure for construction of a new building for a polytechnic of yearly intake 180 students.

Solution :

Cost of existing polytechnic building = Rs 20.8 lakhs

No of students intake = 120 Nos

Unit rate of the existing building = Total cost of existing building / no.of students

= (20,80,000 / 120)

= Rs 17,333/-

Increase in the unit cost = (10 % increased)

= ((10 / 100) x 17,333)

= Rs 1,733

So approximate unit rate of proposed building = Rs 17,333 + 1,733

= Rs 19,066

No of students = 180 nos

Approximate cost of the proposed building

= No of service units in the structure x cost of corresponding service unit

So,

Approximate cost of the proposed building = 180 x 19066

= Rs 34, 31,880

= Rs 34.32 lakhs

Result :

Approximate cost of the new polytechnic building is Rs 34.32 lakhs

Example: 3

The total expenditure towards the construction of a hostel building accommodating 200 students is found to be Rs 10,20,000/- . Now it is proposed to construct another similar building in the same complex to accommodate 120 students. Estimate approximately the probable expenditure assuming the variation in the cost of materials and lobour as negligible.

Given Data:

Expenditure towards the construction of a hostel building

for 200 students is = Rs 10,20,000/- .

To Find:

To Estimate approximately the probable expenditure for 120 students in hostel.

Solution :

Total expenditure	=	Rs 10,20,000/-	
Total capacity	=	200 students	
Unit cost	=	$\left(\frac{10,20,000}{200}\right)$	= Rs 5,100
Capacity of new hotel building	=	120 students	
Approximate cost of building	=	120 x 5,100	= Rs 6,12,000/-

Result :

Approximate cost of building = Rs 6,12,000/-

1.2.4 Plinth area method

The built up covered area measured at the floor level of the basement is called plinth area. To prepare an estimate, the plinth area of a building shall be determined first. It can be calculated including the following such as area of the floor level, porch, stair cover, internal shaft, Machine room etc.

Example : 1

Calculate the approximate cost of the building of plinth area 85 m^2 and the rate may be assumed as Rs. 800 / m^2 for civil works only.

Given Data :

Plinth area rate = Rs 800 / m^2

To Find :

To Calculate the approximate cost of the proposed building for plinth area 85 m^2

Solution :

Plinth Area of the building = 85 m^2

The approximate cost = **Plinth area of the building x plinth area rate**

= 85 x 800

= Rs.68,000

Result :

Approximate cost of proposed building is Rs 68,000 / -

Example : 2

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

Given Data:

Existing building

Plinth area	=	80 m^2
Cost of building	=	Rs 3,00,000 /-

To Find :

To Estimate approximately the cost of the proposed building.

Solution :

Plinth area rate for existing building	= (3,00,000 / 80) = Rs.3750 / m^2
Cost of materials (60 %)	= (60/100) x 3750 = Rs.2250/ m^2
Cost of labour (40 %)	= (40 /100) x 3750 = Rs.1500/ m^2

Proposed building

Increase in the cost of labour (10%)	= 2250 + ((10/100) x 2250)
	(or) 1.1 x 2250
	= Rs. 2475/m^2
Decrease in the cost of labour	= {1500 - ((15/100) x 1500)}
	(or) 0.85 x 1500
	= Rs. 1275/m^2
Plinth area rate for proposed building	= 2475 + 1275 = 3750 / m^2
Plinth area of building	= 110 m^2
Approximate cost	= Plinth area x plinth area rate
	= 110 x 3750 = Rs.4,12,500

Result :

Approximate cost of proposed building is Rs 4,12,500 /-

Example : 3

The actual expenditure incurred in the construction of a single storey residential building of plinth area 72 m^2 is found to be Rs. 2,84,400 / - in which 60 % is towards the cost of materials and the remaining is towards the cost of labour. It is now proposed to construct a similar building of same height and specifications with a plinth area 94 m^2 at place where the cost of materials is 10 % more and the cost of labour is 20 % less. Estimate approximately the cost of the proposal building.

Given data :

Existing building

Plinth area = 72 m^2

Cost of building = Rs 2,84,400 /-

To Find :

To Estimate approximately the cost of the proposed building.

Solution :

Plinth area rate = (2,84,400 / 72) = Rs.3950 / m^2

Cost of materials (60 %) = (60/100) x 3950 = Rs.2370/m^2

Cost of labour (40 %) = (40 /100) x 3950 = Rs.1580/m^2

Increase in the cost of material for proposed building(10%)

= 2370 + ((10/100) x 2370) (or) 1.1 x 2370

= Rs. 2,607 per m^2

Decrease in cost of labour (20%)= {1580 - ((20/100) x 1580)} = Rs.1264/m^2

Plinth area rate = 2607 + 1264 = Rs.3871 / m^2

Plinth area of the proposed building = 94 m^2

Approximate cost of the proposed building

= Plinth area x plinth area rate of the proposed building

= 94 x 3871 = Rs.3, 63,874/-

Answer :

Approximate cost of proposed building is Rs 3,63,874 /-

Example :4

The particulars regarding a two storeyed building are given below

Plinth area of the ground (first) floor = 82 m^2

Plinth area of second floor = 68 m^2

Expenditure for the construction of first floor = Rs 3,52,600 /-

Expenditure for the construction of second floor = Rs 2,65,200 /-

Estimate for probable cost of a similar building proposed to be constructed in the same locality with plinth area of 96 m^2 in Ground floor and 80 m^2 in second floor.

Given Data :

Plinth area of the ground (first) floor = 82 m^2

Plinth area of second floor = 68 m^2

Expenditure for the construction of first floor = Rs 3,52,600 /-

Expenditure for the construction of second floor = Rs 2,65,200 /-

To Find :

To Estimate for probable cost of a similar building with plinth area of 96 m^2 in Ground floor and 80 m^2 in second floor.

Solution :

Plinth area rate for ground floor $= \dfrac{\text{Total cost}}{\text{Plinth area}}$

$= \dfrac{3,52,600}{82} =$ Rs 4,300 per m^2

Plinth area rate for Second floor $= \dfrac{2,65,200}{68} =$ Rs 3,900 per m^2

Probable cost for the proposed building = Plinth area x Plinth area rate
= 96 x 4,300 + 80 x 3900
= Rs 7,24,800/-

Result :

The Probable cost for the proposed building is Rs 7.25 Lakhs.

1.2.5 Carpet area method

It is the usable floor area less for staircase, toilets, kitchen, store, verandah, corridor, passage, porch etc.

Carpet area = Total floor area – circulating area - non usable area

The non usable area included toilet, baths, water closets etc. It may vary from 50 % to 75 % of the total floor area.

Example: 1

The carpet area of a proposed building to be constructed is 600 m^2. Assuming the circulation and non livable area is 20 % and 10 % of the built up area respectively. Plinth area rate of the building is Rs. 1500 / m^2. Estimate the approximate cost of the building.

Given data :

Circulation area	= 20 %
Non livable area	= 10 %
Carpet area of proposed building	= 600 m^2
Plinth area rate of the building	= Rs 1500 / m^2

To Find :

To Estimate the approximate cost of the proposed building.

Solution :

Carpet area	= 100 – 20 % - 10 %
	= 70 % of built up area (or) Plinth area
Carpet area of the proposed building	= 600 m^2 = (70/100) x plinth area
There fore, Plinth area of the building	= (100 / 70) x 600 = 857.142 m^2
Plinth area rate	= Rs 1500/ m^2
Approximate cost of building	= plinth area x plinth area rate
	= 857.14 x 1500 = Rs 12,85,710

Results :

Approximate cost of the proposed building is Rs 12,85,710.

Example : 2

The carpet area of a multistoried building is proposed to be constructed is 780 m^2. Assuming the circulation and non livable areas including area of walls as 25 % and 10% of the built up area respectively. Estimate the approximate cost of the building using the particulars given below.

Plinth area rate for a single storey building is Rs 4300 per m^2.

Add an extra of 2 % for deep foundations

0.5 % for architectural treatment

2 % for water supply arrangements and 5 % for other services in the building cost.

Given data :

carpet area of a multistoried building	= 780 m^2
Circulation area	= 25 %
Non-livable area + area of walls	= 10 %

To Find :

To Estimate the approximate cost of the proposed building.

Solution:

carpet area (100-25-10)	= 65 % of (built up area (or) plinth area)
carpet area of proposed building	= 780 m^2
Therefore plinth area of the building	= (100/65) x 780= 1200 m^2
Plinth area rate	= Rs 4300 per m^2
So building cost (1200 x 4300)	= Rs. 51,60,000
Extra for deep foundation (2%)	= Rs 1,03,200
Extra for architectural treatment (0.5 %)	= Rs 25,800
Extra for water supply arrangements (2 %)	= Rs 1,03,200
Extra for other services 5 %	= Rs 2,58,000

Total cost in Rs

(51,60,000 + 1,03,200 + 25,800 + 1,03,200 + 2,58,000) = Rs 5,650,200

Result :

Approximate cost of the proposed building is Rs 56.502/- lakhs.

1.2.6 Cubical Content method

The cubic content of the proposed building is worked out and multiplied by the rate per cubic volume of similar building in that locality, constructed recently. This method is more accurate.

Cubic content = Plinth area x Height of the building

Example : 1

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

Given Data :

Total cost of the constructed building is	= Rs 4,50,000/-.
The plinth area of the building is	= 60 m^2

Height of the building = 3.2 m.

To Find :

1. Plinth area rate
2. Cubic unit rate
3. Approximate cost of construction for a plinth area 135 m^2

Solution :

Plinth area rate = (Total cost / plinth area) = (4, 50,000 / 60)

= Rs 7,500/-

Cubic content = 60 x 3.2 = 192 m^2

Cubic content rate = (Total cost / cubic contents) = 4,50,000 / 192 = Rs. 2344/-

Approximate cost of similar building = Plinth area x Plinth area rate

= 135 x 7500

= Rs 10,12,500

Result :

1. Plinth area rate	**= Rs 7500/m^2**
2. Cubic unit rate	**= Rs 2344/m^3**
3. Approximate cost of construction	**= Rs 10,12,500**

Example : 2

The cost of construction of an overhead water tank of capacity 100 m^3 is Rs.5,75,000/- Find the unit rate/litre. Find also the approximate cost of a similar water tank in the same area to store 2,50,000 litres.

Given Data :

Overhead water tank of capacity = 100 m^3

The cost of construction = Rs 5,75,000/-

To Find :

To Find the unit rate/litre, and approximate cost.

Solution :

(1 m^3 = 1000 litres)

Capacity of the tank = 100 x 1000 = 1,00,000 litre

Cost of construction = Rs. 5,75,000/-

Unit rate /litre = (5,75,000 / 1,00,000)= Rs 5.75 / litre

Approximate cost of the water tank = 2,50,000 x 5.75 = Rs 14,37,500/-

For storage of 2,50,000 lit.

Answer :

Approximate cost of the tank for storage of 2,50,000 litres is Rs 14,37,500/-

Example : 3

The plinth area of proposed sloped roof building is 82 m^2. The height of main walls above floor level is to be 3 m and the rise of roof above the wall is 1.2m. the cube rate for a similar building is arrived at Rs. 615 per m^3. Find out the approximate cost of building.

Given data :

Plinth area of proposed building	= 82 m^2
Height of main wall	= 3.00 m
Ht of roof above main wall	= 1.2 m

To Find :

To Find out the approximate cost of building.

Solution :

Height of roof	= 3 + (1.2 / 2)	= 3.60 m	
Cubic content	= Plinth area x Height	= 82 x 3.60	= 295.2 m^3
Approximate cost of the proposed building		= 295.2 x 615	= 1,81,548/-

Result :

Approximate cost proposed roof building is Rs. 1,81,548/-

Example : 4

The actual expenditure incurred in the construction of a flat roofed residential building having plinth area 98 m^2 and height 3.20m is Rs. 7,60,000.it is proposed to construct another similar building in the same locality with a plinth area of 110 m^2 and height 3.60m. Estimate the approximate amount required for the proposed building assuming the increase in the cost of materials and labour as 20 %.

Given data :

Plinth area of the completed building	= 98 m^2
Height of the completed building	= 3.20 m
Expenditure incurred	= Rs 7,60,000/-

To Find :

To Estimate the approximate amount required for the proposed building.

Solution :

Existing building :

Cubical content of the completed building	= 98 x 3.2 = 313.6 m^3
Cube rate	= (7,60,000 / 313.6)
	= Rs. 2423.46 per m^3
Increase in cost of material and labour (20 %)	= ((20/100) x 2423.46)
	= Rs. 484.692
Therefore cube rate for proposed building	= 2423.46 + 484.692
	= Rs. 2908.152 per m^3

Proposed building :

Plinth area of the proposed building	= 110 m^2
Height of the proposed building	= 3.60 m
Cubical content of the completed building	= 110 x 3.6 = 396 m^3
	= 396 x 2908.152
Therefore approximate cost	= Rs. 11,51,629/-

Result :

Approximate cost of proposed building is Rs. 11,51,629/-

Example : 5

The actual expenditure incurred in the construction of a flat roofed residential building having a plinth area of 100 m^2 and height 3 m is Rs 5 lakhs. It is proposed to construct another similar building in the same locality with a plinth area of 85 m^2 and height 3.45m. Estimate the approximate amount required for the proposed building assuming the increase in the cost of materials and labour 20 %.

Given Data :

Flat roofed residential building

Plinth area	= 100 m^2
Height of residential building	= 3 m
Expenditure for construction	= Rs 5 lakhs

To Find :

To Estimate the approximate amount required for the proposed building assuming the increase in the cost of materials and labour is 20 %.

Existing building :

Plinth area of the building = $100\ m^2$

Height of the building = 3m

Actual cost of the building = Rs 5,00,000/-

Cubic content = Plinth area x height

= 100 X 3 = $300\ m^3$

Cube rate = (Total expenditure / cubic content)

= (5, 00,000 / 300) = Rs 1666.66 / m^3

Proposed building:

Increase in cost of materials and labour = 20 %

Cubic content (1667 x 1.2) = 2000 / m^3

Plinth area = $85\ m^2$

Height of the building = 3.45 m

Cubic content = Plinth area x height

= 85 X 3.45 = $293.25\ m^3$

Approximate estimated cost = cubic content x unit cost

= 293.25 x 2000 = Rs 5,86,500

Result :

Approximate Estimated cost of the proposed building is Rs 5,86,500

1.2.7 Typical Bay method

In this method, the area of a structure is equally divided into a number of parts (or) bays.

Approximate estimated cost = No of bays in the proposed Structure x cost of one bay

Example : 1

The cost of construction of an auditorium which has 8 bays of 3 metre span each and 10 metre width is Rs. 10,00,000. Determine the approximate cost of construction of a similar building with 12 bays.

Given data :

Cost of construction of existing building = Rs 1,00,000

Number of bays = 8 Nos

To Find :

To determine the approximate cost of proposed building with 12 bays.

Solution :

Cost of building per bay = (1, 00,000 / 8) = Rs 1, 25,000

Number of bays of proposed building = 12 Nos

Therefore approximate cost of prop. Build.= 1,25,000 x 12 = Rs 15,00,000

Result :

Approximate cost of proposed Building is Rs 15,00,000.

Example : 2

The cost of construction of an industrial building which has 6 bays of 4 metre span eachand 12 metre width is Rs 8,18,400. Determine the approximate cost of construction of a similar building with 8 bays.

Given data :

Cost of construction of existing building = Rs 8,18,400

Number of bays = 6 Nos

To Find :

To determine the approximate cost of construction of propsed building

Solution :

Cost of building per bay = (8,18,400 / 6) = Rs 1,36,400/-

Number of bays of proposed building = 8 Nos

Therefore approximate cost of prop. Build.= 1,36,400 x 8 = Rs 10,91,200

Result :

Approximate cost of proposed Building is Rs. 10,91,200.

1.2.8 Rough Quantity method

In rough quantity method, the approximate quantities of materials and labour is involved in different rates. The approximate cost is estimated by assuming suitable rates for the trades.

For example the total quantities of brickwork, cement, concrete, steel, plastering etc are determined from the line plan.

Example : 1

The actual expenditure incurred in the construction of residential building have a total length of main walls 120 m is Rs 5.2 lakhs. Estimate the approximate cost of a similar residential building which have 180 m length of main walls.

Given data :

Existing building

Length of wall = 120 m

Expenditure = 5.2 lakhs

Proposed building

Length of wall = 180 m

To Find :

To Estimate the approximate cost of Proposed Residential Building.

Solution :

Total length of existing main wall = 120 m

Expenditure = Rs 5,20,000

Rate per m length of main wall = (5,20,000 / 120) = Rs 4333.33

Proposed building :

Length of main wall = 180 m

Rate per m length of wall = Rs 4333.33

Approximate cost = 180 x 4333.33 = Rs. 7, 79,999/-

Result :

Approximate cost of the Proposed Residential building is Rs. 7,79,999/- say Rs.7,80,000/-

Example : 2

The actual expenditure incurred in the construction of school building which have a total length of main walls 140 m is Rs 4.97 lakhs. Estimate the approximate cost of a similar school building which will have 180 m length of main walls.

Given data :

Existing building

Length of wall	= 140 m
Expenditure	= 4.97 lakhs

Proposed building

Length of wall	= 180 m

To Find :

To Estimate the approximate cost of Proposed school Building.

Solution :

Total length of existing main wall	= 140 m	
Expenditure	= Rs 4, 97,000	
Rate per m length of main wall	= (4, 97,000 / 140)	= Rs 3,550

Proposed building:

Length of main wall	= 180 m	
Rate per m length of wall	= Rs 3,550	
Approximate cost	= 180 x 3,550	= Rs. 6,39,000/-

Result :

Approximate cost of the proposed school building is Rs. 6, 39,000/-
(or) 6.39 lakhs

Review Questions

PART-A

1. Differentiate supplementary estimate sub estimate.
2. When revised estimates are prepared?
3. State the advantages of group system over trade system.
4. Write short notes on annual maintenance estimate.
5. Mention any four types of estimate.
5. Plinth area method of preparing approximate estimate
6. Define out turn of works.
7. What is a measurement book?
8. What is "Standard data book"?

PART-B

1. Define painting co-efficient and state the coefficient for (i) Fully paneled door (ii) Iron bared door.
2. State the uses of schedule of rates
3. What do you understand by the following estimates:- (i) Repair estimate (ii)Complete estimate
4. State the order of taking off for a building.
5. Explain the two systems adopted in taking off quantities
6. Explain how deductions are made for the openings in plastering, masonry work. and white washing.
7. Explain plinth area estimate and cubical content method.
8. Difference between trade system and group system.

PART-C

1. Explain typical bay method and rough quantity methodof preparation of approximate estimate.
2. The actual cost of a single storey residential building of plinth area 85m2 is found to be Rs. m3,50,000 in which 70% is towards the cost of materials and m30% towards the labour. It is proposed to construct a similar building of same specification with a plinth area 120m2 at a place where the cost of material to be 15% more and cost of labour 20% less. Estimate the rough cost of the proposed building.
3. The actual expenditure incurred in the construction of building of plinth area $82m^2$ is Rs. 8,61,000 in which 65% towards the cost of materials and 35% is towards the cost of labour. It is now proposed to construct a similar building with a plinth area of $72m^2$. Estimate the approximate cost of the proposed building, if the increase in cost of materials and labour is 18%.
4. The total expenditure incurred in the construction of a building for a shopping complex of plinth area 250m2 and height 3.8m is Rs.9.25lakhs. A similar building of plintharea 200m2 and height 3.6m id prepared in the same locality.

The increase in the cost of materials and labour is found to be 20%. Estimate the approximate amount required for the proposed building.

5. The actual expenditure incurred in the construction of a building having plinth area 60m2 and a height 4.6m is Rs.2,58,000. It is proposed to construct a similar building in the same location with a plinth area of 60m2 ands height of building is 4.2m. Estimate the approximate cost of the proposed building if the incresase in cost of materials and labour is 17.5%
6. The actual cost of a single storey residential building of plinth area 75m2 is found to be Rs. 4,50,000/- in which 60% is towards the cost of materials and 40% is towards cost of labour. It is proposed to construct a similar building of same specification with a plinth area of 110m2 at a place where the cost of materials 20% more and cost of labour 10% more. Estimate the rough cost of the proposed building.
7. The cost of constructed of a framed structures has 5 days of m3.5m span and 11m width, the total cost is Rs. 6,00,000. Determine the approximate cost of construction of a similar building with 12 bays.
8. The actual expenditure incurred in the construction of a flat roof building having plinth area 60m2 and height 4.8m is Rs. m3,60,000/- It is proposed to construct a similar building in the same location with a plinth area o f $75m^2$ and height of the building is m3.10m. Estimate the approximate cost the proposed building if the increase in cost of materials and labour is 15%

UNIT-II

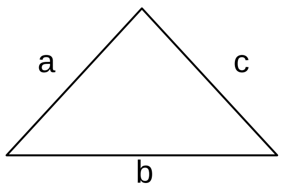
2.1 AREAS AND VOLUMES

2.1.1 Areas of regular and irregular sections

The area of the fields is required for planning and managing. If the land has straight boundary, the areas are computed by sub-division into triangle, trapezoidal, rectangle etc. Then the area of each individual section is calculated. Now the total area of the boundary will be equal to the sum of area of the individual sections.

a) Area of triangle

a. When all the sides are known



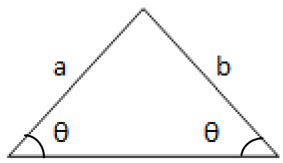
Area of triangle $A = \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

$$S = a+b+c / 2$$

Where a,b and c are the length of the three sides.

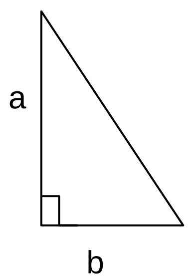
b. If the two sides and the included angles are known

Area of triangle $A = \frac{1}{2}\, ab \sin \theta$



$$\boxed{A = \tfrac{1}{2}\, a\, b \sin \theta}$$

c. If the length of the base and perpendiculars are known



Area of triangle A = ½ x base x perpendicular

$$\boxed{A = \tfrac{1}{2}\, b\, h}$$

b) Area of rectangular figure

Area A = Length x Breadth

A = L x B

Where, L = Length , B = Breadth

c) Area of the trapezoidal section

Area = (a + b) / 2 x h

Where, a = Top width , b = Bottom width , h = height

d) Area of parabola

If the segment is parabolic, its area can be determined from the formula.

Area, A = 2/3 x base x height

$$\boxed{A = {}^{2}/_{3} b\, h}$$

Some important units

1 plot	=	2400 sqft
1 cent	=	40.467 m^2
1 are	=	2.5 cents – 100m^2
1 Acre	=	100 cents
1 Hectare	=	10,000m^2

2.1.2 COMPUTATION OF AREAS OF IRREGULAR FIGURES

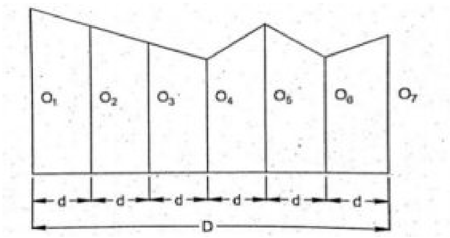
If the boundaries are irregular and curved, the area is determined by ordinates method. This method is suitable for long narrow strip, such as railway, roadway, drainage. Etc.,

A base line or survey line is taken through the area and divided into a number of equal parts. The offsets are measured from the boundary to the base line or a survey line at regular interval. The ordinates at each point of divisions are drawn and sealed. From these lengths and their common interval the area may be computed by the following rules.

1. The end ordinate rule
2. The mid ordinate rule
3. The average ordinate rule or mean ordinate rule
4. The trapezoidal rule
5. Simpson's rule

2.1.2.1 End ordinate rule

In end ordinate rule, the area enclosed by any two successive ordinates with the base line shown in fig.



The straight strip of land is divided in to number of ordinates in equal intervals from the base line or survey line.

Area = Common interval between the ordinates x Sum of all except the last one

$A = (d \times O_1) + (d \times O_2) + (d \times O_3) + (d \times O_4) + (d \times O_5) + (d \times O_6)$

$$\boxed{\mathbf{A = d\,(O_1 + O_2 + O_3 + O_4 + O_5 + O_6)}}$$

The last ordinate does not have horizontal distance. Hence the end ordinate has to be omitted.

2.1.2.2 Mid ordinate rule

In this method, the ordinates are measured at the mid-points of each division and the area is calculated by

Area = Common interval x sum of all mid ordinates

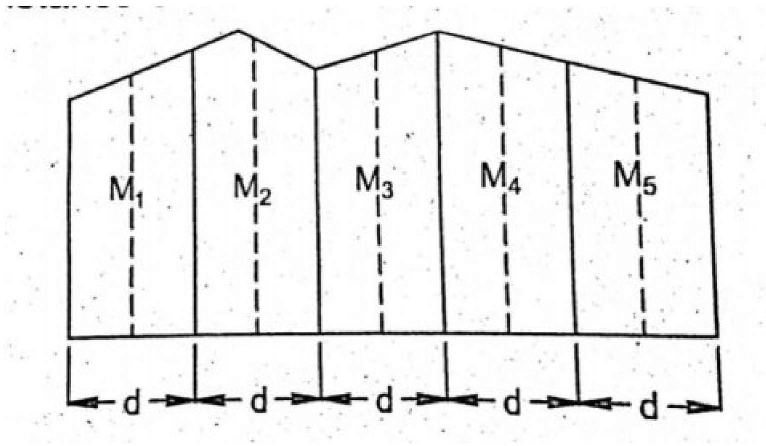
$A = M_1d + M_2d + M_3d + M_4d + M_5d$

$A = d\,(M_1 + M_2 + M_3 + M_4 + M_5)$

Where M_1, M_2,………. M_5 are mid ordinates

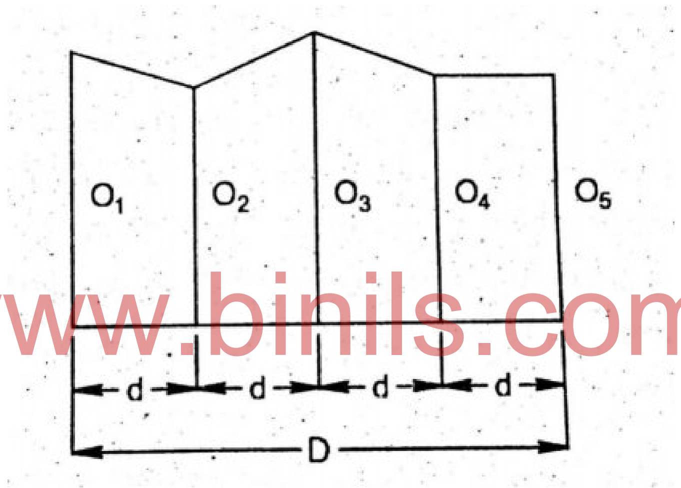
d= Common Interval between the mid ordinates

$$\boxed{\mathbf{A = d\,(M_1 + M_2 + M_3 + M_4 + M_5)}}$$



2.1.2.3 Average ordinate rule (or) Mean ordinate rule

In this method the length of average ordinate is determined and is used determine the area of the entire area. The fig. shown below.



$$A = \frac{Sum\ of\ all\ ordinates}{No\ of\ ordinates}\ X\ Total\ length\ of\ base\ lines$$

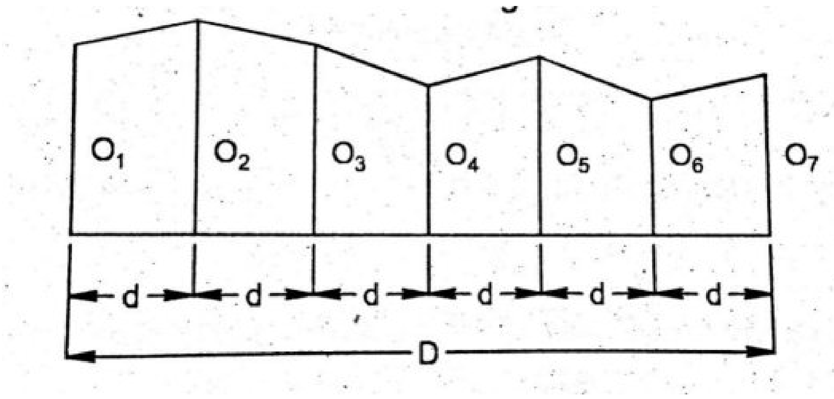
$$A = \frac{O_1+O_2+O_3+O_4+O_5}{5}\ X\ \ D$$

Where, O_1, O_2, O_3….. = The ordinates of each division

D = Total distance of base line

2.1.2.4 Trapezoidal rule

In this method the length of average ordinate is determined and is used to determine the area of the entire area. The fig. shown below.



The area of each trapezoidal is determined separately.

i.e.,

$$A = \frac{O_1 + O_2}{2}d + \frac{O_2 + O_3}{2}d + \frac{O_3 + O_4}{2}d + \frac{O_4 + O_5}{2}d + \frac{O_5 + O_6}{2}d + \frac{O_6 + O_7}{2}d$$

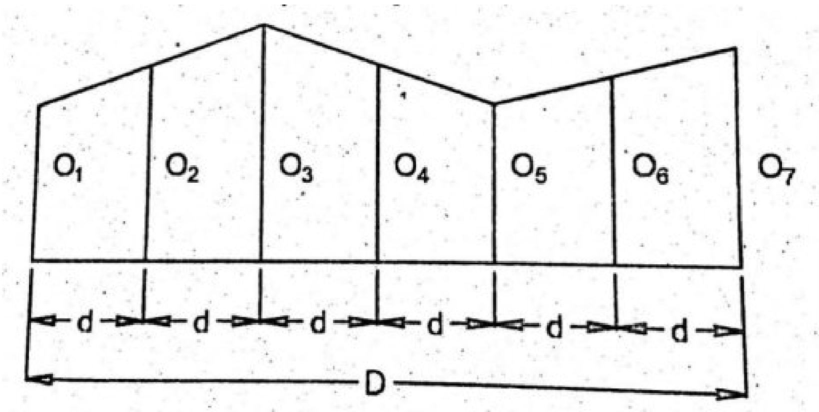
i.e., A =d $\left[\frac{O_1+O_7}{2} + O_2 + O_3 + O_4 + O_5 + O_6 \right]$

$$\textbf{Area, A} = \frac{d}{2}\ ((O_1 + O_7) + 2\,(O_2 + O_3 + O_4 + O_5 + O_6))$$

$$\textbf{Area, A} = \frac{common\ interval}{2}\ X\ ((Sum\ of\ first\ and\ last\ ordinates) + 2\,(Sum\ of\ all\ intermediate\ ordinates))$$

2.1.2.5 SIMPSON'S RULE

If the boundaries are curved, Simpson's rule is used to determine the area. This rule assumes the short lengths of boundary between the ordinates. This rule is applicable only when number of ordinates is odd. If there is an even number of ordinates, the area of the last division must be calculated separately. Then added to the equation.



Simpson's rule states that

To the sum of the first and last ordinates, add four times the sum of even ordinates and twice the sum of the odd ordinates, and multiply the total sum by one third the common interval distance 'd' to get the total area.

There fore Area

$$\textbf{Area, A} = \frac{\textit{common distance}}{3} \quad ((\textit{Sum of first and last ordinates}) + 2\,(\textit{Sum of odd odinates}) + 4\,(\textit{Sum of even ordinats}))$$

$$\textbf{Therefore A} = \frac{d}{3} \quad ((O_1 + O_7) + 2(O_3 + O_5) + 4\,(O_2 + O_4 + O_6))$$

The area obtained by Simpson's rule is more accurate than the trapezoidal rule.

PROBLEMS

1. The following offets were taken at 20 m interval from a survey line to an irregular boundary line 4.5m,4.3m ,6.5m,5.5m ,7.5m calculate the area by Simpson's rule

   Given data :

   Ordinate interval D = 20 m

   Ordinate points O_1=4.5m ,O_2=4.3m ,O_3=6.5m, O_4=5.5m, O_5=7.5m

   To find:

   To Calculate the area by Simpson's rule

   Solution :

$$\textbf{A} = \frac{\textit{common distance}}{3} \quad ((\textit{Sum of first and last ordinates}) + 2\,(\textit{Sum of odd odinates}) + 4\,(\textit{Sum of even ordinats}))$$

$$\mathrm{A} = \frac{d}{3} \quad ((O_1 + O_5) + 2(O_3) + 4\,(O_2 + O_4))$$

$$\mathrm{A} = \frac{20}{3} \quad ((4.5 + 7.5) + 2(6.50) + 4\,(4.3 + 5.5))$$

$$\mathrm{A} = \frac{20}{3} \quad (12 + 13 + 39.2)$$

$$\mathrm{A} = \frac{20}{3} \quad (64.2)$$

$$\mathrm{A} = 428 \text{ m}^2$$

Result :

Area by Simpson's rule is 428 m^2

2. The following ordinate were taken from a chain line to a hedge. Calculate the area by end ordinate rule.

Chainage (m)	0	5	10	15	20
Offset (m)	4	3	2.5	4.8	4.2

Given Date :

Common interval, d= 5 m

O_1 = 4 m, O_2 = 3 m, O_3 = 2.5 m, O_4 = 4.8 m, O_5 = 4.2 m.

To find:

To calculate the area by end ordicate rule

Solution :

A = Common Interval x (Sum of all ordinates except end ordinate)

$A = 5\ (O_1+O_2+O_3+O_4)$

$A = 5\ (4+3+2.5+4.8)$

$= 5(14.3)$

$A = 71.5\ m^2$

Result :

Area by using end ordinate rule is 71.5 m^2

3. A narrow strip of land 60 m long is divided into 6 equal dimensions of 10 m each and width are measured at the mid points of each divisions, as 5.0m 5.6m, 6.2m, 6.0m, 4.8m, and 4.4m. Determine the area of the land.

Given data :

Ordinate interval = 60 /6 = 10 m

Mid ordinate : O_{m1} = 5.0 m O_{m2} = 5.6 m O_{m3} = 6.2 m

O_{m4} = 6.0 m O_{m5} = 4.8 m O_{m6} = 4.4 m

To find:

To determine the area of the land.

Solution :

Area $A = d\ (O_{m1} + O_{m2+} O_{m3+}\ O_{m4} + O_{m5+} O_{m6})$

$= 10\ (5.0+5.6+6.2+6.0+4.8+4.4)$

$= 10\ (32)$

$A = 320\ m^2$

Result :

Area of the land is 320 m^2

4. A narrow strip of land 60 m long is divided into 6 equal division of 10 m each and the width are measured at the mid point of each division as 3.0m, 3.6m, 4.2m,4.0m,3.8m and 3.4m. Determine the area of the land.

Given data :

Length of strip = 60 m

No of divisions = 6

Common distance between ordinates = length of each division = 10 m

Mid ordinates : m_1 = 3.0 m, m_2 = 3.6m m_3 = 4.2m

m_4 = 4.0 m, m_5 = 3.8m m_6 = 3.4m

To find:

To Determine the area of the land.

Solution:

Area = Common distance x sum of all mid ordinates

= 10(3.0+3.6+4.2+4.0+3.8+3.4)

= **220 m^2**

Result :

Area of the land is 220 m^2

5. The following offsets were taken at 15m intervals from a survey line to an irregular bound, any line: 3.50, 4.30, 6.75, 5.25, 7.50, 8.80, 7.90, 6.40, 4.40, 3.25m. Calculate the area by trapezoidal rule.

Given data :

Ordinate interval d = 15 m

O_1 = 3.5 m, O_2 = 4.30 m, O_3 = 6.75 m, O_4 = 5.25 m, O_5 = 7.50 m, O_6 = 8.80 m, O_7 = 7.90 m, O_8 = 6.40 m, O_9 = 4.40 m, O_{10} = 3.25 m

To find:

To calculate the area by trapezoidal rule

Solution :

Trapezoidal rule

$$A = \frac{d}{2}\left((O_1 + O_{10}) + 2(O_2 + O3 + O_4 + O_5 + O_6 + O_7 + O_8 + O_9)\right)$$

$$A=\frac{15}{2}\left((3.5 + 3.25) + 2(4.30 + 6.75 + 5.25 + 7.50 + 8.80 + 7.90 + 6.40+4.40)\right.$$

$$A = \frac{15}{2}(6.75 + 2(51.3))$$

$$A = \frac{15}{2}(109.35)$$

A = 820.125 m^2

Result :

Area by trapezoidal rule is 820.125 m^2

6. A series of offset was taken from a chain line to a curved boundary line at intervals of 10m. The length of the offsets are,0 m, 2.68m, 3.64m, 3.70m, 4.60m, 3.62m, 4.84m and 5.74m. Compute the area of the strip between the chain line and boundary line by using trapezoidal rule.

Given data :

Ordinate interval = 10m

O_1 = 0 m, O_2 = 2.68 m, O_3 = 3.64 m, O_4 = 3.70 m, O_5 = 4.60 m,

O_6 = 3.62 m, O_7 = 4.84 m, O_8 = 5.74 m

To find:

To calculate the area of the strip between the chain line and boundary line by using trapezoidal rule

Solution :

Area, A = $\frac{\mathbf{d}}{\mathbf{2}}\left(\left(\boldsymbol{O_1}+\boldsymbol{O_7}\right)+\mathbf{2}\left(\boldsymbol{O_2}+\boldsymbol{O_3}+\boldsymbol{O_4}+\boldsymbol{O_5}+\boldsymbol{O_6}\right)\right)$

A = $\frac{10}{2}\left((0+5.74)+2(2.68+3.64+3.70+4.60+3.62+4.84)\right)$

A = $\frac{10}{2}\left((5.74)+2(23.08)\right)$

A = $\frac{10}{2}\left((51.90)\right)$

A = 259.50 m^2

Result :

Area by trapezoidal rule is 259.5 m^2

7. The following perpendicular offsets were taken at 5 m intervals from a traverse line to an irregular boundary line 2.10m, 3.15m, 4.50m,3.6m 4.58m, 7.85m, 6.45m, 4.65m, 3.14m. Compute the area of the irregular boundary using (i) Average ordinate rule (ii) Trapezoidal rule (iii) Simpson's rule

Given data :

Offset distance d = 5m, n = 8

Total Distance D = 8 X 5 = 40 m

Offsets : O_1 = 2.10m, O_2 = 3.15m, O_3 = 4.50m, O_4 = 3.60m, O_5 = 4.58m

O_6 = 7.85m, O_7 = 6.45m, O_8 = 4.65m, O_9 = 3.14m

To find :

Area of the irregular boundary using

(i) Average ordinate rule

(ii) Trapezoidal rule

(iii) **Simpson's rule**

Solution :

i) Average ordinate rule

$$\mathbf{A = \frac{O_1+O_2+O_3+O_4+O_5+O_6+O_7+O_8+O_9}{9} \; X \; D}$$

$$A = \frac{2.10+3.15+4.50+3.60+4.58+7.85+6.45+4.65+3.14}{9} \; X \; 40$$

$$= \frac{\mathbf{40}}{\mathbf{9}} \; (2.10 + 3.15 + 4.50 + 3.60 + 4.58 + 7.85 + 6.45 + 4.65 + 3.14)$$

$$= \frac{\mathbf{40}}{\mathbf{9}} \; (\mathbf{40.02})$$

A = 177.87 m^2

ii) Trapezoidal rule

$$A = \frac{\boldsymbol{d}}{\mathbf{2}} \; ((\boldsymbol{O_1} + \boldsymbol{O_9}) + \; \mathbf{2} \; (\boldsymbol{O_2} + \boldsymbol{O_3} + \boldsymbol{O_4} + \boldsymbol{O_5} + \boldsymbol{O_6} + \boldsymbol{O_7} + \boldsymbol{O_8}))$$

$$A = \frac{5}{2} \; ((2.10 + 3.14) + \; 2 \; (3.15 + 4.5 + 3.6 + 4.58 + 7.85 + 6.45 + 4.65))$$

$$A = \frac{5}{2} \; ((5.24) + \; (69.56))$$

= 2.5 (74.8) = 187 m^2

A = 187 m^2

ii) Simpson's rule

$$A = \frac{d}{3} ((O_1 + O_9) + 2(O_3 + O_5 + O_7) + 4(O_2 + O_4 + O_6 + O_8))$$

$$A = \frac{5}{3} ((2.10 + 3.14) + 2(4.5 + 4.58 + 6.45) + 4(3.15 + 3.60 + 7.85 + 4.65))$$

$A = \frac{\mathbf{5}}{\mathbf{3}} ((5.24) + 31.06 + 77))$ **= 188.83 m^2**

A = 188.83 m^2

Result :

i)	Area by average ordinate rule	=	**177.87 m^2**
ii)	Area by Trapezoidal rule	=	**187 m^2**
iii)	Area by Simpson's rule	=	**188.83 m^2**

8. A series of offsets were taken from a chain line to a curved boundary line at a regular interval of 5 metres. The lengths of the offsets are 2m, 1.6m, 2.6m, 2.2m, 2.8m, 3.8m, 3.6m, 3.4m, and 3.6m. Compute the area of the strip between chain line and boundary line by all the available methods and compare the results.

Given data:

Common distance, between ordinates, d = 5m

Ordinates, O_1 = 2.0m, O_2 = 1.6m, O_3 = 2.6m, O_4 = 2.2m, O_5 = 2.8m

O_6 = 3.8m, O_7 = 3.6m, O_8 = 3.4m, O_9 = 3.6m

Total length of chain line, L = 8 x 5 = 40m

To find

To Compute the area of the strip between chain line and boundary line

Soultion:

(i) Area by end ordinate rule.

A = d (O_1 + O_2 + O_3 + O_4 + O_5 + O_6+ O_7 + O_8)

A = 5 (2.0 + 1.6 + 2.6 + 2.2 + 2.8 + 3.8 + 3.6 + 3.4)

A = 5 x 22.0

A = 110 m^2

(ii) Area by mean ordinate rule

$$\mathbf{A = A = \frac{O_1+O_2+O_3+O_4+O_5+O_6+O_7+O_8+O_9}{9}\ \mathit{X}\ \mathit{D}}$$

$$A = \frac{2.0+1.6+2.6+2.2+2.8+3.8+3.6+3.4+3.6}{9}\ X\ 40$$

$$A = \frac{25.6}{9}\ X\ 40$$

A = 113.78 m^2

(iii) Area by Trapezoidal rule

$$\mathbf{A = \frac{d}{2}\ ((O_1 + O_9) + 2\,(O_2 + O_3 + O_4 + O_5 + O_6 + O_7 + O_8))}$$

$$A = \frac{5}{2}\ ((2 + 3.6)) + 2\,(1.6 + 2.6 + 2.2 + 2.8 + 3.8 + 3.6 + 3.4)))$$

$$A = \frac{5}{2}\ (5.6 + 40))$$

A = 114 m^2

(iv) Area of Simpson's rule

$$\mathbf{A} = \frac{d}{3}\ ((O_1 + O_9) + 2(O_3 + O_5 + O_7) + 4(O_2 + O_4 + O_6 + O_8))$$

$$A = \frac{5}{3}\ ((2.0 + 3.6) + 2(2.6 + 2.8 + 3.6) + 4(1.6 + 2.2 + 3.8 + 3.4))$$

$$A = \frac{5}{3}\ ((5.6 + 18.0 + 44.0))$$

A = 112.67 m^2

Result:

Area of the strip by end ordinate rule	=	$110 m^2$
Area by mean ordinate rule	=	$113.78 m^2$
Area by trapezoidal rule	=	$114 m^2$
Area by Simpson's rule	=	$112.67 m^2$

Note: Area cannot be computed by mid ordinate rule, since the mid-ordinates were not measured.

9. The following details refer to the offsets taken from a chain line of a land survey to a hedge. Calculate the area impounded between the chain line and hedge by using (i) Average ordinate rule (ii) Trapezoidal rule (iii) Simpson's rule

Chainage (m)	0	25	50	100	150	200	250	275	300
Offsets(m)	5.0	3.5	2.0	3.0	3.6	3.8	3.5	4.0	3.0

In this problem, it should be noted that the ordinates are not measured at uniform intervals throughout. They are measured at 25 m intervals for the first 50 m length, at 50 m intervals for the next 200 m length and again at 25 m intervals for the remaining 50m length. Hence the entire length of 300 m is considered as three separate portions of 50 m, 200 m, and 50 m length respectively for calculation of area.

Given data:

$O_1 = 5m$, $O_2 = 3.5m$, $O_3 = 2m$, $O_4 = 3m$, $O_5 = 3.6m$, $O_6 = 3.8m$, $O_7 = 3.5m$, $O_8 = 4m$, $O_9 = 3m$

To find

To calculate the area impounded between the chain line and hedge

Solution

i) Area by average ordinate rule

$$\mathbf{A} = \frac{\textit{Sum of all ordinates}}{\textit{No of ordinates}} \; X \; \textit{Total length of base lines}$$

$$A = \frac{5.0+3.5+2.0}{3} \, x \, 50 + \frac{2.0+3.0+3.6+3.8+3.5}{5} \, x \, 200 + \frac{3.5+4.0+3.0}{3} \, x \, 50$$

= 175 + 636 +175

A = 986 m^2

ii) Area by Trapezoidal rule

$$\mathbf{A} = \frac{d}{2}\left(((O_1 + O_3) + 2(O_2)\right) + \frac{d}{2}\left((O_3 + O_7) + 2(O_4 + O_5 + O_6)\right) + \frac{d}{2}\left((O_7 + O_9) + 2(O_6)\right)$$

$$A = \frac{25}{2}\left((5.0 + 2.0) + 2(3.5)\right) + \frac{50}{2}\left((2.0 + 3.5) + 2(3.0 + 3.6 + 3.8)\right) + \frac{25}{2}\left((3.5 + 3.0 + 2(4.0)\right)$$

$= \frac{25}{2}\ (14) + \frac{50}{2}\ (26.3) + \frac{25}{2}\ (14.5)$

= 175 +657.5 +181.25

A = 1013.75 m^2

iii) Area by simpson's rule

$A = \frac{d}{3}((O1+O3)+4(O2)) + \frac{d2}{3}((O3+O7)+2(O5)+4(O4+O6)) + \frac{d3}{3}((O7+O9)+4(O8))$

$A = \frac{25}{3}\ (5.0+2.0+4(3.5)) + \frac{50}{3}\ ((2.0+3.5)+2(3.6))+4(3.0+3.8)) + \frac{25}{3}\ (3.5+3.0+4(4.0))$

$A = \frac{25}{3}\ X(21) + \frac{50}{3}\ X\ (39.9) + \frac{25}{3}\ X\ (22.5)$

= 175 +665 +187.5

A = 1027.5 m^2

Result:

i) Area by average ordinate rule = 986 m^2

ii) Area by Trapezoidal rule = 1013.75 m^2

iii) Area by Simpson's rule = 1027.5 m^2

10.A chain line was run along the entire length of a narrow strip of land and perpendicular offsets were taken to the boundaries on either side of the chain line at regular intervals. The measured values are given below. Determine the area of the strip of land by a suitable formula:

Chainage (m)	0	20	40	60	80	100	120	140
Offset to right (m)	9	6	12	13	11	10	6	5
Offset to left (m)	9	8	10	9	12	8	7	5

Simpson's rule cannot be applied as such since the number of ordinates is even (8). Hence the area is determined by applying trapezoidal rule.

The area left to the chain and right to the chain can be calculated separately and added together to get the total area (or) the total area can be directly determined by applying the total lengths of offsets at each chainage, in the rule.

Solution :

By Trapezoidal rule,

Area to the left of chain

$$\mathbf{A = \frac{d}{2}\ ((O_1+O_8) + 2\ (O_2+O_3+O_4+O_5+O_6+O_7))}$$

$$A = \frac{20}{2}\ ((9+5) + 2\ (8+10+9+12+8+7))$$

= 10 (14 + 108)

= 1220 m^2

Area to the Right of chain

$$\mathbf{A} = \frac{\boldsymbol{d}}{\mathbf{2}} \left((\boldsymbol{O_1} + \boldsymbol{O_8}) + \mathbf{2}\,(\boldsymbol{O_2} + \boldsymbol{O_3} + \boldsymbol{O_4} + \boldsymbol{O_5} + \boldsymbol{O_6} + \boldsymbol{O_7}) \right)$$

$$\mathrm{A} = \frac{20}{2} \left((9 + 5) + 2\,(6 + 12 + 13 + 11 + 10 + 6) \right)$$

= 10 (14 + 116)

= 1300 m^2

Total area of the strip is A = 1220 + 1300 = 2520 m^2

A = 2520 m^2

Alternate method :

Chainage (m)	0	20	40	60	80	100	120	140
Total offset	18	14	22	22	23	18	13	10

By, Trapezoidal Rule

$$\mathbf{A} = \frac{\boldsymbol{d}}{\mathbf{2}} \left((\boldsymbol{O_1} + \boldsymbol{O_8}) + \mathbf{2}\,(\boldsymbol{O_2} + \boldsymbol{O_3} + \boldsymbol{O_4} + \boldsymbol{O_5} + \boldsymbol{O_6} + \boldsymbol{O_7}) \right)$$

$$\mathrm{A} = \frac{20}{2} \left((18 + 10) + 2\,(14 + 22 + 22 + 23 + 18 + 13) \right)$$

= $\frac{20}{2}$ (28+224) = $\frac{20}{2}$ (252)

= 2520 m^2

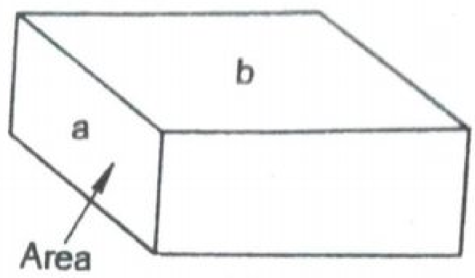
Result :

Area of the narrow strip of land is 2520 m^2.

2.1.4 Volumes of regular and irregular solids

The volume of simple solids can be determined from the formula of solid geometry.

1. **Prism**



(a)

A prism is a regular solid whose two end faces are identical and parallel. The prism fig is shown below. The volume of the prism is given by

V = A x L

Where, A = Area of the end face

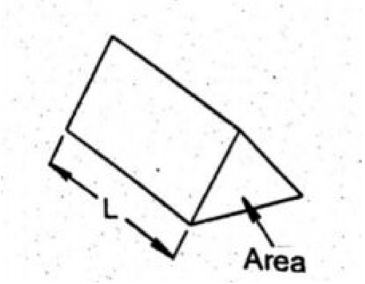
L = Length of the prism

2. Wedge

The volume of the wedge is given by

$$V = \frac{L}{6}(\textit{Sum of parallel edge}) x\ height$$

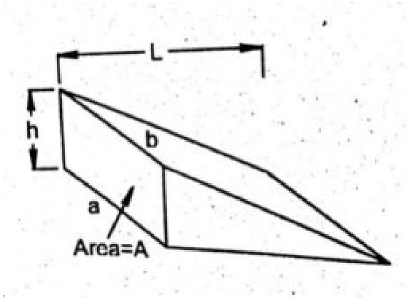
$$= \frac{L}{6}(a + b + c)\ X\ h$$



If a = b = c

i.e., $V = \frac{L}{6}(3a)\ h \quad = \frac{L}{2}(a \times h)$

i.e., $V = \frac{AL}{2}$



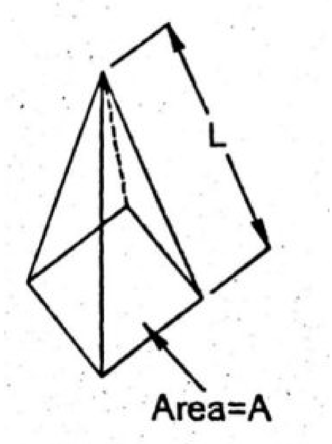
3. Pyramid

Fig shows a pyramid the volume of the pyramid is given by

$$V = \frac{A\ X\ L}{3}$$

Where A = Area of the base

L = Height of the pyramid



2.1.5 Computation of volumes of irregular solids

The computation of volumes of various quantities is done after computing the areas of various cross sections.

Volume = cross sectional area x length

The volume of regular and irregular solids like earth work for canal in cutting is determined by measuring the area of cross sections at regular intervals and applying any one of the following rules.

1. End area rule
2. Mid area rule
3. Average area or Mean area rule
4. Trapezoidal rule
5. Simpson's or Prismoidal rule.

1. End area rule

This is one of the approximate methods.

Volume

V = (Sum of all areas of cross section except last one) x Common interval

V = d ($A_1 + A_2 + A_3 + \ldots\ldots\ldots\ A_{n-1}$)

2. Mid area rule

Volume

V = Common interval X (Sum of all mid sectional area)

V = d ($Am_1 + Am_2 + Am_3 + \ldots\ldots\ldots\ A_{m-1}$)

3. Average area or Mean area rule

The mean area method is an approximate method. It is rarely used in practice volume is computed by multiplying the mean cross sectional area with the total length of the base line.

Volume

V = mean cross sectional area x Total base length

$$V = \frac{A_1+A_2+A_3+\cdots\ldots An}{n} \; X\, L$$

n = number of cross sections

L = Total length

4. Trapezoidal rule

The trapezoidal rule gives correct volume of a solid. It gives fairly good result.

Volume

$$\text{Volume } V = \frac{\text{common interval}}{2}\left((\text{Sum of areas in first and last section}) + 2\,(\text{Sum of areas of all other sections})\right)$$

$$V = \frac{d}{2}\left((A_1 + A_n) + 2\,(A_2 + A_3 + A_4 \ldots\ldots\ldots A_{n-1})\right)$$

5. Prismoidal rule

The prismoidal rule can be applied to determine the volume of earth work. This rule is similar to Simpson's rule for volumes.

The prismoidal formula is applicable only when the number (n) of sections is an odd number. when 'n' is an even number the end area may be calculated separately and added to the volume computed by prismaoidal formula. The volume obtained by the trapezoidal rule is always greater than that obtained by the prismoidal formula.

$$V = \frac{\text{common interval}}{3}\left((\text{Sum of first and last section area}) + 2\,(\text{Sum of all odd area}) + 4\,(\text{Sum of all even area})\right)$$

$$V = \frac{d}{3}\left((A_1 + A_n) + 2\,(A_3 + A_5 + \ldots\ldots.) + 4\,(A_2 + A_4 + A_6 + \cdots)\right)$$

Where, d = Common interval

$A_1, A_2, A_3 \ldots A_n$ = Cross sectional area

n = Number of cross section

Problems :

1. The details of a contour survey on a pond are as follows

Contour level (m)	+75	+76	+77	+78	+79
Plan area enclosed by the contour line (m^2)	0	106	236	442	520

This pond is to be filled by earth upto a level of +79. Determine the volume of earth work in filling by prismoidal rule.

Given data :

Common Interval = 1m

$A_1 = 0$, $A_2 = 106$, $A_3 = 236$, $A_4 = 442$, $A_5 = 520$

To find :

To determine the volume of earth work by prismoidal rule

Solution :

Prismoidal Rule

$$\mathbf{V} = \frac{d}{3}\ ((A_1 + A_5) + \mathbf{2}\,(A_3) + \mathbf{4}\,(A_2 + A_4))$$

$$V = \frac{1}{3}\ ((0 + 520) + 2\,(236) + 4\,(106 + 442))$$

$$V = \frac{1}{3}\ (520 + 472 + 2192)$$

$$V = \frac{1}{3}\ (3184)$$

$$\mathbf{V = 1061.33\ m^3}$$

Result :

Volume obtained by primoidal rule is 1061.33 m^3

2. Calculate the volume of the earth of an embankment using prismoidal formula and trapezeoidal formula and compare the result. The length of embankment of which the cross – section area at 50 m interval are as follows.

Chainage (m)	0	50	100	150	200	250	300
area (m^2)	110	425	640	726	726	1790	2690

Given data :

Common Interval = 50 m

A_1 = 110m^2, A_2 = 425 m^2, A_3 = 640 m^2, A_4 = 726 m^2, A_5 = 726 m^2,

A_6 = 1790 m^2, A_7 = 2690 m^2

To find :

To calculate the volume of earth by prismoidal formula and trapezeoidal formula

Solution :

Prismoidal Rule

$$\mathbf{V} = \frac{\boldsymbol{d}}{\mathbf{3}} \left((\boldsymbol{A_1} + \boldsymbol{A_7}) + \mathbf{2}\,(\boldsymbol{A_3} + \boldsymbol{A_5}) + \mathbf{4}\,(\boldsymbol{A_2} + \boldsymbol{A_4} + \boldsymbol{A_6})\right)$$

$$\mathrm{V} = \frac{50}{3} \left((110 + 2690) + 2\,(640 + 726) + 4\,(425 + 726 + 1790)\right)$$

$$\mathrm{V} = \frac{50}{3} (2800 + 2732 + 11764)$$

$$\mathrm{V} = \frac{50}{3} (17296)$$

$$\mathbf{V = 2,88,266.67\ m^3}$$

Trapezoidal rule

$$\mathbf{V} = \frac{\boldsymbol{d}}{\mathbf{2}} \left((\boldsymbol{A_1} + \boldsymbol{A_n}) + \mathbf{2}\,(\boldsymbol{A_2} + \boldsymbol{A_3} + \boldsymbol{A_4} \ldots\ldots\ldots + \boldsymbol{A_{n-1}})\right)$$

$$\mathrm{V} = \frac{50}{2} \left((110 + 2690) + 2\,(425 + 640 + 726 + 726 + 1790)\right)$$

$$\mathrm{V} = \frac{50}{2} \left((2800) + (8614)\right)$$

$$\mathrm{V} = \frac{50}{2} (11{,}414)$$

$$\mathbf{V = 2,85,350\ m^3}$$

Result :

Volume V = $\mathbf{2,88,266.67\ m^3}$ **(BY PRISMOIDAL RULE)**

Volume V = $\mathbf{2,85,350\ m^3}$**(BY TRAPEZOIDAL RULE)**

From the result obtained from both the methods it is observed that volume obtained by trapezoidal rule is less than the prismoidal rule.

3. The reservoir has the following water spread areas at the respective contour levels. The full tank level of the reservoir is +160 m. compute the capacity of the reservoir by prismoidal rule.

Contour level (m)	+120	+130	+140	+150	+160
Contour area (m^2)	0	1240	2680	5260	9420

Given data :

Common Interval = 10m

$A_1 = 0$, $A_2 = 1240$, A3 = 2680, $A_4 = 5260$, $A_5 = 9420$

To find :

To calculate the capacity of the reservoir by prismoidal rule.

Solution :

Prismoidal Rule

$$\mathbf{V} = \frac{\boldsymbol{d}}{\mathbf{3}}\ ((\boldsymbol{A_1} + \boldsymbol{A_5}) + \mathbf{2}\ (\boldsymbol{A_3}) + \mathbf{4}\ (\boldsymbol{A_2} + \boldsymbol{A_4}))$$

$$\mathrm{V} = \frac{10}{3}\ ((0 + 9420) + 2\ (2680) + 4\ (1240 + 5260))$$

$$\mathrm{V} = \frac{10}{3}\ (9420 + 5360 + 26000)$$

$$\mathrm{V} = \frac{10}{3}\ (40{,}780)$$

$$\mathbf{V = 13{,}593.33\ m^3}$$

Result :

The Capacity of the reservoir by prismoidal rule is $\mathbf{13{,}593.33 m^3}$

4. A tank excavated in a level ground to a depth of 8m with uniform side slopes. The top of the tank at ground level is rectangular in shape of size 40 x 20 m. while the bottom is of size 24 x 12 m. compute the volume of earthwork by

   (i) Mid area method (ii) Trapezoidal rule (iii) Prismoidal rule.

Given data :

Size of tank at top	= 40 x 20 m		
Size of tank at bottom	= 24 x 12 m		
Size of tank at mid portion	= 32 x 16 m		
Top area	= 40 x 20	=	800 m^2
Bottom area	= 24 x 12	=	288 m^2

$$A_m = \frac{800+288}{2} = 544\ m^2$$

To find :

To calculate the volume of earth by Mid area method, Trapezoidal rule, and Prismoidal rule.

Solution :

i) Volume by mid area method

$V = d(A_m) = 8 \times 544 = 4352\ m^3$

ii) Volume by trapezoidal rule

$$V = \frac{d}{2}(800 + 288)$$

$$V = \frac{8}{2}(800 + 288)$$

$V = 4352\ m^3$

iii) Volume by prismoidal rule

$$V = \frac{4}{3}\left((800 + 288) + 4(544)\right)$$

$= 4352\ m^3$

Result :

i) Volume by mid area method is $4352\ m^3$

ii) Volume by trapezoidal rule is $4352\ m^3$

iii) Volume by prismoidal rule is $4352\ m^3$

5. Using prismoidal rule, find the volume of earthwork from the measurements given below. Compare the results using (i) Prismoidal rule (ii) Trapezoidal rule.

Chainage (m)	0	30	60	90	120	150
area (m^2)	38	94	106	95.5	20	18

Given data :

Common interval = 30 m

$A_1 = 38\ m^2$, $A_2 = 94\ m^2$, $A_3 = 106\ m^2$,

$A_4 = 95.5\ m^2$, $A_5 = 20\ m^2$, $A_6 = 18\ m^2$,

To Find :

To calculate the volume of earthwork.

Solution :

Note : since the number of areas is even i.e., 6, the volume between first and fifth area is calculated by prismoidal rule. The volume of the last division is calculated by trapezoidal rule and is added.

i) **Volume by prismoidal rule**

$$\mathbf{V} = \frac{d}{3}\left((A_1 + A_5) + 2\,(A_3) + 4\,(A_2 + A_4)\right) + \frac{d}{2}\left((A_5 + A_6)\right)$$

$$V = \frac{30}{3}\left((38 + 20) + 2\,(106) + 4\,(94 + 95.5)\right) + \frac{30}{2}\left((20 + 18)\right)$$

$$V = \frac{30}{3}\left((58 + 212 + (758)\right) + \frac{30}{2}(38)$$

$$V = 10280 + 570 = 10850 \text{ m}^3$$

ii) **Trapezoidal rule**

$$\text{Volume V} = \frac{d}{2}\left((A1 + A6) + 2(A2 + A3 + A4 + A5)\right)$$

$$V = \frac{30}{2}\left((38 + 18) + 2(94 + 106 + 95.5 + 20)\right)$$

$$V = 15\,(56 + 2(315.5))$$

$$V = 15 \text{ X } 687 = 10305 \text{ m}^3$$

Result :

i) Volume by prismoidal rule is 10850 m^3

ii) Volume by Trapezoidal rule is 10305 m^3

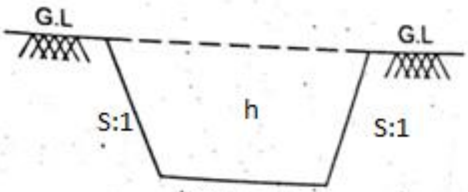
2.2 EMBANKMENTS AND CUTTINGS

2.2.1 Areas of cross sections of embankments of roads, tank bunds etc .

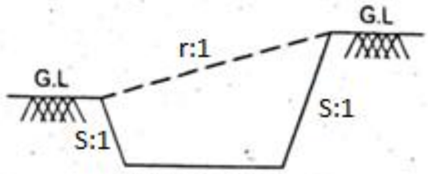
In order to determine the volume of earth work, the cross section are taken at right angles to a centre line. The fixed centre line runs longitudinal through the earth work. The spacing of the cross section will depend upon the accuracy required. It also depends upon the character of the ground. The volume of earth work between successive sections is determined from the area of various cross sections.

The method of the computation of the cross sectional area will depend upon the type of cross section. The following types of cross sections are generally in use

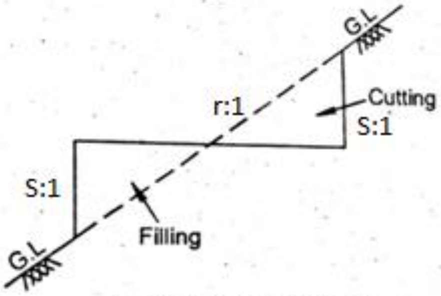
1. Level section
2. Two level section
3. Sidehill two-level section
4. Three level section
5. multi-level section



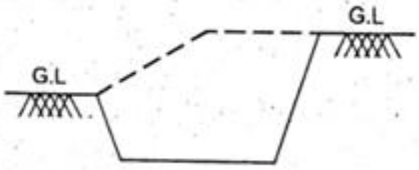
Level section



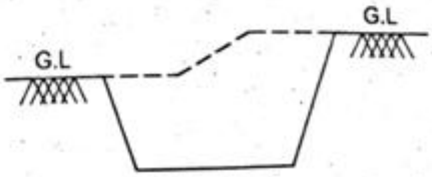
Two level section



Side hill two level section



Three level section



Multi level section

2.2.2 Level section

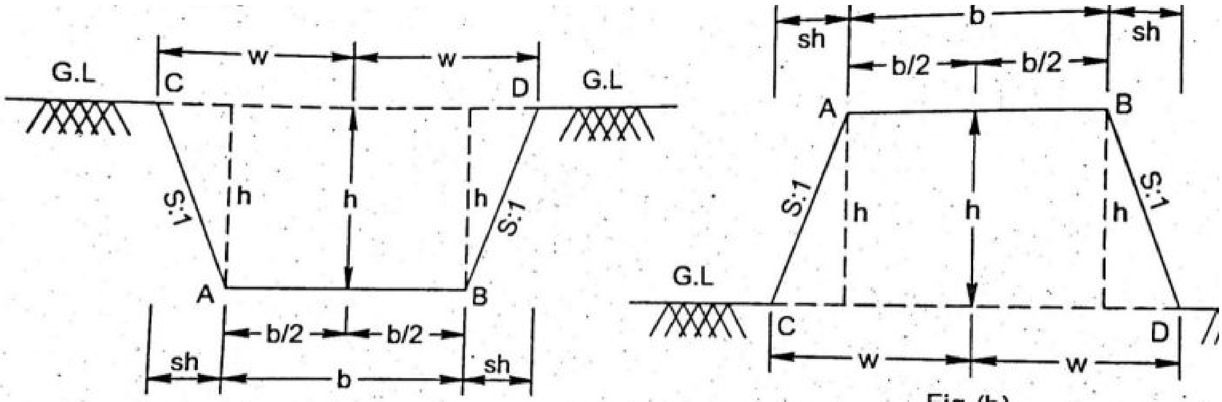


Fig (a) Fig (b)

Fig (a) shows a level section in cutting. Fig (b) shows a level section in filling. Level section, the ground surface is level, and hence there is no cross-fall or transverse gradient relative to the centre line.

The two side width W1 and W2 measured from the centre line to the points of intersection of the side slopes with the original ground surface.

$$W1 = W2 = W$$

Let the side slopes be S:1, i.e., ‘s’ horizontal to one vertical.

Now $$W = \frac{b}{2} + Sh$$

$$W = \frac{b+Sh}{2}$$

$$2W = b + 2Sh$$

Area of cross section $$= \frac{Top\ width+Bottom\ width}{2}\ x\ height$$

Area of cross section A $$= \frac{(2W+b)}{2} \text{ X h}$$

$$= \frac{b+2Sh+b}{2} \text{ X h}$$

$$A = \frac{2(b+Sh)}{2} \text{ X h}$$

A = (b + Sh) h

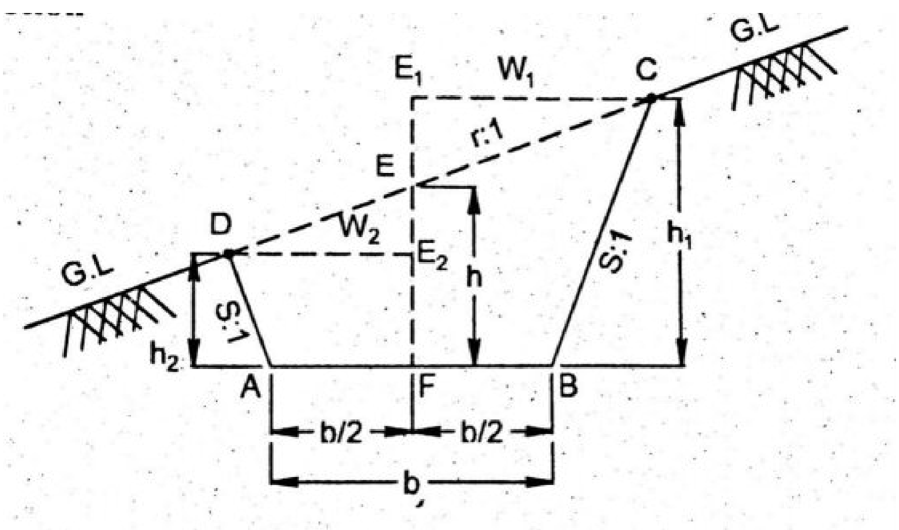
Where b = formation width

H = depth of cutting on the centre line

S = Side slope

A = (b + Sh) h this equation is applicably for both embankment and cutting.

2.2.3. Two level section



In this case, the ground is sloping transverse direction. But the slope of the ground does not cut the formation level. The section in which there is a cross fall of the ground surface relative to the centre line is called two – level section.

Transverse slope of ground = r : 1 (‘r’ horizontal, 1 vertical)

Side slope of cutting = S:1

Depth of cutting at centre of base width = h

W1 $= EE_1r$ -- (1)

W1 $= \frac{b}{2} + FE_1S$

$= \frac{b}{2} + (FE + EE_1)S$

W1 $= \frac{b}{2} + (h + EE_1)S$

W1 $= \frac{b}{2} + hs + EE_1S$ -- (2)

Equating (1) and (2)

$EE_1r = \frac{b}{2} + hs + EE_1S$

$EE_1r - EE_1S = \frac{b}{2} + hs$

$EE_1 (r - S) = \frac{b}{2} + hs$

$EE_1 = \frac{b}{2} + hs$

$$EE_1 = \frac{1}{(r-S)}\ x\ \left\{\frac{b}{2} + hs\right\}$$

From equation (1)

$$W_1 = \frac{r}{(r-S)}\ x\ \left\{\frac{b}{2} + hs\right\} \quad \text{----------------------------------} \ (3)$$

Similarly,

$$W_2 = \frac{r}{(r+S)}\ x\ \left\{\frac{b}{2} + hs\right\} \quad \text{----------------------------------} \ (4)$$

$$h_1 = h + \frac{W1}{r} = \left\{\frac{r}{r-s}\right\}\left\{h + \frac{b}{2r}\right\}$$

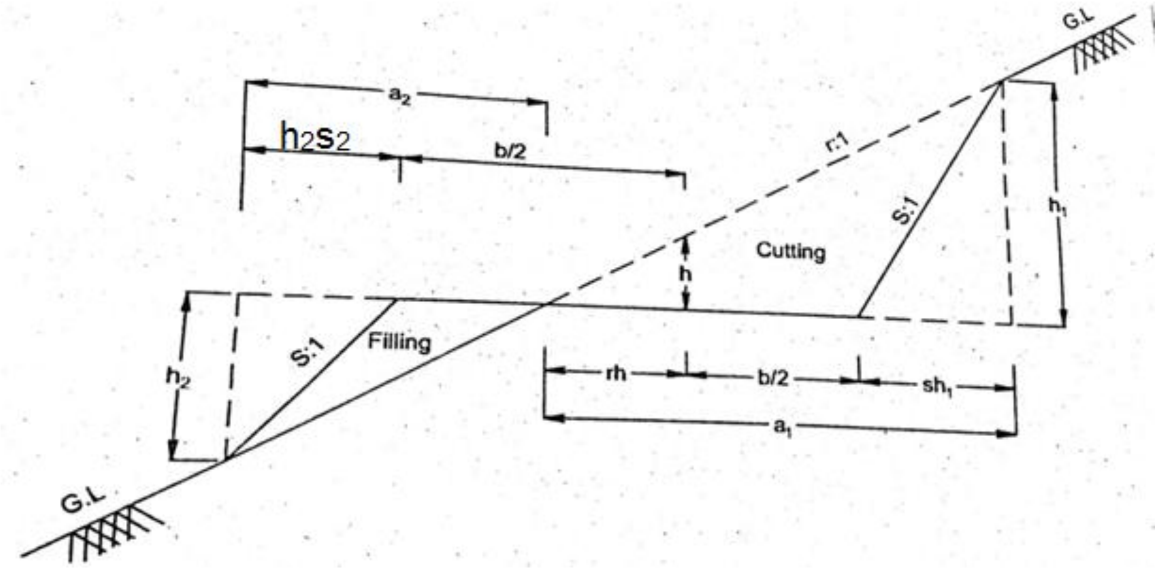
$$h_2 = h - \frac{W1}{r} = \left\{\frac{r}{r+s}\right\}\left\{\frac{h-b}{2r}\right\}$$

$$\text{Area, A} = \frac{1}{2}\left\{(W1 + W2)\left\{h + \frac{b}{2S}\right\} - \frac{b^2}{2S}\right\}$$

$$\boxed{A = \frac{S\left(\frac{b}{2}\right)^2 + r^2\,bh + r^2\,Sh^2}{(r^2 - S^2)}}$$

2.2.4 Side hill two level section

In this case ground is sloping transversely and the slope of ground cuts the formation level in such a way that one portion of the area is in cutting and the other in embankment as shown in fig.



Formation width	= b
Depth of cutting at the centre of formation width	= h
Transverse slope of ground	= r: 1
Side slope of cutting	= S_1:1
Side slope of filling	= S_2: 1
Top width of cutting	= a1
Bottom width of filling	= a2
Maximum depth of cutting	= h1
Maximum depth of filling	= h2

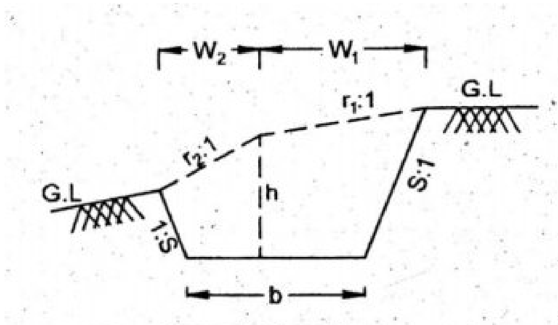
Sectional area of cutting portion = $\frac{1}{2(r-s1)}\left\{\frac{b}{2}+rh\right\}^2$

Sectional area of filling portion = $\frac{1}{2(r-s1)}\left\{\frac{b}{2}-rh\right\}^2$

2.2.5 Three level section

In three level section the transverse section of ground is different i.e., r_1: 1, r_2:2.

To find the area by using formula as given below.



Three level section

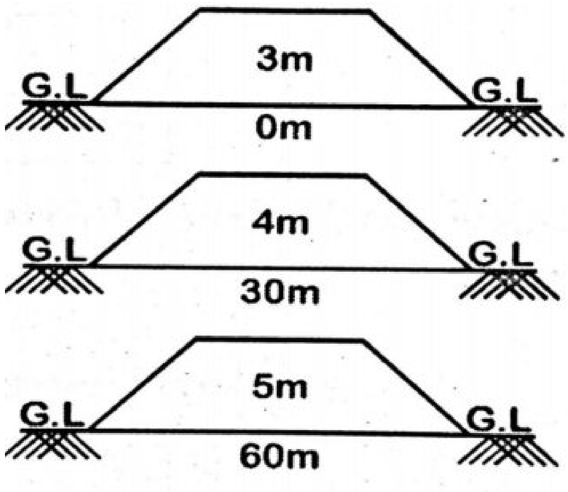
$$W_1 = \frac{r_1}{(r_1 - S)}\ x\ \left\{\frac{b}{2} + hs\right\}$$

$$W_2 = \frac{r_2}{(r_2 + S)}\ x\ \left\{\frac{b}{2} + hs\right\}$$

$$\boxed{A = \frac{h}{2}\left(W_1 + W_2 + b\right) + \frac{b}{4}\left\{\frac{w_1}{r_1} + \frac{w_2}{r_2}\right\}}$$

Problems :

1. The height of an embankment of formation width 10 m side slopes 1.5 :1 are found to be 3m, 4m ,and 5 m at 0m,30m,and 60m chainages respectively as shown in fig... Determine the volume of the bank in this 60m length by prismoidal formula assuming the ground as level in the transverse direction.



Given data :

Common interval	= 30 m
Formation width b	= 10 m
Height of embankment h_1	= 3.0 m
Height of embankment h_2	= 4.0 m

Heigth of embankment h_3 = 5.0 m

Side slope S = 1.5

To Find :

To determine the volume of the bank.

Solution :

For level section area **A = h (b + Sh)**

$A_1 = h_1 (b + Sh_1)$

$= 3(10 + (1.5 \times 3.0)) = 3(10 + 4.5) = 43.5\ m^2$

$A_2 = h_2 (b + Sh_2)$

$= 4.0 (10 + (1.5 \times 4.0)) = 4(10 + 6) = 64.0\ m^2$

$A_3 = h_3 (b + Sh_3)$

$= 5.0(10 + 1.5 \times 5.0)$

$= 5.0(10 + (1.5 \times 5.0))$

$= 5.0 (10 + 7.5)$

$= 87.5\ m^2$

i) Prismoidal formula

$$V = \frac{d}{3} \left((A_1 + A_3) + 2 (A_0) + 4 (A_2) \right)$$

$$V = \frac{30}{3} \left((43.5 + 87.5) + 4 (64) \right)$$

$$V = \frac{30}{3} (387)$$

$$V = 10 (387)$$

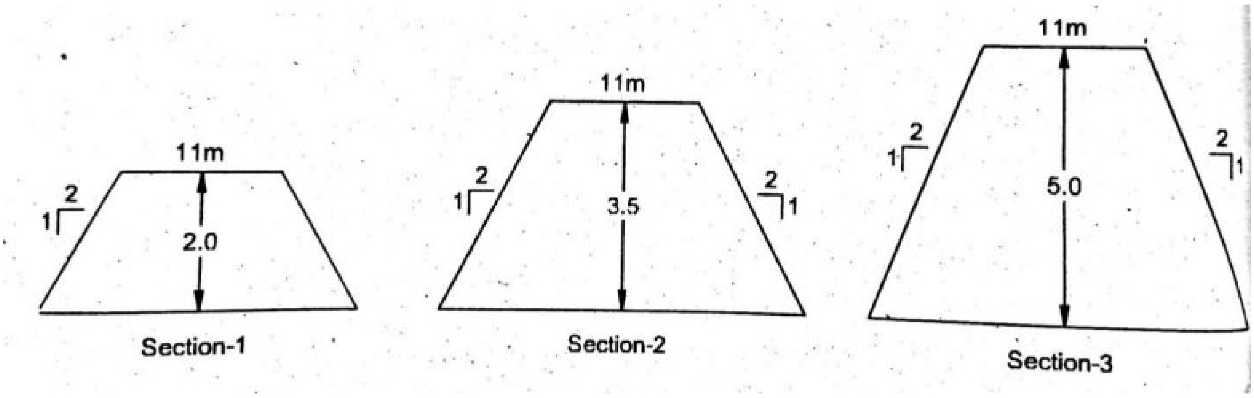
$V = 3870\ m^3$

Result :

i) Volume by Prismoidal formula is 3870 m^3

1. Fig. shows the three cross sections of an embankment at an interval of 30 m. calculate the volume between the end section by (i) Trapezoidal formula

   (ii) Prismoidal formula.



Given data :

Common interval = 30 m

Formation width b = 11 m

Depth of embankment h_1 = 2.0 m

Depth of embankment h_2 = 3.5 m

Depth of embankment h_3 = 5.0 m

Side slope S = 2

To Find :

To calculate the volume between the end section by

(i) Trapezoidal Formula

(ii) Prismoidal formula.

Solution :

For level section area **A** **= h (b + Sh)**

A_1 = $h_1 (b + Sh_1)$

= 2(11 + (2 x 2)) = 2 (15) = 30. 00 m^2

A_2 = $h_2 (b + Sh_2)$

= 3.5 (11 + (2 x 3.5)) = 63.0 m^2

A_3 = $h_3(b + Sh_3)$

= $5.0(b + Sh_3)$

= 5.0(11 + (2 x 5.0))

= 5.0 (11 + 10)

= 105.00 m^2

ii) Trapezoidal formula

$$V = \frac{d}{2} \; ((A_1 + A_3) + \; 2\,(A_2))$$

$$V = \frac{30}{2} \; ((30 + 105) + \; 2\,(63))$$

V = 15 $((135) + (126))$

V = 3915 m^3

iii) Prismoidal formula

V = $\frac{d}{3}$ $((A_1 + A_3) + 2(A_0) + 4(A_2))$

V = $\frac{30}{3}$ $((30 + 105) + 4(63))$

V = $\frac{30}{3}$ $(135 + 252)$

V = 10 (387)

V = 3870 m^3

Result :

ii) Volume by trapezoidal formula is 3915 m^3

iii) Volume by Prismoidal formula is 3870 m^3

2. An embankment is 8 m wide with side slopes of 2 to 1. Assuming the ground to be level in a direction transverse to the centre line. Calculate the volume of earthwork containing in a length of 300m. The center heights at every 50 m interval are given below.

Distance (m)	0	50	100	150	200	250	300
Offsets (m)	0.5	1.0	1.5	1.67	2.0	1.17	0.67

Given data :

Formation width b = 8 m

Common interval d = 50m

Transverse slope = Nil, so level section.

Side slope S: 1 = 2 :1

Hence S = 2

Centre height at section (1) h_1 = 0.5m,

h_2 = 1.0m, h_3 = 1.5m, h_4 = 1.67m, h_5 = 2.0m, h_6 = 1.17m,

h_7 = 0.67m

To Find :

To Calculate the volume of earthwork.

Solution :

For level section area **A = (b + Sh) h**

A_1 = (8.0 + (2X 0.5)) 0.5 = 4.5 m^2

A_2 = (8.0 + (2X 1.0)) 1.0 = 10 m^2

A_3 = (8.0 + (2X 1.5)) 1.5 = 16.5 m^2

A_4 = (8.0 + (2X 1.67)) 1.67 = 18.94 m^2

A_5 = (8.0 + (2X 2.0)) 2.0 = 24 m^2

A_6 = (8.0 + (2X 1.17)) 1.17 = 12.1 m^2

A_7 = (8.0 + (2X 0.67)) 0.67 = 6.26 m^2

i) Trapezoidal formula

$$V = \frac{d}{2}\left((A_1 + A_7) + 2\,(A_2 + A_3 + A_4 + A_5 + A_6)\right)$$

$$V = \frac{50}{2}\left((4.5 + 6.26) + 2\,(10 + 16.5 + 18.94 + 24 + 12.1)\right)$$

$$V = \frac{50}{2}\left((10.76) + 2\,(81.54)\right)$$

V = 4346 m^3

ii) Prismoidal formula

$$V = \frac{d}{3}\left((A_1 + A_7) + 2\,(A_3 + A_5) + 4\,(A_2 + A_4 + A_6)\right)$$

$$V = \frac{50}{3}\left((4.5 + 6.26) + 2\,(16.5 + 24) + 4\,(10 + 18.94 + 12.1)\right)$$

$$V = \frac{50}{3}\left((10.76) + 2\,(40.5) + 4\,(41.04)\right)$$

V = 4265.33 m^3

Result :

i) Volume by trapezoidal formula is 4346 m^3

ii) Volume by Prismoidal formula is 4265.33 m^3

3. A railway embankment is 10 m wide with side slopes 1 ½ to 1. Assuming the ground to be level in a direction transverse to the centre line. Calculate the volume of earthwork contained in a length of 120 m, the centre height at every 20 m intervals being in metres are 2.2, 3.7, 3.8, 4.0, 3.8, 2.8, 2.5.

Given data :

Level section

Common interval = 20m

Formation width b = 10m

Side slope S:1 = 1.5 :1

Hence S = 1.5

Centre height at section (1) h1 = 2.2,

h_2 = 3.7, h_3 = 3.8, h_4 = 4.0, h_5 = 3.8, h_6 = 2.8, h_7 = 2.5

To Find :

To Calculate the volume

Solution :

For level section **A = (b + Sh) h**

A_1 = (10 + (1.5X 2.2)) 2.2 = 29.26 m^2

A_2 = (10 + (1.5X 3.7))3.7 = 57.54 m^2

A_3 = (10 + (1.5X 3.8))3.8 = 59.66 m^2

A_4 = (10 + (1.5X 4.0))4.0 = 64.0 m^2

A_5 = (10 + (1.5X 3.8)) 3.8 = 59.66 m^2

A_6 = (10 + (1.5X 2.8)) 2.8 = 39.76 m^2

A_7 = (10 + (1.5X 2.5)) 2.5 = 34.37 m^2

I) Trapezoidal formula

$$V = \frac{d}{2}\ ((A_1 + A_7) + 2\ (A_2 + A_3 + A_4 + A_5 + A_6))$$

$$V = \frac{20}{2}\ ((29.26 + 34.37) + 2\ (57.54 + 59.66 + 64 + 59.66 + 39.76))$$

$$V = \frac{20}{2}\ ((63.33) + 2\ (280.62))$$

V = 6248.70 m^3

II) Trapezoidal formula

$$V = \frac{d}{3}\ ((A_1 + A_7) + 2\ (A_3 + A_5) + 4\ (A_2 + A_4 + A_6))$$

$$V = \frac{20}{3}\ ((29.26 + 34.37) + 2\ (59.66 + 59.66) + 4\ (57.54 + 64 + 39.76))$$

$$V = \frac{20}{3}((63.33) + 2(119.32) + 4(161.3))$$

$$V = \frac{20}{3}(947.17)$$

V = 6314.47 m^3

Result :

I) Volume by trapezoidal formula is 6248.70 m^3

II) **Volume by Prismoidal formula is 6314.47 m^3**

5.. A ramp having a uniform top width of 5 m and a longitudinal slope (gradient) of 1 in 15 is to be laid from a level ground to a platform of 1.2 m height. Calculate the volume of the ramp by prismoidal formula (i) when the sides of the ramp are vertical and (ii) when the ramp has the side slopes of 1 vertical to 2 horizontal.

Given data :

Top width of ramp 'b' = 5 m

Height of ramp at starting point (G.L) = 0 m

Height of platform = 1.2 m

Side slopes S :1 = 2:1, S = 2.

To Find :

To Calculate the volume of the ramp by prismoidal formula

Solution :

(i) When the sides of the ramp are vertical

Height of ramp at starting point (G.L) = 0 m

Height of ramp at end (plate form) = 1.2 m

Height of ramp at mid point h_m $= \frac{0+1.2}{2} = 0.6$ m

$h_1 = 0m, h_m=h_2=0.6m, h_3=1.2m$

Longitudinal slope 1 in 15 i.e., 1 vertical, 15 horizontal

Therefore, horizontal length of ramp = 1.2 x 15 = 18.00 m

Therefore Common interval @mid point, d = 18/2 = 9m

Area of cross section at 0 m = 0 m^2

Area cross section at mid point = 0.6 x 5 = 3 m^2

Area of cross section at end point = 5 x 1.2 = 6 m^2

$A_1 = 0$, $A_2 = 3\ m^2$, $A_3 = 6\ m^2$

i) Volume by prismoidal rule

$$V = \frac{d}{3}\ ((A_1 + A_3) + 4\ (A_2))$$

$$V = \frac{9}{3}\ ((0 + 6) + 4\ (3))$$

$$V = \frac{9}{3}\ (6 + 12)$$

$$V = 3\ (18\ )$$

$$V = \mathbf{54\ m^3}$$

ii) When the side slope is 2:1

Horizontal – 2, vertical – 1.

Area of cross section at 0m (A_1) = 0 m^2

Area of cross section at mid point (A_2) = $(b + Sh_2)h_2$

(5 + (2 x 0.6)) x 0.6 = 3.72 m^2

Area of cross section at end point (A_3) = $(b + Sh_3)h_3$

(5 + (2 x 1.2)) x 1.2 = 8.88 m^2

A_3 = 8.88 m^2

By Prismoidal formula

$$V = \frac{d}{3}\ ((A_1 + A_3) + 4\ (A_2)$$

$$V = \frac{9}{3}\ ((0 + 8.88) + 4\ (3.72))$$

$$V = \frac{9}{3}\ (8.88 + 14.88)$$

$$V = \frac{9}{3}\ (23.76)$$

$$V = 71.28\ m^3$$

Result :

i) **When the sides are vertical = 54 m^3**

ii) **When the sides have a slope 2 :1 = 71.28 m^3**

6. A ramp having a uniform top width of 5 m and a longitudinal slope (gradient) of 1 in 15 is to be laid from a level ground to a platform of 1.5 m height. Calculate the volume of the ramp by prismoidal formula (i) when the sides of the ramp are vertical and (ii) when the ramp has the side slopes of 1 vertical to 2 horizontal.

Given data :

Top width of ramp 'b' = 5 m

Height of ramp at starting point (G.L) = 0 m

Height of platform = 1.5 m

Side slopes S: 1 = 2:1, S = 2.

To Find :

To calculate the volume of the ramp by prismoidal formula.

Solution :

(ii) When the sides of the ramp are vertical

Height of ramp at starting point (G.L) , h_1 = 0 m

Height of ramp at end (plate form) h_3 = 1.5 m

Height of ramp at mid point, h_m= h_2 $= \frac{0+1.5}{2} = 0.75$ m

Longitudinal slope 1 in 15 i.e., 1 vertical, 15 horizontal

Therefore, horizontal length of ramp = 1.5 x 15 = 22.50 m

Therefore Common interval at mid point, d = $\frac{22.50}{2}$ = 11.25m

Area of cross section at 0 m, A_1 = 0 m^2

Area cross section at mid point, A_2 = 0.75 x 5 = 3.75 m^2

Area of cross section at end point, A_3 = 5 x 1.5 = 7.5 m^2

$A_1 = 0$, $A_2 = 3.75\ m^2$, $A_3 = 7.5\ m^2$

iii) Volume by prismoidal rule

$$V = \frac{d}{3}\left((A_1 + A_3) + 4\,(A_2)\right)$$

$$V = \frac{11.25}{3}\left((0 + 7.5) + 4\,(3.75)\right)$$

$$V = \frac{11.25}{3}(7.5 + 15)$$

$$V = 3\ (22.5\ )$$

$$V = \mathbf{84.375\ m^3}$$

iv) When the side slope is 2:1

Horizontal – 2, vertical – 1.

Area of cross section at 0m (A_1) = 0 m^2

Area of cross section at mid point (A_2) = (b + Sh)h

A_2 = (5 + (2 x 0.75)) x 0.75 = 4.875 m^2

Area of cross section at end point (A_3) = (b + Sh)h

A_3 = (5 + (2 x 1.5)) x 1.5 = 12 m^2

By Prismoidal formula

$$V = \frac{d}{3}\left((A_1 + A_3) + 4\,(A_2)\right)$$

$$V = \frac{11.25}{3}\left((0 + 12) + 4\,(4.875)\right)$$

$$V = \frac{11.25}{3}(12 + 19.5)$$

$$V = \frac{11.25}{3}(31.5)$$

$$V = 118.13\ m^3$$

Result :

i) When the sides are vertical = $84.375\ m^3$

ii) When the sides have a slope 2 :1 = 118.13 m^3

7.A road embankment 10 m wide at the formation level, with side slopes of 2 to 1 and with an average height of 5 m is constructed with an average gradient 1 in 10 from contour 220 m to 280 m. find the volume of earth work.

Given data :

Formation width b = 10 m

Side slopes S:1 = 2:1. S = 2

Height h = 5 m

Gradient = 1in 40 , r = 40

Difference in level = 280 – 220 = 60m

Therefore, Length of embankment, L = 40 x 60 m = 2400 m

To Find :

To find the volume of earth work..

Solution :

Area of the cross section

A	=	(b + Sh) h
	=	(10 + (2 x5)) x 5
	=	(10 +10) x 5
A	=	100 m^2

Volume of embankment

V	=	Length x Area
	=	2400 x 100
V	=	2,40,000 m^3

Result :

volume of earth work is 2,40,000 m^3

8. An embankment 10 m wide side slopes 2 to 1. Assuming the ground to be level in a direction tranverse to the centre line, calculate the volume in cubic meter, contained in a length of 200 m the centre height at every 50 m intervals being 0.5m, 1.00m,1.5m,2.00m and 2.2m.

Given data :

Formation width b = 10m

Side slope S :1 = 2:1, S = 2

Interval = 50 m

h_1 = 0.50m, h_2 = 1.00m, h_3 = 1.5m, h_4 = 2.00m, h_5 = 2.2 m

To Find :

To calculate the volume in cubic meter

Solution :

For level section A = (b + Sh) h

Area of section (1)

$A1 = (b + Sh_1)\, h_1$

$A1 = (10 + 2 \times 0.5) \times 0.5$

$A1 = (10 + 1) \times 0.5$

$A1 = (11) \times 0.5$

$A1 = (11) \times 0.5$

$A1 = 5.5\ m^2$

Area of section (2)

$A2 = (b + Sh_2)\, h_2$

$A2 = (10 + 2 \times 1) \times 1$

$A2 = (10 + 2) \times 1$

$A2 = 12\ m^2$

Area of section (3)

$A3 = (b + Sh_3)\, h_3$

$A3 = (10 + 2 \times 1.5) \times 1.5$

$A3 = (10 + 3) \times 1.5$

A3 = 19.5 m^2

Area of section (4)

A4 = (b + Sh_4) h_4

A4 = (10 + 2 x 2.00) x 2.00

A4 = (10 + 4) x 2.00

A4 = 28 m^2

Area of section (5)

A5 = (b + Sh_5) h_5

A5 = (10 + 2 x 2.2) x 2.2

A5 = (10 + 4.4) x 2.2

A5 = 31.68 m^2

i) Trapezoidal rule

$$V = \frac{d}{2}\ \left((A_1 + A_5) + \ 2\ (A_2 + A_3 + A_4)\right)$$

$$V = \frac{50}{2}\ \left((5.5 + 31.68) + \ 2\ (12 + 19.5 + 28)\right)$$

$$V = 25 \text{ x } \ (37.18 + 119)$$

V = 3904.5 m^3

ii) Prismoidal rule

$$V = \frac{d}{3}\ \left((A_1 + A_5) + \ 2(A_3) + 4\ (A_2 + A_4)\right)$$

$$V = \frac{50}{3}\ \left((5.5 + 31.68) + \ 2(19.5) + 4\ (12 + 28)\right)$$

$$V = \frac{50}{3}\ (37.18 + \ 39 + 160)$$

V = 3936.33 m^3

Result :

i) Volume by trapezoidal formule is 3904.5 m^3

ii) Volume by prismodal formula is 3936.33 m^3

9. Find the area of two level sections for the following particulars.

Base width	= 10 m
Side slopes of cutting	= 1.5 : 1
Transverse slope of ground	= 12 : 1

Depth of cutting at centre = 2.5 m

Given data :

Base width = 10 m

Side slopes of cutting S : 1 = 1.5 : 1, S = 1.5

Transverse slope of ground r:1 = 12 : 1, r = 12

Depth of cutting at centre, h = 2.5 m

To Find :

To calculate area of two level section

Solution :

Cross section area of two level section

$$\boxed{A = \frac{S\left(\frac{b}{2}\right)^2 + r^2\,bh + r^2\,Sh^2}{(r^2 - S^2)}}$$

$$A = \frac{1.5\left(\frac{10}{2}\right)^2 + 12^2\,((10 \times 2.5) + 12^2(1.5 \times 2.5^2))}{12^2 - 1.5^2}$$

$$A = \frac{(1.5\ x\ 2.5) + (144\ x\ 25) + (144\ x\ 9.375)}{144 - 2.25}$$

$$A = \frac{(1.5\ x\ 25) + 144\ \ (25 + 9.375)}{144 - 2.25}$$

$$A = \frac{3.75 + 3600 + 1350}{141.75}$$

$$A = \frac{4953.75}{141.75}$$

$A = 34.95\ m^2$

Result: Area of two level section is 35.95 m^2

10. Calculate the side widths and cross sectional area of an embankment having the following dimensions.

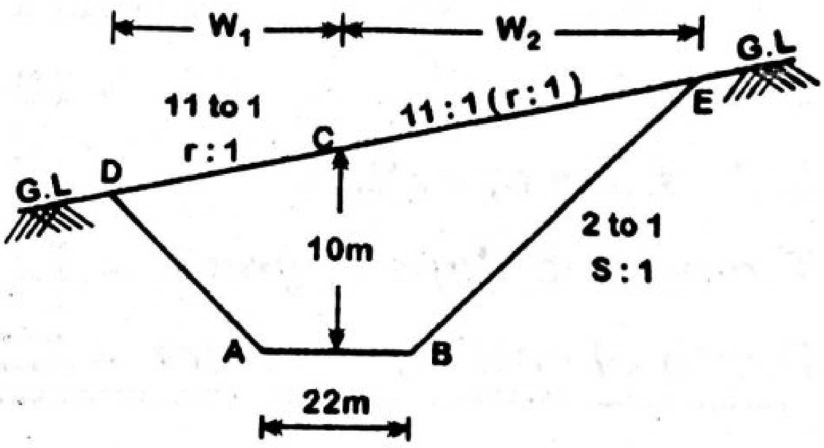
Formation width b = 22 m

Side slope = 2 to 1

Centre height = 10 m

Transverse slope = 11 to 1

Length of embankment = 15m



Given data :

Formation width b = 22 m

Side slope S: 1 = 2 : 1, S = 2

Centre height = 10 m

Transverse slope(r :1) = 11 to 1

r = 11

Length of embankment L = 15 m

To Find :

To calculate side widths and cross sectional area of an embankment.

Solution :

Side width be W1,W2

$$W_1 = \frac{b}{2} + \left\{\frac{rs}{r-s}\right\} x \left\{h + \frac{b}{2r}\right\}$$

$$W_1 = \frac{22}{2} + \left\{\frac{11\ x\ 2}{11-2}\right\} x \left\{10 + \frac{22}{2x11}\right\}$$

$$W_1 = 11 + (\ (2.44)\ x\ (11))$$

$$W_1 = 11 + (\ 26.84)$$

$W_1 \quad = 37.84 \ \text{m}$

$W_2 \quad = \frac{b}{2} + \left\{\frac{rs}{r+s}\right\} x \left\{h - \frac{b}{2r}\right\}$

$W_2 \quad = \frac{22}{2} + \left\{\frac{11 \ x \ 2}{11+2}\right\} x \left\{10 - \frac{22}{2x11}\right\}$

$W_2 \quad = 11 + ((1.69) \ x \ (9.00))$

$W_2 \quad = 11 + (15.21)$

$W_2 \quad = 26.21 \ \text{m}$

Cross section Area

$$\boxed{A = \frac{S\left(\frac{b}{2}\right)^2 + r^2 bh + r^2 Sh^2}{(r^2 - S^2)}}$$

$$A = \frac{2(\frac{22}{2})^2 + 11^2 \ (22 \text{ x } 10) + 11^2 (2 \text{ x } 10^2)}{11^2 \ - 2^2}$$

$$A = \frac{242 + 26620 + 24200}{117}$$

$$A = \frac{51062}{117}$$

A $\quad = 436.43 \ \text{m}^2$

Result :

Side width

W1 = $\mathbf{37.84}$ m

W_2 $= \mathbf{26.24}$ m

Cross sectional area

A $\quad$ = 436.43 m^2

11. A Road embankment is 11 m wide at the formation level. The centre line of the embankment is 3 m above ground surface. If the ground slope is 1 in 22 at right angles to the centre line and the side slopes are 2 :1. Calculate the area of cross section.

Given data :

Formation width b = 11 m

Centre line height h = 3 m

ground slope r:1 = 1 :22, r = 22

side slopes S :1 = 2:1, S = 2

To Find :

To Calculate the area of cross section.

solution :

i) Area calculation

$$\boxed{A = \frac{S\left(\frac{b}{2}\right)^2 + r^2 bh + r^2 Sh^2}{(r^2 - S^2)}}$$

$$A = \frac{2(\frac{11}{2})^2 + 22^2\ (11 \text{ x } 3) + 22^2 (2 \text{ x } 3^2)}{22^2 - 2^2}$$

$$A = \frac{(60.5) + 15972 + 8712}{480}$$

$$A = \frac{24744.5}{480}$$

$A = 51.55\ m^2$

Result :

Area of cross section of road embankment is 51.55 m^2

12. A cutting is to be made for the formation of a railway track with side slopes of 1:5 and formation width of 10 m. The ground is having a transverse slope of 1 in 10 (10:1). The depth of cutting along the centre line of formation will be 1.5m, 2.4m, and 1.2 m at three consecutive sections spaced at 30 m apart. Calculate the volume of earth work in cutting in this 60 m length using prismoidal formulae.

Given data :

Formation width b = 10 m

Side slopes S: 1 = 5 :1, S = 5

Transverse slope r = 10

Chainage interval = 30 m

h_1 = 1.5 m, h_2 = 2.4 m, h_3 = 1.2 m

To Find :

To Calculate the volume of earthwork by prismoidal formulae.

Solution :

ii) Area calculation

$$\boxed{A = \frac{S\left(\frac{b}{2}\right)^2 + r^2\,bh + r^2\,Sh^2}{(r^2 - S^2)}}$$

$$A_1 = \frac{5\left(\frac{10}{2}\right)^2 + 10^2\left((10 \times 1.5) + (2 \times 1.5^2)\right)}{10^2 - 5^2}$$

$$A1 = \frac{(5\,x\,25) + 100\ (15 + 4.50)}{100 - 25}$$

A_1 = 27.67 m^2

$$A_2 = \frac{5\left(\frac{10}{2}\right)^2 + 10^2\left((10 \times 2.4) + (2 \times 2.4^2)\right)}{10^2 - 5^2}$$

$$A2 = \frac{(5\,x\,25) + 100\ (24 + 11.52)}{75}$$

A_2 = 49.03 $\mathbf{m^2}$

$$A_3 = \frac{5\,(10/2)^2 + 10^2\left((10 \times 1.2) + (2 \times 1.2^2)\right)}{10^2 - 5^2}$$

$$A3 = \frac{(5\,x\,25) + 100\ (12 + 2.88)}{75}$$

A_3 = 21.51 $\mathbf{m^2}$

A_1 = 27.67 m^2, A_2 = 49.03 m^2, A_3 = 21.51 m^2

Volume by prismoidal formula

$$V = \frac{d}{3}\ \left((A_1 + A_3) + 2(0) + 4\,(A_2)\right)$$

$$V = \frac{30}{3}\ ((27.67 + 21.51) + \ 2(0) + 4\ (49.03))$$

$$V = \frac{30}{3}\ ((49.18 + 196.12)$$

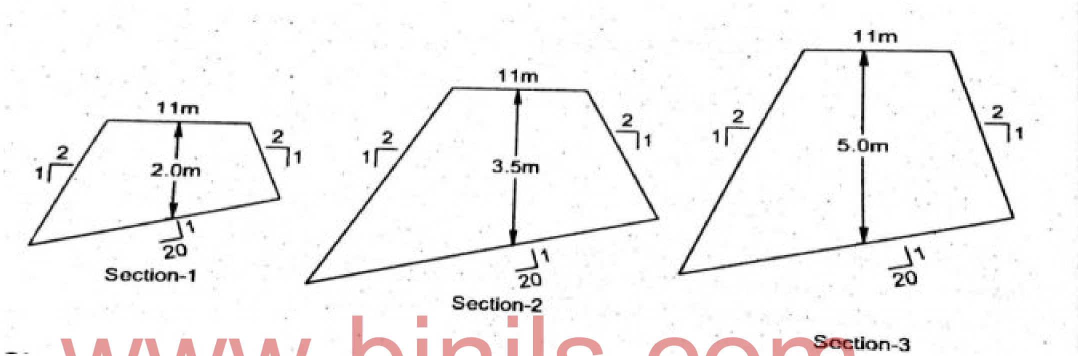
$$V = \frac{30}{3}\ (245.3)$$

$V = 2453\ m^3$

Result :

Volume by Prismoidal formula is 2453 m^3

13. The three embankment sections are shown below of an embankment at an interval of 30 m . calculate the volume between the end sections by (a) trapezoidal formula (b) prismoidal formula.



Given data :

Interval d = 30 m

Formation width b = 11 m

Side slopes S : 1 = 2 :1, S = 2

Transverse slope r:1 = 20:1, r = 20

h_1 = 2.0 m, h_2 = 3.5 m, h_3 = 5.0 m

To Find :

To calculate the volume between the end sections by

(a) Trapezoidal formula

(b) Prismoidal formula.

Solution :

Area calculation

$$A = \frac{S\left(\frac{b}{2}\right)^2 + r^2\,bh + r^2\,Sh^2}{(r^2 - S^2)}$$

$$A_1 = \frac{2\left(\frac{11}{2}\right)^2 + 20^2\,((11 \times 2) + (2 \times 2^2))}{20^2 - 2^2}$$

$$A1 = \frac{121 + 400\ (22 + 8)}{400 - 4}$$

$$A1 = \frac{121 + 400\ (22 + 8)}{400 - 4}$$

A_1 = 30.608 m^2

$$A_2 = \frac{2\left(\frac{11}{2}\right)^2 + 20^2\,((11 \times 3.5) + (2 \times 3.5^2))}{20^2 - 2^2}$$

$$A2 = \frac{121 + 400\ (38.5 + 24.5)}{400 - 4}$$

$$A2 = \frac{121 + 400\ (63)}{396}$$

A_2= 63.941 m^2

$$A_3 = \frac{2\left(\frac{11}{2}\right)^2 + 20^2\,((11 \times 5) + (2 \times 5^2))}{20^2 - 2^2}$$

$$A3 = \frac{121 + 400\ (55 + 50)}{400 - 4}$$

$$A3 = \frac{121 + 400\ (105)}{396}$$

A_3= 106.366 m^2

i) Trapezoidal formula

$$V = \frac{d}{2}\ ((A_1 + A_3) + 2\,(A_2))$$

$$V = \frac{30}{2}\ ((30.608 + 106.366) + 2\,(63.941))$$

$$V = 10 \times (136.97 + 127.88)$$

V = 2648.50 m^3

ii) Prismoidal Formula

$$V = \frac{d}{3}\ ((A_1 + A_3) + 2(A_0) + 4\ (A_2))$$

$$V = \frac{30}{3}\ ((30.608 + 106.366) + 4\ (63.941))$$

$$V = \frac{30}{3}\ (136.97 + 255.76)$$

V = 10 (392.73)

V = 3927.3 m^3

Result :

Volume by Trapezoidal formula is 2648.50 m^3

Volume by Prismoidal formula is 3927.3 m^3

14. An embankment has a longitudinal slope of 1 in 30. Three cross section 30 m apart have centre line height of 5.0, 6.0 and 7.0 m respectively. If side slope of 1 in 1 are used and the formation width is 10 m. calculate the volume of fill by trapezoidal formula and prismoidal formula.

Given data :

Longitudinal slope 1 in 30 = r: 1, r =30 m.

Number of section = 3.

h_1 = 5.0 m, h_2 = 6.0 m, h_3 = 7.0 m

Side slopes S : 1 = 1 :1, S = 1

Formation width b = 10 m

To Find :

To calculate the volume by

(I) Trapezoidal formula

(II) Prismoidal formula.

Solution :

Area calculation

$$A = \frac{S\left(\frac{b}{2}\right)^2 + r^2\,bh + r^2\,Sh^2}{(r^2 - S^2)}$$

Section (1)

$$A_1 = \frac{1\left(\frac{10}{2}\right)^2 + 30^2\,((10 \times 5) + (1 \times 5^2))}{30^2 - 1^2}$$

$$A1 = \frac{25 + 900\ (50 + 25)}{899}$$

$$A1 = \frac{25+900\ (75)}{899}$$

$A_1 = 75.11$ $\mathbf{m^2}$

Section (2)

$$A_2 = \frac{1\left(\frac{10}{2}\right)^2 + 30^2\,((10 \times 6) + (1 \times 6^2))}{30^2 - 1^2}$$

$$A2 = \frac{25 + 900\ (96)}{899}$$

$A_2 = 96.13$ $\mathbf{m^2}$

Section (3)

$$A_3 = \frac{1\left(\frac{10}{2}\right)^2 + 30^2\,((10 \times 7) + (1 \times 7^2))}{30^2 - 1^2}$$

$$A3 = \frac{25 + 900\ (119)}{899}$$

$A_3 = 119.16$ $\mathbf{m^2}$

i) Trapezoidal formula

$$V = \frac{d}{2}\ ((A_1 + A_3) + 2\,(A_2))$$

$$V = \frac{30}{2}\ ((75.11 + 119.16) + 2\,(96.13))$$

V = $15 \times (194.27 + 192.26)$

V = 5797.95 m^3

ii) Prismoidal Formula

$$V = \frac{d}{3} \left((A_1 + A_3) + 2(A_0) + 4\,(A_2) \right)$$

$$V = \frac{30}{3} \left((75.11 + 119.16) + 4\,(96.13) \right)$$

$$V = \frac{30}{3} (194.27 + 384.52)$$

V = 10 (578.79)

V = 5787.90 m^3

Result :

1. **By Trapezoidal formuls volume is 5797.95 m^3**
2. **By Prismoidal formula volume is 5787.90 m^3**

14. A road in embankment has formation width of 10 m. The side slopes and height at centre are respectively 2:1 and 3 m. The slope of the ground in the transverse direction is 1 in 10 workout the cost of earthwork for a horizontal length of 100m at the rate of Rs 4 per m^3.

Given data :

Formation width b = 10 m

Side slope s :1 = 2 :1, s = 2.

Height = 3 m

Transverse slope r:1 = 1 in 10, r = 10

Length of embankement, L = 100m

Cost of earth work = Rs 4 per m^3

To Find :

To calculate the cost of earth work.

Solution :

Calculation of Area of embankment

Step 1.

$$A = \frac{S\left(\frac{b}{2}\right)^2 + r^2 bh + r^2 Sh^2}{(r^2 - S^2)}$$

$$A = \frac{2\left(\frac{10}{2}\right)^2 + 10^2\,((10 \times 3) + (2 \times 3^2))}{10^2 - 2^2}$$

$$A = \frac{50 + 100\ (48)}{96}$$

A = 50.52 m^2

Step 2

Volume

V = A x L

= 50.52 x 100 = 5052 m^3

V = 5052 m^3

Step 3

Cost of earthwork = Rs 4 / m^3

For 5052 m^3 cost of earthwork = 4 x 5052

= Rs 20208 / -

Answer :

Cost of earthwork is Rs. 20208 / -

Review Questions

PART-A

1. State any two rules for calculating area of cross section of embankment.
2. What is level section?
3. Draw two sketches to show areas of level section.
4. What is two level section?
5. State the formula to find the area of cross section of a tank bund.
6. What is the difference between embankment and cutting?

PART-B

1. State the expression to compute the area of cross-section for a level section.
2. State the expression to compute the area of cross-section for a two level section
3. Explain method of calculating area of an irregular boundary.
4. Differenciate between a level section and two level section with sketchs.

PART-C

1. The perpendicular offset were taken from a surveyline to an irregular boundary line, Calculate the area between the survey line, the boundary and the end offsets by the application of (i) Average ordinate rule (ii) Trapezoidal rule and (iii) Simpson's rule.

Distance	0	30	60	90	120	150	180
Offset(m)	4	8	13	18	16	21	6

2. An embankment is 10m wide at top, 2m high and 80m long. The side slope is 2:1. Determine the cost of turfing the sloping sides at a rate of Rs. 200/m^2.

3. Cutting is to be made for the formation of a railway track with side slope of 1.5:1 and formation width of 10m.The ground is having a transverse slope of 1 in 10 (10:1) the depth of cutting along the centre line of formation will be 1.5m,2.4m and 1.2m at three consecutive sections spaced at 30m apart. Calculate the volume of earth work in cutting in this 60m length using prsimoidial formulae.

4. The following offsets were taken at 10m intervals from a survey line to an irregular boundary line:- 4.5m, 3.7m, 3.4m, 4.2m, 3.2m, 2.8m, and 1.2m calculate the area by trapezoidal rule.

5. An embankment is 9m wide with side slope of 2 to 1. Assuming the ground to be level in a direction transverse to the centre line, calculate the volume of earthwork contained in a length of 300m. The centre heights at every 50m intervals are given below:-

Distancein'm'	0	50	100	150	200	250	300
Offset in 'm'	0.5	1	1.5	1.67	2	1.17	0.67

(i) Trapezoidal rule (ii) Simpson's rule

6. A Chain line runs in the middle of an area. The offsets on either side are given below:-

Chainage (m)	0	30	60	90	120	150	180
Offset to the left (m)	5	7	9	7	4	3	2
Offset to the right(m)	8	4	6	5	2	2	2

Calculate (i) Trapezoidal rule (ii) Simpson's rule

7. A chain line was run in the middle of a long strip and perpendicular offsets were taken to the boundaries on the left and right side of the chain line. The measured values are given below. Determine the area of the strip of land by simpson's rule:-

Chainage (m)	0	15	30	45	60	75	90	105	120
Offset to right (m)	10.1	9.6	6.2	12.2	13.1	11.2	10.3	11.2	9.8
Offset to left (m)	12.8	9.4	8.8	10.8	9.6	12.2	10.1	10.8	12.1

UNIT – III

ANALYSIS OF RATES

3.1 ANALYSIS OF RATES

Preparation of Data for the following Building works using standard Data Book.

3.1 Cement Mortar and Lime Mortar

a) Cement Mortar 1:2 – $1m^3$

b) Cement Mortar 1:3 – $1m^3$

c) Cement Mortar 1:4 – $1m^3$

d) Cement Mortar 1:5 – $1m^3$

e) Cement Mortar 1:6 – $1m^3$

f) Lime Mortar 1:2 – $1m^3$

g) Lime Mortar 1:3 – $1m^3$

Materials and labour required

Cement mortar 1:2 - $1m^3$

Cement	-	720kg i.e 1440/2 = 720kg
Sand	-	$1m^3$
Mixing charge	-	$1m^3$

Cement mortar 1:3 - $1m^3$

Cement	-	480kg i.e 1440/3 = 480kg
Sand	-	$1m^3$
Mixing charge	-	$1m^3$

Cement mortar 1:4 - $1m^3$

Cement	-	360kg
Sand	-	$1m^3$
Mixing charge	-	$1m^3$

Cement mortar 1:5 - $1m^3$

Cement	-	288kg
Sand	-	$1m^3$
Mixing charge	-	$1m^3$

Cement mortar 1:6 - 1m^3

Cement	-	240kg
Sand	-	1m^3
Mixing charge	-	1m^3

Lime mortar 1:2 - 1m^3

lime	-	0.5 m^3
Sand	-	1m^3
grinding charge	-	1m^3

Lime mortar 1:3 - 1m^3

Lime	-	as required
Sand	-	1m^3
grinding charge	-	1m^3

Cost of materials and lead particulars

S.no	materials	unit	Cost (Rs.)	Lead Km	Rate for Lead	Handling charge
1	Cement	Tonne	5200	Supplied at site		
2	Lime	m^3	500	15	6	20
3	Sand	m^3	200	40	5	25

Mixing charge	-	Rs. 100/ m^3
Grinding Charge	-	Rs. 120/ m^3

Solution

Cost of materials and lead particulars

S.no	materials	unit	Cost (Rs.)	Lead Km	Rate for Lead	Handling charge	Cost of materials at site
1	Cement	Tonne	5200	Supplied at site			5200
2	Lime	m^3	500	15	6	20	425
3	Sand	m^3	200	40	5	25	610

a) **Cement mortar 1:2 - 1** m^3

Quantity	Description	Rate	Unit	Amount(Rs)
1440/2 = 720kg	cement	5200	1000kg	3744
$1m^3$	Sand	425	m^3	425
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	4269

b) **Cement mortar 1:3 - 1** m^3

Quantity	Description	Rate	Unit	Amount(Rs)
480	Cement	5200	1000kg	2496
$1m^3$	Sand	425	m^3	425
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	3021

c) **Cement mortar 1:4 - 1** m^3

Quantity	Description	Rate	Unit	Amount(Rs)
360 kg	cement	5200	1000kg	1872
$1m^3$	Sand	425	m^3	425
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	2397

d) **Cement mortar 1:5 - 1** m^3

Quantity	Description	Rate	Unit	Amount(Rs)
288kg	cement	5200	1000kg	1497.6
$1m^3$	Sand	425	m^3	425
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	2022.60

e) **Cement mortar 1:6 - 1** m^3

Quantity	Description	Rate	Unit	Amount(Rs)
240kg	cement	5200	1000kg	1248
1m^3	Sand	425	m^3	425
1m^3	Mixing charge	100	m^3	100
			Rate for 1 m^3	1773

f) **Lime mortar 1:2 - 1** m^3

Quantity	Description	Rate	Unit	Amount(Rs)
½ = 0.5 m^3	Lime	610	m^3	305
2/2 = 1m^3	Sand	425	m^3	425
1m^3	Grinding charge	120	m^3	120
			Rate for 1 m^3	850

g) **Lime mortar 1:3 - 1** m^3

Quantity	Description	Rate	Unit	Amount(Rs)
1/3 = 0.33 m^3	Lime	610	1000kg	210.3
3/3 = 1m^3	Sand	425	m^3	425
1m^3	Grinding charge	120	m^3	120
			Rate for 1 m^3	746

3.2 Prepare the data for the Plain cement concrete in foundation / leveling course

a) Plain cement concrete 1:5:10 in foundation using 40mm size broken stone - 10 m^3

b) Plain cement concrete 1:4:8 using 20mm metal - 10 m^3

Materials and labour required

a) **P.C.C 1:5:10 in foundation using 40mm size broken stone - 10** m^3

Broken stone 40mm	-	$9m^3$
Cement mortar 1:5	-	$4.5m^3$
Mason Ist class	-	1.80Nos
Mason IInd class	-	17.70 Nos
Mazdoor IInd class	-	14.10 Nos
Vibrating charges	-	10 m^3

b) **P.C.C 1:4:8 using 20mm metal - 10 m^3**

Broken stone 20 mm	-	$9m^3$
Cement mortar 1:4	-	$4.5m^3$
Mason Ist class	-	1.80Nos
Mason IInd class	-	17.70 Nos
Mazdoor IInd class	-	14.10 Nos

Cost of materials and labour

Cement	-	Rs. 5200/ton
Sand	-	Rs. 600/ m^3
Broken stone 40 mm	-	Rs. 500/ m^3
Broken stone 20 mm	-	Rs. 400/ m^3
Mason Ist class	-	Rs. 500 each
Mason IInd class	-	Rs.450 each
Mazdoor IInd class	-	Rs.300 each
Mixing charge	-	Rs. 100/ m^3
Vibraing charge	-	Rs. 150/ m^3

Solution

a) **P.C.C 1:5:10 in foundation using 40mm size broken stone - 10** m^3

Sub data for C.M 1:5 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
288kg	Cement	5200	1000kg	1497.6
$1m^3$	Sand	600	m^3	600
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	2197.60

Main data for P.C.C 1:5:10 - 10 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
$9m^3$	Broken stone 40mm	500	m^3	4500
$4.5m^3$	Cement mortar 1:5	2197.6	m^3	9889.2
1.80Nos	Mason Ist class	500	Each	900
17.70 Nos	Mason IInd class	450	Each	7965
14.10 Nos	Mazdoor IInd class	300	Each	4230
10 m^3	Vibrating charges	150	m^3	1500
			Rate for 10 m^3	28984.2

b) P.C.C 1:4:8 using 20mm metal - 10 m^3

Sub data for C.M 1:4 – 1 m^3

Quantity	Description	Rate	Unit	Amount (Rs)
360 kg	Cement	5200	1000kg	1872
$1m^3$	Sand	600	m^3	600
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	2572

Main data for P.C.C 1:4:8 – 10 m^3:

Quantity	Description	Rate	Unit	Amount(Rs)
$9m^3$	Broken stone 20mm	400	m^3	3600
$4.5m^3$	Cement mortar 1:4	2572	m^3	11574
1.80Nos	Mason Ist class	500	Each	900
17.70 Nos	Mason IInd class	450	Each	7965
14.10 Nos	Mazdoor IInd class	300	Each	4230
			Rate for 10 m^3	28269

3.3 Flooring concrete

3.3.1 Prepare the data for Flooring with cement concrete 1:4:8, 100mm thick and plastered over with C.M 1:3, 150mm thick - 10 m^2

Materials and labour required

Cement concrete broken stone 1:4:8 – 10 m^3

Broken stone 20 mm	-	9m^3
Cement mortar 1:4	-	4.5m^3
Mason IInd class	-	1.80Nos
Mazdoor Ist class	-	17.70 Nos
Mazdoor IInd class	-	14.10 Nos

Plastering with C.M 1:3, 15mm thick - 10 m^2

Cement mortar 1:3	-	0.14 m^3
Mason Ist class	-	1.1 Nos
Mazdoor Ist class	-	0.5 Nos
Mazdoor IInd class	-	1.1 Nos

Flooring with C.C 1:4:8, plastered with CM 1:3 – 10 m^2

Concrete broken stone 1:4:8	-	1 m^3
Plastering with C.M 1:3, 15mm thick	-	10 m^2

Cost of materials and labour

Cement	-	Rs. 5200/ton
Sand	-	Rs. 600/ m^3
Broken stone 20mm	-	Rs 400/ m^2
Mason Ist class	-	Rs. 500 each
Mason IInd class	-	Rs. 450 each
Mazdoor Ist class	-	Rs. 400 each
Mazdoor IInd class	-	Rs. 300 each
Mixing charge	-	Rs.75/ m^3
Grinding charge	-	Rs. 120/ m^3

Solution

Sub data for Cement Mortar 1:4 – 1 m^3

Quantity	Description	Rate	Unit	Amount (Rs)
360 kg	cement	5200	1000kg	1872
$1m^3$	Sand	600	m^3	600
$1m^3$	Mixing charge	75	m^3	75
			Rate for 1 m^3	2547

Sub data for Cement concrete broken stone 1:4:8 – 10 m^3

Quantity	Description	Rate	Unit	Amount (Rs)
$9m^3$	Broken stone 20 mm	400	m^3	3600
$4.5m^3$	Cement mortar 1:4	2547	m^3	11461.5
1.80Nos	Mason IInd class	450	Each	810
17.70 Nos	Mazdoor Ist class	400	Each	7080
14.10 Nos	Mazdoor IInd class	300	Each	4230
			Rate for 10 m^3	27181.5
			Rate for $1m^3$	2718.15

Sub data for Cement Mortar 1:3 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
480	cement	5200	1000kg	2496
$1m^3$	Sand	600	m^3	600
$1m^3$	Mixing charge	75	m^3	75
			Rate for 1 m^3	3171

Sub data for Plastering with CM 1:3 - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
0.14 m^3	Cement mortar 1:3	3171	m^3	443.94
1.1 Nos	Mason Ist class	500	Each	550
0.5 Nos	Mazdoor Ist class	400	Each	200
1.1 Nos	Mazdoor IInd class	300	each	330
			Rate for 10m^2	1523.94

Main data for Flooring with P.C.C 1:4:8 plastered with C.M 1:3 – 10m^2

Quantity	Description	Rate	Unit	Amount(Rs)
1 m^3	Concrete broken stone 1:4:8	2718.15	m^3	2718.15
10 m^2	Plastering with CM 15mm thick	1523.94	10 m^2	1523.94
			Rate for 10 m^2	4242.09

3.3.2 Prepare the data for Flooring with PCC finished with ellis pattern cement concrete surface-10 m^2

Materials and labour required

C.C 1:4:8, 20mm broken stone - 10m^3

Broken stone 20 mm	-	9m^3
Cement mortar 1:4	-	4.5m^3
Mason II nd class	-	1.80Nos
Mazdoor Ist class	-	17.70 Nos
Mazdoor IInd class	-	14.10 Nos

Flooring with P.C.C finished with Ellis pattern – 10 m^2

C.C 1:4:8 20mm broken stone	-	1m^3
Stone chips (3mm to 10mm size)	-	0.24 m^3
Cement	-	117kg

Mason Ist class	-	0.5Nos
Mazdoor Ist class	-	1.10 Nos
Mazdoor IInd class	-	4.30 Nos

Cost of materials and labour at site

Cement	-	Rs. 5200/ton
Sand	-	Rs. 500/ m^3
Broken stone 20mm	-	Rs 400/ m^3
Stone chips (3mm to 10mm)	-	Rs.450/ m^3
Mason Ist class	-	Rs. 450 each
Mason IInd class	-	Rs. 400 each
Mazdoor Ist class	-	Rs. 350 each
Mazdoor IInd class	-	Rs. 300 each
Mixing charge	-	Rs.100/ m^3

Solution

Flooring with P.C.C finished with ellis pattern cement concrete surface - $10m^2$

Sub data for C:M 1:4 - $1m^3$

Quantity	Description	Rate	Unit	Amount(Rs)
360 kg	cement	5200	1000kg	1872
$1m^3$	Sand	500	m^3	500
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	2472

Sub data for C.C 1:4:8, 20mm broken stone - 10 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
$9m^3$	Broken stone 20 mm	400	m^3	3600
$4.5m^3$	Cement mortar 1:4	2472	m^3	11124
1.80Nos	Mason IInd class	400	Each	720
17.70 Nos	Mazdoor Ist class	350	Each	6195
14.10 Nos	Mazdoor IInd class	300	Each	4230
			Rate for 10 m^3	25869

Main data for Flooring with P.C.C finished with Ellis pattern – 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
1m^3	C.C1:4:8, 20mm broken stone	25869	10m^3	2586.9
0.24 **m^3**	Stone chips (3 to 10mm)	450	m^3	108
117kg	Cement	5200	1000kg	608.4
0.5Nos	Mason Ist class	450	Each	225
1.10 Nos	Mazdoor Ist class	350	Each	385
4.30 Nos	Mazdoor IInd class	300	Each	1290
			Rate for 10 m^2	5203.3

3.3.3 Prepare the data for Flooring with cuddapah slabs with C.M 1:3 - 1 m^2

Materials and labour required

C.M 1:3 - 0.01 m^3

Mason IInd class - 1.6 Nos

Mazdoor Ist class - 0.5 Nos

Mazdoor IInd class - 1.10 Nos

Main Data - 10 m^2

Cuddapah slab 25mm - 10.5 m^2

C.M 1:3 - 0.21 m^3

Pointing in C.M 1:3 - 10 m^2

Mason Ist class - 1.10Nos

Mason IInd class - 2.10Nos

Mazdoor Ist class - 2.20 Nos

Mazdoor IInd class - 1.10 Nos

Cost of materials and labour at site

Cement - Rs. 5200/ton

Sand - Rs. 250/ m^3

Cuddapah slabs - Rs 300/ m^3

Mixing charges - Rs.100/ m^3

Mason Ist class - Rs. 550 each

Mason IInd class	-	Rs. 500 each per day
Mazdoor Ist class	-	Rs. 400 each per day
Mazdoor IInd class	-	Rs. 300 each per day

Solution

Sub data for Cement Mortar 1:3 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
480	cement	5200	1000kg	2496
1m^3	Sand	250	m^3	250
1m^3	Mixing charge	100	m^3	100
			Rate for 1 m^3	2846

Sub data for Pointing with C.M 1:3 – 1 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
0.01 m^3	CM 1:3	2846	m^3	28.46
1.60 Nos	Mason IInd class	500	Each	800
0.50Nos	Mazdoor Ist class	400	Each	200
1.10Nos	Mazdoor IInd class	300	each	330
			Rate for 1 m^2	1358.46

Main data for Flooring with Cuddapah slabs with C.M 1:3 – 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
10.50m^2	Cuddapah slab 25mm	300	m^2	3150
0.21 m^2	CM 1:3	2846	m^3	597.66
10 m^2	Pointing in C.M1:3	1358.46	m^2	13584.60
1.10 Nos	Mason Ist class	550.00	Each	605.00
2.10 Nos	Mason IInd class	500	Each	1050.00
2.20 Nos	Mazdoor Ist class	400	Each	880.00
1.10 Nos	Mazdoor IInd class	300	Each	330
			Rate for 10 m^2	20197.26

3.4 Prepare the data for the Mossaic/ Ceramic tiled flooring

(a) Mossaic tiled flooring using hydraulic pressed cement mosaic tiles with C.M1:4, 20mm thick and pointing with white cement including polishing – 10 m^2

(b) Paving the flooring with ceramic tiles of approved colour, and quality of size 30cm x 30cm over a bed of C.M 1:3 mix 20mm thick and pointing with cement using 2.20kg/sqm including finishing the joint etc complete for 10sqm.

Materials and labour required

a) Mossai tiled flooring with C.M 1:4-10 m^2

Mossaic tiles (Hydraulic pressed)	-	250Nos
Cement Mortar 1:4	-	0.21 m^2
White cement	-	22kg
Mason Ist class	-	1.10Nos
Mason IInd class	-	2.70Nos
Mazdoor Ist class	-	2.70Nos
Mazdoor IInd class	-	3.30 Nos
Polishing		
Hire chages for power polishing	-	L.S
Electric charges	-	L.S
Polisher	-	1.1 Nos
Mazdoor IInd class for watering	-	2.20 Nos

c) Flooring with ceramic tiles over a bed of C.M 1:3 - 10 m^2

Ceramic tiles	-	112 Nos
C.M 1:3	-	0.21/ m^3
Colour cement	-	3.00kg
Mason Ist class	-	1.20Nos
Mason IInd class	-	1.00Nos
Mazdoor Ist class	-	1.00Nos
Mazdoor IInd class	-	1.00 Nos
Stone cutter Ist class	-	0.50 No
Cotton waste	-	0.50kg
Sundries	-	L.S

Cost of materials and labour at site

Cotton waste	-	Rs.50/kg
Cement	-	Rs.5200/ton
Sand	-	Rs. 500/ m^3
Broken stone 20mm	-	Rs. 400/ m^3
Mossaic tiles	-	Rs. 50/each
White cement	-	Rs. 40/kg
Hire charge for polisher machine L.S	–	Rs. 100/-
Electric energy	-	L.S 1500/-
Ceramic tiles	-	Rs. 80/ each
Polisher	-	Rs. 350/each
Stone cutter Ist class	-	Rs. 500/each
Mason Ist class	-	Rs. 450/each
Mason IInd class	-	Rs. 400/each
Mazdoor Ist class	-	Rs. 350/each
Mazdoor IInd classs	-	Rs. 300/each
Mixing charge	-	Rs 100/ m^3

Solution

Mossaic / ceramic tiled Flooring

Sub data for C:M 1:4 - 1m^3

Quantity	Description	Rate	Unit	Amount(Rs)
360 kg	cement	5200	1000kg	1872
1m^3	Sand	500	m^3	500
1m^3	Mixing charge	100	m^3	100
			Rate for 1 m^3	2472

a) Main data for Mossaic tiles flooring with C.M 1:4 - 10 m^2

Quantity	**Description**	**Rate**	**Unit**	**Amount(Rs)**
250Nos	Mossaic tiles	50	Each	12500
0.21 m^2	CM 1:4	2472	m^3	519.12
22kg	White cement	40	Kg	880
1.10 Nos	Mason Ist class	450	Each	495.00
2.70 Nos	Mason IInd class	400	Each	1080.00
2.70 Nos	Mazdoor Ist class	350	Each	945

3.30 Nos	Mazdoor IInd class	300	Each	990
Polishing				
L.S	Hire changes for power polishing	L.S	L.S	100
L.S	Electric charges	L.S	L.S	1500
1.10Nos	Polisher	350	each	385
2.20Nos	Mazdoor II class	300	each	660
			Rate for 10 m^2	20054.12/10 m^2

Sub data

Cement mortar 1:3 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
480	cement	5200	1000kg	2496
1m^3	Sand	500	m^3	500
1m^3	Mixing charge	100	m^3	100
			Rate for 1 m^3	3096

Main data for Flooring with ceramic tiles over a bed of C.M 1:3 - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
112 nos.	Ceramic tiles	80	each	8960
0.21 m^3	C.M 1:3	3096	m^3	650.16
3.00kg	Colour cement	50	kg	150
1.20Nos	Mason I class	450	each	540
1.00 Nos	Mason II class	400	each	400
1.00 Nos	Mazdoor I class	350	Each	350
1.00 Nos	Mazdoor II class	300	Each	300
0.50No	Stone cutter I class	500	Each	250
0.50kg	Cotton waste	50	Kg	25
L.S	Sundries	L.S	L.S	74.84
			Rate for 10 m^2	11700

3.5 Brick work in Super Structure

3.5.1 Prepare the data for Brick Work in C.M 1:5 in super structure using Ist class bricks - 10 m^3

Materials and labour required

Brick (19 x 9 x 9 cm)	-	5000 Nos
Cement Mortar 1:5	-	2.20 m^3
Mason Ist class	-	3.5 Nos
Mason IInd class	-	10.60 Nos
Mazdoor Ist class	-	7.10 Nos
Mazdoor IInd class	-	21.20Nos

Cost of materials and labour

Cement	-	Rs. 5200/ton
Sand	-	Rs.600/ m^3
Brick Ist class	-	Rs. 4000/1000 Nos
Brick IInd class	-	Rs. 3000/1000 Nos
Mason Ist class	-	Rs. 550 each
Mason IInd class	-	Rs. 500 each
Mazdoor Ist class	-	Rs. 450 each
Mazdoor IInd class	-	Rs. 400 each
Mixing charge	-	Rs.75/ m^3

Sub data:- Cement mortar 1:5 - 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
288kg	cement	5200	1000kg	1497.6
1m^3	Sand	600	m^3	600
1m^3	Mixing charge	75	m^3	75
			Rate for 1 m^3	2172.6

Main data for Brick work in C.M1:5 in superstructure using

Ist class bricks – 10m^3

Quantity	Description	Rate	Unit	Amount(Rs)
5000Nos	Brick (19 x 9 x 9cm)	4000	1000 nos	20000
2.20 m^2	CM 1:5	2172.6	m^3	4779.72
3.50 Nos	Mason Ist class	550.00	Each	1925.00
10.60 Nos	Mason IInd class	500	Each	5300.00
7.10 Nos	Mazdoor Ist class	450	Each	3195.00
21.20 Nos	Mazdoor IInd class	400	Each	8480.00
			Rate for 10 m^3	43679.72

3.5.2 Prepare the data for Brick work with first class in C.M 1:4 for partition including plastering both faces with cement mortar 1:5, 12mm thick - 10 m^2

Materials and labour required

B.W with Ist class bricks in C.M 1:4 for partition – 10m^2

Brick Ist class - 5000 Nos

Cement Mortar 1:4 - 1.40 m^3

Mason Ist class - 7 Nos

Mason IInd class - 7.1 Nos

Mazdoor Ist class - 7.10 Nos

Mazdoor IInd class - 7.10Nos

Plastering with C.M 1:5, 12mm thick – 10 m^2

Cement mortar 1:5 - 0.12 **m^2**

Mason Ist class - 0.5 Nos

Mazdoor IInd class - 1.1 Nos

B.W with Ist class in class in C.M1:4 for partition including plastering both faces with C.M1:5 12mm thick – 10m^2

B.W in C.M 1:4 for partition - 20 m^2

Plastering with C.M 1:5 - 10 m^2

Mason Ist class - 1 Nos

Cost of materials and labour

Cement	-	Rs. 5200/ton
Sand	-	Rs. 600/ m^3
Brick Ist class	-	Rs. 4000/1000 Nos
Brick IInd class	-	Rs. 3000/1000 Nos
Mason Ist class	-	Rs. 550 each
Mason IInd class	-	Rs. 500 each
Mazdoor Ist class	-	Rs. 450 each
Mazdoor IInd class	-	Rs. 400 each
Mixing charge	-	Rs.75/ m^3

Sub data:- Cement mortar 1:4 - 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
360kg	Cement	5200	1000kg	1872
1m^3	Sand	600	m^3	600
1m^3	Mixing charge	75	m^3	75
			Rate for 1 m^3	2547

Sub date :- B.W with Ist class Brick in C.M 1:4 for partition - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
5000Nos	Brick Ist class	4000	1000	20000
1.4 m^2	CM 1:4	2547	m^3	3565.8
7 Nos	Mason Ist class	550.00	Each	3850
7.1 Nos	Mason IInd class	500	Each	3550
7.10 Nos	Mazdoor Ist class	450	Each	3195
7.10 Nos	Mazdoor IInd class	400	Each	2480
			Rate for 10 m^2	36640.80
			Rate for 1m^2	3664.08

Sub data:- Cement mortar 1:5 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
288kg	cement	5200	1000kg	1497.6
1m^3	Sand	600	m^3	600
1m^3	Mixing charge	75	m^3	75
			Rate for 1 m^3	2172.6

Sub data:- Plastering with C.M 1:5, 12mm thick – 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
0.12 m^3	C.M 1:5	2172.6	m^3	260.71
0.5 Nos	Mason Ist class	550	Each	275
1.1 Nos	Mazdoor IInd class	400	each	440
			Rate for 10 m^2	975.71
			Rate for 1 m^2	97.57

Main Data:- B.W with Ist class in C.M1:4 for partition including plastering both faces in C.M 1:5, 12mm thick – 10m^2

Quantity	Description	Rate	Unit	Amount(Rs)
20 m^2	B.W in C.M 1:4 for partition	3664.08	m^2	73281.6
10 m^2	Plastering with C.M 1:5	97.57	m^2	975.71
1Nos	Mason Ist class	550	each	550
			Rate for 10 m^2	74807.31

3.6 Prepare the data for Random rubble masonry in cement Mortar- 10 m^3

3.7 Prepare the data for Coursed Rubble masonry in cement Mortar -10 m^3

Materials and labour required

3.6 Random rubble masonry in CM1:5 – 10m^2

Rough stone	-	10m^3
Bond stone	-	1m^3
Cement mortar1:5	-	3.4m^3
Mason Ist class	-	7.1 Nos
Mason IInd class	-	10.6 Nos
Mazdoor Ist class	-	14.10 Nos
Mazdoor IInd class	-	14.10Nos

3.7 Coursed Rubble masonry in CM 1:5 –10 m^3

Coursed rubble stone	-	11 m^3
Cement mortar 1:5	-	3.2m^3
Mason Ist class	-	7.1 Nos
Mason IInd class	-	17.6 Nos
Mazdoor Ist class	-	14.10 Nos
Mazdoor IInd class	-	14.10Nos

Cost of materials and lead particulars

S.no	materials	unit	Cost (Rs.)	Lead Km	Rate for Lead	Handling charge
1	Cement	Tonne	4400	Supplied at site		
2	Rough stone	m^3	220	15	5	40
3	Bond stone	m^3	350	16	6	50
4.	Coursed rubble stone	m^3	190	20	5	60
5	Sand	m^3	150	40	2.50	30

Cost of labours

Mason Ist class	-	Rs.450 each
Mason IInd class	-	Rs.400 each
Mazdoor Ist class	-	Rs.300 each
Mazdoor IInd class	-	Rs.200 each
Mixing charge	-	Rs.100/ m^3

Answer:-

Cost of materials at site

S.no	**materials**	**unit**	**Cost (Rs.)**	**Lead Km**	**Rate for Lead**	**Handling charge**	**Cost at Site (Rs)**
1	Cement	Tonne	4400	Supplied at site			4400
2	Rough stone	m^3	220	15	5	40	335
3	Bond stone	m^3	350	16	6	50	496
4.	Coursed rubble stone	m^3	190	20	5	60	350
5	Sand	m^3	150	40	2.50	30	280

Sub data for Cement mortar 1:5 - 1 m^3

Quantity	Description	Rate	Unit	Amount (Rs)
288kg	cement	4400	1000kg	1267.2
$1m^3$	Sand	280	m^3	280
$1m^3$	Mixing charge	100	m^3	100
			Rate for 1 m^3	1647.20

Main data for Random Rubble masonry in CM 1:5 – 10 m^3

Quantity	Description	Rate	Unit	Amount (Rs)
10 m^3	Rough stone	335	m^3	3350
$1m^3$	Bound stone	496	m^3	496
3.4 m^3	CM 1:5	1647.20	m^3	5600.48
7.1 Nos	Mason Ist class	450	Each	3195
10.6 Nos	Mason IInd class	400	Each	4240
14.1 Nos	Mazdoor Ist class	300	Each	4230
14.1 Nos	Mazdoor IInd class	200	Each	2820
			Rate for 10 m^3	23931.48

Main data for Coursed **Rubble masonry in CM 1:5 –10** m^3

Quantity	Description	Rate	Unit	Amount (Rs)
11m^3	Coursed rubble stone	350	m^3	3850
3.2 m^2	CM 1:5	1647.20	M^2	5271.04
7.1 Nos	Mason Ist class	450	Each	3195
17.6 Nos	Mason IInd class	400	Each	7040
14.1 Nos	Mazdoor Ist class	300	Each	4230
14.1 Nos	Mazdoor IInd class	200	Each	2820
			Rate for 10 m^3	26406.04

3.8 Prepare the data for Lime surki concrete in weathering course finished with pressed tiles in C.M 1:3

Materials and labour required

Weathering course concrete with broken jelly 20mm over the roof slab – 10 m^2

Brick jelly	-	12.8 m^3
Slaked lime	-	5.60m^3
Mason Ist class	-	1.80 Nos
Mazdoor Ist class	-	17.7 Nos
Mazdoor IInd class	-	14.10 Nos

Floor finishing the top with pressed tiles of size 200 x 200 x 20mm with C.M 1:3 mixed with crude oil – 10 m^2

Pressed tiles	-	250 nos
C.M 1:3	-	0.12 m^3
Pointing with C.M 1:3	-	10 m^2
Water proofing compound	-	1.15kg
Mason Ist class	-	1.10 Nos
Mason IInd class	-	2.10 Nos
Mazdoor Ist class	-	2.20 Nos
Mazdoor IInd class	-	1.10Nos

Pointing with C.M 1:3 - 10 m^2

C.M 1:3	-	0.09 m^3
Mason IInd class	-	1.60 Nos
Mazdoor Ist class	-	0.50 Nos
Mazdoor IInd class	-	1.10Nos

Main Data for Lime surki concrete in weathering course finished with pressed tiles in C.M – 10 m^2

Weathering course with broken jelly concrete	-	10 m^2
Floor Finishing with pressed tiles	-	10 m^2

Cost of materials and labour

Cement	-	Rs. 5200/ton
Sand	-	Rs. 550/ m^3
Brick jelly (20mm)	-	Rs. 350/ m^3
Slaked lime	-	Rs. 600/ m^3
Pressed tiles	-	Rs. 40/each
Water proofing compound	-	Rs 100/kg
Mixing charges	-	Rs.100/ m^3
Mason Ist class	-	Rs. 500 each
Mason IInd class	-	Rs. 450 each per day
Mazdoor Ist class	-	Rs. 400 each per day
Mazdoor IInd class	-	Rs. 350 each per day

Solution :

Sub data for Weathering course concrete with broken jelly 20mm over the roof slab – 10 m^2

Quantity	Description	Rate	Unit	Amount (Rs)
12.8m^2	Brick jelly 20mm	350	m^3	4480
5.6 m^3	Slaked lime	600	M^3	3360
1.80 nos	Mason Ist class	500	Each	900
17.7 Nos	Mazdoor Ist class	400	Each	7080
14.1 Nos	Mazdoor IInd class	350	Each	4935
			Rate for 10 m^2	20755

Sub data :- Cement mortar 1:3 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
480	cement	5200	1000kg	2496
1m^3	Sand	550	m^3	550
1m^3	Mixing charge	100	m^3	100
			Rate for 1 m^3	3146

Sub data:-

Floor finishing the top with pressed tiles of size 200 x 200 x 20mm with C.M 1:3 mixed with crude oil – 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
250 Nos	Pressed tiles	40	each	10000
0.12 m^3	C.M 1:3	3146	M^3	377.52
10 m^2	Pointing with C.M1:3	1588.14	10M^2	1588.14
1.15kg	Water prrofing compound	100	kg	115
1.10 Nos	Mason Ist class	500	Each	550
2.10 Nos	Mason IIst class	450	Each	945
2.20 Nos	Mazdoor Ist class	400	Each	880
1.10Nos	Mazdoor IInd class	350	Each	385
			Rate for 10 m^2	14840.66

Sub data:- Pointing with C.M 1:3 – 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
0.09 m^3	Cement mortar 1:3	3146	M^3	283.14
1.60 nos	Mason IInd class	450	Each	720
0.50 Nos	Mazdoor Ist class	400	Each	200
1.10 Nos	Mazdoor IInd class	350	Each	385
			Rate for 10 m^2	1588.14

Main Data for Lime surki concrete in weathering course finished with pressed tiles in C.M – 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
10 m^2	Weathering course broken jelly	20755	10 m^2	20755
10 m^2	Finishing with pressed tiles	14840.66	10 m^2	14840.66
			Rate for 10 m^2	35595.66

3.9 R.C.C WORKS

3.9.1 Prepare the data for R.C.C roof slab 120mm thick of mix 1:$1\frac{1}{2}$:3 using 20mm broken jelly with suitable reinforcement including centering, curing etc., complete – 1 m^3

3.9.2 Prepare the data for R.C.C 1:2:4 beams 300 x 500mm using 20mm broken stone jelly with suitable reinforcement including centering shuttering etc., complete – 1 m^3

3.9.3 Prepare the data for R.C.C column with mix 1:2:4 of size 200 x 200mm with suitable reinforcement including centering, curing etc., complete -1 m^2

3.9.4 Preapre the data for R.C.C 1:2:4 sunshades of 600mm projection and 80mm average thickness rate for 10m run.

Material & Labour requirements

3.9.1 C.C 1 : $1\frac{1}{2}$: 3 – 10 m^3

Broken stone	-	9 m^3
Sand	-	4.5 m^3
Cement	-	4308kg
Mason IInd class	-	3.50 Nos
Mazdoor Ist class	-	21.20 Nos
Mazdoor IInd class	-	35.30 Nos

R.C.C roof slab 1:1$\frac{1}{2}$:3 using 20mm broken jelly - 1m^3

Concrete 1:1$\frac{1}{2}$:3	-	as required
Steel	-	90kg/m^3 of concrete
Binding wire	-	1% of reinforcement
Centering	-	as required as 20% extra for sides
Bar bending	-	as required

3.9.2 R.C.C beam of mix 1:2:4 – 1 m^3

Concrete 1:2:4	-	1 **m^3**
Steel	-	150kg/ m^3 concrete
Binding wire	-	1% of reinforcement
Centering	-	as required
Bar bending	-	as required

3.9.3 R.C.C column of mix 1:2:4 – 1 m^3

Concrete 1:2:4	-	1 **m^3**
Steel	-	90 kg/ m^3 concrete
Binding wire	-	1% of reinforcement
Centering	-	as required
Bar bending	-	as required

3.9.4 C.C 1: 2:4 – 10 m^3

Broken stone	-	9 **m^3**
Sand	-	4.5 **m^3**
Cement	-	3240 kg
Mason IInd class	-	3.50 Nos
Mazdoor Ist class	-	21.20 Nos
Mazdoor IInd class	-	35.30 Nos

3.9.4 R.C.C 1:2:4 Sunshade 600mm wide – 1m run:

Concrete 1:2:4	-	as required
Steel	-	75kg/**10 m^3** of concrete
Binding wire	-	1% of reinforcement
Centering	-	as required as 20% extra for sides
Bar bending	-	as required

Cost of materials and labour at site

Cement	-	Rs. 5200/ton
Steel	-	Rs. 48000/ton
Binding wire	-	Rs.80/kg
Sand	-	Rs. 420/ m^3
Broken stone (20mm)	-	Rs. 500/ m^3
Centering charges	-	Rs. 150/ m^2
Bar bending	-	Rs. 250/100kg
Mixing charges	-	Rs.100/ m^3
Mason Ist class	-	Rs. 500 each
Mason IInd class	-	Rs. 450 each per day
Mazdoor Ist class	-	Rs. 400 each per day
Mazdoor IInd class	-	Rs. 300 each per day

Solution

3.9.1 Sub data for C.C 1:11/2:3 – 10 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
9 m^3	Broken stone (20mm size)	500	M^3	4500
4.5 m^3	Sand	420	M^3	1890
4308kg	Cement	5200	Ton(1000kg)	22401.16
3.50nos	Mason IInd class	450	Each	1575
21.20 Nos	Mazdoor Ist class	400	Each	8480
35.30 Nos	Mazdoor IInd class	300	Each	10590
			Rate for 10 m^3	494366.16

Main data for R.C.C 1:1$\frac{1}{2}$:3, 120mm thick using 20mm broken jelly - 1m^3

Quantity	Description	Rate	Unit	Amount(Rs)
0.12m^3	Concrete 1:1$\frac{1}{2}$:3	49436.6	m^3	5932.39
10.8kg	Steel	48000	Ton	518.4
0.108 kg	Binding wire	80	kg	8.64
1.20 m^3	Centering	150	m^2	180
10.8kg	Bar bending	250	100kg	27
			Rate for m^3	6666.43

Calculation

a. Concrete

Assume : length = 1m, breadth = 1m, thickness = 120mm (0.12m)

Volume = l x b x t

= 1 x 1 x 0.12 = 0.12 m^3

b. Steel : 90kg/ m^3 of concrete

= 90 x 0.12 = 10.8kg

c. Binding wire :- 1% of reinforcement

= 1/100 x 10.8 = 0.108kg

d. Centering :- l x b = 1 m^2

Add 20% extra = 1 + (20/100 x 1)= 1.20 m^2

e. Bar bending :- 10.8kg

3.9.2 Sub data: R.C.C 1 :2 :4 - 10 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
9 m^3	Broken stone (20mm size)	500	m^3	4500
4.5 m^3	Sand	420	m^3	1890
3240kg	Cement	5200	ton	16848
3.50nos	Mason IInd class	450	Each	1575
21.20 Nos	Mazdoor Ist class	400	Each	8480
35.30 Nos	Mazdoor IInd class	300	Each	10590
			Rate for 10 m^3	43883

Main Data for R.C.C beam of mix 1:2:4 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
1m^3	Concrete 1:2:4	4388.30	m^3	4388.30
150kg	Steel	48000	Ton	7200
1.5 kg	Binding wire	80	kg	120
1.3 m^2	Centering	150	m^2	195
150kg	Bar bending	250	100kg	375
			Rate for m^3	12278.30

Calculation:-

a. Binding wire - 1% of reinforcemen

- 1/100 x 150 = 1.5kg

b. Area for Centering - l x b = l = 1m , b = (500+300+500)

(0.5+0.3+0.5) = 1.3m

There fore, Area of centering, A - 1 x 1.30 = 1.3 m^2

c. Bar Bending - 150kg

3.9.3 Main Data for R.C.C column of mix 1:2:4 – 1 m^3

Quantity	Description	Rate	Unit	Amount(Rs)
$0.04m^3$	Concrete 1:2:4	4388.30	m^3	175.53
3.6kg	Steel	48000	Ton	172.8
0.036 kg	Binding wire	80	kg	2.88
0.8 m^3	Centering	150	m^3	120
3.6kg	Bar bending	250	100kg	9
			Rate for m^3	480.21

Calculation:-

a. Volume of Concrete - 1 x 0.2 x 0.2 = $0.04m^3$

b. Steel - $90kg/m^3$ of concrete = 90 x 0.04 = 3.6kg

c. Binding wire- 1% = 1/100 x 3.6 = 0.036kg

d. Centering - area = l x b = 1 x (0.2 + 0.2+ 0.2+ 0.2) = $0.8m^2$

3.9.4 Main Data for R.C.C sun shade of mix 1:2:4 – 1 m run

Quantity	Description	Rate	Unit	Amount(Rs)
$0.048m^3$	Concrete 1:2:4	4388.30	m^3	210.63
3.60kg	Steel	48000	Ton	172.8
0.036 kg	Binding wire	80	kg	2.88
$3.60m^3$	Bar bending	250	100kg	9
0.72kg	centering	150	m^2	108
			Rate for per m run	503.31

Calculation:-

- Concrete - 1 x 0.6 x 0.08= $0.048m^3$
- Steel $75kg/m^3$ - 0.048 x 75 = 3.6kg
- Binding wire 1% steel - 1/100 x 3.6 = 0.036kg

- Bar bending = 3.6kg
- Centering l x b - 1m x 0.6 = $0.6m^2$

  Add 20% extra = 0.6 + (20/100 x 0.6) = $0.72m^2$.

3.10 Plastering Brick masonry with CM

Prepare the data for the following items of work

a) Plastering the brick masonry in CM 1:5 12mm thick -$10m^2$

b) Plastering the brick masonry in CM 1:3 10mm thick - $10m^2$

Quantity of materials and labour required

a) **Plastering the brick masonry in CM 1:5 12mm thick** -$10m^2$

Cement mortar 1:5	-	$0.14\ m^3$
Mason Ist class	-	1.10 nos
Mazdoor Ist class	-	0.50nos
Mazdoor IInd class	-	1.10 nos

b) Plastering the brick masonry in CM 1:3 10mm thick - $10m^2$

Cement mortar 1:3	-	$0.10\ m^3$
Mason Ist class	-	1.10 nos
Mazdoor Ist class	-	1.10nos
Mazdoor IInd class	-	1.10 nos

Cost of materials and labour

Cement	-	Rs. 5200/ton
Sand	-	Rs. 500/ m^3
Mixing charges	-	Rs.100/ m^3
Mason Ist class	-	Rs. 450 each
Mason IInd class	-	Rs. 350 each per day
Mazdoor Ist class	-	Rs. 300 each per day
Mazdoor IInd class	-	Rs. 100 each per day

Solution:-

1. Sub data for C.M 1:5 - $1m^3$

Quantity	Description	Rate	Unit	Amount(RS)
288kg	cement	5200	1000kg	1497.6
$1m^3$	Sand	500	m^3	500
$1m^3$	Mixing charge	100	m^3	100
			Rate for $1m^3$	2097.6

2. **Sub data for C.M 1:3 - 1m^3**

Quantity	Description	Rate	Unit	Amount(Rs)
480kg	cement	5200	1000kg	2496
1m^3	Sand	500	m^3	500
1m^3	Mixing charge	100	m^3	100
			Rate for 1m^3	3096

Main data for a) Plastering the brick masonry in CM 1:5 12mm thick -10m^2

Quantity	Description	Rate	Unit	Amount(Rs)
0.14 m^3	Cement mortar 1:5	2097.6	m^3	293.66
1.10 nos	Mason Ist class	450	Each	495
0.50 Nos	Mazdoor Ist class	300	Each	150
1.10 Nos	Mazdoor IInd class	100	Each	110
			Rate for 10 m^2	1048.66

Main data for b) Plastering the brick masonry in CM 1:3 10mm thick - 10m^2

Quantity	Description	Rate	Unit	Amount(Rs)
0.10 m^3	Cement mortar 1:3	3096	m^3	309.6
1.10 nos	Mason Ist class	450	Each	495
1.10 Nos	Mazdoor Ist class	300	Each	330
1.10 Nos	Mazdoor IInd class	100	Each	110
			Rate for 10 m^2	1244.6

3.11 Pointing for stone masonry with cement mortar

a) Prepare the data for Pointing with C.M 1:3 for R.R masonry - 10 m^2

b) **Prepare the data for Pointing with C.M 1:4 for R.R masonry - 10 m^2**

Quantity of materials and labour required

a) Pointing with C.M 1:3 for R.R masonry - 10 m^2

Cement	-	34kg
Sand	-	0.09m^3
Mason IInd class	-	1.60 nos
Mazdoor Ist class	-	0.50nos
Mazdoor IInd class	-	1.10 nos
Mixing charge	-	10m^3

b) Pointing with C.M 1:4 flush pointing for R.R masonry - 10 m^2

Cement mortar 1:4	-	0.09m^3
Mason IInd class	-	1.60 nos
Mazdoor Ist class	-	0.5nos
Mazdoor IInd class	-	1.1nos

Cost of materials and labour

Cement	-	Rs. 5200/ton
Sand	-	Rs. 520/ m^3
Mason Ist class	-	Rs. 480 each
Mason IInd class	-	Rs. 430 each per day
Mazdoor Ist class	-	Rs. 400 each per day
Mazdoor IInd class	-	Rs. 380 each per day
Mixing charges	-	Rs.300/ m^3

Solution:-

Main data for a) Pointing with C.M 1:3 for R.R masonry - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
34kg	Cement	5200	1000kg	176.80
0.09 m^3	sand	520	m^3	46.80
1.60Nos	Mason IInd class	430	Each	688
0.5Nos	Mazdoor Ist class	400	Each	200
1.10 Nos	Mazdoor IInd class	380	Each	418
10 m^3	Mixing charge	300	m^3	300
			Rate for 10 m^2	1829.6

b) Pointing with C.M 1:4 flush pointing for R.R masonry - 10 m²

Sub data for C.M 1:4 –1m³

Quantity	Description	Rate	Unit	Amount(Rs)
360kg	cement	5200	1000kg	1872
$1m^3$	Sand	520	m^3	520
$1m^3$	Mixing charge	300	m^3	300
			Rate for $1m^3$	2692

Main data for Pointing with C.M 1:4 flush pointing for R.R masonry - 10 m²

Quantity	Description	Rate	Unit	Amount(Rs)
0.09 m^3	Cement mortar 1:4	2692	m^3	242.28
1.60nos	Mason IInd class	430	Each	688
0.5 Nos	Mazdoor Ist class	400	Each	200
1.10 Nos	Mazdoor IInd class	380	Each	418
			Rate for 10 m^2	1548.28

3.12 Painting the wood work

Prepare the data for Painting two coats with synthetic paint with primer of approved quality and colour for new wood works - 10 m²

Materials and labour required

Priming coat for new wood work - 10 m²

Wood primer - 1.44lit

Painter I class - 0.70 no

Painting two coats over the new wood work - 10 m²

Priming coat - 10 m^2

Synthetic enamel paint for wood - 2.55 lits

Painter Ist class - 1.20 nos

Cost of materials and labour

Wood primer - Rs. 400/lit

Synthetic paint for wood - Rs. 700/lit

Painter Ist class - Rs. 450/each

Sub data for Priming coat - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
1.44lit	Wood primer	400	Lit	576
0.7 no	Painter I class	450	each	315
		Rate for 10 m^2		891

Main data for Painting two coats over the new wood work - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
10m^2	Primer coat	891	10m^2	891
2.55 lit	Synthetic enamel paint for wood	700	Lit	1785
1.2 no	Painter I class	450	each	540
			Rate for 10m^2	3216

3.13 Painting steel work

Prepare the data for Painting two coats with synthetic enamel paint with primer of approved quality and colour for new iron works -10 m^2

Materials and labour required

Priming coat for new iron work - 10 m^2

Red oxide primer - 1.33lit

Painter I class - 0.70 no

Painting the two coats over the new iron work - 10 m^2

Priming coat - 10 m^2

Synthetic enamel paint for iron - 2.55 lits

Painter Ist class - 1.20 nos

Cost of materials and labour

Synthetic paint for iron - Rs. 650 / lit

Painter Ist class - Rs. 450/each

Red oxide - Rs. 200/lit

Sub data for Priming coat - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
1.33lit	Red oxide primer	200	Lit	266
0.7 no	Painter I class	450	each	315
			Rate for 10m^2	581

Main data for Painting two coats over the new wood work - 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
10m^2	Primer coat	581	10m^2	**581**
2.55 lit	Synthetic enamel paint for iron	650	Lit	1657.5
1.2 no	Painter I class	450	each	540
			Rate for 10m^2	2778.50

3.14 White washing and painting works

Prepare the data for the following items of work

a) White washing with two coats of shell lime rate for 10 m^2

Shell lime	-	0.07 m^3
Mason Ist class	-	1.60 nos
Mazdoor Ist class	-	0.50nos
Mazdoor IInd class	-	2.70 nos
Gum, conjee, water, brush etc	– L.S	

b) Painting 2 coats with ready mixed paint - 10 m^2

Ready mixed paint	-	2.55lit
Painter Ist class	-	1.2 nos

Cost of materials and labour at site

Shell lime	-	Rs. 500 / m^3
Mason Ist class	-	Rs. 400 each
Mazdoor Ist class	-	Rs. 350 each per day
Mazdoor IInd class	-	Rs. 250 each per day
Gum, gunjees, brush	-	Rs. 100/100 m^2
Ready mixed paint	-	Rs.300 / lit
Painter Ist class	-	Rs. 400 / each

Solution:-

a) Main data for White washing with two coats of shell lime rate for 10 m^2

Quantity	Description	Rate	Unit	Amount(Rs)
0.07 m^3	Shall lime	500	m^2	35
1.60nos	Mason Ist class	400	Each	640
0.5 Nos	Mazdoor Ist class	350	Each	175
2.70 Nos	Mazdoor IInd class	250	Each	675
10 m^3	Gum,gunjee, water	100	100 m^3	10
			Rate for 10 m^2	1535

b) Main data for Painting 2 coats with ready mixed paint - 10 m^2

Quantity	Description	Rate	Unit	Amount (Rs)
2.55lit	Ready mixed paint	300	lit	765
1.60m^3	Painter Ist class	400	each	640
			Rate for 10 m^2	1405

3.15 Form works for beams and slabs

a) Prepare the data for Strutting to centering of R.C.C slabs for plain surfaces above 3m height – 10m^2

b) Prepare the data for Centering for soffits of R.C.C slabs including strutting 3m height - 1m^2

Quantity of materials and labour required :

a) Strutting to centering of R.C.C slabs for plain surfaces above 3m height – 10m^2

Casuarina post 150mm c/c and braces	-	98.5m for 5 operation
Carpender Ist class	-	0.3 nos
Mazdoor Ist class	-	0.3 nos
Nails coirs etc	-	Rs. 100/10 m^2

Cost of materials and labour at site

Casuarina post 750mm c/c and braces	-	Rs. 50/m
Carpender Ist class	-	Rs. 300/each/1 operation
Mazdoor Ist class	-	Rs. 200/each/1 operation
Nails coirs etc	-	Rs. 100/10 m^2

a) Main data for Strutting to centering of R.C.C slabs for plain surfaces above 3m height – 10m^2

Quantity	Description	Rate	Unit	Amount (Rs)
19.7m	Casuarina post 750mm c/c (for each operation = 98.5/5 = 19.7m)	50	m	985
0.3Nos	Carpender Ist class	300	Each	90
0.3 Nos	Mazdoor Ist class	200	each	60
10 m^2	Nails coirs etc	100	10 m^2	100
			Rate for 10 m^2	1235

b) Centering for soffits of R.C.C slabs including strutting 3m height - 1m^2

Country wood boarding 40mm thick	-	0.4m^3
Country wood joists	-	0.12m^3
Casuarina post	-	98.5m
Carpenter Ist class	-	3.8 nos
Mazdoor Ist class	-	5.4 Nos
Mazdoor IInd class	-	21.5 Nos
Wedge nail coirs etc	-	L.S

Cost of materials and labour at site

Country wood boarding 40mm thick	-	Rs. 1000/m^3
Country wood joists	-	Rs. 600/m^3
Casuarina post	-	Rs.200/10m
Carpenter Ist class	-	Rs.400/each
Mazdoor Ist class	-	Rs. 300/each
Mazdoor IInd class	-	Rs. 200/each
Wedge nail coirs etc	-	L.S

b) **Main data for Centering for soofits of R.C.C slabs including strutting 3m height - 1m^2**

Quantity	Description	Rate	Unit	Amount(Rs)
0.4 m^3	Country wood boarding 40mm thick	1000	m^3	400
0.12 m^3	Country wood joists	600	m^3	72
98.5m	Casuarina post	200	10m	1970
3.8nos	Carpenter Ist class	400	Each	1520
5.4nos	Mazdoor Ist class	300	Each	1620
21.5nos	Mazdoor IInd class	200	Each	4300
L.S	Wedge nail coirs etc	L.S	Each	100
			Rate for 1m^2	9982

3.16 AC Sheet roofing

a) Prepare the data for Roofing with A.C sheet – rate for 10 m^2

Quantity of materials required

A.C Corrugated sheet - 11.5m^2

Ridges - Rs. 90 /10m^2

Fitter IInd class - 2.2nos

Carpender Ist class - 1.1 Nos

Mazdoor IInd class - 3.20 nos

Cost of materials at site

A.C Corrugated sheet - Rs.250/m^2

Ridges - L.S

Fitter IInd class - Rs. 500/each

Carpender Ist class - Rs.400/each

Mazdoor IInd class - Rs. 200each

a) Main data for Roofing with A.C sheet – rate for 10 m^2

Quantity	Description	Rate	Unit	Amount (Rs)
11.50 m^2	A.C .Sheet	250	m^2	2875
10m^2	Ridges	90	m^2	90
2.2nos	Fitter IInd class	500	Each	1100
1.1 nos	Carpender Ist class	400	Each	440
3.20nos	Mazdoor IInd class	200	each	640
			Rate for 10 m^2	5145

3.17 Supplying and fixing Rain water pipes

a) Prepare the data for Providing and fixing rain water down fall pipes – 10mm dia with accessories rate per m.

b) Prepare the data for Cutting, threading, joining G.I pipes – 50mm dia – 30mm turn

c) Prepare the data for Providing and fixing GI pipes – 10m

Materials and labour requirement

Providing and fixing rain water down fall pipes – 3m

100mm dia AC pipe	-	3m
100mm dia AC Tee	-	1 No
100mm dia AC bend	-	1 no
100mm dia AC clamps	-	2 nos
TW plugs	-	4 nos
Plumber	-	1 no
Cement packing L.S	-	Rs.20

Cost of materials and Labour at site

100mm dia AC pipe	-	Rs.50/m
100mm dia AC street	-	Rs. 100/each
100mm dia AC bend	-	Rs. 60/each
100mm dia AC clamps	-	Rs.40/each
TW plugs	-	Rs.25/each
Plumber	-	Rs.25/each
Cement packing L.S	-	Rs.20

Solution:-

a) Providing and fixing rain water down fall pipes – 3m

Quantity	Description	Rate	Unit	Amount(Rs)
3m	100mm dia AC pipe	50	m	150
1no	100mm dia AC tee	100	Each	100
1no	100mm dia AC bend	60	Each	60
2nos	100mm dia AC clamps	40	Each	80
4nos	TW plugs	25	Each	100
1 no	Plumber	25	Each	25
L.S	Cement packing	20	LS	20
			Rate for 3 m run	535

b) Cutting, threading, joining G.I pipes – 50mm dia – 30mm turn

Materials and labour requirement

50mm dia GIpipe	**-**	**30m**
Cutting and threading	-	10 nos
50mm dia GI tees	-	3 nos
50mm dia GI elbows	-	2 nos
50mm dia GI couplings	-	5 nos
50mm dia GI Unions	-	1 no
Mason Ist class	-	1 no
Stone cutter IInd class	-	3 nos
Mazdoor Ist class	-	2 nos
Mazdoor IInd class	-	1 no
L.S Sundries for other items	-	Rs.40
Plumber	-	3 nos

Cost of materials and labour

50mm dia GIpipe	**-**	**150/m**
Cutting and threading	-	50/each
50mm dia GI tees	-	50/each
50mm dia GI elbows	-	40/each
50mm dia GI couplings	-	30/each
50mm dia GI Unions	-	45/each

Mason Ist class	-	400/each
Stone cutter IInd class	-	350/ each
Mazdoor Ist class	-	300/each
Mazdoor IInd class	-	250/each
L.S Sundries for other items	-	40
Plumber	-	400/each

c) Providing and fixing GI pipes – 10m

Materials and labour requirement

25mm dia GI pipe	-	10m
Fitting and wastage	-	15% of pipe cost
White lead, oil, hemp	-	Rs.35
Plumber Ist class	-	0.83 Nos.
Mazdoor Ist class	-	0.67 Nos.
Cement, sand, grit (L.S)	-	LS
Water charges	-	1%

Cost of materials and labour

25mm dia GI pipe	-	100/m
Fitting and wastage	-	15% = 15/100 x 1000 = 150/-
White lead, oil, hemp	-	Rs.60
Plumber Ist class	-	Rs. 400/each
Mazdoor Ist class	-	Rs. 350/each
Cement, sand, grit (L.S)	-	Rs. 100
Water charges	-	1%(L.S)

Solution:-

a)Main data for Cutting, threading, joining G.I pipes – 50mm dia – 30mm turn

Quantity	Description	Rate	Unit	Amount
30m	50mm dia GIpipe	150	m	4500
10nos	Cutting and threading	50	each	500
3 nos	50mm dia GI tees	50	each	150
2 nos	50mm dia GI elbows	40	each	80
5 nos	50mm dia GI couplings	30	each	150
1 no	50mm dia GI Unions	45	each	45

1no	Mason Ist class	400	each	400
3 nos	Stone cutter IInd class	350	each	1050
2 nos	Mazdoor Ist class	300	each	600
1 no	Mazdoor IInd class	250	each	250
LS	Sundries for other items	40	each	40
3 nos	Plumber	400	each	1200
			Rate for 30 mm turn	8965

b) Main data for Providing and fixing GI pipes – 10m

Quantity	Description	Rate	Unit	Amount
10m	25mm dia GI pipe	100	m	1000
15%	Fitting and wastage		L.S	150
LS	White lead, oil, hemp	35	L.S	35
0.83 Nos.	Plumber Ist class	400	Each	332
0.67 Nos.	Mazdoor Ist class	350	Each	234.5
LS	Cement, sand, grit	100	LS	100
1%	Water charges		LS	18.5
			Rate for 10m	1870

Calculation:-

- Fitting and wastage 15% of pipe cost

  = 15/100 x 1000 = 150

- Water charge

  = 1/100 x 1851.5 = 18.50

Review Questions

PART-A

1. Define observed data.
2. Define Data
3. Define sub data
4. Define main data
5. Define the lump sum provision.
6. State a few works for which lump sum provisions are made in estimate.
7. What do you mean by sundries

PART-B

1. What is lead statement? Explain its use.
2. Give an example of main data and sub data.
3. Name the units for the materials used in brick masonry in C.M 1:6.
4. Prepare the Data for L.M 1:4 – 1m^3
5. State the thickness of the following works in a residence a) Plastering brick wall c) Flooring concrete. c) Roof slab

PART-C

1. **Prepare the data for R.C.C sunshade, 45mm thick in 1:2:4 – 1 m^2 and Painting two coats with approved cement paint, the cement plastered wall surface, ceiling and other new surfaces 10m^2.**

Materials and labours required

R.C.C Sunshade 45mm thick - 10m^2

Broken stone(20mm)	-	0.45m^3
Sand	-	0.225m3
Cement	-	162kg
Steel	-	60kg
Centering charges	-	10m^2
Labour for mixing, placing, Bending and tying reinforcement for 10m^2	-	Rs. 400.00

Painting 2 coats with cement paint -10m^2

Cleaning the plastering surface	-	10m^2
Cement Paint	-	3.23kg
Painter I class	-	0.5 NO
Mazdoor category I	-	0.5No.
Mazdoor categoryII	-	0.8 No.

Cost of materials and labour at site:

Broken stone(20mm)	-	Rs. 525.00/m^3
Sand	-	Rs. 190.00/m^3
Cement	-	Rs. 160.00/bag
Reinforcement steel	-	Rs. 17,000/tone

Cleaning the plastered surface	-	Rs. 10.00/10m^2
Cement Paint	-	Rs. 50/kg
Centering charges	-	Rs. 100/m^2
Painter I class	-	Rs. 160.00/ each
Mazdoor category I	-	Rs. 120.00/each.
Mazdoor categoryII	-	Rs. 100.00/each.

2. **Prepare the data for R.C.C 1:1.5:3m^3 for 300mm x 300mm size columns – Rate per mm^3.**

Materials and labours required

R.C.C 1:1.5:3 for 300mm x 300mm size columns – 1mm^3

Broken stone(20 mm)	-	0.9m^3
Sand	-	0.45m^3
Cement	-	430kg
Steel bars	-	180kg
Binding wire	-	2kg
Mason II class	-	0.5 no
Mazdoor category I	-	3.5No.
Mazdoor categoryII	-	3.5 No.
Catering Charges	-	13.33m^2

Cost of materials and labour at site:

Broken stone(20mm)	-	Rs. 400/m^3
Sand	-	Rs. 190.00/m^3
Cement	-	Rs. 160.00/bag
Binding wire	-	Rs. 30/kg
Steel bar	-	Rs. 750.00/quintal
Bending and tying rods	-	Rs. 2,000/t
Mason II class	-	Rs. 140/each
Centering charges	-	Rs. 120/m^2
Mazdoor category I	-	Rs. 150.00/each.
Mazdoor categoryII	-	Rs. 120.00/each.

3. **Prepare the data for Cement concrete 1:4:10 in foundations.**

Materials and labours required

Cement Concrete 1:4:10 -10mm^3

Broken stone(40mm)	-	9.5 m^3
Cement Mortar1:4	-	3.8m^3
Mason II class	-	2 Nos
Mazdoor category I	-	16Nos.
Mazdoor categoryII	-	16 Nos.

Cement Mortar 1:4 – 1m^3

Cement	-	360kg
Sand	-	1m^3
Mixing charges	-	L.S

<u>Cost of materials and labour at site:</u>

Broken stone(40mm)	-	Rs. 480/m^3
Sand	-	Rs. 150.00/m^3
Cement	-	Rs. 140.00/bag
Mason II class	-	Rs. 160/each
Mixing charges	-	Rs. 100/m^2
Mazdoor category I	--	Rs. 160.00/each.
Mazdoor categoryII	-	Rs. 110.00/each.

4. **Prepare the data Prepare the data for A.C Sheet roofing for 1m^2 and Prepare the data for weathering course with brick jelly for 1m^2**

<u>Materials and labours required</u>

<u>A.C sheet roofing – 10m^2</u>

A.C. Sheet	-	11.5m^2
Adjustable ridges, 'U'bolts etc	-	Rs. 300/10m^2
Fitter II Class	-	2.2 Nos
Carpenter I class	-	1.1 Nos
Mazdoor I class	-	3.2 Nos.

<u>Weathering course with Brick jelly – 10m^2</u>

Broken jelly	-	12.8m^3
Lime	-	5m^3
Mason I	-	1.8Nos
Mazdoor I	-	17.7Nos
Mazdoor II	-	14.1Nos

<u>Cost of materials and labour at site:</u>

A.C.Sheet	-	Rs. 52/m^2
Lime	-	Rs. 1025/m^3
Fitter II	-	Rs. 170/-
Carpenter I	-	Rs. 180/-
Mason I	-	Rs. 180/ each
Mason II	-	Rs. 160/ each
-Mazdoor I	-	Rs. 120/-
Mazdoor II	-	Rs. 100/-

UNIT – IV

TAKING OFF QUANTITIES BY TRADE SYSTEM

4.1 General

The dimensions (length, breadth and depth) of various items of works are measured from the drawing and entered in a standard form (or) the quantities of work from the detailed measurements of various items of work in a project is known as taking off quantities.

4.1.1 Method of taking off quantities

The method of taking off quantities of various items of work is called system. The following two systems are generally adopted in quantity surveying.

1. Trade System
2. Group System

Trade System

In this trade system, all the measurement are recorded trade by trade. The measurements for same work at various places of the construction are recorded under a particular trade. Deductions (or) additions are done them and there.

4.1.2 Methods

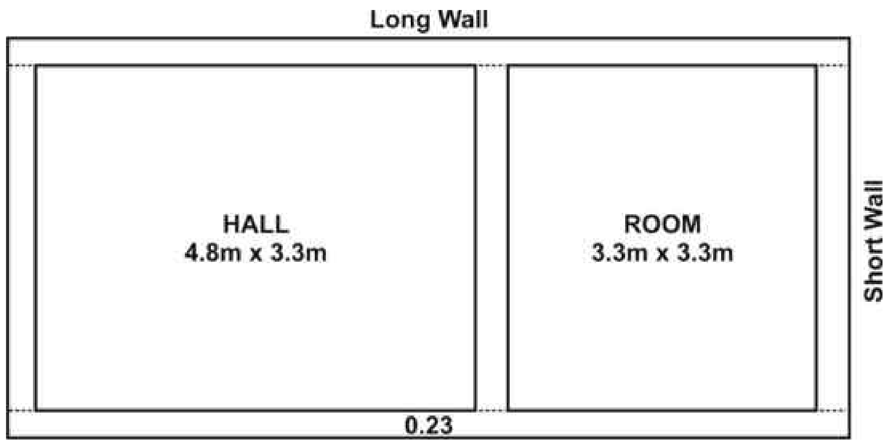
The quantities of various items of work can be determined by the following methods.

1. Individual wall method (or) long and short wall method.
2. Centre line method

4.1.2.1. Individual wall method (or) long and short wall method

In this method, the longer wall are considered as long walls and measured from out to out. The shorter walls perpendicular to longer wall are considered shorts walls and measured from in to in.

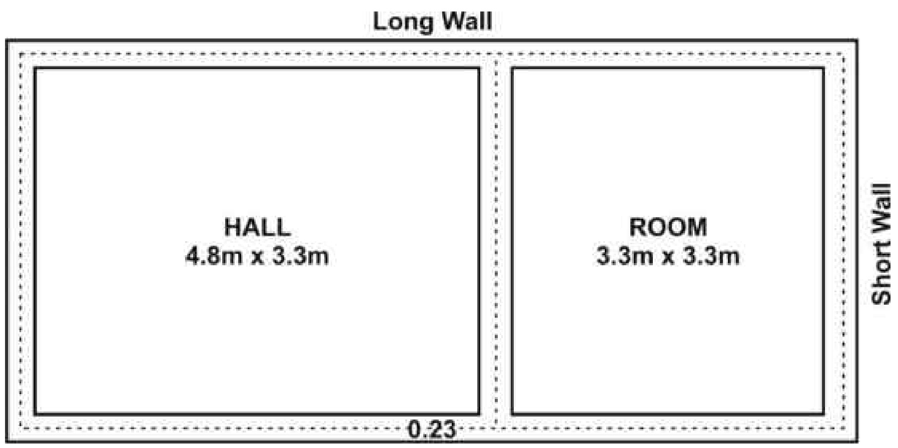
Example :



Length of long wall	=	0.23 + 4.80 + 0.23 + 3.30 + 0.23
	=	8.79 m
Length of short wall	=	3.30 m
Number of long walls	=	2
Number of short walls	=	3

4.1.2.2. Centre Line Method

In this method, the total length of centre line of main walls all round the building is calculated first and then calculated the centre line lengths of cross walls (or) interior walls by subtracting half the width at each end.



Length of centre line		
for main walls	=	(8.56 + 3.53)2
	=	24.18 m
Cross Wall	=	3.53 – 0.23
	=	3.30 m

4.1.3 Entering the dimensions

Detailed measurements of each item of work are taken out and quantities under each item are calculated and entered in a standard form

Detailed Estimate

S.No.	Description of work	No	Dimensions			Quantity	Remarks
			L	B	D		

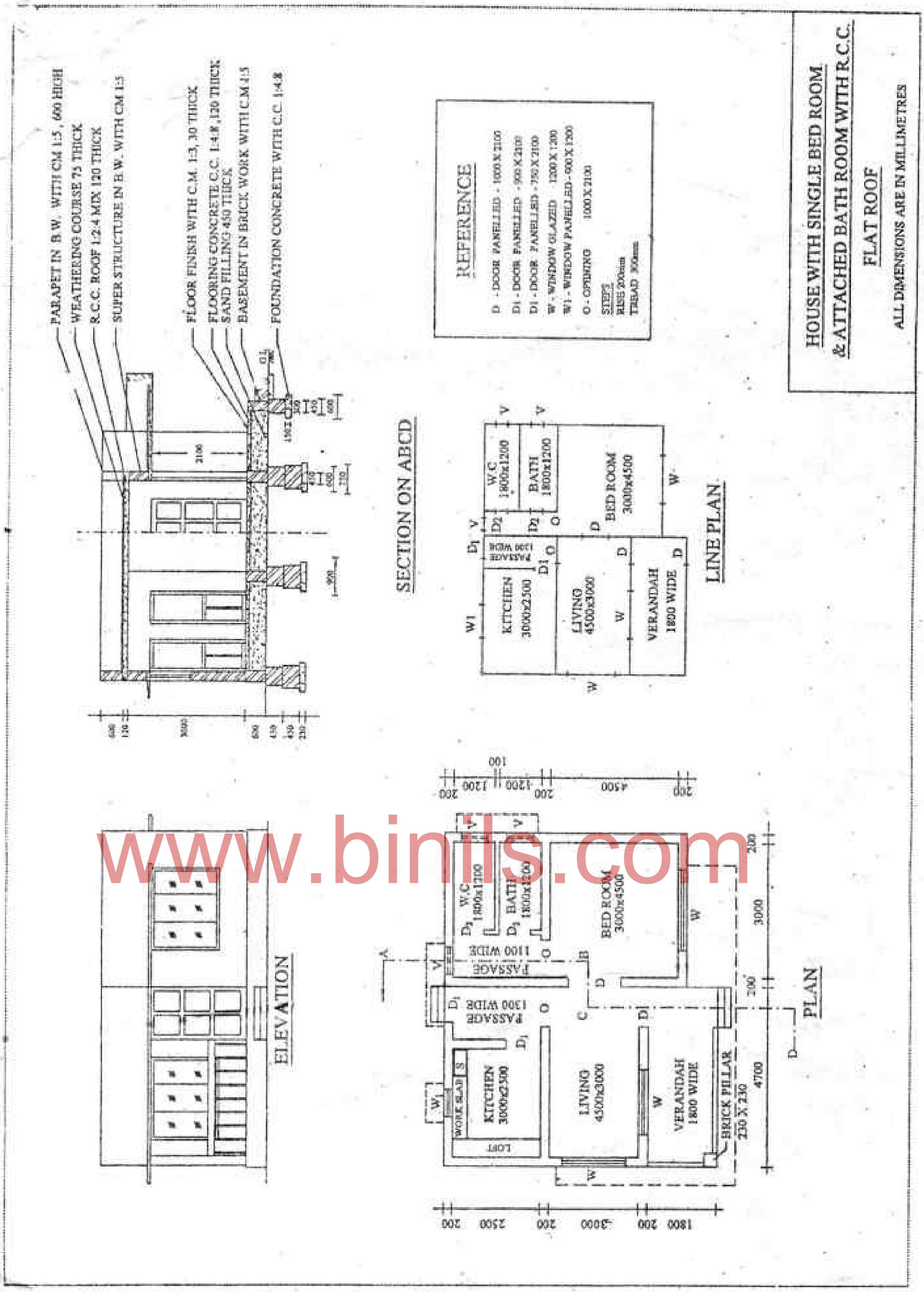
The total cost of the building is calculated by multiplying the quantities under each item of work taken from detailed estimate with specified rate in a standard form.

Abstract Estimate

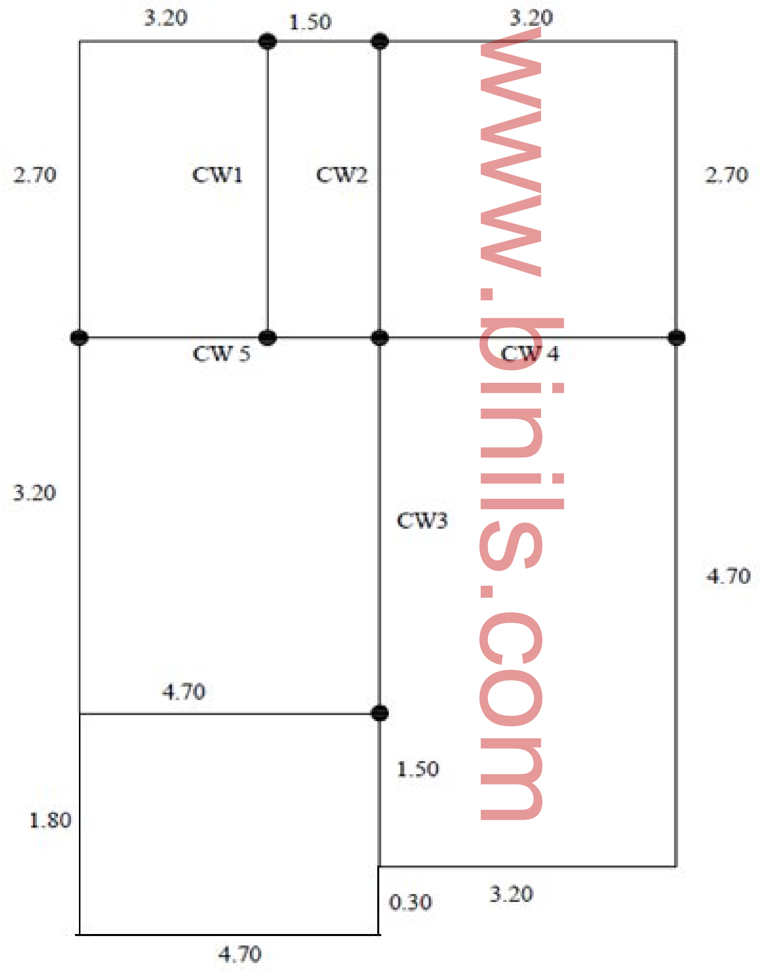
S.No.	Quantity	Description of work	Rate	Per	Amount

4.1.3.1 Rounding off quantities

The total quantities under each item of work is rounded to nearest number (digit or decimal) based on the type of work. This rounding off quantities is necessary for preparation of estimate, & bill for payment.


HOUSE WITH SINGLE BED ROOM & ATTACHED BATH ROOM WITH R.C.C.
FLAT ROOF
ALL DIMENSIONS ARE IN MILLIMETRES
REFERENCE
D - DOOR PANELLED - 1000 X 2100
D1 - DOOR PANELLED - 900 X 2100
D2 - DOOR PANELLED - 750 X 2100
W - WINDOW GLAZED - 1200 X 1200
W1 - WINDOW PANELLED - 600 X 1200
O - OPENING 1000 X 2100
STEPS
RISE 200mm
TREAD 300mm
PARAPET IN B.W. WITH CM 1:5, 600 HIGH
WEATHERING COURSE 75 THICK
R.C.C. ROOF 1:2:4 MIX 120 THICK
SUPER STRUCTURE IN B.W. WITH CM 1:5
FLOOR FINISH WITH C.M. 1:3, 30 THICK
FLOORING CONCRETE C.C. 1:4:8, 120 THICK
SAND FILLING 450 THICK
BASEMENT IN BRICK WORK WITH C.M 1:5
FOUNDATION CONCRETE WITH C.C. 1:4:8
SECTION ON ABCD
W.C 1800x1200
BATH 1800x1200
BED ROOM 3000x4500
PASSAGE 1100 WIDE
KITCHEN 3000x2500
LIVING 4500x3000
VERANDAH 1800 WIDE
LINE PLAN
ELEVATION
PASSAGE 1300 WIDE
WORK SLAB
LOFT
BRICK PILLAR 230 X 230
PLAN

A SMALL RESIDENTIAL BUILDING (TWO ROOMS) WITH R.C.C FLAT ROOF
CENTRE LINE PLAN



Main wall all around the building

C/L = 2 (7.90 + 7.40)
= 30.60m

Cross wall 1 & 2 = 2.70m
Cross wall 3 &4 = 3.20m
Cross wall 5 = 4.70m

Verandah = 1.80 +4.70 +0.30
= 6.80m

4.1.4 Detailed Estimate

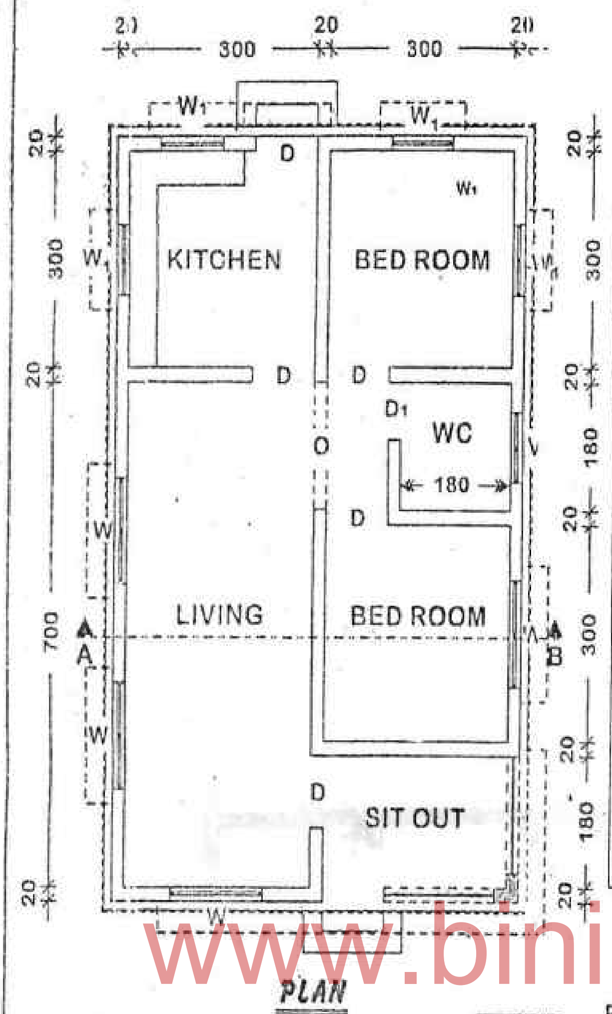
4.1.4. a) A small Residential Building (Two rooms) with RCC Flat roof

Sl.. No.	Description	Nos.	Dimensions			Qty.	Remarks
			L	B	D		
1.	Earthwork excavation in hardsoil						
	Main walls all round in the building (Except Verandah)	1	30.60	0.90	1.13	31.12	C/L = 30.60 m
	Cross walls 1 & 2	2	1.80	0.90	1.13	3.66	2.70 – 0.90 = 1.80
	Cross walls 3 & 4	2	2.30	0.90	1.13	4.68	3.20 – 0.90 = 2.30
	Cross walls 5	1	3.80	0.90	1.13	3.86	4.70 – 0.90 = 3.80
	All round Verandah	1	6.05	0.60	0.68	2.18	6.80 – 0.75 = 6.05
	Steps	2	1.30	0.60	0.15	0.23	
	TOTAL					**45.73m^3**	
2.	Cement concrete 1:4:8 mix using 40 mm hard broken stone for foundations.						
	Main wall all round the building	1	30.60	0.90	0.23	**6.33**	
	Cross walls 1 & 2	2	1.80	0.90	0.23	**0.75**	
	Cross walls 3 & 4	2	2.30	0.90	0.23	**0.95**	
	Cross wall 5	1	3.80	0.90	0.23	**0.79**	
	All round Verandah	1	6.05	0.60	0.15	**0.54**	
	Steps	2	1.30	0.60	0.15	**0.23**	
	TOTAL					**9.59m^3**	
3.	Brick masonry in CM 1:5 using I class bricks in foundation, basement, superstructure and parapet wall						
	1st Footing (Foundation)						
	Main walls all round the building	1	30.60	0.75	0.45	10.33	
	Cross walls 1 & 2	2	1.95	0.75	0.45	1.32	2.70 – 0.75 = 1.95
	Cross walls 3 & 4	2	2.45	0.75	0.45	1.65	3.20 – 0.75 = 2.45
	Cross walls 5	1	3.95	0.75	0.45	1.33	4.70 – 0.75 = 3.95
	2nd Footing (Foundation)						
	Main walls all round the building	1	30.60	0.60	0.45	8.26	
	Cross walls 1 & 2	2	2.10	0.60	0.45	1.13	2.70 – 0.60 = 2.10
	Cross walls 3 & 4	2	2.60	0.60	0.45	1.40	3.20 – 0.60 = 2.60
	Cross walls 5	1	4.10	0.60	0.45	1.11	4.70 – 0.60 = 4.10
	All round Verandah Footing	1	6.20	0.45	0.45	1.26	6.80 – 0.60 = 6.20
						27.79m^3	
	Basement						
	Main walls all round the building	1	30.60	0.45	0.60	8.26	
	Cross wall 1 & 2	2	2.25	0.45	0.60	1.22	2.70 – 0.45 = 2.25
	Cross wall 3 & 4	2	2.75	0.45	0.60	1.49	3.30 – 0.45 = 2.75
	Cross wall 5	1	4.25	0.45	0.60	1.15	4.70 – 0.45 = 4.25
	For Verandah	1	6.35	0.45	0.60	1.14	6.80 – 0.45 = 6.35
						13.26m^3	
	Steps						
	First Step	2	1.00	0.60	0.20	0.24	
	Second Step	2	1.00	0.30	0.20	0.12	
						0.36m^3	
	Superstructure						
	Main walls all round the building	1	30.60	0.20	3.00	18.36	
	Cross wall 1 & 2	2	2.50	0.20	3.00	3.00	2.70 – 0.20 = 2.50
	Cross wall 3 & 4	2	3.10	0.20	3.00	3.72	3.30 – 0.20 = 3.10
	Cross wall 5	1	4.50	0.20	3.00	2.70	4.70 – 0.20 = 4.50
	Brick Pillar in Verandah	1	0.23	0.23	2.10	0.11	
	Parapet wall all round	1	30.60	0.20	0.60	3.67	
						31.56m^3	
	Deductions for						
	Door – D	2	1.00	0.20	2.10	(-) 0.84	

	Door – D1 Opening – O Window – W Window – W1 Ventilator – V	1 2 3 1 3	0.90 1.00 1.20 0.90 0.60	0.20 0.20 0.20 0.20 0.20	2.10 2.10 1.20 1.20 0.45	(-) 0.38 (-) 0.84 (-) 0.86 (-) 0.22 (-) 0.16	
	<u>Lintels</u> Main walls all round Cross wall 1 & 2 Cross wall 3 & 4 Cross wall 5	 1 2 2 1	 30.60 2.50 3.00 4.50	 0.20 0.20 0.20 0.20	 0.10 0.10 0.10 010	 (-) 0.61 (-) 0.10 (-) 0.12 (-) 0.09	
	TOTAL					**(-)4.22m^3**	
	Net Quantity			(31.56 - 4.22)		**27.34m^3**	
	<u>Total Quantity</u> Footing 1st & 2nd Basement Superstructure & Parapet wall					 27.79 13.26 27.34	
	TOTAL					**68.39m^3**	
4.	Damp proofing course with CM 1:3, 20 mm thick Main walls all round Cross wall 1 & 2 Cross wall 3 & 4 Cross wall 5 For Verandah Deduct for Doors – D Doors – D1 Opening – O	 1 2 2 1 1 2 1 2	 30.60 2.50 3.10 4.50 6.60 1.00 0.90 1.00	 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.20	 - - - - - - - -	 6.12 1.00 1.24 0.90 1.32 (-) 0.40 (-) 0.18 (-) 0.40	 6.80 – 0.20 = 6.60
	TOTAL					**9.60m^3**	
5.	Filling in Basement with sand including consolidation Living Bedroom Kitchen Passage WC, Bath & Passage Verandah	 1 1 1 1 1 1	 4.25 2.55 2.55 0.85 2.55 4.25	 2.55 4.25 2.05 2.05 2.05 1.43	 0.45 0.45 0.45 0.45 0.45 0.45	 4.88 4.88 2.35 0.78 2.35 2.73	 4.70 – 0.45 = 4.25 3.00 – 0.45 = 2.55 2.50 – 0.45 = 2.05 1.30 – 0.45 = 0.85 1.80 – 0.225 - 0.15 = 1.43
	TOTAL					**17.97m^3**	
6.(a)	Cement concrete 1:4:8 using 40MM HBs for flooring to a thickness of 120 mm Living Bedroom Kitchen Passage WC, Bath & Passage Verandah	 1 1 1 1 1 1	 4.25 2.55 2.55 0.85 2.55 4.25	 2.55 4.25 2.05 2.05 2.05 1.43	 - - - - - -	 10.84 10.84 4.60 1.74 5.23 6.06	
	TOTAL					**39.31m^2**	
6.(b)	Floor finish with CM 1:3, 30mm thick Living Bedroom Kitchen Passage WC, Bath & Passage Verandah Sills of Door – D Door – D1 Opening – O	 1 1 1 1 1 1 2 1 2	 4.25 2.55 2.55 0.85 2.55 4.25 1.00 0.90 1.00	 2.55 4.25 2.05 2.05 2.05 1.43 0.20 0.20 0.20	 - - - - - - - - -	 10.84 10.84 4.60 1.74 5.23 6.06 0.40 0.18 0.40	
	TOTAL					**40.29m^2**	
7.	RCC works with CC 1:2:4 mix using 20 mm HBs including reinforcement, centering, curing etc complete <u>Lintel</u>						

	Main walls all round the building	1	30.60	0.20	0.10	0.61	
	Cross walls 1 & 2	2	2.50	0.20	0.10	0.10	2.70 – 0.20 = 2.50
	Cross walls 3 & 4	2	3.00	0.20	0.10	0.12	3.20 – 0.20 = 3.00
	Cross walls 5	1	4.50	0.20	0.10	0.09	4.70 – 0.20 = 4.50
	<u>Sunshade</u>						
	Front side of Bedroom W	1	2.25	1.05	0.08	0.19	Sunshade thickness
	Front side of Verandah	1	4.70	0.75	0.08	0.28	= 0.10 + 0.06 / 2 = 0.08m
	Side of Living Verandah	1	4.25	0.45	0.08	0.15	
	For Kitchen W1	1	1.20	0.45	0.08	0.04	
	For Backside D1 & V	1	2.10	0.45	0.08	0.08	
	For WC & Bath V	1	2.20	0.45	0.08	0.08	
	Loft	1	2.50	0.45	0.08	0.09	
	Work slab	1	3.00	0.45	0.08	0.11	
	<u>Roof Slab</u>						
	Over kitchen & living	1	4.70	6.10	0.12	3.44	
	Over Bedroom & WC, Bath Passage	1	3.40	7.60	0.12	3.10	
	For Verandah portion	1	4.90	2.00	0.12	1.18	
	TOTAL					**9.66m^3**	
8.	Supplying & Fixing hi position of best TW panelled doors including all fittings and furnitures etc complete etc.						
	Door D (1.00 x 2.10m)	2				2 Nos.	
	Door D1 (0.90 x 2.10)	1				1 No	
	Door D2 (0.75 x 2.10)	2				2 Nos.	
9.	Supplying and fixing in position of glazed windows						
	Window – W (1.20 x 1.20)	3				3 Nos.	
	Window – W1 (0.90 x 1.20)	1				1 No	
	Ventilator – V (0.60 x 0.45)	3				3 Nos.	
10.	Plastering with CM 1:3, 12 mm thick for Ceiling						
	Living	1	4.50	3.00		13.50	
	Bedroom	1	3.00	4.50		13.50	
	Kitchen	1	3.00	2.50		7.50	
	Passage	1	1.30	2.50		3.25	
	WC, Bath & Passage	1	3.00	2.50		7.50	
	Verandah	1	4.70	1.80		8.46	
	<u>Sunshades Top & Bottom & Sides</u>						
	Front side of Bedroom W	2	2.25	1.05	-	4.73	
	Front side of Verandah	2	4.70	0.75	-	7.05	
	Side of Living & Verandah	2	4.25	0.45	-	3.83	
	For Kitchen W1	2	1.20	0.45	-	1.08	
	For backside D1 & V	2	2.10	0.45	-	1.89	
	For WC & Bath V	2	2.20	0.45	-	1.98	
	Front face & Sides for all	1	21.35	-	0.05	1.07	
	For Loft	1	2.50	0.95	-	2.38	
	For Work slab	1	3.00	0.95	-	2.85	
	TOTAL					**80.57m^2**	
11.	Plastering with CM 1:5, 12mm thick for walls						
	<u>Inside plastering</u>						
	Living	1	15.00	-	3.00	45.00	(4.50 + 3.00) 2 = 15.00
	Bedroom	1	15.00	-	3.00	45.00	(3.00 + 4.50) 2 = 15.00
	Kitchen	1	11.00	-	3.00	33.00	(3.00 + 2.50) 2 = 11.00
	Passage	1	7.60	-	3.00	22.80	(1.30 + 2.50) 2 = 7.60
	WC, Bath & Passage	1	11.00	-	3.00	33.00	(3.00 + 2.50) 2 = 11.00
	<u>Outside plastering</u>						
	Basement wall all round	1	33.00	-	0.60	19.80	31.20+(5x0.45) – 0.45 = 33.00
	Above basement to Parapet	1	31.40	-	3.72	116.81	30.60+(5x0.20) – 0.20 = 31.40
	Parapet top face	1	30.60	0.20	-	6.12	3.00 + 0.12 + 0.60 = 3.72
	Inside face of parapet wall	1	29.80	-	0.60	17.88	30.60–(5 x 0.20) +0.20=29.80

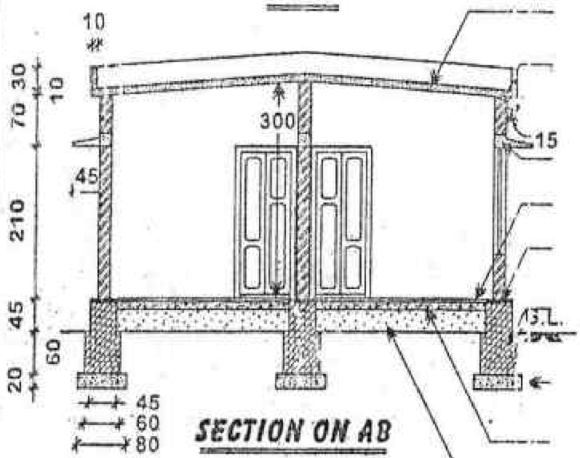
	<u>Steps</u>						
	Tread	2	1.00	0.60	-	1.20	
	Rise	2	1.00	-	0.60	1.20	
	Sides 1st Step	2 x 2	0.60	-	0.20	0.48	
	Sides 2nd Step	2 x 2	0.30	-	0.20	0.24	
	Brick pillar in Verandah	1	0.92	-	2.10	1.93	0.23 x 4 = 0.92
	TOTAL					**344.46m^3**	
	<u>Deductions</u>						
	Doors – D	2 x 2	1.00	-	2.10	(-) 8.40	
	Doors – D1	1 x 2	0.90	-	2.10	(-) 3.78	
	Opening – O	2 x 2	1.00	-	2.10	(-) 8.40	
	Windows – W	3 x 2	1.20	-	1.20	(-) 8.64	
	Windows – W1	1 x 2	0.90	-	1.20	(-) 2.16	
	Ventilator – V	3 x 2	0.60	-	0.45	(-) 1.62	
	TOTAL					**(-) 33.00m^2**	
	Net Quantity		(344.46 – 3300)			**311.46**	
12.	Weathering course with brick jelly concrete in lime 75mm thick						
	Over Living & Kitchen	1	4.70	5.70	-	26.79	
	Over Bedroom & WC, Bath & Passage	1	3.00	7.20	-	21.60	
	TOTAL					**48.39m^2**	
13.	Brick work 100mm thick for brick partition in CM 1:3 including plastering both the faces with CM 1:5, 12mm thick						
	In between WC & Bath	1	1.80	-	3.00	5.40	
	In between WC, Bath & Passage	1	2.50	-	3.00	7.50	
	TOTAL					**12.90m^2**	
	<u>Deductions</u>						
	Door – D2	2	0.75	-	2.10	(-) 3.15	
	TOTAL					(-) 3.15	
	Net Quantity			(12.90 – 3.15)		**9.75 m^2**	
14.	White washing two coats with best lime quantity as per plastering area deduct steps tread area			(81+312-1.2)		391.80m^2	
	TOTAL					**391.80m^2**	
15.	Colour washing two coats Quantity as per plastering area					**392.00m^2**	
16.	Painting two coats with approved enamel paint for doors & windows						
	Panalled Doors – D	2x2.60	1.00	-	2.10	10.92	Painting coefficient for Panelled Door – 2.6
	Doors – D1	1x2.60	0.90	-	2.10	4.91	Window Panalled – 2.6
	Doors – D2	2x2.60	0.75	-	2.10	8.19	Window Glazed – 1.6
	Panalled Window – W	3x2.60	1.20	-	1.20	11.23	
	Glazed Window – W1	1x1.60	0.90	-	1.20	1.73	
	Glazed Ventilator – V	3x1.60	0.60	-	0.45	1.30	
	TOTAL					**38.28m^2**	
17.	Electrification with all fittings					**LS**	
18.	Water supply & sanitary works					**LS**	
19.	Contingencies and unforeseen items					**LS**	
20.	Petty super vision charges					**LS**	



PLAN

REFERENCE

FOUNDATION	R.R. IN C.M. 1:8
BASEMENT	R.R IN C.M. 1:8
WALLS	B.W. IN C.M. 1:6 20 Tk
LINTEL	R.C.C. 1:2:4, 15 Tk
ROOF	R.C.C. 1:2:4 10 Tk
DOORS	D - 100 x 210 ,FULLY PANELLED
	D_1 - 80 x 210 ,FULLY PANELLED
WINDOWS	W - 150 x 150 ,FULLY GLAZED
	W_1 - 100 x 150 ,FULLY GLAZED
VENTILATOR	V - 100 x 50 ,FULLY GLAZED
PLASTERING	INSIDE & OUT SIDE WITH C.M. 1:5, CEILING C.M. 1:3
STEPS	
TREAD	30
RISE	15



SECTION ON AB

ROOFING WITH C.C.1:2:4, 100 THICK

BRICK WORK IN SUPER STRUCTURE WITH C.M. 1:5, 200 THICK

LINTEL CUM SUNSHADE, 150 THICK

FLOOR FINISH WITH C.M. 1:4, 20 THICK

D.P.C. WITH C.M. 1:3, 20 THICK

R.R.MASONRY IN FOUNDATION AND BASEMENT WITH C.M. 1:5

CEMENT CONCRETE FOR FOUNDATION, 1:4:8, 200 THICK

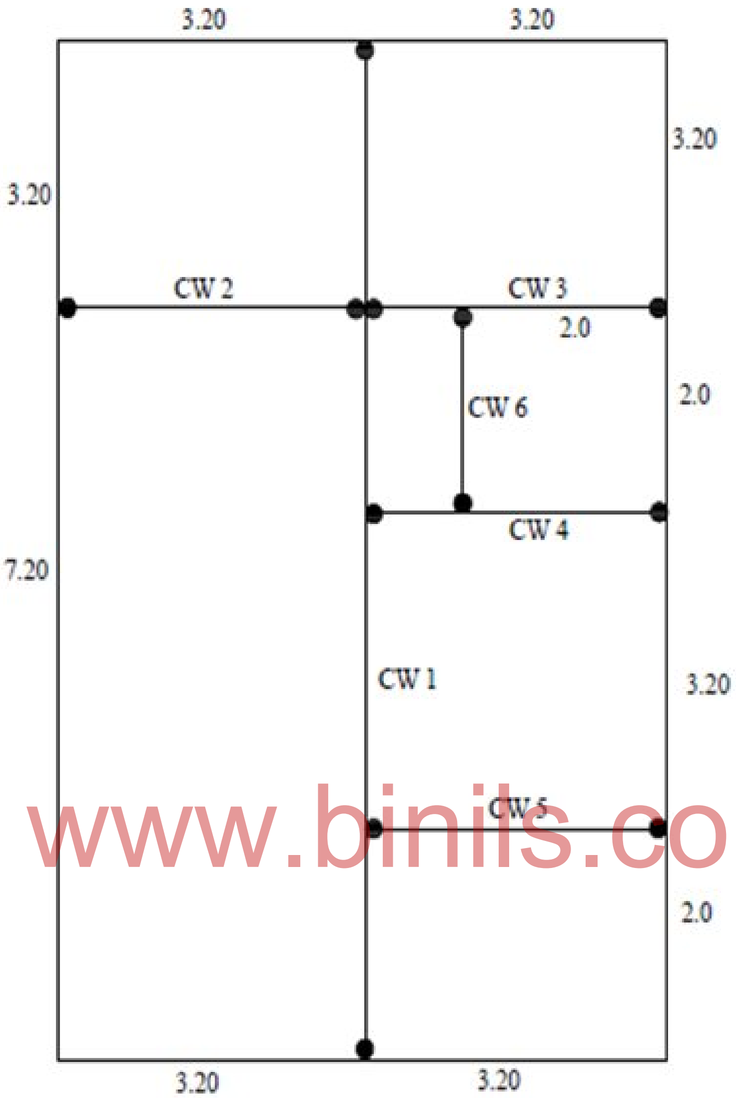
FLOORING WITH CEMENT CONCRETE, 1:4:8, 130 THICK

SAND FILLING, 300 THICK

A COTTAGE WITH SLOPED R.C.C. ROOF

ALL DIMENSIONS ARE IN CM.

A SMALL RESIDENTIAL BUILDING (TWO/THREE BED ROOMS) WITH RCC SLOPED ROOF - CENTRE LINE PLAN



Main wall all around the building

$$C/L = 2\,(6.40 + 10.40) = 33.60\text{m}$$

Cross wall 1	= 10.40m
Cross wall 2,3,4 &5	= 3.20m
Cross wall 6	= 2.0m

Detailed Estimate

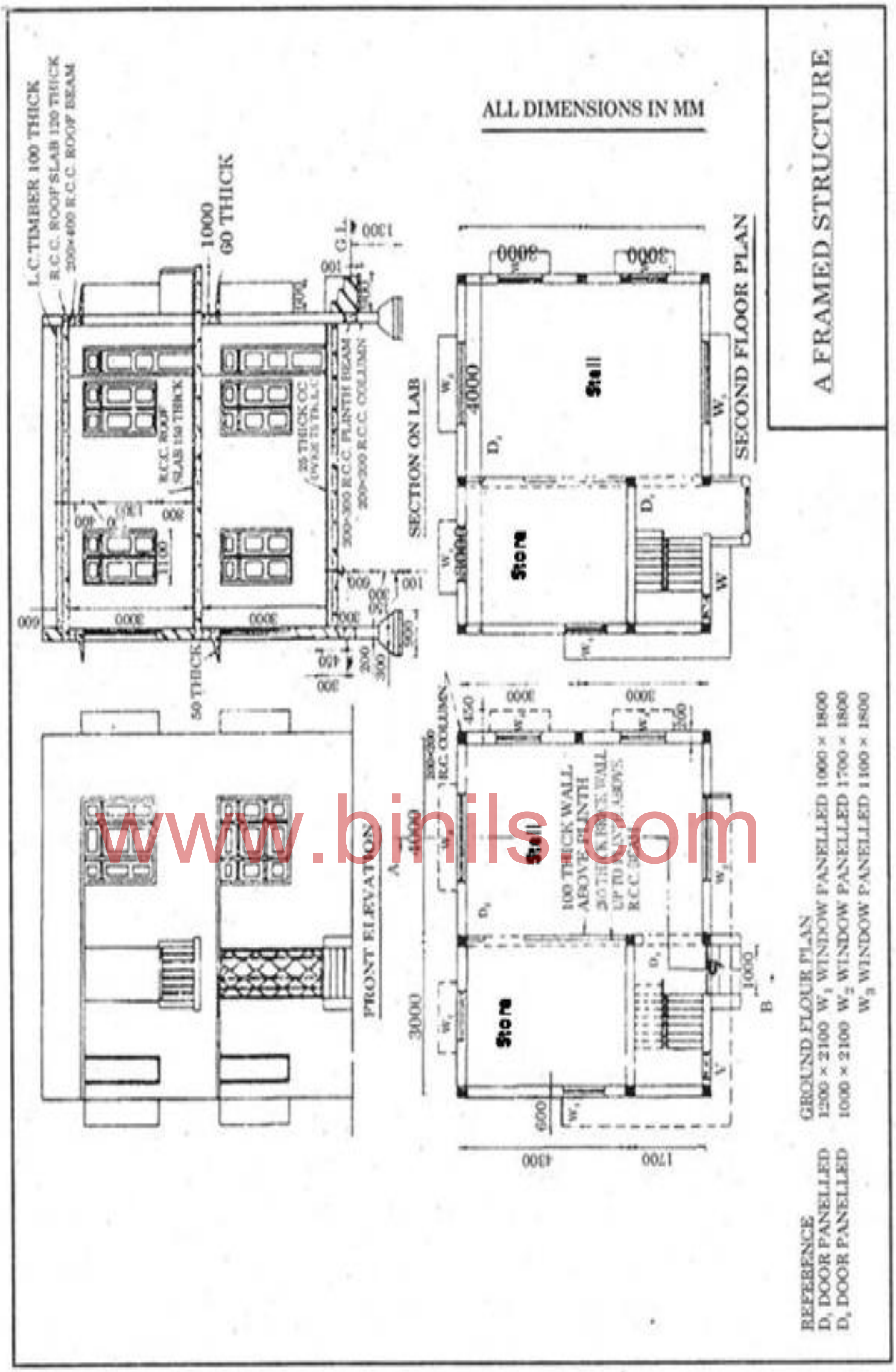
4.1.5. A small residential building with Two / Three rooms with RCC sloped roof

Sl. No.	Description	Nos.	Dimensions L	Dimensions B	Dimensions D	Qty.	Remarks
1.	Earthwork excavation in hard soil for foundation						
	(a) Main walls all round the building	1	33.60	0.80	0.80	21.50	2(10.40+6.40)=33.60
	(b) Cross wall – 1	1	9.60	0.80	0.80	6.14	10.40-0.80=9.60
	(c) Cross wall – 2,3,4&5	4	2.40	0.80	0.80	6.14	3.20-0.80=2.40
	(d) Cross wall – 6	1	1.20	0.80	0.80	0.77	2.00-0.80=1.20
	(e) Steps	2	2.00	0.40	0.10	0.16	1.60+(2x0.2)=2.00 0.6+0.2-0.4=0.40
	TOTAL					**34.71m³**	
2.	Cement Concrete 1:4:8 mix, using 40mm jelly for foundation						
	(a) Main walls all round	1	33.60	0.80	0.20	5.38	
	(b) Cross wall – 1	1	9.60	0.80	0.20	1.54	
	(c) Cross wall – 2,3,4&5	4	2.40	0.80	0.20	1.54	
	(d) Cross wall – 6	1	1.20	0.80	0.20	0.19	
	(e) Steps	1	2.00	0.80	0.10	0.16	
	TOTAL					**8.81m³**	
3.	Random rubble masonry in CM 1:5 for footings & basement						
	Footings						
	(a) Main walls all round the building	1	33.60	0.60	0.60	12.10	
	(b) Cross wall – 1	1	9.80	0.60	0.60	3.53	10.40-0.60=9.80
	(c) Cross wall – 2,3,4&5	4	2.60	0.60	0.60	3.74	3.20-0.60=2.60
	(d) Cross wall – 6	1	1.40	0.60	0.60	0.50	2.00-0.60=1.40
	Basement						
	(a) Main walls all round the building	1	33.60	0.45	0.45	6.80	
	(b) Cross wall – 1	1	9.95	0.45	0.45	2.02	10.40-0.45=9.95
	(c) Cross wall – 2,3,4&5	4	2.75	0.45	0.45	2.23	3.20-0.45=2.75
	(d) Cross wall – 6	1	1.55	0.45	0.45	0.31	2.00-0.45=1.55
	TOTAL					**31.23m³**	
4.	Sand filling in basement						
	(a) Sitout	1	2.75	1.55	0.30	1.28	3.20-0.45=2.75
	(b) Living	1	2.75	6.75	0.30	5.57	7.20-0.45=6.75
	(c) Kitchen & Beds	3	2.75	2.75	0.30	6.81	
	(d) WC	1	1.55	1.55	0.30	0.72	2.00-0.45=1.55
	(e) Passage	1	0.55	1.55	0.30	0.26	1.00-0.45=0.55
	TOTAL					**14.64m³**	
5.	Brick masonry in CM 1:5 using I class bricks for superstructure						
	(a) Main walls all round the building	1	33.60	0.20	2.80	18.82	2.10+0.70=2.80
	(b) Cross wall – 1	1	10.20	0.20	3.00	6.12	10.40-0.20=10.20
	(c) Cross walls – 2,3,4&5	4	3.00	0.20	2.90	6.96	(2.80+3.00)/2=2.90
	(d) Cross wall – 6	1	1.80	0.20	2.92	1.05	2.00-0.20=1.80
	(e) Parapet wall	1	34.80	0.10	0.30	1.04	(3-2.8)/3x1.8)+2.8=2.92
	(f) Steps i) First step	2	1.60	0.60	0.15	0.29	(10.70+6.70)2=34.80
	ii) Second Step	2	1.00	0.30	0.15	0.09	1.00+2(0.30)=1.60
	TOTAL					**34.37m³**	
	Deductions for openings						

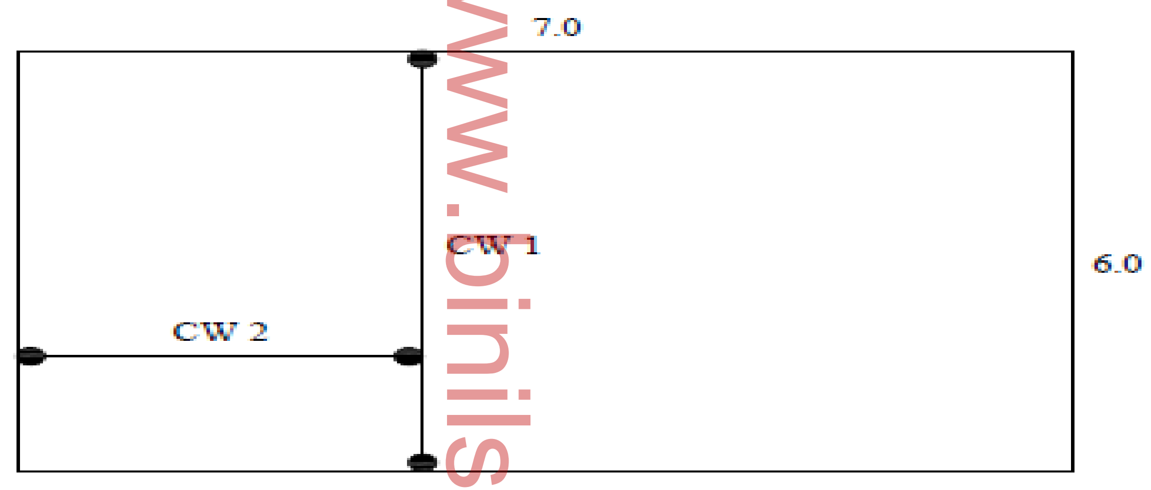
	Doors – D Doors – D1 Opening – O Windows – W Windows – W1 Ventilator – V Sitout open, front Sitout open, side Lintels in outer walls Lintels in cross wall – 1 Lintels in cross walls – 2,3,4&5 Lintels in cross wall – 6	5 1 1 4 4 1 1 1 1 1 4 1	1.00 0.80 1.80 1.50 1.00 1.00 2.80 1.60 28.40 10.20 3.00 1.80	0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.20	2.10 2.10 2.10 1.50 1.50 0.50 2.10 2.10 0.15 0.15 0.15 0.15	(-) 2.10 (-) 0.34 (-) 0.76 (-) 1.80 (-) 1.20 (-) 0.10 (-) 1.18 (-) 0.67 (-) 0.85 (-) 0.31 (-) 0.36 (-) 0.05	3.00-0.20=2.80 1.80-0.20=1.60 33.60-2.0-3.2=28.40
	TOTAL					**(-)9.72m^3**	
	Nett Quantity		(34.37 – 9.72)			**24.65 m^3**	
6.	Damp proofing course in CM 1:3, 20mm thick (a) Main walls all round (b) Cross wall – 1 (c) Cross walls – 2,3,4&5 (d) Cross walls – 6	 1 1 4 1	 33.60 10.20 3.00 1.80	 0.20 0.20 0.20 0.20	 - - - -	 6.72 2.04 2.40 0.36	
	TOTAL					**11.52m^2**	
	Deductions for Door sills Door – D Door – D1 Opening – O	 5 1 1	 1.00 0.80 1.80	 0.20 0.20 0.20	 - - -	 (-) 1.00 (-) 0.16 (-) 0.36	
	TOTAL					**1.52m^2**	
	Nett Quantity	(11.52 – 1.52)				**10.00m^2**	
7.	RCC 1:2:4 mix, using 20mm jelly for lintels, sunshades, roof etc. (a) Lintels (i) Main walls all round (ii) Cross wall – 1 (iii) Cross walls – 2,3,4&5 (iv) Cross wall – 6 (b) Beam in sitout (c) i) Sunshade in front sitout & W ii) Sunshade for W iii) Sunshade for W1 iv) Sunshade for D (d) Roof slab (e) Cooking slab	 1 1 4 1 1 1 3 4 1 1 1	 28.40 10.20 3.00 1.80 5.60 8.50 1.90 1.40 1.40 10.90 4.00	 0.20 0.20 0.20 0.20 0.20 0.45 0.45 0.45 0.45 6.90 0.45	 0.15 0.15 0.15 0.15 0.30 0.08 0.08 0.08 0.08 0.10 0.08	 0.85 0.31 0.36 0.05 0.34 0.31 0.21 0.20 0.05 7.52 0.14	0.95+1.50+3.40+0.45+2.20=8.50 1.50+(2x0.2)=1.90 1.00+(2x0.2)=1.40 6.60+(0.15x2)=6.90 3.00+1.00=4.00
	TOTAL					**10.34m^3**	
8.	Plastering with CM 1:3, 12 mm thick for Ceiling (a) Sitout (b) Living (c) Kitchen & Beds (d) WC (e) Passage (f) i) Sunshades for front sitout & W ii) Sunshade for W iii) Sunshade for W1 iv) Sunshade for D v) Cooking Slab vi) Bottom of Beam	 1 1 3 1 1 1 3 4 1 1 1	 3.00 3.00 3.00 1.80 1.00 8.50 1.90 1.40 1.40 4.00 4.40	 1.80 7.00 3.00 1.80 1.80 1.00 1.00 1.00 1.00 1.00 0.20	 - - - - - - - - - - -	 5.40 21.00 27.00 3.24 1.80 8.50 5.70 5.60 1.40 4.00 0.88	0.45+0.1+0.45=1.00 2.80+1.60=4.40
	TOTAL					**84.52m^2**	
9.	Plastering with CM 1:5, 12mm thick Inner sides of walls (a) Sitout	 1	 1.80	 -	 3.00	 5.40	

		1	1.80	-	2.80	5.04	
		2	3.00	-	2.90	17.40	(3.0+2.80)2=2.90
	(b) Living	1	20.00	-	2.90	58.00	(7+3)2=20
	(c) Kitchen & beds	3	12.00	-	2.90	104.40	(3+3)2=12
	(d) WC	1	1.80	-	2.92	5.26	
		1	1.80	-	2.80	5.04	
		2	1.80	-	2.86	10.30	(2.80+2.92)/2=2.86
	(e) Passage	1	1.80	-	3.00	5.40	
		1	1.80	-	2.92	5.26	
		2	1.00	-	2.96	5.92	(2.92+3.00)/2=2.96
	<u>Outer sides of walls</u>						
	(f) Basement to roof	1	34.40	-	2.80	96.32	(10.60+6.60)2=34.40
	(g) Parapet wall outer side	1	35.20	-	0.55	19.36	(10.80+6.80)2=35.20
	(h) Parapet wall inner side	1	34.40	-	0.30	10.32	
	(i) Parapet top	1	34.80	0.10	-	3.48	
	(j) Jambs of Doors						
	(i) Door – D	5	0.20	-	6.20	6.20	(1+2.1)2=6.20
	(ii) Door – D1	1	0.20	-	5.80	1.16	(0.8+2.1)2=5.80
	(iii) Opening – O	1	0.20	-	7.80	1.56	(1.8+2.1)2=7.80
	(iv) Window – W	4	0.20	-	6.00	4.80	(1.5+1.5)2=6.00
	(v) Window – W1	2	0.20	-	5.00	2.00	(1+1.5)2=5.00
	(vi) Ventilator – V	1	0.20	-	3.00	0.60	(1+0.5)2=3.00
	(k) Steps i) First Step						
	Tread	2	2.20	0.30	-	1.32	(0.6x2)+1.00=2.20
	Rise	2	2.80	-	0.15	0.84	(0.6x2)+1.60=2.80
	ii) Second Step						
	Tread	2	1.00	0.30	-	0.60	
	Rise	2	1.60		0.15	0.48	(0.3x2)+1.00=1.60
	TOTAL					**376.46m^2**	
	<u>Deductions for openings</u>						
	Doors – D	5	1.00	-	2.10	(-) 10.50	
	Doors – D1	1	0.80	-	2.10	(-) 1.68	
	Opening – O	1	1.80	-	2.10	(-) 3.78	
	Windows – W	4	1.50	-	1.50	(-) 9.00	
	Windows – W1	4	1.00	-	1.50	(-) 6.00	
	Ventilator – V	1	1.00	-	0.50	(-) 0.50	
	Sitout Open, Front	1	2.80	-	2.10	(-) 5.88	
	Sitout Open, Right Side	1	1.60	-	2.10	(-) 3.36	
	TOTAL					**(-) 40.70m^2**	
	Nett Quantity	(376.46-40.70)				**335.76 m^2**	
10.	Cement Concrete 1:4:8 mix, 40mm jelly used, 130 mm thick for flooring						
	(a) Sitout	1	3.00	1.80	-	5.40	
	(b) Living	1	3.00	7.00	-	21.00	
	(c) Kitchen & Beds	3	3.00	3.00	-	27.00	
	(d) WC	1	1.80	1.80	-	3.24	
	(e) Passage	1	1.00	1.80	-	1.80	
	TOTAL					**58.44m^2**	
11.	Floor finish with CM 1:4, 20 mm thick						
	(a) Sitout	1	3.00	1.80	-	5.40	
	(b) Living	1	3.00	7.00	-	21.00	
	(c) Kitchen & beds	3	3.00	3.00	-	27.00	
	(d) WC	1	1.80	1.80	-	3.24	
	(e) Passage	1	1.00	1.80	-	1.80	
	(f) Door Sills						
	Sitout	1	4.40	0.20	-	0.88	
	Door – D	5	1.00	0.20	-	1.00	
	Doors – D1	1	0.80	0.20	-	0.16	
	Opening - O	1	1.80	0.20	-	0.36	
	TOTAL					**60.84m^2**	
12.	Weathering course with brick jelly concrete in lime						

	Over the roof slab	1	6.70	10.70	-	71.69	
	TOTAL					**71.69m²**	
13.	Supplying and fixing of fully panalled doors Door – D of Size (1.0x2.10)m Doors – D1 of size (0.8x2.10)	 5 1	 - -	 - -	 - -	 5 Nos. 1 No.	
14.	Supplying & fixing of fully glazed windows and ventilators Windows – W of size (1.5x1.5)m Windows – W1 of size (1.0x1.5)m Ventilator – V of size (1.0x0.5)m	 4 1 1	 - - -	 - - -	 - - -	 4 Nos. 1 No. No.	
15.	White washing with lime in 2 coats Quantity as per plastering area Quantity as ceiling plastering area					 336.00 85.00	
	TOTAL					**421.00m²**	
16.	Colour washing with approved colour Quantity as per white washing area					 421.00m²	
17.	Painting with enamel paint over priming coat for doors & windows Fully Panelled doors – D Fully Panelled doors – D1 Fully glazed window – W Fully glazed window – W1 Fully glazed Ventilator - V	 5x2.60 1x2.60 4x1.60 1x1.60 1x1.60	 1.00 0.80 1.50 1.00 1.00	 - - - - -	 2.10 2.10 1.50 1.50 0.50	 27.30 4.37 9.00 2.40 0.80	 Painting coefficient for fully paneled doors & windows=2.60 For fully glazed windows is 1.60
	TOTAL					**43.87m²**	
18.	Electrification works					**LS**	
19.	Water supply & sanitary works					**LS**	
20.	Contingencies and Unforeseen items					**LS**	
21.	Petty supervision charges					**LS**	


A FRAMED STRUCTURE
ALL DIMENSIONS IN MM
SECTION ON LAB
FRONT ELEVATION
SECOND FLOOR PLAN
GROUND FLOOR PLAN
L.C.TIMBER 100 THICK
R.C.C. ROOF SLAB 120 THICK
200×400 R.C.C. ROOF BEAM
1000
60 THICK
50 THICK
R.C.C. ROOF SLAB 150 THICK
25 THICK CC
300×300 R.C.C. PLINTH BEAM
200×200 R.C.C. COLUMN
R.C.C. COLUMN
100 THICK WALL ABOVE PLINTH
Stall
Store
REFERENCE
D_1 DOOR PANELLED 1200 × 2100 W_1 WINDOW PANELLED 1000 × 1800
D_2 DOOR PANELLED 1000 × 2100 W_2 WINDOW PANELLED 1700 × 1800
W_3 WINDOW PANELLED 1100 × 1800

TWO STOREY BUILDING (FRAMED STRUCTURE) WITH RCC ROOF - CENTRE LINE PLAN



Main wall all around the building

$C/L = 2\,(7.0 + 6.0)$
$= 26.00m$

Cross wall 1 = 6.0m
Cross wall 2 = 3.0m

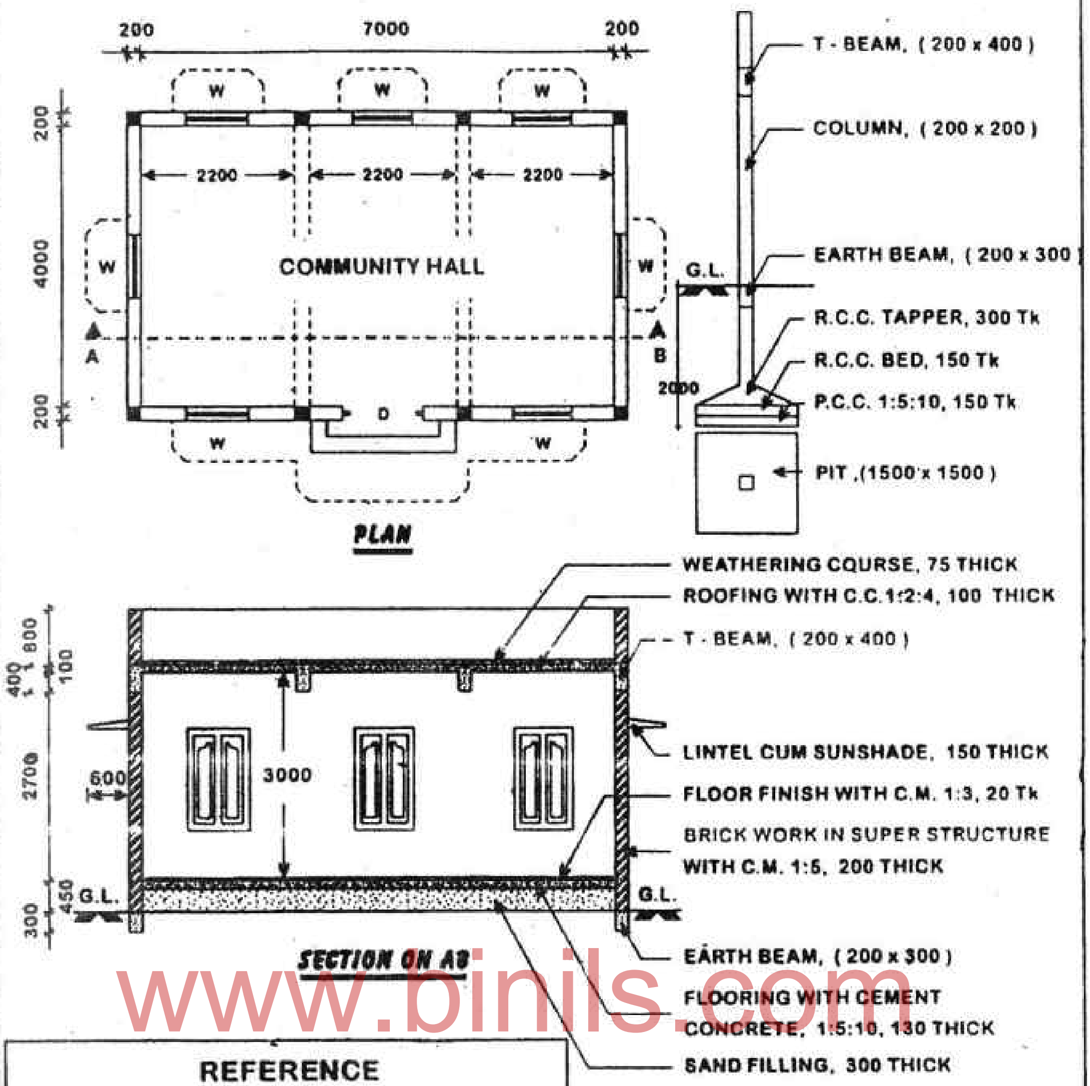
Detailed Estimate
4.1.6 Two storied Building (Framed Structure) with RCC roof

Sl. No.	Description	Nos.	Dimensions L	B	D	Qty.	Remarks
1.	Earthwork excavation for foundation						
	Columns	9	0.90	0.90	1.30	9.48	(7.0+6.0)2=26.00
	Main walls all round	1	18.80	0.20	0.15	0.56	26.0-(8x0.9)=18.80
	Cross Wall – 1	1	4.00	0.20	0.15	0.12	6.00-0.20=5.80
	Cross Wall – 2	1	1.90	0.20	0.15	0.06	5.80-(2x0.9)=4.00
	Steps	1	1.70	0.90	0.25	0.38	3.00-0.20=2.80 2.80-(1x0.9)=1.90 1.0+(2x0.2)+(2x0.15)=1.70
	TOTAL					**10.60m³**	
2.	Plain cement concrete 1:4:8 mix, using 40mm jelly for base						
	Column Base	9	0.90	0.90	0.10	0.73	
	TOTAL					**0.73m³**	
3.	RCC 1:2:4 mix, using 20mm Jelly column footings, columns, plinth beams, roof beams and lintels etc.						
	Column footings bottom portion	9	0.90	0.90	0.15	1.09	
	Column footings sloped portion	9	$(0.9^2-0.3^2)/2$		0.3	1.22	0.6+0.45+2.6+2.6+0.6 =6.85
	Columns	9	0.20	0.20	6.85	2.47	
	TOTAL					**4.78m³**	
	<u>Plinth Beam</u>						
	Walls all round	1	26.00	0.20	0.30	1.56	
	Cross wall – 1	1	5.80	0.20	0.30	0.35	6.00-0.2=5.80
	Cross wall – 2	1	2.80	0.20	0.30	0.14	3.00-0.2=2.80
	TOTAL					**2.05m³**	
	<u>Roof Beam (Ground Floor)</u>						
	Wall all round	1	26.00	0.20	0.40	2.08	
	Cross wall – 1	1	5.80	0.20	0.40	0.46	
	Cross wall – 2	1	2.80	0.20	0.40	0.22	
	TOTAL					**2.76m³**	
	Roof Beam (First Floor)	Qty as per ground floor				**2.76m³**	
	<u>Lintels (Ground Floor)</u>						
	Walls all round	1	26.00	0.20	0.15	0.78	
	Cross wall – 1	1	5.80	0.20	0.15	0.17	
	Cross wall-2	1	2.80	0.20	0.15	0.08	
	TOTAL					**1.03m³**	
	Lintels (First Floor)	Qty as per ground floor				1.03m³	
	Nett quantity	4.78+2.05+(2x2.76)+(2x1.03)				**14.41**	
	TOTAL					**14.41m³**	
4.	Brick work in CM 1:6, using I class bricks for superstructure						
	<u>Ground Floor</u>						
	Wall all round	1	24.40	0.20	3.05	14.88	26.00-(8x.02)=24.40
	Cross wall – 1	1	5.60	0.20	3.05	3.42	6.00-(2x0.2)=5.60
	Cross wall – 2	1	2.80	0.20	3.05	1.71	3.80-0.2=2.80
	Deduct for partition portion	1	4.10	0.20	2.60	(-) 2.13	4.30-0.2=4.10
	TOTAL					**17.88m³**	
	<u>Second Floor</u>						
	Wall all round	1	24.40	0.20	2.60	12.69	
	Cross wall - 1	1	5.60	0.20	2.60	2.91	
	Cross wall – 2	1	2.80	0.20	2.60	1.46	
	Deduct for partition portion	1	4.10	0.20	2.60	(-) 2.13	
	Balcony Pillars	2	0.20	0.20	2.60	0.06	
	TOTAL					**14.99m³**	

	Parapet Wall						
	Walls all round	1	24.40	0.20	0.70	$3.42m^3$	
	Deductions for openings						
	Doors – D1	2	1.20	0.20	2.10	(-) 1.01	
	Windows – W1	4	1.00	0.20	1.80	(-) 1.44	
	Windows – W2	4	1.70	0.20	1.80	(-) 2.45	
	Windows – W3	4	1.10	0.20	1.80	(-) 1.58	
	Ventilators – V	2	0.60	0.20	0.45	(-) 0.11	
	Gate	1	1.00	0.20	2.10	(-) 0.42	
	Balcony Opening	1	1.00	0.20	2.10	(-) 0.42	
	Lintels	Qty.	as above	(1.03+ 1.03)		(-) 2.06	
	TOTAL					**(-)9.49m^3**	
	Net Quantity	(17.88+14.99+3.42-9.49)				**26.80 m^3**	
5.	Partition wall in CM 1:6, 100mm thick including plastering etc.						
	Between Store & Stall	2	4.10	-	2.60	21.32	4.30-0.2=4.10
	Balcony Parapet	1	2.40	-	0.80	1.92	
	TOTAL					**23.24m^2**	
	Deductions for						
	Doors – D2	2	1.00	-	2.10	(-)4.20m^2	
	Nett Quantity	(23.24 – 4.20)				**19.50m^2**	
6.	RCC 1:2:4 mix, using 20mm Jelly for roof slab, sunshade and staircase						
	Roof slab						
	Ground floor roof slab	1	7.20	6.20	0.15	6.70	
	Firs floor roof slab	1	7.20	6.20	0.12	5.36	
	Balcony	1	1.00	1.60	0.15	0.24	
	Deduct for Staircase	1	2.00	1.50	0.15	(-)0.45	
	TOTAL					**11.85m^3**	
	Sunshade						
	Front & Left side	2x1	10.55	0.60	0.06	0.76	2.75+3.20+0.6+1.9+2.1
	For Window – W1	2x1	1.30	0.45	0.05	0.06	=10.55
	For Window – W2	2x1	2.00	0.45	0.05	0.09	
	For Window – W3	2x2	1.40	0.45	0.05	0.13	
	Sun Breakers	2x2	0.70	0.06	1.80	0.30	
	TOTAL					**1.34m^3**	
	Staircase						
	Landing slab	1	0.60	1.90	0.15	0.17	
	Flight slab	2	2.05	0.70	0.15	0.43	$\sqrt{1.4^2+1.5^2}=2.05$
	Steps	$15x^{1}/_{2}$	0.70	0.20	0.15	0.21	
	TOTAL					**0.81m^3**	
	Nett Quantity	(11.85+1.34+0.81)				**14.00m^3**	
7.	Sand filling in basement						
	Stall	1	3.80	5.80	0.50	11.02	
	Store	1	2.80	4.10	0.50	5.74	
	Stairs	1	2.80	1.50	0.50	2.10	
	TOTAL					**18.86m^3**	
8.	Flooring with lime concrete 75mm thick, finished with CC 1:3:6, 25mm thick						
	Stall	1	3.80	5.80	-	22.04	
	Store	1	2.80	4.10	-	11.48	
	Stairs	1	2.80	1.50	-	4.20	
	TOTAL					**37.72m^2**	
9.	Plastering with CM 1:6, 12mm thick inner sides of wall						
	Ground Floor & First Floor						
	Stall	2	19.20	-	3.00	115.20	(3.8+5.8)2=19.20
	Store	2	14.00	-	3.00	84.00	(2.9+4.1)2=14.00
	Staircase	2	8.60	-	3.00	51.60	(2.8+1.5)2=8.60
	Parapet	1	25.20	-	0.60	15.12	(6.8+5.8)2=25.20

	Balcony Parapet	1	2.40	-	0.80	1.92	(0.8+0.8+0.8)=2.40
	Outer sides of wall						
	Walls all round	1	26.80	-	7.42	198.86	(7.2+6.2)2=26.80
	Top of parapet	1	26.00	0.20	-	5.20	(0.45+3.0+0.15+3.0+0.12+
	Outside of Parapet	1	2.40	-	0.80	1.92	0.10+0.60)=7.42
	TOTAL					**473.82m^2**	
	Deductions for						
	Openings & Gate	2x1	1.00	-	2.10	(-) 4.20	
	Doors – D1	2x1	1.20	-	2.10	(-) 5.04	
	Doors – D2	2x1	1.00	-	2.10	(-) 4.20	
	Windows – W1	4x1	1.00	-	1.80	(-) 7.20	
	Windows – W2	4x1	1.70	-	1.80	(-) 12.24	
	Windows – W3	4x1	1.10	-	1.80	(-) 7.92	
	Ventilator – V	4x1	0.40	-	1.80	(-) 1.44	
	TOTAL					**(-) 42.24m^2**	
	Nett Quantity		(473.82 – 42.24)			**431.58m^2**	
10.	Ceiling plastering with CM 1:3, 12mm thick						
	Stall	2	3.80	5.80	-	44.08	
	Store	2	2.80	4.10	-	22.96	
	Staircase (FF)	1	2.80	1.50	-	4.20	
	Staircase (GF)	1	0.80	1.50	-	1.20	
	Sunshades Top & Bottom						
	Front & Left	2	10.55	1.26	-	26.59	
	Window – W1	2	1.30	0.95	-	2.47	
	Window – W2	2	2.00	0.95	-	3.80	
	Window – W3	2	1.40	0.95	-	2.66	
	Sub Breakers	4	1.46	1.80	-	10.51	
	TOTAL					**118.47m^3**	
11.	White washing 2 coats with best quality of lime						
	Quantity as per plastering					440.00	
	Quantity as per ceiling plastering					120.00	
	Add etc for staircase & ventilators					40.00	
	TOTAL					**600.00m^2**	
12.	Weathering course 100mm thick lime with brick jelly						
	Over roof	1	6.80	5.80	-	39.44	
	TOTAL					**39.44m^3**	
13.	Supplying and fixing of paneled doors and windows						
	Doors-D1 (1.20x2.10)m	2	-	-	-	2 Nos.	
	Doors-D2 (1.00x2.10)m	2	-	-	-	2 Nos.	
	Windows-W1 (1.00x1.80)m	4	-	-	-	4 Nos.	
	Windows-W2 (1.70x1.80)m	4	-	-	-	4 Nos.	
	Windows-W3 (1.10x1.80)m	4	-	-	-	4 Nos.	
14.	Supplying & fixing of collapsible gate						
	Gate (1.00 x 2.10)m	1	-	-	-	1 No.	
15.	Supplying & fixing of RCC golly work Ventilators						
	For Staircase (0.40 x 1.80)	2	-	-	-	2 Nos.	
16.	Painting of door and windows with enamel paint 2 coats over priming						
	Panelled Doors – D1	2x2.6	1.20	-	2.10	13.10	Painting coefficient for panelled doors and windows = 2.60
	Doors – D2	2x2.6	1.00	-	2.10	10.92	
	Windows – W1	4x2.6	1.00	-	1.80	18.72	
	Windows – W2	4x2.6	1.70	-	1.80	31.82	
	Windows – W3	4x2.6	1.10	-	1.80	20.59	
	Collapsible Gate – G	1x3.0	1.00	-	2.10	6.30	Collapsible gates = 3.0

	TOTAL					**101.45m^2**	
17.	Providing Electrification works					**LS**	
18.	Providing water supply & sanitary works					**LS**	
19.	Providing petty supervision works					**LS**	



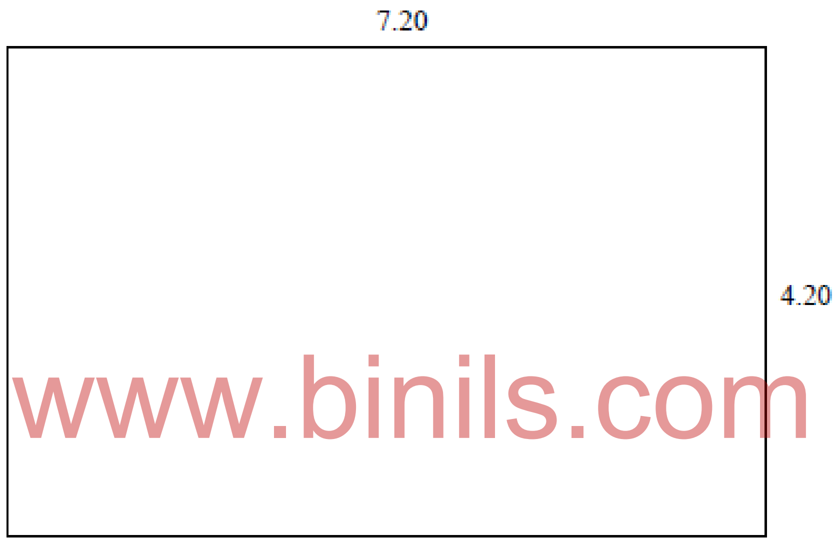
REFERENCE	
FOUNDATION	P.C.C. 1:5:10, 150 Tk
	R.C.C. (BED) 1:2:4, 150 Tk
	R.C.C. (TAPPER) 1:2:4, 300 Tk
	R.C.C.COLUMN, 200 x 300
DOORS	D - 1200 x 2200 ,FULLY PANELLED
WINDOWS	W - 900 x 1500 ,FULLY PANELLED
STEPS	TREAD - 300 , RISE - 150.

COMMUNITY HALL WITH COLUMNS AND T - BEAMS

ALL DIMENSIONS ARE IN MM.

A COMMUNITY HALL WITH RCC COLUMNS AND T- BEAMS

CENTRE LINE PLAN



Main wall all around the building

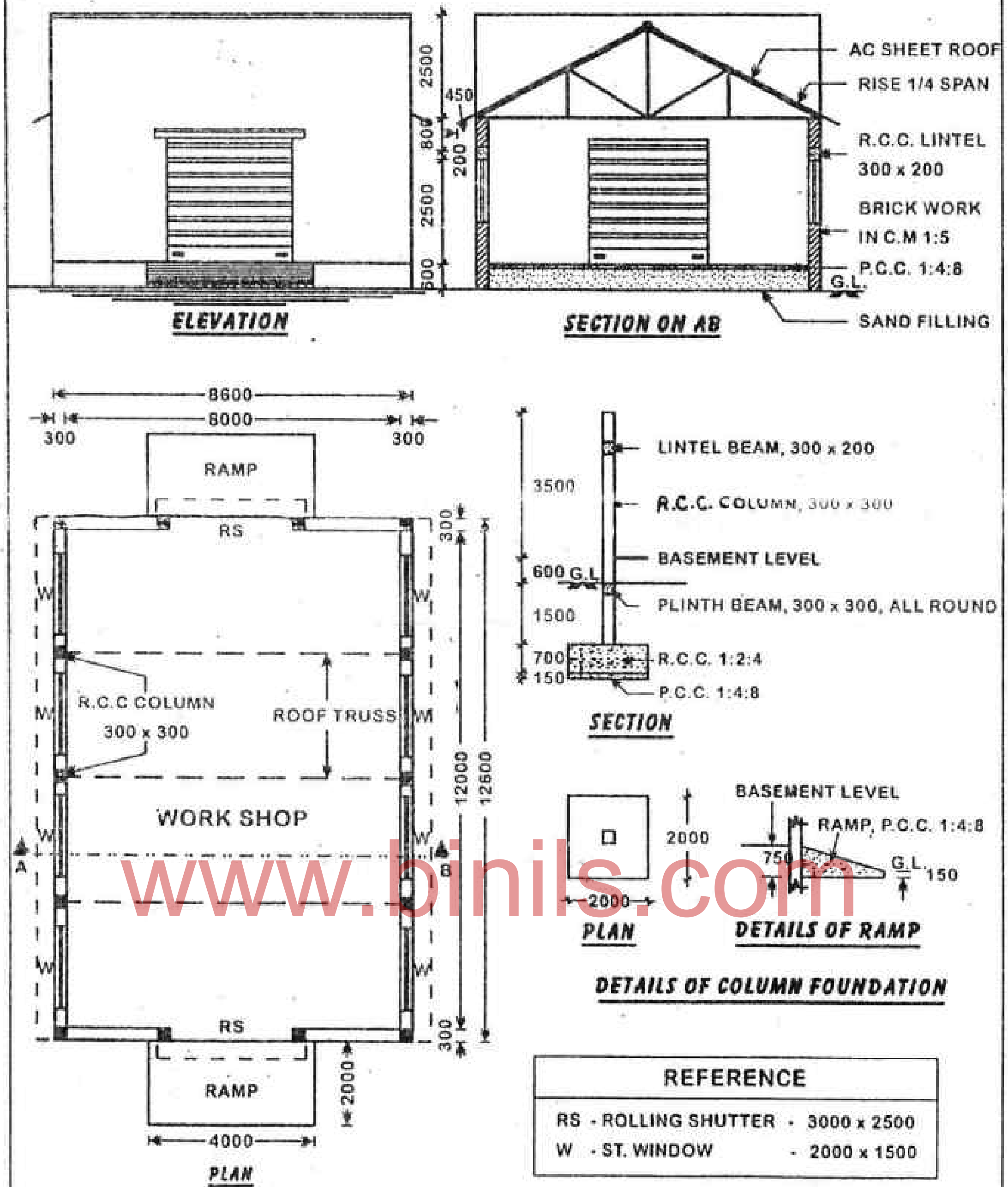
$$C/L = 2\,(7.20 + 4.20)$$
$$= 22.80m$$

Detailed Estimate

4.1.7. A Community Hall with RCC Columns and T-beams

Sl. No.	Description	Nos.	Dimensions L	B	D	Qty.	Remarks
1.	Earthwork excavation in hard soil for foundation						
	(a) RCC Columns	8	1.50	1.50	2.00	36.00	(7.2+4.2)2=22.80
	(b) Earth beam all round	1	10.80	0.20	0.30	0.65	22.80-(8x1.5)=10.80
	(c) Steps	1	2.80	0.80	0.10	0.22	1.2+2(2x0.3+0.2)=2.80 (2x0.3)+0.2=0.80
	TOTAL					**36.87m^3**	
2.	Plain cement concrete 1:4:8 mix using 40mm jelly for base concrete						
	(a) RCC Column footings	8	1.50	1.50	0.15	**2.70**	
	(b) For Steps	1	2.80	0.80	0.10	**0.22**	
	TOTAL					**2.92m^3**	
3.	RCC 1:2:4 mix using 20mm jelly for column, footings beams etc.						
	(a) RCC column bed	8	1.50	1.50	0.15	2.70	(1.50+0.20)/2=0.85
	(b) Footing tapper portion	8	0.85	0.85	0.30	1.73	(7.2+4.2)=22.80
	(c) RCC column below earth beam	8	0.20	0.20	1.10	0.35	(2.00-0.15-0.15-0.30-0.30=1.10)
	(d) RCC column upto T-beam	8	0.20	0.20	3.15	1.01	0.45+2.70=3.15
	(e) Earth beam	1	22.80	0.20	0.30	1.37	(7.20+4.20)2=22.80
	(f) Lintel all round the wall	1	22.80	0.20	0.15	0.68	
	(g) Sunshade for W	5	1.30	0.60	0.08	0.31	
	(h) Front sunshade	1	6.10	0.60	0.08	0.29	
	(i) Front sunshade	1	2.60	0.60	0.08	0.13	2.60+(2x1.75)=6.10
	(j) T-beam	4	4.40	0.20	0.30	1.06	2.2+(0.2x2)=2.60
	(k) RCC Slab	1	7.40	4.40	0.10	3.26	4.00+0.2+0.2=4.40
	TOTAL					**12.89m^3**	
4.	Brick work in CM 1:5 using first class bricks						
	(a) Main walls all round upto parapet	1	22.80	0.20	4.35	19.84	(0.45+2.70+0.40+0.80)=4.35
	(b) steps First	1	2.40	0.60	0.15	0.22	1.20+(0.3x4)=2.40
	Second	1	1.80	0.30	0.15	0.08	1.20+(0.3x2)=1.80
	TOTAL					**20.14m^3**	
	<u>Deductions for</u>						
	i) RCC Lintel all round	1	22.80	0.20	0.15	(-) 0.68	
	ii) Door – D	1	1.20	0.20	2.20	(-) 0.53	
	iii) Windows – W	7	0.90	0.20	1.50	(-) 1.89	
	iv) RCC Column	8	0.20	0.20	4.35	(-) 1.39	
	v) RCC T-Beam	4	4.00	0.20	0.30	(-) 0.96	
	TOTAL					**(-)5.45m^3**	
	Nett Quantity		(20.14 – 5.45)			**14.69m^3**	
5.	Sand filling in basement	1	7.00	4.00	0.30	**8.40**	
	TOTAL					**8.40m^3**	
6.	PCC 1:5:10 using 40 mm jelly, 130mm thick for flooring	1	7.00	4.00	-	28.00m^2	
7.	Floor finish with CM 1:4, 20mm thick for						
	Flooring	1	7.00	4.00	-	28.00	
	Door Sill	1	1.20	0.20	-	0.24	
	TOTAL					**28.24m^2**	
8.	Plastering with CM 1:4, 12 mm thick						
	i) Inside of wall all round	1	22.00	-	3.00	66.00	(7.0+4.0)2=22.00
	ii) Outside of wall all round	1	23.60	-	4.35	102.66	(7.4.+4.4)2=23.60
	iii) Parapet wall top	1	22.80	0.20	-	4.56	

	iv) Parapet wall inside v) Top of steps vi) Front & sides of 1st Step vii) Front & sides of 2nd step viii) Front side of top side	1 1 1 1 1	22.00 2.40 2.40 3.60 1.80	- 0.60 - - -	0.80 - 0.15 0.15 0.15	17.60 1.44 0.36 0.54 0.27	 (0.3+1.8+0.3)=2.40 (0.6+2.4+0.6)=3.60
	TOTAL					**193.43m^2**	
	Deductions for i) Door – D ii) Window – W	 1 7	 1.20 0.90	 - -	 2.20 1.50	 (-) 2.64 (-) 9.45	
	TOTAL					**(-) 12.09m^2**	
	TOTAL		(193.43-12.09)			**181.34m^2**	
9.	Plastering with CM 1:3, 10mm thick for ceiling i) For ceiling ii) For beam 3 sides iii) Sunshades top & Bottom for back & side sunshade iv) Front sunshade v) Front sunshade	 1 2 2x5 2 2	 7.00 4.00 1.30 6.30 2.60	 4.00 - 0.60 0.60 0.60	 - 1.00 - - -	 28.00 8.00 7.80 7.56 3.12	
	TOTAL					**54.48m^2**	
10.	White washing with lime in 2 coats Quantity as per plastering area except steps tread portion As per ceiling plastering area		(181.34-1.44)			 179.90 55.00	
	TOTAL					**234.90m^2**	
11.	Colour washing with approved quality Quantity as per item No.10					**247.00m^2**	
12.	Supplying & fixing fully panelled doors of size 1.20m x 2.20m	1				**1 No.**	
13.	Supplying & fixing fully panelled window for size 0.90m x 1.50m	7				**7 Nos.**	
14.	Painting with enamel paint over priming coats for doors & windows (a) Panelled Door -D (b) Panelled Window – W	 1x2.60 7x2.60	 1.20 0.90	 - -	 2.50 1.50	 7.80 24.57	Painting coefficient for panelled doors & windows =2.6
	TOTAL					**32.37m^2**	
15.	Weathering course with brick jelly concrete in lime 75mm thick and two courses of flat tiles in CM 1:3 over the slab	1	7.00	4.00	-	**28.00m^2**	
16.	Electrification with all fittings					**LS**	
17.	Water supply and sanitary works					**LS**	
18.	Contingencies and unforeseen items					**LS**	
19.	Petty supervision charges					**LS**	

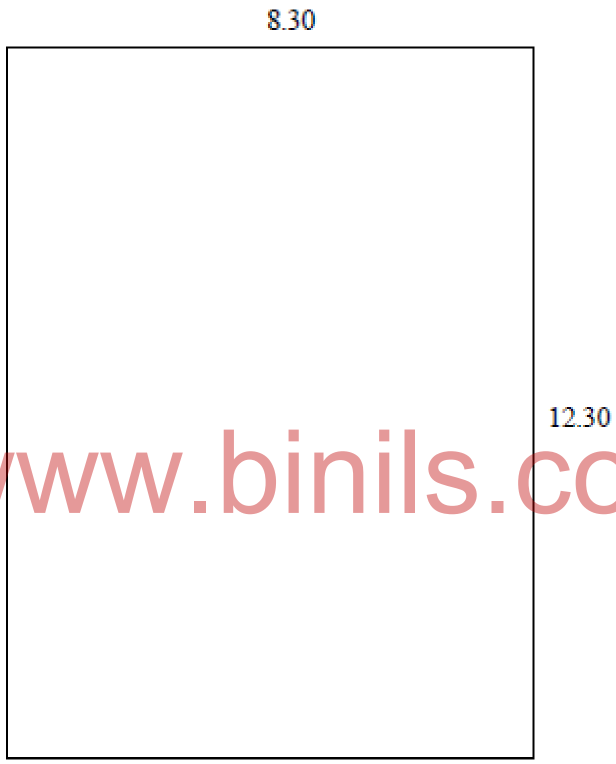


REFERENCE		
RS - ROLLING SHUTTER	-	3000 x 2500
W - ST. WINDOW	-	2000 x 1500

INDUSTRIAL BUILDING WITH AC SHEET & STEEL TRUSSES

ALL DIMENSIONS ARE IN M.M.

A SMALL INDUSTRIAL BUILDING WITH AC/GI SHEET ROOF ON STEEL TRUSS- CENTRE LINE PLAN



Main wall all around the building

$$C/L = 2\,(8.30 + 12.30)$$
$$= 41.20\text{m}$$

Detailed Estimate

4.1.8. A small industrial building with AC/GI sheet roof on steel trusses

Sl. No.	Description	Nos.	Dimensions			Qty.	Remarks
			L	B	D		
1.	Earth work excavation in hard gravelly soil for foundations.						
	(a) RCC Column	14	2.00	2.00	2.35	131.60	
	(b) Plinth beam	1	13.20	0.30	0.30	1.19	(12.30+8.30)2=41.20
	(c) Ramp	2	4.00	2.00	0.15	2.40	41.20-(14x2)=13.20
	TOTAL					**135.19m^3**	
2.	Plain cement concrete 1:4:8 mix using 40mm Jelly, base concrete for RCC footings & Ramp						
	(a) Under RCC Column Footings	14	2.00	2.00	0.15	8.40	
	(b) Ramp i) Base	2	4.00	2.00	0.15	2.40	
	ii) Slope	2	4.00	2.00	0.30	4.80	(0.6+0)/2 = 0.3
	TOTAL					**15.60m^3**	
3.	RCC 1:2:4 mix using 20mm Jelly for footings, columns, plinth beam, lintel & Sunshade						
	(a) Column footings	14	2.00	2.00	0.70	39.20	
	(b) RCC column below plinth level	14	0.30	0.30	1.20	1.51	
	(c) Plinth beam	1	41.20	0.30	0.30	3.71	(12.3+8.30)2=41.20
	(d) RCC column above GL	14	0.30	0.30	3.90	4.91	0.6+2.5+0.8=3.90
	(e) Lintel	1	41.20	0.30	0.20	2.47	
	(f) Sunshade	2	3.60	0.45	0.08	0.26	Sunshade average thickness = 0.08m 3.0+(0.3x2)=3.60
	TOTAL					**52.6m^3**	
4.	Brick masonry in CM 1:6 using I class bricks for superstructure						
	(a) Walls all round above the Plinth beam	1	41.20	0.30	3.90	48.20	
	(b) Front & back side wall above 3.90 m height	2	8.60	0.30	2.50	12.90	
	TOTAL					**61.10m^3**	
	<u>Deductions for</u>						
	i) RCC Column	14	0.30	0.30	3.90	(-) 4.91	
	ii) RCC Lintel	1	41.20	0.30	0.20	(-) 2.47	
	iii) Rolling shutters	2	3.00	0.30	2.50	(-) 4.50	
	iv) Windows – W	8	2.00	0.30	1.50	(-) 7.20	
	TOTAL					**(-) 19.08m^3**	
	TOTAL		(61.10 – 19.08)			**42.02m^3**	
5.	Filling in basement with sand including consolidation etc.						
	In Basement	1	8.00	12.00	0.45	43.20	Depth of sand filling taken as 0.45 m
	TOTAL					**43.20m^3**	
6.	Cement concrete 1:4:8 mix using 40mm Jelly 130mm thick for flooring	1	8.00	12.00	-	96.00m^2	
	TOTAL					**96.00m^2**	
7.	Floor finish with CM 1:4, 20 mm, thick over flooring						
	Concrete	1	8.00	12.00	-	96.00	
	Door sills	2	3.00	0.30	-	1.80	
	TOTAL					**97.80m^2**	
8.	Plastering with CM 1:4 mix, 12mm thick						

	(i) Inside of walls all round above basement	1	40.00	-	3.50	140.00	(8.0+12.0)2=40.00
	(ii) Outside of wall all round including basement	1	42.40	-	4.10	173.84	(8.6+12.6)2=42.40
	(iii) Front & Backside walls above 3.5 m	2x2	8.60	-	2.50	86.00	
	(iv) Side & Top of walls	2	13.60	0.30	-	8.16	2.5+8.6+2.5 = 13.60
	(v) Ramp Top	2	4.00	2.09	-	16.72	$\sqrt{2^2+0.6^2} = 2.09$
	(vi) Ramp sides	2x2	2.00	-	0.3	2.40	0.6+0/2 = 0.3
	(vii) Sunshades Top & bottom	2x2	3.60	0.45	-	6.48	
	(viii) Sunshade sides	2x2	0.45	-	0.08	0.14	
	(ix) Sunshade front	2	3.60	-	0.08	0.58	
	(x) Jambs & Soffits of rolling shutter RS	2	0.30	-	8.00	4.80	
	(xi) Jambs & Soffits of windows – W	8	0.30	-	7.00	16.80	
	TOTAL					**455.92m^2**	
	<u>Deductions for</u> (i) Rolling Shutters RS	2x2	3.00	-	2.50	**(-)30.00**	
	(ii) Windows – W	2x8	2.00	-	1.50	**(-)48.00**	
	TOTAL					**(-)78.00m^2**	
	TOTAL					**377.92m^2**	
9.	Supplying fixing in position rolling shutters of size 3.0m x 2.5m	2	-	-	-	2 Nos.	
10.	Supplying & fixing in position of steel windows of size 2.0m x 1.5m	8	-	-	-	8 Nos.	
11.	White washing with lime in two coats As per plastering area Less ramp top & sides			(380-16.72-2.40)		360.88	
	TOTAL					**360.88m^2**	
12.	Colour washing with approved paint in two coats Area as per white washing	-	-	-	-	361.00m^2	
13.	Painting with enamel paint over priming coat for (a) Rolling Shutters - RS	2x2	3.00	-	2.50	30.00	
	(b) Steel windows - W	2x8	2.00	-	1.50	48.00	
	TOTAL					**78.00m^2**	
14.	Supplying & fixing steel trusses for a span of 8.6 m	3	-	-	-	3 Nos.	
15.	Supply & fixing of steel purlins of required size	6	12.60			75.60	
	TOTAL					**75.60Rm**	
16.	Supplying & fixing of AC Sheets over steel trusses with ridge pieces	2	12.6	-	5.37	135.32	8.6/2 + 0.45 = 4.75 $\sqrt{4.75^2+2.5^2}=5.37$
	TOTAL					**135.32m^2**	
17.	Electrification with all fittings					**LS**	
18.	Water supply & Sanitary works					**LS**	
19.	Contingencies & Unforeseen items					**LS**	
20.	Petty supervision charges					**LS**	

Review Questions

PART-A

1. What is detailed estimate?
2. What id abstract estimate?
3. State the methods of taking off quantitites.
4. What is centre line method?
5. Why rounding of quantities are necessary?

PART-B

1. Explain the individual wall method of taking off quantities
2. State the procedure of long wall and short wall method of detailed estimate.
3. Prepare detailed quantity for 100mm thick RCC roof slab of room size 4m x 5m
4. Prepare the detailed quantity for centering area of the beam size 0.30 x 0.45m length 6.30m.
5. Prepare the detailed quantity for the given sketch for D.P.C in C.M 1:3, 20mm thick.

PART-C

1. Take the following quantities for the commercial building using trade system.
   (i) R.C.C roof slab 1:2:4 mix 150mm thick
   (ii) Plastering with C.M 1:5 12mm thick
   (iii) B.W IN CM1:5 for superstructure
   (iv) Sand filling in basement
   (v) Foundation concrete with C.C 1:4:8

2. Take the following quantities for the a community hall with RCC columns using trade system.
   (i) R.C Slab 100mm thick
   (ii) C.C.1:5:10 for foundation
   (iii) Painting doors and windows
   (iv) White washing inside walls and ceilings.
   (v) P.C.C 1:4:8 for foundation

V TAKING OFF QUANTITIES BY GROUP SYSTEM

5.1 General

In group system, the measurements are recorded item by item. All the different trades involved in a particular item of work are recorded at the same time, before next item. Each trade coming under various items of works are grouped together finally during abstracting.

Group system is adopted in Central Public Works Department (CPWD) and Military Engineering Services.

5.2 Standard Method of Measurement

It is important to establish a considerable degree of standardization in the method of preparing bills of quantities and the units used in them.

To achieve this aim, a standard method of measurement is used, the purpose of which can be summarized as follows :

i) To facilitate pricing by standardizing the layout and content of the bills of the quantities.

ii) To provide a systematic structure of bill items, leading to uniform itemization and descriptions.

iii) To provide a rational system of billing suitable for both manual and computer operation.

iv) To simplify the measurement of works and the administration of contracts.

v) To provide a uniform basis for measuring the works so as to avoid misunderstanding and ambiguities and

vi) To assist in the financial control of the works.

5.3 Taking off and Recording the dimensions

Taking off is the procedure by which dimensions of the works are calculated (or) scaled off from the drawings and recorded onto dimension papers.

5.4 Order of taking off

The order of taking off a building is given below :

1. Cleaning and levelling the site.
2. Earthwork excavation for foundation.
3. Sand filling for foundation.
4. Plain cement concrete for foundation.
5. Brick masonry / stone masonry for footings & basement.
6. Damp proof course.
7. Sand filling for basement.
8. Plain cement concrete for flooring.
9. Floor finish works.
10. Brick work for superstructure.
11. RCC work in lintel, sunshades, beams and roof etc.
12. Wood works for doors and windows.
13. Steel works for doors and gates etc.
14. Plastering work inner and outer surfaces.
15. Weathering course over roof.
16. Paving flat tiles over weathering course.
17. White washing
18. Colour washing
19. Water supply, Plumbing and Sanitary Fittings.
20. Electrical works.
21. Road and path works.

5.5 Dimension paper

The normal format of dimension paper is indicated below :

1	2	3	4	1	2	3	4

Column 1 is the "timesing" column in which multiplying figures are entered when there is more than one of the particular item being measured.

Column 2 is the "dimension" column in which the actual dimensions taken from the drawings are entered.

Column 3 is the "squaring" column in which the product of the figures in column 1 and column 2 is recorded ready for transfer to the abstract (or) bill.

Column 4 is the "description" column in which the written description and standard phraseology of item Description (SPID). The right hand side of this column is known as the "waste" area. It should be used for preliminary calculations, buildup of lengths, explanatory notes and related matters.

5.6 Entering dimension paper

A constant order of entering dimensions must be maintained throughout, that is (1) length (2) breadth (or) width and (3) depth (or) height, so that there can be no doubt as to the shape of the item being measured.

Dimensions should usually be recorded in metres to three decimal places and a line drawn across the dimensions column under each set of measurements.

Very often when measuring a number of dimensions for one item of construction it will be necessary to deduct some dimensions from the total. To ensure that this is done clearly, it is good practice to enter such dimensions in the timesing column under the heading deductions (DDT)

Many of the words entered in the description column can be abbreviated to save both space and time.

All entries in the dimension sheet should be made in ink (or) blue / black ball pen.

Each dimension sheet should be headed with name of work, each sheet should be numbered consecutively at the bottom.

5.7 Spacing dimensions

Dimensions should be written neatly and legibly. They are to be written in a spacious manner. Sufficient spaces were left between each entries, the left out entries can be inserted in that spaces.

5.8 Descriptions

The brief description of the item is written on the description column. The right hand side of this columns is used for waste that is rough work. When the same description has to be written for two (or) more sets of dimensions a vertical line has to be drawn in description column. This denotes the same description for following dimensions.

5.9 Cancellation of Dimensions

A dimensions which are entered incorrectly can be cancelled. The cancellation of the entry should be carried out by entering "Nil" in the squaring column.

1	2	3	4
2/4	2.50 0.20 3.00	Nil	

5.10 Squaring dimensions

The term "squaring the dimensions" refers to the calculation of the numbers, lengths, areas (or) volumes and their entry in the squaring column (3) in the dimension paper.

5.11 Method of squaring

	1	2	3	4
Volume	2/ 5/	1.50 1.50 0.90	20.25	EW Exc. 2x5x1.50x1.50 x0.90 = 20.25
Area	4/	3.60 3.30	47.52	White Washing 4x3.60x3.30 = 47.52
Linear	3/	12.00	36.00	Rain Water Pipe 3 x 12=36
	4.2/	1.50 0.80 0.20	1.92	(4+2)x1.50x0.80x 0.20=1.92

5.12 Checking the squaring

i) The squaring has to be checked according to the measurements (volume, area (or) linear)

ii) Overwriting the figures must be avoided

iii) Red ink has to be used for checking the squaring. Different persons may be involved for checking the squaring.

iv) Every checking has to be done by making tick (✓) marks.

v) Corrections should be made in different coloured ink and it must be cross checked.

5.13 Casting up the dimensions

It means summing of quantities algebraically in the squaring column. Where deduction immediately follows an item, it should written immediately. This enables to make only one entry in the abstract.

5.14 Abstracting and billing

Abstracting

Abstracting is the process whereby the squared dimensions are transferred to an abstract sheet, where they are written in a recognized order, ready for billing under the appropriate headings and are subsequently reduced to the recognized units of measurements in readiness for transfer to the bills.

5.15 Functions of Abstract

i) Tenders can be obtained from the contractor as per abstract.

ii) Abstract helps in comparing various tenders obtained from different contractors for the same job.

iii) Abstract also helps in preparing the revised estimate after assessing the value of executed work.

5.16 Use of Abstract

i) The measurements of various items, their unit, rate and amount is entered in Abstract.

ii) The various items can be analyzed by this abstract and important items for which large amount is necessary.

iii) Requirement of materials and labours for each items can be calculated by this abstract.

iv) Total estimated cost can be calculated as per Abstract.

5.17 Order of Abstracting

1. Preliminary items : i) It includes dismantling and demolition.
   ii) site items (cleaning and levelling etc)
2. Earthwork : Includes excavation for foundation trenches, embankments
3. Concrete works : Foundation, Column, Beams, Slab etc.
4. Brick work : Super Structure, parapet wall, partition wall etc.
5. Stone masonry : Footings, basement, super structure etc.
6. Wood work and joineries.
7. Form work : It includes actual contact with concrete surface, raking etc
8. Steel work : It includes gates, grill works, fencing etc.
9. Roof covering
10. Ceiling and linings
11. Paving floor tiles and floor finishes
12. Plastering and pointing
13. Glazing – Glass door, windows, ventilators etc.
14. Painting, Polishing and varnishing etc.
15. Laying of water and sewer lines
16. Electrical works
17. Road Work
    a. Soling
    b. Sub base
    c. Wearing coat
    d. Finishing coat

5.18 Preparing the Abstract

i) Before preparing the abstract, one should have the idea about the form of the bill.

ii) Knowing the general nature of work, the dimensions should be verified with the drawings.

iii) Sufficient space should be allotted for each section of trade.

iv) Similar trades should be grouped together.

v) Descriptions should be written in abbreviated form.

5.19 Checking the Abstract

i) All items in the abstract sheet should be checked for the total quantity transferred from the dimension paper.

ii) The units and rates for each and every item should be checked to arrive at the correct abstract amount.

iii) The description of all items should be checked.

iv) Each trade after checking should be ticked in red.

v) If any trade is found missing it should be written in red ink, during checking.

5.20 Casting and Reducing the Abstract

i) After checking, the casting and reducing of the abstract will be carried out.

ii) All deductions will be transferred to the addition column and subtraction made.

iii) All costs will be checked and ticked.

iv) After casting and checking the abstract, totals should be reduced to units of measurements.

5.21 Billing

Billing is the final stage in the bill preparation process in which the items and their associated quantities are transferred from the abstract onto the standard billing sheets, that enable the tenderer to price each item and arrive at a total tender sum.

5.21.1 Writing the bill

i) The bill is written by copying out the quantities and descriptions from the abstract in the standard tabular form.

ii) The bill of quantities is divided into trades as in the case of abstract.

iii) The quantity surveyor will use abbreviations in writing the measurements and will leave it to the biller to write the full and proper descriptions.

iv) The bill has a series of preliminary items.

v) Each and every trade has a preamble describing the materials and workmanship.

vi) Rules and order for the abstract will be followed in the bill.

vii) The bill of quantity is a contract document and all descriptions must be complete and clear.

viii) The draft bill should be written on one side of the paper only.

ix) The bill of quantities is also required to calculate the quantities of different materials required for the project.

x) Loop has been formed on the line indicating & transfer of totals.

xi) Each trade should start on a new sheet of paper.

Item No.	Quantity	Unit	Preambles	Rate	Amount
1	30.00 Cubic metres	Cubic Metres	Brick work in Cement mortar as described	5000.00	150000.00

5.21.2 Checking the bill

The bill must be carefully checked from the abstract, each item being ticked in red ink and the items in the abstract being at the same time run through in red.

The following points to the remembered in checking the bill.

1. Correctness of figures.
2. Figures are entered in the right column.
3. Changes from cubes to supers, supers to runs etc should be properly indicated.
4. Correctness of descriptions.
5. Proper heading.
6. Order of items.
7. Check whether pages of the draft bill are numbered in sequence.
8. When the bill in completely finished it should be all pinned together finally checked for sequence of pages.

Detailed estimate using Group System

5.2.1 A small Residential Building with two / three rooms with RCC flat roof

Timesing (1)	Dimension (2)	Squaring (3)	Description (4)	
(1) Earth work excavation for fdn for all types of soil				
1 /	30.60 0.90 1.13	31.12m^3	i) Main Walls all round	C/L = 30.60m
2 /	1.80 0.90 1.13	3.66 m^3	ii) Cross walls 1 & 2	2.70 ddt 0.90 1.80
2 /	2.30 0.90 1.13	4.68 m^3	iii) Cross walls 3 & 4	3.20 ddt 0.90 2.30
1 /	3.80 0.90 1.13	3.86 m^3	iv) Cross walls 5	4.70 ddt 0.90 3.80
1 /	6.05 0.60 0.68	2.18 m^3	v) All round verandah	6.80 ddt 0.75 6.05
2 /	1.30 0.60 0.15	0.23 m^3	vi) Steps	
		45.73 m^3	**Total Quantity**	
(2) C.C 1:4:8 for Foundations				
1 /	30.60 0.90 0.23	6.33 m^3	i) Main Walls all round	C/L = 30.60m
2 /	1.80 0.90 0.23	0.75 m^3	ii) Cross walls 1 & 2	
2 /	2.30 0.90 0.23	0.95 m^3	iii) Cross walls 3 & 4	
1 /	3.80 0.90 0.23	0.79 m^3	iv) Cross walls 5	
1 /	6.05 0.60 0.15	0.54 m^3	v) All round verandah	

2 /	1.30 0.60 0.15	0.23 m^3	vi) Steps	
		9.59 m^3	**Total Quantity**	
(3) Brick work in CM 1:5 1st Footings				
1 /	30.60 0.75 0.45	10.33 m^3	i) Main walls all round	C/L = 30.60m
2 /	1.95 0.75 0.45	1.32 m^3	ii) Cross walls 1 & 2	2.70 ddt 0.75 1.95
2 /	2.45 0.75 0.45	1.65 m^3	iii) Cross walls 3 & 4	3.20 ddt 0.75 2.45
1 /	3.95 0.75 0.45	1.33 m^3	iii) Cross wall 5	4.70 ddt 0.75 3.95
2nd Footing				
1 /	30.60 0.60 0.45	8.26 m^3	i) Main walls all round	C/L = 30.60m
2 /	2.10 0.60 0.45	1.13 m^3	ii) Cross walls 1 & 2	2.70 ddt 0.60 2.10
2 /	2.60 0.60 0.45	1.40 m^3	iii) Cross walls 3 & 4	3.20 ddt 0.60 2.60
1 /	4.10 0.60 0.45	1.11 m^3	iv) Cross wall 5	4.70 ddt 0.60 4.10
1 /	6.20 0.45 0.45	1.26 m^3	v) All round verandah	6.80 ddt 0.60 6.20
		27.79 m^3	**Total Quantity**	
(4) Brick work in CM 1:5 for basement				
1 /	30.60 0.45 0.60	8.26 m^3	i) Main walls all round	C/L = 30.60m

2 /	2.25 0.45 0.60	1.22 m^3	ii) Cross walls 1 & 2	2.70 ddt 0.45 2.25
2 /	2.45 0.45 0.60	1.49 m^3	iii) Cross walls 3 & 4	3.30 ddt 0.45 2.75
1 /	4.25 0.45 0.60	1.15 m^3	iv) Cross wall 5	4.70 ddt 0.45 4.25
1 /	6.35 0.45 0.60	1.14 m^3	v) For Verandah	6.80 ddt 0.45 6.35
		13.26 m^3	**Total Quantity**	
(5) Brick work in CM 1:5 for steps				
1 /	1.00 0.60 0.20	0.24 m^3	i) First Step	
2 /	1.00 0.30 0.20	0.12 m^3	ii) Second Step	
		0.36 m^3	**Total Quantity**	
(6) DPC in CM 1:3, 20 tk				
1 /	30.60 0.20	6.12 m^2	i) Main walls all round	C/L = 30.60m
2 /	2.50 0.20	1.00 m^2	ii) Cross walls 1 & 2	
2 /	3.10 0.20	1.24 m^2	iii) Cross walls 3 & 4	
1 /	4.50 0.20	0.90 m^2	iv) Cross wall 5	
1 /	6.60 0.20	1.32 m^2	v) For Verandah	6.80 ddt 0.20 6.60
		10.58 m^2	**Total Quantity**	
Deductions for door sills				
2 /	1.00 0.20	0.40 m^2	Doors – D	
1 /	0.90 0.20	0.18 m^2	Door – D1	

2 /	1.00 0.20	0.40 m^2	Opening - O	10.58 ddt 0.98 9.60
		0.98 m^2		
		9.60 m^2	**Nett Quantity**	
(7) Sand filling in basement				
1 /	4.25 2.55 0.45	4.88 m^3	i) Living	4.70 ddt 0.45 4.25
1 /	2.55 4.25 0.45	4.88 m^3	ii) Bed Room	3.00 ddt 0.45 2.55
1 /	2.55 2.05 0.45	2.35 m^3	iii) Kitchen	2.50 ddt 0.45 2.05
1 /	0.85 2.05 0.45	0.78 m^3	iv) Passage	1.30 ddt 0.45 0.85
1 /	2.55 2.05 0.45	2.35 m^3	v) WC, Bath & Passage	
1 /	4.25 1.43 0.43	2.73 m^3	vi) For Verandah	1.800 ddt 0.225 1.575 ddt 0.15 1.425
		17.97 m^3	**Total Quantity**	
(8) C.C 1:4:8 for flooring				
1 /	4.25 2.55	10.84 m^2	i) Living	
1 /	2.55 4.25	10.84 m^2	ii) Bed Room	
1 /	2.55 2.05	4.60 m^2	iii) Kitchen	
1 /	0.85 2.05	1.74 m^2	iv) Passage	
1 /	2.55 2.05	5.23 m^2	v) WC, Bath & Passage	
1 /	4.25 1.43	6.06 m^2	vi) For Verandah	

		39.31 m²	**Total Quantity**	
(9) Floor finish with CM 1:3				
1 /	4.25 2.55	10.84 m^2	i) Living	
1 /	2.55 4.25	10.84 m^2	ii) Bed Room	
1 /	2.55 2.05	4.60 m^2	iii) Kitchen	
1 /	0.85 2.05	1.74 m^2	iv) Passage	
1 /	2.55 2.05	5.23 m^2	v) WC, Bath & Passage	
1 /	4.25 1.43	6.06 m^2	vi) For Verandah	
1 /	1.00 0.20	0.40 m^2	vii) Sills of Door – D	
1 /	0.90 0.20	0.18 m^2	viii) Door – D1	
1 /	1.00 0.20	0.40 m^2	viii) Opening - O	
		40.29 m^2	**Total Quantity**	

(10) BKW in CM 1:5 for Superstructure				
1 /	30.60 0.20 3.00	18.36 m^3	i) Main walls all round	C/L = 30.60m
1 /	2.50 0.20 3.00	3.00 m^3	ii) Cross walls 1 & 2	2.70 ddt 0.20 2.50
1 /	3.10 0.20 3.00	3.72 m^3	iii) Cross walls 3 & 4	3.30 ddt 0.20 3.10
1 /	4.50 0.20 3.00	2.70 m^3	iv) Cross wall 5	4.70 ddt 0.20 4.50
1 /	0.23 0.23 2.10	0.11 m^3	v) Brick pillar in verandah	

1 /	30.60 0.20 0.60	3.67 m^3	vi) Parapet wall allround	
		31.56 m^3	**Total Quantity**	
Deductions for Openings				
2 /	1.00 0.20 2.10	0.84 m^3	Door - D	
1 /	0.90 0.20 2.10	0.38 m^3	Door – D1	
2 /	1.00 0.20 2.10	0.84 m^3	Opening – O	
3 /	1.20 0.20 1.20	0.86 m^3	Window - W	
1 /	0.90 0.20 1.20	0.22 m^3	Window – W1	
3 /	0.60 0.20 0.45	0.16 m^3	Ventilator – V	
Deduction for lintels				
1 /	30.60 0.20 0.10	0.61 m^3	Main walls allround	
2 /	2.50 0.20 0.10	0.10 m^3	Cross walls 1 & 2	
2 /	3.00 0.20 0.10	0.12 m^3	Cross walls 3 & 4	
1 /	4.50 0.20 0.10	0.09 m^3	Cross wall 5	
		4.22		31.56 ddt 4.22 27.34

		27.34 m^3	**Nett Quantity**	
(11) R.C.C. 1:2:4 for Lintels				
1 /	30.60 0.20 0.10	0.61 m^3	i) Main walls all round	
2 /	2.50 0.20 0.10	0.10 m^3	ii) Cross walls 1 & 2	2.70 ddt 0.20 2.50
2 /	3.00 0.20 0.10	0.12 m^3	iii) Cross walls 3 & 4	3.20 ddt 0.20 3.00
1 /	4.50 0.20 0.10	0.09 m^3	iv) Cross wall 5	
		0.92 m^3	**Total Quantity**	

(12) R.C.C. 1:2:4 for Sunshades & Loft				
1 /	2.25 1.05 0.08	0.19 m^3	i) Front side of Bedroom W	
1 /	4.70 0.75 0.08	0.28 m^3	ii) Front side of Verandah	
1 /	4.25 0.45 0.08	0.15 m^3	iii) Side of living Verandah	
1 /	1.20 0.45 0.08	0.04 m^3	iv) For Kitchen W1	
1 /	2.10 0.45 0.08	0.08 m^3	v) For backside D1 & V	
1 /	2.20 0.45 0.08	0.08 m^3	vi) For WC & Bath V	
1 /	2.50 0.45 0.08	0.09 m^3	vii) For loft	

1 /	3.00 0.45 0.08	0.11 m^3	viii) Work slab	
		1.02 m^3	**Total Quantity**	
(13) R.C.C. 1:2:4 for roof slab				
1 /	4.70 6.10 0.12	3.44 m^3	i) Over Kitchen & Living	
1 /	3.40 7.60 0.12	3.10 m^3	ii) Over Bedroom & WC, Bath Passage	
1 /	4.90 2.00 0.12	1.18 m^3	iii) For Verandah portion	
		7.72 m^3	**Total Quantity**	
(14) Plastering with CM 1:3 for Ceiling				
1 /	4.50 3.00	13.50 m^2	i) Living	
1 /	3.00 4.25	13.50 m^2	ii) Bed Room	
1 /	3.00 2.50	7.50 m^2	iii) Kitchen	
1 /	1.30 2.50	3.25 m^2	iv) Passage	
1 /	3.00 2.50	7.50 m^2	v) WC, Bath & Passage	
1 /	4.70 1.80	8.46 m^2	vi) For Verandah	
	Sunshades Top & Bottom			
2 /	2.25 1.05	4.73 m^2	i) Front side of Bedroom W	
2 /	4.70 0.75	7.05 m^2	ii) Front side of Verandah	
2 /	4.25 0.45	3.83 m^2	iii) Side of living & Verandah	
2 /	1.20 0.45	1.08 m^2	iv) For Kitchen W1	
2 /	2.10 0.40	1.89 m^2	v) For backside D1&V	

2 /	2.20 0.45	1.98 m^2	vi) For WC & Bath V	
1 /	21.35 0.05	1.07 m^2	vii) For face & side for all	
1 /	2.50 0.95	2.38 m^2	viii) For Loft	
1 /	3.00 0.95	2.85 m^2	ix) For Work slab	
		80.57 m^2	**Total Quantity**	
(15) Plastering with CM 1:5 for walls inside plastering				
2 /	15.00 3.00	90.00 m^2	i) Living & Bedroom	4.50 3.00 7.50x2=15.00
2 /	11.00 3.00	66.00 m^2	ii) Kitchen, WC & Bath & Passage	3.00 2.50 5.50x2=11.00
1 /	7.60 3.00	22.80 m^2	iii) Passage	1.30 2.50 3.80x2=7.60
Outside plastering				
1 /	33.00 0.60	19.80 m^2	i) Basement wall allround	5x0.45=2.25 31.20 33.45 ddt 0.45 33.00
1 /	31.40 3.72	116.81 m^2	ii) Above basement to Parapet	5x0.20=1.00 30.60 31.60 ddt 0.20 31.40 | 3.00 0.12 0.60 3.72
1 /	30.60 0.20	6.12 m^2	iii) Parapet top	5x0.20=1.00 30.60 ddt 1.00 29.60 0.20 29.80
1 /	29.80 0.60	17.88 m^2	iv) Inside face of Parapet	
	Steps			
2 / 2	1.00 0.60	2.40 m^2	i) Tread & Rise	
2 / 2	0.60 0.20	0.48 m^2	ii) Sides 1st Step	
2 / 2	0.30 0.20	0.24 m^2	iii) Sides 2nd step	
1 /	0.92 2.10	1.93 m^2	iv) Brick pillar in Verandah	0.23 4 0.92

		344.46 m²	**Total Quantity**	
	Deductions			
4 / 4 /	1.00 2.10	16.80 m²	D – Doors & O - Opening	
1 / 2 /	0.90 2.10	3.78 m²	D1 – Door	
3 / 2 /	1.20 1.20	8.64 m²	W – Windows	
1 / 2 /	0.90 1.20	2.16 m²	W1 – Windows	344.46 33.00 311.46
3 / 2 /	0.60 0.45	1.62 m²	V – Ventilator	
		33.00 m²	**Total Quantity**	
		311.46 m²	**Nett Quantity**	
(16) Weathering Course with BK Jelly				
1 /	4.70 5.70	26.79 m²	i) Over living & Kitchen	
1 /	3.00 7.20	21.60 m²	ii) Over Bed room & WC, Bath & Passage	
		48.39 m²	**Total Quantity**	
(17) BK WK 100 tk for partition in CM 1:3				
1 /	1.80 3.00	5.40 m²	i) Between WC & Bath	
1 /	2.50 3.00	7.50 m²	ii) Between WC, Bath & Passage	
		12.90 m²	**Total Quantity**	
Deduction				
2 /	0.75 2.10	3.15 m²	Door – D2	12.90 3.15 9.75
		3.15		
		9.75 m²	**Nett Quantity**	
(18) White washing two coats				
		311.46 80.57 392.03	Plastering as per item No. 15 Ceiling as per item No. 14	392.03
		1.20	Deduction step tread	
		390.83	**Nett Quantity**	

(19) Painting two coats for Doors & Windows				
2 / 2.60 /	1.00 2.10	10.92 m^2	i) D-Panelled Doors	
1 / 2.60 /	0.90 2.10	4.91 m^2	ii) D1-Panelled Doors	
2 / 2.60 /	0.75 2.10	8.19 m^2	iii) D2-Panelled Doors	
3 / 2.60 /	1.20 1.20	11.23 m^2	iv) W-Panelled Window	
1 / 1.60 /	0.90 1.20	1.73 m^2	v) W1-Glazed Window	
3 / 1.60 /	0.60 0.45	1.30 m^2	vi) V-Ventilator	
		38.28 m^2	**Total Quantity**	

ABSTRACT

1. EW Exc in surf for fdns n.e 0.90m width and n.e. 1.13m in depth

31.12	
3.66	
4.68	45.73 cubic metres
3.86	
2.18	
0.23	
45.73	

2. PCC 1:4:8 for foundations :

6.33	
0.75	
0.95	9.59 cubic metres
0.79	
0.54	
0.23	
9.59	

3. BKWK in CM 1:5 for Footings, Basement & Steps

10.33	8.26	8.26	0.24	14.63	
1.32	1.13	1.22	0.12	13.16	41.41
1.65	1.40	1.49	0.36	13.26	Cubic
1.33	1.11	1.15		0.36	Metres
14.63	1.26	1.14		41.41	
	13.16	13.26			

4. DPC in CM 1:3, 20 tk

6.12	DDT	10.58	
1.00	0.40	0.98	9.60 Sq.m
1.24	0.18	9.60	
0.90	0.40		
1.32	0.98		
10.58			

5. Sand filling for basement

4.88	
4.88	
2.35	
0.78	17.97 Cubic metres
2.35	
2.73	
17.97	

6. PCC 1:4:8 for Flooring, 130 tk

10.84	
10.84	
4.60	
1.74	39.31 Sq.m
5.23	
6.06	
39.31	

7. Floor finish with CM 1:3, 20 tk

10.84	
10.84	
4.60	
1.74	
5.23	40.29 Sq.m
6.06	
0.40	
0.18	
0.40	
40.29	

8. BKWK in CM 1:5 for Super Structure

	ddt	ddt		
18.36	0.84	0.61		
3.00	0.38	0.10	3.30	
3.72	0.84	0.12	0.92	27.34 Cubic metres
2.70	0.86	0.09	4.22	
0.11	0.22	0.92		
3.67	0.16		31.56	
31.56	3.30		4.22	
			27.34	

9. RCC 1:2:4 for Lintels, Sunshades & Roof Slab

0.61	0.19	3.44	0.92	
0.10	0.28	3.10	1.02	
0.12	0.15	1.18	7.72	9.66 Cubic metres
0.09	0.04	7.72	9.66	
0.92	0.08			
	0.08			
	0.09			
	0.11			
	1.02			

10. Plastering with CM 1:3, 12 tk for Ceiling

13.50	4.73		
13.50	7.05		
7.50	3.83		
3.25	1.08	53.71	
7.50	1.89	26.86	80.57 Cubic metres
8.46	1.98	80.57	
53.71	1.07		
	2.38		
	2.85		
	26.86		

11. Plastering with CM 1:5, 12 tk for Wall surface

90.00	19.80	2.40	DDT	178.80	344.46
66.00	116.81	0.48	16.80	160.61	33.00
22.80	6.12	0.24	3.78	5.05	311.46
178.80	17.88	1.93	8.64	344.46	
	160.61	5.05	2.16		
			1.62		
			33.00		

311.46 Sq.m

12. Weathering course in BK Jelly with lime

26.79	
21.60	48.39 Sq.m
48.39	

13. BKWK, 100 tk for partition

5.40	ddt	12.90	
7.50	3.15	3.15	9.75 Sq.m
12.90		9.75	

14. White washing two coats with lime

311.45	ddt	392.03	
80.57	1.20	1.20	390.83 Sq.m
392.03		390.83	

15. Painting two coats for Door & Windows

10.92	
4.91	
8.19	
11.23	38.28 Sq.m
1.73	
1.30	
38.28	

5.2.2 A small residential building with Two / Three rooms with RCC Sloped roof

Timesing	Dimension	Squaring	Description	
(1)	(2)	(3)	(4)	
(1) Earth work excavation in hard soil				
1 /	33.60 0.80 0.80	21.50 m^3	i) Main Walls all round	10.40 9.40 16.80 2 33.60
1 /	9.60 0.80 0.80	6.14 m^3	ii) Cross wall 1	10.40 ddt 0.80 9.60
4 /	2.40 0.80 0.80	6.14 m^3	iii) Cross wall 2, 3, 4 & 5	3.20 ddt 0.80 2.40
1 /	1.20 0.80 0.80	0.77 m^3	iv) Cross wall 6	2.00 ddt 0.80 1.20
2 /	2.00 0.40 0.10	0.16 m^3	v) Steps — 1.60 2x0.2=0.40 2.00	0.6 0.2 0.8 ddt 0.4 0.4
		34.71 m^3	**Total Quantity**	
(2) PCC 1:4:8 for foundation				
1 /	33.60 0.80 0.20	5.38 m^3	i) Main Walls all round	
1 /	9.60 0.80 0.20	1.54 m^3	ii) Cross wall 1	
4 /	2.40 0.80 0.20	1.54 m^3	iii) Cross wall 2, 3, 4 & 5	
1 /	1.20 0.80 0.20	0.19 m^3	iv) Cross wall 6	
2 /	2.00 0.80 0.10	0.16 m^3	v) Steps	
		8.81 m^3	**Total Quantity**	

(3) R.R. Masonry in CM 1:5 for Footings				
1 /	33.60 0.60 0.60	12.10 m^3	i) Main Walls all round	
1 /	9.80 0.60 0.60	3.53 m^3	ii) Cross wall 1	
4 /	2.60 0.60 0.60	3.74 m^3	iii) Cross wall 2, 3, 4 & 5	10.40 ddt 0.60 9.80
1 /	1.40 0.60 0.60	0.50 m^3	iv) Cross wall 6	3.20 ddt 0.60 2.60
For Basement				
1 /	33.60 0.45 0.45	6.80 m^3	i) Main Walls all round	
1 /	9.95 0.45 0.45	2.02 m^3	ii) Cross wall 1	10.40 ddt 0.45 9.95
4 /	2.75 0.45 0.45	2.23 m^3	iii) Cross wall 2, 3, 4 & 5	3.20 ddt 0.45 2.75
1 /	1.55 0.45 0.45	0.31 m^3	iv) Cross wall 6	2.00 ddt 0.45 1.55
		31.23 m^3	**Total Quantity**	
(4) Sand filling for basement				
1 /	2.75 1.55 0.30	1.28 m^3	i) Sitout	3.20 ddt 0.45 2.75
1 /	2.75 6.75 0.30	5.57 m^3	ii) Living	7.20 ddt 0.45 6.75
3 /	2.75 2.75 0.30	6.81 m^3	iii) Kitchen & Beds	
1 /	1.55 1.55			2.00 ddt 0.45

	0.30	0.72 m^3	iv) WC	1.55
1 /	0.55 1.55 0.30	0.26 m^3	iv) Cross wall 6	1.00 ddt 0.45 0.55
		14.64 m^3	**Total Quantity**	
(5) DPC in CM :13, 20 tk				
1 /	33.60 0.20	6.72 m^2	i) Main Walls all round	
1 /	10.20 0.20	2.04 m^2	ii) Cross wall 1	
4 /	3.00 0.20	2.40 m^2	iii) Cross walls 2, 3, 4 & 5	
1 /	1.80 0.20	0.36 m^2	iv) Cross wall 6	
		11.52 m^2	**Total Quantity**	
Deductions for Door sills				
5 /	1.00 0.20	1.00 m^2	i) Door – D	
1 /	0.80 0.20	0.16 m^2	ii) Door – D1	
1 /	1.80 0.20	0.36 m^2	iii) Opening – O	11.52 ddt 1.52 10.00
		1.52 m^2		
		10.00 m^2	**Nett Quantity**	
(6) PCC 1:4:8 for Flooring, 130 Tk				
1 /	3.00 1.80	5.40 m^2	i) Sitout	
1 /	3.00 7.00	21.00 m^2	ii) Living	
3 /	3.00 3.00	27.00 m^2	iii) Kitchen & Beds	
1 /	1.80 1.80	3.24 m^2	iv) WC	
1 /	1.00 1.80	1.80 m^2	v) Passage	
		58.44 m^2	**Total Quantity**	
(7) Floor finish with CM 1:4, 20 tk				
1 /	3.00 1.80	5.40 m^2	i) Sitout	

1 /	3.00 7.00	21.00 m^2	ii) Living	
3 /	3.00 3.00	27.00 m^2	iii) Kitchen & Beds	
1 /	1.80 1.80	3.24 m^2	iv) WC	
1 /	1.00 1.80	1.80 m^2	v) Passage	
1 /	4.40 0.20	0.88 m^2	vi) Door Sills a) Sitout	
5 /	1.00 0.20	1.00 m^2	b) Door – D	
1 /	0.80 .020	0.16 m^2	c) Door – D1	
1 /	1.80 0.20	0.36 m^2	d) Opening - O	
		60.84 m^2	**Total Quantity**	
(8) BKW in CM 1:5 for Superstructure and Parapet				
1 /	33.60 0.20 2.80	18.82 m^3	i) Main Walls all round	2.10 0.70 2.80
1 /	10.20 0.20 3.00	6.12 m^3	ii) Cross wall 1	10.40 ddt 0.20 10.20
4 /	3.00 0.20 2.90	6.96 m^3	iii) Cross wall 2, 3, 4 & 5	2.80 ddt 3.00 5.80/2 = 2.90
1 /	1.80 0.20 2.92	1.05 m^3	iv) Cross wall 6 — 2.00 DDT 0.20 1.80	3.00 2.80 0.2/3x1.80 =0.12
1 /	34.80 0.10 0.30	1.04 m^3	v) Parapet Wall	0.12 2.80 2.92
2 /	1.60 0.60 0.15	0.29 m^3	vi) Steps (a) First Step	
2 /	1.00 0.30 0.15	0.09 m^3	(b) Second Step	

		$34.37\ m^3$	**Total Quantity**	
Deductions for Openings				
5 /	1.00 0.20 2.10	$2.10\ m^3$	i) Doors – D	
1 /	0.80 0.20 2.10	$0.34\ m^3$	ii) Doors – D1	
1 /	1.80 0.20 2.10	$0.76\ m^3$	iii) Opening – O	
4 /	1.50 0.20 1.50	$1.80\ m^3$	iv) Windows – W	
4 /	1.00 0.20 1.50	$1.20\ m^3$	v) Windows – W1	
1 /	1.00 0.20 0.50	$0.10\ m^3$	vi) Ventilator – V	
1 /	2.80 0.20 2.10	$1.18\ m^3$	vii) Sitout Open Front	3.00 ddt 0.20 2.80
1 /	1.60 0.20 2.10	$0.67\ m^3$	viii) Sitout open, sides	1.80 ddt 0.20 1.60
Deductions for Lintels				
1 /	28.40 0.20 0.15	$0.85\ m^3$	i) Lintels in Outer walls	33.60 31.60 DDT 2.00 DDT 3.20 31.60 28.40
1 /	10.20 0.20 0.15	$0.31\ m^3$	ii) Lintel in Cross wall -1	
4 /	3.00 0.20 0.15	$0.36\ m^3$	iii) Lintel in Cross wall 2, 3, 4 & 5	
1 /	1.80 0.20 0.15	$0.05\ m^3$	iv) Lintels in Cross wall – 6	34.37 9.72 24.65

		9.72 m^3	**Total Quantity**	
		24.65 m^3	**Nett Quantity**	
(9) RCC 1:2:4 for Lintels, Sunshades & Roof				
1 /	28.40 0.20 0.15	0.85 m^3	**a) Lintels** i) Main Walls all round	
1 /	10.20 0.20 0.15	0.31 m^3	ii) Cross wall 1	
4 /	3.00 0.20 0.15	0.36 m^3	iii) Cross wall 2, 3, 4 & 5	
1 /	1.80 0.20 0.15	0.05 m^3	iv) Cross wall 6	
1 /	5.60 0.20 0.30	0.34 m^3	**b) Beam in sitout**	
1 /	8.50 0.45 0.08	0.31 m^3	**c) Sunshades** i) In front sitout & W	0.95 1.50 3.40 0.45 2.20 8.50
3 /	1.90 0.45 0.08	0.21 m^3	ii) For W	2x0.2=0.40 1.50 1.90
4 /	1.40 0.45 0.08	0.20 m^3	iii) For W1	2x0.2=0.40 1.50 1.90
1 /	1.40 0.45 0.08	0.05 m^3	iv) For D	
1 /	10.90 6.90 0.10	7.52 m^3	**d) Roof Slab**	0.15x2=0.30 3.00 6.60 1.00 6.90 4.00
1 /	4.00 0.45 0.08	0.14 m^3	**e) Cooking Slab**	
		10.34 m^3	**Total Quantity**	

10. Weathering course with BK jelly over the roof slab				
1/	6.70 10.70	71.69 m^2		
		71.69	**Total Quantity**	
11. Plastering with CM 1:3 for Ceiling				
1 /	3.00 1.80	5.40 m^2	**a) For Ceiling** i) Sitout	
1 /	3.00 7.00	21.00 m^2	ii) Living	
3 /	3.00 3.00	27.00 m^2	iii) Kitchen & Beds	
1 /	1.80 1.80	3.24 m^2	iv) WC	
1 /	1.00 1.80	1.80 m^2	v) Passage	
1 /	8.50 1.00	8.50 m^2	**b) Sunshades top & Bottom** i) Front Sitout & W	0.45 0.10 0.45 1.00
3 /	1.90 1.00	5.70 m^2	ii) For W	
5 /	1.40 1.00	7.00 m^2	iii) For W1 & D	
1 /	4.00 1.00	4.00 m^2	iv) Cooking Slab	
1 /	4.40 0.20	0.88 m^2	v) Bottom of Beam	2.80 1.60 4.40
		84.52 m^2	**Total Quantity**	
(12) Plastering with CM 1:5				
1 /	1.80 3.00	5.40 m^2	**a) Inner sides of wall** i) Sitout	
1 /	1.80 2.80	5.04 m^2	”	3.00 2.80 5.80/2=2.90
2 /	3.00 2.90	17.40 m^2	”	
1 /	20.00 2.90	58.00 m^2	ii) Living	7 3 10 x 2 = 20
3 /	12.00 2.90	104.40 m^2	iii) Kitchen & Beds	3 3 6 x 2 = 12

1 /	1.80 2.92	5.26 m^2	iv) WC	
1 /	1.80 2.80	5.04 m^2	”	
2 /	1.80 2.86	10.30 m^2	”	2.80 2.92 5.72/2 = 2.86
1 /	1.80 3.00	5.40 m^2	v) Passage	
1 /	1.80 2.92	5.25 m^2	”	2.92 3.00 5.92/2=2.96
2/	1.00 2.96	5.92 m^2	”	
1 /	34.40 2.80	96.32 m^2	**a) Outer sides of walls** i) Basement roof	10.60 6.60 17.20x2=34.40
1 /	35.20 0.55	19.36 m^2	ii) Parapet wall outer	10.80 6.80 17.60x2=35.20
1 /	34.40 0.30	10.32 m^2	iii) Parapet wall inner	
1 /	34.80 0.10	3.48 m^2	iv) Parapet top	
5 /	0.20 6.20	6.20 m^2	**b) Jambs of doors** Door – D	1.00 2.10 3.10x2=6.20
1 /	0.20 5.80	1.16 m^2	Door – D1	0.80 2.10 2.90x2=5.80
1 /	0.20 7.80	1.56 m^2	Opening – O	1.80 2.10 3.90x2=7.80
4 /	0.20 6.00	4.80 m^2	Windows – W	1.5 1.5 3.0x2=6.00
2 /	0.20 5.00	2.00 m^2	Windows – W1	1.0 1.5 2.5x2=5. 0
1 /	0.20 3.00	0.60 m^2	Ventilator - V	1.0 0.5 1.5x2=3.0
2 /	2.20 0.30	1.32 m^2	**c) Steps** First Step Tread	0.6 0.6 2 2 1.2 1.2 1.0 1.6 2.20 2.80
2 /	2.80 0.15	0.84 m^2	First Step rise	
2 /	1.00			

	0.30	0.60 m^2	Second Step Tread	
2 /	1.60 0.15	0.48 m^2	Second step rise	
		376.46 m^2	**Total Quantity**	
Deductions for Openings				
5 /	1.00 2.10	10.50 m^2	Door – D	
1 /	0.80 2.10	1.68 m^2	Door – D1	
1 /	1.80 2.10	3.78 m^2	Opening – O	
4 /	1.50 1.50	9.00 m^2	Windows - W	
4 /	1.00 1.50	6.00 m^2	Windows – W1	
1 /	1.00 0.50	0.50 m^2	Ventilator – V	
1 /	2.80 2.10	5.88 m^2	Sitout Open, Front	
1 /	1.60 2.10	3.36 m^2	Sitout Open, Right side	376.46 ddt 40.70 335.76
		40.70 m^2		
		335.76 m^2	**Nett Quantity**	
(13) White washing two coats with lime				
		84.52 335.76	Quantity as per item 11 for plastering Quantity as per item 12 for ceiling	
		420.28 m^2	**Total Quantity**	
(14) Painting with enamel paint for Door & Windows				
5 / 2.60	1.00 2.10	27.30 m^2	D–Fully Panalled door	
1 / 2.60	0.80 2.10	4.37 m^2	D1–Fully Panalled door	
4 / 1.60	1.50 1.50	9.00 m^2	W-Fully Glazed window	
1 / 1.60	1.00 1.50	2.40 m^2	W1-Fully Glazed window	

1 / 1.60	1.00 0.50	0.80 m^2	V-Fully Glazed ventilator	
		43.87 m^2	**Total Quantity**	

ABSTRACT

1. EW Exc for foundation

21.50	
6.14	
6.14	34.71 Cubic metres
0.77	
0.16	
34.71	

2. PCC 1:4:8 for foundation

5.38	
1.54	
1.54	8.81 Cubic metres
0.19	
0.16	
8.81	

3. RR masonry in CM 1:5 for footings & basement

12.10	6.80		
3.53	2.02	19.87	31.23 Cubic metres
3.74	2.23	11.36	
0.50	0.31	31.23	
19.87	11.36		

4. Sand filling for basement

1.28	
5.57	
6.81	14.64 Cubic metres
0.72	
0.26	
14.64	

5. DPC in CM 1:3, 20 tk

6.72	
2.04	
2.40	11.52 Sq.m
0.36	
11.52	

6. PCC 1:4:8, 130 tk for flooring

5.40	
21.00	
27.00	58.44 Sq.m
3.24	
1.80	
58.44	

7. Floor finish with CM 1:4, 20 tk

5.40	
21.00	
27.00	
3.24	
1.80	
0.88	60.84 Sq.m
1.00	
0.16	
0.36	
60.84	

8. BKWK in CM 1:5

18.82	ddt	ddt	
6.12	2.10	0.85	
6.96	0.34	0.31	34.37
1.05	0.76	0.36	9.72
1.04	1.80	0.05	24.65
0.29	1.20	1.57	
0.09	0.10	8.15	24.65 Cubic metres
34.37	1.18	9.72	
	0.67		
	8.15		

9. RCC 1:2:4

0.85	0.31	7.52	7.66	
0.31	0.21	0.14	1.91	
0.36	0.20	7.66	0.77	10.34 Cubic metres
0.05	0.05		10.34	
0.34	0.77			
1.91				

10. Plastering with CM 1:3, 12 tk for Ceiling

5.40	8.50	58.44	
21.00	5.70	26.08	84.52 Sq.m
27.00	7.00	84.52	
3.24	4.00		
1.80	0.88		
58.44	26.08		

11. Plastering with CM 1:5, 12 tk

5.40	96.32	6.20	1.32	227.42
5.04	19.36	1.16	0.84	129.48
17.40	10.32	1.56	0.60	16.32
58.00	3.48	4.80	0.48	3.24
104.40	129.48	2.00	3.24	376.46
5.26		0.60		
5.04		16.32		
10.30				
5.40				
5.26				
5.92				
227.42				

ddt

10.50

1.68 376.46

3.78 ddt 40.70 335.76 Sq.m

9.00 335.76

6.00

0.50

5.88

3.66

40.70

12. White washing two coats

84.52

335.76 420.28 Sq.m

420.28

13. Weathering course with brick jelly

71.69 Sq.m

14. Painting with enamel paint for Doors & Windows

27.30

4.37

9.00 43.87 Sq.m

2.40

0.80

43.87

5.2.3. A Community Hall with RCC Columns and T-Beams

Timesing	Dimension	Squaring	Description	
(1)	(2)	(3)	(4)	
(1) Earth work excavation for foundation				
8 /	1.50 1.50 2.00	36.00 m^3	i) RCC Columns	7.2 4.2 11.4x2=22.80
1 /	10.80 0.20 0.30	0.65 m^3	ii) Earth Beam allround	8x1.5=12 22.80 DDT 12.00 10.80
1 /	2.80 0.80 0.10	0.22 m^3	iii) Cross walls 3 & 4	0.3 0.8 2 2 0.6 1.6 0.2 1.2 0.8 2.8
		36.87 m^3	**Total Quantity**	
(2) PCC 1:4:8 for base concrete				
8 /	1.50 1.50 0.15	2.70 m^3	a) RCC Column footings	
1 /	2.80 0.80 0.10	0.22 m^3	b) For steps	
		2.92 m^3	**Total Quantity**	
(3) RCC 1:2:4 for footings, Columns & Beams				
8 /	1.50 1.50 0.15	2.70 m^3	a) Column Bed	
8 /	0.85 0.85 0.30	1.73 m^3	b) Footing tapper portion	1.50 0.20 1.70/2=0.85
8 /	0.20 0.20 1.10	0.35 m^3	c) Column below earth beam	0.15 0.15 2.00 0.30 DDT 0.90 0.30 1.10 0.90
8 /	0.20 0.20 3.15	1.01 m^3	d) Column upto T-beam	0.45 2.70 3.15
1 /	22.80 0.20 0.30	1.37 m^3	e) Earth beam	7.20 4.20 11.40x2=22.80

1 /	22.80 0.20 0.15	0.68 m^3	f) Lintel all round	
5 /	1.30 0.60 0.08	0.31 m^3	g) Sunshade for W	
1 /	6.10 0.60 0.08	0.29 m^3	h) Front sunshade	1.75 2 3.50 2.60 6.10
1 /	2.60 0.60 0.08	0.13 m^3	i) Front sunshade	0.2 2 0.4 2.2 2.6
4 /	4.40 0.20 0.30	1.06 m^3	j) T-Beam	0.2 2 0.4 2.2 2.6
1 /	7.40 4.40 0.10	3.26 m^3	k) Roof slab	4.00 0.20 0.20 4.40
		12.89 m^3	**Total Quantity**	
(4) BK W in CM 1:5				
1 /	22.80 0.20 4.35	19.84 m^3	a) Main walls allround upto parapet	0.45 2.70 0.40 0.80 4.35
1 /	2.40 0.60 0.15	0.22 m^3	b) Steps i) First Step	0.3 4 1.2 1.2 2.40
1 /	1.80 0.30 0.15	0.08 m^3	ii) Second step	0.3 2 0.6 1.2 1.80
		20.14 m^3	**Total Quantity**	

Deductions				
1 /	22.80 0.20 0.15	0.68 m^3	i) RCC lintel allround	
1 /	1.20			

	0.20 2.20	0.53 m^3	ii) Door – D	
7 /	0.90 0.20 1.50	1.89 m^3	iii) Window – W	
8 /	0.20 0.20 4.35	1.39 m^3	iv) RCC Column	
4 /	4.00 0.20 0.30	0.96 m^3	v) RCC T-Beam	20.14 5.45 14.69
		5.45		
		14.69 m^3	**Nett Quantity**	
(5) Sand Filling in basement				
1 /	7.00 4.00 0.30	8.40 m^3	Inside Basement	
		8.40 m^3	**Total Quantity**	
(6) PCC 1:5:10 for flooring				
1 /	7.00 4.00	28.00 m^2	For Flooring	
		28.00 m^2	**Total Quantity**	
(7) Floor finish with CM 1:4, 20 tk				
1 /	7.00 4.00	28.00 m^2	i) For flooring	
1 /	1.20 0.20	0.24 m^2	ii) Door sill	
		28.24 m^2	**Total Quantity**	
(8) Plastering with CM 1:4, 12 tk				
1 /	22.00 3.00	66.00 m^2	i) Inside of wall allround	7.00 4.00 11.00x2=22.00
1 /	23.60 4.35	102.66 m^2	ii) Outside of wall allround	7.4 4.4 11.80x2=23.60
1 /	22.80 0.20	4.56 m^2	iii) Parapet wall top	
1 /	22.00 0.80	17.60 m^2	iv) Parapet wall inside	
1 /	2.40 0.60	1.44 m^2	v) Top of steps	

1 /	2.40 0.15	0.36 m^2	vi) Front & sides of 1st step	0.3 1.8 0.3 2.4
1 /	3.60 0.15	0.54 m^2	vii) Front & side of 2nd step	
1 /	1.80 0.15	0.27 m^2	viii) Front side of top side	
		193.43 m^2	**Total Quantity**	
Deductions				
1 /	1.20 2.20	2.64 m^2	i) Door – D	
7 /	0.90 1.50	9.45 m^2	ii) Window – W	193.43 12.09 181.34
		12.09		
		181.34 m^2	**Nett Quantity**	
(9) Plastering with CM 1:3, 10 tk Ceiling				
1 /	7.00 4.00	28.00 m^2	i) For ceiling	
2 /	4.00 1.00	8.00 m^2	ii) For beam 3 sides	
2 / 5 /	1.30 0.60	7.80 m^2	iii) Sunshades Top & Bottom for back & side sunshades	
2 /	6.30 0.60	7.65 m^2	iv) Front Sunshade	
2 /	2.60 0.60	3.12 m^2	v) Front Sunshade	
		54.48 m^2	**Total Quantity**	
(10) White washing 2 coats with lime				
		179.90 54.48	Quantity Plastering as per item no. 8 Deduct steps tread area Ceiling plastering as per item No.9	181.34 1.44 179.90
		234.38 m^2	**Total Quantity**	
(11) Painting with enamel paint for doors & windows				
1 / 2.60 /	1.20 2.50	7.80 m^2	a) Panelled Door – D	
7 / 2.60 /	0.90 1.50	24.57 m^2	b) Panelled Window-W	
		32.37 m^2	**Total Quantity**	

(12) Weathering course with the jelly concrete 75 tk.				
1 /	7.00 4.00	28.00 m^2	Over the roof	
		28.00 m^2	**Total Quantity**	

ABSTRACT

1. EW Exc. for foundation

36.00
0.65
0.22 — 36.87 Cubic metres
36.87

2. PCC 1:4:8 for base concrete

2.70
0.22 — 2.99 Cubic metres
2.99

3. RCC 1:2:4 for footings, columns, beams & slab

2.70
1.73
0.35
1.01
1.37
0.68 — 12.89 Cubic metres
0.31
0.29
0.13
1.06
3.26
12.89

4. BK WK in CM 1:5

19.84	ddt		
0.22	0.68		
0.08	0.53	20.14	14.69 Cubic metres
20.14	1.89	5.45	
	1.39	14.69	
	0.96		
	5.45		

5. Sand filling in basement

8.40	8.40 Cubic metres

6. PCC 1:5:10 for Flooring

28.00	28.00 Sq.m

7. Floor finish CM 1:4, 20 tk

28.00	
0.24	28.24 Sq.m
28.24	

8. Plastering with CM 1:4, 12 tk

66.00	ddt	193.43	
102.66	2.64	12.09	
4.56	9.45	181.34	
17.60	12.09		
1.44			
0.36			181.34 Sq.m
0.54			
0.27			
193.43			

9. Plastering with CM 1:3, 10 tk for Ceiling

28.00	
8.00	
7.80	54.48 Sq.m
7.56	
3.12	
54.58	

10. White washing two coats with lime

179.90	
54.48	234.38 Sq.m
234.38	

11. Painting with enamel paint for door & windows

7.80	
24.57	32.37 Sq.m
32.37	

12. Weathering course with BK jelly concrete 75 tk

28.00	28.00 Sq.m

Review Questions

PART-A

1. Write Short notes on cancellation of dimension and spacing of dimensions.
2. Explain the group system.
3. Write an example of casting and reducing the abstract.
4. What is timesing column in group system?
5. Define squaring.
6. What is billing?

PART-B

1. What is the function of the abstact
2. Explain uses of abstract sheet.
3. Explain about the method of writing the bill?
4. What are the points to be considered while checking the bill?
5. Write short notes on descriptive column.

PART-C

1. Take out the quantity using group system
   - B.W in C.M 1:5 for footing and basement
   - Earth work excavation
   - Lintels
2. Take out the quantity using group system
   - R.C Plinth beam
   - C.C using 1:4:10 mix for foundation
   - Sand filling for basement
   - Roof slab