A Course Material on

# Estimation and Quantity Surveying


By

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# QUALITY CERTIFICATE

This is to certify that the e-course material

Subject Code : **CE2402**

**Scubject : Estimation and Quantity Surveying**

**Class :** IV Year CIVIL

being prepared by me and it meets the knowledge requirement of the university curriculum.

**Signature of the Author**

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Designation: Lecturer

This is to certify that the course material being prepared by Mr.R.Arthanareswaran is of adequate quality. He has referred more than five books amont them minimum one is from aborad author.

Signature of HD

Name: N.Sathish Kumar

SEAL

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**CE 2402** **ESTIMATION AND QUANTITY SURVEYING** **L T P C**
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**OBJECTIVE**

This subject covers the various aspects of estimating of quantities of items of works involved in buildings, water supply and sanitary works, road works and irrigation works. This also covers the rate analysis, valuation of properties and preparation of reports for estimation of various items. At the end of this course the student shall be able to estimate the material quantities, prepare a bill of quantities, make specifications and prepare tender documents. Student should also be able to prepare value estimates.

**UNIT I ESTIMATE OF BUILDINGS 11**

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

**UNIT II ESTIMATE OF OTHER STRUCTURES 10**

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, syphon, fall.

**UNIT III SPECIFICATION AND TENDERS 8**

Data – Schedule of rates – Analysis of rates – Specifications – sources – Detailed and general specifications – Tenders – Contracts – Types of contracts – Arbitration and legal requirements.

**UNIT IV VALUATION 8**

Necessity – Basics of value engineering – Capitalised value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease

**UNIT V REPORT PREPARATION 8**

Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells.

**TEXT BOOKS** **TOTAL: 45 PERIODS**


1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt. Ltd., 2003
2. Kohli, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S.Chand & Company Ltd., 2004


**REFERENCES**


1. PWD Data Book

# UNIT I
# ESTIMATE OF BUILDINGS

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

## 1.1 General

Estimating is the technique of calculating or computing the variousquantities and the expected Expenditure to be incurred on a particular work orproject. In case the funds available are less than the estimated cost the work isdone in part or by reducing it or specifications are altered, the following requirementare necessary for preparing an estimate.

1. Drawings like plan, elevation and sections of important points.
2. Detailed specifications about workmanship& properties of materials etc.
3. Standard schedule of rates of the current year.

## 1.2 UNITS OF MEASUREMENTS

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

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

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

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

(m2)

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

### 1.2.1 RULES FOR MEASUREMENT

The rules for measurement of each item are invariably described in IS- 1200. However some of the general rules are listed below.

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

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

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

I) linear measurement shall be measured to the nearest 0.01m.

II) Areas shall be measured to the nearest 0.01 sq.m

III) Cubic contents shall be worked-out to the nearest 0.01 cum

4. Same type of work under different conditions and nature shall be measured separatelyunder separate items.

5. The bill of quantities shall fully describe the materials, proportions, workmanships

and accurately represent the work to be executed.

6. In case of masonry (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described:

a) From foundation to plinth level

b) From plinth level to first floor level

c) From Fist floor to second floor level and so on.

## 1.3 REQUIREMENTS OF ESTIMATION AND COSTING

1. Estimate gives an idea of the cost of the work and hence its feasibility can be determined i.e. whether the project could be taken up with in the funds available or not.

2. Estimate gives an idea of time required for the completion of the work.

3. Estimate is required to invite the tenders and Quotations and to arrange contract.

4. Estimate is also required to control the expenditure during the execution of work.

5. Estimate decides whether the proposed plan matches the funds available or not

.

### 1.3.1 PROCEDURE OF ESTIMATING OR METHOD OF ESTIMATING.

Estimating involves the following operations

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

### 1.3.2 DATA REQUIRED TO PREPARE AN ESTIMATE

1. Drawings i.e. plans, elevations, sections etc.
2. Specifications.
3. Rates.

### 1.3.3 DRAWINGS

If the drawings are not clear and without complete dimensions the preparation of estimation become very difficult. So, it is very essential before preparing an estimate

### 1.3.4 SPECIFICATIONS

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

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

### 1.3.5 RATES

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

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

### 1.3.6 LUMPSUM

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

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

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

In general, certain percentage on the cost of estimation is allotted for the above L.S.Items Even if sub estimates prepared or at the end of execution of work, the actual cost should not exceed the L.S.amounts provided in the main estimate.

### 1.3.7 WORK CHARGED ESTABLISHMENT:

During the construction of a project considerable number of skilled supervisors, work assistance, watch men etc., are employed on temporary basis. The salaries of these persons are drawn from the L.S. amount allotted towards the work charged establishment.

That is, establishment which is charged directly to work. AnL.S.amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.

## 1.4 METHODS OF TAKING OUT QUANTITIES

The quantities like earth work, foundation concrete, brickwork in plinthand super structure etc., can be workout by any of following two methods:

a) Long wall - short wall method

b) Centre line method.

c) Partly centre line and short wall method.

### 1.4.1 LONG WALL-SHORT WALL METHOD

In this method, the wall along the length of room is considered to be longwall while the wall perpendicular to long wall is said to be short wall. To get thelength of long wall or short wall, calculate first the centre line lengths of individual walls. Then the length of long wall, (out to out) may be calculated after adding half breadth at each end to its centre line length. Thus the length of short wall Measured into in and may be found by deducting half breadth from its centre linelength at each end. The length of long wall usually decreases from earth work tobrick work in super structure while the short wall increases. These lengths aremultiplied by breadth and depth to getquantities.

### 1.4.2 CENTRE LINE METHOD

This method is suitable for walls of similar cross sections. Here the totalcentre line length is multiplied by breadth and depth of respective item to get thetotal quantity at a time. When cross walls or partitions or verandah walls joinwith main all, the centre line length gets reduced by half of breadth for eachjunction. Such junction or joints are studied carefully while calculating total centreline length. The estimates prepared by this method are most accurate and quick.

### 1.4.3 PARTLY CENTRE LINE AND PARTLY CROSS WALL METHOD

This method is adopted when external (i.e., around the building) wall isof one thickness and the internal walls having different thicknesses. In such cases,centre line method is applied to external walls and long wall-short wall method isused to internal walls. This method suits for different thicknesses walls and differentlevel of foundations. Because of this reason, all Engineering departments arepracticing this method.

### 1.4.4 DETAILED ESTIMATE

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

### I) DETAILS OF MEASUREMENTS AND CALCULATION OF QUANTITIES

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

**Details of measurements form**

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

**ii) Abstract of Estimated Cost :**

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

**Types of Estimates**

**ABSTRACT OF ESTIMATE FORM**

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

The detailed estimate should accompanied with

I) Report

ii) Specification

iii) Drawings (plans, elevation, sections)

iv) Design charts and calculations

v) Standard schedule of rates.

### 1.4.5 FACTORS TO BE CONSISDERED WHILE PREPARING DETAILED ESTIMATE

i) **Quantity and transportation of materials:**

For bigger project, the requirement of materials is more. such bulk volume of materials will be purchased and transported definitely at cheaper rate.

ii) **Location of site:**

The site of work is selected, such that it should reduce damage or in transit during loading, unloading, stocking of materials.

iii) **Local labor charges:**

The skill, suitability and wages of local labors are considered while preparing the detailed estimate.

### 1.4.6 DATA

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

### 1.4.7 FIXING OF RATE PER UNIT OF AN ITEM

The rate per unit of an item includes the following:

1) **Quantity of materials & cost:**

The requirement of materials is taken strictly in accordance with standard data book(S.D.B). The cost of these includes first cost,freight,insurance and transportation charges.

2) **Cost of labour:**

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

3) **Cost of equipment (T&P):**

Some works need special type of equipment, tools and plant. In such case, an amount of 1 to 2% of estimated cost is provided.

4)**Overhead charges:**

To meet expenses of office rent, depreciation of equipment salaries of staff postage, lighting an amount of 4% of estimate cost is allocated.

### 1.4.8 METHODS OF PREPARATION OF APPROXIMATE ESTIMATE

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

a) Plinth area method

b) Cubical contents methods

c) Unit base method.

### 1.4.9 Plinth area method

The cost of construction is determined by multiplying plinth area with plinth area rate. The area is obtained by multiplying length and breadth (outer dimensions of building). In fixing the plinth area rate, careful observation and necessary enquiries are made in respect of quality and quantity aspect of materials and labour, type of foundation, height of building, roofwood work, fixtures, number of storey's etc., As per IS 3861-1966, the following areas include while calculating the plinth area of building

**Types of Estimates**

a) Area of walls at floor level.

b) Internal shafts of sanitary installations not exceeding 2.0m2, lifts, air-conditioning ducts etc.,

c) Area of barsati at terrace level: Barsati means any covered space open on one side constructed on one side constructed on terraced roof which is used as shelter during rainy season.

d) Porches of non cantilever type.

Areas which are not to include

a) Area of lofts.
b) Unenclosed balconies.
c) Architectural bands, cornices etc.,
d) Domes, towers projecting above terrace level.
e) Box louvers and vertical sun breakers.

### 1.4.10 Cubical Contents Method

This method is generally used for multi-storeyed buildings. It is more accurate that the other two methods viz., plinth area method and unit base method. The cost of a structure is calculated approximately as the total cubical contents (Volume of buildings) multiplied by Local Cubic Rate. The volume of building is obtained by Length x breadth x depth or height. The length and breadth are measured out to out of walls excluding the plinth off set. The cost of string course, cornice, corbelling etc., is neglected. The cost of building= volume of buildings x rate/ unit volume.

**Example 1.1:** Prepare an approximate estimate of building project with totalplinth area of all building is 800 sqm. and from following data.

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

**Solution:**

Data given:

Plinth area = $800m^2$

Plinth area rate = Rs. 4500 per Sq.m

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

Add the cost of the water supply charges @7½%

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

Add the Cost of Sanitary and electrical installation @ 15%

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

Add the cost of archetectural features @1%

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

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

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

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

**Total Rs. 47,70,000=00**

Assume Add supervision charges 8% on overall cost

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

**Grand Total Rs. 51,51,600=00**

28,250

16,950

**Total Cost Rs. = 7,19,750.00**

**Cubical content Method:**

**Example 1.2 :**Prepare the rough estimate for a proposed commercial complexfor a municipal corporation for the following data.

Plinth Area = 500m2/floor Ht of each storey = 3.5m No. of storey's = G+2

Cubical content rate = Rs. 1000/m3

Provided for a following as a percentage of structured cost

a) water supply & Sanitary arrangement -8%

b) Electrification -6%

c) Fluctuation of rates - 5%

d) Contractors profit - 10%

e) Petty supervision & contingencies - 3%

**Sol :**

Cubical content = No. of storey's (Plinth Area x height of each storey)

= 3(500x3.5) = 5250m3

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

other provisons:-

| | | |
|---|---|---|
| a) Water supply and sanitation = 52.5x8/100 | = | Rs.4.2 Lakhs |
| b) Electrification = 52.5 x 6/100 | = | Rs.3.15 lakhs |
| c) fluctuation of rates = 52.5 x 5/100 | = | Rs.2.625 |
| Total | = | Rs. 9.975 Lakhs |
| Structural cost | = | Rs. 52.500 Lakhs |
| Total | = | Rs.62.475 Lakhs |
| d) P.S./& contingencies = 62.475 x 3/100 | = | Rs.1.874 Lakhs |
| e) Contractors Profit = 62.475 x 10/100 | = | Rs.6.247 Lakhs |
| Total Cost | = | Rs.70.596 Lakhs |

**Unit Base Method**

**Example 1.3:** Prepare an approximate estimate or rough cost estimate of ahospital building for 50 beds. The cost of construction altogether for each bed isRs. 60,000/ -. Determine the total cost of hospital building.

**Solution:**

No. of beds = 50

Cost of construction = Rs. 60,000/-

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

**Example 1.4:** To prepare the rough cost estimate of a hostel building whichaccommodate 150 students. The cost of construction including all provisions isRs. 15,000/- per student. Determine total cost of building.

**Solution :**

No.of students= 150

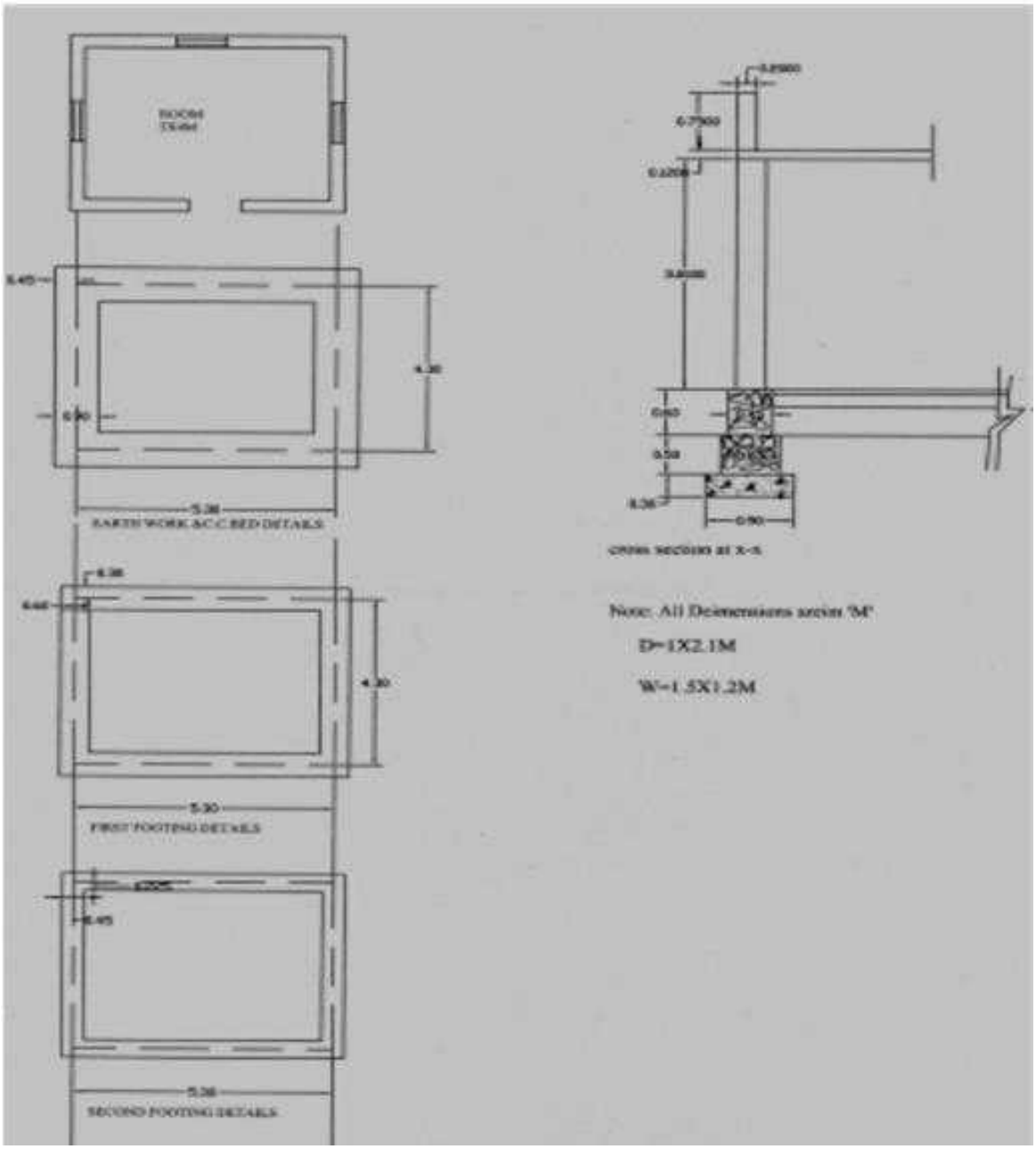
Cost of construction including all L.S. provisions = Rs. 15,000/- Total Cost of hostel building =150 x 15000 = Rs. 22,50,000/- (Rupees twenty two lakhs, fifty thousand only)

**Example 1.5**: From the given figure below calculate the detailed and abstract estimate for

the single roomed building (Load bearing type structure) by

a) long wall & short wall method

b) Centre Line Method



**a) Long wall - Short Method**

| S.No. | Particulars of Items | No. | L | B | H | Q | Explanation |
|---|---|---|---|---|---|---|---|
| 1. | **Earth Work excavation for foundation** | | | | | | |
| | a) Long walls | 2 | 6.2 | 0.9 | 1.4 | 15.264 | L=5.3+.45+.45=6.2<br>D=0.3+0.5+0.6=1.4 |
| | b) Short walls | 2 | 3.4 | 0.9 | 1.4 | 8.568 | L=4.3-0.45-0.45=3.4 |
| | | | | | **Total** | **24.192** | $m^3$ |
| 2. | **C.C.(1:4:8) bed for foundation** | | | | | | |
| | a) Long walls | 2 | 6.2 | 0.9 | 0.3 | 3.348 | |
| | b) Short walls | 2 | 3.4 | 0.9 | 0.3 | 1.836 | |
| | | | | | **Total** | **5.184** | $m^3$ |
| 3. | **R.R.Masonry in CM (1:6) for** | | | | | | |
| | a) Footings | | | | | | |
| | i) Long walls | 2 | 5.9 | 0.6 | 0.5 | 3.54 | L=5.3+0.3+0.3=5.9 |
| | ii) Short walls | 2 | 3.7 | 0.6 | 0.5 | 2.22 | L=4.3-0.3-0.3=3.7 |
| | | | | | **Total** | **5.76** | $m^3$ |
| | b) Basement | | | | | | |
| | i) Long walls | 2 | 5.75 | 0.45 | 0.6 | 3.105 | L=5.3+0.225+0.225=5.75 |
| | ii) Short walls | 2 | 3.85 | 0.45 | 0.6 | 2.079 | L=4.3-0.225-0.225=3.85 |
| | | | | | **Total** | **5.184** | $m^3$ |
| | **Total R.R. Masonry for footings and Basement** | | | | | | |
| | | | **= 5.76+5.184 =** | | | **10.94 $m^3$** | |
| 4. | **Brick masonary with CM (1:6) for super structure** | | | | | | |
| | a) Long Walls | 2 | 5.6 | 0.30 | 3.00 | 10.08 | L=5.3+0.15+0.15=5.6 |
| | b) Short walls | 2 | 4.0 | 0.30 | 3.00 | 7.20 | L=4.3-0.15-0.15=4.0 |
| | c) for parapet wall | | | | | | |
| | 5.6<br>4.6<br>0.2 | | | | | | |
| | a) Long Walls | 2 | 5.6 | 0.2 | 0.75 | 1.68 | |
| | b) Short walls | 2 | 4.4 | 0.2 | 0.75 | 1.32 | |
| | | | | | **Total** | **20.28** | $m^3$ |

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

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

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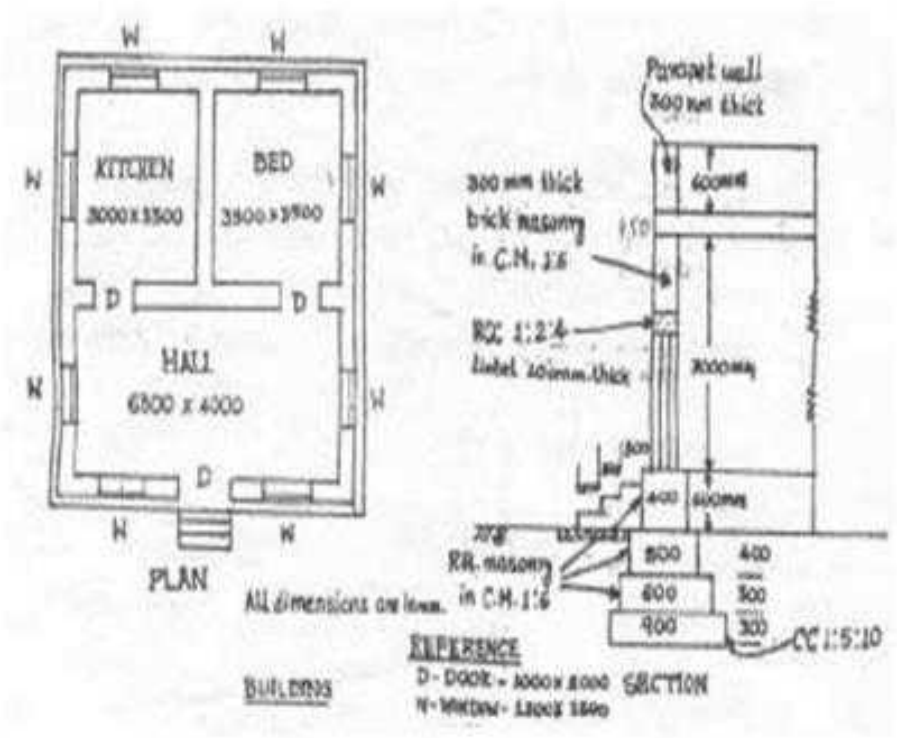
**b) Centre Line Method**

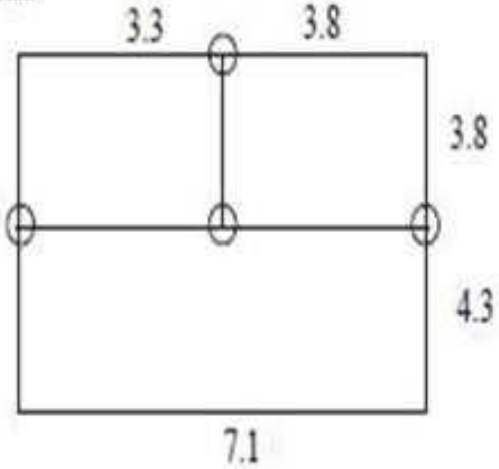
| S.No. | Particulars of Items | No. | L | B | H | Q | Explanation |
|---|---|---|---|---|---|---|---|
| 1. | **Earth Work exevation for foundation** | 1 | 19.2 | 0.9 | 1.4 | 24.192 | $m^3$ L=2(5.3+4.3)=19.2 |
| | 53 / 43 | | | | | | |
| 2. | **C.C.(1:4:8) bed for foundation** | 1 | 19.2 | 0.9 | 0.3 | 5.184 | $m^3$ |
| 3. | **R.R.Masonry in CM (1:6) for** | | | | | | |
| | a) Footings | 1 | 19.2 | 0.6 | 0.5 | 5.76 | |
| | b) Basement | 1 | 19.2 | 0.45 | 0.6 | 5.184 | |
| | | | | | **Total** | **10.944** | |
| 4. | **Brick masonry with** | | | | | | |
| | CM(1:6) for superstructure | 1 | 19.2 | 0.3 | 3.0 | 17.28 | $m^3$ |
| | For parapet wall | 1 | 20.0 | 0.2 | 0.75 | 3.00 | |
| | Deductions for openings | | | | | | |
| | a) Doors | 1 | 1.0 | 0.3 | 2.1 | 0.63 | |
| | b) Windows | 3 | 1.5 | 0.3 | 1.2 | 1.62 | |
| | | | | | **Total** | **(-)2.25** | $m^3$ |
| | **Net Brick Masonry =** | | **17.28** | **+3.0** | **-2.25 =** | **18.03** | $m^3$ |
| 5. | **R.C.C. (1:2:4) for** | | | | | | |
| | a) roof slab | 1 | 5.6 | 4.6 | 0.12 | 3.090 | |
| | b) Lintels over | | | | | | |
| | i) Doors | 1 | 1.2 | 0.3 | 0.15 | 0.054 | |
| | ii) Windows | 3 | 1.5 | 0.3 | 0.15 | 0.202 | |
| | c) beams | 1 | 19.2 | 1.3 | 0.3 | 1.728 | |
| | | | | | **Total** | **5.074** | $m^3$ |
| 6. | **Sandfilling for basement** | 1 | 4.85 | 3.85 | 0.48 | 8.96 | L=5.0-0.075-0.075=4.85 |
| 7 | **C.C.(1:4:8) for flooring** | 1 | 4.85 | 3.85 | 0.1 | 1.86 | B=4.0-0.075-0.075=3.85 |

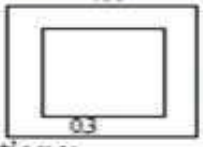
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8. | **flooring with Mosaic tiles** | 1 | 5.0 | 4.0 | -- | 20.0 | |
| 9 | **Plastering with CM (1:6)for super structure** | | | | | | |
| | **Inside** | | | | | | |
| | Forwalls | 1 | 18.0 | -- | 3.0 | 54.0 | |
| | **Out side** | | | | | | |
| | Forwalls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

**Example 1.6** From the given figure below calculate the details and abstractestimate for the single Storied residential buildingwith no of rooms (Load bearing type structure) by Centre line




Centre line diagram

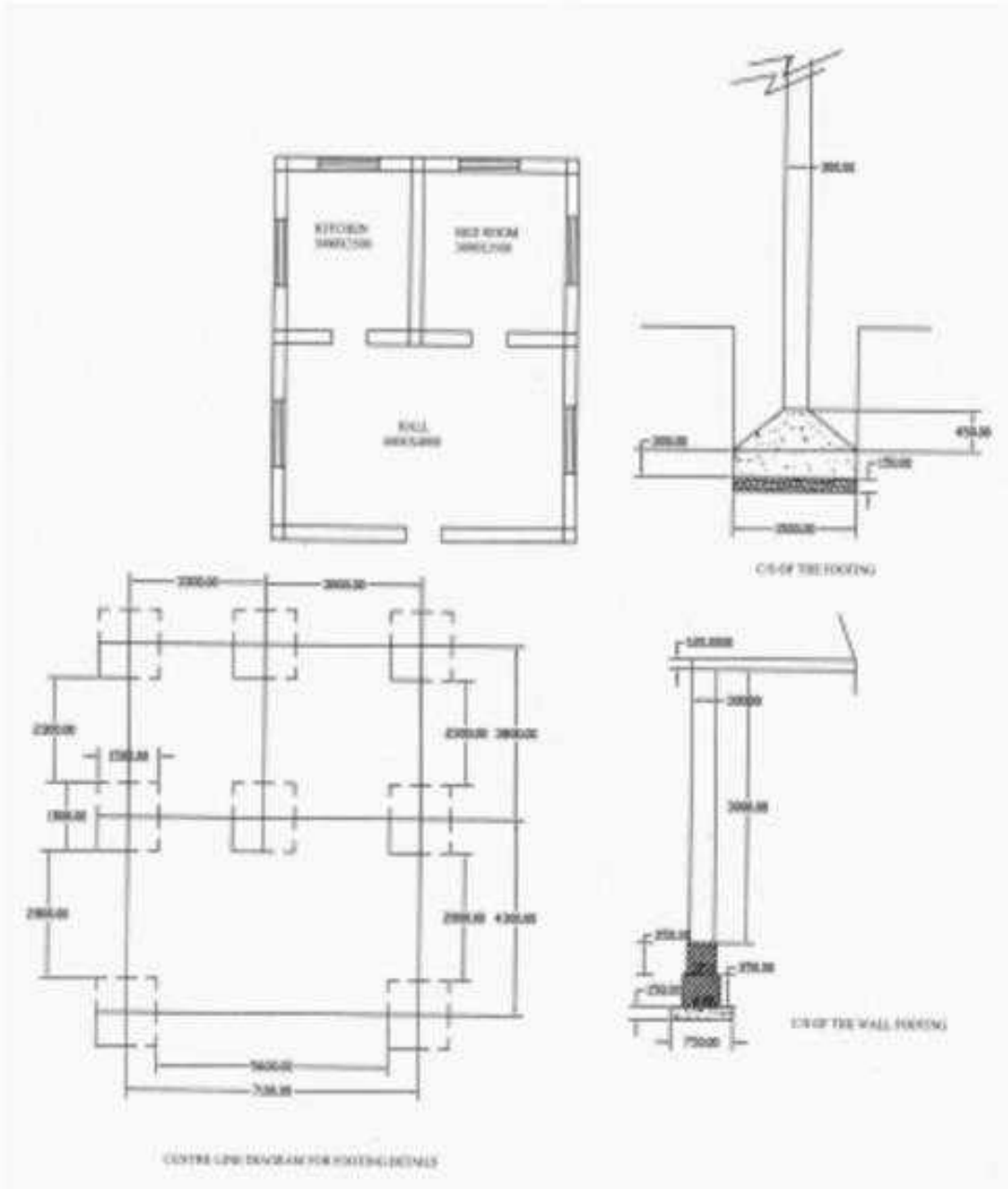


| S.No. | Particulars of Items | No | L | B | H | Q | Explanation |
|---|---|---|---|---|---|---|---|
| 1. | Earth work Excavation | 1 | 39.5 | 0.9 | 1.0 | 35.55 | 41.3-4x0.9/2=39.5 |
| 2. | C.C. bed (1:5:10) | 1 | 39.5 | 0.9 | 0.3 | 10.665 | $m^3$ |
| 3. | R.R. Masonary in CM 1:6 | | | | | | |
| | 1st Footing | 1 | 40.1 | 0.6 | 0.3 | 7.218 | 41.3-4x0.6/2=40.1 |
| | IInd Footing | 1 | 40.3 | 0.5 | 0.4 | 8.06 | 41.3-4x0.5/2=40.3 |
| | Basement | 1 | 40.5 | 0.4 | 0.6 | 9.72 | 41.3-4x0.4/2=40.5 |
| | | | | | Total | **25.00** | $m^3$ |
| 4. | Damp proof course over basement alround the building with CC (1:2:4) | 1 | 40.5 | 0.6 | --- | 16.2 | $m^2$ |
| | Deduct for Door sills | 3 | 1.0 | 0.3 | | - 0.9 | $m^2$ |
| | Net Quantity =16.2-0.9=15.3sq.m | | | | --- | | |
| 5. | First class brick work in wall in | | | | | | |
| | a) superstructure with CM1:6 | 1 | 40.7 | 0.3 | 3.0 | 36.63 | L =41.3-4x0.3/2 |
| | b) Parapet wall | 1 | 30.4 | 0.3 | 0.6 | 5.472 | L=2(7.1+8.1) |
| | | | | | Total | **42.102** | $m^3$ |
| |   | | | | | | |
| | **Deductions:** | | | | | | |
| | Doors | 3 | 1.0 | 0.3 | 2.0 | 1.80 | |
| | Windows | 8 | 1.2 | 0.3 | 1.5 | 4.32 | |
| | Lintel opening over | | | | | | |
| | Doors | 3 | 1.2 | 0.3 | 0.1 | 0.108 | Asue 100mm |
| | Windows | 8 | 1.4 | 0.3 | 0.1 | 0.336 | projection on either |
| | | | | | Total | **6.564** | side |
| | Net Quantity of BM = 42.102-6.564 = 35.538$m^3$ | | | | | | |
| 6. | Plastering with 12mmth in CM1:5 | 1x2 | 40.1 | --- | 3.0 | 240.6 | L=41.3-4x0.3=40.1 |
| | Deductions for openings | | | | | | |

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

**Example 1.7** From the given figure below calculate the details and abstractestimate for the

single storied residential building withno. of rooms (**Framed Structured** type) by Centre Line Method



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

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

## UNIT III
## SPECIFICATION AND TENDERS

Data – Schedule of rates – Analysis of rates – Specifications – sources – Detailed and general specifications – Tenders – Contracts – Types of contracts – Arbitration and legal requirements

### 3.1 GENERAL OR BRIEF SPECIFICATION:

This gives the nature and class of the work and materials in general terms, to be used in the various parts of work, from the foundation to the superstructure. It is a short description of different parts of work specifying materials, proportions, qualities, etc., General specifications give general idea of the whole work or structure and are useful for preparing for estimate

### 3.2 DETAILED SPECIFICATIONS

### 3.2.1 DETAILED SPECIFICATIONS OF EXCAVATIONS, FILLING AND BACK FILLING

**Scope of Work**

The scope for work covered under this specifications pertain to excavation of foundations, trenches, pits and over areas, in all sorts of soil, soft and hard rock, correct to dimensions given in the drawing including shoring, protections of existing underground utilities of any, such as water lines, electric cables etc. dewatering and shoring if necessary, stacking the useful materials as directed within the lead specified, refilling around the foundation and into the plinth with selected useful excavated earth and disposing off the surplus earth / materials within specified lead and finishing the surface to proper levels, slopes and camber etc. all complete.

**Site Clearance:**

Before the earth work is started the area coming under cutting and filling shall be cleared of all obstruction, loose stones, shrubs, rank vegetation, grass, bushes and rubbish removed up to a distance of 150 metres outside the periphery of the area under clearance. This work is deemed to be included in the earthwork item rate and no separate payment will be admissible.

**Roots and Vegetation clearance:**

The roots of trees if any shall be removed to a minimum depth of 60 cm below ground level or a minimum of 30 cm below formation level whichever is lower and the hollows filled up with earth leveled and rammed. This work is deemed to be included in the earthwork items and no separate payment will be admissible for the work. Any material obtained from

the site will be the property of the Government of India and the useful materials as decided by the Engineer-in-charge will be conveyed and properly stacked as directed within the lead specified.

**Setting out and making profile**s:

Masonry or concrete pillars will be erected at suitable points in the area to serve as benchmarks for the execution of the work. These benchmarks shall be connected with G.T.S. or any other permanent benchmark approved by the Engineer-in-charge. Necessary profiles with pegs, bamboos and strings or Burjis shall be made to show the correct formation levels before the work is started. The contractor shall supply labour and materials for setting out and making profiles and Burjis for the work at his own cost and the same shall be maintained during the excavation work. The Department will show grid co-ordinate or other reference points. It shall bethe responsibility of the contractor to set out center lines correctly with reference to the drawings and install substantial reference marks. Checking of such alignment by the Department will not absolve the contractor from his responsibility to execute the work strictly in accordance with the drawings.

**Excavation:**

The contractor shall notify the Engineer-in-charge before starting excavation and before the ground is disturbed, to enable him to take existing level for the purpose of measurements. The ground levels shall be taken at 5 to 15 metres intervals in uniformly sloping ground and at closer distance where local mounds, pits, or undulations are met with, as directed by the Engineer-in-charge. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the Engineer-in-charge, before the earthwork is actually started. The labour required for taking levels, shall be supplied by the Contractor at his own cost. The Contractor shall perform excavation in all types of soils, murrum, soft and hard rock, boulders etc. in foundation, over areas and in trenches to widths, lines, levels, grades and curves as shown in the drawing or lesser widths, lines, levels, grades and levels as directed by the Engineer-in-charge and per items in the schedule of quantities. The item in the schedule of quantities shall specify the excavation in trenches or over areas.

For this purpose, the excavation for any depth in trenches for foundation not exceeding 1.5m in width or 10sqm. on plan shall be described as excavation in foundation trenches. Excavation exceeding 1.5m in width as well as 10sqm. on plan (excluding trenches for pipes, cables etc.) and exceeding 30cm in depth shall be described as excavation over areas.

Excavation exceeding 1.5m in width as well as 10sqm. on plan but not exceeding 30cm. in depth shall be described as surface Excavation.

**Classification of Earth work:**

The earthwork shall be classified under the following main categories and measured separately for each category. All types of soil, murrum, boulders, Soft rock, Hard rock.

**All types of Soils, Murrum, Boulders:**

This includes earth, murrum, top deposits of agricultural soil, reclaimed soil, clay, sand or any combination thereof ad soft and hard murrum, shingle etc. which is loose enough to be removed with spadies, shovel and pick axes. Boulders not more than 0.03 cum. in volume found during the course of excavation shall also fall under this classification.

**Excavation in Soft Rock:**

This shall include all materials which are rock or hard conglomerate, all decomposed weathered rock, highly fissured rock, old masonry, boulders bigger than 0.03 cum, in volume but not bigger than 0.5 cum. and other varieties of soft rock which can be removed only with pick axes, crow bars, wedges and hammers with some difficulty. The mere fact that the contractor resorts to blasting and / or wedging and chiseling of reasons of his own, shall not mean the rock is classifiable as hard rock.

**Excavation in Hard Rock** :

This includes all rock other than soft rock mentioned in para above 1.5.1 (b) viz. soft rock, occurring in masses, boulders having approximate volume more than 0.5 cum. plain or reinforced cement concrete, which can best be removed by chiseling and wedging where blasting cannot be permitted owing to any restriction at site.

**Excavation in Hard Rock by Chiseling and Wedging:**

Where blasting is not permitted and if the Engineer-in-charge so desires, the excavation shall be done by chiseling and wedging or any other agreed method.

**Note**: All the excavated hard rock obtained shall be stacked properly and neatly within the specified lead by the contractor as directed by the Engineer-in-charge

**Excavation:**

The excavation under all classifications in areas in trenches or in pits shall be carried out systematically. Cutting shall be done from top to bottom and not under pining or under cutting will be allowed. The bottom and sides of excavation shall be dressed to proper level, slopes, steps, camber etc. by removing high spots and ramming thoroughly as directed by the

Engineerin-charge. All the excavation shall be carried out strictly to the dimensions given in the drawing. The width shall generally be of the width of mudmat concrete and depth as shown in drawing or as directed by the Engineer-in-charge, according to availability of the desired bearing capacity of soil below. Any excavation if taken below the specified depths and levels, the contractor shall at his own cost fill up such over cut to the specified level with cement concrete 1:4:8 in case of excavation in all types of soils an with cement concrete 1:2:4 in case of excavation soft and hard rock. After the excavation is completed, the contractor shall notify the Engineer-in-charge to that effect and no further work shall be taken up until the Engineer-in-charge has approved the depth and dimensions an also the nature of foundation materials, levels and measurements shall also be recorded prior to taking up any further work.

**Shoring:**

Unless separately provided for in the schedule of quantities, the quoted rate for excavation shall include excavation of slopes to prevent falling in soil by providing and / or fixing, maintaining and removing of shorting, bracing etc. The contractor would be responsible for the design of shoring for proper retaining of sides of trenches, pits etc. with due consideration to the traffic, superimposed loads etc. shoring shall be of sufficient strength to resist the pressure and ensure safety from slips and to prevent damage to work and property and injury to persons. It shall be removed as directed after items for which It is required are completed should the slips occur, the slipped materials shall be removed and slope dressed to a modified stable slope. Removal of the slipped earth will not be measured for payment.

**Dewatering:**

Unless specifically provided for as a separate item in the schedule of quantities, rate shall also include bailing or pumping out all water which may accumulate in the excavation during the progress of further works such as mud mat concrete, R.C. footings, shuttering etc. either due to seepage, springs, rain or any other cause and diverting surface flow by bunds or other means. Care shall be taken to ensure that the water discharged sufficiently away from the foundations keep it free from nuisance to other works in the neighborhood.

**Disposal of Excavated Materials: Antiquities:**

Any finds of archeological interest such as relics of antiquity, coins, fossils or other articles of value shall be delivered to the Engineer-in-charge and shall be the property of

the Government.

**Useful Materials:**

Any material obtained from the excavation which in the opinion of the Engineer-ncharge is useful, shall be stacked separately in regular stacks as directed by the Engineer-incharge and shall be the property of the Government. No material excavated from foundation trenches of whatever kind they may be are to be placed even temporarily nearer than about 3m from the outer edge of excavation. Discretion of the Engineer-in-charge in such cases is final. All materials excavated will remain the property of the Department. Rate for excavation includes sorting out of the useful materials and stacking them separately as directed within the specific lead. Material suitable and useful for backfilling or there use shall be stacked in convenient place but not in such a way as to obstruct free movement of materials, workers and vehicles or encroach on the area required for constructional purposes. It shall be used to the extent required to completely backfill the structure to original ground level or other elevation shown on the plan or as directed by the Engineer-in-charge. Materials not useful in anyway shall be disposed off, leveled and compacted as directed by the Engineer-in-charge within a specified lead. The site shall be left clan of all debris and leveled on completion.

**Backfilling in sides of Foundations, Plinth, Under Floor etc:**

The backfilling shall be done after the concrete or masonry has fully set and shall be done in such a way as not to cause under-thrust on any part of the structure. Where suitable excavated material is to be used for backfilling, it shall be brought from the place where it was temporarily deposited and shall be used in backfilling. The scope of work for backfilling/ filling in foundation, plinth, under floors etc. shall include filling for all the buildings covered under the contract. Surplus earth available from one building, if required, shall be used for backfilling filling for other buildings also within the specified lead mentioned in the item. All timber shoring and form work left in the trenches, pits, floors etc. shall be removed after their necessity ceases and trash of any sort shall be cleared out from the excavation. All the space between foundation masonry or concrete and the sides of excavation shall be backfilled to the original surface with approved materials in layers not exceeding 150mm, in thickness, watered and well consolidated by means of rammers to at least 90% of the consolidation. Areas inaccessible to mechanical equipment such as areas adjacent to walls and columns etc. shall be tamped by hand rammer or by hand held power rammers to the required density. The

backfill shall be uniform in character and free from large lumps, stones. shingle or boulder not larger than 75mm. in any direction, salt, clods, organic or other foreign materials which might rot. The backfilling in plinth and under floor shall be well consolidated by means of mechanical or hand operated rammers as specified to achieve the required density. Test to establish proper consolidation as required will be carried out by the Department at rates specified. Two tests per 50 sqm. will be taken to ascertain the proper consolidation. The cost of tests carried out will be recovered from the contractor's bill.

**Filling in Plinth and Under Floors:**

After the available suitable excavated materials are exhausted as backfilling, the contractor shall notify the Engineer-in-charge of the fact and levels taken jointly with Engineerin- charge. The earth, murrum, sand, gravel etc. or such materials suitable for filling proposed to be filled under floors and so mentioned in t he item of schedule of quantities shall then be brought to site from approved locations and sources.

**Earth Filling:**

The earth, soft murrum etc. so brought shall be filled up in layers of 15 cm depth, each layer being well watered and consolidated by approved hand or mechanical tampers or other suitable means to achieve the required density.

**Gravel or sand filling:**

Gravel if required to be filled under floors, shall be single washed gravel of approved quality and of size varying from 12mm t0 20mm. it shall be uniformly blind with approved type of soil and / or sand to obtain full compaction. Gravel shall be filled in specified thickness and shall be well watered and rammed entirely to the satisfaction of the Engineer- in-charge.If sand is required to be filled under floors, it shall be clean, medium grained and free from impurities. The filled in sand shall be kept flooded with water for 24hrs. to ensure maximum consolidation shall be done by the contractor at his own cost. The surface shall

then be well dressed and got approved from Engineer-in-charge before any other work is taken over the fill.

**Lead and Lift:**

**Lead:** The lead for disposal / deposition of excavated materials shall be as specified in the respective item of work. For the purpose of measurements of lead, the area to be excavated or filled or area on which excavated material is to be deposited/ disposed off shall be divided in suitable blocks and for each of the block, the distance between center lines shall be taken as

the leads which shall be measured by the shortest straight line route on the plan and not the actual route adopted.

**Lift:** Lift shall be measured from ground level. Excavation up to 1.5m depth below ground level and depositing excavated material on the ground shall be included in the item of earthwork for various kinds of soil. Extra lift shall be measured in unit of 1.5m or part thereof. Obvious lift shall only be measured that is lifts inherent in the lead due to ground slope shall not be measured, except for lead up to 250m. All excavation shall be measured in successive stages of 1.5m stating the commencing level. This shall not apply to cases where no lift is involved as in hill side cutting.

**Mode of Measurements:**

All excavation in areas having depth more than 30cm. pits, trenches etc. shall be measured net. The dimensions for the purpose of payment shall be reckoned on the horizontal area of the excavations for the purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, rafts or other foundations, multiplied by the mean depth from the surface of ground determined by levels. Excavation for side slopes will not be paid for. Excavation in areas having depths less than 30 cms. shall be measured as surface excavation on square meter basis, mentioning the average depth of excavation.

Reasonable working space beyond concrete dimension required for waterproofing and shuttering where considered necessary in the opinion of Engineer-in-charge will be allowed in execution and considered for payment for underground water tank, sump septic tank etc.

Where direct measurements of rock excavation are not possible, volume of rock can be calculated on the basis of length, breadth, and depth of stacks made at site as mentioned in para 1.5.1 (c). The net volume shall be worked out by reducing it by 40% taking the voids into consideration as 40%. Similarly to arrive at net quantity to be paid in the case of soil reduction at 20% of corresponding stack / truck measurements shall be made. The rate for excavation shall include carting and disposing and leveling the excavated materials within the specified lead. The rate shall also be inclusive of cost of all tools, plants, explosives, shoring, dewatering at various stages, labour, materials etc. to complete all the operations specified.

The backfilling and consolidation in sides of foundation and in plinth with excavated material will not be paid for separately. The rate quoted for excavation shall be deemed to have been included the cost of stacking of excavated materials, conveying within the specified

lead, picking of selected stacked materials, conveying it to the place of final backfill, compaction to the required proctor density etc. Payment for filling and consolidation inside the trenches, sides of foundations, plinth etc. with selected materials brought by the contractor other than the excavated material, shall be paid for separately as per the rates in schedule of quantities which includes cost of such materials/ excavation, royalty, its conveyance within the specified lead, watering, consolidating, dressing etc. Actual quantity of consolidated filling shall be measured and paid in cubic meters up to two places of decimal. The rate quoted in cum. for items of excavation is deemed to include the necessary additional quantity of excavation involved beyond the plan dimensions of the work which may be necessary to be carried out for carrying out the work in an engineering made, decided upon by the contractor. Therefore no extra payment will be made for any excavation done other than the required quantity as per the plan dimension indicated in the drawings. Measurements for excavation over areas shall be determined by levels or by "Dead men" or both at the discretion of the Engineer-in-charge. If however the Engineer-in-charge decided on measurement by levels, levels of site shall be jointly taken and recorded by the Engineer- incharge or his representatives and the contractor, before commencement of the work and after completion of the work and the quantity of work done shall be computed based on these levels. The volume of earth work shall be computed based on "Simpson's formula ' or any other approved method at the discretion of the Engineer-in-charge.

**3.2.2ANTITERMITE TREATMENT**:

**General:**

Pre constructional anti-termite treatment is a process in which soil treatment is applied to a building in early stages of its construction. The purpose of anti-termite treatment is to provide the building with a chemical barrier against the sub-terrain termites. Anti-termite treatment being a specialized job, calls for thorough knowledge of the chemicals, soils, termite to be dealt with and the environmental conditions, in order to give effective treatment and lasting protection to the property undergoing treatment. It is therefore imperative that the works of anti-termite treatment should be got executed through specialized agencies only. The specialized agency should be preferably a member of the Indian pest control Association and shall have sufficient experience of carrying out similar works of magnitude envisaged in this tender.

The pre constructional soil treatment is required to be applied during the construction

stages of the sub-structure up to plinth level. The contractor has to be watchful of the various stages of sub-structure works and arrange to carry out the soil treatment in time after proper coordination with Department and other contractors if any, working at site.

**Scope:**

The scope of pre constructional anti-termite treatment covers the soil treatment with approved chemicals in water emulsion in foundation trenches for columns, plinth beams, plinth filling, at junction of walls and floor, in expansion joints etc. in stages as detailed in this specifications and drawings. Unless otherwise stipulated, the anti-termite treatment will be carried out as per IS 6313 (part II) 1981 and / or as per direction of the Engineer-in-charge.

**Site preparation:**

In order to ensure uniform distribution of the chemical emulsion and to assist penetration, the following site preparation shall be carried out:

a) Remove all trees, stumps, logs or roots from the building site.

b) Remove all concrete form work if left anywhere, leveling pegs, timber off- cuts and other building debris from the area to be treated.

c) If the soil to be treated is sandy or porous, preliminary moistening will be required to fill capillary spaces in soil in order to prevent the loss of emulsion through piping or excessive percolations.

d) In the event of water logging of foundation, the water shall be pumped out before application of chemical emulsion and it should be applied only when the soil is absorbent

e) On clays and other heavy soils where penetration is likely to be slow and on sloping sites, where run-off of the treating solution is likely to occur, the surface of the soil should be scarified to a depth of 75mm at least.

f) All sub-floor leveling and grading should be completed. All cutting trenches and excavations should be completed with backfilling in place, borrowed fill must be free from organic debris and shall be well compacted. If this is not done supplementary treatments should be made to complete the barrier.

**Chemical to be used:**

The effectiveness of chemical depends upon the choice of the chemical, the dosage adopted and the thoroughness of application. The chemical solutions or emulsions are required to be dispersed uniformly in the soil and to the required strength so as to form an

effective chemical barrier which is lethal and repellent to termites.

**Soil treatment:**

One of the following chemicals in water emulsion, after approval from the Engineer-incharge shall be used uniformly over the area to be treated.

**Mode and Rate of Application:**

The chemical emulsion as stated above will be applied uniformly by sprayers at the prescribed rates as detailed below in all the sages of the treatment.

**Treatment in Foundation Trenches:**

In case of normal wall load bearing structures, columns pits, wall trenches and basement, the treatment shall be at 5 litres/sqm. or surface area of the bottom and sides to a height of at least 300mm. After the foundation work, the sides shall be treated at 7.5 litres/sqm. of vertical surface of substructure on each side. After the earth filling is done, treatment shall be done by rodding the earth at 150mm centers close to wall surface and spraying the chemical with the above dose i.e. 7.5 litres/sqm. In case of framed structure, the treatment shall start at adepth of 500mm below ground level. From this depth the backfill around the columns, beams and R.C.C. basement walls shall be treated at 7.5 litres / sqm. of the vertical and at 5 litres / sqm. for the horizontal surface at the bottom in the trenches / pits.

**Treatment on Top Surfaces on Plinth Filling:**

The top surface of the filled earth within plinth walls shall be treated with chemical emulsion at the rate of 5 litres/sqm. of the surface area before sub-base to floor is laid. If filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 to 75mm deep at 150 mm centers both ways shall be made with crow bars on the surface to facilitate saturation of the soil with the emulsion.

**Treatment at Junction of Walls and floors:**

Special care shall be taken to establish continuity of the vertical chemical barrier on the inner wall surfaces from the finished ground level (or from level where the treatment had stopped) up to the level of the filled earth surface. To achieve this a small channel 30 X 30 mm. shall be made at all the junctions of wall / column with floor (before laying sub-grade) and rod holes made in the channel up to the finished ground level at 150mm apart and the iron rod moved backward and forward to break the earth and chemical emulsion poured along the channel at 7.5 litres (or at recommended quantity per sqm. of the vertical wall / column surfaces so as to soak the soil right up to the bottom. The soil shall be tamped back into place

after this operation.

**Treatment for Expansion Joints:**

The soil beneath the expansion joins shall receive special attention when the treatment under 2.5.1 above is in progress. This treatment shall be supplemented by treating through the expansion joint after sub-grade has been laid at the rate of 2 litres per metre length of expansion joint.

**Precautions during Treatment:**

1. Utmost care shall be taken to see that the chemical barrier is complete and continuous. Each part of the area shall receive the prescribed dosage of chemical emulsion.

2. The treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water.

3. Once formed, the treated soil barrier shall not be disturbed. If by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

**Precautions for Health Hazards and Safety Measures:**

All the chemicals mentioned above are poisonous and hazardous to health. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray mist or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely source of accidental poisoning. They should be cautioned to observe carefully all the safety precautions particularly when handling these chemicals in the form of concentrates. These chemicals are usually brought to the site in the form of emulsifable concentrates. The containers should be clearly labeled and should be stored carefully out of the reach of children and pets animal. They should be kept securely locked. Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water especially before eating. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes they shall be flushed with plenty of water and immediate medical attention should be sought.

The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing. Care should be taken in the

application of chemicals / soil toxicants to see that they are not allowed to contaminate wells or springs and other sources of drinking water.

**Guarantee :**

The contractor has to furnish the guarantee for 10 (ten) years from the date of completion of work, starting that in case of reappearance of termites within the building area due to defective materials or workmanship or due to any other reasons, the contractor will arry out the necessary post constructional treatment to keep the entire area free from termite, once again, without any extra cost to the Department during the guarantee period.

**Mode of measurement:**

The payment will be made on the basis of plinth area measurements at ground floor only for all the stages of treatment in sqm. correct to two places of decimals. Rate includes the cost of materials, labour and all tools, plants, sprayers required for complete operation.

### 3.2.3 HARD CORE / SOLING UNDER FLOORS / FOUNDATIONS:

**Scope of work:**

The work covered under this specification includes all type of soling work either by bricks or by rubble stones laid under floors / foundations, hand packed, complete as per specification mentioned below and applicable drawings.

**Rubble Stone Soling:**

The rubble stone shall be of best variety of black trap / granite / basalt or other approved-variety of stone available locally. The stone shall be hard, durable free from defects and of required size and shall be approved by the Engineer-in-charge.

**Preparation of Surface:**

The bed on which rubble soling is to be laid shall be cleared of all loose materials, leveled, watered ad compacted and got approved by the Engineer-in-charge before laying rubble soling. Cable or pipe trenches if shown in the drawing and as required by the Engineer-in-charge shall be got done before the soling is started.

**Workmanship:**

Over the prepared surface, the stone shall be set as closely as possible and well packed and firmly set. The stones shall be of full height and shall be laid so as to have their bases of the largest area resting on the sub-grade. Soling shall be laid in one layer of 230mm or 150mm depth or specified thickness of soling with a tolerance of 25mm. After packing the

stones properly in position, the interstices between them shall be carefully filled with quarry spoils or stone chips of larger size possible to obtain a bard, compact surface. Spreading of loose spoils or stone chips is prohibited. The entire surface shall be examined for any protrusions and the same shall be knocked off by a hammer and all interstices shall be filled with approved murrum. Excess murrum if any over the surfaces shall be removed. Unless other wise specified, the murrum shall be supplied by the contractor at his own cost from the selected area. The surfaces shall then be watered and consolidated with mechanical or sufficiently heavy wooden tampers and log-rammers as approved by the Engineer. After compaction, the Engineer-in-charge to give the required slope or level and dense sub-base and the surface shall present clean look. Adequate care shall be taken by the contractor while laying and compacting the rubble soling to see that concrete surfaces in contact with soling are not damaged.

**Mode of Measurement:**

The quoted rate shall be per square metre of the soling of specified thickness. The linear dimension shall be measured up to two places of decimals of a metre and are worked out correct to the two places of decimals of a square metre. Plan areas of soling work actually done limiting to the dimensions as per drawings shall be measured for payment. The rate shall include all the materials labour, transport etc. and no extra payment shall be made for work done at different levels. The rate shall also include the cost of preparation of surface, all materials and labour, watering, consolidation etc. all complete

### 3.2.4 REINFORCED CONCRETE AND ALLIED WORKS:

**Scope:**

This specification covers the general requirements for concrete jobs, using on-site production facilities including requirements in regard to the quantity, handling, storage of ingredients, proportioning, batching, mixing and testing of concrete and also requirements in regard to the quality. This also covers the transportation of concrete from the mixer to the place of final deposit and the placing, consolidation, curing, protecting, repairing ad finishing of concrete. After award of the work, if so desired by the contractor, he / they may be allowed by the Engineer-in-charge till the designed mix is obtained, to carry out the reinforce concrete work In foundation and plinth as per equivalent nominal mix against the specified design mix concrete as per IS Codes. However, all other specification for design mix shall govern for

nominal mix also and nothing extra shall be paid for use of extra cement on this account whether the cement is supplied by the Department or procured by the contractor.

**Cement Concrete (Plain and Reinforced):**

The quality of materials and method and control of manufacture and transportation of all concrete work in respect of mix, where reinforced or otherwise, shall conform to the applicable portions of these specifications. The Engineer-in-charge shall have the right to inspect the sources of materials, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipments and the quality control system. Such an inspection shall be arranged by the contractor and the Engineer-in-charge's approval shall be obtained prior to starting the concrete work.

**Materials for Standard Concrete:**

The ingredients to be used in the manufacture of standard concrete shall consist solely of a standard type Portland cement, clean sand, natural coarse aggregate, clean water, ice and admixtures if specially called for as per drawings or schedule of quantities.

**Cement :**

Unless otherwise specified or called for by the Engineer-in-charge, cement shall be ordinary Portland cement in 50 kg bags. The use of bulk cement will be permitted only with the approval of the Engineer-in-charge. Changing of brands or type of cement within the same structure will not be permitted. Ordinary Portland cement (OPC) 43 grade manufactured as per I.S. specifications of reputed brands like ACC / Ultratech / Zuari / Coramendel or any other brands as approved by the Engineer-in-charge from time to time shall be procured and used on the work. Joint account of cement consumed at site for every day for items of work carried shall be maintained by the Contractor for verification to ensure effective control on quality of cement used in the work.

A certified report attesting to the conformity of the cement to IS specifications by the cement manufactures chemist shall be furnished to the Engineer-in-charge, if demanded. Incase the cement is required to be arranged by the Contractor, the Contractor will have to make his own arrangement for the storage of adequate quantity of cement. Cement in bulk may be stored in bins or silos which will provide complete protection from dampness, contamination and minimize caking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls

and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access. Damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangements shall be such that there is no dead storage. Not more than 12 bags shall be
stacked in any tier. The storage arrangement shall be got approved by the Engineer-in-charge. Consignments in cement shall be stored as received and shall be consumed in the order of their delivery. Contractor shall establish cement/concrete/soil testing laboratories at site of work with qualified person to handle the laboratory. Every consignment of cement procured shall accompany test certificate from the company indicating lot No etc. Sample shall be taken for each lot and sent to Standard Approved Material Testing Laboratory for physical and chemical analysis. The cost of testing shall be borne by the Contractor.

Cement held in store for a period of 90 (ninety) days or longer shall be retested before use in work. Should at any time the Engineer-in-charge have reasons to consider that any cement is defective, then irrespective of its origin and / or manufacturers test certificate, such cement shall be tested immediately at a National Test Laboratory / Departmental Laboratory or such approved laboratory, and until the results of such tests are found satisfactory, it shall not be used in any work.

**Aggregates:**

"Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete.

"Fine Aggregate" is aggregate most of which passes through 4.75 mm I.S. sieve. "Coarse Aggregate" is aggregate most of which is retained on 4.75 mm I.S. sieve. All fine and coarse aggregates proposed for use in the work shall be subject to the Engineer-in-charge's approval and after specific materials have been accepted, the source of supply of such materials shall not be changed without prior approval of the Engineer-in- charge. Aggregate shall, except as noted above, consists of natural sand, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, curable against weathering, of limited porosity and free from deleterious materials that may cause corrosion to the reinforcement or may impair the strength and / or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of and shall be based on the "mix design" and preliminary test on concrete specified hereinafter.

**Sampling and Testing:**

Sampling of the aggregates for mix design and determination of suitability shall be taken under the supervision of the Engineer-in-charge and delivered to the laboratory, well in advance of the schedule placing of concrete. Record of tests which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to the Engineer-in-charge in advance of the work or use, in determining suitability of the proposed aggregate.

**Storage of aggregates:**

All coarse and fine aggregates shall be stacked separately in stock pile in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but also at the time of loading into mixer. Rakers shall be used for lifting the coarse aggregate from bins or stock piles. Coarse aggregate shall be piled in layers not exceeding 1.00 meters in height to prevent conning or segregation. Each layer shall cover the entire area of the stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected. Rejected materials after remixing may be accepted, if subsequent tests demonstrate conformity with required gradation.

**Specific Gravity:**

Aggregates having a specific gravity below 2.6 (saturated surface dry basis) shall not be used without special permission of the Engineer-in-charge.

**Fine Aggregate:**

Fine aggregate except as noted above, and for other than light weight concrete shall consist of natural or crushed sand conforming to IS 383. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, loam, alkali, organic matter mica, salt or other deleterious substances which can be injurious to the setting qualities / strength / durability of concrete.

**Screening and Washing:**

Sand shall be prepared for use by such screening or washing or both as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions. Sand with silt content more than 3 percent will not be permitted to be used unless same is washed and silt content is brought within 3% by weight.

GRADATION: Unless otherwise directed or approved, the grading of sand shall be within the limit indicated hereunder:-

Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron (IS) sieve by not more than 5% it shall be regarded as falling within that grading

zone. This tolerance shall not be applied to percentage passing the 600 micron (IS) sieve or to percentage passing any other sieve size on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates conforming to Grading zone IV shall not be used unless mix designs and preliminary tests have shown its suitability for producing concrete of specified strength and workability.

**Fineness Modulus:**

The sand shall have a fineness modulus of not less than 2.2 or more than 3.2 the fineness modulus is determined by adding the cumulative. Percentages retained on the following IS sieve sizes (4.75 mm, 2.36 mm, 1.18mm, 600 micron, 300 micron and 150 micron) and dividing the sum by 100.

**Coarse Aggregate:**

Coarse aggregate for concrete except as noted above and for other than light weight concrete shall conform to IS 383. This shall consist of natural or crushed stone and gravel, and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, sag, alkali, mica, organic matter or other deleterious matter.

The coarse aggregate and fine aggregate shall be tested from time to time as required by the Engineer-in-charge to ascertain its suitability for use in construction and the charges for testing aggregate shall be born by the contractor as specified herein after.

**Screening and Washing:**

Crushed rock shall be screened and / or washed for the removal of dirt or dust coating, if so demanded by Engineer-in-charge.

**Grading:**

Coarse aggregates shall be either in single or graded in both the cases. The grading shall be within the following limits:

| IS Sieve designation | Percentage passing for single sized aggregates | | | | | | Percentage passing for graded aggregates of nominal size | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 63mm | 40mm | 20mm | 16mm | 12.5mm | 10mm | 40mm | 20mm | 16mm | 12.5mm |
| 75mm | 100 | - | - | - | - | - | - | - | - | - |
| 63mm | 85-100 | 100 | - | - | - | - | 100 | - | - | - |
| 37.5mm | 0-30 | 85-100 | 100 | - | - | - | 95-100 | 100 | - | - |
| 19mm | 0.5 | 0.20 | 85-100 | 100 | - | - | 30-70 | 95-100 | 100 | 100 |
| 16mm | - | - | - | 85-100 | 100 | - | - | - | 90-100 | - |
| 11.2mm | - | - | - | - | 85-100 | 100 | - | - | - | 90-100 |
| 9.5mm | - | 0.5 | 0.20 | 0.30 | 0-45 | 85-100 | 10-35 | 25-55 | 30-70 | 40-85 |
| 4.75mm | - | 0.5 | 0-5 | 0-10 | 0-20 | 0-20 | 0-5 | 0-10 | 0-10 | 0-10 |
| 2.36mm | - | - | - | - | 0-5 | 0-5 | - | - | - | - |

**Foreign Material Limitations:**

The percentages of deleterious substances in the coarse aggregate delivered to the mixer shall not exceed the following.

| Sl. No. | Substances | Percent by weight | |
|---|---|---|---|
| | | Uncrushed | Crushed |
| I | Material finer than 75 micron IS Sieve | 3.00 | 3.00 |
| II | Coal and Lignite | 1.00 | 1.00 |
| III | Clay lumps | 1.00 | 1.00 |
| IV | Soft fragments | 3.00 | - |
| V | Total of all the above substances | 5.00 | 5.00 |

**Water:**

Water used for both mixing and curing shall be free from injurious amount of deleterious materials; potable waters are generally satisfactory for mixing and curing concrete. In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS 456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The samples shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water. Average 28 days compressive strength of at least three 150mm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. The initial setting time of test block made with the appropriate test cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than (+) 30 minutes form the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test blocks shall be prepared and tested in accordance it the requirements of IS 4031. Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-in-charge may refuse to permit its use. As a guide, the following concentrations represent the maximum permissible values.

**Limits of acidity:**

To neutralize 200ml sample of water, using phenolphthalein as an indicator, it should not require more than 2ml of 0.1 normal NaOH. The details of test shall be as given in IS 3025.

**Limits of alkalinity:**

To neutralize 200ml sample of water, using methyl orange as an indicator, it should not

require more than 10ml of 0.1 normal HCL. The details of test shall be as given in IS 3025.

**Beam and Lintel:**

Beam shall be measured from face to face of the columns, walls, cross beams including haunches if any. The depth of the beams shall be measured from the top of the slab tot eh bottom of the beam except in the case of inverted beam where it shall be measured from top of slab to top beams. The beams and lintels with narrow width even though acting as facia in elevation in some cases will be measured as beams and lintels only.

**I) Slab:**

The length and breadth of slab laid to correct thickness as shown in the detailed drawing for as ordered by the Engineer-in-charge shall be measured between beams, walls ad columns.

**II) Chajjas, Facias, Fins ad Mullions:**

a. Chajjas shall be measured net from supporting faces upto the edges of chajjas without any facia.

b. Facia shall be measured full excluding chajja thickness. c. End fins shall be measured full.

d. Intermediate fins, mullions shall be measured between chajjs or other supporting structural members.

e. Parapets shall be measured from top of slab / chajja.

**III Staircase:**

The concrete in all members of staircase like waist slabs, steps, cantilever steps, stringer beams etc. shall be measured for their length, breadth ad depth, limiting dimensions to those specified on drawings. No deductions shall be made for embedded plugs, pockets.

**Rates:**

The rate for PCC / RCC shall include the cost of all materials, labour, transport, tools ad plants and all the operations mentioned hitherto, including or excluding the cost of form work and / or reinforcement as mention din the schedule for quantities. The rates also shall include the cost of testing material, mix design; cube test ad allied incidental expenses. The reinforcement steel used in the works shall be measured and paid for separately under relevant item.

### 3.2.5 FORM WORK

**General:**

The form work shall consist of shores, bracings, sides of beams and columns, bottom of

slabs etc, including ties, anchors, hangers, inserts etc. complete which shall be properly designed and planned for the work. The false work shall be so constructed that up and down vertical adjustment can be made smoothly. Wedges may be used at the top or bottom of timber shores, but not at both ends, to facilitate vertical adjustment and dismantling of form work.

**Design of Form Work**

The design and engineering of form work as well as its construction shall be the responsibility of Contractor. The drawings and calculations for the design of the form work shall be submitted well in advance to the Engineer-in-charge for approval before proceeding with work, at no extra cost to the Department. Engineer-in-charge's approval shall not however, relieve Contractor of the full responsibility for the design and construction for the form work. The design shall take into account all the loads vertical as well as lateral that the
forms will be carrying including live and vibration loadings.

**Tolerances:**

Tolerances are specified permissible variation from lines, grade or dimensions given in drawings. No tolerances specified for horizontal or vertical buildings lines or footings. Unless otherwise specified, the following tolerances will be permitted.

**Tolerances for R.C. Buildings: I) Variation from the plumb:**

a) In the line ad surfaces of columns, piers, walls and in buttresses: 5 mm per 2.5m, but not more than 25 mm.

b) For exposed corner columns ad other conspicuous lines

In any bay or 5 m, maximum : (+) 5 mm In 10 m or more: (+) 10mm

ii) Variation from the level or from the grades indicated on the drawings.

a) In slab soffits, ceilings, beam soffits and in arises.

b) In 2.5m (+) 5mm In any bay or 5m maximum (+) 8 mm In 10 or more (+) 15mm

c) For exposed lintels, sills, parapets, horizontal grooves and conspicuous lines

iii) Variation of the linear building lines from established position in plan and related position of columns, walls and partitions. In any bay or 5m maximum (+) 10 mm In 10 or more (+) 20mm

iv) Variation in the sizes ad locations of sleeves, openings in walls and floors except in the case of and for anchor bolts : (+) 5mm

v) Variation in cross sectional dimensions of columns and beams and in the thickness of slabs and

walls: (+) 10 mm/(-)5mm

vi) Footing :

a) Variation in dimensions in plan (+) 50mm/(-) 5mm.V- Page 55 of 197

b) Misplacement or eccentricity: 2% of footing within the direction of misplacement but not more than 50mm.

c) Reduction in thickness (-) 5% of specified thickness subject to maximum of 50mm. vii) Variation in steps:

a) In a flight of stairs
Rise (+) 3.0 mm

Tread (+) 5.0 mm

b) Consecutive steps Rise (+) 1.5 mm Tread (+) 3.0 mm

### 3.2.6 STEEL REINFORCEMENT

Steel reinforcement bars, if supplied or arranged by contractor, shall be either plain round mild steel bars grade as per IS 432 (part-I) or medium tensile steel bars as per IS 452 (part-I) or hot rolled mild steel ad medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars and hot weld strength deformed bars as per IS 1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566. Substitution of reinforcement will not be permitted except upon written approval from Engineer-in-charge. **Storage :**

The reinforcement steel shall not be kept in direct contact with ground but stacked on top of an arrangement of timber sleepers or the like. Reinforcement steel shall be with cement wash before stacking to prevent scale and rust. Fabricated reinforcement shall be carefully stock to prevent damage, distortion, corrosion ad deteriorations.

**Quality :**

All steel shall be grade I quality unless specifically permitted by the Engineer-in-charge. No rolled material will e accepted. If demanded by the Engineer-in-charge. Contractor shall submit the manufacturers test certificate for steel. Random tests on steel supplied by contractor may be performed by Department as per relevant Indian Standards. All costs incidental to such tests shall be at contractors expense. Steel not conforming to specifications shall be rejected. All reinforcement shall be clean, free from grease, oil, paint, dirt

loose mill, scale dust, bituminous materials or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used. All bars shall be rigidly held in position before concreting. No welding of rods to obtain continuity shall be allowed unless approved by the Engineer-in- charge. If welding is approved, the work shall be carried as per 2751, according to best modern practices ad as directed by the Engineer-in-charge in all cases of important connections, tests shall be made to prove that the joints are of the full strength of bars welded. Special specifications, as specified by the Engineer-in-charge, shall be adhered to in the welding of cold worked reinforcing bars and bars other than mild steel.

**Laps :**

Laps ad splices for reinforcement shall be shown in the drawings. Splices, in adjacent bars shall be staggered ad the locations of all splices, except those pecified on the drawing shall be approved by the Engineer-in-charge. The bars shall not be lapped unless the length required exceeds the maximum available length of bars at site.

**Bending :**

All bars shall be accurately bent according to the sizes ad shapes shown on the detailed working drawings/ bar being schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and rebent in a manner that will injure the materials. Bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 25mm in diameter which may be bent hot if specifically approved by the Engineer-incharge. Bars bent hot shall not be heated beyond cherry red colour (not exceeding 645oC ) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only of ht means used for straightening and rebinding be such as shall not, in the opinion of the Engineer-in-charge injure the material. NO reinforcement bar shall be bent when in position in the work without approval, whether or not it is partially embedded in ardened concrete. Bars having links or bends other than those required by

design shall not be used.

**Bending at Construction Joints :**

Where reinforcement bars are bent aide at construction joints and afterwards bent back into their original position, care should be taken to ensure that no time the radius of the bend

is less than 4 bar diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

**Fixing / Placing ad Tolerance on Placing :**

Reinforcement shall be accurately fixed by ay approved means maintain din the correct position as shown in the drawings by the use of blocks, spacer and chairs as per IS 2502 to prevent displacement during placing ad compaction of concrete. Bar intended to be in contact at crossing point shall be securely bound together at all such points with number 16 gauge annealed soft iron wire. The vertical distances required between successive layers of bars in beams or similar members shall be maintained by the provision of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

**Tolerance on placing of reinforcement :**

Unless otherwise specified by the Engineer-in-charge, reinforcement shall be placed within the following tolerances:

Tolerance in spacing

a) For effective depth, 200 mm or less + 10 mm

b) For effective depth, more than 200 mm + 15 mm

**Cover to Reinforcement :**

The cover shall in no case be reduced by more than one third of specified cover or
5mm whichever is less. Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish shall be as follows) :

a) At each end of reinforcing bar not less than 25 mm, nor less than twice the diameter of such bar.

b) For a longitudinal reinforcing bar not less than 25 mm, nor more than 40 mm, nor less

than the diameter of such bar. In the case of column of maximum dimensions of 200mm or under, whose reinforcing bars do not exceed 12mm, a cover of 25mm may be used.

c) For longitudinal reinforcing bar in a bar, not less than 25 mm nor less than the diameter of such bar and.

d) For tensile, compressive, shear, or other reinforcement in a slab, not less than 25mm,
nor less than the diameter of such bar and.

e) For any other reinforcement not less than 15mm, nor less than the diameter of such bar.

f) Increased cover thickness may be provided when surfaces of concrete members are exposed to the action of harmful chemicals (as in the case of concrete in contact with earth faces contaminated with such chemicals), acid, vapour, saline, railways) etc. and such

increase of cover may be between 15mm and 50 mm beyond the figures given in (a to e) above as may be specified by the Engineer-in-charge.

g) For reinforced concrete members, totally immersed in sea water the cover shall be 40mm, more than specified ( a to e) above.

h) For reinforced concrete members, periodically immersed in sea water or subject to sea spray, the cover of concrete shall be 50 mm more than that specified (a to e) above.

i) For concrete of grade M25 and above, the additional thickness of cover specified in (f),

(g) and (h) above a my be reduced to half. In all such cases the cover should not exceed 75mm.

j) Protection to reinforcement in case of concrete exposed to harmful surroundings may

also be given by providing a dense impermeable concrete with approved protective coating as specified on the drawings. In such case, the extra cover, mentioned in (h) and (i) above, may be reduced by the Engineer-in-charge, to those shown on the drawing.

k) The correct cover shall be maintained by cement mortar briquettes or other approved means. Reinforcement for footings, grade beams ad slabs on sub grade shall be supported on precise concrete blocks as approved by the Engineer-in-charge. The use of pebbles or stones shall be permitted.

l) The minimum clear distance between reinforcing bars shall be in accordance with IS 456 or as shown in drawings.

### 3.2.7 STRUCTURAL STEEL

**Scope of Work :**

The work covered by this specification consists of furnishing ad erecting of structural steel complete in strict accordance with this specifications ad the applicable drawings. **Materials :**

All structural steel shall be of standard sections as marked on the drawings ad shall be free of scale, blisters, laminations, cracked edges ad defects of any sort. If the structural steel

is not supplied by the Department and the Contractor is required to bring such steel, the

Contractor shall furnish duplicate copies of all mill orders and / or also the test report received from the mills, to satisfy the Engineer-in-charge. All structural steel and electrodes shall comply in all respects with relevant I.S.S. for structural steel.

**Workmanship :**

All workmanship shall be of first class quality in every respect to get greatest accuracy to ensure that all parts will fit together properly on erection. All ends shall be cut true to planes. They must fit the abutting surfaces closely. All stiffeners shall fit tightly at both ends. All holes in plates and section between 12mm and 20 mm thick shall be punched to such diameter that 3mm of metal is left all around the hole to be cleaned out to correct size by reamer.

The base connection shall be provided as shown on drawings and the greatest accuracy of workmanship shall be ensured to provide the best connections. Figured dimensions on the drawings shall be taken.

**Erection and Marking :**

Erection ad fabrication shall be according to IS 800-1984 section –11. During erection, the work shall be securely braced and fastened temporarily to provide safety for all erection stresses etc. No permanent welding shall be done until proper alignment has been obtained. Any part which do not fit accurately or which are not in accordance with the drawings and specifications shall be liable to rejection and if rejected, shall be at once be made good. Engineer-in-charge shall have full liberty at all reasonable times to enter the contractors premises for the purpose of inspecting the work and no work shall be taken down, painted r dispatched until it has been inspected and passed. The contractor shall supply free of charge all labour ad tools required for testing of work.

**Delivery at Site :**

The contractor shall deliver the component parts of the steel work in an undamaged state at the site of the works and the Engineer-in-charge shall be entitled to refuse acceptance of any portion which has been bent or otherwise damaged before actual delivery on work. **Shop Drawing :**

The shop drawings of structural steel based on contract drawings hall be submitted to the Engineer-in-charge. The necessary information for fabrication, erection, painting of structure etc. must be furnished immediately after acceptance of the leader.

**Painting :**

Painting should be strictly according to IS. 1477-1971 (Part-I-Pretreatment) and IS 1477-1971 (part-II painting). Painting should be carried out on dry surfaces free from dust, scale etc. The paint shall be approved by the Engineer-in-charge. Once coat of shop paint (red lead) shall be applied on steel, except where it is to be encased in concrete or where surfaces are to be field welded.

**Welding :**

Welding shall be in accordance with IS. 816-1969,IS819-1957, IS 1024-1979, IS1261-1959, IS 1323-1982 and IS 9595-1980 as appropriate. For welding of any particular type of joint, welders shall give evidence of having satisfactory completed appropriate test as described in ay of IS 817-1966, IS 1393-1961, IS 7307 (part-I) –1974, IS 7310 (part-I) 1974 and IS 7318 (part-I) 1974 as relevant.

**Welding Consumables:**

Covered electrodes shall conform to IS 814 (part-I) – 1974 and IS814 (part-II)- 1974 or IS 1395-1982 as appropriate. Filler rods and wires for gas welding shall conform to IS 1278-1972. The bar wire electrodes for submerged are welding shall conform t IS 7280-1974. The combination of are and flash shall satisfy the requirements of IS 3613-1974.

The filler rods ad bare electrodes for gas shielded metal, are welding shall conform to IS 6419-1971 and IS 6560-1972 as appropriate .

**Type of Welding :**

Are welding (direct or alternating current) or Oxyacetylene welding may used. Field welding may be used. Field welding shall be by D.C.

### 3.2.8 DAMP PROOF COURSE

**Scope of work:**

The work covered under this specifications consists supplying and laying plain cement concrete or cement plaster 1:3 as damp proof course with or without waterproofing admixture with this specification and applicable drawings. **Workmanship :**

Surface to receive damp proof course shall be cleaned and carefully wiped to remove all dust, laitance etc. and shall be approved by the Engineer-in-charge Damp proof course shown

shall be cement concrete as per proportion indicated in the schedule or cement

plaster in the ratio CM 1:3. Approved water proofing compound @ 2% by weight of cement or as directed by the manufacturer shall be mixed in cement mortar for this concrete or plaster. The damp proof course shall be laid to the full width of the walls and the edges shall be straight, even and truly vertical. Wooden forms shall be used to obtain good edges. No masonry work shall be commenced on freshly laid damp proof course unless it is cured for

48hours of its laying by curing of damp proof course shall be continued along with the masonry work. Specification for cement, sand, aggregate and water shall be as described herein before for concrete works / cement plaster.

**Mode of measurement :**

The work shall be measured in sqm. area actually laid limited to sites as shown in

drawing. The rate shall include cost of all the materials, labour etc. and scaffolding (if any).

### 3.2.9 BRICK WORK

**Scope of work:**

The work covered under this specification pertains to procurement of best quality locally available bricks and workmanship of building walls of various thickness. In strict compliance with the specifications and applicable drawings.

**Materials :**

Brick shall be best quality locally available bricks and shall be got approved by the Engineer-in-charge before incorporation in the work. The nominal size of bricks (F.P.S) shall be 22.9 X 11.4 X7cm (9" X 4 1/2 X 2 3/4" ). Permissible tolerance on dimensions shall be +

3mm. in length and + 1.5 mm in width / thickness. The contractor shall get approved the sample and source of bricks from Engineerin- charge before procurement on large scale and shall maintain the same for the entire work. In case the size of bricks used in the work found lesser than the specified one for the whole lot : Extra cement consumed due to more number of joints and due to additional thickness of plaster than the specified in the tender to match with adjoining columns and beams, shall be to contractor's account. If the plastering to be done is more than the specified thickness to bring the plaster surface to perfect line, level ad plumb with adjoining columns, beams walls etc., the contractor shall be responsible to provide and fix chicken wire mesh to receive more thickness of plaster at his own cost and nothing extra will be paid on this account.

In case the size of bricks used in the work, found more than the permissible, the contractor shall chip out the exposed edges of bricks upto the required level of wall to receive specified thickness of plaster at no extra cost. Bricks shall generally conform to IS 1077-1970. In any case minimum crushing strength shall not be less than 35 kg/sq.cm and water absorption shall not be more than 25% by weight. The Engineer-in-charge shall have the right to reject bricks obtained from any field where the soil have an appreciable quantity of sulphates and chlorides. The specifications for cement, sand and water shall be same as described herein before under cement concrete. Bricks shall be thoroughly soaked in water before using till the bubles ceases. No half or quarter brick shall be used except as closer. The closers shall be cut to required size and used near the end of the walls. The walls shall be raised truly to plumb. The type of bond to be adopted shall be decided by the Engineer-in-charge, but vertical joints shall be laid staggered.

**Workmanship :**

Four courses of brick work with four joints should not exceed by more than 40mm the same bricks piled one over the other without mortar. Brick work shall not be raised more than 10 courses a day unless otherwise approved by the Engineer-in-charge. The brick work shall be kept wet for at least 7 days. Brick work shall be uniformly raised around and no part shall be raised more than 1.0 metre above another at any time.

All joints shall be thoroughly flushed with mortar of mix as specified in the schedule of quantities, at every courses. Care shall be taken to see that the bricks are bedded effectively and all joints completely filled to the full depth. The joints of brick work to be plastered shall be raked out to a depth not less than 10mm as the work proceeds. The surface of brick work shall be cleaned down and wiped properly before the mortar sets.

The adhesion between the brick masonry surface d the concrete surface of columns, beams, chajjas, lintels etc. should be proper by ensuring that the concrete surface coming in contact with brick masonry is backed / chipped / keyed, cleaned and cement slurry is applied so that a proper bond is achieved between the two dissimilar materials. It is responsibility of the contractors to ensure that there will not be any cracks / fissure anywhere in the brick masonry. In case the cracks appear subsequently in those areas, they should be made good by cement grouting or epoxy putty grouting/ poly sulphide compound grouting or as per

standard modern specifications/methods with the prior approval of the Engineer-in-charge, at the cost of the contractor. All the courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Specified mortar of good and approved quality shall be used. Lime shall not be used where reinforcement is provided in brick work. The mortar should completely cover the bed and sides of the bricks. Proper care should be taken to obtain uniform mortar joint thought out the construction. The walls should be raised uniformly in proper, approved bond. In construction of the wall, first of all two end corners are carefully laid to line and level ad then it between portion is built, with a cord stretching along the headers or stretchers held in position at the ends. This helps in keeping the alignment of the courses and marinating them in level. Similarly all other courses are building

## 3.3 SCHEDULE OF RATES

**Definition:**

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

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

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

### 3.3.1 PROCEDURE OF RATE ANALYSIS

**Cost of materials at source and at site of construction.**

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

Purpose of Analysis of rates:

1. To work out the actual cost of per unit of the items.

2. To work out the economical use of materials and processes in completing the particulars item.

3. To work out the cost of extra items which are not provided in the contract bond, but are to be done as per the directions of the department.

4. To revise the schedule of rates due to increase in the cost of material and labour or due to change in technique.

### 3.3.2 REQUIREMENT OF LABOUR AND MATERIALS

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

The labour can be classified in to

1) Skilled 1st class

2) Skilled IInd Class

3) un skilled

The labour charges can be obtained from the standard schedule of rates 30% of the skilled labour provided in the data may be taken as Ist class, remaining 70% as II class. The rates of materials for Government works are fixed by the superintendent Engineer for his circle every year and approved by the Board of Chief Engineers. These rates are incorporated in the standard schedule of rates.

**Lead statement:**

The distance between the source of availability of material and construction site is known as "Lead " and is expected in Km. The cost of convenayce of material depends on lead. This statement will give the total cost of materials per unit item. It includes first cost, convenayce loading, unloading stacking, charges etc. The rate shown in the lead statement are for mettalled road and include loading and staking charges. The environment lead on the metalled roads are arrived by multiplying by a factor

a) for metal tracks - lead x 1.0

b) For cartze tracks - Lead x 1.1 c) For Sandy tracks - lead x 1.4

Note: For $1m^3$ wet concrete = $1.52m^3$ dry concrete approximately

SP.Wt of concrete= 1440 $kg/m^3$ (or) 1.44 $t/m^3$

1 bag of cement = 50 Kg

## UNIT IV
## VALUATION

Necessity – Basics of value engineering – Capitalised value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease

### 4.1 OBJECTS OF VALUATION

It is the technique of estimating and determining the fair price or value of a property such as a building, a factory or other engineering structures of various types, land etc.

#### 4.1.1 Six important Purposes of Valuation:

The main purposes of valuation are as follows:

**Buying or Selling Property**

When it is required to buy or sell a property, its valuation is required.

**Taxation**

To assess the tax of a property, its valuation is required. Taxes may be municipal tax, wealth tax, Property tax etc, and all the taxes are fixed on the valuation of the property

**Rent Function**

In order to determine the rent of a property, valuation is required. Rent is usually fixed on the certain percentage of the amount of valuation which is 6% to 10% of valuation.

**Security of loans or Mortgage**

When loans are taken against the security of the property, its valuation is required.

**Compulsory acquisition**

Whenever a property is acquired by law; compensation is paid to the owner. To determine the amount of compensation, valuation of the property is required.

Valuation of a property is also required for **Insurance, Betterment charges, speculations** etc.

**Valuation of Building:**

Valuation of a building depends on the type of the building, its structure and durability, on the situation, size, shape, frontage, width of roadways, the quality of materials used in the construction and present day prices of materials. Valuation also depends on the height of the building, height of the plinth, thickness of the wall, nature of the floor, roof, doors, windows etc.

The valuation of a building is determined on working out its cost of construction at present day rate and allowing a suitable depreciation.

**Six Methods of Valuation**

1. Rental Method of Valuation

2. Direct Comparisons of the capital value
3. Valuation based on the profit
4. Valuation based on the cost
5. Development method of Valuation
6. Depreciation method of Valuation

## 4.2 DEFINITIONS

### 4.2.1 Market Value

The market value of a property is the amount which can be obtained at any particular time from the open market if the property is put for sale. The market value will differ from time to time according to demand and supply.

The market value also changes from time to time for various miscellaneous reasons such as changes in industry, changes in fashions, means of transport, cost of materials and labour etc.

### 4.2.2 Book Value

Book value is the amount shown in the account book after allowing necessary depreciations. The book value of a property at a particular year is the original cost minus the amount of depreciation allowed per year and will be gradually reduced year to year and at the end of the utility period of the property, the book value will be only scrap value.

### 4.2.3 Capital cost

Capital cost is the total cost of construction including land, or the original total amount required to possess a property. It is the original cost and does not change while the value of the property is the present cost which may be calculated by methods of Valuation.

**Capitalized Value of a Property**

The capitalized value of a property is the amount of money whose annual interest at the highest prevailing rate of interest will be equal to the net income from the property. To determine the capitalized value of a property, it is required to know the net income from the property and the highest prevailing rate of interest.

Therefore, Capitalized Value = Net income x year's purchase

**Year's Purchase**

Year's purchase is defined as the capital sum required to be invested in order to receive a net receive a net annual income as an annuity of rupee one at a fixed rate of interest.

The capital sum should be 1×100/rate of interest.

Thus to gain an annual income of Rs x at a fixed rate of interest, the capital sum

should be x(100/rate of interest).
But (100/rate of interest) is termed as Year's Purchase.

The multiplier of the net annual income to determine the capital value is known as the Year's Purchase (YP) and it is useful to obtain the capitalized value of the property.

### 4.2.4 Sinking Fund Method

In this method, the depreciation of a property is assumed to be equal to the annual sinking fund plus the interest on the fund for that year, which is supposed to be invested on interest bearing investment. If A is the annual sinking fund and b, c, d, etc. represent interest on the sinking fund for subsequent years and C = total original cost, then –

### Rental Method of Valuation

In this method, the net income by way of rent is found out by deducting all outgoing from the gross rent. A suitable rate of interest as prevailing in the market is assumed and Year's purchase is calculated. This net income multiplied by Year's Purchase gives the capitalized value or valuation of the property. This method is applicable only when the rent is known or probable rent is determined by enquiries.

### 4.2.5 Direct comparison with the capital Value

This method may be adopted when the rental value is not available from the property concerned, but there are evidences of sale price of properties as a whole. In such cases, the capitalized value of the property is fixed by direct comparison with capitalized value of similar property in the locality.

### Valuation based on profit

This method of Valuation is suitable for buildings like hotels, cinemas, theatres etc for which the capitalized value depends on the profit. In such cases, the net income is worked out after deducting gross income; all possible working expense, outgoings, interest on the capital invested etc. The net profit is multiplied by Year's Purchase to get the capitalized value. In such cases, the valuation may work out to be high in comparison with the cost of construction.

### Valuation based on cost

In this method, the actual cost incurred in constructing the building or in possessing the property is taken as basis to determine the value of property. In such cases, necessary depreciation

should be allowed and the points of obsolescence should also be considered.

**Development Method of Valuation**

This method of Valuation is used for the properties which are in the underdeveloped stage or partly developed and partly underdeveloped stage. If a large place of land is required to be divided into plots after providing for roads, parks etc, this method of valuation is to be adopted. In such cases, the probable selling price of the divided plots, the area required for roads, parks etc and other expenditures for development should be known.

If a building is required to be renovated by making additional changes, alterations or improvements, the development method of Valuation may be used.

**4.2.6 Depreciation Method of Valuation**

According to this method of Valuation, the building should be divided into four parts:

1. Walls
2. Roofs
3. Floors
4. Doors and Windows

And the cost of each part should first be worked out on the present day rates by detailed measurements.

The present value of land and water supply, electric and sanitary fittings etc should be added to the valuation of the building to arrive at total valuation of the property.

Depreciation is the gradual exhaustion of the usefulness of a property. This may be defined as the decrease or loss in the value of a property due to structural deterioration, life wear and tear, decay and obsolescence.

**4.2.6.1 Methods for calculating depreciation**

1. Straight line Method
2. Constant percentage method
3. Sinking Fund Method
4. Quantity Survey Method

**Straight Line Method**

In this method, it is assumed that the property losses its value by the same amount every year. A fixed amount of the original cost is deducted every year, so that at the end of the utility period, only the scrap value is left.

***Annual Depreciation, D = (original cost of the asset – Scrap Value)/life in years***

For example, a vehicle that depreciates over 5 years, is purchased at a cost of **US$17,000**, and will have a salvage value of **US$2000**, will depreciate at **US$3,000** per year: **($17,000? $2,000)/ 5 years = $3,000** annual straight-line **depreciation expense**. In other words, it is the **depreciable cost** of the asset divided by the number of years of its useful life.

**Constant Percentage Method or Declining balance Method**

In this method, it is assumed that the property will lose its value by a constant percentage of its value at the beginning of every year.

**Annual Depreciation, D = 1-(scrap value/original value)1/life in year**

**Quantity Survey Method**

In this method, the property is studied in detail and loss in value due to life, wear and tear, decay, and obsolescence etc, worked out. Each and every step is based is based on some logical grounds without any fixed percentage of the cost of the property. Only experimental valuer can work out the amount of depreciation and present value of a property by this method.

**4.3 FIXATION OF RENT**

Capitalized value of the property can be known by any of the methods discussed earlier and suitable value of year's purchase is adopted according to the admissible rate of interest (8% or any other fair rate).

Then,

Net income = capitalized value / year's purchase

All possible outgoings are added to this net income which will give gross income from the property. Gross income or gross rent = Net rent + outgoings

The standard rent = (Gross Income / 12) per month.

**4.4 CALCULAITON OF STANDARD REND OF A GOVT. PROPERTY**

(In Punjab / Haryana), standard rent is calculated on the capital cost of the residence and shall be either:

1. (a) A percentage equal to the rate of interest on the capital ( which includes the cost on sanitary, water supply and electrical installation, fencing, boundary walls and service roads etc. as fixed from time to time) value of a building. In addition, municipal and other taxes and the expenditure for the maintenance of building are also realised, or

(b) 6%per annum of the capital value of a building constructed/ occupied after 1992 whichever is

less.

2. Municipal taxes etc. levied on the occupant will be payable to the occupant direct to the authorities concerned in addition to the above rent calculations.

3. Generally the value of the land is excluded. If value of land to be considered a little less percentage says 1 to 2 % on value of land be taken for calculation of standard rent.

## UNIT V
## REPORT PREPARATION

Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells.

### 5.1 Report On Estimates for the Construction of Residential Building

The detailed estimate for construction of a residential building for the Executive Engineer at Udaynagar has been prepared in compliance of S.E.'s letter no……. dated……..

There is no building for the residence of the Executive Engineer at Udaynagar and he has to live in a rented building with meager accommodation at a very high rent. It has, therefore, been proposed to construct a residential building for the Executive Engineer. The head of the accounts will be 50 civil original works, building.

The estimate provides for the following accommodation:-

One drawing room, one dining room, three bed rooms, one guest room, and the necessary store kitchen, baths, front and back verandahs and motor garage per plan enclosed. A site has already been selected having a land of 60 m 30 m (200 100') for the construction of the building having good soil and proper drainage and this much of land has to be acquired. The building shall be oriented to face north direction

The building shall have lime concrete foundation and first class brick masonry with lime mortar up to plinth level and the superstructure shall be of first class brick work in cement mortar, 1 :6 Lintels shall be of R.B. work and roof shall be R.C.C with lime concrete terrace finishing. The drawing and dining rooms shall have mosaic floor and other rooms 2.5 cm(1') c.c. floor over 7.5 cm (3') lime concrete. Inside and outside walls shall be 12 mm(1/2 ,) cement line plastered 1:1:6, and ceiling shall be 6 mm (1/2') cement plastered 1:3. Inside of drawing and dining rooms shall be colour washed and inside of remaining rooms shallbe white washed and outside wall be colour washed. Doors and windows shall be 4.5cm . $1\frac{3}{4}$ " . thick teak wood with chaukhat o sal wood and enamel painted. All work shall be strictly as per detailed P.W.D. Specification.

The estimate has been prepared at P.W.D Schedule of rates, and for non-schedule items on analysis of rates. The foundation has been designed for a safe load of 9 tonne per sq m (8 ton per sq ft) and the R.C.C roof has been designed for a safe load of 150 kg per sq m (30 1bs per sq ft) with 1400 kg per sqcm (20000 1bs per sq in) as sage tensile stress of steel and 50 kg sq cm (750 1bs per sq in) as safe compressive stress of concrete. All designs and calculations have been included in the estimate. Plans and drawings and site plans are also enclosed with the

estimate.

Provision has been made for electrification and sanitary and water supply works and 20% of the estimated cost of the building works ahs been included for these works. As there is no sewer line in the area a septic tank shall have to be constructed for which lump sum provision of Rs.700,00 has been made in the estimate.

Provision for compound with a gate in the front and barbed wire fencing on the sides and back, and approach road have also been made in the estimate.

A statement of important materials as cement, steel, coal, etc., which shall have to be arranged by the department is also enclosed with the estimate. A rent statement is also enclosed.

The work shall be carried on contract by inviting tenders. The work shall be completed within six months from the date of start. The estimate work out as Rs. 5,000,00 and is submitted for sanction and allotment of fund

**5.2 Report on Estimate for Construction of a Culvert**

The estimate has been prepared for the construction of an arch culvert of 3m span in 15 km-300 m on Lucknow –Daulatpur road. The road at this point is flooded almost every year during the rainy reason, causing flood and damages in the area. During the last inspection the Executive Engineer has asked to prepare an estimate and this estimate has been prepared in compliance of E.E's letter no ……dated …….. the cost of construction will be met from 50 civil work special repairs.

The culvert has been designed for I.R.A Class a loading. The catchment area has been determined from the 2.5 cm (1‘) map of the area, which comes to 1200 acres, and the water way has been calculated by the Talbot formula a –cA $^{3}\!/_{4}$, where a = waterway in sq. ft , a= Catchment area in acres, and c= constant and has been taken as 0.2. All calculation and design have been enclosed with the estimate.

The soil has been tested and has been found to be good, and ordinary spread foundation will be sufficient. The foundation shall be of cement concrete 1:4:8 and abutments, wing walls and parapets shall be of brick masonary in 1:5 cement mortar, the arch work shall be of brick masonry in 1:3 cement mortar. Exposed surfaces shall be cement pointed 1:2. all works shall be as per detailed P.W.D Specifications. The estimate has been prepared at P.W.D Schedule of Rates.

A statement of materials, cement, bricks, coal, etc., required for the construction , has been enclosed with he estimate. The work shall be executed on contract by inviting tenders and the work shall be started after the rainy season and shall be completed within four month's time.

The estimate amounting to Rs. 15,000.00 is submitted for sanction and allotment of

fund.

**5.3 Report on the Estimate for a Road Construction**

The estimate for the construction of Hindnagar – kaliganj road of 25 km – 500 in length has been prepared for linking Kalignaj with the District Headquarters in compliance with S.E.'s letter no……..dated……

Kalignaj is an important market place for agricultural products and there are some cottage industries in the area, and there having no road the area is not being developed. The proposed road will also serve many villages on either side. The people of the locality have also represented and demanded separately for the construction of this road. It is therefore essential to construct this road. The proposal has been included in the Fourth Five year Plan and the cost will be met from the Road Development Fund.

Alignment of the road follows an existing card road with straightening when necessary and avoiding conjested areas as far as possible. Flat curves have been provided with a minimum radius of 150 m. In selecting the alignment principles of shortest route, serving maximum population, minimum drainage crossing easy gradient economy of construction, etc.., have been followed. The road passes mostly through uncultivated area in plane land, and mostly in banking of 60 cm to 90 cm high excepting a few places where the road passes in low where high banking will be required.

Planet table survey has been made for the whole length of the road for 60 m width on each side of the centre line and L-section has been prepared by taking levels at every 30 m and cross levels have been taken at every 90 metre. Formation line has been fixed to have easy gradient and ruling gradient of 1 in 40 has not reached anywhere. Highest flood level has been kept in view and formation line has been kept above normal flood level.

A number of culverts will be required along the length of the road and ridge of about 30 m span will be required across the stream in km 12. A list of bridges and culverts of different span has been enclosed and provisions have been made on the basis of running metre of span at the rate of Rs. 5,000.00 per r m of span for culverts and Rs. 6,000.00 per r m of span for bridges. Bridges shall have to be designed on I.R.C class A Loading and their detailed estimate shall have to be prepared separately.

A present land of 30 m width shall be required and has been provided in the estimate. Temporary land for borrowpits shall be required for one year for taking earth for embankment and provision has been made accordingly

The whole work of construction shall be spread in five years, earth work one year, rest for settlement one year, metalling two years and painting one year.

Second coat bituminous painting shall be done after one year of 1st cost of painting and cost of painting shall be met from maintenance grant.

All works shall be done strictly as per detailed P.W.D Specifications. The estimate

has been prepared at P.W.D Schedule of rates and local current rates and analysis of rates have been given for non-schedule items. The work shall be done by contract by inviting tenders.

Survey Plan, L-sections and Cross-sections of the proposed road are enclosed with the estimate. An index plan showing the alignment has also been enclosed.

The estimate amounting to Rs. 25,00,000.00 has been submitted for sanction and allotment of fund.

**5.4 Principle for the preparation of Water supply Scheme**

1. Selection of source:- Where raw water from flowing streams, lakes , tanks ad other impoundment from contaminated catchments and ponds form the source, provision should be made in the scheme for filtering such water prior to disinfection.

2. Quality of water.- The chemical quality of supplies proposed from ground water through tube wells, wells and infiltration works should be of acceptable quality, to be adjudged wit reference to local condition, where special treatment of removal of dissolved substance like iron, sulphates and flurides is necessary, provision should be made there in the scheme.

3. Disinfections. – It is advisable to provide for continuous effective disinfections of supplies drawn through tube wells, wells and infiltration works where local conditions indicate the need.

Where surface water is the source, treatment including filtration and disinfection of the final effluent is essential.

It is equally important to ensure that the free residual chlorine of a minimum of 0.2 ppm is maintained at all points in the distribution system.

4. Simple drip-feed device.- For simple rural well supplies, disinfection should be arranged by a simple and economical drip feed of a decanted bleaching powder solution, the dosage being adjusted to suit the rate of draw from the source. A simple gravity feed arrangement for such a purpose should be followed.

5. Pressure-feed chlorinators. – There are different types of pressure-feed chlorinators available for injecting chlorine solution into force mains. The two good classification of these chlorinates are –

(a) the positive-feed type, and

(b) the vaccum type

The details of their working and operation, and the care of chlorinator equipment are set out in paras 10-6-22 and 10-6-3 on pages 132-136 of the Manual of Water supply issued by the Ministry of Health.

Common defects and handicaps experienced in operating some of the pressure-type chlorinators in the market are to be attributed to the provision of inferior rubber holders, mal-adjustments of the plunger stroke and inferior types of rubber diaphragm. Every care should be

exercised in selecting a good and robust quality of chlorinator suited to the needs of each case.

6. Structure of infiltration galleries - In developing safe supplies through infiltration works the essential details to be followed in the design of infiltration galleries have been set out in the Water supply Manual .

7. Slow sand filter.- Where slow sand filtration is adopted for treatment of raw water, the design criteria to the adopted are as set out in the Water Supply Manual. A typical design calculation to determine the economical size of filters is given in the following page.

8. Type design of iron removal plant. – A typical design of an iron –removal plant should b followed. The basic factors governing the design of such plants are set out in the Water Supply Manual. These may be adopted with suitable notification where removal of iron from ground or surface water is necessary.

9. Mechanical fitter plants. – Where full-scale treatment of raw water comprising chemical design mixing, flocculation, sedimentation and filtration followed by disinfection is necessary, the functional aspect of each component as well as the design criteria recommended in respect of each, as set out in the Water Supply Manual may be adopted with suitable modification.

10. Economical size for source mains. – the per capita rate of supply to be adopted in respect of each community, the most economical means of conveyance of the supply from the source to the service points and the design of the distribution system in each case may generally follow the guide – lines set out in the Water Supply Manual.

11. Charts for pipe flow computation. – It is recommended that Hazen and William's Formula should be adopted in the design of pressure mains while the Cutter's Formula orthe Manning's Formula should be used for free-flow conduits. Readymade charts for computing pipe size under the Hazen and William and Kutter's Formulae may be used.

The Hazen and Williams's Chart is based on a value of 100 for 'c'. For other values of 'c' applicable to different pipe materials (as recommended in the Water Supply Manual) the corresponding figures will have to be deducted.

The Kutter's Charts are for a value of 'n' =.015 which may be adopted for all pipes upto 24 ❜ dia. and masonry conduits of all sizes. A value of 'n' = .013 may be used for pipes above 24❛ dia.

**5.5 The project or scheme of major work consist of the following works**

(1) Preliminary investigation, Reconnaissance, Preliminary survey, trial boring, soil testing etc.
(2) Preparation of preliminary estimate and obtaining administrative approval
(3) Selection of site or alignment
(4) Surveying –Plane table survey, leveling, contouring, etc.,
(5) Preparation of survey plan, plotting of levels and contours, preparation of

longitudinal section, cross section etc., as may be required,

(6) Working out the requirements – number, type and size of buildings of different categories. Water-way for bridges and culverts, capacity of channels (canals distributories, minor, etc). width and type of road etc, as the case may be,

(7) Marking formation line of road or formation line of bed of channels in the L-section drawing cross sections of road channels, etc. as the case may be ,

(8) Designing – structural design and calculations, basis of deign, etc.,

(9) Planning, preparation of drawings- Plan , elevation, sections, detailed drawings, etc., (10) Preparation of Layout plan, Site plan or Index plan. In case of irrigation project and Road project the alignment is marked on the Shajra maps showing the different plots of land to be acquired. For irrigation project , the area served by different outlets and channels are marked on the Shajra map,

(11) Preparation of general specification of the different building of works, and preparation of Detailed specifications of each item of works.

(12) Working out the Analysis of rates of different items of work. Usually, the rates are taken as per printed Schedule of Rates and Analysis of rates are prepared only for non-scheduled items,

(13) Preparation of Detailed estimate and abstract of cost of each building or each work

(14) preparation of general abstract of cost for the whole project. 10 per cent of the whole estimate cost is provided for departmental charges.

(15) Preparation of rent statement or return (revenue income) and comparing the total amount of capital cost with the return,

(16) Working out the requirement of important materials and preparing a statement of important materials as cement, steel brick, coals, etc. which are to be arranged by the department,

(17) Phasing of the project – Big projects are constructed in phases – 1st phase, 2nd phase, 3rd phase etc.,

(18) Estimate for temporary accommodation for office, store sheds, staff quarters, accommodation for workmen (labour huts) arrangements for temporary water supply and sanitary works and public health work, approach roads, etc. should also be prepared under separate head. Temporary accommodation and Prelimarny works,

(19) The main estimate should also include the cost of land, Development of land – Levelling and dressing, Cost of roads, Cost of water supply works, Cost of sewer and sewer works, cost of surface drains ad storm water drains. Cost of Electrification external services, Cost of Arboriculture, Cost of Preliminary investigation and surveying etc. Estimate for those works may be prepared in detail if possible, but as all the details of the work are not known at the time of preparing the estimate they are estimated on area basis of the whole project area at the rate of per unit (Rupees per hectare of Rupees per acre) or comprehensive to give a clear idea and picture of the whole project.

(20) Technical Report of project – Report should be concise but comprehensive to give a clear idea and picture of the whole project. The report should given the brief history of the work, reference to administrative approval necessity justifying the most suitability of the project, availability of materials and labour, agency for the work cost
of each phase of work, time required for the completion of each phase of work and also of the whole work, the total cost of the whole project.

For different stage of preparation and execution of project Accounts and Procedure of work

## UNIT I
## ESTIMATE OF BUILDINGS

**1..What are methods to be adopted for volume calculating?**

- From cross-section
- From spot level
- From contours

**2.Define analysis of rates.**

Determination of rates of works from the qualities and cost of materials and labours required is termed as analysis of rates

**3.Define a tender.**

Tender is an offer given in writing to execute specified articles or materials at a certain rate, within a fixed time, under certain conditions of agreement between the contractor and the party, which may be a government department or an individual.

**4.Define 'contract'**

Contract is merely an agreement being enforceable by law between two persons or parties.

**5.What are the types of culvert?**

1. Arch culvert
2. Slab culvert
3. Pipe culvert
4. Box culvert

**6.what are the methods of estimate?**

1.Detailed estimate
2. Abstract estimate

**7. What are the types of estimate?**

1 Preliminary Estimate or Rough cost estimate
2. Plinth area estimate
3. Cube Rate Estimate or Cubical Content Estimate
4. Approximate Quantity Method Estimate
5. Detailed Estimate or Item Rate Estimate
6.Revised Estimate
7. Supplementary Estimate And Revised Estimate.
8.Annual Repair or Maintenances Estimate
9. Supplementary Estimate

**8. Briefly explain about preliminary Estimate.**

The estimate which prepared using any rough method to get the approximate cost construction anticipated in a project is called an approximate or rough estimate. Since this estimate is normally prepared in the preliminary estimate.

**9.Estimate the quantities of brickwork and plastering required in a wall 4m long, 3m high and 30 cm thick. Calculate also the cost if the rate of brickwork is Rs.32.00 per cu.m and of plastering is Rs. 8.50 per sq.m**

Quantities of brickwork = LxBxH

= 4m x 3m x 0.30m

= 3.6 cu.m

Quantity of plastering (two faces) = 2 x 4m x 3m

= 24sq.m

Cost of brickwork =3.6 x 320.00

= Rs.1152.00

Cost of plastering = 24x 8.50

= Rs.204.00

Total cost =1152.00 + 204.00

= Rs.1356.00

**10. Define detailed estimate**

The estimate, which provides the itemwise quantities of works, item wise unit rates and itemwise expenditure anticipated in thre project/construction, is called a detailed estimate

**11. Define Abstract estimate**

This is the third and final stage in a detailed estimate. The quantities and rates of each item of work, arrived in the first two stages, are now entered in an abstract form. The total cost of each item of work is now calculated by multiplying the quantities and respective rates.

**12. Define quantity surveyor**

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

**13. Write the duties of quantity surveyor.**

- Preparing bill of quantities (Taking off, squaring, Abstracting and billing)
- Preparing bills for part payments at intervals during the execution of work.
- Preparing bill of adjustment in the case of variations ordered during the execution of work
- Giving legal advice in case of court proceedings

**14. Write the essential qualities of a good surveyor.**

- The quality surveyor must be well versed with the drawings of work.
- He should be able to read the drawing correctly and bill the quantities accurately
- He should have a through knowledge of the construction procedure to be adopted, the various items of works involved in the execution: and the different materials to be used in the work.
- He should be able to prepare schedule to be priced by tenderor.

**15. What are the main components of culvert?**

1.Abutments
2.Wing walls
3.Arch

**16 Marks**

**1.Methods Of Taking Out Quantities**

The quantities like earth work, foundation concrete, brickwork in plinthand

super structure etc., can be workout by any of following two methods:

a) Long wall - short wall
method b) Centre line
method.
c) Partly centre line and short wall method.

LONG WALL-SHORT WALL METHOD

In this method, the wall along the length of room is considered to be longwall while the wall perpendicular to long wall is said to be short wall. To get thelength of long wall or short wall, calculate first the centre line lengths of individual walls. Then the length of long wall, (out to out) may be calculated after adding half breadth at each end to its centre line length. Thus the length of short wall

Measured into in and may be found by deducting half breadth from its centre linelength at each end. The length of long wall usually decreases from earth work tobrick work in super structure while the short wall increases. These lengths aremultiplied by breadth and depth to getquantities.

CENTRE LINE METHOD

This method is suitable for walls of similar cross sections. Here the totalcentre line length is multiplied by breadth and depth of respective item to get thetotal quantity at a time. When cross walls or partitions or verandah walls joinwith main all, the centre line length gets

reduced by half of breadth for eachjunction. Such junction or joints are studied carefully while calculating total centreline length. The estimates prepared by this method are most accurate and quick.

PARTLY CENTRE LINE AND PARTLY CROSS WALL METHOD

This method is adopted when external (i.e., around the building) wall isof one thickness and the internal walls having different thicknesses. In such cases,centre line method is applied to external walls and long wall-short wall method isused to internal walls. This method suits for different thicknesses walls and differentlevel of foundations. Because of this reason, all Engineering departments arepracticing this method.

**2.Detailed Estimate**

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

I) DETAILS OF MEASUREMENTS AND CALCULATION OF QUANTITIES

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

Details of measurements form

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

ii) Abstract of Estimated Cost
:

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

Types of Estimates

ABSTRACT OF ESTIMATE FORM

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

The detailed estimate should accompanied with

I) Report
ii) Specification
iii) Drawings (plans, elevation, sections)
iv) Design charts and calculations
v) Standard schedule of rates.

**3.Methods Of Preparation Of Approximate Estimate**

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

a) Plinth area method
b) Cubical contents methods
c) Unit base method.

**Plinth area method**

The cost of construction is determined by multiplying plinth area with plinth area rate. The area is obtained by multiplying length and breadth (outer dimensions of building). In fixing the plinth area rate, careful observation and necessary enquiries are made in respect of quality and quantity aspect of materials and labour, type of foundation, height of building, roof,wood work, fixtures, number of storey's etc., As per IS 3861-1966, the following areas include while calculating the plinth area of building

**Types of Estimates**

a) Area of walls at floor level.
b) Internal shafts of sanitary installations not exceeding 2.0m2, lifts, air-conditioning ducts etc.,
c) Area of barsati at terrace level: Barsati means any covered space open on one side constructed on one side constructed on terraced roof which is used as shelter during rainy season.
d) Porches of non cantilever type.

Areas which are not to include
a) Area of lofts.
b) Unenclosed balconies.
c) Architectural bands, cornices etc.,
d) Domes, towers projecting above terrace level.
e) Box louvers and vertical sunbreakers.

**Cubical Contents Method**

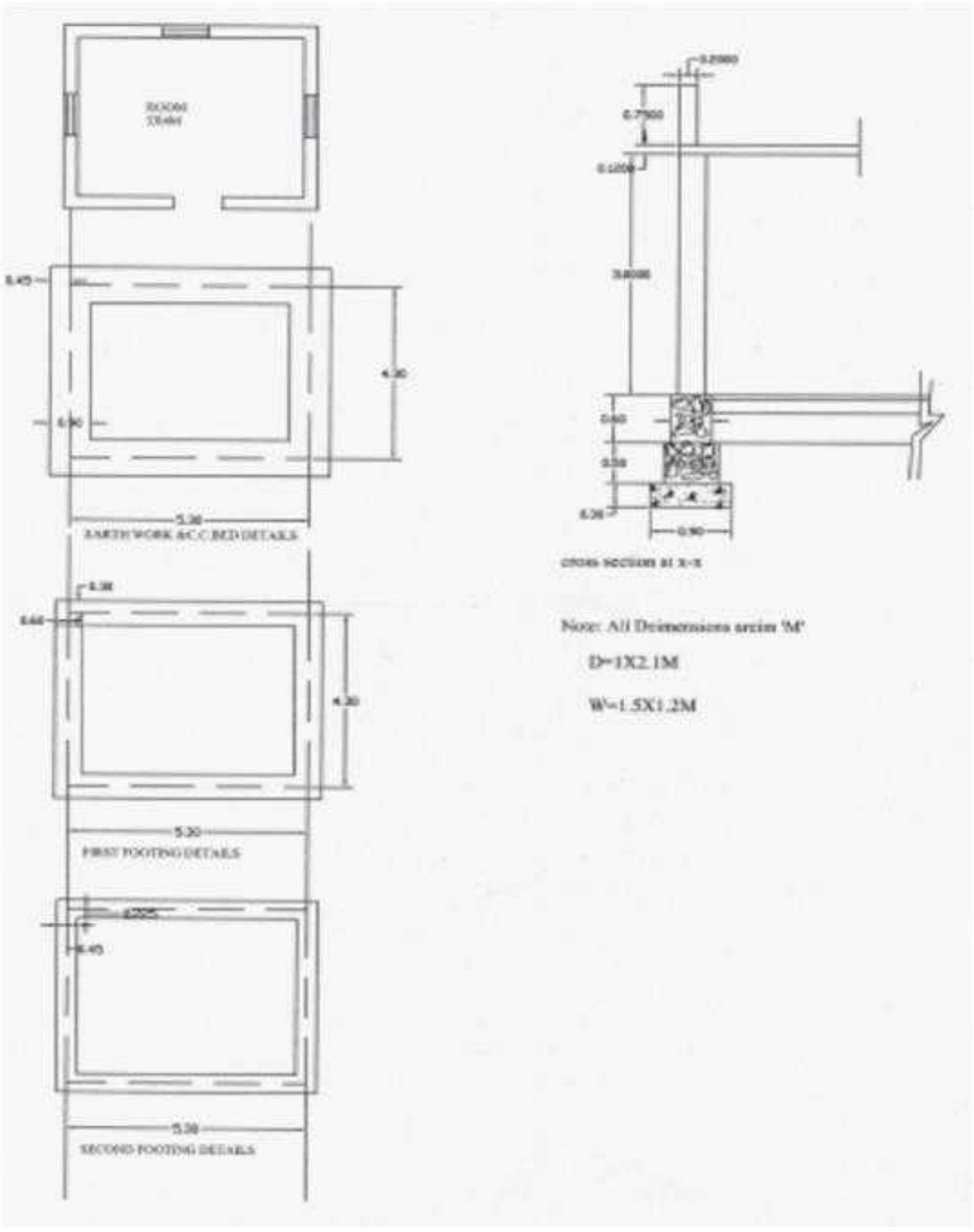
This method is generally used for multistoreyed buildings. It is more accurate that the other two methods viz., plinth area method and unit base method. The cost of a structure is calculated approximately as the total cubical contents (Volume of buildings) multiplied by Local Cubic Rate. The volume of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

**4. Estimation of different foundations, steps and boundary walls.**

From the Drawing given below determine

(a) Earth work excavation
(b) CC (1:5:10) Bed
(c) R.R.Masonry in C.M. (1:6)
(d) Brick Work in C.M.(1:6).

Single Roomed Building (Load Bearing type structure)
Measurement of Materials and Works
Long wall - Short wall Method


5.45
4.30
5.30
EARTH WORK &C.C BED DETAILS
5.30
4.30
5.30
FIRST FOOTING DETAILS
5.45
5.30
SECOND FOOTING DETAILS
0.7500
0.060
0.90
Note: All Dimensions are in 'M'
D=1X2.1M
W=1.5X1.2M

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

**Centre Line Method**

| S.No. | Particulars of Items | No. | L | B | H | Q | Explanation |
|---|---|---|---|---|---|---|---|
| 1. | **Earth Work excavation for foundation**   | 1 | 19.2 | 0.9 | 1.4 | 24192 | $m^3$ L=2(5.3+4.3)=19.2 |
| 2. | **C.C.(1:4:8) bed for foundation** | 1 | 19.2 | 0.9 | 0.3 | 5.184 | $m^3$ |
| 3. | **R.R.Masonry in CM (1:6) for** | | | | | | |
| | a) Footings | 1 | 19.2 | 0.6 | 0.5 | 5.76 | |
| | b) Basement | 1 | 19.2 | 0.45 | 0.6 | 5.184 | |
| | | | | | Total | 10944 | $m^3$ |
| 4. | **Brick masany with CM(1:6) for super structure** | 1 | 19.2 | 0.3 | 0.3 | 17.28 | $m^3$ |

**5.Prepare an approximate estimate of building project with totalplinth area of all building is 800 sqm. and from following data.**

**i) Plinth area rate Rs. 4500 per sqm**

**ii) Cost of water supply @7½%of cost of building.**

**iii) Cost of Sanitary andElectrical installations each @ 7½% of cost ofbuilding. iv) Cost of architectural features @1% of building cost.**

**v) Cost of roads and lawns @5% of building cost.**

**vi) Cost of P.S. and contingencies @4% of building cost. Determine the total cost of building project.**

**Solution:**

Data given:

Plinth area = $800m^2$

Plinth area rate = Rs. 4500 per Sq.m

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

Add the cost of the water supply charges @7½%

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

Add the Cost of Sanitary and electrical installation @ 15%

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

Add the cost of archetectural features @1%

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

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

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

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

**Total Rs. 47,70,000=00**

Assume Add supervision charges 8% on overall cost

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

**Grand Total Rs. 51,51,600=00**

**6.Prepare the rough estimate for a proposed commercial complexfor a municipal corporation for the following data.**

**Plinth Area = 500m2/floor Ht of each storey = 3.5m No. of storey's = G+2**

**Cubical content rate = Rs. 1000/m3**

**Provided for a following as a percentage of structured cost a) water supply & Sanitary arrangement -8%**

**b) Electrification -6%**

**c) Fluctuation of rates - 5%**

**d) Contractors profit - 10%**

**e) Petty supervision & contingencies - 3%**

**Sol :**

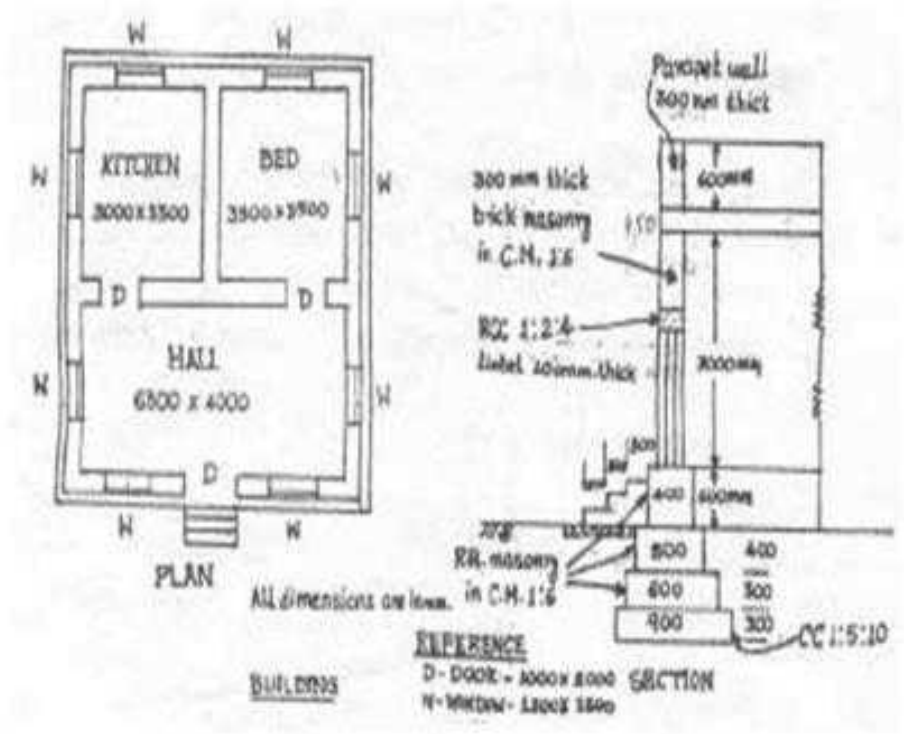
Cubical content = No. of storey's (Plinth Area x height of each storey)= 3(500x3.5) = 5250m3

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

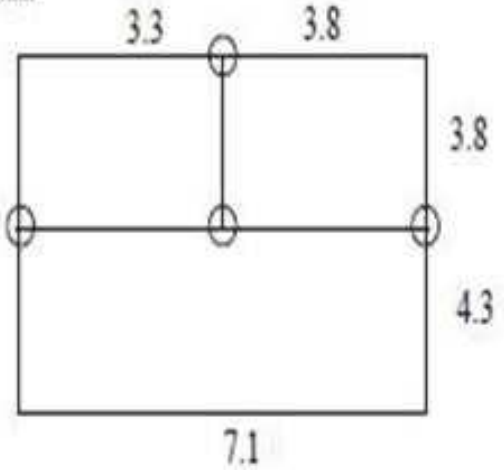
other provisons:-

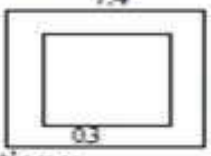
| | | |
|---|---|---|
| a) Water supply and sanitation = 52.5x8/100 | = | Rs.4.2 Lakhs |
| b) Electrification = 52.5 x 6/100 | = | Rs.3.15 lakhs |
| c) fluctuation of rates = 52.5 x 5/100 | = | Rs.2.625 |
| Total | = | Rs. 9.975 Lakhs |
| Structural cost | = | Rs. 52.500 Lakhs |
| Total | = | Rs.62.475 Lakhs |
| d) P.S./& contingencies = 62.475 x 3/100 | = | Rs.1.874 Lakhs |
| e) Contractors Profit = 62.475 x 10/100 | = | Rs.6.247 Lakhs |
| Total Cost | = | Rs.70.596 Lakhs |

**7.From the given figure below calculate the details and abstractestimate for the single Storied residential buildingwith no of rooms (Load bearing type structure) by Centre Line Method**




Centre line diagram



| S.No. | Particulars of Items | No | L | B | H | Q | Explanation |
|---|---|---|---|---|---|---|---|
| 1. | Earth work Excavation | 1 | 39.5 | 0.9 | 1.0 | 35.55 | 41.3-4x0.9/2=39.5 |
| 2. | C.C. bed (1:5:10) | 1 | 39.5 | 0.9 | 0.3 | 10.665 | $m^3$ |
| 3. | R.R. Masonary in CM 1:6 | | | | | | |
| | 1st Footing | 1 | 40.1 | 0.6 | 0.3 | 7.218 | 41.3-4x0.6/2=40.1 |
| | IInd Footing | 1 | 40.3 | 0.5 | 0.4 | 8.06 | 41.3-4x0.5/2=40.3 |
| | Basement | 1 | 40.5 | 0.4 | 0.6 | 9.72 | 41.3-4x0.4/2=40.5 |
| | | | | | Total | **25.00** | $m^3$ |
| 4. | Damp proof course over basement alround the building with CC (1:2:4) | 1 | 40.5 | 0.6 | --- | 16.2 | $m^2$ |
| | Deduct for Door sills | 3 | 1.0 | 0.3 | | - 0.9 | $m^2$ |
| | Net Quantity =16.2-0.9=15.3sq.m | | | | --- | | |
| 5. | First class brick work in wall in | | | | | | |
| | a) superstructure with CM1:6 | 1 | 40.7 | 0.3 | 3.0 | 36.63 | L =41.3-4x0.3/2 |
| | b) Parapet wall | 1 | 30.4 | 0.3 | 0.6 | 5.472 | L=2(7.1+8.1) |
| | | | | | Total | **42.102** | $m^3$ |
| |   | | | | | | |
| | **Deductions:** | | | | | | |
| | Doors | 3 | 1.0 | 0.3 | 2.0 | 1.80 | |
| | Windows | 8 | 1.2 | 0.3 | 1.5 | 4.32 | |
| | Lintel opening over | | | | | | |
| | Doors | 3 | 1.2 | 0.3 | 0.1 | 0.108 | Asue 100mm |
| | Windows | 8 | 1.4 | 0.3 | 0.1 | 0.336 | projection on either |
| | | | | | Total | 6.564 | side |
| | Net Quantity of BM = 42.102-6.564 = 35.538$m^3$ | | | | | | |
| 6. | Plastering with 12mmth in CM1:5 | 1x2 | 40.1 | --- | 3.0 | 240.6 | L=41.3-4x0.3=40.1 |
| | Deductions for openings | | | | | | |

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

## UNIT II
## ESTIMATE OF OTHER STRUCTURES

**1.What are factors to be considered in design of septic tank? The following factors should be taken into consideration:**

- Material should be water proof and corrosion resistant.
- Natural ventilation provided should be adequate
- A manhole should be provided to permit inspection and cleaning.
- Baffles should be limited to one at the inlet and one at the outlet.
- The escape of gas and sludge to effluent pipe should be avoided.

**2.Define lead.**

Lead is the crow flying horizontal distance from the centre of borrow pit to the centre of the earthwork at site, i.e centre of the area of excavation to the centre of placed earth.

**3.Define lift.**

Lift is the distance through which the excavated soil is lifted beyond a certain specified depth.

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

Total expenditure = Rs.4,97,000

Total length of main walls = 140m

Rate per m length of main wall = 4,96,000/140 = Rs.3550/- Length of main walls in the proposed building = 180m Approximate cost = 180 x 3550 = Rs.6,39,000/-

**5.Define estimate.**

An estimate is a computation or calculation of the quantities required and expenditure likely to be incurred in the construction of a work. The estimate is the probable cost of a work and is determined theoretically by mathematical calculation based on the plans and drawing and current rates.

**6.Write the recommendation for degree of accuracy in measurements.**

- Dimensions of works shall be measured to an accuracy of 0.01 m
- Thickness of R.C works shall be measured to an accuracy of 0.0005 m
- Areas of works shall be calculated to the nearest 0.01 $m^2$
- Volumes of work shall be calculated to the nearest 0.01 $m^3$
- Volumes of wood shall be calculated to the nearest 0.001 $m^3$

**7.Briefly explain about revised estimate**

The estimate, which is prepared When any major change or alteration is made in the plan / structural arrangement, with or without affecting the estimate cost, and

When the estimated cost is likely to exceed by more than 5% during execution, due to increase in the cost of materials and labour or due to increase in the cost of materials and labour or due to alterations in the items of works to get the revised quantities /rates/ amount is called a revised estimate

**8.Calculate the quality of brickwork in an arch over a 1.80m span opening. The arch is 40cm.thick and the breath of a wall is 40 cm.**

Radius of the arch =1.8m Thickness of arch = 40 cm The breath of wall = 40cm Mean dia = 3.60+0.40 = 4 m Mean length of the arch

given = 1/6 *(22/7)* 4 = 2.1m Quantity of brickwork = 2.1*0.40*0.4 = 0.34cu.m
No of bricks required = 0..34cu.m @ 550 bricks per cu.m = 187

**9.Define Floor area**

It defined as covered area i.e plinth area excluding area of walls (generally 10% - 15 %) sills of the doors are not included in floor area. The floor area of very storey shall be measured separately.

**10.Define Carpet area**

This means area in a building which is useful one i.e area of drawing room, dining room bedroom etc. Areas of kitchens, staircase, stores, verandahs, entrance hall, bathroom, basement etc. are excluded. It is generally 50% to 60% of the plinth area.

**11. Define Plinth area**

It is defined area of a building measured at floor level. It is measured by taking external dimensions excluding plinth offset if any.

**12.What are the methods of taking out estimates?**

- Centre line method
- Crossing method
- Out to Out and in to in method
- Bay method
- Service unit method

**13. Briefly explain about Out to Out and in to in method.**

This method is most practicable under all circumstances and is generally followed in the P.W.D for computing the quantities of various items.

**14. Briefly explain about bay method.**

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

**15.Workout the quality of stone metal required for 2Km.Length for wearing coat of a 4m wide road. The thickness of the metal road required is 12cm loose.**

**Solution**

Quality of metal = 1 X 2 X 1000 X 4 X 0.12 = 960.00cu.m

**16.An approach road 2Km.long is to be constructed. Work out the quantity of materials required i.e. stone metal and bricks. Data is given below.**

Length = 2 Km
Metalled width = 3.60m
Soiling of bricks = 10cm
Wearing coat of stone metal = 12 cm

Solution

Quantity of bricks = 1 x 2 x 1000 x 3.60 x 0.10 = 720 cu.m
No of bricks = 720.0 x 3.60 x 0.12 = 3,60,000
Stone metal = 1 x 2000 x 3.60 x 0.12 = 864 cu.m
Bricks = 3,60,000 Nos

**17.A cement concrete road (1:2:3) is to be constructed over the existing water bound macadam road .The thickness of slab =10cm.The length of the road is one km and the width 3.60m.Calculate the quality of cement concrete and the material required,**

Solution

Quality of cement concrete = 1 x 1000 x 3.60 x 0.10 = 360 cu.m

**18.Calculate the quality of earthwork for the construction of an approach road**

**Length = 1Km**

**Width of formation = 10 m Height of embankment = 60 cm Side slope = 1:2**

**Solution**

Quantity of earth work = L ($Bd+Sd^2$) B=10cm ; d =0.60m ;S = 2

Quantity of earth work = 1000 x (10 x 0.60) +2 x 0.60 x 0.60 = 6720 cu.m

19.What are the methods of measurements of earthwork?

The work shall be measured as given below

- Each dimension shall measured nearest to 0.01
- Area shall be worked out nearest to 0.01 $m^2$
- Volume shall be worked out nearest to 0.01 $m^3$

## UNIT III
## SPECIFICATION AND TENDERS

**1.write the essentials requirements of contract.**

- There must be an offer of one party, and its acceptance by the other party to make an agreement.
- There must be an intention of both the parties to create legal relation.
- The object of the contract must be legal, and it must not be opposed to any policy of the government or company.
- The agreement to make a contract should be supported by consideration, or recongnised by law.

**2.what are the types of contract?**

1.Lump-sum contract
2.Cost plus percentage of cost contract
3.Item rate contract
4.Labour contract
5.Integrated contracting system

**3.what are the important legal implications of a contract?**

- Agreement should not violate the provisions of law.
- It should not have any adverse effect on the morals of the society
- The form of contract should be in writing and each page of the documents of the contract should of the contract should be signed by both the parties.
- A contractor who refuse to carry out the work before completion can be sued in a court of law for breach of contract.

**4.What is specification?**

Specification is an important document attached with a tender form/contract agreement, which in most cases controls the quality of materials and works.

**5.State the different types of specification.**

1. General or brief specification
2. Detailed specification
3. Standard specification

**6.Describe general or brief specification**

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

General specifications give idea of the whole work or structure and are useful for preparing the estimate.

**7. Describe detailed specification**

The detailed specifications form a part of the contract document. The detailed specification of an item of the work specifies the qualities and quantities of materials proportion of mortar workmanship, the method of preparation and execution and method measurement.

The detailed specifications of different items of work are prepared separately which description what the work should be and how they should executed and constructed.

**8. What are the types of penalties that are imposed on a contract and why are they imposed?**

Penalties may be imposed for non-fulfillment of conditions of contract such as not

maintaining progress, delay in completion and unsatisfactory work etc. The penalty may be fixed sum per day or a percentage of the estimated cost upto 10%

**9.What is arbitration?**

Arbitration means the settlement of a dispute by the decision of a third person chosen and acceptable as a judge. The decision of the arbitrator is binding on both the parties. In public works department the superintending engineer function as the arbitrator

**10.Why and when the earnest money deposit are collected?**

While submitting a tender, the bidder has to deposit with the department an amount equal to about 2 ½% of the estimated cost of the work which is called earnest money deposit. This amount serves as a check to prevent the contractor from refusing to accept the work or runway, when his tender has been accepted. In case of refusal to take up the work his earnest money is forefeied.

**11.Why and when the security deposit are collected?**

At the time of execution of the contract agreement, the successful tender has to deposit a further sum of 1% of the contract amount to the department. This amount is known as security deposit. This amount is kept as a check so that the contractor fulfils all terms and conditions of the contract. The security deposit will be refunded to the contractor on the satisfactory completion of the whole work, after the observation period of 6 months

**12.What is a tender notice?**

Tender notice is the publicity of offer to the contractor to quote their rates for construction for construction work or supplied. Sealed tenders are invited in the most open and public manner. It is made public by advisement in leading newspaper, in the government gazette or by notice in English and in the regional languages in public places.

**13.What information should a contract document contain?**

1.Title page
2.Index page
3.Tender notice and tender forms
4.Schedule of quantities
5.Drawings
6.General specifications
7.Detailed specification
8.Schedule of issue of materials
9.Conditions of contract.

**1.Detailed Specifications Of Excavations, Filling And Backfilling**
**Scope of Work**

The scope for work covered under this specifications pertain to excavation of foundations, trenches, pits and over areas, in all sorts of soil, soft and hard rock, correct to dimensions given in the drawing including shoring, protections of existing underground utilities of any, such as water lines, electric cables etc. dewatering and shoring if necessary, stacking the useful materials as directed within the lead specified, refilling around the foundation and into the plinth with selected useful excavated earth and disposing off the surplus earth / materials within specified lead and finishing the surface to proper levels, slopes and camber etc. all complete.

**Site Clearance:**

Before the earth work is started the area coming under cutting and filling shall be cleared of all obstruction, loose stones, shrubs, rank vegetation, grass, bushes and rubbish removed up to a distance of 150 metres outside the periphery of the area under clearance. This work is deemed to be included in the earthwork item rate and no separate payment will be admissible.

**Roots and Vegetation clearance:**

The roots of trees if any shall be removed to a minimum depth of 60 cm below ground level or a minimum of 30 cm below formation level whichever is lower and the hollows filled up with earth leveled and rammed. This work is deemed to be included in the earthwork items and no separate payment will be admissible for the work. Any material obtained from the site will be the property of the Government of India and the useful materials as decided by the Engineer-in-charge will be conveyed and properly stacked as directed within the lead specified.

**Setting out and making profile**s:

Masonry or concrete pillars will be erected at suitable points in the area to serve as benchmarks for the execution of the work. These benchmarks shall be connected with G.T.S. or any other permanent benchmark approved by the Engineer-in-charge. Necessary profiles with pegs, bamboos and strings or Burjis shall be made to show the correct formation levels before the work is started. The contractor shall supply labour and materials for setting out and making profiles and Burjis for the work at his own cost and the same shall be maintained during the excavation work. The Department will show grid co-ordinate or other reference points. It shall bethe responsibility of the contractor to set out center lines correctly with reference to the drawings and install substantial reference marks. Checking of such alignment by the Department will not absolve the contractor from his responsibility to execute the work strictly in accordance with the drawings.

**Excavation:**

The contractor shall notify the Engineer-in-charge before starting excavation and before the ground is disturbed, to enable him to take existing level for the purpose of measurements. The ground levels shall be taken at 5 to 15 metres intervals in uniformly sloping ground and at closer distance where local mounds, pits, or undulations are met with, as directed by the Engineer-in-charge. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the Engineer-in-charge, before the earthwork is actually started. The labour required for taking levels, shall be supplied by the Contractor at his own cost. The Contractor shall perform excavation in all types of soils, murrum, soft and hard rock, boulders etc. in foundation, over areas and in trenches to widths, lines, levels, grades and curves as shown in the drawing or lesser widths, lines, levels, grades and levels as directed by the Engineer-in-charge and per items in the schedule of quantities. The item in the schedule of quantities shall specify the excavation in trenches or over areas.

For this purpose, the excavation for any depth in trenches for foundation not exceeding 1.5m in width or 10sqm. on plan shall be described as excavation in foundation trenches. Excavation exceeding 1.5m in width as well as 10sqm. on plan (excluding trenches for pipes, cables etc.) and exceeding 30cm in depth shall be described as excavation over areas. Excavation exceeding 1.5m in width as well as 10sqm. on plan but not exceeding

30cm.
in depth shall be described as surface Excavation.

**Classification of Earth work:**

The earthwork shall be classified under the following main categories and measured separately for each category. All types of soil, murrum, boulders, Soft rock, Hard rock.

**All types of Soils, Murrum, Boulders:**

This includes earth, murrum, top deposits of agricultural soil, reclaimed soil, clay, sand or any combination thereof ad soft and hard murrum, shingle etc. which is loose enough to be removed with spadies, shovel and pick axes. Boulders not more than 0.03 cum. in volume found during the course of excavation shall also fall under this classification. **Excavation in Soft Rock:**

This shall include all materials which are rock or hard conglomerate, all decomposed weathered rock, highly fissured rock, old masonry, boulders bigger than 0.03 cum, in volume but not bigger than 0.5 cum. and other varieties of soft rock which can be removed only with pick axes, crow bars, wedges and hammers with some difficulty. The mere fact that the contractor resorts to blasting and / or wedging and chiseling of reasons of his own, shall not mean the rock is classifiable as hard rock.

**Excavation in Hard Rock** :

This includes all rock other than soft rock mentioned in para above 1.5.1 (b) viz. soft rock, occurring in masses, boulders having approximate volume more than 0.5 cum. plain or reinforced cement concrete, which can best be removed by chiseling and wedging where blasting cannot be permitted owing to any restriction at site.

**Excavation in Hard Rock by Chiseling and Wedging:**

Where blasting is not permitted and if the Engineer-in-charge so desires, the excavation shall be done by chiseling and wedging or any other agreed method.

**Note**: All the excavated hard rock obtained shall be stacked properly and neatly within the specified lead by the contractor as directed by the Engineer-in-charge

**Excavation:**

The excavation under all classifications in areas in trenches or in pits shall be carried out systematically. Cutting shall be done from top to bottom and not under pining or under cutting will be allowed. The bottom and sides of excavation shall be dressed to proper level, slopes, steps, camber etc. by removing high spots and ramming thoroughly as directed by the Engineerin-charge. All the excavation shall be carried out strictly to the dimensions given in the drawing. The width shall generally be of the width of mudmat concrete and depth as shown in drawing or as directed by the Engineer-in-charge, according to availability of the

desired bearing capacity of soil below. Any excavation if taken below the specified depths and levels, the contractor shall at his own cost fill up such over cut to the specified level with cement concrete 1:4:8 in case of excavation in all types of soils an with cement concrete 1:2:4 in case of excavation soft and hard rock. After the excavation is completed, the contractor shall notify the Engineer-in-charge to that effect and no further work shall be taken up until the Engineer-in-charge has approved the depth and dimensions an also the nature of foundation materials, levels and measurements shall also be recorded prior to taking up any further work.

**Shoring:**

Unless separately provided for in the schedule of quantities, the quoted rate for excavation shall include excavation of slopes to prevent falling in soil by providing and / or fixing, maintaining and removing of shorting, bracing etc. The contractor would be responsible for the design of shoring for proper retaining of sides of trenches, pits etc. with due consideration to the traffic, superimposed loads etc. shoring shall be of sufficient strength to resist the pressure and ensure safety from slips and to prevent damage to work and property and injury to persons. It shall be removed as directed after items for which It is required are completed should the slips occur, the slipped materials shall be removed and slope dressed to a modified stable slope. Removal of the slipped earth will not be measured for payment.

**Dewatering:**

Unless specifically provided for as a separate item in the schedule of quantities, rate shall also include bailing or pumping out all water which may accumulate in the excavation during the progress of further works such as mud mat concrete, R.C. footings, shuttering etc. either due to seepage, springs, rain or any other cause and diverting surface flow by bunds or other means. Care shall be taken to ensure that the water discharged sufficiently away from the foundations keep it free from nuisance to other works in the neighborhood.

**Disposal of Excavated Materials:**

**Antiquities:**

Any finds of archeological interest such as relics of antiquity, coins, fossils or other articles of value shall be delivered to the Engineer-in-charge and shall be the property of the Government.

**Useful Materials:**

Any material obtained from the excavation which in the opinion of the Engineer-ncharge is useful, shall be stacked separately in regular stacks as directed by the Engineer-incharge and shall be the property of the Government. No material excavated from foundation trenches of whatever kind they may be are to be placed even temporarily nearer than about 3m from the outer edge of excavation. Discretion of the Engineer-in-charge in such cases is final. All materials excavated will remain the property of the Department. Rate for excavation includes sorting out of the useful materials and stacking them separately as directed within the specific lead. Material suitable and useful for backfilling or there use shall be stacked in convenient place but not in such a way as to obstruct free movement of materials, workers and vehicles or encroach on the area required for constructional purposes.

It shall be used to the extent required to completely backfill the structure to original ground level or other elevation shown on the plan or as directed by the Engineer-in-charge. Materials not useful in anyway shall be disposed off, leveled and compacted as directed by the Engineer-in-charge within a specified lead. The site shall be left clan of all debris and leveled on completion.

**Backfilling in sides of Foundations, Plinth, Under Floor etc:**

The backfilling shall be done after the concrete or masonry has fully set and shall be done in such a way as not to cause under-thrust on any part of the structure. Where suitable excavated material is to be used for backfilling, it shall be brought from the place where it was temporarily deposited and shall be used in backfilling. The scope of work for backfilling/ filling in foundation, plinth, under floors etc. shall include filling for all the buildings covered under the contract. Surplus earth available from one building, if required, shall be used for backfilling filling for other buildings also within the specified lead mentioned in the item. All timber shoring and form work left in the trenches, pits, floors etc. shall be removed after their necessity ceases and trash of any sort shall be cleared out from the excavation. All the space between foundation masonry or concrete and the sides of excavation shall be backfilled to the original surface with approved materials in layers not exceeding 150mm, in thickness, watered and well consolidated by means of rammers to at least 90% of the consolidation. Areas inaccessible to mechanical equipment such as areas adjacent to walls and columns etc. shall be tamped by hand rammer or by hand held power rammers to the required density. The backfill shall be uniform in character and free from large lumps, stones. shingle or boulder not larger than 75mm. in any direction, salt, clods, organic or other foreign materials which might rot. The backfilling in plinth and under floor shall be well consolidated by means of mechanical or hand operated rammers as specified to achieve the required density. Test to establish proper consolidation as required will be carried out by the Department at rates specified. Two tests per 50 sqm. will be taken to ascertain the proper consolidation. The cost of tests carried out will be recovered from the contractor's bill.

**Filling in Plinth and Under Floors:**

After the available suitable excavated materials are exhausted as backfilling, the contractor shall notify the Engineer-in-charge of the fact and levels taken jointly with Engineerin- charge. The earth, murrum, sand, gravel etc. or such materials suitable for filling proposed to be filled under floors and so mentioned in t he item of schedule of quantities shall then be brought to site from approved locations and sources.

**Earth Filling:**

The earth, soft murrum etc. so brought shall be filled up in layers of 15 cm depth, each layer being well watered and consolidated by approved hand or mechanical tampers or other suitable means to achieve the required density.

**Gravel or sand filling:**

Gravel if required to be filled under floors, shall be single washed gravel of approved quality and of size varying from 12mm t0 20mm. it shall be uniformly blind with approved type of soil and / or sand to obtain full compaction. Gravel shall be filled in specified thickness and shall be well watered and rammed entirely to the satisfaction of the Engineer-

in-charge.If sand is required to be filled under floors, it shall be clean, medium grained and free from impurities. The filled in sand shall be kept flooded with water for 24hrs. to ensure maximum consolidation shall be done by the contractor at his own cost. The surface shall then be well dressed and got approved from Engineer-in-charge before any other work is taken over the fill.

**2.Lead and Lift:**

**Lead:** The lead for disposal / deposition of excavated materials shall be as specified in the respective item of work. For the purpose of measurements of lead, the area to be excavated or filled or area on which excavated material is to be deposited/ disposed off shall be divided in suitable blocks and for each of the block, the distance between center lines shall be taken as the leads which shall be measured by the shortest straight line route on the plan and not the actual route adopted.

**Lift:** Lift shall be measured from ground level. Excavation up to 1.5m depth below ground level and depositing excavated material on the ground shall be included in the item of earthwork for various kinds of soil. Extra lift shall be measured in unit of 1.5m or part thereof. Obvious lift shall only be measured that is lifts inherent in the lead due to ground slope shall not be measured, except for lead up to 250m. All excavation shall be measured in successive stages of 1.5m stating the commencing level. This shall not apply to cases where no lift is involved as in hill side cutting.

**Mode of Measurements:**

All excavation in areas having depth more than 30cm. pits, trenches etc. shall be measured net. The dimensions for the purpose of payment shall be reckoned on the horizontal area of the excavations for the purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, rafts or other foundations, multiplied by the mean depth from the surface of ground determined by levels. Excavation for side slopes will not be paid for. Excavation in areas having depths less than 30 cms. shall be measured as surface excavation on square meter basis, mentioning the average depth of excavation.

Reasonable working space beyond concrete dimension required for waterproofing and shuttering where considered necessary in the opinion of Engineer-in-charge will be allowed in execution and considered for payment for underground water tank, sump septic tank etc.

Where direct measurements of rock excavation are not possible, volume of rock can be calculated on the basis of length, breadth, and depth of stacks made at site as mentioned in para 1.5.1 (c). The net volume shall be worked out by reducing it by 40% taking the voids into consideration as 40%. Similarly to arrive at net quantity to be paid in the case of soil,

reduction at 20% of corresponding stack / truck measurements shall be made. The rate for excavation shall include carting and disposing and leveling the excavated materials within the specified lead. The rate shall also be inclusive of cost of all tools, plants, explosives, shoring, dewatering at various stages, labour, materials etc. to complete all the operations specified.

The backfilling and consolidation in sides of foundation and in plinth with excavated material will not be paid for separately. The rate quoted for excavation shall be deemed to

have been included the cost of stacking of excavated materials, conveying within the specified lead, picking of selected stacked materials, conveying it to the place of final backfill, compaction to the required proctor density etc. Payment for filling and consolidation inside the trenches, sides of foundations, plinth etc. with selected materials brought by the contractor other than the excavated material, shall be paid for separately as per the rates in schedule of quantities which includes cost of such materials/ excavation, royalty, its conveyance within the specified lead, watering, consolidating, dressing etc. Actual quantity of consolidated filling shall be measured and paid in cubic meters up to two places of decimal. The rate quoted in cum. for items of excavation is deemed to include the necessary additional quantity of excavation involved beyond the plan dimensions of the work which may be necessary to be carried out for carrying out the work in an engineering made, decided upon by the contractor. Therefore no extra payment will be made for any excavation done other than the required quantity as per the plan dimension indicated in the drawings. Measurements for excavation over areas shall be determined by levels or by "Dead men" or both at the discretion of the Engineer-in-charge. If however the Engineer-in-charge decided on measurement by levels, levels of site shall be jointly taken and recorded by the Engineer-incharge or his representatives and the contractor, before commencement of the work and after completion of the work and the quantity of work done shall be computed based on these levels. The volume of earth work shall be computed based on "Simpson's formula ' or any other approved method at the discretion of the Engineer-in-charge.

## UNIT IV
## VALUATION

**1. Define valuation**

Valuation is the process of estimating the cost of a property based on its present condition. The properties may be immovable properties like land, buildings, mines trees quarries etc., and movable properties such as coal, oil, steel, cement, sand etc.

**2. What are the important factors influencing the value of building?**

1. Type of the building
2. Location of the building
3. Expected life of the building
4. Size and shape of the building
5. The Present condition of the building
6. Legal control of the building

**3. What is the purpose of valuations?**

1. For assessment of wealth tax, property tax etc
2. For fixation of rent
3. For security of loans or mortgage
4. For insurance, betterment charges etc
5. For compulsory acquisition
6. For reinstatement.

**4. Define Floor rate.**

It is the ratio between the total built up area (Plinth area) of all floors and the area of the plot.

Floor Area Ratio = Total Plinth area of all floors / Plot area

**5. Define Plinth area rate.**

It is the ratio between the total present cost of a particular type of building and its plinth area.

Plinth area rate = Total present cost of a building/ plinth area.

**6. A property fetches a net income of Rs.900.00 deducting all outgoings. Workout the capitalized value of the property if the rate of interest is 6% per annum.**

Year's purchase = 100/6 = 16.67

Capitalized value of the property = net income x Y.P

= 900 x 16.67

= Rs.15003.00

**7. Find the plinth area required for the residential accommodation for an assistant Engineer in the pay scale of Rs.400.00 to 1,000 per month.**

Average pay = 400+1000 /2 = Rs.700/month

Average month rent @10% of salary = 700.00/10 = Rs.70.00

Average annual rent 70.00 x 12 = Rs. 840.00

Capital cost of the building @ 6% interest = 840 x 100 / 6 = Rs.14000.00

Plinth area required @ Rs.150.00 per sq.m of plinth area

= 14000/150 = 93.33sq.m

Normally the quarters for the assistant engineer should be constructed at the cost of Rs.14000.00 having plinth area of 93.33 sq.m.

But due to the increase in the cost of construction, this may be increased by 100% and the capital cost of construction may be fixed as Rs.28,000.00 and the approximate plinth areas of 93.33

**8. A pumping set with a motor has been installed in a building at a cost Rs.2500.00.Assuming the life of the pump as 15 years, workout the amount of annual installment of sinking fund to be deposited to accumulate the whole amount of 4% compound interest.**

The annual sinking fund $I = Si/(1+i)^n - 1$

$= 2500 \times 0.04 /(1+0.04)^{15} - 1 = Rs.125$

The owner is to deposit Rs.125/-annually in 4% compound interest carrying investment for 15 years to accumulate Rs.2500/-

**9. An old building has been purchased by a person at a cost of Rs.30,000/- excluding the cost of the land.Calculate the amount of annual sinking fund at 4% interest assuming the future life of the building as 20 years and scarp value of the building as 10% of the cost of purchase.**

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

$S = 3000x (90/100) = Rs.27000.00$

Annual installments of sinking fund $I = Si/(1+i)^n - 1$

$= 27000 \times 0.04 /(1+0.04)^{20} - 1 = Rs.907.20$

Annual installments for sinking fund requires for 20 years = Rs.907.20

**10. Write the necessity of valuation.**

- Rent fixation. It is generally taken as 6% of the valuation of the property
- For buying and selling
- Acquisition of property by Govt.
- To be mortgaged with bank or any other society to raise loan
- For various taxes to be given and fixed, by the Municipal Committee
- Insurance: For taking out on insurance policies.

**11.Define the Value :**

Value-Present day cost of a engineering structures (saleable value)

**12.Define the Cost:**

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

**13.Define the Gross income:**

Total amount of the in come received from the property during the year, without deducting outgoings

**14.Define the Net come:**

An amount left at the end of the year after deducting all useable outgoings

**15.Define the Obsolescence:**

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

**16.Define the Scrap Value:**

Scrap Value: If a building is to be dismantelled after the period its utility is over, some amount can be fetched from the sale of old materials. The amount is known as scrap value of a building. If various from 7% to 10% of the cost of construction according to the availability of the material.

**17.Define the Salvage value**

If a property after being discarded at the end of the utility period is sold without being into pieces, the amount thus realized by sale is known as its salvage value.

**18.Define the Capitalized value:**

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

**19. Define sinking fund.**

A fund which is gradually accumulated and set aside to reconstruct the property after the expiry of the period of utility is known as sinking fund. The sinking funds may be found out by taking a sinking fund policy with any insurance company or deposition

some amount in the bank. Generally while calculating the sinking fund, life of the building is considered. 90 % of the cost of construction is used for calculations 10 % is left out as scrap value.

$$\text{sinking fund (I)} = Si/ (1+i)^n - 1$$

Where I = Annual instalment required
n = Number of year required to creat sinking fund
i = Rate of interest expressed in decimal i.e 5% as 0.05
S = Sinking fund

**20.Define Market value**

Market value: The market value of a property is the amount, which can be obtained at any particular time from the open market if the property is put for sale. The market value will differ from time to time according to demand and supply.

**21.Define Book value**

Book value: Book value is the amount shown in the account book after allowing necessary depreciations. The book value of a property at a particularly year is the original cost minus the amount of depreciation up to the previous year.

**22.Write the various methods of valuation.**

1.Plinth area method
2.depreciation rate method
3.Rental method
4.Land and building method
5.Development method

**23.The estimated value of a building is Rs.5,00,000.The carpet area of the building is 70 sq.m If the plinth area is 20% more than this ,what is the plinth rate of the building?**

Value of building = Rs.5, 00,000
Carpet area = 70 $m^2$
Plinth area = 20 % more = 1.20 x 70 = 84 m2
Plinth area rate of the building = Value of the building/Plinth area
= 5,00,000/84 = Rs.5952.38$m^2$

**24.The present value of a property is 20000/- Calculate the standard rent. The rate of interest may be assumed as 6%.**

Annual rent @ 6% = 20000x 6 /100 = Rs.1200/-
Standard rent per month = 1200/12 = Rs.1200/12 = Rs.100/-

**25.Write the various methods of depreciation**

1.Straigth line method
2.Constant percentage basis
3.Quantity survey method
4.Sinking fund method.

**26.Define the Year's purchase**

Year's purchase : It may be as the figure which when multiplied by the net income from a property gives capitalized value of the property.It can also be defined as "a certain amount of capital whose annuity of Rs.1/- at a certain rate of interest can be received"

Year's purchase = 100/rate of interest = 1/i

**27.Define the Annuity**

Annuity : The return of capital investment in the shape of annual installments monthly, quarterly, half yearly &yearly.

**28.Define Analysis of work:**

The process of determining the rate of an item of work or supply of the material is known as the analysis of rate or rate analysis.

**29.What is the size of septic tank for 50 users?**

4 cum

**30. What is the size of septic tank for 25 users?**

2.5 cum

**31.Define contract:**

The contract is an under taking by a person or firm to do any work under certain terms and condition

**32.Define Contractor:**

A person or a firm who undertakes any type of contract is termed as contractor.

**33.Define Tender:**

Tender is a written offer submitted by the contractors in pursuance of the notification given to execute certain work under certain terms and conditions.

**34.What are the Essentials of contract:**

The contract language is law full .

The contract is made by parties competent to contract. The contract is made by free consent of the parties. The contract is made under valid consideration.

There shall be a definite proposal and its acceptance.

**35.What are the type of contract?**

1. Item rate contract
2. Percentage rate contract
3. Lump-sum contract
4. Material supply contract

**36.What are type of termination of contract?**

Agreement Breach Performance
Impossibility of performance
Operation of provision of law
Conditions relating to documents
Conditions relating to the execution of work
Conditions relating to labour and personal

**1. Six Methods of Valuation**

1. Rental Method of Valuation
2. Direct Comparisons of the capital value
3. Valuation based on the profit
4. Valuation based on the cost
5. Development method of Valuation
6. Depreciation method of Valuation

2.**Sinking Fund Method**

In this method, the depreciation of a property is assumed to be equal to the annual sinking fund plus the interest on the fund for that year, which is supposed to be invested on interest bearing investment. If A is the annual sinking fund and b, c, d, etc. represent interest on the sinking fund for subsequent years and C = total original cost, then –

**Rental Method of Valuation**

In this method, the net income by way of rent is found out by deducting all outgoing from the gross rent. A suitable rate of interest as prevailing in the market is assumed and Year's purchase is calculated. This net income multiplied by Year's Purchase gives the capitalized value or valuation of the property. This method is applicable only when the rent is known or probable rent is determined by enquiries.

**3.Methods for calculating depreciation**

1. Straight line Method
2. Constant percentage method
3. Sinking Fund Method
4. Quantity Survey Method

**Straight Line Method**

In this method, it is assumed that the property losses its value by the same amount every year. A fixed amount of the original cost is deducted every year, so that at the end of the utility period, only the scrap value is left.

***Annual Depreciation, D = (original cost of the asset – Scrap Value)/life in years***

For example, a vehicle that depreciates over 5 years, is purchased at a cost of

**US$17,000**, and will have a salvage value of **US$2000**, will depreciate at **US$3,000** per year:

**($17,000? $2,000)/ 5 years = $3,000** annual straight-line **depreciation expense**. In other words, it is the **depreciable cost** of the asset divided by the number of years of its useful life.

**Constant Percentage Method or Declining balance Method**

In this method, it is assumed that the property will lose its value by a constant percentage of its value at the beginning of every year.

**Annual Depreciation, D = 1-(scrap value/original value)1/life in year**

**Quantity Survey Method**

In this method, the property is studied in detail and loss in value due to life, wear and tear, decay, and obsolescence etc, worked out. Each and every step is based is based on some logical grounds without any fixed percentage of the cost of the property. Only experimental valuer can work out the amount of depreciation and present value of a property by this method.

**4.A govt. accommodation is built at the cost of Rs. 60,000/- . The water supply and sanitary and electrical installation expenditure is Rs. 15000/-. Calculate the standard rend of the building if the following rate of return are fixed:**

i. 6% on construction cost.
ii. $1\ ^1/_2$ % towards maintenance of building work,
iii. $4\ ^1/_2$ % on installation expenditure. v. 4% on maintenance of installation.
v. Rs. 120/- as property tax per year.
vi. Cost of land is be neglected.

***Solution:***

(a) (i) Return on construction cost = = Rs. 3600/-
(ii) Return on installation cost = = Rs. 675/-
(iii) Cost of maintenance of building = = Rs. 900/-
(iv) Cost of maintenance of installations = = Rs. 600/-
(v) Property tax = Rs. 120/-
Gross return = Rs.5895/-
Standard rent = Gross rent/12 =

= Rs. 491.25 P.M. (Per Month).

b) Standard rent is also equal to 6% of capital value

Capital value

(1) Construction cost = Rs. 60,000.00
(2) Installation cost = Rs. 15,000.00
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Total = Rs. 75000.00

Standard rent =

= 4500/- per year

## UNIT V
## REPORT PREPARATION

**1. Define Engineer:**

He is the person appointed by the owner. He is technically very sound in work an his job is to see that the work is being done by contractor entirely according to drawings and specification.

**2. Define Owner:**

The person of behalf of which work is to be done. He may be an individual or firm or organization.

**3. Define Site:**

Site means the place where the work is to be executed

**4. Define Drawings:**

The section, map, plans etc… which completely define the construction work geometrically is known as drawings

**5. Define work:**

It means the work is to be carried out under this contract.

**6. What is called Tender Notice?**

The notice inviting tender is called tender notice.

**7. Define Specification:**

The drawings of a structure show the propositions and its relative position of its various parts is called specification.

**8. What are the objects of specification?**

1. Quality
2. Instruction
3. Aim of the project

**9. What are the types of specifications?**

1. Brief Specification.
2. General specification.

**10.Define Arbitration:**

Arbitration is the settlement of a dispute by the decision not of a court or law but of one or more persons chosen by the parties themselves involved in the dispute.

**11. Define Arbitrators:**

The persons chosen have the right to take decision are called arbitrators.

**12. What are the types of Arbitration?**

1. Arbitration without intervention of court.
2. Arbitration with intervention of court and thre is no suit pending
3. Arbitration is suits.

**13. What do you mean by Gross income?**

It is total income that can be fetched from the property as rent or other source without deducting out goings, operational and collection charges.

**14. Define Net income:**

It is the amount left with the owner from the gross income after deducting outgoings, operational and collection expense.

**15. Define Capital cost:**

The total cost of construction of the project including land is called capital cost.

**1.Explain report on estimate for the construction of residential building.**

Report On Estimates for the Construction of Residential Building.

The detailed estimate for construction of a residential building for the Executive Engineer at Udaynagar has been prepared in compliance of S.E.'s letter no……. dated……..

There is no building for the residence of the Executive Engineer at Udaynagar and he has to live in a rented building with meager accommodation at a very high rent. It has, therefore, been proposed to construct a residential building for the Executive Engineer. The head of the accounts will be 50 civil original works, building.

The estimate provides for the following accommodation:-

One drawing room, one dining room, three bed rooms, one guest room, and the necessary store kitchen, baths, front and back verandahs and motor garage per plan enclosed.

A site has already been selected having a land of 60 m 30 m (200 100') for the construction of the building having good soil and proper drainage and this much of land has to be acquired. The building shall be oriented to face north direction.

The building shall have lime concrete foundation and first class brick masonry with lime mortar up to plinth level and the superstructure shall be of first class brick work in cement mortar, 1 :6 Lintels shall be of R.B. work and roof shall be R.C.C with lime concrete terrace finishing. The drawing and dining rooms shall have mosaic floor and other rooms 2.5 cm(1') c.c. floor over 7.5 cm (3') lime concrete. Inside and outside walls shall be 12 mm (1/2 **,)** cement line plastered 1:1:6, and ceiling shall be 6 mm (1/2') cement plastered 1:3. Inside of drawing and dining rooms shall be colour washed and inside of remaining rooms shallbe white washed and outside wall be colour washed. Doors and windows shall be 4.5 cm $1\frac{3}{4}$" thick teak wood with chaukhat o sal wood and enamel painted. All work shall be strictly as per detailed P.W.D. Specification.

The estimate has been prepared at P.W.D Schedule of rates, and for non-schedule items on analysis of rates. The foundation has been designed for a safe load of 9 tonne per sq m (8 ton per sq ft) and the R.C.C roof has been designed for a safe load of 150 kg per sq m (30 1bs per sq ft) with 1400 kg per sqcm (20000 1bs per sq in) as sage tensile stress of steel and 50 kg sq cm (750 1bs per sq in) as safe compressive stress of concrete. All designs and calculations have been included in the estimate. Plans and drawings and site plans are also enclosed with the estimate.

Provision has been made for electrification and sanitary and water supply works and 20% of the estimated cost of the building works ahs been included for these works. As there is no sewer line in the area a septic tank shall have to be constructed for which lump sum provision of Rs.700,00 has been made in the estimate.

Provision for compound with a gate in the front and barbed wire fencing on the sides and back, and approach road have also been made in the estimate.

A statement of important materials as cement, steel, coal, etc., which shall have to be arranged by the department is also enclosed with the estimate. A rent statement is also enclosed.

The work shall be carried on contract by inviting tenders. The work shall be completed within six months from the date of start.

2. Explain report on estimate fix construction of a culvert.

Report on Estimate for Construction of a Culvert:

The estimate has been prepared for the construction of an arch culvert of 3m span in 15 km-300 m on Lucknow –Daulatpur road. The road at this point is flooded almost every year during the rainy reason, causing flood and damages in the area. During the last inspection the Executive Engineer has asked to prepare an estimate and this estimate has been prepared in compliance of E.E's letter no ……dated …….. the cost of construction will be met from 50 civil work special repairs.

The culvert has been designed for I.R.A Class a loading. The catchment area has been determined from the 2.5 cm (1') map of the area, which comes to 1200 acres, and the water way has been calculated by the Talbot formula a –cA $^{3}/_{4}$, where a = waterway in sq. ft , a= Catchment area in acres, and c= constant and has been taken as 0.2. All calculation and design have been enclosed with the estimate.

The soil has been tested and has been found to be good, and ordinary spread foundation will be sufficient.The foundation shall be of cement concrete 1:4:8 and abutments, wing walls and parapets shall be of brick masonary in 1:5 cement mortar, the arch work shall be of brick masonry in 1:3 cement mortar. Exposed surfaces shall be cement pointed 1:2. all works shall be as per detailed P.W.D Specifications.

The estimate has been prepared at P.W.D Schedule of Rates. A statement of materials, cement, bricks, coal, etc., required for the construction , has been enclosed with he estimate. The work shall be executed on contract by inviting tenders and the work shall be started after the rainy season and shall be completed within four month's time.

3. Explain report on estimate for a Road Construction.

Report on the Estimate for a Road Construction.

The estimate for the construction of Hindnagar – kaliganj road of 25 km – 500 in

length has been prepared for linking Kalignaj with the District Headquarters in compliance with S.E.'s letter no…….dated……

Kalignaj is an important market place for agricultural products and there are some cottage industries in the area, and there having no road the area is not being developed. The proposed road will also serve many villages on either side. The people of the locality have also represented and demanded separately for the construction of this road. It is therefore essential to construct this road. The proposal has been included in the Fourth Five year Plan and the cost will be met from the Road Development Fund.

Alignment of the road follows an existing card road with straightening when necessary and avoiding conjested areas as far as possible. Flat curves have been provided with a minimum radius of 150 m. In selecting the alignment principles of shortest route, serving maximum population, minimum drainage crossing easy gradient economy of construction, etc.., have been followed. The road passes mostly through uncultivated area in plane land, and mostly in banking of 60 cm to 90 cm high excepting a few places where the road passes in low where high banking will be required.

Planet table survey has been made for the whole length of the road for 60 m width on each side of the centre line and L-section has been prepared by taking levels at every 30 m and cross levels have been taken at every 90 metre. Formation line has been fixed to have easy gradient and ruling gradient of 1 in 40 has not reached anywhere. Highest flood level has been kept in view and formation line has been kept above normal flood level.

A number of culverts will be required along the length of the road and ridge of about 30 m span will be required across the stream in km 12. A list of bridges and culverts of different span has been enclosed and provisions have been made on the basis of running metre of span at the rate of Rs. 5,000.00 per r m of span for culverts and Rs. 6,000.00 per r m of span for bridges. Bridges shall have to be designed on I.R.C class A Loading and their detailed estimate shall have to be prepared separately.

A present land of 30 m width shall be required and has been provided in the estimate. Temporary land for borrowpits shall be required for one year for taking earth for embankment and provision has been made accordingly.

The road shall be metalled with soling coat of brick on edge with over burnt bricks and two coats of metalling, inter coat and top coat, each of 8 cm compacted layer with stone ballast. The two wearing coats shall be of one coat of bituminous painting. Provisions for metalling and painting have been made in the estimate accordingly. Brick shall be burnt by contract by the side of road distributed along the road in three brick kilns. Coal shall have to be supplied to contractors for burning bricks and a statement of coal requirement is enclosed. Stone metal shall be hard granite type and shall be collected from the approved quarry.

The whole work of construction shall be spread in five years, earth work one year, rest for settlement one year, metalling two years and painting one year.

Second coat bituminous painting shall be done after one year of 1st cost of painting and cost of painting shall be met from maintenance grant.

All works shall be done strictly as per detailed P.W.D Specifications. The estimate has been prepared at P.W.D Schedule of rates and local current rates and analysis of rates have been given for non-schedule items. The work shall be done by contract by inviting tenders.

Survey Plan, L-sections and Cross-sections of the proposed road are enclosed with the estimate. An index plan showing the alignment has also been enclosed.

The estimate amounting to Rs. 25,00,000.00 has been submitted for sanction and allotment of fund.