1.INTRODUCTION

DEFINITION OF ESTIMATING AND COSTING

Estimating is the technique of calculating or Computing the various quantities and the expected Expenditure to be incurred on a particular work or project. In case the funds avilable are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following requirement are necessary for preparing an estimate.

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

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

c) Standard schedule of rates of the current year.

NEED FOR ESTIMATION AND COSTING

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

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

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

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

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

PROCEDURE OF ESTIMATING OR METHOD OF ESTIMATING.

Estimating involves the following operations

1. Preparing detailed Estimate.

2. Calculating the rate of each unit of work

3. Preparing abstract of estimate

DATA REQUIRED TO PREPARE AN ESTIMATE

1. Drawings i.e.plans, elevations, sections etc.

2. Specifications.

3. Rates.

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.

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.

RATES:

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

1. For arriving at the unit rates of each item.

2. The rates of various materials to be used in the construction.

3. The cost of transport materials.

4. The wages of labour, skilled or unskilled of masons, carpenters, Mazdoor, etc.,

LUMPSUM:

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

1. Water supply and sanitary arrangements.

2. Electrical installations like meter, motor, etc.,

3. Architectural features.

4. Contingencies and unforeseen items.

Ingeneral, certain percentage on the cost of estimation is alloted for the above L.S.Items.

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

WORK CHARGED ESTABLISHMENT:

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

Measurement of Materials and Works

2.UNITS OF MEASUREMENTS:

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

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

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

c) Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., are expressed in square meters (m2)

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

Sl. No.	Particulas of item	Units of Measurement	Units of payment
I	Earth work: 1. Earth work in Excavation 2. Earthwork in fillingin foundation trenches 3. Earth work in filling in plinth	 Cum Cum Cum	 Per%cum Per%cum Per%cum
II	Concrete: 1. Lime concretre in foundation 2. Cement concrete in Lintels 3. R.C.C.in slab 4. C.C. or R.C.C. Chujja, Sunshade 5. L.C. in roof terracing (thickness specified) 6. Cement concrete bed 7. R.C. Sunshade (Specified Width & Hight	 Cum Cum Cum Cum Sqm Cum Cum	 Percum Percum Percum Percum perSqm Percum 1m
III	Damp ProofCource (D.P.C) (Thickness should be mentioned)	Sqm	Persqm
IV	Brick work: 1. Brickwork in foundation 2. Brick work in plinth 3. Brick work in super structure 4. Thin partition walls 5. Brick work in arches 6. Reinforced brick work (R.B.Work)	 Cum Cum Cum Sqm Cum Cum	 Percum Percum Percum persqm Percum Percum
V	Stone Work: Stone masonry	 Cum	 PerCum

VI	Roofing 1. R.C.C. and R.B.Slab roof (excluding steel) 2. L.C. roof over and inclusive of tiles or brick or stone slab etc (thickness specified) 3. Centering and shuttering form work 4. A.C.Sheet roofing	 Cum Sqm Sqm Sqm	 PerCum persqm persqm persqm
VII	Plastering, points&finishing 1. Plastering-Cement or Lime Mortar (thickness and proportion specified) 2. Pointing 3. White washing, colour washing, cement wash (number of coats specified) 4. Distempering (number of coats specified)	 Sqm Sqm Sqm Sqm Sqm	 persqm persqm persqm persqm persqm

RULES FOR MEASUREMENT :

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

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

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

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

i) Linear measurement shall be measured to the nearest 0.01m.

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

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

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

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

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

a) from foundation to plinth level

b) from plinth level to First floor level

c) from Fist floor to Second floor level and so on.

METHODS OF TAKING OUT QUANTITIES:

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

a) Long wall - short wall method

b) Centre line method.

c) Partly centre line and short wall method.

a) Long wall-short wall method:

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

b) Centre line method:

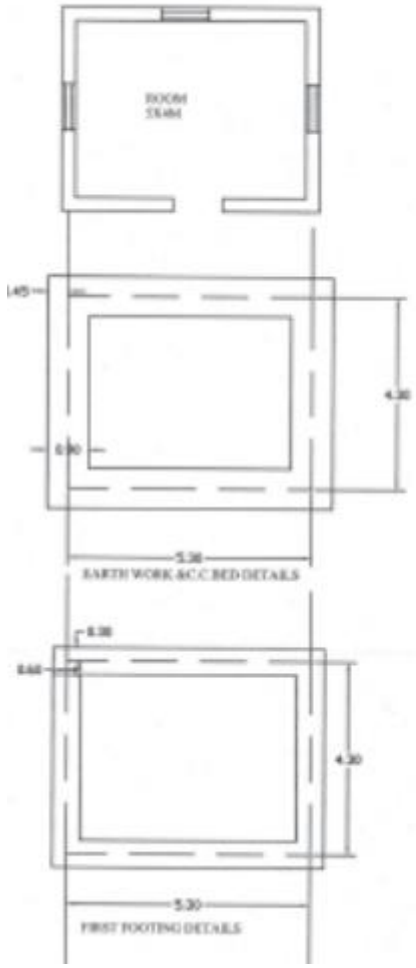
This method is suitable for walls of similar cross sections. Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time. When cross walls or partitions or verandah walls join with mainall, the centre line length gets reduced by half of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

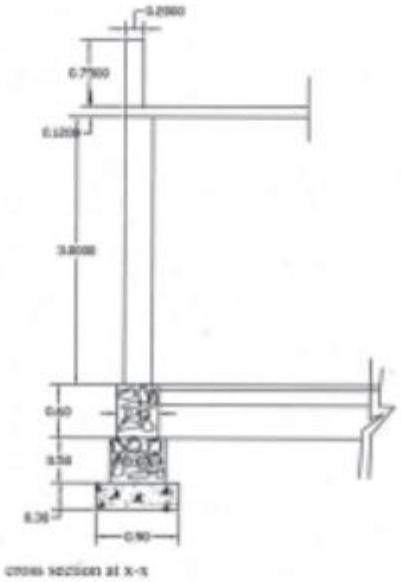
c) Partly centre line and partly cross wall method:

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

I. Example 1: From the given figure below calculate the detailed and abstract estimate for the single roomed building (Load bearing type structure) by a) long wall & short wall method (b) Centre Line Method

Single Roomed Building (Load Bearing type structure)





CROSS SECTION AT X-X

Note: All Dimensions are in 'M'

D=1X2.1M

W=1.5X1.2M

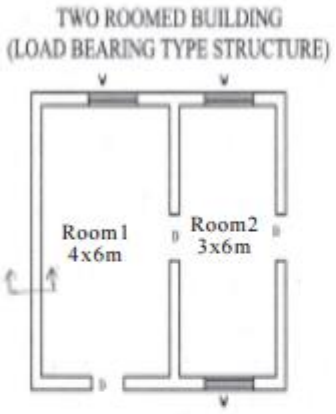
Long wall - Short wall Method

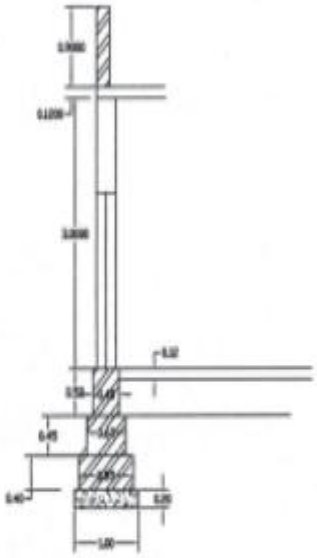
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation for foundation**						
	a) Long walls	2	6.2	0.9	1.4	15.264	L=5.3+.45+.45=6.2 D=0.3+0.5+0.6=1.4
	b) Short walls	2	3.4	0.9	1.4	8.568	L=4.3-0.45-0.45=3.4
					Total	**24.192**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation				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

Centre Line Method

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

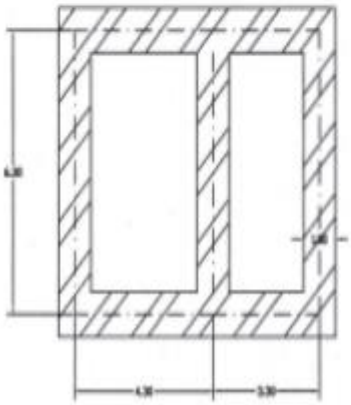
Example :2 :-From the given figure below calculate the details and abstract estimate for the double roomed building (Load bearing type structure) by a) long wall & short wall method (b) Centre Line Method





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

Note: All Dimensions are in 'M'



Plan for first footing

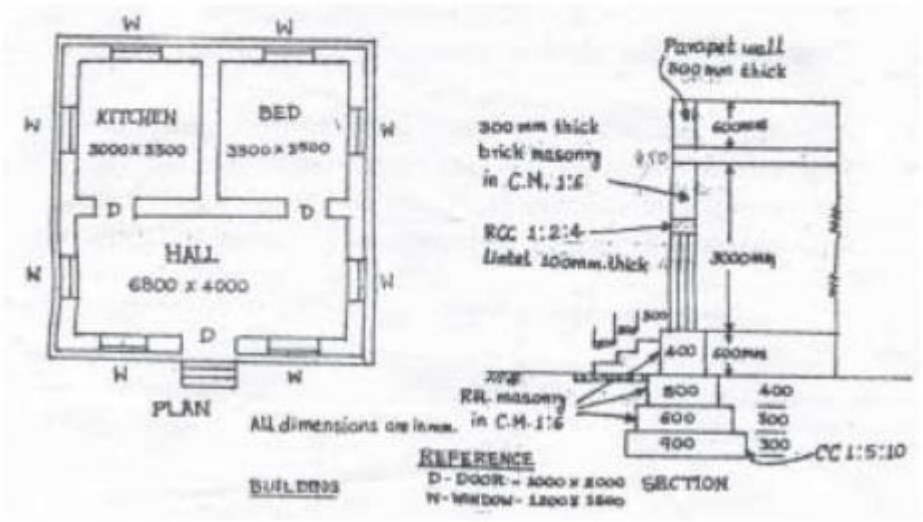
S.No.	Particulars of Items	No	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation						
	a) Long walls	2	8.6	1.0	1.05	18.05	L=7.6+0.5+0.5=86
	b) Short walls	3	5.3	1.0	11.05	16.70	L=6.3-0.5-0.5=5.3
					Total	**34.75**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	8.6	1.0	0.2	3.44	
	b) Short walls	3	5.3	1.0	0.2	3.18	
					Total	**6.62**	**m^3**
3.	**Brick masanory for** footings with CM(1:4)						
	first footing						
	a) Long walls	2	8.45	0.85	0.4	5.746	L=7.6+0.425+0.425=8.45
	b) Short walls	3	5.45	0.85	0.4	5.560	L=6.3-0.425-0.425=5.45
	2nd fooring						
	a) Long walls	2	8.20	0.6	0.45	4.428	L=7.6+0.3+0.3=8.2
	b) short walls	3	5.70	0.6	0.45	4.617	L=6.3-0.3-0.3=5.7
	ii) for base ment	2	8.00	0.4	0.4	2.560	L=7.6+0.2+0.0=8.0
	long walls	3	5.90	0.4	0.4	2.832	L=6.3-0.2-0.2=5.9
	short walls						
	iii) for super structure	2	7.90	0.3	3.0	14.22	L=7.6+0.15+0.15=7.9
	long walls	3	6.00	0.3	3.0	16.20	L=6.3-0.15-0.15=6.0
	short walls						
	iv) Parapet wall						
	a) long walls	2	7.90	0.2	0.70	2.212	
	b) Shot walls	2	6.20	0.2	0.70	1.736	
					Total	**60.11**	
	Deductions for openings						
	Doors	3	1.0	0.3	2.1	1.89	
	Windows	3	1.5	0.3	1.2	1.62	
	Lintels over doors	3	1.20	0.3	0.10	0.108	
	windows	3	1.70	0.3	0.10	0.153	
	Net B.M.=60.11-377=56.34m^3				Total	**3.771**	

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	4.3 3.3 6.3						
	Total centre line length =(4.3+3.3)2+6.3x3=34.1m						
1.	**Earth work excavation**	1	33.1	1.0	1.05	34.75	L=34.1-2x1/2=33.1
2.	**C.C.(1:4:8) bed for foundation**	1	33.1	1.0	0.20	6.62	**m^3**
3.	**Brick masonry with CM(1:4)**						
	a) for foundation						
	i) first footing	1	33.25	0.85	0.40	11.30	L=34.1-0.85=33.25
	ii) 2nd footing	1	33.50	0.60	0.45	9.045	L=34.1-0.6x2/2
	b) for basement	1	33.7	0.40	0.40	5.392	L=34.1-0.4x2/2
	c) for super structure	1	33.80	0.30	3.0	30.42	L=34.1-0.3x2/2
	d) for parapet wall						
	7.9 6.6 02 7.7 6.4						
	Total centre line length =2(7.7+6.4)=28.2	1	28.2	0.2	0.70	3.948	
					Total	**60.10**	**m^3**
	Deductions for Openings Doors	3	1.0	0.3	2.1	1.89	
	windows	3	1.5	0.3	1.2	1.62	
	Lintels Doors	3	1.2	0.3	0.1	0.108	
	Windows	3	1.7	0.3	0.1	1.153	
					Total	**3.771**	**m^3**
	Net B.M.=60.11-3.771=56.34m^3						
4.	Quantity of R.C.C.Roof, Plastering for walls and cealing and flooring, White washing is same as Longwall & Short wall method.						

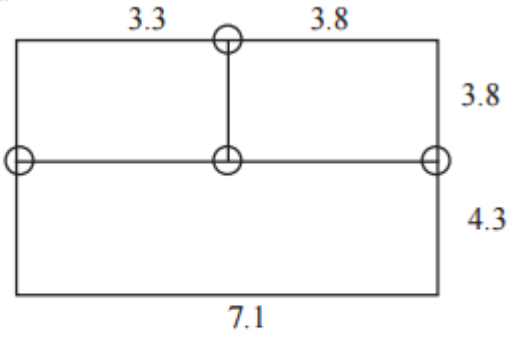
Abstract estimate of two roomed building (Load bearing type structure)

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

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



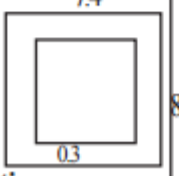
Centre line diagram



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

no of T Junctions = 4

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



	Doors	3x2	1.0	---	2.0	12.0	
	windows	8x2	1.2	---	1.5	28.8	
					Total	**40.8**	**m²**
	Plastering for parapet wall (sides)	1x2	30.4	---	0.6	36.48	
	Top	1	30.4	0.3	---	9.12	
					Total	**45.60**	**m²**
	Net Plastering = 240.6-40.8+45.6=245.4 m²						
7.	Flooring with 25mm th CC(1:2:4)						
	Kitchen	1	3.0	3.5	--	10.5	
	Bed	1	3.5	3.5	--	12.25	
	Hall	1	6.8	4.0	--	27.20	
	Sills of Doors	3	1.0	0.3	--	0.90	
8.	Ceiling = Same as				Total	**50.85**	**m²**
	Flooring					50.85	**m²**
9.	white washing = Same as Plastering for walls and ceiling 245.4+50.85 = 296.25 m²						
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**	**m³**
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	**m²**
13	2% unforeseen items						
14	4% P.S & contingencies and round off.						

FIXING OF RATE PER UNIT OF AN ITEM:

The rate per unit of an item includes the following:

Quantity of material and cost:

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

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

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

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

METHODS OF PREPARATION OF APPROXIMATE ESTIMATE:

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

a) Plinth area method

b) Cubical contents methods

c) Unit base method.

a) Plinth area method:

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

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

a) Area of walls at floor level.

b) Internal shafts of sanitary installations not exceeding 2.0m2 , lifts, airconditionsing ducts etc., c) Area of barsati at terrace level:

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

d) Porches of non cantilever type.

Areas which are not to include

a) Area of lofts.

b) Unenclosed balconies.

c) Architectural bands, cornices etc.,

d) Domes, towers projecting above terrace level.

e) Box louvers and vertical sunbreakers.

b) Cubical Contents Method:

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

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

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

c) Unit Base Method:

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

3.ANALYSIS OF RATES

Definition :

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

1. Specifications of works and material about their quality, proportion and constructional operation method.

2. Quantity of materials and their costs.

3. Cost of labours and their wages.

4. Location of site of work and the distances from source and conveyance charges.

5. Overhead and establishment charges

6. Profit

Cost of materials at source and at site of construction.

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

Purpose of Analysis of rates:

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

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

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

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

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

The labour can be classified in to

1) Skilled 1st class

2) Skilled IInd Class

3) un skilled

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

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

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

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

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

$= 119.26$ bags

Quantity of Sand required $= \frac{2}{(1+2+4)} \times 1.52 \times 20 = 8.28m^3$

Quantity of cource aggreate $= \frac{4}{7} \times 1.52 \times 20 = 16.56m^3$

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

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

Quantity of CA required $= \frac{6}{10} \times 1.52 \times 15 = 13.68m^3$

Example 2:- Calculate the quantity of materials for the following items.

a) C.M. (1:4) for $1m^3$ of work

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

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

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

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

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

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

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

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

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

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

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

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

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

4.ROAD ESTIMATION

Introduction:-

Generally all the Civil Engineering projects like roads, railways, earth dams, canal bunds, buildings etc. involves the earth work.This earth work may be either earth excavation or earth filling or Some times both will get according to the desired shape and level.

Basically the volume of earthwork is computed from length, breadth, and depth of excavation or filling.

Lead and Lift:

Lead:

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

Lift :

It is the average height through which the earth has to be lifted from source to the place of spreading or heaping.

The unit of lift is 2.00m for first lift and one extra lift for every 1.0m. for example when earth is to be lifted for 4.5m, Four lifts are to be paid to the contractor.

i.e. Upto2.0- 1 lift

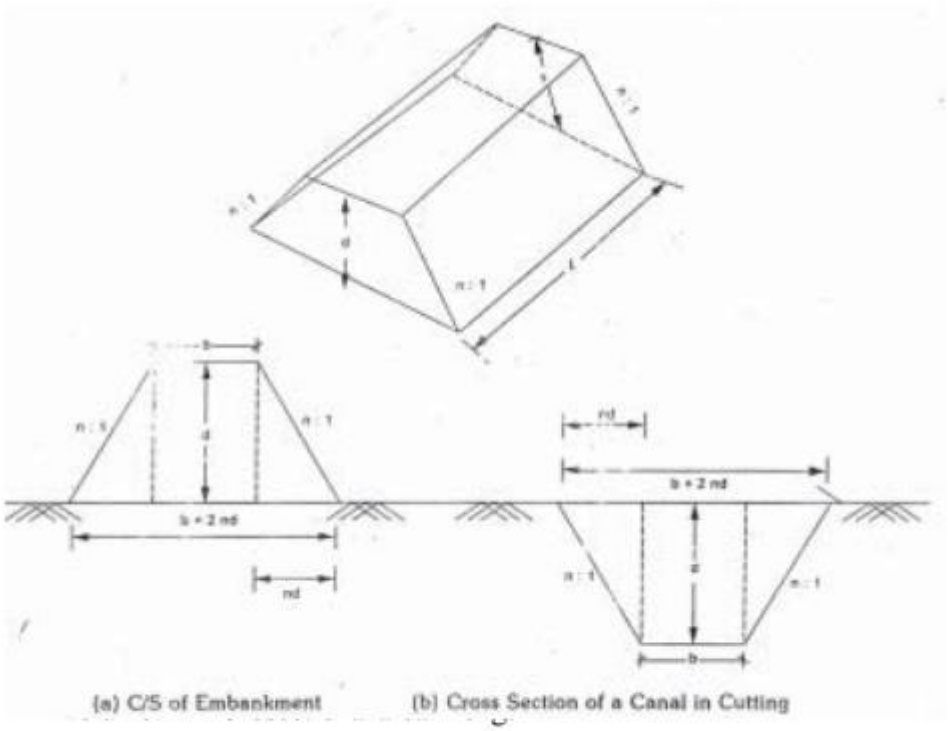
1.0 - 1 Lift

1.0 - 1 lift

Total 04 lifts 0.5 - 1 lift

Calculation of earth work for Roads:

case 1) volume of earth work in banking or in cutting having "no longitudinal slope".



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

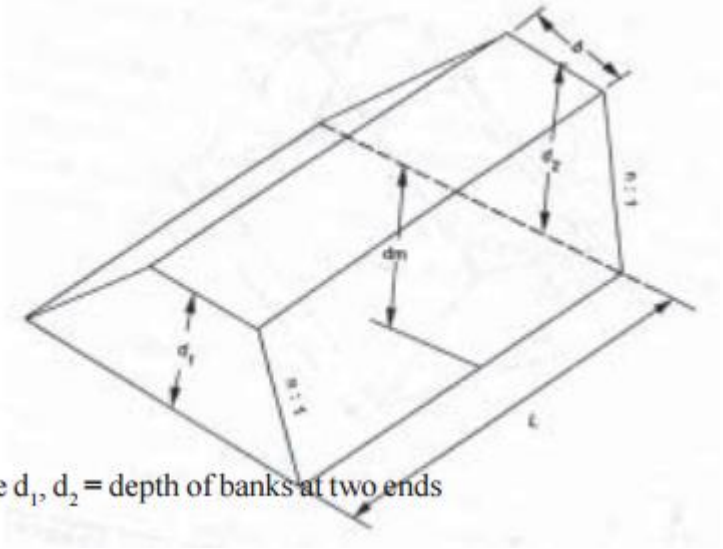
$$V = (bd+2x1/2x\,ndx\,d)L$$

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

Case 2:

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

1. By Mid Section or Mid ordinate method.



Where d_1, d_2 = depth of banks at two ends

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

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

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

ii) Trepezoidal formula: (for two sections)

In this method also called mean sectional area method

Let A_1 & A_2 be two areas at two ends.

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

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

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

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

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

The volume of earth work

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

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

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

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

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

Volume of earth work

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

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

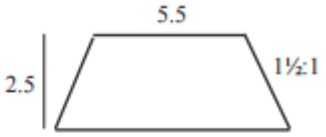
Example 7.1 : Find the volume of earth work in embankment of length 12m. Top width is 5.5m and depth is 2.5m the side slopes ara 1½:1

Sol : Top width b=5.5m

Depth d=2.5m

side slopes =1½:1 i.e. n=1.5

length L=12m



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

$=(5.5\times2.5+1.5\times2.5^2)12$

$=77.5m^3$

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

a) Mid Sectional Area (ii)Mean sectional Area method.

Sol: a) b=8m, d1=2m, d2=2.5m, l=70m, n=2

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

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

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

b) Area of c/s at one end $A_1=bd_1+nd_1^2=8x2+2x2^2=24m^2$

Area of C/s at other end $A2=bd_2+nd_2^2=8\times2.5+2\times2.5^2=32.5m^2$

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

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

Cement concrete road

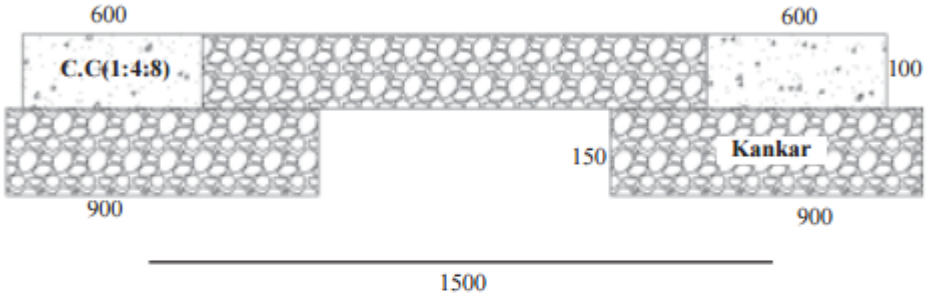
C.C. road is laid over an existing W.B.M road, In certain cases. It is laid over a prepared sub grade and a base course is provided. The concrete used for roads is M15 grade using 20mm H.B.G. metal while for base course a concrete of 1:4:8 using 40mm HBGmetal the stages of Estimations of a C.C.road is

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

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

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

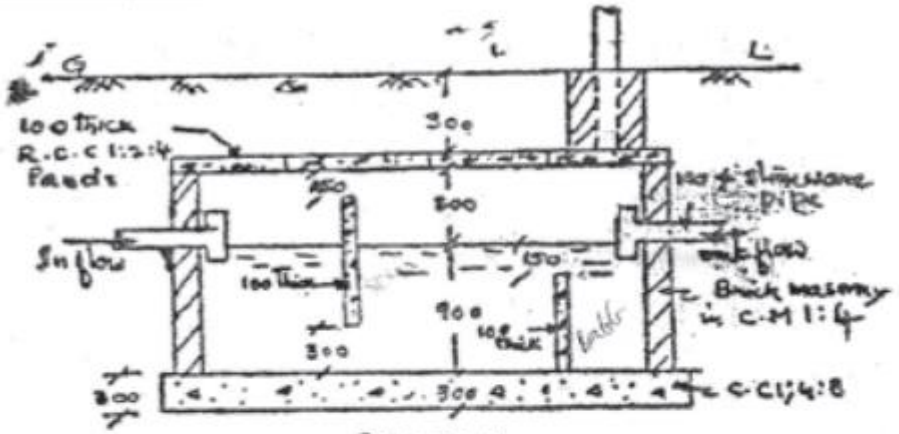
Example 8.3 :- Prepare an estimate for 1 Km length of C.C. track or the fig shown below.

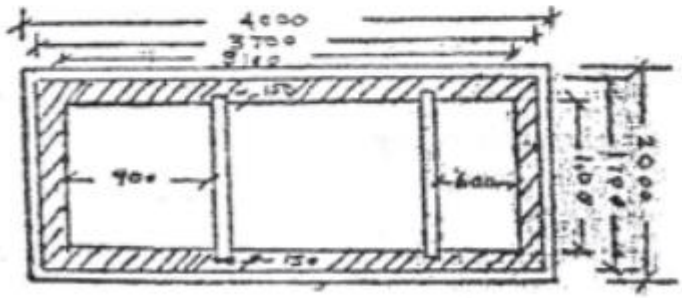


S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	C.C.(1:2:4) in tracks including laying	2	1000	0.6	0.1	120m^3	
2.	laying of kankar (for loose thickness increase with 33 $\frac{1}{3}$ %)						
	a) in between C.C tracks	1	1000	0.9	0.133	120	
	b) under C.C. tracks	2	1000	0.9	0.20	360	
						480 m^3	

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

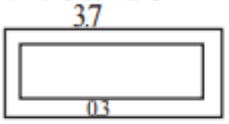
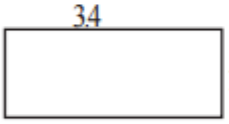
SEPTIC TANK

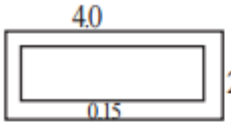
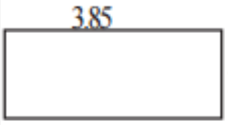




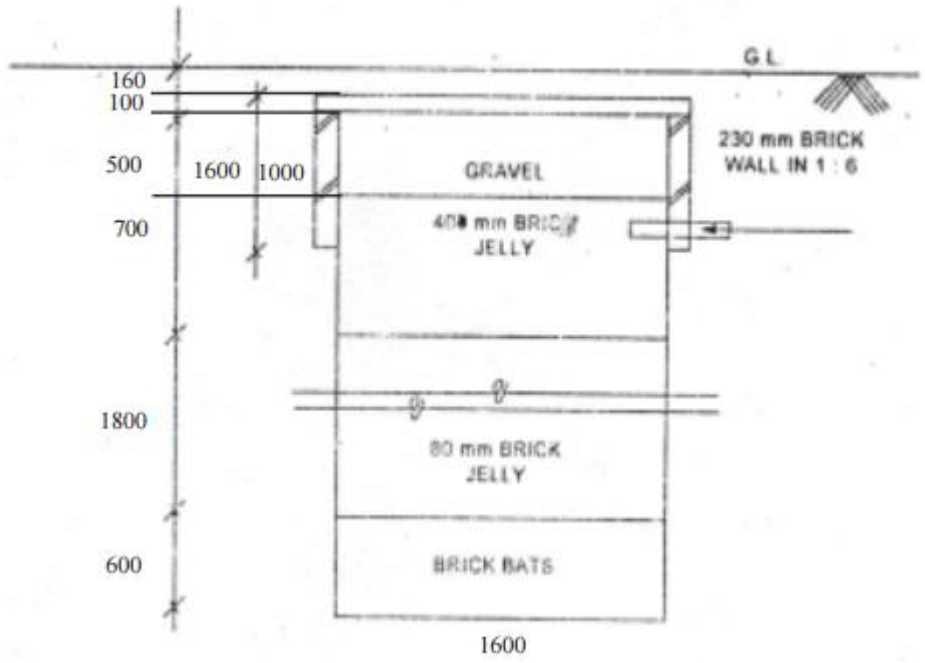
PLAN

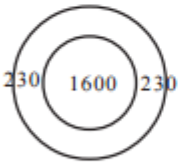
SEPTIC TANK

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

6.	a) Earth filling with excavated soil around the brick wall  centre line method  Total Centre line length =						
	(1.85+3.85)2=11.4	1	11.4	0.15	1.30	2.223	
	b) over R.C.C. pannels	1	3.70	1.70	0.30	1.1887	
	(neglecting the space for venti pipe footing)				Total	**4.11**	
7	supply fixing of steel grills including labour for fabrication @ 750N/m³	1	0.839	x750=	6292N	62.92 Kgs	
8	Provision of 100mm dia inlet and out let tees	1x2	---	--	--	2Nos	
9.	Provision of A.C. ventilating shaft 3m hight duly embedded in b/wat bottom	1x1			1 No	1 No	
10	Provision for A.C. cowl for ventilating pipe	1x1			1nos	1 No	
11	Unforcean itsm @2x				L.S	L.S	
12	P.S.& contingencies @4%				L.S	L.S	

SOAK PIT


G L
160
100
500
1600
1000
700
1800
600
GRAVEL
230 mm BRICK
WALL IN 1 : 6
JELLY
80 mm BRICK
JELLY
BRICK BATS
1600

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	Earth work excavation in non cohesive soils like sandy soils with an intial lead & lift						
	a) Soak pit	1	$\frac{\pi}{4}$ x 1.6^2		3.86	7.76	
	b) side brick wall	1	$\frac{\pi}{4}(2.06^2 - 1.6^2)$		1.16	1.53	
					Total	**9.29**	
2.	Brick work in CM (1:5) with country bricks including cost and conveyance etc complete alround the pit						
		1	$\frac{\pi}{4}(2.06^2 - 1.6^2)$		0.9	1.19	
	centre line method						
		1	$\pi(1.83)$	0.23	0.9	1.19	
3.	supply & packing including cost & con-veyance						
	a) Brick bats	1	$\frac{\pi}{4} \times 1.6^2$		0.6	1.2	
	b) 80mm brick jelly	1	$\frac{\pi}{4} \times 1.6^2$		1.8	3.62	
	c) 40mm brick jelly	1	$\frac{\pi}{4} \times 1.6^2$		0.7	1.4	
	d) gravel brick jelly	1	$\frac{\pi}{4} \times 1.6^2$		0.5	1.00	
					Total	**7.22**	
4.	R.C.C. (1:2:4) slab panels (precast) using 20mm HBG metal inlcuidng cost & conveyance	1	$\frac{\pi}{4} \times 2.06^2$		0.1	0.33	
5.	Filling with clay soil on top of pit upto G.L.	1	$\frac{\pi}{4} \times 2.06^2$		0.16	0.53	

7.	Laying of joining 100mm popies including earth work Encavation, sand filling packing joints etc complets L=12+0.23+1.6/2	1	13.03		---	13.03	RM
8	Unforcean items of work@2%	1	--		--	LS	
9	Petty supervision and contingencies@4%	1	---		---	LS	

5.CONTRACTS

Agreements between two entities, creating an enforceable obligation to do, or to refrain fr om doing, a particular thing.

Nature and Contractual Obligation

The purpose of a contract is to establish the agreement that the parties have made and to fi x their rights and duties inaccordance with that agreement. The courts must enforce a vali d contract as it is made, unless there are grounds that barits enforcement.

Statutes prescribe and restrict the terms of a contract where the general public is affected. The terms of an insurancecontract that protect a common carrier are controlled by statute i n order to safeguard the public by guaranteeing that therewill be financial resources availa ble in the event of an accident.

The courts may not create a contract for the parties. When the parties have no express or i mplied agreement on theessential terms of a contract, there is no contract. Courts are only empowered to enforce contracts, not to write them, forthe parties. A contract, in order to be enforceable, must be a valid. The function of the court is to enforce agreements only ift hey exist and not to create them through the imposition of such terms as the court conside rs reasonable.

It is the policy of the law to encourage the formation of contracts between competent parti es for lawful objectives. As ageneral rule, contracts by competent persons, equitably mad e, are valid and enforceable. Parties to a contract are bound bythe terms to which they hav e agreed, usually even if the contract appears to be improvident or a bad bargain, as long as itdid not result from Fraud, duress, or Undue Influence.

The binding force of a contract is based on the fact that it evinces a meeting of minds of t wo parties in Good
Faith. Acontract, once formed, does not contemplate a right of a party to reject it. Contrac ts that were mutually entered into betweenparties with the capacity to contract are binding

obligations and may not be set aside due to the caprice of one party or theother unless a s tatute provides to the contrary.