10111CE702-ESTIMATION AND QUANTITY SURVEYING

VII SEMESTER

E-LEARNING MATERIAL

SUBMITTED BY,

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10111CE702 **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.

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCE

1. PWD Data Book.

ESTIMATING AND COST ENGINEERING

UNIT - I

INTRODUCTION

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

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

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

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

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

TYPES OF ESTIMATES

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

(1) Preliminary or Approximate estimate.

(2) Rough cost estimate based on plinth area.

(3) Rough cost estimate based on cubic contents.

(4) Detailed estimate.

(5) Annual repair estimate.

(6) Special repair estimate.

(7) Revised estimate

(8) Supplementary estimate.

1. Preliminary or Approximate estimate

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

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

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

The following documents should be attached with it.

(a) Detailed report

(b) Site plan of the proposal

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

2. Plinth area Estimate (Based on Rough Cost)

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

The following documents are attached with the estimate.

(a) Line plan with brief specifications.

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

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

3. Cubic Contents Estimate (Based on Rough Cost)

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

The cubic contents of the proposed building are multiplied with cubic rates arrived at for the similar construction i.e. total cost of construction divided by cubic contents = cost per cubic metre.

Documents attached are as in No. 2

(Administrative approval is granted on rough cost estimate)

4. Detailed Estimate

After getting Administrative approval on rough cost estimate, detailed estimates are prepared.

In this, the estimate is divided in to sub-heads and quantities of various items are calculated individually.

In the end of the detailed quantities, an *abstract* of *cost* giving quantities of each item and rate of every item according to the sanctioned schedule of rates shall be attached. In case of non-schedule rates i.e. rates which are not given in the sanctioned schedule of rates, proper analysis of rates shall be attached. If however the work proposed to be constructed is located in a remote place, the provision for the carriage of the material shall be added in the estimate to avoid any excess over the administratively approved estimate later on. Detailed specifications & report should also be attached with the estimate. Technical sanction is given on detailed estimate.

The detailed estimate shall also provide for the cost of approach road, water supply, electric installations and acquisition of land etc, so as to call it a comprehensive estimate.

5. Annual repair estimate

In order to keep building and roads in perfect condition, annual repairs should be carried out as follow:-

(i) In case of a building-white washing, oiling and painting of doors and windows, cement plaster repairs (inside & outside), repairs of floors etc. In no case this annual repair amount should increase more that 11/2% to 2% of the capital cost of the building.

(ii) In case of a road-filling patches, maintenance of berms etc.

6. Special repair estimate

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

(i) In case of a building-opening of new doors, change of floors, replastering walls etc.

(ii) In case of roads-if the whole surface is full of corrugation & patches, then the total surface is to be scarified. The old metal is taken out, consolidation by adding more metal is done and top surface is repainted.

7. Revised estimate

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

8. Supplementary Estimate

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

METHODS OF TAKING OUT ESTIMATES

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

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

1. Centre line method

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

2. Crossing Method

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

3. Out to out & in to in Method

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

4. Bay Method

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

5. Service Unit Method.

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

PROBLEM: I

Calculate the quantities of the following items from the given figure, 3.12 upto G.L., using

(a) Centre line method

(b) Crossing method.

1. Excavation for foundations.
2. Cement Concrete in foundations.
3. Brick work in cement mortar (1:4)

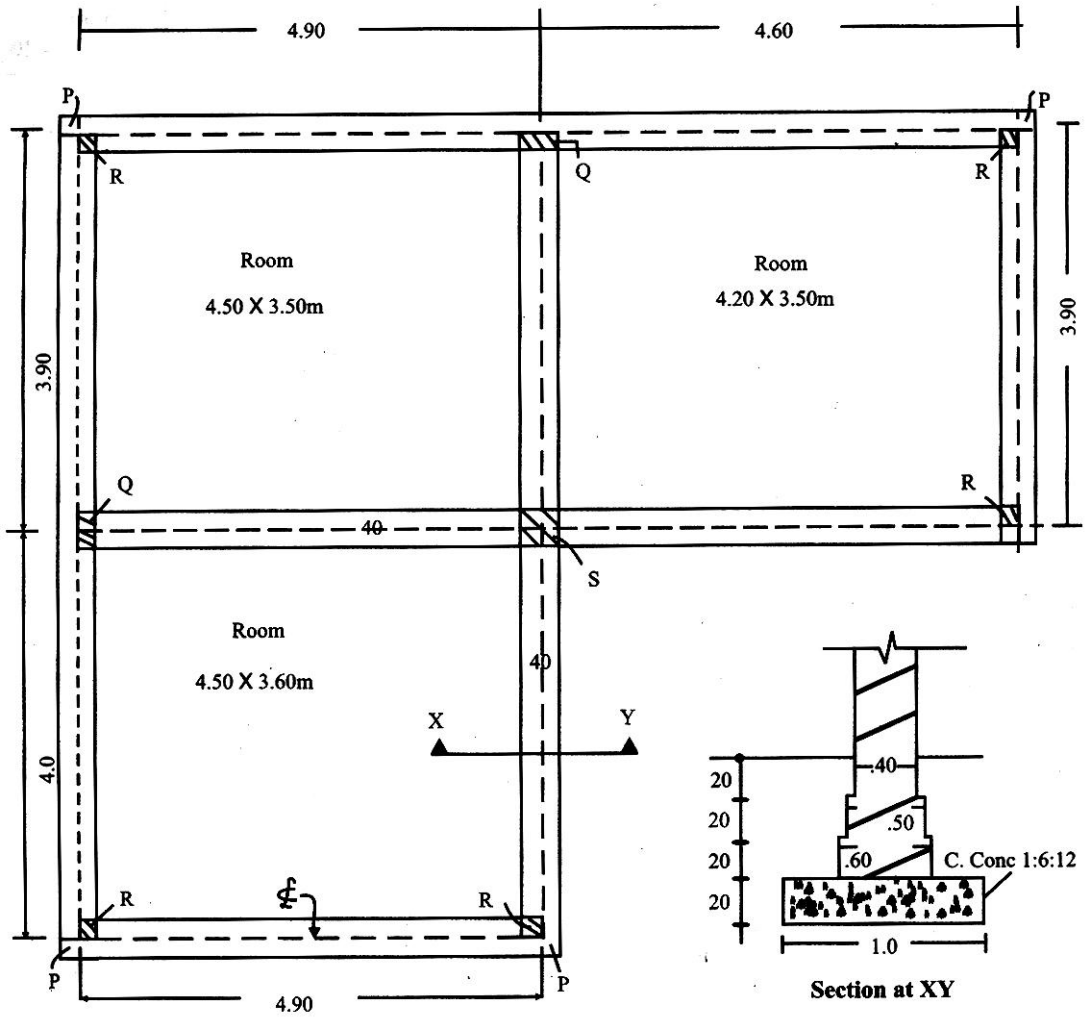


Fig. 3.12

Solution:

(a) BY CENTRE LINE METHOD

ESTIMATES

Detail of Work	No.	Measurements			Contents
		L	B	H	
		(a) BY CENTRE LINE METHOD			
1. Excavation for foundations					
	1	42.8	1.0	0.80	34.26
Total	cub. m.				=
2. C. Concrete in foundation	1	42.8	1.0	0.20	34.24
	cub. m.				8.56

Total					=
3. B. Brick in Cement mortar (1:4)	1	42.8	0.60	0.20	8.56
	1	42.8	0.50	0.20	
1st. step	1	42.8	0.40	0.20	5.13
2nd.step					4.28
3rd.step					3.42
	cub. m.				----------
					12.83
					=
Total					**12.83**

by) BY CROSSING METHOD

1.	Excavation for foundations						
	Top Rooms Long Walls						
	(.40 + 4.50 + .40 + 4.20 + .40) = 9.90	2	9.9	1.0	0.80	15.84	
	Short walls	3	3.5	1.0	0.80	8.40	
	Bottom Room Long walls	1	5.3	1.0	0.80	4.24	
	(.40 + 4.50 + .40 =5.30)						
	Short walls	2	3.6	1.0	0.80	5.76	
						34.24	
	Total	cub. m.					**34.24**
2.	C. Concrete in foundations						
	Top Rooms Long Walls		9.9	1.0	0.20	3.96	
	Short walls	2	3.5	1.0	0.20	2.10	
		2					
	Bottom Room Long walls		5.3	1.0	0.20	1.06	
	Short walls	1	3.6	1.0	0.20	7.44	
		2					
						8.56	
	Total						**8.56**
3.	B. Brick in cement mortar	cub. m.					
	Top Rooms						
	Long Walls 1st. step		9.90	0.60	0.20	2.38	
	2nd.step		9.90	0.50	0.20	1.98	
	3rd.step	2	9.90	0.40	0.20	1.58	
		2					
	Short walls 1st. step	2	3.50	0.60	0.20	1.26	
	2nd.step		3.50	0.50	0.20	1.05	
	3rd.step	3	3.50	0.40	0.20	0.84	
	Bottom Room	3					
	Long walls 1st. step	3	5.30	0.60	0.20	0.64	
	2nd.step		5.30	0.50	0.20	0.53	
		1					
		1					

Detail of Work		No.	Measurements			Contents
			L	B	H	
	3 rd step	1	5.30	0.40	0.20	0.42
Short Walls	1 st step	2	3.60	0.60	0.20	0.86
	2 nd. Step	2	3.60	0.50	0.20	0.72
	3^{rd}. step	2	3.60	0.40	0.20	0.58

						12.83
	Total	cub. m.				**12.83**

As already discussed, in this method, the length of centre line is fixed once for all and this is used or calculating quantities of various items. The only requirement for the uses for this method is that the section of walls should be symmetrical throughout.

How to Fix Centre Line.

The Centre line of the given plain marked and centre to centre distances of walls are added. Refer given figure 3.12, the total length of centre line, room-wise is as under from top right corner.

All horizontal – 4.60 + 4.90 + 4.90 + 4.60 + 4.90=23.90

All vertical – 3.90 + 3.90 + 3.90 + 4.0 + 4.0=19.70

But there are hatched rectangles showing that these portions have been added twice i.e. this portion is part of both the lines meeting at rt. Angle to each other. So this portion is to be added only once.

The deductions to be made are as under:-

1. At L-junction Walls

   At L-junction, two squares P & R are formed. The hatched portion R' comes twice, whereas portion 'P' does not come even once. So 'P' is compensated with 'R' coming twice. Thus in the case of L-junction, no deduction is to be done from the total length of centre line.

2. At L-junction Walls.

In this case, the hatched rectangular portion 'Q' comes twice. So the deduction in this case is ½ of thickness of wall for each T-junction.

2. At Cross Walls.

   In this case also, the hatched square portion 'S' comes twice. So, for correct calculations, it is to be added only once. Thus for a cross wall, the deducaiton is thickness of wall.

   Form above lines we have found out this conclusion that to get the correct length of the centre line, the following deductions are to be made:-

   ½ * thickness of the wall at T-junction * No. of junctions

   + 1 * thickness of wall at cross-junction * no. junctions

   =1/2 *.40*2+1*.40*1 =0.80m.

   =43.60-0.80=42.80m.

All the quantities shall be calculated using 42.80m. as length of centre line.

DETAILED ESTIMATES

WINDOW IN AN EXISTING WALL

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

IMPORTANT POINTS ABOUT ESTIMATING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DATA REQUIRED FOR PREPARATION OF AN ESTIAMTE

1. Complete and fully dimensioned plans & sections of the work of question.
2. Detailed specifications, giving the nature and class of work and material to be used.
3. Rates for calculating abstract of cost. These should be approved ones. Premium above C.S.R., as prevailing at the time of finding cost should also be added.

Prob.

Calculate the following items from the plan and section given in the fig.3.13 using centre line method:

(i) Excavation for foundations.

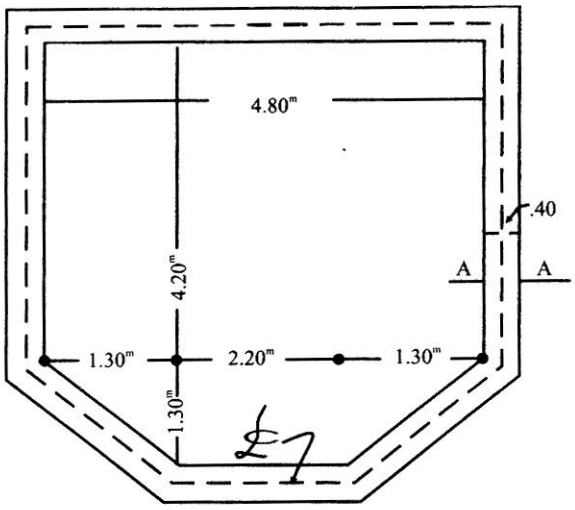
(ii)Cement Concrete (1:6:18) in foundations.

(iii) Brick Work in cement mortar (1:6) in foundations and plinth.

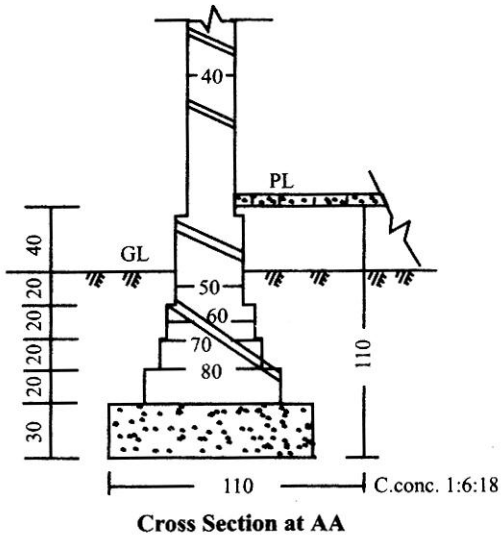
Sol: Total length of the wall along the centre line

5.20+ 4.40 + 4.40 + 4.40 +2.12 + 2.12 +2.12+2.20+2.20 = 20.44 say 20.50m.

4.80+.40 = 5.20 /(1.30+.20)^2 +(1.30 +.20)^2=



PLAN



Cross Section at AA

Fig. 3.13

ESTIMATES

Detail of Work	No.	Measurements			Contents
		L	B	H	
1. Excavation for foundations	1	20.50	1.10	1.10	24.80
Total	cub. m.				= **24.80**
2. Cement. Concrete in foundation (1:6:18)	1	20.50	1.10	.30	6.80
Total	cub. m.				= 6.80
3. **Brick work** in Cement mortar (1:6) in foundation and plinth					

1 st. step	1	20.50	.80	0.20	3.28
2 nd.step	1	20.50	.70	0.20	2.87
3 rd.step	1	20.50	.60	0.20	2.46
4 th. step	1	20.50	.50	0.20	6.15
					14.76
Total	cub. m.		SAY		= **14.80**

Prepare a detailed estimate of a shop shown in fig and calculate its cost with approved rates. Also find out the plinth area rate of the shop.

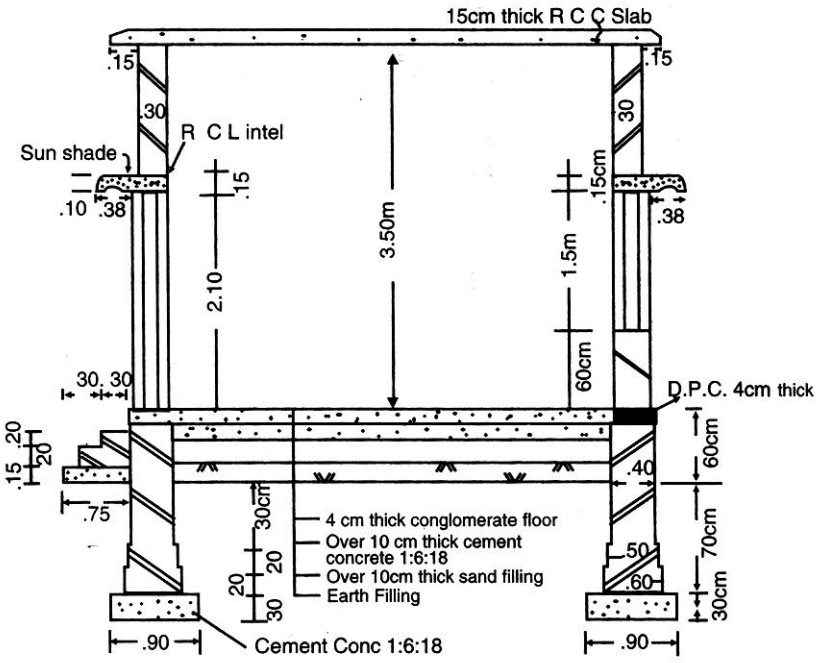


Fig. 4.1

SOLUTION

Detail of Work	No.	Measurements			Qty.	Remarks
		L	B	H		
Sub-Head I EARTH WORK						*Refer Fig*. 4.1
1. Excavation for foundations						
Long walls	2	6.20	.90	1.0	11.16	5.60+.60=6.20
Short walls	2	3.40	.90	1.0	6.12	4.0-.60=3.40
Steps in front of door	1	1.30	.75	.15	.15	1+.30=1.30
					17.43	
Total		cub. m.		say		=17.50
Sub-Head II CONCRETE						
2. Cement Concrete in foundations (1:6:18)						
Long walls	2	6.20	.90	.30	3.35	
Short walls	2	3.40	.90	.30	1.84	
Steps	1	1.30	.75	.15	.15	
					5.34	
Total		cub. m.				=5.34
3. Reinforced Cement Concrete (1:2:4)						
Lintels						
Door (1.0 m. x 2.10 m.)	1	1.30	.30	.15	.06	A = .24 sq.m.
Windows (1.0 m. x 1.5 m.)	3	1.30	.30	.15	.18	Bearing 15 cm.
Sun-shades.						
Door	1	1.30	.38	.12	.06	.15+.10
						2
=.12						
Window	3	1.30	.38	.12	.18	
					.48	
Roof Slab: B.F.			cub. m.		0.48	
Room	1	5.90	4.90	.15	4.33	5.0+.60+.15+.15
						=5.90
Total		cub. m.			4.81	=4.81
4. Damp proof course, 4 cm. thick of cement concrete (1:2:4) with 2 coats of biumen.	2	5.70	.35	–	3.99	5.0+.30+.30+.05+ .05=5.70
Long walls	2	4.00	.35	–	2.80	
					6.79	where .05=plinth offset
Short walls						

Deduct Door (1.0 m. x 2.10 m.)	1	1.00	.35	–	0.35 6.44	
Total **Sub-Head IIICONCRETE**		sq. m.			say	= 6.50

5. B.B. in mud mortar in foundations and plinth							
Long walls	1st. step	2	5.90	.60	.20	1.41	5.60+.30=5.90
	2 nd.step	2	5.80	.50	.20	1.16	5.60+.20=5.80
	3 rd.step	2	5.70	.40	.90	4.10	5.60+.10=5.70
Short walls	1st. step	2	3.70	.60	.20	.89	
	2 nd.step	2	3.80	.50	.20	.76	
	3 rd.step	2	3.90	.40	.90	2.80	
Steps in front of Door,	1st. step	1	1.00	.60	.20	.12	
	2 nd.step	1	1.00	.30	.20	.06	
						11.30	
Deduct							
D.P.C vide item 4 above		1	6.50	x.04		.26	
	Total		cub. m.				=11.04
6. B.B. in mud mortar in superstructure							
Long walls		2	5.60	.30	3.5	11.76	
Short walls		2	4.00	.30	3.5	8.40	
						20.46	
Deduct							
Door		1	1.00	.30	2.1	.63	
Windows		3	1.00	.30	1.5	1.35	
R.C.C. lintels marked A in items (3)						.24	
						2.22	
						17.24	
	Total		cub. m.	*Say			= 18.00
SUB-HEAD IV FLOORING							
7. Conglomerate floor, 4 cm. thick over 10 cm. thick cement concrete over 10 cm. thick sand.							
Room		1	5.0	4.0	–	20.0	
	Total	sq.m.					= 20.00

*At certain *places, the quantities coming in fraction are made round figures, keeping in mind the wastage due to handling. But not for steel and* R.C.C

Detail of Work	No.	Measurements			Qty.	Remarks
		L	B	H		
7. (a) Topping, 4 cm. thick of cement concrete (1:2:4)						
Door	1	1.00	.35	–	0.35	
	sq.m.					= 0.35
Total						
SUB-HEAD V WOOD WORK						
8. Deodar wood doors and windows	1	1.00	–	2.1	2.1	
Door	3	1.00	–	1.5	4.5	
Windows					____	
	sq.m.				6.6	= 6.6
Total						
SUB-HEAD VI FINISHING	1	18.00	–	3.5	63.00	5+5+4+4= 18.00
9. Cement plaster 1.25 cm. thick (1:6)	1	20.40	–	4.10	83.64	5.60+5.60+4.60+4.60=20.40 m.
Inside						
Room					_____	
Outside					146.64	
Room						
	1	1.00	–	2.1	2.1	
	3	1.00	–	4.5	4.5	
Deduct					____	
Door						
Windows					6.60	
					____	
		sq.m.			140.04	
		sq.m.	Say			= 140.00
Total						
Net Total						
SUB-HEAD VII PAINTING						
10. Chocolate painting to Doors and windows						
Twice the quantity of doors and windows (item 8)		2x	6.6x	1.30=		
						*Refer Page 23 of Painting
Total						= 17.16

ABSTRACT OF COST					
	Sub-Heads of Work	Quantity	Unit payment	Rate	Cost
	SUB-HEAD I EARTH WORK				Rs. P.
1	Excavation for foundations	17.50 cub. m.	% cub	292.00	17.50
	SUB-HEAD II CONCRETE				
2	Cement concrete in foundations (1:6:18).	5.34 cub.m.	cub.m.	229.00	1222.86
3	Reinforced cement concrete (1:2:4) lintels, slabs including reinforcement upto 90 kg/cub.m. of concrete.	4.81 cub.m.	cub.m.	1301.00	6257.81
4	Damp proof course of cemnt concrete (1:2:4), 4 cm. thick with 2 coats of bitumen, 20/30 penetration at 1.65 kg/sq.m. laid hot and sanded.	6.50 sq.m.	sq.m.	28.00	182.00
	SUB-HEAD III BRICK WORK				
5	B.B. in mud mortar in foundations and plinth.	11.00 cub.m.	cub.m.	289.00	3179.00
6	B.B. in mud mortar in superstructure.	18.00 cub.m.	cub.m.	302.00	5436.00
	SUB-HEAD IV FLOORING				
7	Conglomerate flooring**,** 4 cm. thick over 10 cm. thick cement concrete (1:6:18) 10 cm. thick sand.	20.00 sq.m.	sq.m.	51.00	1020.00
	(a) Topping, 4 cm. thick of cement (1:2:4).	0.35 sq.m.	sq.m.	24.00	8.40
8	**SUB-HEAD V WOOD WORK**				
	Deodar wood doors and windows	6.6 sq.m.	sq.m.	334.00	2204.40
9	**SUB-HEAD VI FINISHING**				
	Cement plaster 1.25 cm. thick (1:6)	140.00 sq.m.	sq.m.	10.00	1400.00
					20927.97
					20927.97
	SUB-HEAD VII PAINTING				
10	Chocolate painting to Doors and windows of an approved quality.	17.16 sq.m.	sq.m.	7.10	121.83
					21049.80
				Total	= 21049.80

UNIT – II
GENERAL SPECIFICATIONS

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

1. GENERAL SPECIFICATIONS OF FIRST CLASS BUILDINGS

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

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

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

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

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

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

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

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

Miscellaneous:-

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

Plinth Area Rate

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

2. GENERAL SPECIFICATIONS OF SECOND CLASS BUILDINGS

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

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

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

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

(b) Back of almirahs.

(c) Top course of parapet.

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

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

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

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

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

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

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

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

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

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

3. GENERAL SPECIFICATION SOR THIRD CLASS BUILDINGS

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

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

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

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

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

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

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

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

4. GENERAL SPECIFICTIONS OF FOURTH CLASS BUILDINGS

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

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

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

Roofing:- Third class mud roof.

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

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

Finishing:- mud and mud plaster inside and outside.

Painting: Two coats of ordinary paint.

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

DETAILED SPECIFICATIONS

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

1. EXCAVATION OF FOUNDATIONS

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

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

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

Foundation in bad soil

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

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

2. EARTH FILLING

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

3. Concrete in foundations

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

3.1. LIME CONCRETE

Ingredients

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

3.1.1. Lime

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

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

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

3.1.**2 surkhi**

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

3.1.3 Aggregate

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

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

3.1.4 Water

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

4. Mixing And Laying

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

5. Tests

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

6. Curing

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

PERMISSIBLE SAFE LOADS OF FOUNDATIONS.

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

…… Ordinary clay …… …… Solid clay …… …… Very hard clay …… ……	

7. USE OF COARSE AAGAGREGATE FOR DIFFERENT TYPES OF CONCRETE

(I) 65mm, Nominal size:

For unreinforced mass concrete word on ordinary work.

(ii) 40mm, Nominal size:

For unreinforced mass work of cement concrete on small jobs over 15 cm minimum dimensions. For reinforced works, it shall be used where the dimension of members exceed 45cm.

(iii) 20mm Nominal size:

Unless otherwise mentioned, if will be used as under-

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

(b) Conglomerate floor.

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

(iv) 15mm Nominal size.

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

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

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

7. CEMENT CONCRETE

8.1 Ingredients

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

8.1.1 Cement

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

8.1.2 Fine Aggregate (Sand)

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

8.1.3. COURSE AGGREGATE

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

8.1.4 WATER

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

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

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

9. LAYING AND CONNSOLIDATION OF CEMENT CONCRETE IN FOUNDATIONS

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

10. FARMA OR BATCH BOX

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

15" x 15" x 9 x 5"/8 = 1.25 cft.

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

11. REINFORCED CEMENT CONCRETE

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

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

12. MIXING

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

13. Reinforcement

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

Figs.8.3,8.4 and 8.5 show the method of bending and overlapping the steel bars.

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

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

15. PLACING AND HANDLING THE CONCRETE

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

16. FORMS AND CENTRING

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

17. LAYING

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

18. CURING

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

19. EXPASION JOINTS

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

20. BEARING

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

21. DAMP PROOF COURSE

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

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

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

BRICK WORK

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

22. **BRICK WORK IN MUD MORTAR**.

23.**1 Bricks**

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

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

23.2 **Mud mortar**

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

23.3 **Joints**

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

23. BRICK WORK IN LILME MORTAR

24.1 **Bricks**

Same specifications as per para 23.

24.2 **Lime mortar**

Ingredients-Lime, Surkhi sand or cinder and water. The proportions upon the ingredients available at site.

General one part of lime and 2 parts of surkhi are suitable.

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

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

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

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

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

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

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

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

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

24. BRICK WORK IN CEMENT MORTAR

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

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

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

25.4 Joints: (Same as per in item 24.5)

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

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

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

BRICK OR TILE FLOORING

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

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

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

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

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

35. TERRAZO FLOORING

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

36. MARBLE FLOORS

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

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

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

37. ROOFING

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

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

DOORS & WINDOWS

Doors and windows may range from the humble ledged and braced doors and windows which are usually, fitted to out houses, to the multiple, paneled and paneled and fitted fitted with ornate molding and paneled, and which are usually associated with the entrances to important buildings.

In all cases the construction shall be such as to ensure that the door shall be satisfactory in service.

46.1 Timber

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

46.2 Panels

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

46.3 Sash Bars

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

47. WHITE WASHING

The surface to be white washed must be clean and smooth and perfectly dry before applying white wash.

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

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

47.1 Colour washing

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

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

48. PAINTING

48.1 Wood work (New)

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

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

DETAILED SPECIFICATIONS OF ROADS

1. Earth filling (Embankment)

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

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

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

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

II.Soling coat

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

3. Width

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

III. Collection of soling

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

4. Stacking

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

5. Stone

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

6. Kankar

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

7. Laying

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

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

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

8. Kankar

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

9. Measurement

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

V.wearing coat (consolidation).

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

11. Measurement

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

Stacking

(Same as per item 4)

VI. Wearing coat (consolidation)

12. Preparation of surface

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

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

13. Spreading of metal

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

14. Rolling and consolidation

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

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

15. Bajri binding

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

17. Camber

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

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

17. Progress

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

18. Test of good consolidation

Rough tests are as below:

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

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

UNIT - III

Qualifications of contractor

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

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

Quotation

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

Tenders

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

Earnest money

It is a guarantee is the shape of money, gives by the contractor along with their tenders, confirming their willingness to work for the department. Mode of money to be is informed by the department 2% of the total estimate.
In case, if the tender of the contractor is not accepted. The money is refunded immediately.

Security money

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

Classification of contracts

The contracts can be classified as under:

(a) Scheduled contract or item rate contract
(b) Lump sum contract
(c) Combination of both

Notice Inviting Tenders (N.I.T.)

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

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

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

Opening of tenders

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

Contract agreement

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

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

Copy of letter from S,E,to contractor

Office of superintending engineer
North circle, P.W.D. Patiala date _____

To
Sh.ABC
Contractor
Patiala

Subject: reference No. _____, construction of panchayat bhawah at Patiala

Reference your tender No._____. Dated _____

Dear Sir,

On behalf of governor of Punjab, I am accepting your tender for the above mentioned work.

Please attend ‘divisional’ office (south) immediately, for instructions regarding taking over the site and commencement of the work.

Please attend this office on _____to complete your contract agreement

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

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

(i) Schedule I and II

(ii) Particular specifications

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

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

Yours faithfully,

UNIT IV

INTRODUCTION, NECESSITY OF VALUATION OF BUILDING, DEFINITION OF TERMS USED, VALUATION OF A BUILDING, CALCULATION OF STANDARD RENT, CONCEPT OF CAPITALIZED VALUE AND YEAR'S PURCHASE, TYPICAL PROBLEMS.

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

Necessity of Valuation

The following reasons necessitates the valuation of property:-

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

(ii) For buying and selling.

(iii) Acquisition of property by Govt.

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

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

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

Roll of an Engineer

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

(a) To e acquired

(b) To be divide

(c) To be allotted to a claim holder.

The following factors require consideration for valuation:-

(i) **Locality:-**

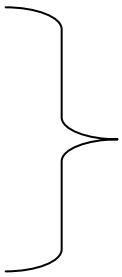
In case a building is located in such an area, where there is easy access to market, schools and is located on road side. The Orientation of the building is according to Engineering rules. It will fetch more cost than a building which is in a neglected condition and is locate at unhealthy site.

(ii) **Structure:-**

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

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

First Class
Second Class
Third Class
Fourth Class



For Details, see chapter on specifications

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(ii) Facility of air and light.

(iii) Facility of drainage of rain water.

(iv) Facility of access.

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

Dominant owner.

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

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

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

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

Building Cost Index:

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

This index depends upon cost of material, labour, transport etc.

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

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

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

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

Where

I = Annual instalment required

N = Number of years required to creat sinking fund.

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

S = Amount of sinking fund.

Example:

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

The annual sinking fund

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

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

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

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

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

Solution:

Cost of the shop = Rs. 20000/-

Less crape value = Rs. 2000/-

Net Rs. 18000/-

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

Annual instalment of sinking fund.

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

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

IMPORTANT TABLE

How to prepare Table I

Example:

Find the amount of Annual Sinking found @ 3% to give Re1/- at the end of 10 years.

Solution:

$$Annual\ Sinking\ \ fund = \frac{i}{(1+i)^n - 1}$$

I = Rate of interest = 3% = 0.03

N = number of years = 10

$$= \frac{.03}{(1+.03)^{10}-1} = Rs.0.0872$$

TABLE I

ANNUAL SINKING FUND

(Amount to be deposited annually at compound interest to return Re 1/ in number of years)

Years	% age Rates				
	3%	4%	5%	6%	7%
1	1.000	1.000	1.000	1.00	1.000
2	0.493	0.40	0.488	0.485	0.483
3	0.323	0.320	0.317	0.314	0.311
4	0.240	0.235	0.232	0.228	0.225
5	0.188	0.185	0.180	0.177	0.174
6	0.155	0.151	0.147	0.143	0.140
7	0.130	0.126	0.123	0.119	0.115
8	0.122	0.108	0.104	0.101	0.097
9	0.098	0.094	0.091	0.087	0.083
10	0.087	0.083	0.080	0.076	0.072
20	0.037	0.033	0.030	0.027	0.024

TABLE II

Amount of Re.1/- kin years @

Years	Compound interest (% age rate)		
	4%	5%	6%
1	1.040	1.050	1.060
2	1.082	1.102	1.124
3	1.125	1.157	1.191
4	1.170	1.215	1.262
5	1.216	1.276	1.338
6	1.265	1.340	1.418
7	1.316	1.407	1.504
8	1.368	1.477	1.594
9	1.423	1.551	1.689
10	1.480	1.629	1.791
20	2.191	2.653	3.207
30	3.243	3.745	5.743
40	4.801	5.816	10.286
50	7.107	9.033	18.420
100	50.505	131.501	339.302

How to prepare Table II

Example:

Calculate the amount available at the end 50 years for Re. 1/- invest @ 4%

Solution:

Amount after years = $(1+i)^n$

N = number of years

I = rates of interest

Amount of Re. 1/- after 50 years@ 4% = $(1+.04)^{50}$ = Rs. 7.107.

Table III

Present value of Rupee @ Compound Interest in given years

Years	% age Rates		
	6%	8%	10%
1	0.943	0.926	0.909
2	0.890	0.857	0.826
3	0.840	0.794	0.751
4	0.792	0.735	0.683
5	0.747	0.680	0.621
6	0.705	0.630	0.564
7	0.665	0.583	0.513
8	0.627	0.540	0.466
9	0.592	0.500	0.424
10	0.558	0.463	0.385
20	0.311	0.214	0.149
30	0.174	0.099	0.057
50	0.054	0.021	0.008
80	0.009	0.002	0.0005
100	0.003	0.0004	0.00007

How to Prepare Table III

Example:

Find out the present value of Re. 1/- in 50 years @ 6%

Solution:

Form Table II, we known Re1/- becames (1+i)n ‘n’ years

$$present\ value\ of\ rupee\ in\ 'n'\ years = \frac{1}{(1+.06)^n}$$

$$present\ value\ of\ \text{Re}1/-\ in\ 50\ years\ @\ 6\% = \frac{1}{(1+.06)^{60}} = Rs.0.054$$

Present value of rupee in ‘n’ years =

Year’s Purchase. It may be defined 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 Re. 1/- at a certain rate of interest can be received”

$$\frac{100}{5} = Rs.20/-\ or\ \frac{1}{.05} = Rs.20/-$$

$$For\ 6\%\ interest\ Y.Ps' = \frac{1}{.06} = Rs.16.67$$

Where I = rate of interest in decimal.

Example:

To get 5% or Rs. 5/- as interest, one will have to deposit Rs. 100/- in the bank and to get Re 1/- per year as interest one will have to deposit.

And so on.

Annuity:-

The return of capital investment in the shape of annual instalments (monthly, quarterly, half yearly & yearly) for a fixed number of years is known as annity.

Market Value:

It is defined as the value which a property can fetch when sold out in open market. This value is variable, depending upon the will to buy or sell.

Book Value:

It is the amount of a property shown in the books, after allowing necessary depreciations year-wise. The book value is independent of market-value.

Deprecation:

A structure, after sometimes gradually losses some of its value due to its constant use and some other similar reasons, such as

(a) The property in neglected condition

(b) The property being away from schools & market

(c) Design being out of fashion

(d) Poor specifications followed which requiring maintenance. The loss thus involve in the value of properties known as Depreciation.

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

Where D = Deprecated Value

P = Present Value

Rd = Fixed percentage of deprecation

N = number of year the building has been constructed in existence

P = Present Value

The present value of building can be found out using any of the following methods

(i) Value depending upon Plinth Area.

This method has already been health with in details in the previous chapters.

The plain the area is multiplied with plinth area rate.

(ii) value from detailed measurement:

Detailed measurements of the building are taken and multiplied by current rates, sub-head-wise. The current rates are taken from schedule of rates and premium is added to it.

(iii) Value from records on M.B

The value of the total construction is found out from the records entered in the measurement book. In this method, old cost is noted and is multiplied by the increase in price index i.e. percentage of increase.

Rd = Fixed percentage of depreciation

Experience has also shown that the time passes, due to constant use, wear and tear, the cost of the building depreciates. This depreciation increases with the time. The following are the values of rd for different structures.

Structure with 80-100 years life rd = 1

”	”	70-75	”	”	” = 1.3
”	”	50	”	”	” = 2
”	”	25	”	”	” = 4
”	”	20	”	”	” = 5

A = Life of Structure

Experience has also shown that well contracted structure can last upto 100 years. This life depends upon the durability of various materials used. Thus by seeing specification the life of a structure can be found out. The following chart shown expected life of the various materials and constructions.

The following are the various methods of valuation:

a) Depreciation method of valuation
b) Valuation based on cost
c) Valuation based on profit
d) Valuation by Development method
e) Rental method of valuation

a) Depreciation method of valuation

In this method, the structure is divided into four parts for calculating depreciation:

i) Walls
ii) Roofs
iii) Floors
iv) Doors and Windows

The measurement is done accurately and the cost is found out using current rates. Life of each portion is found out using Table A. to find out depreciated value, the formula used is

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

where all the values are given, 'D' can be calculated.

This value does not in clued cost of land, water supply, sanitary fitting, electric installations etc.

The cost of above items are added to get the total valuation of property.

The table C gives calculate values of depreciation for different values of 'n' and 'rd'.

Table C

rd → n↓	**1**	**1.3**	**2**	**4**	**5**
20	.818	.770	.668	.442	.358
30	.740	.675	.546	.294	.214
40	.670	.593	.446	.195	.125
50	.605	.520	.364	.130	.077
60	.547	.456	.298	.086	.046
70	.495	.400	.243	.057	.027
80	.447	.351	.199	.038	.016
100	.366	.270	.133	.017	.006

Problem I:

The estimated cost of a building is Rs. 20,000. It is 20 years old & well maintained. The life of the structure is assumed to be 80 years. Work out the cost of building for acquisition solution.

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

where P =Rs.20,000/-, rd = 1, n=20

$\therefore$ D = 2000 $\left(\frac{100-1}{100}\right)^{20}$ = Rs.16400/-

$\therefore$ Depreciated value = Rs.16400/-

Problem II

A plot measures 500 sq.m. The built up area is 300 sq.m. The plinth area rate of this 1st class building is Rs.600/- per sw/metre. This rates includes cost of water supply, sanitary and electric installation. The age of the building is 40 years. The cost of the land is Rs.80/- per sq.m.

Solution

Cost of land = 500 x 80 = Rs.40,000/-

Cost of building = 300 x 600 = Rs. 1,80,000/-

Life of a building is given 40 years. So rd = 2. The depreciated value,

$$= 1,80,000\left(\frac{100-2}{100}\right)^{40}$$

= 1,80,000 x .466 = Rs. 80280/-

Total value of property = 50280 + 40000 = **Rs. 120,280/-**

Second Method

Assuming that a property loses its value by same amount every year, the formula for depreciation is as below:

$$D=\frac{C-S}{n}, \text{where } D=\text{Depreciated value}$$

C = Original cost, S=Scrap value

n = life of the property

Example

A building is situated on Ambala-Kalka road and costs Rs.38,000/-, considering its scrap value as 10% of the cost and life as 80 years. Find out depreciated value if the life of the building is 20 years.

Solution

$$D=\frac{D-S}{n}$$

*C=Rs.38,000/-, S=10% or Rs.3,800/-, n = 80 years.

$$D=\frac{38000-3800}{80}=Rs.428/-\ per\ year$$

∴ In 20 years = 428 x 20 = Rs. 8560/-

∴ Value of property = 38000 – 8560/-

= Rs.29440/-

b) Valuation based on cost

In this method, the actual cost of the construction is found out and valuation is done after considering depreciations and also caring for type of construction and design of the construction.

c) Valuation based on profit

Under this sub-head, valuation of cinemas, theatres, hotels, banks, big shop etc. Located at sui9table places is done where profit is of capitalized value. The capitalized value is calculated by multiplying year's purchase with net profit. The net profit is worked out after deducting all possible outgoings and expenditures from the gross income. In such cases the cost will be too high as compared with the cost of construction actually incurred.

d) Valuation by development method

This method is also used for working out the value of a building. In certain cases, some additions, alterations and improvements are carried out which increases the cost of the building. The valuator should be careful while doing evaluation about this.

In cases, when the building is still under development. In this case the future development of the building and profits from it should be anticipated while evaluating.

e) Rental method of valuation

Rent of a building is used as a base for calculating value of a building. In this method the net income by the war of way of rent is found out after deducting all out goings from the gross income. A suitable rate of interest prevailing in the

market is also to be assumed of such type of buildings. Based on the above rate of interest, the Y' P. is obtained. The net income is multiplied with Y's P. to obtain capitalized value.

FIXATION OF RENT

a) Government residential bungalows or quarters

Every govt official occupying govt. accommodation has to pay rent which is called standard rent or 10% of his pay, whichever is less. The practice in P.W.D. is that when a net residential building is constructed, a ren … I statement is attached with the estimate, which will give the calculations of rent to be fixed. The total expenditure incurred on the construction i.e., cost of the building, cost of water supply, sanitary and electric installations etc. are calculated @6% interest and divided it by 12, which will give rent per month. This is also known as Standard Rent.

Note: If a land is purchased for the construction of the building, its cost should also be added while calculating the Rental statement.

b) Private property or Building

In case of private properties, the Net income is worked out by dividing the capitalized value by a proper figure or year's purchase. To get the gross rent, outgoings such as annual repairs, municipal which will give rent per month. This is also known as standard rent.

In case of private properties, the rent depends upon the situation, demand, type of construction, accommodation and facilities provided. For example a property used for Hotel, Cinema, Bank or Shop, located in the main market will fetch more rent than actually calculated.

Problem I

The present value of a property is 20,000/-, Calculate the standard rent. The rate of interest may be assumed as 6%.

Solution

$$\text{Annual rent @ } 6\% = \frac{20,000 \times 6}{100}$$

$$= Rs.1200/-$$

$$\therefore \text{ Standard rent per month } = \frac{1200}{12} = Rs.100/-$$

Problem II

A residence is to be constructed over a plot of land measuring 600 sq.m. The byelaws permit a 30% of covered area. The constructions to be done is of A class specifications. Also add for services @30% of the total cost. The water supply is from a common source. Prepare rental statement also.

Solution

Covered area = 30% of 600 sq.m. = 180 sq.m.

Rough cost estimate = 180 x 500 = Rs.90,000/-

(Rs.500-Rate per sq.m)

Add for services @ 30% = Rs.27,000/-

Total = 90,000 + 27,000 = Rs.1,17,000/-

RENTAL STATEMENT

Average Salary of the tenant	Cost of Building	Cost of Service	Total	Rent @ 6%	Rent @ 10%	Rent to be charged
Rs. 1200.00 per month	Rs. 90,000/-	Rs. 27,000/-	Rs. 1,17,000	$\frac{1,17,000 \times 6}{100}$ = Rs.7020/- ∴ standard rent = $\frac{7020}{12}$ = Rs. 585/-	$\frac{1200}{10}$ =Rs.120/-	Standard rent or 10% of the Salary, whichever is less. In this case Rs.120/-

Loss = Rs. 585 – Rs. 120 = Rs.465/-

Problem III

An R.C.C framed structure building having estimated future life of 80 years, fetches a gross annual rent of Rs.2200/- per month. Work out its capitalized value on the basis of 6% net yield. The rate of compound interest for sinking fund may be 4%. The plot measures 400 sq.m. & cost of land may be taken as Rs.120/- per sq.m. The other out goings are:

i) Repair & maintenance = $\frac{1}{12}$ of gross income

ii) Municipal & property taxes = 25% gross income

iii) Management & miscellaneous = 7% gross income

The plinth area of the building is 800 sq.m. & cost per sq.m. may be taken as Rs.500/- per sq.m.

Solution

Gross annual rent = 2200 x 12 = Rs. 26400/-

Rate of compound interest = 4%

Life of the building = 80 years

Cost of the building = 800 x 500 = Rs. 4,00,000/-

Out goings:

i) Repair & maintenance = $\frac{1}{12} \times 26400$ = Rs. 2200/-

ii) Municipal Taxes $= \frac{25}{100} \times 26400$ = Rs. 6600/-

iii) Management & Miscellaneous $= \frac{7}{100} \times 26400 =$ Rs. 1848/-

iv) Sinking Fund $\frac{4,00,000 \times .04}{(1+.4)^{80} - 1}$ = Rs. 731/-

Total Outgoings (i+ii+iii+iv) = Rs. 11379/-

Net income = Rs. 26400 – 11379

= Rs. 15021/-

Capitalized Value = Y's.P. x Net income

Where Y's P. = 6%

$\therefore$ Capitalized value $\frac{100}{6} \times 15021$ **= Rs. 250350**

Problem IV

Calculate the annual rent of a building with the following data:

Cost of Land = Rs. 20,000/-

Cost of building = Rs. 80,000/-

Estimate life = 80 years

Return expected = 5% on land

6% on building

Annual repairs are expected to be 0.8% of the cost construction and other out goings will be 25% of the gross rent. There is no proposal to set up a sinking fund. *(Haryana 1975)*

Solution

Amount of return required on land @ 5% of Rs.20,000/- = Rs. 1000/-

Amount of return required on building@ 6% of Rs.80,000/- = Rs. 4800/-

$\therefore$ Net Income = Rs. 5800/-

Let gross rent per annum = x

Amount of annual repairs 8% of Rs. 80,000/- = Rs. 640/-

Amount for other repairs = .25x

Net income = Gross income – Outgoings.

$$5800 = x - 640 - .25x$$

$$5800+640=.75\ x$$

$\therefore$ x $x = \frac{6440}{.75} = \text{Rs.}8586\ \text{per annum}$

$\therefore$ Rent per month $= \frac{8586}{12}$ = Rs. 715.50

Problem V

Calculate standard rent of a building with the following data:

i) Cost of land	= Rs. 40,000/-
ii) Cost of building	= Rs. 50,000/-
iii) Expected life of building	= 60 years
iv) Return expected	= 5% on land 8% on building
v) Annual repairs	= @ 10% on the cost of building
vi) Sinking fune	= @ 30 of the return from building

UNIT – V

INTRODUCTION

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

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

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

Cash Book

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

Maintenance of Cash Book

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

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

1. All transactions should be maintained in the cash book by Divisional Engineer or S.D.E. as a regular arrangement.
2. All entries in the cash book must be made day by day in the concise and clear manner and transactions invariably recorded at the time and on the date on which they actually occur and strictly in order of their occurrence.
3. Interpolation of entries should be avoided but when it becomes necessary to make an entry between two ruled lines or make any addition or alterations, these entries should be duly attested with signatures.
4. Incorrect entries should be crossed and correct entries written should be duly attested with dated initials of the disbursing officer.
5. The S.D.E. should see that no line is left blank and also between two entries. The same blank space should be cancelled with diagonal lines.
6. On payment side, there are two money columns, column 9 is meant for cast payment while columns 10 and 11 for payment by cheques.
7. The cash in chest must be kept as low as possible.
8. The cash book must be checked by S.D.E. daily or whenever he is available at his sub-division, with reference to vouchers and receipts (P.W.A. 3). After checking both sides accounts, dated initials should be put under last entry.

9. When a cheque is issued to add cash in the chest, its amount and number are recorded on payment side. The account is simultaneously entered on receipt side as cash from treasury.
10. When a new cheque is issued against a Time barred or lost cheque, the entry in red ink is made in column 8 only. The amount of the cheque is not to be shown in column 11. A certificated of "Non-payment" from the bank is necessary before issuing a new cheque.
11. When a cheque previously issued is to be cancelled, a minus entry in column 11 should be shown. A cross reference against original entry is necessary. Reason of cancellation should also be given.
12. If an officer issues a cheque on tour he should enter the payment as soon as he reaches the head quarters, in column 1, the entry is made as date of entry of cheque/date of issue of cheque.
13. Temporary advance or Imprest given should be entered in column 8, in red ink. The amount is not entered in column 9 as it still forms the part of cash. In the column of money, only increase or decrease of imprest is recorded.
14. Balancing: The cash book should be balanced on the date prescribed for closing of cash book accounts of the month. It is advisable to have weekly balancing if entries are numbered.
15. The details of actual cash found at the monthly counting should be recorded in form P.W.A. 2 and a certificate of the reconciliation of book balance with the actual one recorded below the closing entries of the month.

16. Whenever it is found that cash in the chest is not as per balance of the cash book, it should unless the error can be detected, be set right at once, be rectified forthwith by making the necessary receipts or payment entry. “To cash found surplus” under public works deposit or “Under miscellaneous P.W. Advances”. As the case may be.
17. The actual balance of cash in each chest should be counted on the last working day of each month.
18. The details of actual balance should be recorded and a certificate of the count of cash specifying both in the words and figures, the actual cash balance (excluding imprest an temporary advance) and reconciliation of the balance so counted with the book balance should be recorded below the entry of each month.
19. The cash book should always be kept under lock and key.

Subsidiary Cash Book

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

Debit & Credit

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

Common Irregularities In Writing A Cash Book

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

(a) Blank space left between two consecutive lines

(b) Corrections not initialed with date

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

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

(e) Cash book not checked by Executive Engineer

(f) Detail of balance not correct

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

Imprest

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

Mainterance of Imprest Account

1. The fixed amount of imprest is entered in red ink in column 5. If additional amount is taken during the month, it is also entered in the same way.
2. Entry for payment should be done strictly in accordance with their occurrence.

3. Vouchers for payments should be kept as a proof of payment and a certificate on it, “paid by me”, should also be given.
4. For keeping record of imprest, no other advance should be mixed with the imprest amount.
5. The column 3 of the form is meant for full description of the work done or supplies made and name of the work for which purchase has been done.
6. Account of imprest should be closed at least 2 days before the closing of cash book.

Imprest Cash Accounts

Impreset cash book of Sh…….

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

Temporary Advance

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

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

Treasury Challans

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

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

MISCELLANEOUS

Cash Balance Reports

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

i) That there is no large cash balance

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

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

Cancellation of Cheques

The following reasons result in cancellation of a cheque

i) Timebarred cheques

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

iii) Wrong issuance of cheque.

iv) Writing mistake detected after issuance of cheque

When a new cheques is issued in place of a cancelled cheque. A red ink entry on the payment sid of the cash book is done. It is also very important to write this fact on the counter foil of the original cancelled cheque issued.