ESTIMATION AND COST EVALUATION – 2

SEMESTER-6^{th}

Scanned with CamScanner

CH8APTER-1

TOPIC: RCC DECK SLAB CULVERT WITH SPLAYED WING WALL

ABSTRACT OF ESTIMATED COST

Item No.	Description of item	Quantity	Unit	Rate Rs. P.	Unit of Rate	Amount Rs. P.
1.	Earthwork in excavation in foundation depth not exceeding 1.5 m below G.L. ...	78.86	cu m	9.00	cu m	709.74
2.	Cement concrete in foundation (1:3:6) ...	28.30	cu m	700.00	cu m	19,810.00
3.	1st. class brickwork in cement mortar (1:4)	115.58	cu m	650.00	cu m	75,127.00
4.	Cement concrete M-15 for R.C.C. work ...	20.90	cu m	900.00	cu m	18,810.00
5.	Hire charge for shuttering and staging ...	33.00	sq m	60.00	sq m	1,980.00
6.	Supplying Tor Steel including bending binding and placing in position ...	1.20	Qtl	950.00	Qtl	1,140.00
7.	Cement concrete (1:2:4) coping finished with cement plaster (1:4)	11.50	sq m	40.00	sq m	460.00
8.	Rule pointing with cement mortar (1:3) ...	166.40	sq m	10.00	sq m	1,664.00
9.	Double layer 1st. class brick flat soling including brake joints with cement mortar ...	30.00	sq m	80.00	sq m	2,400.00

Total = Rs. 1,22,100.74
Add 5 % contingency = Rs. 6,105.04
$2\frac{1}{2}$ % W.C. = Rs. 3,052.52
Estimated cost = Rs. 1,31,258.30

10.26 Process of calculations to estimate quantities of earthwork, concretework and masonrywork for (1) Abutments, (2) Wing walls and (3) Return walls of a splayed Culvert or Bridge.

(1) Abutments : – For earth or concretework : —

(a) *Length* = Roadwidth + 2 (parapet thickness + one side end offsets).
End offsets for one end = Summation of inner foundation offsets+offset due to inner battering if any.
(b) *Breadth and depth* are shown in the section of the abutment.

For Masonrywork below G. L.

(a) *Length* = Same as concretework as above – 2 x offset of concrete.
Length for each individual offset differ and should be calculated individually by deduction of the projections from the each end.
(b) *Breadth and depth* for each individual offset are shown in the section of the abutment.

For masonrywork above G. L.

(i) With vertical inner face : –

(a) *Length* = Roadwidth + 2 parapet thickness (outer face battering should not be accounted if any).
(b) Breadth and depth are as shown in the section.

(ii) With battered inner face : –

When the inside face of Abutment is continued to wing wall the extra bottom length due to batter may be considered as if included in the wing wall i.e. the two walls join on a vertical plane.
(a) *Length* = Road width + 2 parapet thickness.
When the width of Abutment at the ends is not equal to the inclined width of the wingwall joining with abutment as shown in fig 10-28.
Length = $\frac{1}{2}$ (Top length + Bottom length).
Bottom length = Top length + 2 x offset due to inner batter face of Abutment.

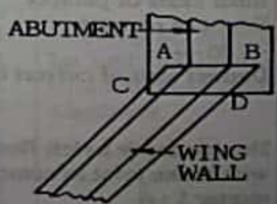


FIG. 10-28

Scanned with CamScanner

(2) **Wing walls** : - The thickness and height of the wall is maximum at the junction with its abutment and both the dimensions are gradually reduced to the section as that at return wall with which it joins.

For earth or concrete work

Following Fig. 10-29 consider the end of excavation is up to the line RS. We have to find out the quantity for the are ADSR.

(a) *Length* = Y + offsets from the outer edge of return wall

(b) *Breadth* = $\frac{1}{2}$ (AD + RS);

AD is the inclined trench width of wing wall parallel to the centre line of the road and generally the trench width of the abutment. If not equal, the offset (as shown in Fig. 10-28) is mentioned.

RS = Inclined foundation trench width of Return wall parallel to the centre line of the road.

= Foundation width of Return wall x $\sqrt{\Sigma \text{ sq. of prop. of splay}}$.

Usually, the proportion of splay X : Y = 1:1 (for 45°)

$\sqrt{\text{sq. of prop. of splay}} = \sqrt{1^2 + 1^2} = \sqrt{2}$

Thus when the ratio X : Y = 1:1$\frac{1}{2}$ then the multiplying factor $= \sqrt{1^2 + 1.5^2} = 1.80$

(c) *Depth* = usually the same depth of excavation as that of abutment is provided.

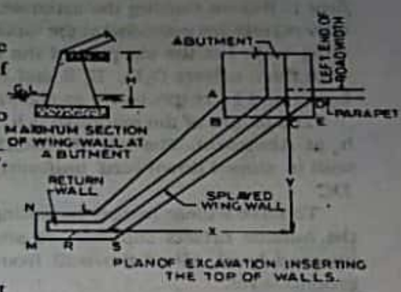


FIG. 10-29

Deduction for end offset of Abutment :- During excavation for Abutment the portion ABCD (see Fig. 10-29) has already been excavated. Therefore, the volume of work for this portion should be deducted from the volume of work for the wing wall. Now AD = Foundation width

$$BC = AD - CE \; ; \; CE = DE \times \frac{X}{Y}$$

∴ **Deduction** for Abutment offset = $\frac{1}{2} \times [\text{ trench width} + (\text{ trench width} - \text{offset} \times \frac{X}{Y})] \times \text{depth}$.

For concretework the depth of concrete instead of depth of earthwork shall be considered.

For masonrywork below G. L.

(a) Length = Y + offset of masonry in foundation of return wall

(b) Breadth = same process as that of earthwork

(c) Depth = thickness of the footing.

The construction of wingwall may be with its battered inner and outer faces starting from the top of the foundation concrete up to top (as shown in Fig. 10-29). In such cases the whole mass shall be calculated in one operation considering this as *Frusta of Pyramid* , erected vertically on AD as base.

Volume = $\frac{h}{3}(A_1 + A_2 + \sqrt{A_1A_2})$, where, A_1 and A_2 are the areas of ends, i.e. vertical sectional area. At Abutment and at the end ; h is the measurement of Y.

Deduction for end offsets of Abutment :- Following the same procedure as in the case of earthwork. deduction for Abutment offset for the corresponding footing of wing wall = $\frac{1}{2} \times [\text{width of Abut. footing} + (\text{width of Abut. footing} - \text{projection} \times \frac{X}{Y}] \times \text{depth}$. The projection is from top face of the Abutment up to the edge of the corresponding footing.

26

Scanned with CamScanner

For masonrywork above G. L.

Wing walls above G.L. may have the following shapes :- (i) Inside face vertical or battered but at the outer face with offsets; (ii) Both the faces are battered.

(i) Inside face vertical with offsets at the outer-face :- Before starting the estimate, let us clarify how offsets are provided at the outside face of the wing wall. Let the top plan of the wall is ABCD with three offsets D_1D, E_1E and F_1F of lengths L_1, L_2 and L_3 respectively as shown in Fig. 10-30

The height of the wingwall is h_1 at the end and h_2 at Abutment. The top of ABCD of the Wing wall is sloped downward uniformly from AB to DC

To have a clear picture regarding the shape of the outside offsets suppose we are to reach the inclined level AF of the wall from the left side ground level.

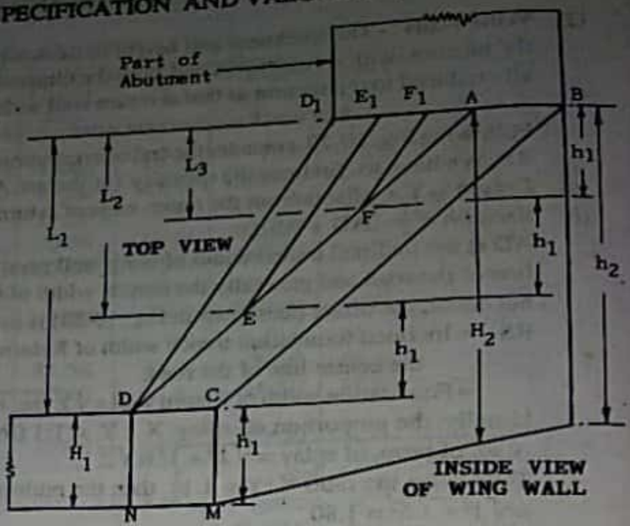


FIG. 10-30

For this purpose three numbers steps ADD_1, AEE_1 and AFF_1 are constructed with a uniform rise h_1, when $h_2 = 4h_1$

The second step AEE_1 is constructed over the first step ADD_1 and similarly the third step AFF_1 over AEE_1. Now by crossing the three steps from the left we have reached to the height of $F = 3h_1$. The difference of level between the points F_1 and A is also h_1.

But, actually these triangular steps are known as offsets of the wing wall. The projections are shown on plan and height on elevation drawn by the side of the section of the Abutment. The purpose of these offsets is to strengthen the core part ABCD of the wing wall.

Masonrywork above G. L. excluding offsets but including inside batter : –

Considering the mass as Frusta of Pyramid, $V = \frac{h}{3}(A_1 + A_2 + \sqrt{A_1A_2})$. The notations are same as given before. When there be no battered at the inside face, the volume for the rectangular mass within the same inclined width through its length shall be calculated for different height at the ends by ordinary method, i.e., average depth x inclined breadth x straight length.

Referring to the Fig 10–30.

Vol. of 1st. offset $= \frac{h}{2} L_1 \times AD_1 \times h_1$, Vol. of 2nd. offset $= \frac{h}{2} L_2 \times AE_1 \times h_1$ and Vol . of 3rd. offset $= \frac{h}{2} L_3 \times AF_1 \times h_1$.

Note that the height h_1 may not be uniform in all cases.

Deduction of Abutment offset :- When the width of Abutment at the ends is not equal to the inclined width of the wing wall as well as the inside face of the Abutment is battered then the length of the Abutment includes the offsets at the end. In this case deduction for the offset projection is made from the volume of wing wall.

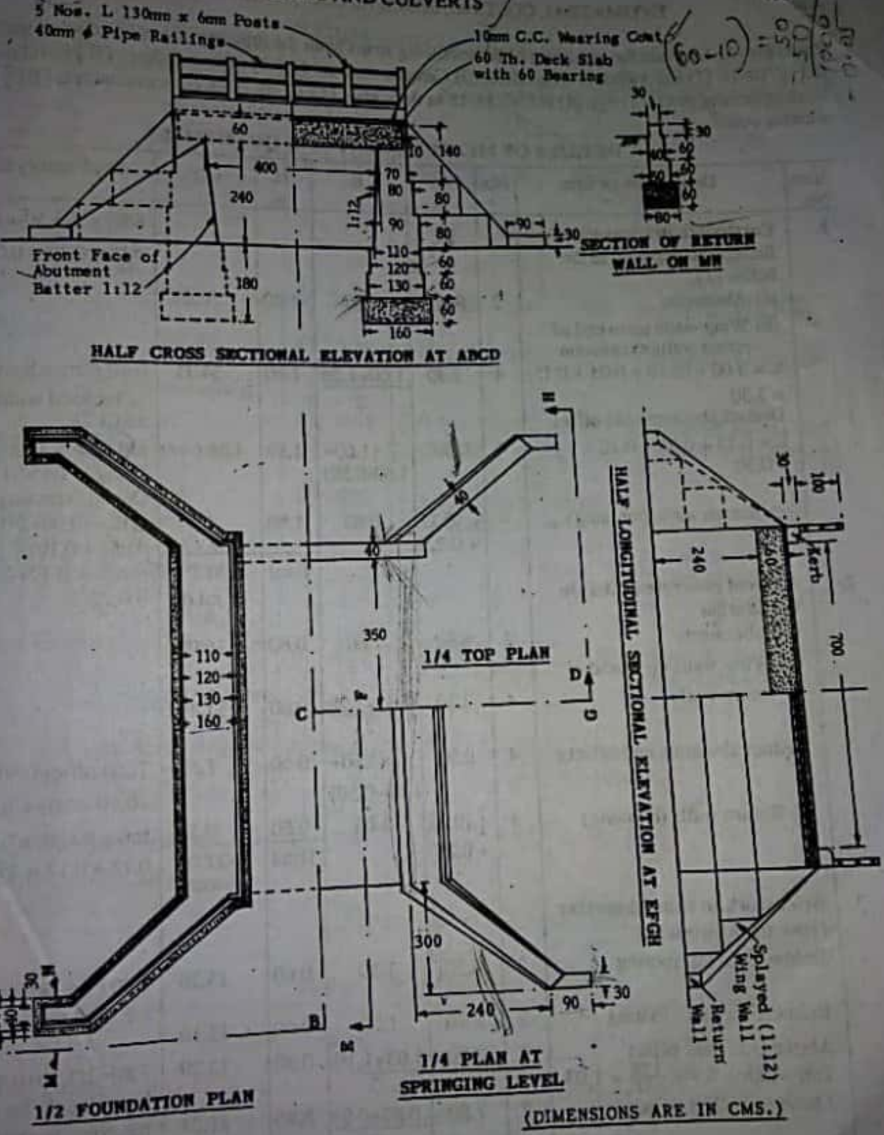
(3) Return wall :-

For earthwork in excavation

Length = Average length for the RMNL (see Fig. 10-29.) $= \frac{1}{2}$ (RM + NL)

RM = MS – RS. Length of RS is calculated previously. NL = RM + MN x $\frac{X}{Y}$. MN is the trench width.

Scanned with CamScanner



SLAB CULVERT

FIG. 10-31

Scanned with CamScanner

Example -5. Estimate the quantities of the following items from the drawing of a splayed wing wall shown in Fig. 10-31. (1) Earthwork in excavation, (2) Cement concrete (1:3:6) in foundation, (3) First class brick-work in cement mortar (1:6), (4) R.C.C. M-15 in deck slab, (5) 10 cm thick cement concrete ($1:1\frac{1}{2}:3$) wearing coat.

DETAILS OF MEASUREMENT AND QUANTITIES

Item No.	Description of item	No.	L. m	B. m	H. m	Qty.	Explanatory notes
1.	**Earthwork in excavation in foundation depth up to 2m below G.L.**						$8.80 = 2(3.50 + 0.40 + \frac{2.40}{12} + 0.10 + 0.05 + 0.15)$
	(a) Abutment ...	2	8.80	1.60	1.80	50.69	
	(b) Wing walls up to end of return walls excavation $L = 3.00 + (0.10 + 0.05 + 0.15) = 3.30$	4	3.30	$\frac{1.60+1.28}{2}$	1.80	34.21	0.80 is trench width ∴ Inclined width up to end 1.28 $= 0.80 \times \sqrt{1.25^2 + 1^2}$
	Deduct abutment end offset $L = 0.15 + 0.05 + 0.10 + \frac{0.40}{2} = 0.50$	4	0.50	$\frac{1}{2}$(1.60+ 1.60-0.50)	1.80	4.86 (-ve)	Splay is 1.25 : 1
	(c) Return walls (remaing) ...	4	$\frac{1}{2}$ [0.12 + 0.22]	0.80	1.80	0.97	Outside remaing length 0.12 =[0.90+2 (0.15 + 0.05) + 0.10] − 1.28 Inside = 0.12+0.12x $\frac{2.4}{3.0}$ = 0.22
					Total	81.01 cu m	
2.	**Cement concrete (1:3:6) in foundation**						
	(a) Abutments ...	2	8.80	1.60	0.60	16.90	
	(b) Wing walls up to end of return walls ...	4	3.30	$\frac{1.60+1.28}{2}$	0.60	11.40	
	Deduct abutment end offsets	4	0.50	$\frac{1}{2}$(1.60+ 1.60−0.50)	0.60	1.62	Total offset 0.50 = $\frac{0.40}{2}$ +0.10 +0.05 + 0.15
	(c) Return walls (remaing)	4	$\frac{1}{2}$(0.12 + 0.22)	0.80	0.60	0.32	Inner length = 0.22 $0.12 + 0.12 \times \frac{2.4}{3.0}$
					Total	=27.00 cum	
3.	**Brickwork in cement mortar (1:6) (a) Abutments**						
	Below G.L. 1st. footing ...	2	8.50	1.30	0.60	13.26	8.80 (as earthwork) − 2×0.15
	Below G.L. 2nd. footing ...	2	8.40	1.20	0.60	12.10	
	Above G.L. 1st. offset ... Top width = $0.9 + \frac{1.60}{12} = 1.03$	2	7.80	$\frac{1.03+1.10}{2}$	0.80	13.29	7.80=2(3.50+0.40)
	Above G.L. 2nd. offset Bottom width = $0.80+\frac{1.60}{12}=0.93$ Top width = $0.80 + \frac{0.80}{12} = 0.87$	2	7.80	$\frac{0.87+0.93}{2}$	0.80	11.23	Extra length for battering is accounted in wing wall.
					C. O.	49.88	

Scanned with CamScanner

Item No.	Description of item	No.	L. m	B. m	H. m	Qty.	Explanatory notes
	B. F.					49.88	
	Above G.L. top wall	2	7.80	$\frac{0.77+0.70}{2}$	1.40	16.05	
	Bottom width $=0.70+\frac{0.80}{12}=0.77$						
	Deduct bearing of deck slab	2	7.80	0.60	0.60	5.62(-ve)	
	(b) Wing walls up to end. of return wall						Incline width
	Below G.L. 1st. footing ...	4	3.15	$\frac{1.30+0.80}{2}$	0.60	7.94	$0.80=0.50\sqrt{1.25^2+1^2}$
	Below G.L. 2nd. footing ...	4	3.10	$\frac{1.20+0.64}{2}$	0.60	6.84	$0.64=0.40\sqrt{1.25^2+1^2}$
	Deduct abutment end offsets						
	For 1st. footing ...	4	0.35	$\frac{1}{2}(1.30+1.30-0.28)$	0.60	0.97(-ve)	For splay 2.4 as x and 3.0 as y. $0.28=0.35\times\frac{2.4}{3.0}$
	For 2nd footing ...	4	0.30	$\frac{1}{2}(1.20+1.20-0.24)$	0.60	0.78(-ve)	
	Above G. L. The whole section with parallel inclined width considered as Frusta of pyramid Vol. $=\frac{h}{3}(A_1+A_2+\sqrt{A_1A_2})$ $A_1=\frac{1}{2}(0.96+0.64)\times 2.4=1.92$ $A_2=\frac{1}{2}(0.68+0.64)\times 0.30=0.20$	4	$\frac{2.70}{3}$	$(1.92+0.20+\sqrt{1.92\times 0.20})$		9.86	Top inclined width = $0.40\times1.6=0.64$ Bottom width at abutment $=0.64+\frac{2.4}{12}\times1.6=0.96$ Bottom width at the end $=0.64+\frac{0.30}{2}\times0.3=0.68$
	(c) Return wall (remaining portion a trapezium) $1.54=0.90+(0.90-0.40\sqrt{1^2+1.25^2})$	4	$\frac{0.90+1.54}{2}$	0.30	0.30	0.44	
					Total	=83.64cum	
4.	R.C.C. M-15 in deck slab	1	7.80	5.20	0.60	24.34cum	
5.	10 cm thick cement concrete $(1:1\frac{1}{2}:3)$ wearing coat ...	1	7.00	4.40	0.10	3.08cum	

...of Quantities

TOPIC: QUANTITY OF STEEL FOR DECK SLAB WITH BAR BENDING SCHEDULE

Approximate estimate of wing walls and parapet —

Note : The wing walls and parapet may be estimated approximately by taking the mean length which may be taken as the length of the 3rd step which is equal to 2.85 m, and this mean length multiplied by the breadth and the height of the different steps will give the quantities. The length column will remain same. The length of one middle step of the wing wall can be found easily in the same method as given inthe previous page, without much labour and time. The quantities of masonry work in wing walls and parapets may thus be calculated as :—

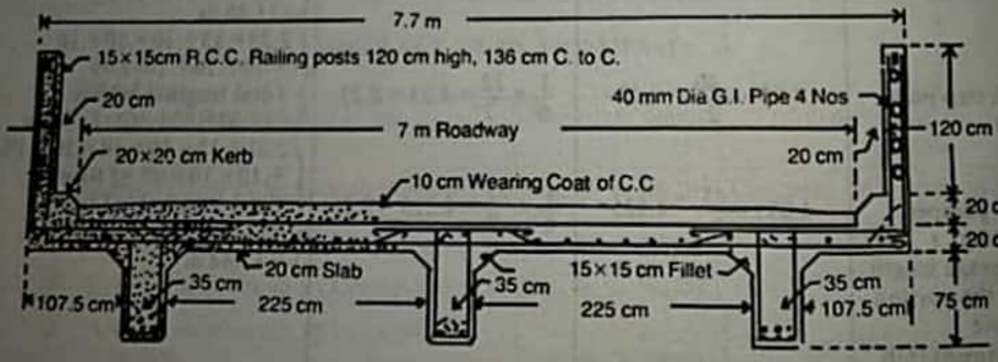
Details of work		No.	L. m	B m	Ht. m	Qntty. m³
Wing walls—						
1st step	...	4	2.85	1.00	.30	3.42
2nd step	...	4	2.85	.90	.70	7.18
3rd step	...	4	2.85	.80	.50	4.56
4th step	...	4	2.85	.70	.60	4.79
5th step	...	4	2.85	.60	.70	4.79
6th step	...	4	½ [2.85+2.85+.90+1.80)]=4.20	.50	.70	5.88
7th step above crown full length	...	2	2(2.85+.10)+(3.60+.90+.90)=11.30	.50	.70	7.91
8th step parapet full length	...	2	11.30 (same as 7th step)	.40	.40	3.62
9th parapet coping	...	2	11.30+(2×.05)=11.40	.45	.20	2.05
				Total...	44.20	cu m

The quantity of wing walls and parapets as calculated corrected in pages 392.393 works out as 44.12 cu m. The difference in between the correct quantity and approximate quantity comes to 44.20 – 44.12=0.08 cu m. For practical purposes to save labour and calculations approximate method may be adopted.

Example 5. —Estimate the cost of R.C.C.T-beam decking including beam for a bridge of one span of 6 metre section is given (Fig. 8-12). Assume 45 cm bearing on either abutment. The mild steel reinforcements are 2.5 per cent in beam and one per cent in slab and post. Density of mild steel is 78.5 quintal per cu m (7.85 g/cm²)

Assume suitable rates.

R.C.C. T-BEAM DECKING



SECTION

Reinforcement – Beam 2½% Slab and Posts 1%

Fig. 8-12

Scanned with CamScanner

Details of Measurement and Calculation of Quantities (Ex. 5)

1	R.C.C. work 1:2:4 excluding steel and its bending but including centering and shuttering and binding of bars—						Length of beams =clear span+2 bearings =6.00+2×.45 =6.90 m
	T-beam ribs ...	3	6.90	.35	.75	5.434	45 cm bearings
	Fillets ...	3×2	6.90	½(.15×.15)		0.466	Triangular
	Deck slab ...	1	6.90	7.70	.20	10.626	
	Railing posts ...	6×2	.15	.15	1.20	0.324	6 posts each side.
	Kerbs ...	2	6.90	.35	.20	0.966	
					Total	17.816 cu m	
2	R.C.C. 1 : 2 : 4 in wearing coat ...	1	6.90	7.00	.10	4.83 cu m	10 cm average thickness.
3	40 mm dia. G.I. Pipe in railing ...	2×4	6.90	—	—	55.20 r m	
4	Steel reinforcement bars including binding—						
	Beam @2½% ...	3	×6.90×	.35×.95	$\frac{2.5}{100}$	78.5= 13.50 q	Full depth including slab thickness.
	Slab @ 1%		10.626	$\times\frac{1}{100}$	78.5=	8.34 q	
	Railing posts @ 1%		0.324	$\times\frac{1}{100}$	78.5 =	0.26 q	
					Total	22.10 q	

ABSTRACT OF ESTIMATED COST (Ex. 5)

Scanned with CamScanner

CHAPTER – 2

TOPIC: DETAILED ESTIMATE OF SIMPLE TYPE OF VERTICAL FALL TO GIVEN SPECIFICATION

Item No.	Particulars	Quantity	Unit	Rate Rs. P.	Per	Amount Rs. P.
1	Earthwork in excavation ...	63.42	cu m	350.00	% cu m	221.97
2	Cement concrete 1 : 4 : 8 with brick ballast ...	11.89	cu m	375.00	/ cu m	4458.75
3	First class brickwork in 1 : 4 cement mortar ...	25.91	cu m	365.00	/ cu m	9457.15
4	R.C.C. slab including steel reinforcement complete work ...	2.90	cu m	775.00	/ cu m	2247.50
5	10 cm thick brick floor in 1 : 3 cement mortar with 1 : 2 cement pointing ...	20.28	sq m	40.00	/ sq m	811.20
6	Cement struck pointing with 1 : 2 cement mortar in walls ...	61.54	sq m	5.60	/ sq m	344.62
7	10 cm dry brick pitching with straight over burnt brick ...	24.36	sq m	12.00	/sq m	292.32
	Total ...					17833.51
	Add 5% for Contingencies and Workcharged Establishment ...					891.68
	Grand Total ...					18725.19

FALL

Irrigation channels are given certain longitudinal slope to develop certain velocities depending on the nature of soil and silt content in water. Steeper longitudinal slope develops higher velocities causing scour in the bed of the channel. If the general ground has a steep slope and the channel is given a flatter slope, the channel may meet the ground level and further may move the ground level necessitating high bank. To obviate the difficulty, falls or drops are given in the channel at suitable points where it tends to go near or above the ground level. At falls masonry structures are constructed to prevent scouring and to confine and to direct the channel water along its course. Estimate of a small fall has been given in Example 8.

Scanned with CamScanner

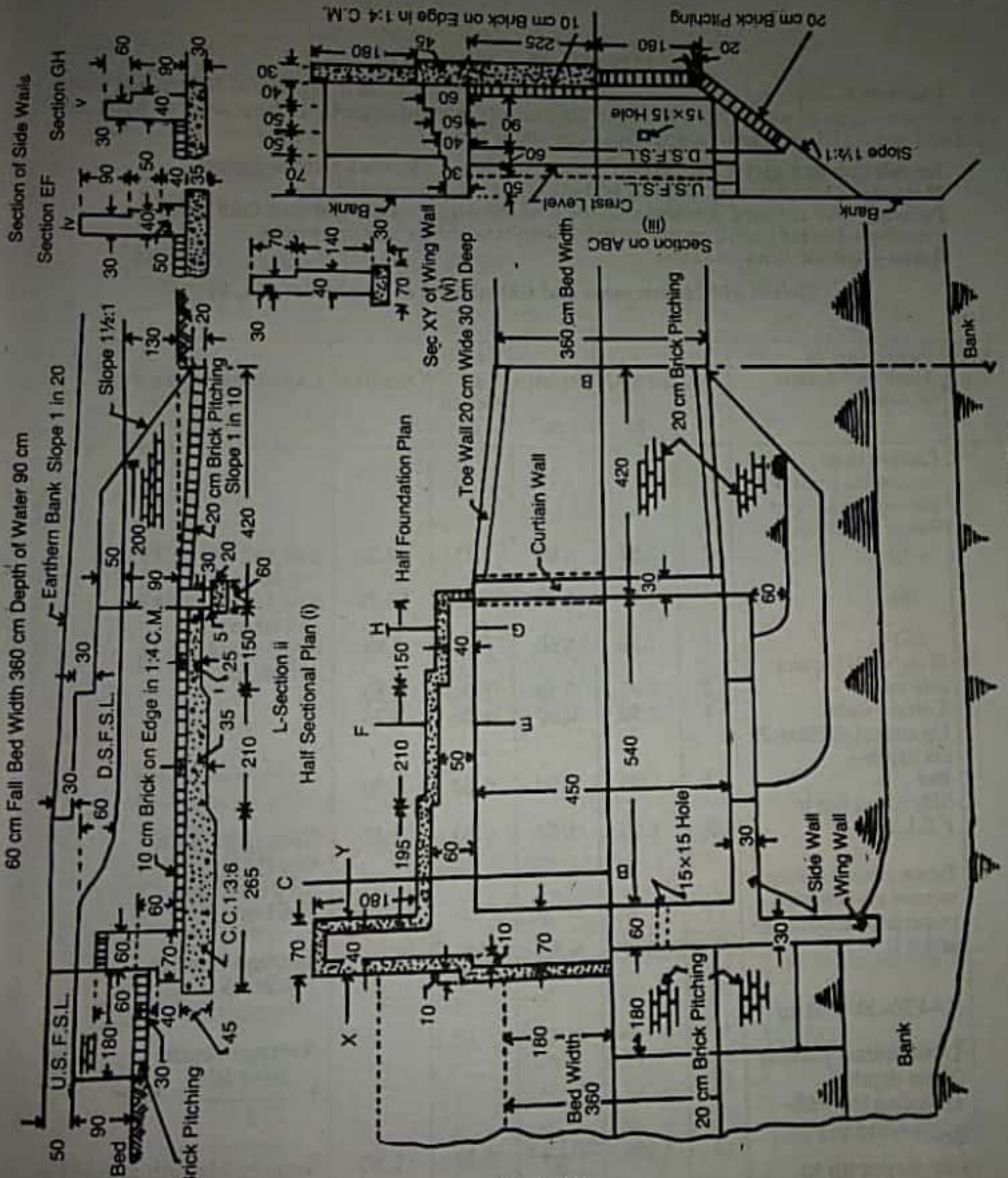


Fig. 9-10

Scanned with CamScanner

ESTIMATE OF A 60 cm FALL

Example 8—Prepare a detailed estimate of a 60 cm fall for a distributory of 360 cm bed width and 90 cm depth of water, from the drawing given (Fig. 9-10 page 441). Side slope of bank and channel are 1½ : 1. The general specifications are as follows :—

Foundation and apron concrete—Cement concrete 1 : 3 : 6 with stone ballast.
Masonry—All brickwork shall be of I-class in 1 : 4 cement mortar.
Pointing—All exposed surfaces shall be pointed with 1 : 4 cement and sand mortar.
Pitching—Pitching shall be of dry brick with straight over burnt bricks.
Rates—Assume suitable rates.

Details of Measurement and Calculation of Quantities (Ex. 8)

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
1	**Earthwork in excavation** Crest wall, side walls and floor (taken together)—						
	(i) ...	1	2.65	6.00	1.15	18.29	B=4.5+2×.6+2×.15 =6.00 m
	(ii) ...	1	2.10	5.80	1.05	12.79	B=4.5+2×.5+2×.15 =5.80 m
	(iii) ...	1	1.50	5.60	0.95	7.98	B=4.5+2×.4+2×.15 =5.60 m
	Wing walls beyond side walls ...	2	1.80	0.70	1.00	2.52	
	Curtain walls ...	1	4.50	0.60	1.20	3.24	
	Up stream pitching 20 cm depth—						
	Bed	1	1.80	3.60	0.20	1.30	
	Side slopes (up to F.S.L.)	2	1.80	1.62	0.20	1.17	Sloping breadth $=h\sqrt{s^2+1}$ $=.9\sqrt{(1½^2+1)}$ =1.62 m
	Down stream channel beyond curtain wall. trapezium section$(Bd+sd^2)\times L$ ...	(4.0	5×.8+1½	$\times .8^2$)	×3.90	=16.38	Average breadth $=\frac{4.5+3.6}{2}=4.05$ m
	(L=4.20-.30=3.90 m)						Average depth $=\frac{.60+1.00}{2}=.80$ m
	Down stream pitching 20 cm depth, excluding toe wall—						
	Bed	1	3.90×	$\frac{4.1+3.2}{2}$	×0.20=	2.85	Sloping breadth at middle
	Side slopes up to F.S.L. (Upper length =2.0 m) ...	2	$\frac{4.2+2.0}{2}$	×1.44	×0.20=	1.79	$=d\sqrt{s^2+1}$ $=8\sqrt{1½^2+1}=1.44$ m
					C.O.	68.31	

Scanned with CamScanner

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
					B.F.	68.31	
	Curved portion ...	2	$\pi \times .6^2$	(area)	×0.20	0.45	Taken as quadrant of sphere.
	Top wall ...	2	3.90	0.20	0.30	0.47	
					Total	69.23	
	Deduct for set back of wing wall ...	2	0.60	0.10	1.15	0.14	
				Net	Total	69.09 cu m	
2	**Cement concrete 1 : 3 : 6** in foundation and floor—Crest wall side walls and floor—						
	(i) ...	1	2.65	6.00	0.45	7.16	
	(ii) ...	1	2.10	5.80	0.35	4.26	
	(iii) ...	1	1.50	5.60	0.25	2.10	
	Wing wall beyond side wall	2	1.80	0.70	0.30	0.76	
	Curtain wall ...	1	4.50	0.60	0.20	0.54	
					Total	14.82	
	Deduct for set back of wing wall ...	2	0.60	0.10	1.15	0.14	
				Net	Total	14.68 cu m	
	I-class brickwork in 1 : 4 cement mortar—						
	Crest wall—						
	1st step ...	1	4.50	0.70	0.40	1.26	
	2nd step ...	1	4.50	0.60	1.00	2.70	
	Side wall—						
	(i) 1st step ...	2	2.35	0.60	0.40	1.13	As per cross sec. BC
	2nd step ...	2	2.35	0.50	0.50	1.18	
	3rd step ...	2	2.35	0.40	0.50	0.94	
	4th step ...	2	2.35	0.30	0.70	0.99	
	(ii) 1st step ...	2	2.10	0.50	0.40	0.84	As per cross sec. EF
	2nd step ...	2	2.10	0.40	0.50	0.84	
	3rd step ...	2	2.10	0.30	0.90	1.13	
	(iii) 1st step ...	2	1.50	0.40	0.90	1.08	As per cross sec. GH
	2nd step ...	2	1.50	0.30	0.60	0.54	
	3rd step ...				C.O.	12.63	

Scanned with CamScanner

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
					B.F.	12.63	
	Wing wall beyond side wall	2	1.80	0.40	0.40	0.58	As per cross sec. XY
		2	1.90	0.40	0.50	0.76	
		2	2.00	0.40	0.50	0.80	
		2	2.10	0.30	0.70	0.88	
	Curtain wall	1	4.50	0.30	0.40	0.54	
	Toe wall	2	3.90	0.20	0.30	0.47	
					Total	16.66	cu m
4	**Brick-on-edge floor in 1:8 cement mortar including pointing** ...	1	5.40	4.50	—	24.30 sq m	Down stream in between walls
5	**Cement pointing in 1 :3 cement mortar**— Crest wall (up stream face top and down stream (face)	1	4.50	—	2.40	10.80	Ht.=.6+.6+1.2 =2.40 m
	Side wall inner face (i)...	2	1.80	—	2.00	7.20	
	(ii)...	2	2.10	—	1.70	7.14	
	(iii)...	2	1.50	—	1.40	4.20	
	Side wall portion above crest wall ...	2	0.60	—	0.80	0.96	
	Vertical faces of steppings	2×2	—	0.30	0.30	0.36	
	Vertical face of end	2	—	0.40	0.90	0.72	
		2	—	0.30	0.60	0.36	
	Top of side walls ...	2	6.00	0.30	—	3.60	Full length of 30 cm wall
	Top of curtain wall	1	4.50	0.30	—	1.35	
	Top of toe walls ...	2	3.90	0.20	—	1.56	
	Wing wall top face	2	2.10	0.30	—	1.26	
	Wing wall up-stream side triangular portion above slope ...	2	½(2.10×1.40)		—	2.94	Triangular portions of slope
					Total	42.45 sq m	

Scanned with CamScanner

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
6	**Brick-pitching—**						
	Up-stream bed ...	1	1.80	3.60	0.20	1.30	
	Up-stream side slopes	2	1.80	1.62	0.20	1.17	
	Down-stream bed ...	1	3.90×	$\frac{4.1+3.2}{2}$	×0.20=	2.85	Dimensions same as in item 1)
	Down-stream side slopes	2	$\frac{4.2+2.0}{2}$	×1.44	×0.20=	1.79	
	Side curved portions	2	$\pi x.6^2$	(area)	×0.20=	0.45	
					Total	7.56 cu m	

Scanned with CamScanner

TOPIC: DETAILED ESTIMATE OF SIPHON WELL DROP TO GIVEN SPECIFICATION

Due to relative levels sometime it is required to lower the bed of the irrigation channel or the drainage channel at their crossing. When the bed of the irrigation channel is depressed and taken under nala or stream it is known as Irrigation Syphon. When the bed of the nala or stream is depressed and taken under the irrigation channel it is known as Drinage Syphon. The Syphon crossing may be of rectangular closed masonry channel or of circular brickwork or of R.C.C. or Hume pipe of the required diameter and number. Approach and exit may be through masonry drop pit or of masonry sloped channel. The down stream end is kept lower than the up stream end by at least 15 cm for better flow. An estimate of a small Drainage Syphon has been given in Example 7.

DRAINAGE SYPHON ACROSS A MINOR

Example 7.—Prepare a detailed estimate of a Drainage Syphon across a minor from the given drawing, Figs. 9-8 and 9-9.

Foundation concrete shall be of 1 : 4 : 8 cement concrete with brick ballast. All brickwork shall be of 1 : 4 cement mortar. Exposed surfaces of brickwork shall be struck pointed with 1 : 2 cement mortar. Brick pitching shall be of dry brick with straight over burnt bricks.

Assume suitable rates for the different items of work.

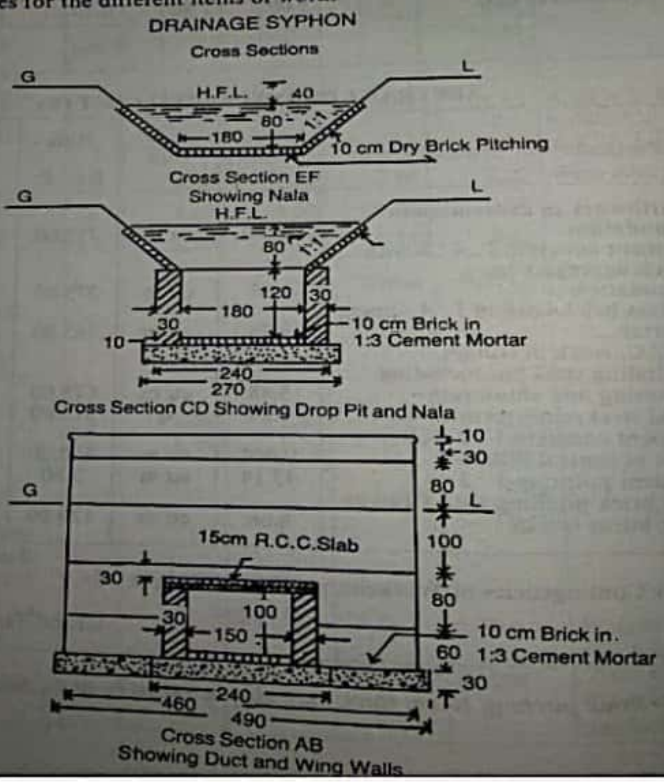


Fig. 9-8

Scanned with CamScanner

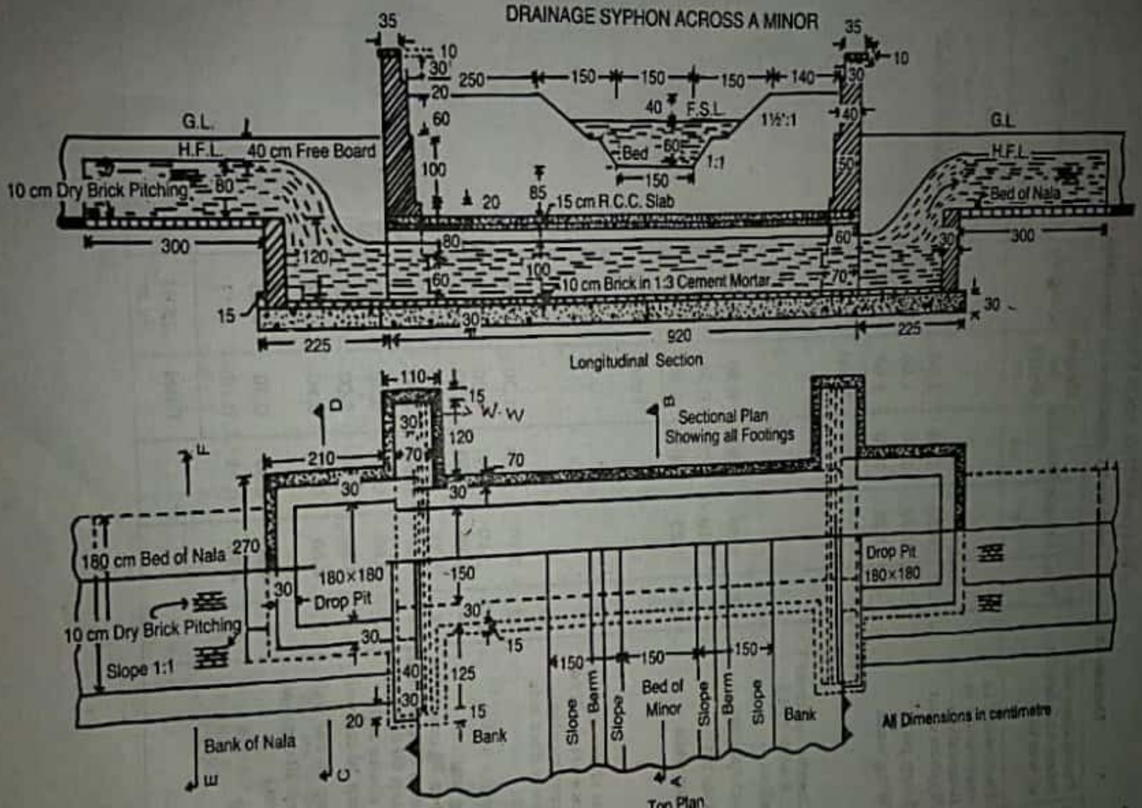


Fig. 9.9

Scanned with CamScanner

Details of Measurement and Calculation of Quantities (Ex. 7)

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
1	Earthwork in excavation in foundation—						
	Syphon duct ...	1	9.50	2.40	1.60	36.48	*For bed level of nala.*
	Drop pit ...	2	2.10	2.70	1.60	18.14	
	Wing walls ...	4	1.25	1.10	1.60	8.80	
					Total	63.42 cu m	
2	Cement concrete 1 : 4 : 8 with brick ballast—						
	Syphon duct ...	1	9.50	2.40	0.30	6.84	
	Drop pit ...	2	2.10	2.70	0.30	3.40	
	Wing walls ...	4	1.25	1.10	0.30	1.65	
					Total	11.89 cu m	
3	First class brickwork in 1 : 4 cement mortar—						
	Syphon duct side walls	2	9.20	0.30	1.30	7.18	
	Drop pit walls ...	2×2	2.10	0.30	1.30.	3.28	
		2	1.80	.30	1.30	1.40	
	Wing walls—						
	1st step 70 cm walls	4	1.25	0.70	0.70	2.45	
	2nd step 60 cm walls	4	1.25	0.60	0.60	1.80	Upto top of slab.
	2nd step 60 cm walls above slab	2	4.60	0.60	0.20	1.10	
	3rd step 50 cm wall	2	4.60	0.50	1.00	4.60	
	4th step 40 cm wall	2	4.60	0.40	0.80	2.94	
	5th step 30 cm wall (parapet)	2	4.60	0.30	0.30	0.83	
	Coping	2	4.70	0.35	0.10	0.33	
					Total	25.91 cu m	

Scanned with CamScanner

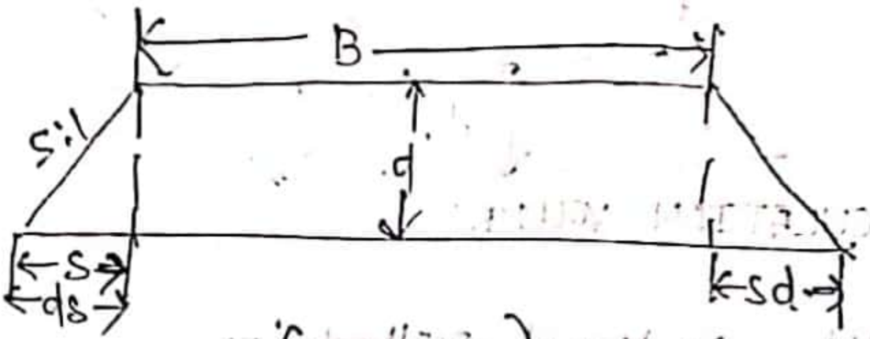
Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
4	R.C.C. slab of syphon duct including steel reinforcement complete work	1	9.20	2.10	0.15	2.90 cu m	
5	10 cm thick brick floor in 1 : 3 cement mortar including 1 : 2 cement pointing —						
	Floor of syphon duct	1	9.20	1.50	—	13.80	
	Floor of drop pit ...	2	1.80	1.80	—	6.48	
					Total	20.28 sq m	
6	Cement struck pointing 1 : 2—						
	Syphon duct inner faces	2	9.20	—	1.00	18.40	
	Drop pit 3 vertical faces	2×3	1.80	—	1.20	12.96	
	Drop pit 3 top faces	2	5.70	—	0.30	3.42	L=2×180+210 =570 cm
	Parapet wall inner face top and outer face up to G.L.	2	4.60	—	2.30	21.16	Ht.=20+10+30+10 +35+10+5+110 =230 cm
	Outer face of wing wall above slab ...	2	1.80	—	1.20	4.32	
	Triangular portion of outer face of wing wall	2×2	(½×.8	×.8)	=	1.28	
					Total	61.54 sq m	*Thin piching, unit in area basis.*
7	10 cm dry brick pitching with straight over burnt bricks—						
	Bed of nala	2	3.00	1.80	—	10.80	*Up and down streams.*
	Side slopes of nala	2×2	3.00	1.13	—	13.56	*Sloping breadth=* $\sqrt{.8^2+.8^2}$=1.13 m
					Total	24.36 sq m	

Scanned with CamScanner

ROAD ESTIMATE

Banking :-

Cutting:-



(Crossection)

B = formation width
d = depth

length = lead

A = Area of rectangle + 2 x Area of triangle

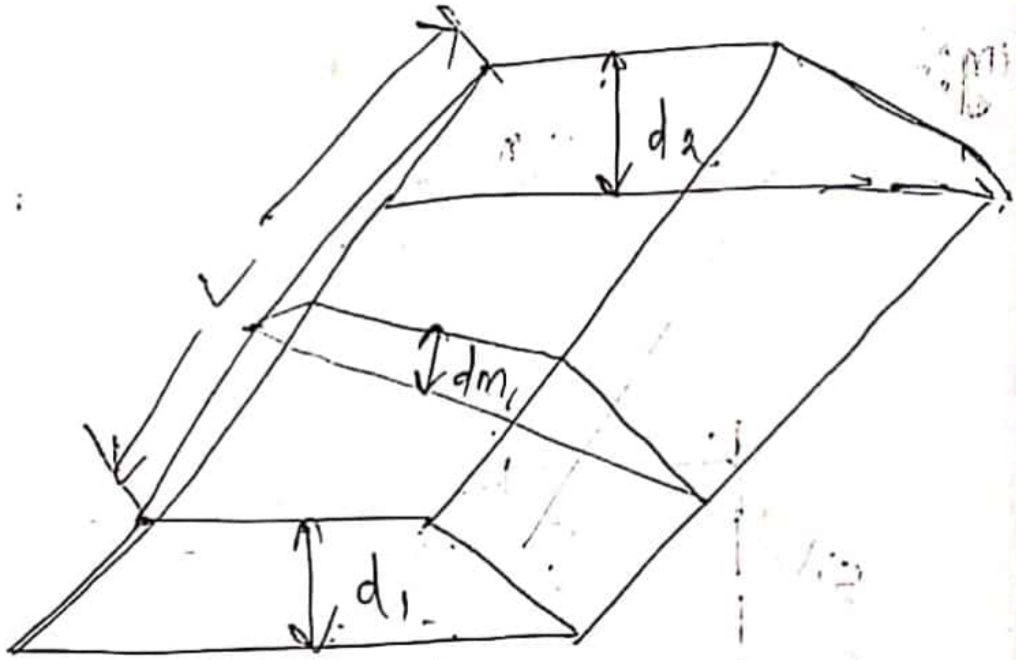
$= B \times d + 2 \times \frac{1}{2} \times sd \times d$

$A = Bd + sd^2$

Normally lead = 30 m and lift is = 1.5 m

$vol^m = A \times L = (Bd + sd^2) \times L$

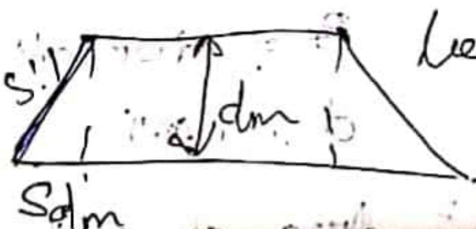
Scanned with CamScanner



CALCULATION VOLUME :-

① Mid- sectional method :-

$$d_m = \frac{d_1 + d_2}{2}$$



Area of rectangle = $A = B \times d_m$

Area of triangle $A = 2 \times \frac{1}{2} \times s d_m \times d_m$

$$A = B \times d_m + 2 \times \frac{1}{2} \times s d_m \times d_m$$

$$\boxed{A = B d_m + s d_m^2}$$

$$\boxed{Vol^m = A \times L}$$

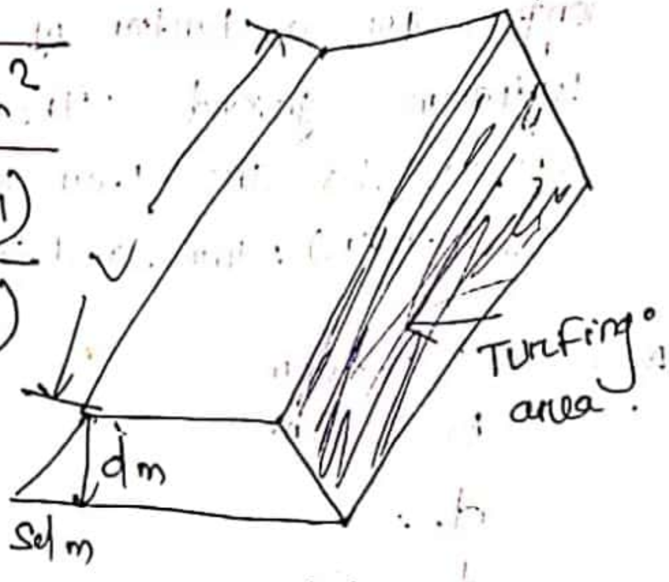
Scanned with CamScanner

Slopeing length $= \sqrt{(sd_m)^2 + d_m^2}$

$= \sqrt{s^2 d_m^2 + d_m^2}$

$= \sqrt{d_m^2 (s^2+1)}$

$= d_m \sqrt{(s^2+1)}$



$$A = 2 \times d_m \sqrt{s^2+1} \times L$$

(II) Mean sectional method:-

$A_1 = B \times d_1 + s d_1^2$

$A_2 = B \times d_2 + s d_2^2$

$$A_{mean} = \frac{A_1 + A_2}{2}$$

$$\text{Quantity or vol}^m = \left(\frac{A_1 + A_2}{2}\right) \times L$$

(III) Prismoidal formula:-

$$\text{Vol}^m = \frac{L}{6}\left(A_1 + A_2 + 4A_m\right)$$

Scanned with CamScanner
Scanned with CamScanner

Q
1. Calculate the quantity of earth work for 200m length for a portion of a road in an uniform ground. The ht of banks at the two sides are 1.0m and 1.6m. The formation width (B) = 10m. and side slope 2:1.

A: $L = 200m$

$B = 10m$

$d_1 = 1$

$d_2 = 1.6m$.

Side slope = 2:1

Mid sectional method :-

$$d_m = \frac{d_1 + d_2}{2}$$

$$= \frac{1+1.6}{2}$$

$$= 1.3m$$

$$Area = Bd + sd^2$$

$$= (10 \times 1.3) + 2 \times 1.3^2$$

$$= 16.38 m^3$$

$$Vol^m = 16.38 \times 200 = 3276 m^3$$

Mean sectional method :-

$$A_1 = B \times d_1 + sd_1^2 = 12 m^2$$

$$A_2 = Bd_2 + sd_2^2 = 21.12 m^2$$

$$A_m = Bd_m + sd_m^2 = 16.38 m^2$$

$$= \frac{A_1 + A_2}{2} = 16.56 sq.m.$$

Quantity $= 16.56 \times 200 = 3312$ [illegible]

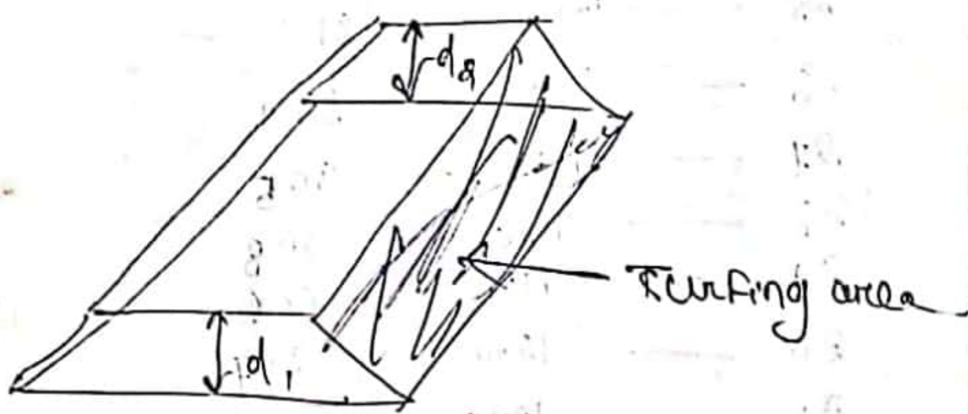
Scanned with CamScanner

Prismoidal formula :-

$$\frac{L}{6}\left(A_1+A_2+4A_m\right)$$

$= 3288\ m^3$

Turfing area =



Sloping length for 1st surface

$= \sqrt{1^2+2^2}$

$= 2.23\ mt.$

Sloping length for 2nd surface

Slope (2:1) $= \sqrt{(1.6)^2+(3.2)^2}$

$y = 1.6\ mt$ $= 3.6\ mt$

$x = 3.2\ mt.$

Avg. sloping length $= \frac{2.23+3.6}{2} = 2.915\ m$

Turfing Area =

$= 2 \times L + S.L$

$= 2 \times 20.0 + 2.915$

$= 116.8\ m^2$

Scanned with CamScanner
Scanned with CamScanner

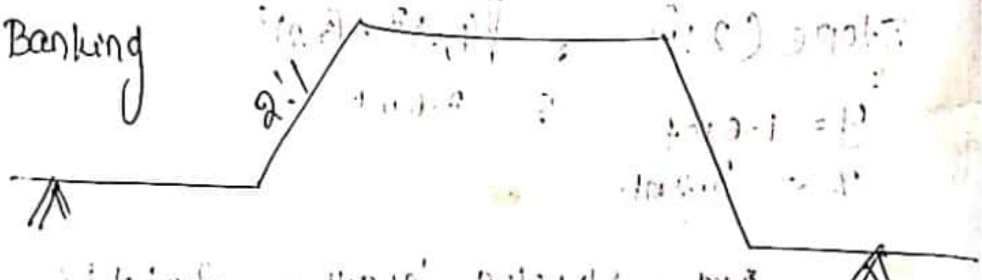
Q.2.

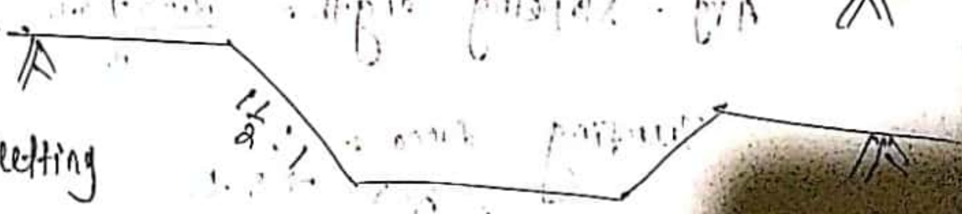
Estimate the cost of earthwork for a portion of road 400 m. length from the following data. Formation width 10m. Side slopes are 2:1 in banking, $1\frac{1}{2}:1$ in cutting.

Station	Distance	R.L of Ground	R.L. of formation
25	1000	51.0	52.0
26	1040	50.9	|
27	1080	50.5	|
28	1120	50.8	|
29	1160	50.6	Downward gradient
30	1200	51.7	
31	1240	51.2	1 in 200.
32	1280	51.4	Gradient 20.
33	1320	51.3	
34	1360	51.0	
35	1400	50.6	

A.

Banking





Cutting

NOTE:- Longitudinal secⁿ is usually plotted with a horizontal scale of 1cm = 10m to 1 cm = 20m and vertical scale is 1cm = 1m to 1 cm = 2m.

Scanned with CamScanner
Scanned with CamScanner

Formation level (-ve value).

1	0.9	9.1	0.6	0.6	0.3	0.4	0.8	0.9	0.8	0.6
2.0	51.8	51.6	51.4	51.2	51.0	50.8	50.6	50.4	50.2	50.0
.0	50.9	50.5	50.8	50.6	50.7	51.2	51.4	51.3	51.0	50.6
0	1040	1080	1120	1160	1200	1240	1280	1320	1360	1400
-	26	27	28	29	30	31	32	33	34	35

R.L of formation

$= \frac{1}{\text{gradient}/\text{Distance}}$

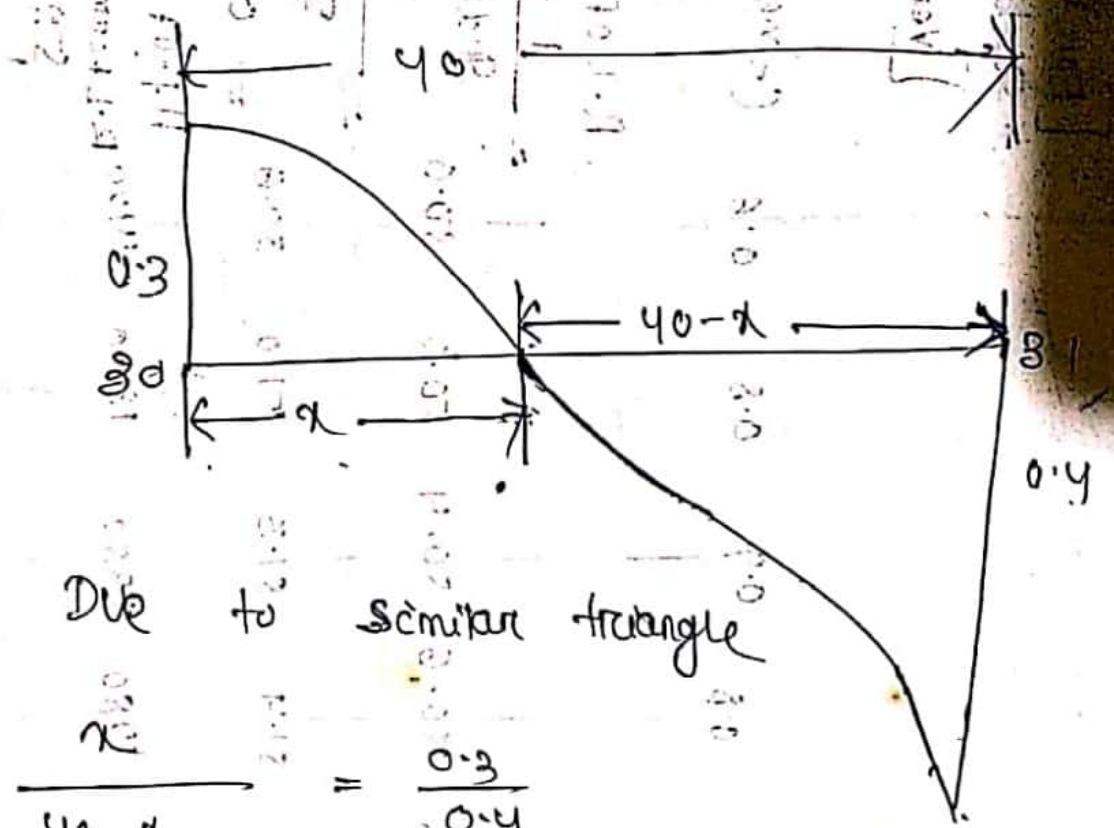
$= \frac{1}{200/40}$

$\Rightarrow 0.2$

Ht of bank = R.L formation - R.L of ground

52 - 51 = 1.

Scanned with CamScanner



Due to similar triangle

$$\frac{x}{40-x} = \frac{0.3}{0.4}$$

$\Rightarrow 0.4x = 12 - 0.3x$

$\Rightarrow 0.7x = 12$

$\Rightarrow x = 17.14\ mt. \simeq 17\ mt$ say

$40 - x = 40 - 17 = 23m$

[illegible]	[illegible]	4.5	1.805	11.305
1.1	1	10	2	12
0.6	0.85	8.5	1.445	9.945
0.6	0.6	6	0.72	6.72
0.3	0.45	4.5	0.405	4.905
ng to cutting				
0	0.15	1.5	0.045	1.545

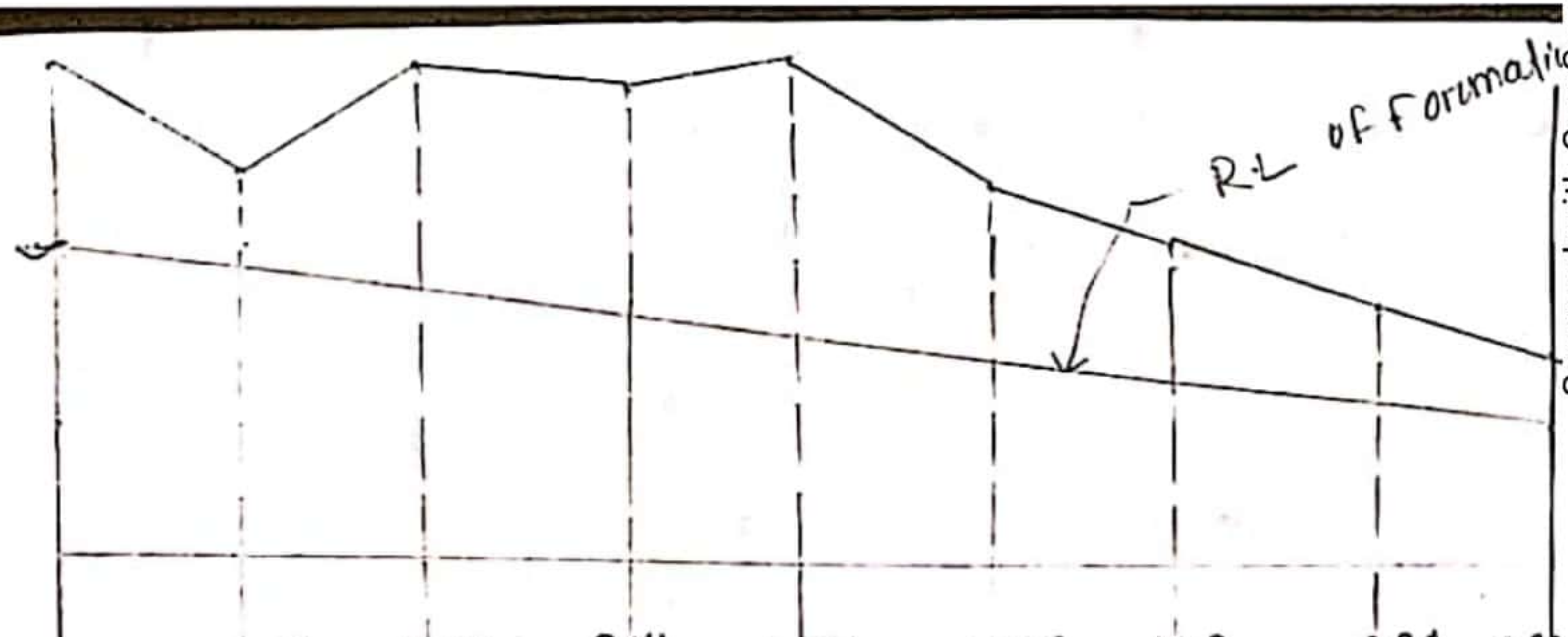
Scanned with CamScanner

18	76.7
19	75.5
20	75.2
21	74.9
22	74.7

Banking:-

Cutting:-

Scanned with CamScanner



Depth of cutting →	2	1.07	2.34	2.41	2.68	1.85	1.42	0.99	0.6[illegible]
Ht of bank →									
R.L of formation →	73.0	73.13	73.26	73.39	73.52	73.65	73.78	73.91	7[illegible]
R.L of ground →	75.0	74.2	75.6	75.8	76.2	75.5	75.2	74.9	7[illegible]

Scanned with CamScanner

17	340	2.41	2.375	35.625	3.46
18	360	2.68	2.575	38.175	9.71
19	380	1.85	2.265	33.975	7.69
20	400	1.49	1.635	24.525	4
21	420	0.99	1.205	18.075	2.17

Scanned with CamScanner

1.INTRODUCTION

DEFINITION OF ESTIMATING AND COSTING

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

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

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

c) Standard schedule of rates of the current year.

NEED FOR ESTIMATION AND COSTING

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

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

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

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

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

PROCEDURE OF ESTIMATING OR METHOD OF ESTIMATING.

Estimating involves the following operations

1. Preparing detailed Estimate.

2. Calculating the rate of each unit of work

3. Preparing abstract of estimate

DATA REQUIRED TO PREPARE AN ESTIMATE

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

2. Specifications.

3. Rates.

DRAWINGS

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

Scanned with CamScanner

SPECIFICATIONS

a) General Specifications:

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

b) Detailed Specifications:

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

RATES:

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

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

LUMPSUM:

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

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

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

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

WORK CHARGED ESTABLISHMENT:

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

Scanned with CamScanner

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

RULES FOR MEASUREMENT :

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

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

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

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

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

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

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

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

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

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

Scanned with CamScanner

a) from foundation to plinth level

b) from plinth level to First floor level

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

METHODS OF TAKING OUT QUANTITIES:

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

a) Long wall - short wall method

b) Centre line method.

c) Partly centre line and short wall method.

a) Long wall-short wall method:

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

b) Centre line method:

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

c) Partly centre line and partly cross wall method:

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

Scanned with CamScanner

FIXING OF RATE PER UNIT OF AN ITEM:

The rate per unit of an item includes the following:

Quantity of material and cost:

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

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

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

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

METHODS OF PREPARATION OF APPROXIMATE ESTIMATE:

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

a) Plinth area method

b) Cubical contents methods

c) Unit base method.

a) Plinth area method:

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

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

a) Area of walls at floor level.

Scanned with CamScanner

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

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

d) Porches of non cantilever type.

Areas which are not to include

a) Area of lofts.

b) Unenclosed balconies.

c) Architectural bands, cornices etc.,

d) Domes, towers projecting above terrace level.

e) Box louvers and vertical sunbreakers.

b) Cubical Contents Method:

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

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

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

c) Unit Base Method:

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

3.ANALYSIS OF RATES

Definition :

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

Scanned with CamScanner

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

2. Quantity of materials and their costs.

3. Cost of labours and their wages.

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

5. Overhead and establishment charges

6. Profit

Cost of materials at source and at site of construction.

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

Purpose of Analysis of rates:

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

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

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

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

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

The labour can be classified in to

1) Skilled 1st class

2) Skilled IInd Class

3) un skilled

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

Scanned with CamScanner

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

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

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

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

$= 119.26$ bags

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

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

b) Quantity of cement required $= \frac{1}{10} \times 1.52 \times 1.5 = 2.28m^3 \times \frac{1440}{50} = 65.66$ Bags

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

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

Scanned with CamScanner

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4.ROAD ESTIMATION

Introduction:-

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

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

Lead and Lift:

Lead:

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

Scanned with CamScanner

Lift :

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

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

i.e. Upto2.0- 1 lift

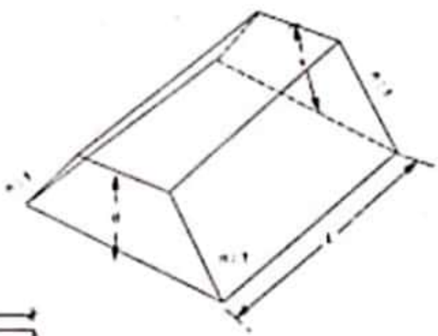
1.0 - 1 Lift

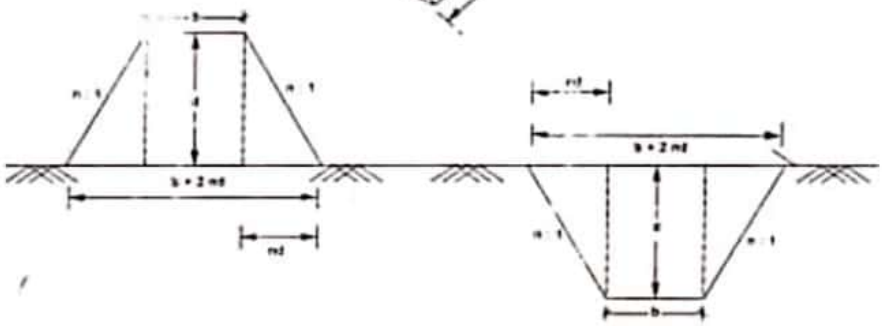
1.0 - 1 lift

Total 04 lifts 0.5 - 1 lift

Calculation of earth work for Roads:

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





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

$$V = (bd + 2 \times 1/2 \times nd \times d)L$$

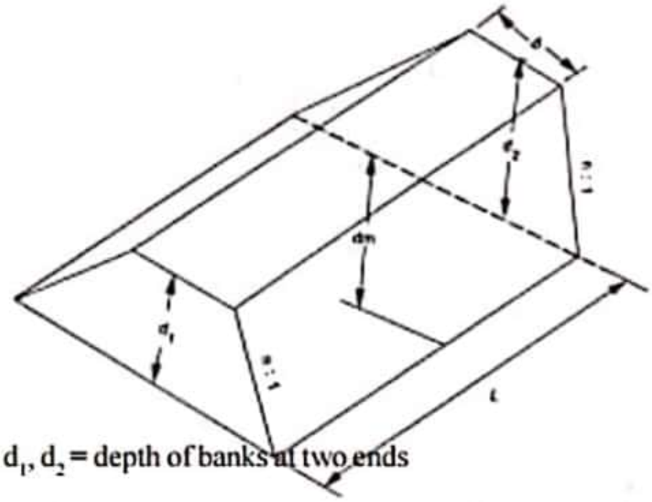
$$V = (bd + nd^2)L$$

Case 2:

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

1. By Mid Section or Mid ordinate method.

Scanned with CamScanner



Where d_1, d_2 = depth of banks at two ends

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

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

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

ii) Trepezoidal formula: (for two sections)

In this method also called mean sectional area method

Let A_1 & A_2 be two areas at two ends.

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

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

Volume of earth work (v) = Am × L

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

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

The volume of earth work

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

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

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

Scanned with CamScanner

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

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

Volume of earth work

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

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

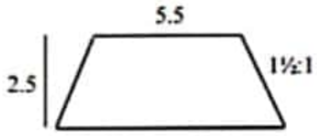
Example 7.1 : Find the volume of earth work in embankment of length 12m. Top width is 5.5m and depth is 2.5m the side slopes ara 1½:1

Sol : Top width b=5.5m

Depth d= 2.5m

side slopes =1½:1 i.e. n=1.5

length L=12m



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

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

$=77.5m^3$

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

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

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

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

Mid sectional Area = Am = bdm+ndm² = $(8x2.25+2x2.25^2)2=28.125m^2$

Volume of earth work (V)=AmxL = 28.125x70=1968.75m³.

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

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

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

Volume of earth work (V)=AmxL=28.25x70=1977.5m³.

Scanned with CamScanner

Cement concrete road

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

a) Earth work excavation and deposting on the bank

b) Cement concrete (1:4:8) for base course

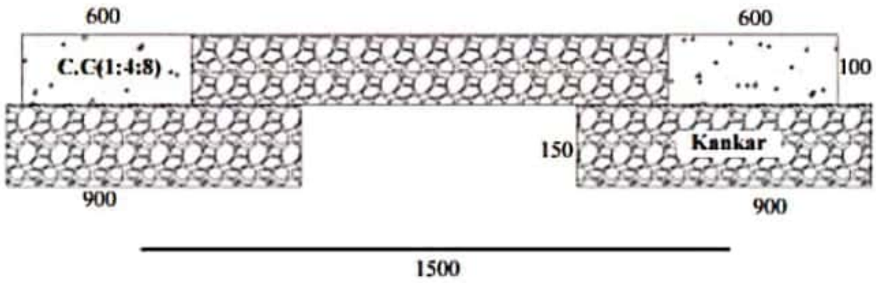
c) Cement concrete (1:2:8) for wearing course.

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

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

Scanned with CamScanner

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



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

Scanned with CamScanner