INSTITUTE OF TEXTILE TECHNOLOGY

CHOUDWAR

SUB-E&CE-II

BRANCH-CIVIL ENGG.

SEM-5th

PREPARED BY

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Chapter-I Detail Estimation of Culvert & Bridges

Culvert :-

A culvert is one which has a linear water wave up to 6m. Structures having a linear water wave above 6m. & below 30m. at miner bridges. Structures having a linear water wave or more are measure bridges.

Abutment :-

It is a machionary or reinforced concrete work that constitutes the end support of bridges or similar structure by which it joints the bank of water way.

Wing Wall :-

- wing wall is a retaining wall which sustains the embankments of the approaches where they join the bridge.

Q// Prepair a detail estimate of slab culvert of 1.50m span & 4m. road way from the given drawing the general specifications are as follows.
Foundation concrete shall be of cement concrete 1:3:6 with stone ballast & coarse sand.
Machionary shall be of first class brick work in 1:4 cement coarse sand mortar. Slab shall be of R.C.C 1:2:4 with reinforcement as per drawing exposed surface of brick machionary shall be cement pointed 1:2. Road shall be provided with 10 cm.

Item No.	Descriptions of Item of work	No	Length (m)	breadth (m)	height / depth (m)	quantity (l x b x h x no.)	Exp. Note -
1.	Earth work in excavation in foundation						l = 4.8 + 0.15 + 0.15 = 5.1 m.
	i) Abutment	2	5.1	0.7	0.6	4.28 m^3	
	ii) wing walls	4	1.2	0.7	0.6	2.01 m^3	
					Total =	6.29 m^3	
2.	cement Concrete 1:3:6 in foundat^n with stone balast						
	i) Abutment	2	5.1	0.7	0.3	2.14 m^3	l = 4.8 + 0.15 + 0.15 = 5.1 m.
	ii) wingwalls	4	1.2	0.7	0.3	1.01 m^3	
					Total =	3.148 m^3	
3.	1st class brickwork in cement motar						H = 1.00 + 0.30 + 0.2 = 1.5 m.
	i) Abutment	2	4.80	0.4	1.5	5.76 m^3	l = 4.9 - (0.1 + 0.1) = 4.7 m.
	ii) wing walls	4	1.2	0.4	1.5	2.88 m^3	
	iii) Parapet upto kerve	2	4.7	0.4	0.3	1.128 m^3	H = 0.2 + 0.1 = 0.3 m.
	iv) Parapet above kerve	2	4.7	0.3	0.5	1.41 m^3	H = 0.6 - 0.1 = 0.5 m.
	v) coping	2	4.9	0.4	0.1	0.39 m^3	
					Total =	11.568 m^3	

Plain cement concrete assume suitable rates.

Deduction						
bearing of the R.C.C slab in abutment	2	4.8	0.3	0.2	0.57 m³	11.568 − 0.57 = 11.00 m³
				Total =	11.00 m³	
4. R.C.C work 1:2:4 slab excluding steel & its bending but including centering & shortening & binding steel.	1	4.8	2.1	0.2	2.01 m³	b = 1.5 + 0.3 + 0.3 = 2.1 m
5. Steel bars including bending in R.C.C work - 20mm dia-bars						
i) Main straight bars 30 cm c/c	17	2.38	—	—	40.46 m	$N_o = \frac{4.8}{0.30} + 1 = 17$ (0.30 — spacing)
ii) Main bent up bar 30 cm c/c	16	2.54	—	—	40.64	L = (2.1 − 2 hooks − 2 side covers (40mm))
				Total =	81.1 m	
	Total	81.1 m @ 2.47 kg =			8200.31 kg.	

9D = 1 hook value
assume side cover = 40
⇒ 2100 + 2 × 9 × 20 − 2 × 40
= 2380 mm = 2.38 m
L = 2.38 + 0.16 = 2.54 m

10 mm dia bars - distribution botom bars 25 c/c	9	4.90	—	—	44.10m	L = 4.80 - (2 x 4 cm) + (18 X 10mm) = 4.90 m
Distribution top bars	4	4.90	—	—	19.6 m	Total 44.1 + 19.6 = 63.70
			Total 63.70m @ 0.62 kg = 39.49m			
		Total of steel	200.32 + 39.49 = 239.8 kg = 2.39 quintal			
6. Cement Concrete 1:2:4 wearing course	1	4.00	2.3	0.1	0.92 cm^3	B = 0.4 + 1.5 + 0.4 = 2.3
7. Cement pointing 1:2 in wall — face wall from 10 cm below g.l. upto bottom of coping	2	4.70	—	2.10	19.74	
inner side of parapet excluding coping	2	4.70	—	0.80	7.52	
Coping (inner edge, top, outer edge & outer side)	2	4.90	0.70	—	6.86	B = (10 + 40 + 10 + 10) cm = 0.70m
Ends of parapet	4	—	0.40	0.20	0.32	upto kerb.
Ends of parapet	4	—	0.30	0.50	0.60	above kerb.
Ends of Coping	4	—	0.40	0.20	0.32	Edge & under side
				Total	35.36	
Deduct — Rectangular opening	2	1.50		1.30	3.90	Including 10 cm below G.L. & edge of R.C.C. slab.
Triangular portion below earth slope	2	(½ x 1.30 x 1.30)			1.69	
			Total of	deduction	5.59	
			Net	Total =	29.77 m^2	

Item No.	Particulars of items of work	Quantity	Unit	Rate Rs. P.	Per.	Amount Rs. P.
1.	Earthwork in excavation in foundation	6.30	cu m	350.00	% cu.m.	22.05
2.	cement concrete 1:3:6 in foundation with stone ballast	3.15	cu m	400.00	cu m	1260.00
3.	1-class brickwork in 1:4 cement mortar	11.00	cu m	365.00	cu m	4015.00
4.	R.C.C. work 1:2:4 in slab excluding steel & its bending but including centering. shuttering & binding steel	2.016	cu m	775.00	cu.m	1562.40
5.	steel bars including bending in R.C.C. work	2.398	quintal	515.00	quintal	1234.97
6.	cement concrete 1:2:4 in wearing coat	0.92	cu m	450.00	cu m	414.00
7.	cement pointing 1:2 in wall	29.77	sq m	5.60	sq m	166.71
					Total =	8675.13
	Add 5% - (3% for contingencies & 2% for workcharged establishment)					433.75
					Grand total =	9108.88

Rate per running metre of Span = $\frac{\text{Total Cost}}{\text{Span}} = \frac{9108.88}{1.5}$ = Rs. 6072.58 per metre.

(ABSTRACT OF ESTIMATED COST)

R. Sarain

Item No.	Description of Item	No.	Length in (m)	Breadth in (m)	height or depth in (m)	Quantity	Exp. Note (M. Chakraborty)
1.	Earthwork in excavation						
	i) Abutments –						5 + 0.15 + 0.15 = 5.30
	~~wing walls~~	2	5.30	0.8	0.75	6.36	
	ii) ~~Abutments~~ wingwalls	4	1.4	0.8	0.75	3.36	0.45 + 0.3 = 0.75
					Total =	9.72 cum.	
2.	Cement Concrete in foundation.						
	i) Abutments –	2	5.30	0.8	0.3	2.54	
	ii) wing wall –	4	1.4	0.8	0.3	1.34	
					Total =	3.88 m^3	
3.	1st class brick work in cement mortar 1:4 for						
	abutment –	2	5	0.5	1.57	7.85	
	wing wall –	4	1.4	0.5	1.57	4.39	
	parapets of 40 cm layer	2	5.3	0.4	0.4	2.12	
	parapets of 50 cm layer	2	5.3	0.5	0.3	1.59	
					Total	15.95 cum.	
3.	Deduction for bearing of RCC slab in abutment	2	5	0.3	0.22	(–) 0.66 cum	
					Total	15.29 cum	
4.	Cement pointing 1:3 to exposed surface of brick work						
	Inner faces of abutments	2	5.00	—	1.05	10.5	0.9 + 0.15 = 1.05
	Face wall as a whole	2	5.30	—	1.89	20.034	
	Inner side & top of parapets	2	5.30	—	1.12	11.872	

	End of parapets					
	90 —	4	0.4		0.4	0.64
	50 —	4	0.5		0.3	0.6
					Total =	31.77 m²
	Deduction for —					
	Rectangular opening	2	1.5	—	1.05	3.15
	face walls hidden by earth	4×½	1.4 ×	1.4	—	3.9
5	8cm. × 12 cm string course	2	5.3	—	—	10.6
6.	RCC slab excluding reinforcement bill including shuttering	1	5	2.1	0.22	2.31
7.	Reinforcement —					
i)	16 mm dia straight bars	26	2.39	—	@ 1.58kg	96.12 kg
ii)	16 mm ϕ bent up bars	25	2.54	—	@ 1.58kg	100.33 kg
iii)	10 mm ϕ bottom distribution bars	10	5.23	—	@ 0.62kg	32.42
iv)	10 mm dia top bars	4	5.23	—	@ 0.62kg	12.97
					Total =	241.84 kg.

2100 - (2×25) + 2×9×D
= 2100 - 50 + 2×9×16
= 2398 ≃ 2.39

23.40 + 220 - 25
= 2595 ≃ 2590
2.590

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	9.72	cum	8.00	cum.	77.76
2.	Cement concrete (1:2:4) with stone chips in foundation	3.88	cum	850	Cum	3298
3.	First class brick work in cement mortar (1:4)	15.29	cum	723.82	Cum	11067.20
4.	Cement pointing (1:3)	24.7	sq m.	.10	sq. m.	247.00
5.	8cm x 12 mm string course	10.6	r.m	10	rm.	106.00
6.	R.C.C work (1:2:4) excluding reinforcement but including shuttering	2.31	cum	1000	cum.	2310.00
7.	Mild steel bar for reinforcement including bending & binding.	2.41	quintal	900	~~sq~~ qu.	2169.00
					Total =	RS.
				Add 5% for contingency =		RS.
				Add 2½ for W.C =		RS.
					Grand total	

Item No	Particulars of item	No.	Length m.	Breadth m.	Height or depth m	Quantity	Exp. Note
1.	Earthwork in excavation in foundⁿ.						
	i) Face wall	2	3.1	0.8	0.8	3.96	$\frac{2.3+1.8}{2} = 2.05$
	ii) wing walls inclined portion	4	2.05	0.75	0.8	4.92	$\frac{0.8+0.7}{2} = 0.75$
	iii) wing wall triangular corner	4	$\frac{1}{2} \times 0.8 \times 0.6$		0.8	0.768	
	Turn wall						
	Under pipes	4	0.875	0.7	0.8	1.96	
		1	9.5	3.1	0.15	4.41	$\frac{0.8+2.3}{2} = 1.55$
					Total =	16.01 m^3	
2.	Cement Concrete in foundation 1:4:8:						
	i) Face walls	2	3.1	0.8	0.3	1.48	~~$\frac{2.3+1.8}{2} = 2.05$~~
	ii) wing wall inclind portion	4	2.05	0.75	0.3	1.89	$\frac{0.8+0.7}{2} = 0.75$
	iii) wing wall triangular corner	4	$\times \frac{1}{2} \times 0.6 \times 0.8 \times$		0.3	0.288	
	Turn wall						
	upper pipe & in bet^n pipe	4	0.875	0.7	0.3	0.735	
	upto half →	1	9.8	3.1	0.50	15.19	No = $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$
	deduct half of pipe				Total =	19.51 cubm.	$= 1.5$
		1.5	9.8	$\frac{\pi}{4} \times$	0.72	5.66 cum.	
					Total =	13.85	~~0.15 + 0.35 =~~
3.	First class brick work in 1:6 cement Sand mortar.					13.90 cum	$0.15 + \frac{0.7}{2} = 50$
	Face wall						
	~~wing walls~~ ~~40~~ 50cm	2	4.00	0.5	0.5	2	
	10 cm	2	3.8	0.4	1.6	4.864	

Parapet 30cm	2	3.8	0.3	0.3	0.684
Coping 35cm	2	3.9	0.35	0.1	0.273
wing wall					
first ~~half straight~~ step 50cm →	4	1.10	0.5	0.3	0.66
2nd step 40cm	4	1.8	0.4	0.3	0.864
→ straight portion	4	1.8	0.4	0.2	0.576
→ sloping portion	4	1.9	0.3	0.35	0.798
3rd step					
Turn wall					
for 40cm breadth	4	0.75	0.4	0.5	0.6
30cm breadth	4	0.75	0.3	0.3	0.27
				Total =	11.589 m^3
Deduct pipe opening	6	$\frac{\pi}{4} \times (0.7)^2 \times 0.4$		(-)	0.92 m^3
				Total =	10.669 m^3

4. Cement ~~concrete~~ pointing 1:2 in expose surface above G.L.

face walls outer side	2	3.1	—	1.4	8.68
face walls, Parapet outer side	2	3.8	—	0.5	3.8
parapet inner faces	2	3.8	—	0.6	4.56
Coping (inner edge, top edge, outer edge)	2	3.9	—	0.6	4.68

$\frac{0+0.4}{2} = 0.2$

$\frac{0+0.7}{2} = 0.35$

$\frac{0.7+0.8}{2} = 0.75$

$0.3+0.4+0.5+0.$
$= 1.4$

$h = 30+20+10 =$

$h = 35+10+10+5 = 60$

end of parapet					
For 40 cm	4	0.4	—	0.2	0.32
For 30 cm	4	0.3	—	0.3	0.36
ends of coping	4	0.35	—	0.1	0.14
wing walls vertical face	4	2.30	—	0.8	7.36
wing walls top	4	2.30	0.3	—	2.76
Turn wall vertical face (3 sides)	4	1.8	—	0.3	2.16
Turn wall Top	4	0.75	0.3	—	0.9
				Total =	35.72 m^2
Deduct for pipe opening	6	$\pi/4 \times$	$(0.6)^2$	= (-)	1.69 m^2
				Grand Total =	34.03 m^2
5. Hume pipe heavy ~~tight~~ type 60cm dia including collar joint	3	10.8	—	—	32.4 rm.

$h = \frac{1.4+0.5}{2} = 0.8$

$L = 0.7+0.3+0.8$
$= 1.8$

70
80 ← turn wall
80

$L = \frac{0.7+0.8}{2} = 0.75$

ABSTRACT

Item No.	Particulars of item of work	Quantity	Unit	Rate Rs. P.	Per Rs. P.	Amount Rs. P.
1.	Earth work in exc. in foundn	16.01	m^3	350.00	% cum.	56.03 (5603)
2.	Cement Concrete 1:4:8 in foundn brick balast.	13.90	m^3	300.00	cum.	4170
3.	1st class brick work in 1:6 cement mortar	10.669	m^3	340.00	cum.	3627.46
4.	Cement pointing	34.03	m^2	5.60	Sq. m.	190.56
5.	Flame pipe heavy type 60 cm dia including collar joint.	32.4	m.	125.00	per. m.	405
					Total =	~~8449.05~~ 17977.2
	ADD 5 % for contigencies & work charge establishment				= Rs.	898.88
					Grand Total =	18876.06

Estimation of irrigation structures :-

Canal Fall :-

Irrigation ~~canals are~~ channels are given certain longitudinal slope to develop certain velocities depending on the nature of soil & silt content in water. - steeper longitudinal slope develops higher velocities causing scour in the bed of the channel.
- Canal falls machionary structures are constructed to prevent scouring & to confine & to direct the channel water along its course.

estimation of canal fall :-

Item No.	Description of Item	No.	Length in (m)	Breadth in (m)	Height or Depth in (m)	Quantity	Explanatory note.
1.	Earthwork in excavation						
	a) Crest wall —	1	2.65	6	1.15		B = 4.5 + 2x 0.6 + 2x 0.15 = 6 m.
	b) Side wall —	1	2.1	5.8	1.05		B = 4.5 + 2x 0.5 + 2x 1.5 = 5.80m
	c) Floor	1	1.5	5.6	0.95		0.6 + 0.1 + 0.45 = 1.15
	wing wall →	2	1.80	0.7	1.00		0.6 + 0.1 + 0.35 = 1.05
	Curtain wall →	1	4.50	0.60	1.20		0.6 + 0.1 + 0.25 = 0.95
	- Toe wall →	2	3.9	0.2	0.3		
	- upstream pitching 20cm depth						
	- Side slope (upto F.S.L)						
	Down stream channel beyond curtain wall (trapezium section)						
	(Bd + sd 2) L.						
	- Down stream pitching 20cm depth, excluding toe wall						
	Bed —						
	sides slope -						

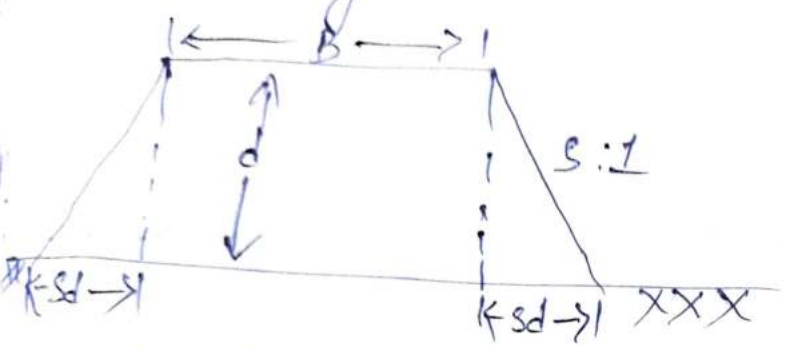
Prepare a detail estimate of a Syphon aqueduct from the given figure. The general Specification. cement concrete of ~~Syphone 1:3~~ in foundn shall be of 1:3 brick ballast. Brick ballast 10 cm thick dry, brick pitching shall be provide for both ~~use~~ U/S & D/S

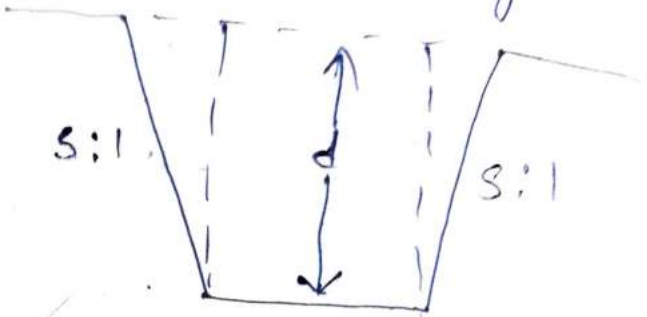
Item No.	Particulars of Item	No.	Length (m)	Breadth (m)	Height	Quantity	Remarks
1	Earthwork in excavation in foundation						
	→ Syphon duct	1	8.00	2.70	1.60	34.56 m^3	
	→ u/s drop pit	1	2.25	2.7	1.60	9.75	
	→ D/S drop pit	1	2.25	2.7	1.[illegible] 1.	8.505	
	→ wing wall	4	1.3	1.00	1.6	8.32	
					Total =	61.105 m^3	
	Syphon duct	1	8.00	2.70	0.3		
	drop pit	2	2.25	2.70	0.3		
	wing wall	1	1.3	1.00	0.3		

Road estimating :-

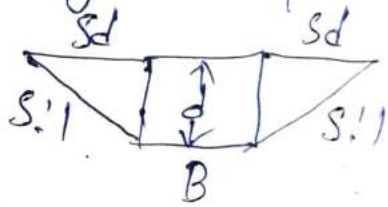
- Cross-section of earthwork of road in banking or in cutting is usually in the form of trapezium & the quantity of earth work may be calculated by the formula.

Quantity or volume = Sectional area x length





- Sectional area = Area of the central rectangular portion + Area of 2 sides triangular portion.



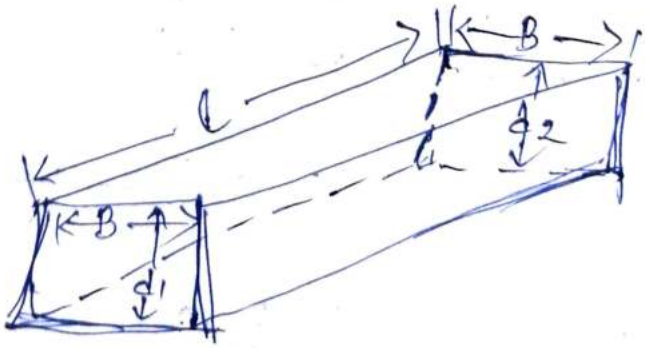
Bd = rectangle area

$\frac{1}{2} \times b \times h$ — triangle area

Area = $Bd + (2 \times \frac{1}{2} \times Sd \times d)$

$Bd + Sd^2$

when the ground is in a longitudinal slope the height of banking or the depth of cutting will be different at the two ends of the section & in this case mean height or average depth is taken into consideration



mean depth (dm) = $\frac{d_1 + d_2}{2}$

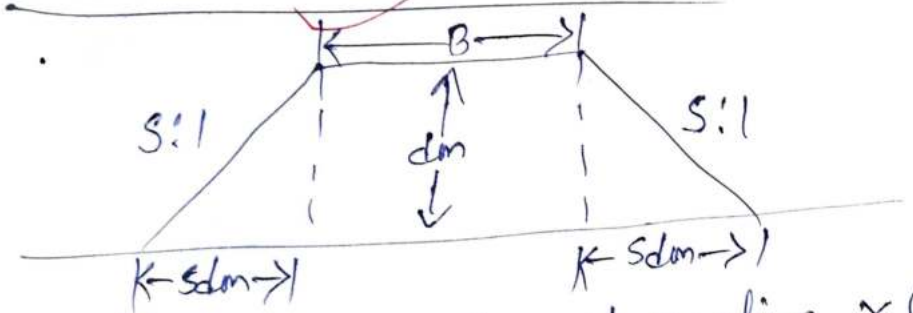
or Alternatively mean sectional area of 2 ends may be taken out & to find quantity the sectional area is multiplyed by the length.

Lead & Lift :-

Lead is the horizontal distance from the centre of borrow pit & to the centre point of place or spreading soil. The normal lead is 30m.
Lift is the distance through which the excavated soil is beyond a certain specific depth The normal lift is 1.5 m. The quantity of earth work may be calculated by the 3 method

① Mid - Sectional Area method
② Mean Sectional area method
③ Prismoidal Formula

Mid - Sectional Area Method :-



Quantity = Area of mid section × length
Let, d_1 & d_2 be the height of the bank at the two ends of the embankments
L = length of the section
B = formation width.
& S:1 = is the side slope
Area of mid section = Area of central section + Area of 2 triangular portion
$= (B \times dm) + (2 \times \frac{1}{2} \times S dm \times dm)$
$= B.dm + (S.dm \times dm)$ $\boxed{A = B.dm + S.dm^2}$ $dm = \frac{d_1 \times d_2}{2}$

Q// Calculate the quantity of earth work for 200m length for a portion of a road in an uniform ground the heights of banks at the 2 end being 1 meter & 1.6 m. The formation width is 10m. & side slope is 2:1.

$L = 200m$ $d_1 = 1m.$ $d_2 = 1.60m$

$B = 10m$, $S:1 = 2:1$

$\Rightarrow S = 2$

Mid Ordinate Formula

$A = Bdm + Sdm^2$

$Q = (B.dm + Sdm^2)L$

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

$dm(Avg) = \frac{d_1 + d_2}{2} = \frac{1 + 1.6}{2} = 1.3$

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

$= 16.38 m^2$

$Q = (10 \times 1.3 + 2 \times (1.3)^2) \times 200$

$= 3276 m^3$

mean Sectional Area method

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

$A_1 = Bd_1 + S.d_1^2$

$A_2 = B.d_2 + S.d_2^2$

$Q = \left(\frac{A_1 + A_2}{2}\right) L$

$A_1 = 10 \times 1 + 2 \times (1)^2$

$= 12 m^2$

$A_2 = 10 \times 1.60 + 2 \times (1.60)^2$

$= 21.12 m^2$

$A = \frac{12 + 21.12}{2} = 16.56 m^2$

$Q = \left(\frac{12 + 21.12}{2}\right) 200 = 3312 m^3$

Prismoidal formula method

$A_1 = B.d_1 + Sd_1^2$

$A_2 = B.d_2 + Sd_2^2$

$A_m = B.d_m + Sd_m^2$

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

$A_1 = 12\ m^2$

$A_2 = 21.12\ m^2$

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

$= 16.38\ m^2$

$Q = \frac{L}{6}(A_1 + A_2 + 4A_m)$

$Q = \frac{200}{6}(12 + 21.12 + 4 \times 16.38)$

$= 3288\ m^3$

Q) Calculate the area of the slide slope of portion of bank for a length of 200 m., the heights of bank at the 2 end being 2.50 m & 3.50 m & the ratio of the slide slope is 2:1. (b) If the slide slope are to be provided with 15cm thick, stone pitching. Calculate the cost of pitching at the rate of rupees 150 per cum.

$d_m = \frac{d_1 + d_2}{2} = \frac{2.5 + 3.5}{2} = 3m$

(1) $A = 2.L.d_m\sqrt{S^2 + 1}$

$= 2 \times 200 \times 3\sqrt{2^2 + 1^2} = 2683.28\ m^2$

$L = 200\ m$
$d_1 = 2.5m$
$d_2 = 3.5\ m$
$S:1 = 2:1$
$S = 2$

(2) Q = Area × thickness

$= 2683.28 \times 0.15$

$= 402.49\ m^3$

thickness $= 15cm = \frac{15}{100}$

$\simeq 0.15\ m$

Cost of stone pitching =
Total Quantity × Rat for 1 cum.

= 402.49 × 150

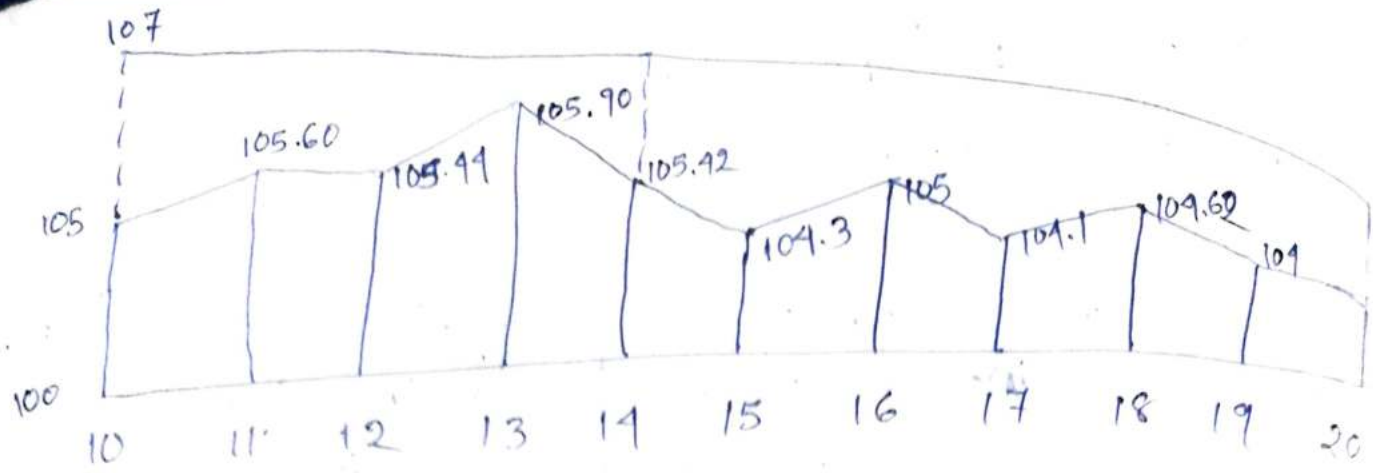
= RS. 60373.8

Q) Reduce level of ground (RL of ground) along the centre line of a proposed road for chainage 10 to chainage 20 are given below. the formation level at the 10th chainage is 107 & the road is in down word gradient of 1 in 150 up to the chainage 14 & then the gradient changes to 1 in 100 downward. Formation width of the road is 10 m. & Side slope of the banking is 2:1 (horizontal : vertical. Length of the chain is 30 m draw longitudinal section of the road & a tipical cross section & prepare & estimate of earth work at the rate of rupees 275/- per m^3. Distance of Point 10 = 300 m.

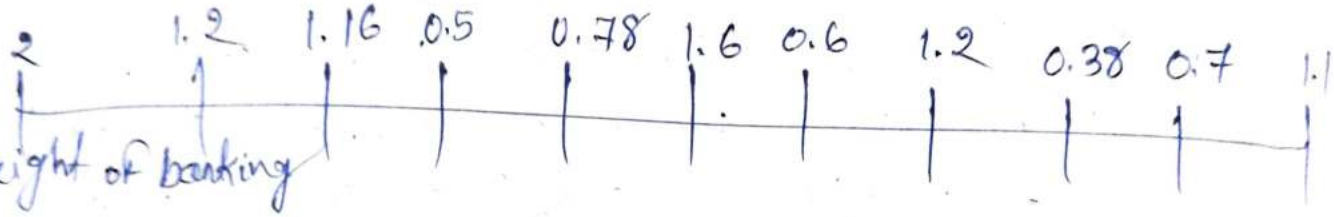
- Find also the area of the side slope & the cross of fencing the side slope at the rate of rupees 60/- Sq. m.

chainage	10	11	12	13	14	15	16	17	18	19	20
RL of ground	105	105.60	105.44	105.90	105.42	104.80	105	104.10	104.62	104	1033

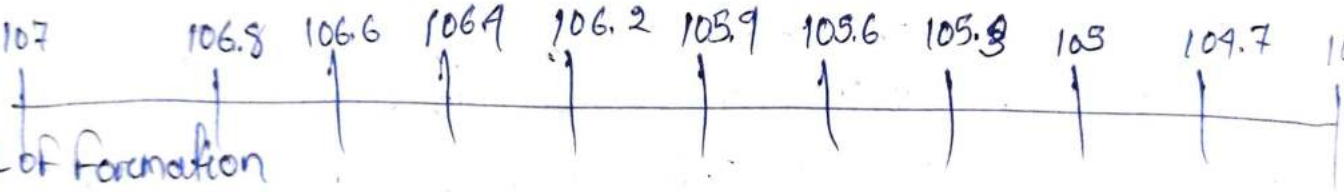
← Down ward gradient 1 in 150 → Down ward gradient 1 in 100 →



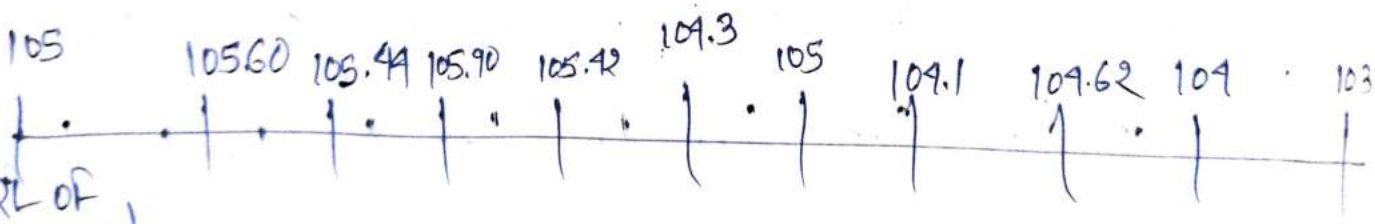
Depth of Cutting



Height of banking



RL of formation



RL of Groound

Distance of metre chainage

Station / Chainage (m)	Length (m)	+Height or depth Difference of R.L (m)	mean height or depth (m)	Central Area (Bd)(m^2) (B=10)	Side area Sd^2 (m^2) S:1 = 2:1 S=2	Total sectional area (Bd + Sd^2)	Length in between stations (L) in (m)	Quantity (Bd + Sd^2) L — Banking	Cutting
10	300	2	~~1.6 x 10~~ 1.6	1.6 x 10 = 16	2 x (1.6)^2 = 5.12	16 + 5.12 = 21.12	30	633.6	—
11	330	1.2	1.18	11.8	2.78	14.58	30	437.4	—
12	360	1.16	0.83	8.3	1.32	9.67	30	290.1	—
13	390	0.5	0.62	6.2	0.76	6.96	30	208.8	—
14	420	0.75	1.175	11.75	2.76	14.51	30	435.3	—
15	450	1.6	1.10	11.0	2.42	13.42	30	402.6	—
16	480	0.6	0.9	9	1.62	10.62	30	318.6	—
17	510	1.2	0.79	7.9	1.24	9.14	30	274.2	—
18	540	0.38	0.54	5.4	0.58	5.98	30	179.4	—
19	570	0.7	0.90	9.0	1.62	10.62	30	318.6	—
20	600	1.1							

Total = 3498.6

ABSTRACT OF ESTIMATED COST

Item No.	Description of Item	Quantity	Unit	Rate Rs. P.	Per	Cost Rs. P.
①	Earthwork in banking	3498.6	Cum	275.00	1 Cum	9621.15 ($\frac{3498.6 \times 275}{100}$)
					Total =	9621.15
			Add	5% Contingency =		481.05
				Grand total =		Rs. 10102.20

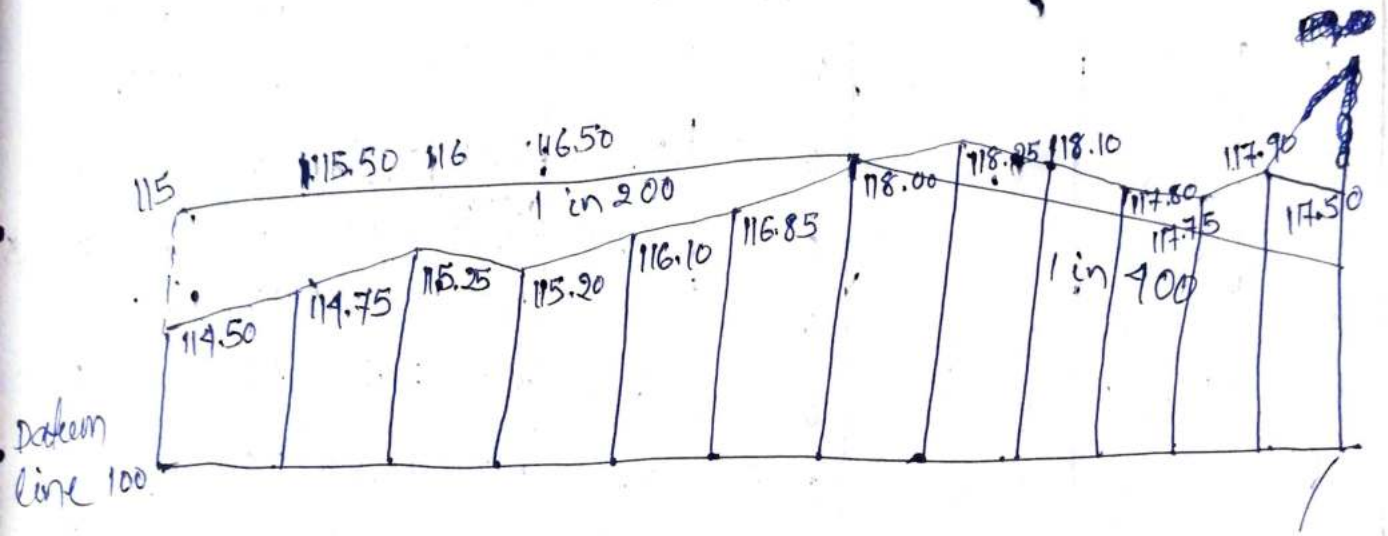
Calculation of area of side slopes

Station or Chainage	Height or Depth	Mean height or depth (D) in (m)	Sloping width of side slope	Length (CL) in (m)	Area of both side slope $2L.d\sqrt{S^2+1}$ in $(m)^2$
10	2.00	—	—	—	—
11	1.2	$\frac{2.00+1.2}{2} = 1.6$	$1.6\sqrt{2^2+1} = 3.57$	30	$2\times30\times1.6\sqrt{1^2+1} = 214.66$
12	1.16	1.18	$1.18\sqrt{2^2+1} = 2.63$	30	158.31
13	0.5	0.83	1.85	30	111.35
14	0.78	0.62	1.38	30	83.18
15	1.6	1.17	2.61	30	156.97
16	0.6	1.1	2.45	30	147.58
17	1.2	0.9	2.01	30	120.74
18	0.38	0.79	1.76	30	104.64
19	0.7	0.54	1.20	30	72.44
20	1.1	0.9	2.01	30	120.74

Quantity = 1290.61 m^2

Abstract of Cost of turfing

Item No.	Description of Item	Quantity	Unit	Rate Rs. P.	Per	Cost Rs. P.
(1)	turfing slide slopes	1290.61	Sq.m	60.00	1 Sq.m	774.36
				Total =		Rs. 774.36
			Add 5% Contingency			= 774.36 × 5%
						= 38.71
				Grand Total =		Rs. 813.07



Height of cutting						0						
Height of banking	0.5	0.75	0.75	1.3	0.9	0.65	0	0.5	0.6	0.55	0.75	1.15	1.00
RL of formation	115	115.50	116.00	116.50	117.00	117.50	118.00	117.75	117.50	117.25	117.00	116.75	116.50
RL. of ground	114.50	114.75	115.25	115.20	116.10	116.85	118.00	118.25	118.10	117.80	117.75	117.90	
Distance in m.	0	100	200	300	400	500	600	700	800	900	1000	1100	1200

Station	Distance in (m)	Height or depth betn (Difference betn G.L & F.L)	Mean height or depth (d) in (m)	Central area (B.d) in m²	Area of sides (Sd²) (m²)	Total sectional area (Bd + Sd²)	Distance in betn Stations (L) in (m)	Quantity (Bd+Sd²)L Bank.	Cut
0	0	0.5					—	—	
1	100	0.75	(0.5+0.75)/2 = 0.625	10×0.625 = 6.25	2×0.625² = 0.78	6.25+0.78 = 7.08	100	7031	
2	200	0.75	0.75	7.5	1.125	751.12	100	8625	
3	300	1.3	1.025	10.25	210.12		100	1235.1	
4	400	0.9	1.1	11	2.42		100	1342	
5	500	0.65	0.775	7.75	1.20		100	895	
6	600	0	0.325	3.25	0.211		100	346.1	
7	700	0.5	0.25	2.5	0.09	2.5+0.09 = 2.59	100	—	
8	800	0.6	0.55	5.5	1.5×0.55² = 0.45	5.95	100	—	
9	900	0.55	0.57	5.75	0.49	6.24	100	—	
10	1000	0.75	0.65	6.5	0.63	7.13	100	—	
11	1100	1.15	0.95	9.5	1.35	10.85	1.00	—	
12	1200	1	1.07	10.75	1.73	12.48	100	—	

Quantity = 5384

Abstract of estimated cost

Item No.	Particulars of items	Quantity	Unit	Rate Rs. P.	Per	Cost Rs. P.
1	earthwork in banking	5384	Cum	275.00	% Cum	14806.00
2	earthwork in cutting	4524	Cum.	350.00	% Cum	15834.00

Total = 30640

Add 5% Contingency = 30640 × 5%

= 1532

Grand Total = 32172