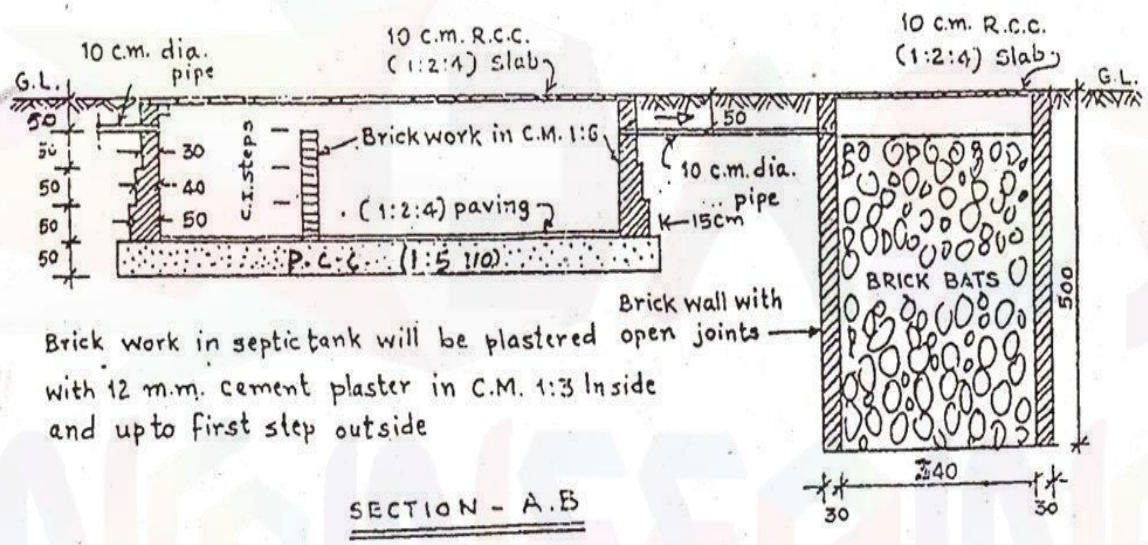
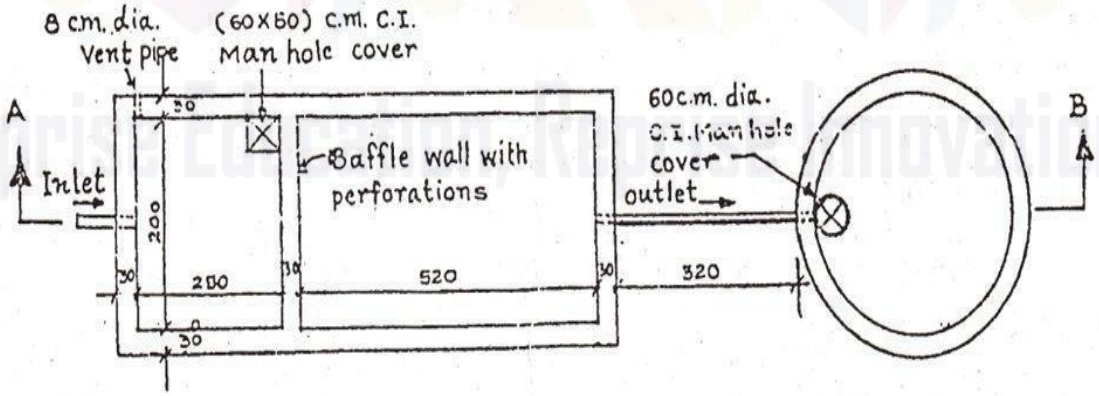
15CV81- MODULE 2

ESTIMATE OF OTHER STRUCTURES

Estimate the quantity of following items of septic tank fig.



SECTION - A.B



PLAN

(All dimensions are in Centimeter)

SEPTIC TANK WITH SOAK PIT

Item No	Particulars of items	No	L (m)	B (m)	D (m)	Quantity (m^3)	Explanatory Note
1.	**Earth work**						

	excavation Septic tank	1	8.4	2.60	2.5	54.6m^3	L= (.3+2+.3+5.2+.3)=8.4m
	Soak – pit up to 5m depth				5	62.83 m^3	
		1	(2)		Total	117.43m^3	
2.	**Cement concrete 1:5:10** - Floor and foundation	1	8.4	2.60	0.50	10.92 m^3	
3.	**Brick Bats** in Soak pit					40.86 m^3	
4.	**Brick work in C.M. 1:6**	1	(1	.7)	4.50		
	Septic tank						
	Long wall						
	1st step	2	8.5	0.5	0.5	4.25 m^3	
	2nd step	2	8.3	0.4	0.5	3.32 m^3	
	3rd step	2	8.1	0.3	1.0	4.86 m^3	
	Short wall						
	1st step	2	2.0	0.5	0.5	1.0 m^3	
	2nd step	2	2.0	0.4	0.5	0.8 m^3	
	3rd step	2	2.0	0.3	1.0	1.2 m^3	
	Baffle wall						
		1	2.0	0.3	1.5	0.9 m^3	
					Total	16.33 m^3	

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5.	R.C.C.cover slab for septic tank	1	8.1	2.6	0.1	2.106 m^3	
					0.1	1.257 m^3	
	Soak pit	1	(2)		Total	3.363 m^3	
6.	Internal plastering 12 mm C.M. 1:3						
	Long wall	2	7.2		2.0	28.8m^2	
	Short wall	2	2		2.0	8.0m^2	
					Total	36.80m^2	

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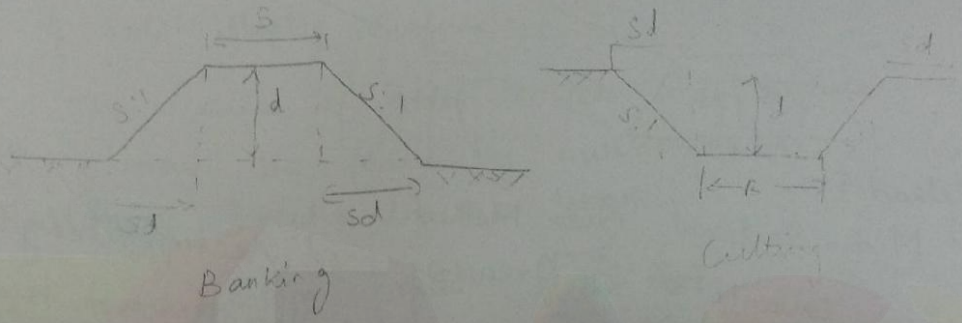
UNIT-2 Estimate of Other Structures.

Road Estimating

Cross section of earth work of road in banking or cutting is usually in the form of trapezium.

Qty of earth work may be calculated by following method Quantity = sectional area × length.



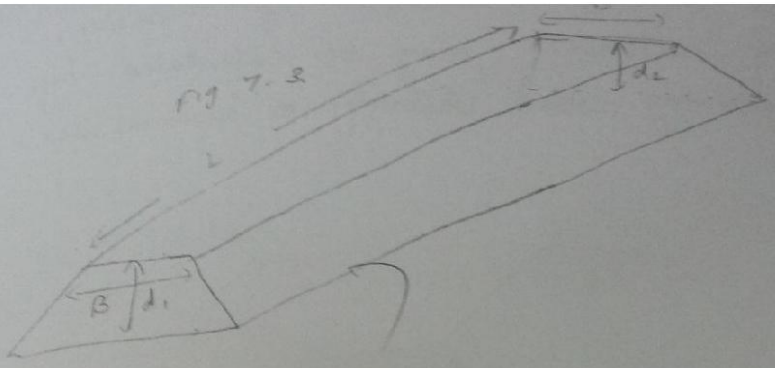
Sectional area = Area of central rectangular portion + Area of 2 side triangular portions.

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

$$A = Bd + Sd^2$$

$$\boxed{Qty = (Bd + Sd^2) \times L}$$

when the ground is in a longitudinal slope, the ht of bank (or) the depth of cutting will be different at the two ends of the section. & mean ht (or) depth may be taken for 'd' & the sectional area at mid section is taken out for mean ht.



Method I :-

Mid - Sectional Area Method :-

Quantity = Area of mid section × Length.

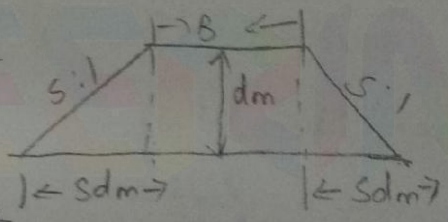
Let d_1 & d_2 be the ht of bank at two ends portion of embankment,

L - Length of the section

B → formation width.

S:1 → horizontal : Vertical

Area of mid section = Area of rectangular portion + area of 2 triangular portion.



$= Bdm + \frac{1}{2} Sdm^2 + \frac{1}{2} Sdm^2$

$A = Bdm + Sdm^2$

Quantity of Earthwork $= (Bdm + Sdm^2) \times L$

$Q = (Bd + Sd^2) \times L$

d → Mean ht (or) depth.

Calculations

Station (or) Chainage	Depth (or) Ht	Mean Depth (or) Ht "d"	Area of Central Portion Bd	Area of Side Sd²	Total Sectional Area (Bd+sd²)	Length b/w Stns L	Quantity (Bd+sd²) × L	
							Embankment	Cutting

Area of Side sloping Surface:

The area of sides which may require turfing, may be found by multiplying the mean sloping breadth by the length.

The mean sloping breadth: $\sqrt{s^2d^2+d^2}$

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

$B = d\sqrt{s^2+1}$

Area of both sides slopes $= 2L \times d\sqrt{s^2+1}$

Calculation:

Station (or) Chainage	Depth (or) ht	Mean depth (or) ht	Breadth Side slopes $d\sqrt{s^2+1}$	Length b/w stations L	Total Area of both side slopes: $2Ld\sqrt{s^2+1}$

Method II

Mean Sectional Area Method:-

Qty = Mean Sectional Area × Length

Sectional area at one end: $A_1 = Bd_1 + sd_1^2$

" " at other end: $A_2 = Bd_2 + sd_2^2$

$d_1 d_2$ are hts (or) depths at 2 ends

The mean sectional Area $A = \frac{A_1 + A_2}{2}$

Quantity $Q = \frac{A_1 + A_2}{2} \times$ Length.

Calculation.

Stn (or) Chainage	Ht (or) Depth "d"	Area of Central Portion Bd	Area of sides sd^2	Total sectional Area $Bd+sd^2$	Mean sectional Area	Length b/w station L	Quantity $(Bd+sd^2) \times L$ Embankment	Cutting

Method III Prismoidal formula Method:-

Quantity (or) Volume $= L/6 (A_1 + A_2 + 4A_m)$

$A_1, A_2 \rightarrow$ Cross sectional areas at the 2 ends of the embankment.

$d_1 d_2 \rightarrow$ hts of banks at the 2 ends.

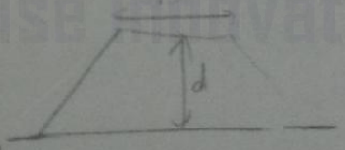
$d_m \rightarrow$ mean ht at the mid section.

$B \rightarrow$ formation width.

$s:1 \rightarrow$ side slope.

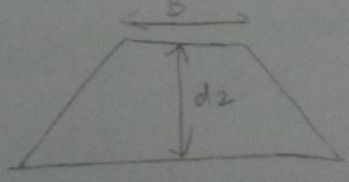
1) Cross sectional area at one end.

$$A_1 = Bd_1 + sd_1^2$$



2) Cross sectional area at other end

$$A_2 = Bd_2 + sd_2^2$$



3) Cross section at middle

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

$$A_m = Bd_m + sd_m^2 = B\left(\frac{d_1+d_2}{2}\right) + s\left(\frac{d_1+d_2}{2}\right)^2$$

Quantity $= \frac{L}{6}(A_1 + A_2 + 4A_m)$ ... 1.

$= \frac{1}{6}\left[(Bd_1 + Sd_1^2) + (Bd_2 + Sd_2^2) + 4\left\{B\left(\frac{d_1+d_2}{2}\right) + S\left(\frac{d_1+d_2}{2}\right)^2\right\}\right]$

$= \frac{1}{6}\left[\left(Bd_1 + Bd_2 + 4\frac{Bd_1}{2} + 4\frac{Bd_2}{2}\right) + Sd_1^2 + Sd_2^2 + \left(4S \times \frac{d_1^2 + d_2^2 + 2d_1d_2}{4}\right)\right]$

$= \frac{L}{6}\left[(3Bd_1 + 3Bd_2) + 2Sd_1^2 + 2Sd_2^2 + 2Sd_1d_2 \right]$

$= \frac{3BL}{6}(d_1+d_2) + \frac{2LS}{6}\left[d_1^2 + d_2^2 + d_1 + d_2\right]$

$= \frac{BL}{2}(d_1+d_2) + \frac{LS}{3}\left[d_1^2 + d_2^2 + d_1d_2\right]$

$= \left\{B\left(\frac{d_1+d_2}{2}\right) + S\left(\frac{d_1^2 + d_2^2 + 2d_1d_2}{3}\right)\right\} \times L$

Problem-1

Calculate the qty of earthwork for 200 m length for a portion of a road in an Uniform ground the ht of banks at the two ends beings 1.00m & 1.60m. The formation width is 10m & side slopes 2:1 (Horizontal : Vertical) Assume that there is no transverse slope.

Sol Method I

Qty: $(Bd + Sd^2) \times L$

Given $B = 10m$, $S = 2$, $L = 200m$

d: mean depth $\frac{d_1+d_2}{2}$ $\frac{1.00+1.60}{2}$

$Q = (Bd + Sd^2) \times L$

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

$= (13 + 3.38) \times 200 = 16.38 \times 200 = 3276 \text{ Cum}$

By Method I

A_1 = Sec. area at one end

A_2 = " " " other end

$A_1 = Bd_1 + Sd_1^2 = (10 \times 1) + (2 \times 1^2) = 12 \text{ sqm}$

$A_2 = Bd_2 + Sd_2^2 = (10 \times 1.6) + (2 \times 1.6^2) = 21.12 \text{ sqm}$

Mean Sec. area $= \frac{A_1 + A_2}{2}$

$= \frac{12 + 21.12}{2} = 16.56 \text{ sqm}$

Qty = Mean Sec area × Length.

$= 16.56 \times 200 = 3312 \text{ Cum}$

Method II by Prismoidal formula

$Q = L/6 (A_1 + A_2 + 4A_m)$

A_1 = Sec. area at one end

$= Bd_1 + Sd_1^2 = (10 \times 1) + (2 \times 1^2) = 12 \text{ sqm.}$

A_2 = Sec. area at one end

$= Bd_2 + Sd_2^2$

$= (10 \times 1.6) + (2 \times 1.6^2) = 21.12 \text{ sqm}$

A_m = Mid sec. area

$= Bd_m + Sd_m^2$

$d_m = \frac{d_1 + d_2}{2} = \frac{1.00 + 1.60}{2} = 1.30 \text{ m.}$

$A_m = (10 \times 1.30) + (2 \times 1.30^2)$

$= 16.38 \text{ sqm.}$

Quantity = $\frac{200}{6}$ [12 + 21.12 + (4 × 16.38)]

= $\frac{200}{6}$ × 98.64 = 3288 cum.

2) Calculate the area of the side slopes of Portion of a bank for a length of 200 m the heights of banks a the two ends being 2.50 m & 3.50m & the ratio of the side slope 2 : 1

ii) If the side slopes are to be provided with 15cm thk stone pitching, ~~solution~~ Calculate the cost of pitching at the rate of Rs. 150/- per cum.

i) Mean height d = $\frac{2.5 + 3.5}{2}$ = 3m

Sloping breadth at the mid section = $d\sqrt{s^2+1}$

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

= 6.71

Area of 2 side slopes = $2L \times d\sqrt{s^2+1}$

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

= 2 × 200 × 6.71

= 2684 sqm

ii) Qty of pitching = Area × thickness

= 2684 × 0.15 = 402.6 cum

Cost of stone pitching = 402.6 × 150

= 60390.0 Rs.

Quantity = $\frac{200}{6}$ [12 + 21.12 + (4 × 16.38)]

= $\frac{200}{6}$ × 98.64 = 3288 cum.

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= 2684 × 0.15 = 402.6 cum

Cost of stone pitching = 402.6 × 150

= 60390.0 Rs.

Ex-3. Reduced level (RL) of ground along the centre line of a proposed road from chainage 10 to 20 are given below. The formation level at the 10th chainage is 104 and the road is in downward gradient of 1 in 150 up to chainage 14 and then the gradient changes to 1 in 100 downward. Formation width of road is 10 m and side slopes of banking are 2:1 (H:V). Length of the chain is 30 m.

Draw Longitudinal section of the road and a typical cross-section and prepare an estimate of earthwork at the rate of Rs. 270% cum.

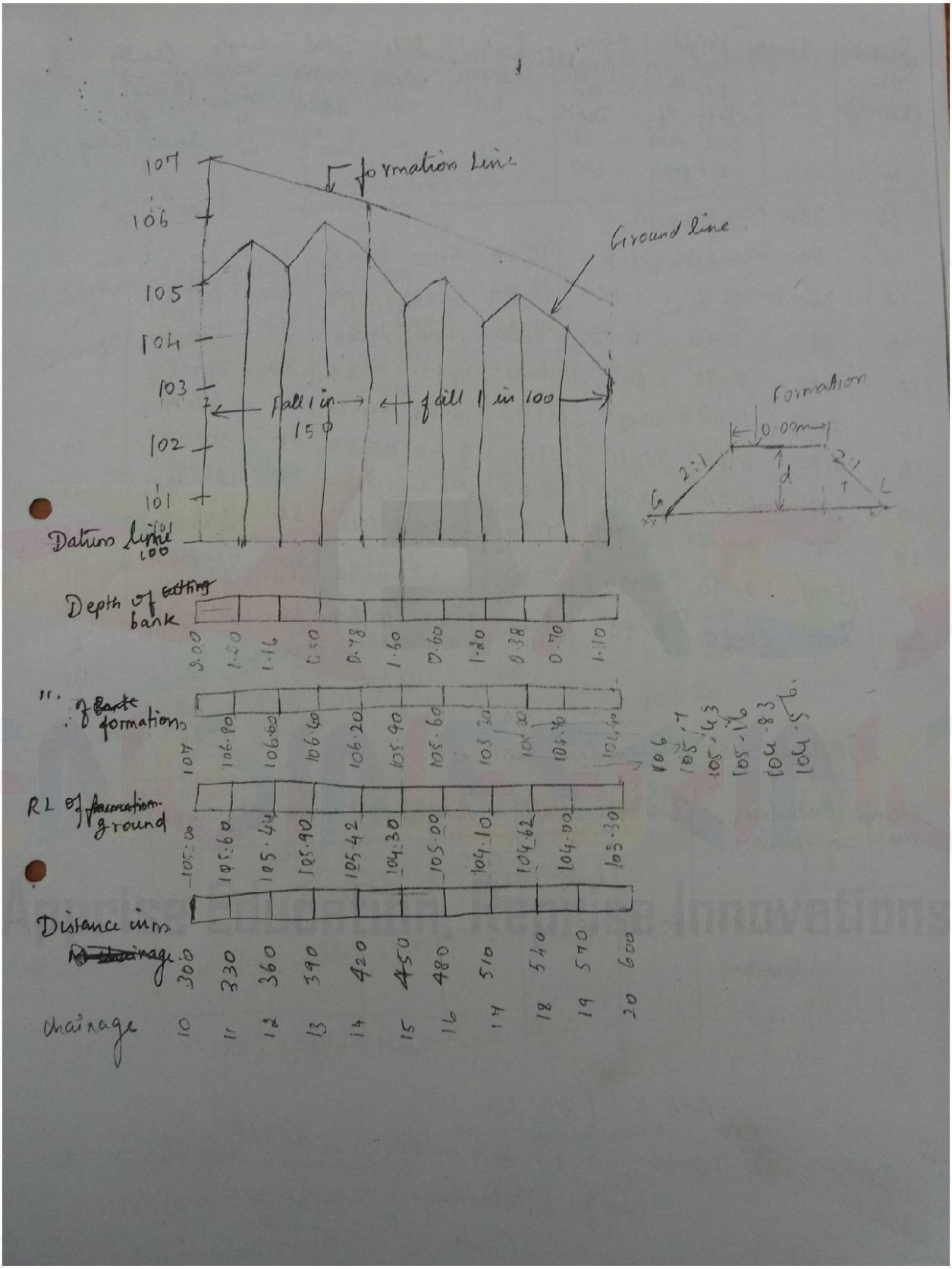
i) Find also the area of the side slopes and the cost of turfing the side slopes at the rate of Rs 60.00 % sq.m.

Chainage	10	11	12	13	14	15	16	17	18	19	20
RL of ground	105.00	105.60	105.44	105.90	105.42	104.30	105.00	104.10	104.62	104.00	103.3

RL of formation 107.00

Gradient Down gradient 1 in 150 →

← Down gradient 1 in 100


107
106
105
104
103
102
101
Formation Line
Ground line
Fall 1 in 150
Fall 1 in 100
Datum line 100
Depth of cutting
bank
3.00 1.30 1.16 0.50 0.78 1.60 0.60 1.80 0.38 0.70 1.10
" of formations
107 106.90 106.60 106.60 106.20 105.90 105.60 105.30 104.80 104.40
RL of formation ground
105.00 105.60 105.44 105.90 105.42 104.30 105.00 104.10 104.62 104.00 103.30
Distance in ms
300 330 360 390 420 450 480 510 540 570 600
Chainage
10 11 12 13 14 15 16 17 18 19 20
Formation
0.00m
2:1
2:1
d
G
T
L
106
105.7
105.43
105.16
104.83
104.56

Stations (or) Chainage m	Length m	Height (or) Depth Diff of G.L and F.L (m)	Mean height (or) Depth d (m)	Central area Bd m^2	Side area sd^2 m^2 (s=0.5)	Total x-sec area $Bd+sd^2$ m^2	Length inb/w stns L m^2	Quantity (Bd+sd²)L Banking m^3	Cutting m^3
10	300	2.00	—	16.00	5.12	21.12	30	633.6	—
11	330	1.20	1.6	11.80	2.78	14.58	30	437.4	—
12	360	1.16	1.18	8.30	1.38	9.68	30	290.4	—
13	390	0.50	0.83	6.4	0.82	7.22	30	216.6	
14	420	0.78	0.64	11.90	2.83	14.73	30	441.9	
15	450	1.60	1.19	11.10	2.42	13.42	30	402.6	
16	480	0.60	1.10	9.00	1.62	10.62	30	318.6	—
17	510	1.20	0.90	7.90	1.25	9.15	30	274.5	—
18	540	0.38	0.79	5.40	0.58	5.98	30	179.4	—
19	570	0.70	0.54	9.00	1.62	10.62	30	318.6	—
20	600	1.10	0.90						

Total = 3513.6 Cum

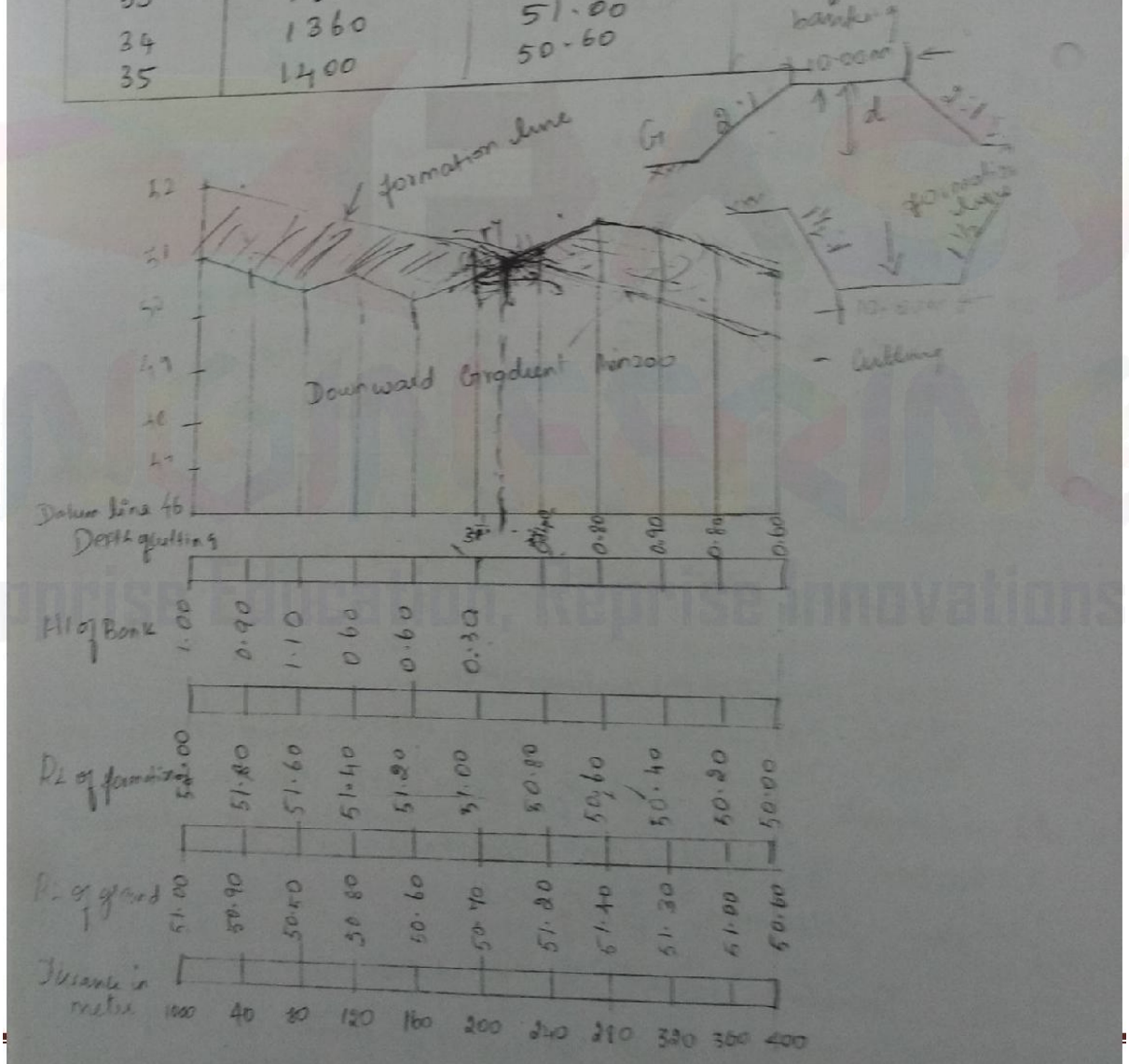
Abstract of Estimated cost :-

Item No	Particulars of items	Quantity	Unit	Rate Rs. P.	Per	Cost Rs	P.
	Earth work in banking	3513.6	Cum	275.00	1 Cum	9662.40	
					Total	9662.40	

Add 3% (3% for Contingencies & 2% for work Charged Establishment) 483.12

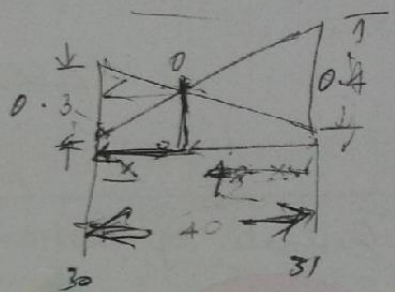
Total Rs 10145.52

Station	Distance in m	RL of Ground	RL of formation
25	1000	51.00	52.00
26	1040	50.90	↓
27	1080	50.50	↓
28	1120	50.80	↓
29	1160	50.60	↓
30	1200	50.70	↓
31	1240	51.20	Downward gradient of 1 in 200
32	1280	51.40	
33	1320	51.30	
34	1360	51.00	
35	1400	50.60	



The road passes from banking to cutting in between the stations 30 (1200m) and 31 (1240m) The distance where it passes through Zero, i.e. ground level, may be determined as follows.

The two Δs on either side of Zero point are symmetrical



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

$$0.4x = 0.3(40-x)$$

$$0.4x = 12 - 0.3x$$

$$0.7x = 12$$

$$x = 12/0.7 = 17.14\text{m}$$

$$= 17\text{m say}$$

Therefore length of banking portion is 17m, & the length of cutting portion is $40 - 17 = 23$m.

Station	Distance Km m	Ht (+) Depth (−) Diff of GL & F.L	Mean Ht (+) Depth (−) d (m)	Central area B d (m²)	Area of sides s d² m²	Total sec area B d + s d² m²	Dist in b/w Stations L (m)	Quantity (B d + s d²) × L Banking m³	Cutting m³
28	1-00	1.00	—	—	—	—	—	—	—
16	1-40	0.90	0.95	9.50	1.81	11.31	40	452.40	
27	1-80	1.10	1.00	10.00	2.00	12.00	40	480.00	
28	1-120	0.60	0.85	8.50	1.45	9.95	40	398.00	
29	1-160	0.60	0.60	6.00	0.72	6.72	40	268.80	
20	1-200	0.30	0.45	4.50	0.41	4.91	40	196.40	
Passes from banking to cutting									
—	1-217	0.06	0.15	1.50	0.05	1.55	17	26.35	—
31	1-240	0.40	−0.10	2.00	0.06	2.06	23		47.38
32	1-280	0.80	−0.60	6.00	0.54	6.54	40		261.6
33	1-320	0.90	−0.85	8.50	1.08	9.58	40		383.20
34	1-360	0.80	−0.85	8.50	1.08	9.58	40		383.20
35	1-400	0.60	−0.60	4.00	0.74	7.74	40		309.60
							Total	1821.95	1384.98

Ex-1 Prepare a detailed Estimate of a septic tank with soak pit for 25 Users for the drawings.

Item no	Particulars of operations	No	L	B	D	Qty	Remarks
1	Earth work Septic tank	1	2.8	1.7	1.95	9.26	Ht = 1.40 + 0.3 + 0.2 + 0.05 = 1.95 m.
	Soak pit up to 3.00 m depth.	1	$\frac{\pi \times 2.00^2}{4}$		3.00	9.42	
	Soak pit lower portion.	1	$\frac{\pi \times 1.4^2}{4}$		0.20	0.30	
					Total	19.00	cum.
2	Cement concrete 1:3:6 - floor & foundation ~~Sloping~~ Sloping floor	1	2.80	1.70	0.20	0.95	Average thickness $\frac{10+0}{2}$ = 5 cm.
		1	2.00	0.90	0.05	0.09	
3	1st class BW in 1:4 cm in. Septic tank Long walls.						
	1st step	2	2.60	0.30	0.60	0.94 ~~0.32~~	
	2nd step	2	2.40	0.20	1.15	~~0.92~~ 1.10	
	Short walls						
	1st step	2	0.9	0.30	0.60	0.32	
	2nd step	2	0.9	0.20	1.15	0.42	
4	2nd class BW in 1:6 cm						
	Soak pit Upper portion	1	$\pi \times 1.20$	0.20	0.50	0.38	
	Lower portion	1	$\pi \times 1.20$	0.20	0.20	0.15	
						0.53	
5	2nd class dry BW in soak pit	1	$\pi \times 2$	0.20	2.50	1.88	cum.

6	Precast R.C work finished smooth including steel reinforcement complete laid in position.						
	Roof Cover slab of Septic tank	1	2.40	1.30	0.075	0.234	7.5cm thk
	Roof Cover slab of Soak pit	1	$\frac{\pi \times 1.40^2}{4}$	×	0.075	0.115	
	Baffle wall in Septic tank	1	1.00	0.04	0.45	0.018	
					Total	0.367	cumm
7	12mm cement plaster 1:3 with Standard water proofing Compound in Septic tank						
	Long walls	2	2.00	-	1.70	6.80	
	Short walls	2	0.90	-	1.70	3.06	
					Total	9.86	sqm
8	20mm Cement plaster 1:3 with standard water proofing Compound in floor of septic tank	1	2.00	0.90	-	1.80	sqm.
9	50mm size brick aggregate:-						
	Outside of soak pit	1	$(\pi \times 5.55)$	×0.15	2.50	1.74	L = mean Circum.
	At bottom of soak pit	1	$\frac{\pi \times 1.01^2}{4}$	×	0.20	0.16	
						2.00	cubic cum