ESTIMATING

&

COST EVALUATION-II

TH-5

5th SEM

CIVIL ENGG.

Under SCTE&VT,Odisha

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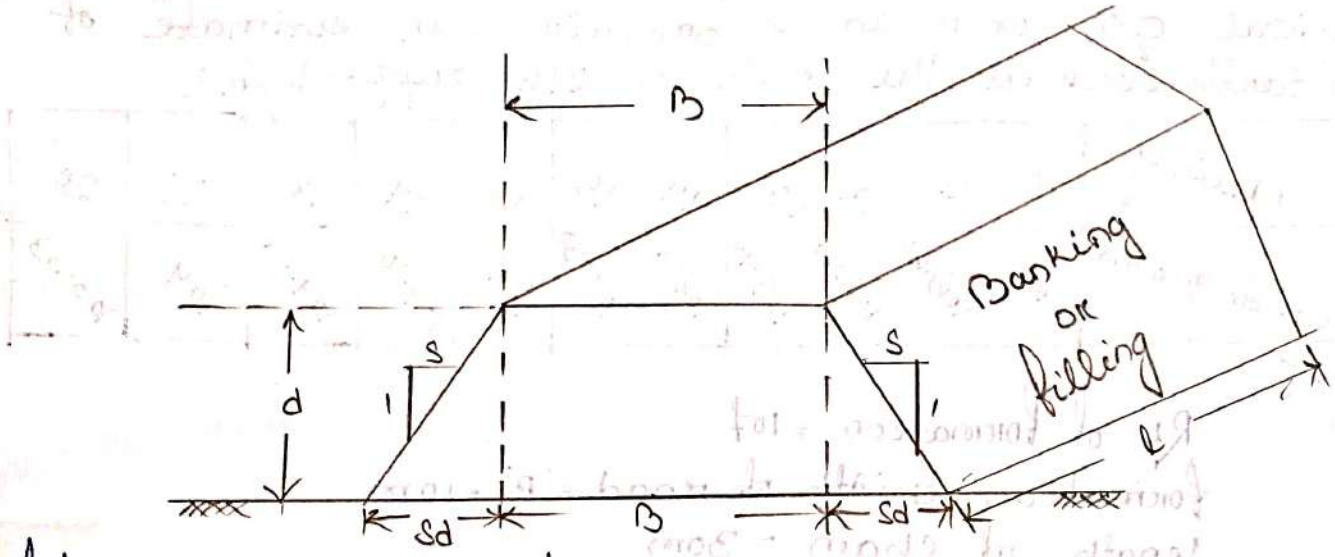
KALINGA NAGAR POLYTECHNIC.TARAPUR,JAJPUR ROAD

CH-3

Detailed estimate of Road:

Estimate of road (Earth work):→

→ crossection of earthwork of road in cutting or in banking is usually in the form of trapisium and the quantity of earth work may be calculated by following method.



let,

B = Breath of surface
d = Depth of banking or filling
S = Slope
S:1 = means S = Horizontal
1 = Vertical

Here IV = S horizontal
dV = Sd horizontal
L = length of road

Quantity of volume = c/s area x length

c/s area = Area of central rectangular portion + 2x Area of trangular portion

$= BD + \frac{1}{2} \times Sd \times d + \frac{1}{2} \times Sd \times d$

$= BD + \frac{1}{2} Sd^2 + \frac{1}{2} Sd^2$

$= BD + Sd^2$

Quantity of earth work = Area x length

$= (BD + Sd^2) \times L \, m^3$

height of Bank = RL of formation − RL of ground

Pro-1 The RL of ground along the centreline of a road from chainage 10 to 20 are given below the RL of formation at the 10th chainage is 107 and road is in down ward gradient of 1 in 150 up to chainage 14 then the gradient Chainages to 1 in 100 downward. formation width of road is 10m and slide slopes of banking are 2:1 (Horizontal : vertical)
length of chain = 30m. Draw longitudinal c/s and typical c/s of road & prepair an estimate of Earthwork at the rate of 275 ruppees/m^3.

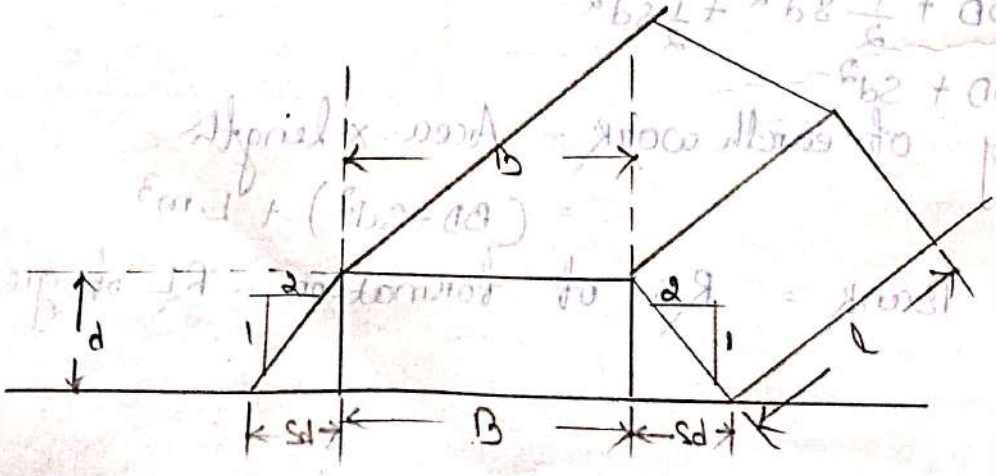
Chainage	10	11	12	13	14	15	16	17	18	19	20
RL of ground	105	105.60	105.44	105.90	105.42	104.30	105	104.10	104.62	104	103.33

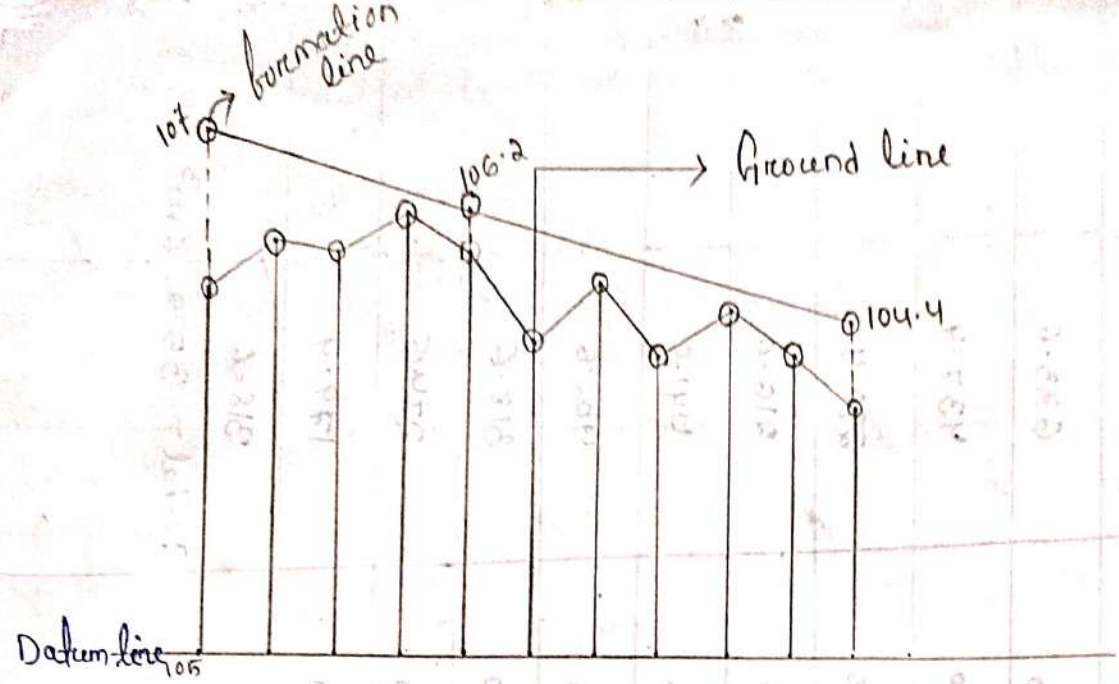
Sol?:

RL of formation = 107
formation width of road = 'B' = 10m
length of chain = 30m
downward gradient 1 in 150 upto chainage 14
1 vertical = 150 horizontal
$\Rightarrow$ 150 = 1V.
1 horizontal = $\frac{1}{150}$ ~~vertical~~
30 horizontal = $\frac{1}{150} \times 30V = 0.2$ vertical

gradient $\rightarrow$ Downward gradient 1 in 100 upto chainage 20
100 horizontal = 1 vertical
$1h = \frac{1}{100} V$
$30h = \frac{1}{500} \times 30V = 0.3V$

Longitudinal crossection of Road





Depth of cutting										
Depth of filling	2	1.2	1.16	0.5	0.78	1.6	0.6	1.2	0.38	0.7	1.1
RL of formation	107	106.8	106.6	106.4	106.2	105.90	105.60	105.30	105	104.70	104.4
RL of ground	105	105.60	105.44	105.96	105.42	104.30	105	104.10	104.69	104	103.32
Distance	300	330	360	390	420	450	480	510	540	570	600
Chainage	10	11	12	13	14	15	16	17	18	19	20

Chainage	Length (m)	Height or depth of cutting or banking (m)	Mean height or depth (m)	Central Area BD (m^2)	Side Area (sd^2)	Total Area ($BD+sd^2$) (m^2)	Length bet^n Station	Quantity $(BD+sd^2)\frac{n}{2} \times L$ Banking	Cutting
10	300	2.0	—	—	—	—	—	—	—
11	330	1.2	$\frac{2+1.2}{2} = 1.6$	$10 \times 1.6 = 16$	$2 \times (1.6^2) = 5.12$	$16 + 5.12 = 21.12$	30	633.6	
12	360	1.16	1.18	11.8	2.784	14.58	30	437.4	
13	390	0.5	0.83	8.3	$1.377 \rightleftharpoons 1.38$	9.68	30	290.4	
14	420	0.87	0.64	6.4	$0.819 \rightleftharpoons 0.82$	7.22	30	216.6	
15	450	1.6	1.19	11.9	2.832	14.73	30	441.9	
16	480	0.6	1.1	11	2.42	13.42	30	402.6	
17	510	1.2	0.9	9	1.62	10.62	30	318.6	
18	540	0.88	0.79	9	$1.248 \rightleftharpoons 1.25$	9.15	30	2745	
19	570	0.7	0.54	4	0.58	5.98	30	179.4	
20	600	1.1	0.9	9	1.62	10.62	30	318.6	

Total = 3513.6 m^3

for 1 m^3 Rate = 275/-

for 3513.6 m^3 = 3513.6 × 275 = 966240/- (Ans)

Prob-2 Estimate the quantity of Earthwork for a portion of road for 700m length from the following data:—

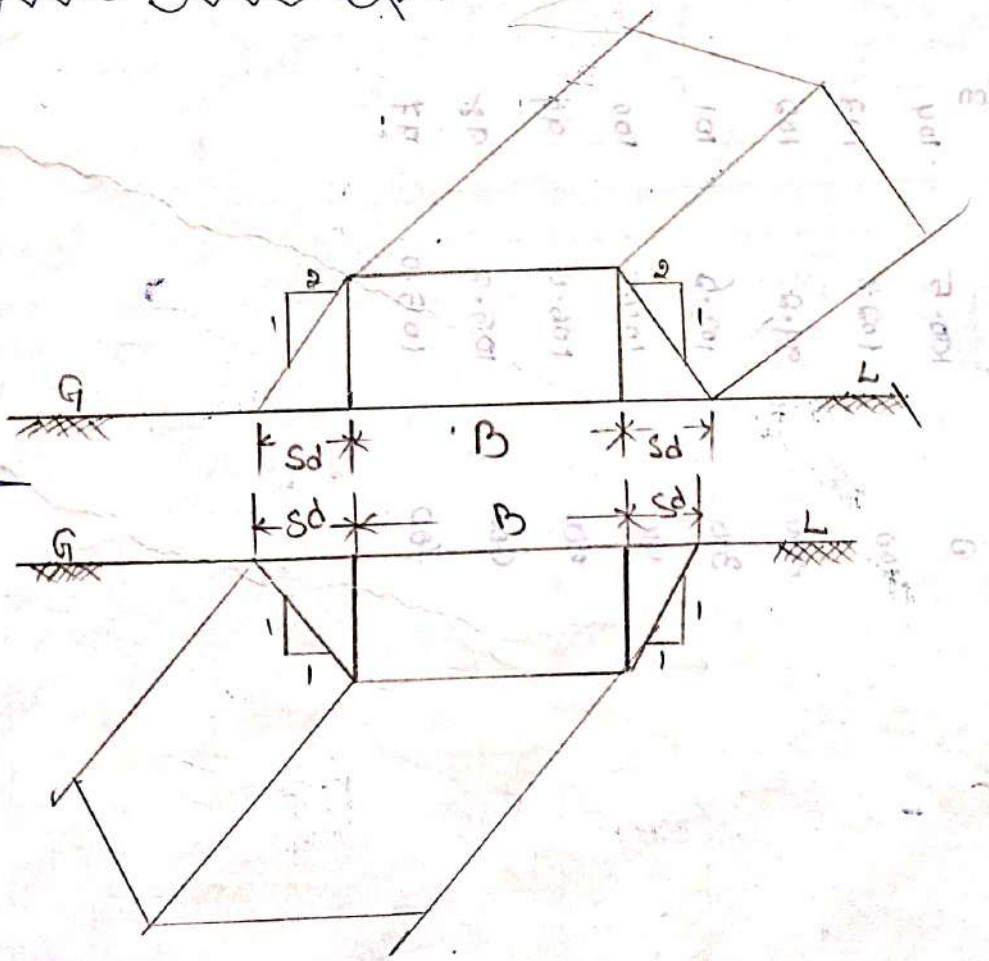
Formation width = 10m
Slopes in cutting = 1:1
slopes in filling = 2:1
formation level at 0 chainage = 104
Downward gradient 1 in 100.

Distance	0	100	200	300	400	500	600	700	X
RL of ground	100.5	102.8	99.2	103.6	104.5	106.5	105.3	105.0	X

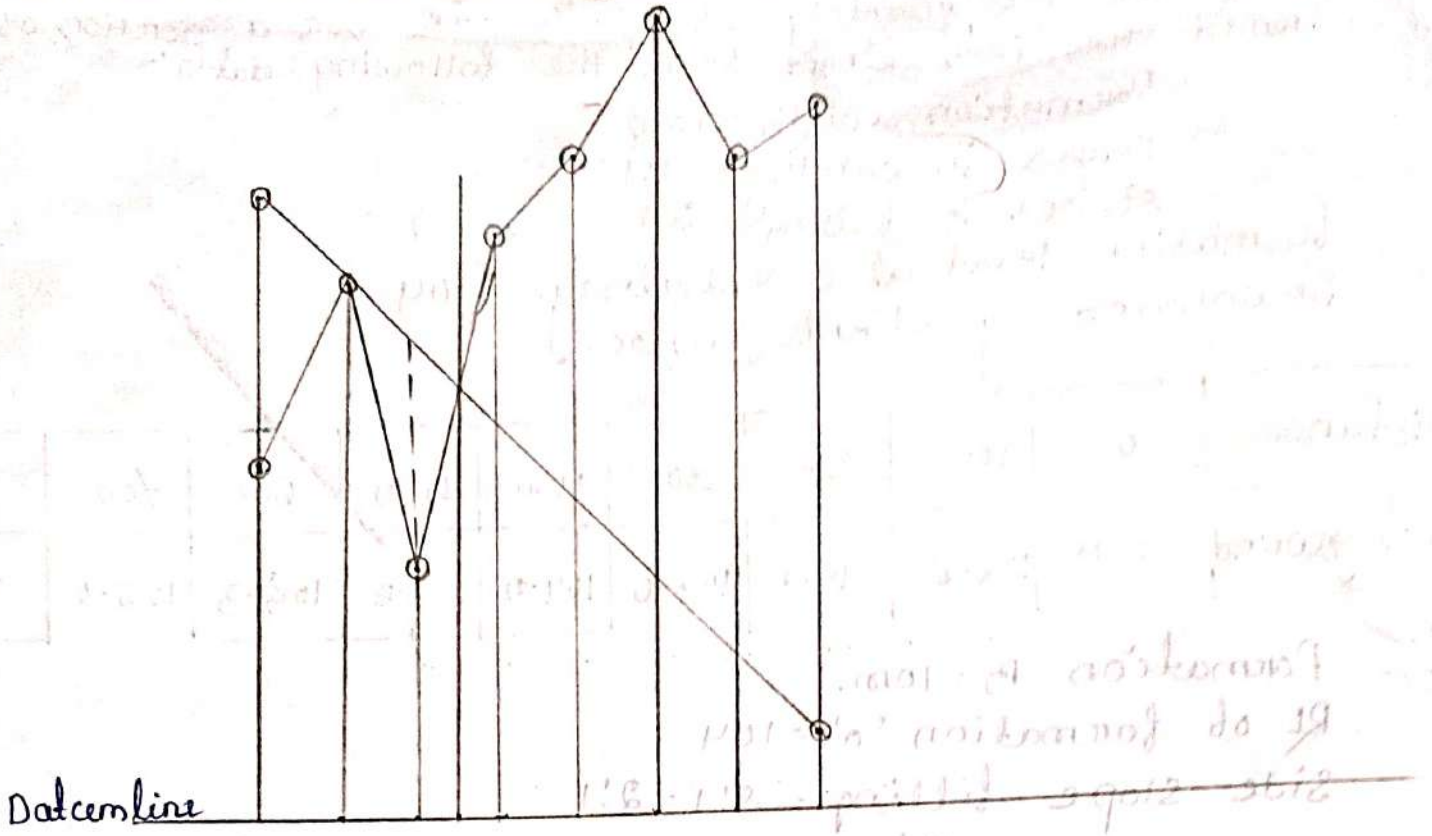
Sol:— Formation B = 10m.
RL of formation '0' = 104
Side slope filling = S:1 = 2:1
cutting = S:1 = 1:1

Gradient → Downward gradient 1 in 100
that means 100h = 1V
1h = 1/100 V
100h = 100/100 = 1 vertical

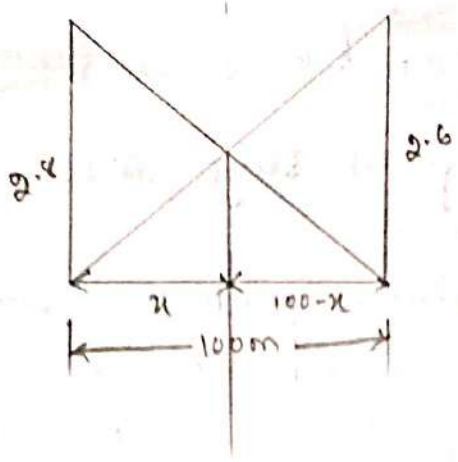
Longitudinal c/s of road:—



Cutting:—



Depth of cutting			2.6	4.5	7.4	7.3	6
Depth of filling	3.5	0.2	2.8				
RL of formation	104	103	102	101	100	99	98	97
RL of ground	100.5	102.8	99.2	103.6	104.5	106.4	105.2	105.0
Distance Chainage	0	100	200	300	400	500	600	700



$$\Rightarrow \frac{2.8}{x} = \frac{2.6}{100-x}$$

$$\Rightarrow 2.8(100-x) = 2.6x$$

$$\Rightarrow -2.8x + 280 = 2.6x$$

$$\Rightarrow 280 - 2.8x = 2.6x$$

$$\Rightarrow 280 = 2.6x + 2.8x$$

$$\Rightarrow 280 = 5.4x$$

$$x = \frac{280}{5.4} = 51.85$$

$x = 51.85$

$100 - 51.85$

$= 48.15$

Chainage	Length m	Height or depth of cutting or banking (m)	Mean height or depth (m)	Central area BD m²	Side area SD²	Total area (BD+SD) m²	Length in bet² station	quantity (BD+SD²)x L Banking	Cutting
0	0	3.5	—	—	—	—	—	—	—
1	100	0.2	$\frac{3.5+0.2}{2} = 1.85$	$10 \times 18.5 = 18.5$	$2 \times (1.85)^2 = 6.845$	$18.5 + 6.845 = 25.34$	100	2534	
2	200	2.8	1.5	15	4.5	19.5	100	1950	
Passes	251.85	0	1.4	14	3.92	17.92	51.85	929.152	
3	300	-2.6	1.3	13	$1 \times (1.3)^2 = 1.69$	14.69	48.15		707.32
4	400	-4.5	3.55	35.5	12.60	48.1	100		4810
5	500	-7.4	5.95	59.5	35.40	94.9	100		9490
6	600	-7.3	7.35	73.5	54.02	127.52	100		12752
7	700	-8	7.65	76.5	58.52	135.02	100		13502
						Total =		5414.15 m³	-41261.32 m³

Total banking = 5414.15 m³

Total cutting = -41261.32 m³

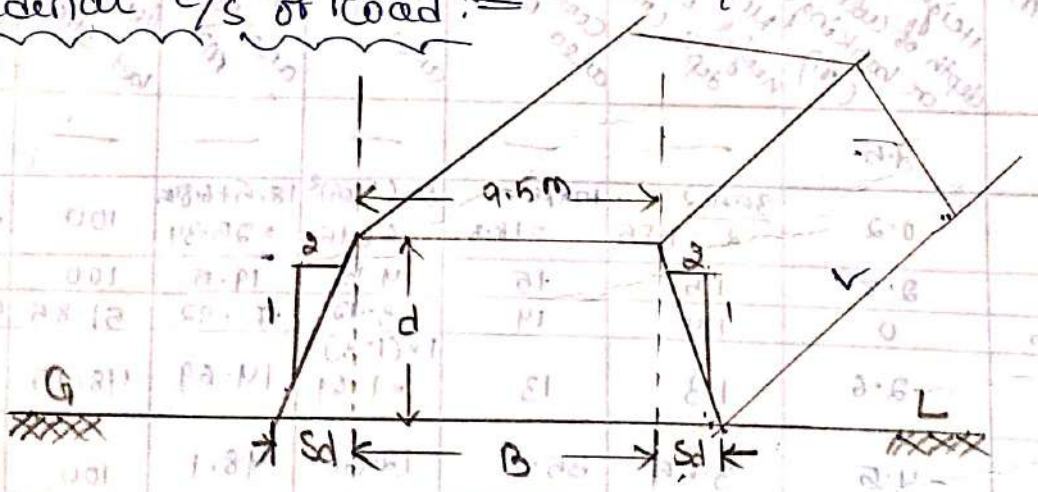
use (-ve sign for cutting) (Ans).

Pro-3 Workout the earth work for road from the following data
formation width = 9.5m.
Banking / Embankment slope = 2:1
Cutting slope = 1.5 : 1
The formation are filling gradient = 1 in 200
RL of formation at chainage '0' = 102.50

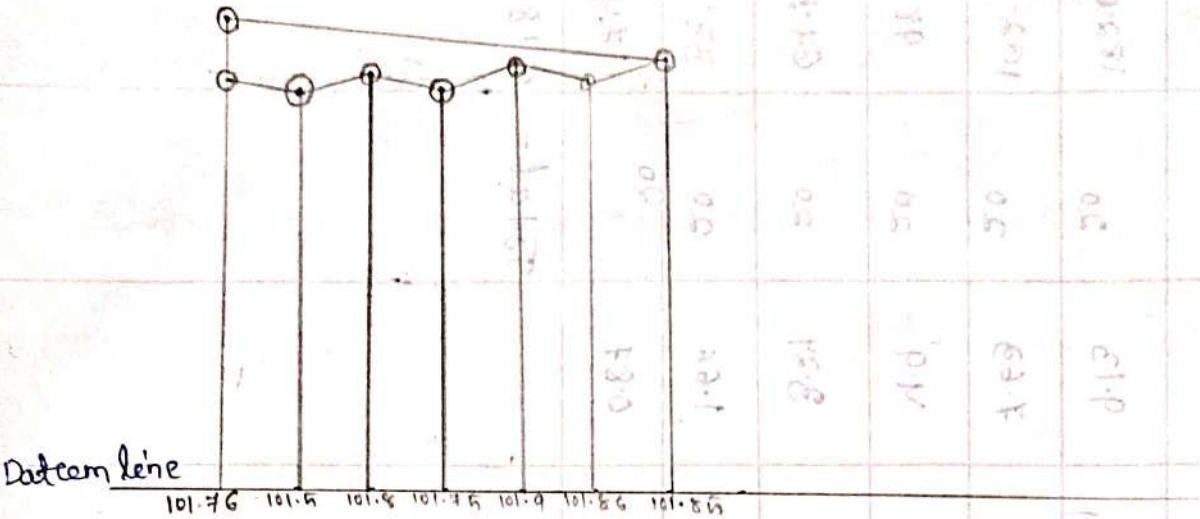
Distance	0	20	40	60	80	100	120	X
RL of ground	101.76	101.5	101.8	101.75	101.9	101.86	101.85	X

Sol?-
Formation width = B = 9.5m
RL of formation at '0' = 102.50
Embankment S:1 = 2:1
Cutting S:1 = 1.5:1
Gradient - Downward gradient 1 in 200
200h = 1V
$1h = \frac{1}{200} V$
$20h = 20/200\ V = 0.1V$

Longitudinal c/s of road :=



Typical c/s of Road :-



Depth of cutting

Depth of filling 0.74 0.9 0.5 0.45 0.2 0.14 0.05

RL of formation 102.50 102.4 102.3 102.2 102.1 102 101.9

RL of ground 101.76 101.5 101.8 101.75 101.9 101.85 101.85

Distance 0 20 40 60 80 100 120

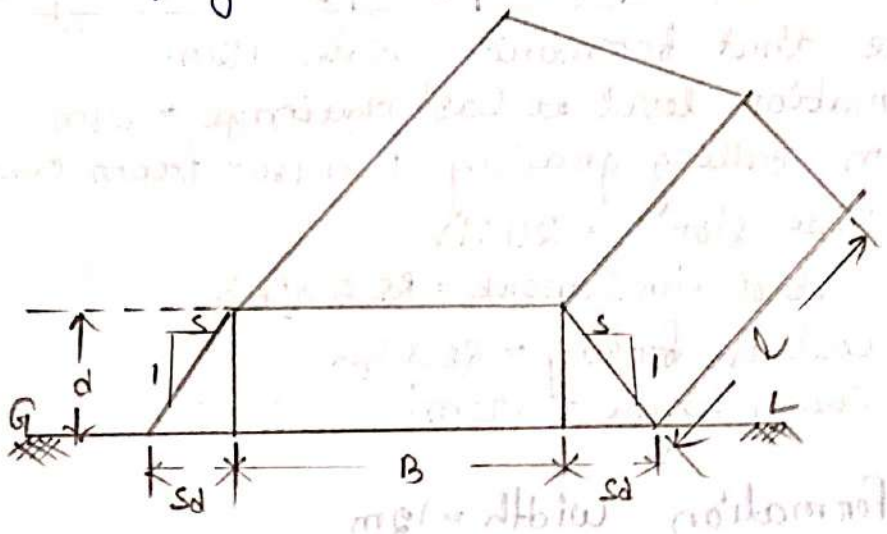
chainage 1 2 3 4 5 6 7

Chainage	Length (m)	Height or depth of cutting or banking (m)	mean height or depth (m)	central area (BD) m^2	Side area (sd^2) m^2	Total area ($BD + sd^2$) m^2	Length in bet^n station	Quantity Banking	Quantity Cutting ($BD \times L$) m^3
0	0	0.74	—	—	—	—	—	—	—
1	20	0.9	$\frac{0.74+0.9}{2} = 0.82$	$9.5 \times 0.82 = 7.79$	$2 \times (0.82)^2 = 1.34$	9.13	20	182.6	
2	40	0.5	0.7	6.65	0.98	7.63	20	152.6	
3	60	0.45	0.47	4.465	0.44	4.9	20	98	
4	80	0.2	0.32	3.04	0.20	3.24	20	64.8	
5	100	0.14	0.17	1.615	0.05	1.66	20	33.2	
6	120	0.05	0.095	0.90	0.01	0.87	20	17.4	
							Total =	548.4	m^3

Area of side sloping surface:—

The area of sides may required turfing or pitching may be found by multipling the mean slopping breadth by the length.

The mean sloping breadth =



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

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

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

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

Area of both side slope = $2Ld\sqrt{1+s^2}$

Tabulation:—

Station or chainage	Depth of height (m)	mean depth (m)	Breadth of side slope $d\sqrt{1+s^2}$ (m)	length in bet? station (m)	Total area of both side slope $2Ld\sqrt{1+s^2}$ (m^2)

Prob-1 Calculate the cost of earthwork & turfing for a portion of a National highway for the following data.

Chainage	0	1	2	3	4
RL of ground	62.00	61.40	61.70	61.5	60.8

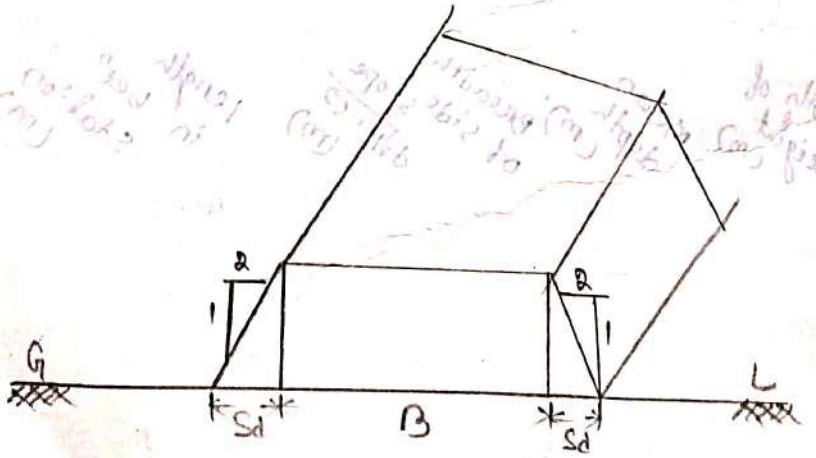
Assume that formation width = 12m.
formation level at last chainage = 64m
uniform falling grading 1 in 180 from chainage 0 to 4.
Side slope = 2H : 1V
Cost of earth work = Rs 53/m³.
Cost of turfing = Rs 3/m²
Chain length = 120m.

Sol?:-

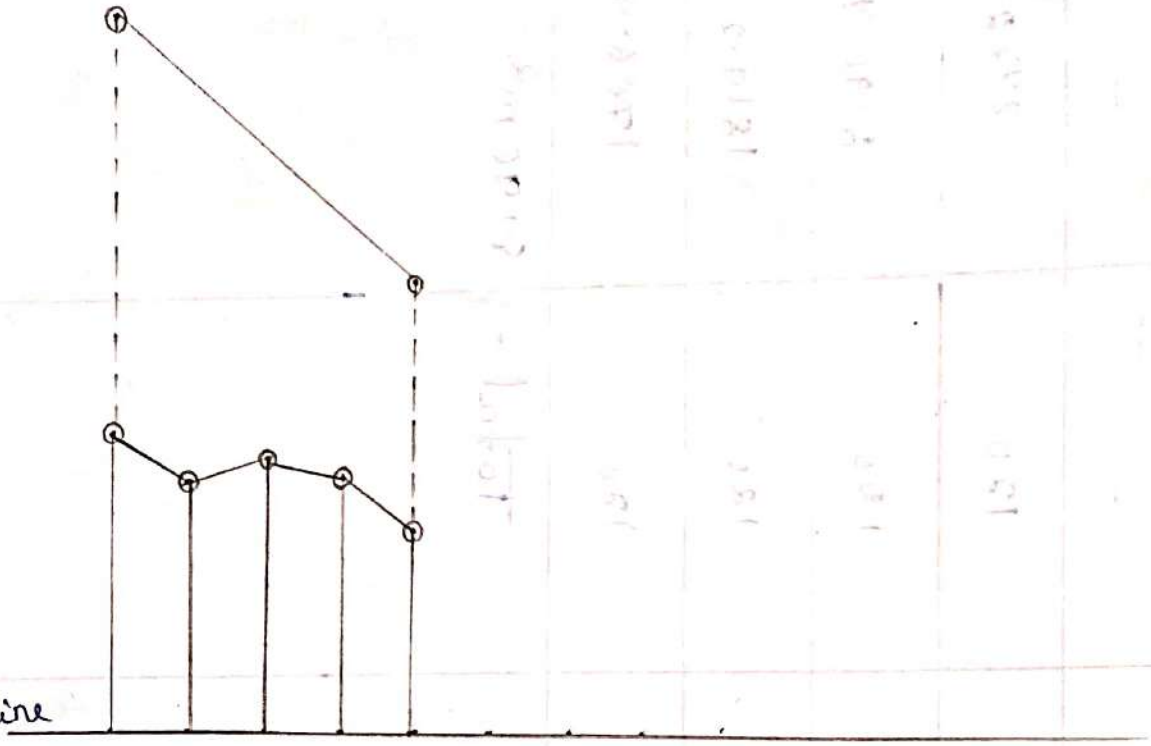
Formation width = 12m

1 in 180
180 h = 1V
1h = $\frac{1}{180}$ V
120h = $\frac{120}{180}$ = 0.66V.

Longitudinal c/s of Road:-



Typical c/s



Depth of cutting

Depth of filling 4.64 4.58 3.62 2.16 2.2

RL of formation 66.64 66.98 65.38 64.66 64

RL of ground 62.00 61.40 61.70 61.5 60.8

Distance

Chainage 0 1 2 3 4

Station or Chainage	Depth or height (m)	mean depth (m)	Breadth $d\sqrt{1+s^2}$ (m)	Length in between Station (m)	Total area of both Side slope $2ld\sqrt{1+s^2}$ $(m)^2$
0	4.64	—	—	—	—
1	4.58	4.61	10.30	120	2472
2	3.62	4.1	9.16	120	2198.4
3	3.16	3.39	7.58	120	1819.2
4	3.2	3.18	7.11	120	1706.4
				Total =	8196 m^2

1 m^2 turfing Rate = 3/-

8196 m^2 turfing = 8196 x 3

= 24588/-

Chainage	Length (m)	Height or depth of cutting or banking (m)	mean height or depth (m)	central Area BD (m^2)	side Area (sd2)	Total Area (BD+sd2) m^2	length in bet^n station	Quantity (BD+(sd2)) × L	
								Banking	cutting
0	0	4.64	—	—	—	—	—	—	—
1	120	4.58	4.61	12 × 4.61 = 55.32	2×(4.61²) = 42.50	97.82	120	11738.4	
2	240	3.62	4.1	49.2	33.62	82.82	120	9938.4	
3	360	3.16	3.39	40.68	22.98	63.66	120	7639.2	
4	480	3.2	3.18	38.16	20.22	58.38	120	7005.6	
							Total =	36321.6 m^3	

$1 m^3$ earthwork Rate = 53/-

$36321.6 m^3$ earthwork = 36321.6 × 53
= 1925044.8/-

Total cost = 24588 + 1925044.8
= 1949632.8/- (Ans)

Estimate of water bound macadam road:-

(Estimate of WBM road):-

Q:-1 Estimate the items of construction of a WBM road from the following data:→

length of road := 100m.

metal width := 5500mm.

thickness of grade I metal = 80mm

wiering coat of grade II metal = 120mm loose consolideted to 80mm thick

Surface of the road is to be finished with 2 coats bitumine as given below.

1st coat = 12mm chips @ $0.018 m^3$ & bitumen @ 1.22kg per sq.m of road surface.

2nd coat = 6mm chips @ $0.01 m^3$ & bitumen @ 1.22kg per sq.m of the road surface.

Consumption of fuel @ 0.4kg/kg of bitumen.

Sol:-

length of road = 100m

metal width = 5500mm

thickness of grade I metal = 80 mm

1st Coat = Chips = $0.018 m^3/m^2$

Bitumen = $1.22 kg/m^2$

2nd coat = Chips = $0.01 m^3/m^2$

Bitumen = $1.22 kg/m^2$

fuel = 0.4 kg/kg.

Sl.No	P.O.I	No	L	B	D	Q	Explⁿ note
1	Site clearance	1	100 m	6.7 m		670	B = 5.5 + 0.6 + 0.6 = 6.7
2	Metal soling						
	grade - I	1	100m	5.5m	0.08	44m³	
	grade - II	1	100m	5.5m	0.12	66m³	
3	Chips						
	12mm size chips	1	100m	5.5	0.018	9.9	
	6mm size chips	1	100m	5.5	0.01	5.5	
4	Bitumen						
	1st coat	1	100	5.5	1.22	671kg	
	2nd coat	1	100	5.5	1.22	671kg	

Total bitumen = 671 + 671 = 1342kg
for 1kg bitumen fuel required = 0.4kg
for 1342kg bitumen required fuel = 1342 × 0.4 = 536.8kg.

Q-2 Estimate the following quantities for construction of a WBM road for 1km length having following specification.

Formation width of road = 10m.
average height of bank = 1m.
Side slope of bank = 2:1
metal width of road = 3.8m.
Soling coat of over burnt brick = 10cm. thick
inter coat of metaling shall be of stone ballast 12cm thick loose compacted to 8cm.

Top coat of metaling shall be stone ballast of 9cm thick loose layer compacted to 6cm.

Bitumen @ 2.2kg per sqm for both inter & top coat.

(i) Earth work in escavation.

(ii) No of brick for soling

(iii) Metal soling.

(iv) Quantity of bitumen

Sol) Data given :-

length of road (L) = 1km.

formation width (b) = 10m.

height of bank (d) = 1m.

Side slope of bank (S) = 2:1

metal width of road = 3.8m.

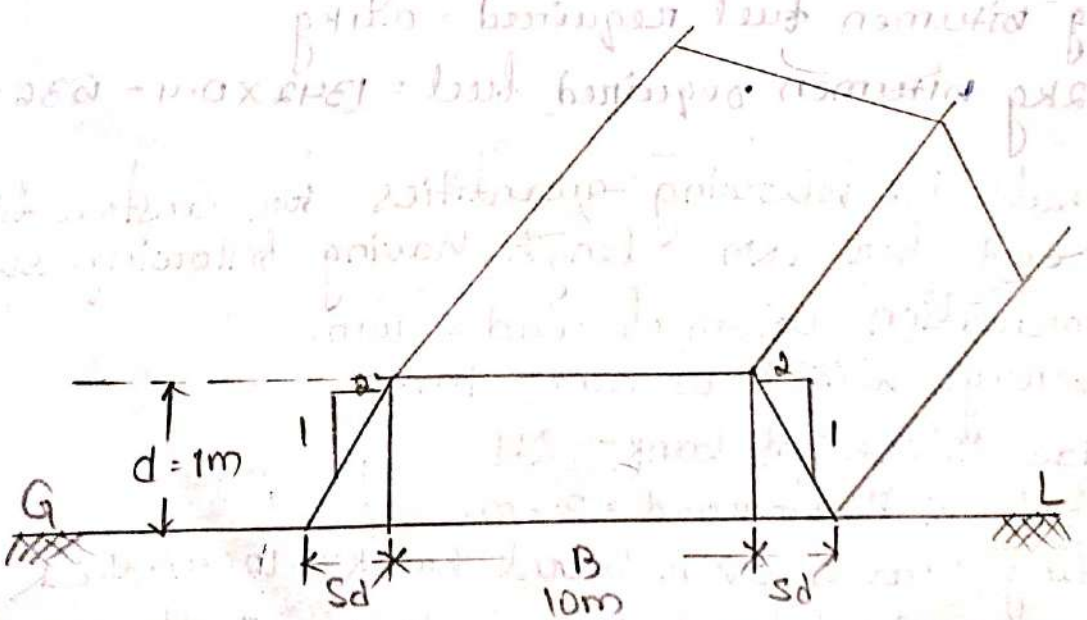
Soling coat of over burent brick = 10cm thick

Inter coat ballast = 12 cm thick

Top coat ballast = 9cm thick

Inter coat of bitumen = 2.2 kg/sqm.

Top coat bitumen = 2.2 kg/sqm.



(i) Earthwork in excavation :—

Quantity of earth work

= Area of road surface × length of road

$(bd * Sd^2) \times L$

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

$= 12 m^3$

(ii) No of brick for soling :—

P.O.I	NO	L	B	D	Q	Expln note
Brick Soling	1	1000m	3.8m	0.1m	$380 m^3$	

Volume of 1 brick $= 0.2 \times 0.1 \times 0.1 = 0.002 m^3$

No of bricks $= \frac{380 m^3}{0.002} = 190,000$ nos

(iii) Metal soling :—

P.O.I	NO	L	B	D	Q	Expln Note
Metal Soling						
Inter coat	1	1000m	3.8m	0.12m	$456 m^3$	
Top coat	1	1000m	3.8m	0.09m	$342 m^3$	
				Total	$= 748 m^3$	

(iv) Quantity of bitumen :—

P.O.I	NO	L	B	D	Q	Expln Note
Bitumen						
Inter coat	1	1000m	3.8m	2.2 kg/sq.m	8360kg	
Top coat	1	1000m	3.8m	2.2 kg/sq.m	8360kg	
				Total	= 16720 kg	

—o—

Q-3 Estimate the items of construction of a WBM road for the following data :-

Length of the road = 150 m

Formation width = 10 m

metal width = 8 m

Thickness of grade-I metal = 90 mm

wearing coat of grade-II metal = 12 cm thick loose & 8 cm thick compacted.

1st coat 12 mm chips @ 0.020 m^3 & bitumen @ 1.24 kg per m^2 of road surface.

fuel consumption @ 0.45 kg/kg of bitumen.

2nd coat 6 mm chips @ 0.02 m^3 & bitumen @ 1.24 kg/m^2 of road surface.

Sol :-

Sr. No.	P.O.I.	NO.	Length	Breadth	depth	Quantity	Expl. Notes
1.	Cleaning of side	1	150	10	—	1500 m^2	
2.	Grade-I metal soling	1	150	8	0.09	108 m^3	
3.	Grade-II wearing coat	1	150	8	0.12	144 m^3	
4.	1st coat finishing :-						
	12 mm chips @ 0.020 m^3/m^2	1	150	8	0.020	24 m^3	
	Bitumen @ 1.24 kg/m^2	1	150	8	1.24 kg/m^2	1488 kg	
5.	2nd coat finishing :-						
	6 mm chips @ 0.02 m^3/m^2	1	150	8	0.02	24 m^3	
	Bitumen 1.24 kg/m^2	1	150	8	1.24	1488 kg	

Total bitumen = 1488 + 1488 kg = 2976 kg.

Fuel consumption →

For 1 kg bitumen fuel required = 0.45 kg.

For 2976 kg bitumen fuel required = 0.45×2976

= 1339.2 kg.

Ch-1 Dt-7.1.16

Detailed estimate of culvert & bridge

Culvert:- A structure is said to be a culvert when water way or clear span is less than 6m.

Bridge:- A structure is said to be a bridge when the water way or clear span is more than 6m.

Abutment:- The end support of a bridge or culvert is known as "abutment".

Pier:- The intermidiate support of a bridge or culvert is known as "pier".

Face wall In a Culvert:- The culvert has two face walls in the upstream side & downstream side.

→ The wall which provides stability to the structure is known as "face wall".

Curtain wall:- The wall in the upstream & the down stream side of a culvert connecting the abutments below ground level in order to prevent scoring of earth below the bed of the culvert.

Q:-1 What is the min^m dia of concrete pipes provided in a pipe culvert.

Ans:- The dia of the concrete pipe provided in a pipe culvert is restricted to 30cm internal dia.

Wing wall:- It is a smaller wall attached on next to a largere wall or structure.

or The wing walls can either be attached to the abutment or be independent of it.; Wing walls are Provided at both ends of the abutments to retain the earth filling.

Pro-1 Detail estimate of RCC deck slab culvert with right angled wing wall :-

Sl-No	P.O.T	NO	Length	Breadth	Depth	Quantity	Explⁿ Note
1.	Earth work in excavation						
	Abutment	2	5.1m	0.7m	0.6m	4.284 m^3	4.8+.15+.15 = 5.1m
	wing wall	4	1.2	0.7m	0.6m	2.016 m^3	
					Total=	6.3 m^3	
2.	Plain cement concrete in foun.						
	Abutment	2	5.1m	0.7m	0.3m	2.142	
	wing wall	4	1.2m	0.7m	0.3m	1.008	
					Total =	3.15m^3	
3.	Brick work in ~~foundation, plinth~~ & superstructure						
	Abutment	2	4.8m	0.4m	1.5m	5.76 m^3	D= 0.3+1+0.2 = 1.5m
	wing wall	4	1.2m	0.4m	1.5m	2.88 m^3	
	Parapet upto kerb	2	4.7m	0.4m	0.3m	1.128 m^3	L = 4.9 − 0.1 − 0.1 = 4.7m
	Parapet above kerb	2	4.7m	0.3m	0.15m	1.41m^3	
	Parape coping	2	4.9m	0.4m	0.1m	0.392m^3	
					Total =	11.57 m^3	
(-)	Deduction for bearing of RCC slab	2	4.8m	0.3m	0.2m	0.576m^3	
				Net brickwork =	11.57 −	0.576 =	11 m^3

4.	RCC WORK Slab	1	4.8m	2.1m	0.2m	2.02m³	B = 1.5 + .3 + .3 = 2.1m
5.	Wearing Coat	1	4m	2.3	0.1	0.92m³	B = 1.5 + 0.4 + 0.4 = 2.3m
6.	Cement Pointing						
	Face wall below 10cm G.L upto bottom coping.	2	4.7m	—	2.1m	19.74m²	D = 0.1 + 1.5 + 0.5 = 2.1
	Inner side of parapet excluding coping.	2	4.7m	0.8m	—	7.52m²	B = 0.2 + 0.1 + 0.5 = 0.8
	Coping	2	4.9m	0.7m	—	0.686m²	B = 0.4 + 0.1 + 0.1 + 0.1 = 0.7
	Ends of parapet	4	—	0.4m	0.2m	0.32m²	
	"	4	—	0.3m	0.5m	0.6m²	
	Ends of coping	4	—	0.4m	0.2m	0.32m²	D = 0.1 + 0.1 = 0.2m
					Total =	35.96m²	
	Deduction for rectangular opening	2	1.5m	—	1.1	3.3m²	D = 1 + 0.1 = 1.1m
	Deduction for traiangular portion	4	$\frac{1}{2}$ × 1.3 × 1.3			3.38m²	
					Total =	6.68m²	
	Net pointing =		35.36m² − 6.68		= 28.68m²		

1	Steel bars including bending in RCC work					
	20mm dia straight bar	17	2.38 m	—	—	40.46
	20mm dia bent up bar	16	2.454m	—	—	40.64
	10mm dia distribution bar at bottom	9	4.9 m	—	—	44.1 m
	10mm dia distribution bar at top	4	4.9 m	—	—	19.6 m
					total -	144.8 m

⇒ Calculation of quantity of steel for deck slab with bar bending schedule :→

→ Unit of RCC = M^3

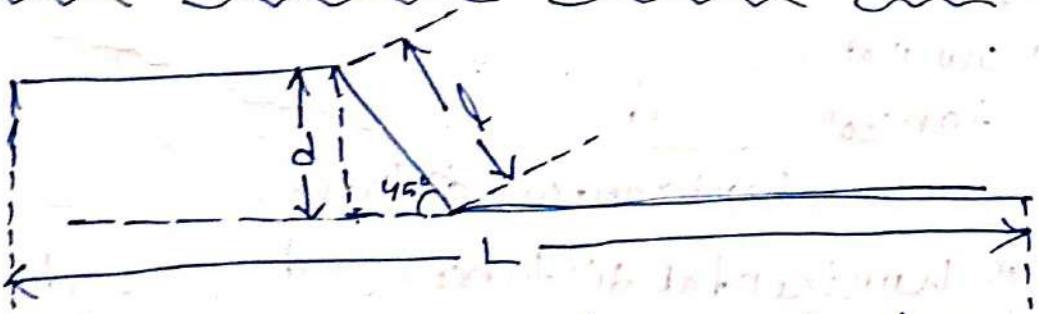
→ Main bars are provided along shorter span & distribution bars are provided along longer span.

→ In RCC work the end or side covers of steel bar may be taken as 4cm to 5cm. & the bottom & top covers may be taken as 1.2cm to 2 cm, for slabs. & 2.5 cm to 5cm for beams.

→ The length of one hook may be taken as 9 times of the dia of bar.

→ The total length of a straight bar hooked at both ends may be taken as, "L + 2 × 9 times of dia" which = $\boxed{L + 18 \text{ dia}}$

⇒ For 45° cranked or bent up bar :=



Let, The additional length of one bent up bar = l_1

$$\sin 45° = d/l \quad (P/H)$$

$$\Rightarrow l = \frac{d}{\sin 45°}$$

$$\text{Additional length } (l_1) = l - d = \frac{d}{\sin 45°} - d$$

$$= \frac{d - d\sin 45°}{\sin 45°} = \frac{d(1 - \sin 45°)}{\sin 45°}$$

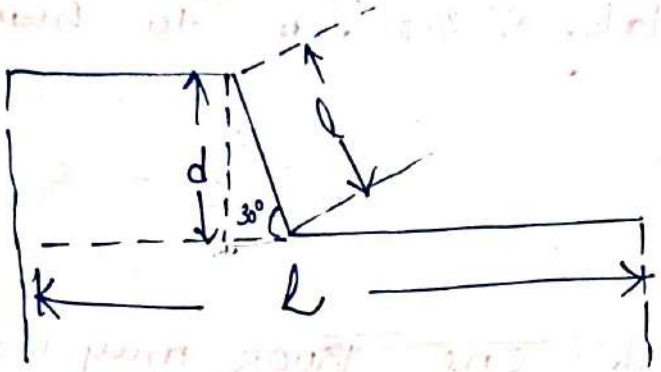
$$= \frac{d(1 - 0.707)}{0.707}$$

$= d\,\frac{0.292\,d}{0.0707} = 0.41d \simeq 0.45d$

for two side bent up additional length $= 2 \times 0.45d$
$= 0.9d \simeq 1d$

Here, d = total depth of slab − (top cover + bottom cover)

For 30° cranked or bent up bar,



$\sin 30° = \frac{d}{l}$

$\Rightarrow l = \frac{d}{\sin 30°}$

Additional length = l − horizontal distance

we know that,

$\tan 30° = \frac{d}{\text{horizontal distance}}$

$\Rightarrow$ horizontal distance $= \frac{d}{\tan 30°} = \frac{d}{0.57}$

Additional length $(l_1) = \frac{d}{0.5} - \frac{d}{0.57}$

$= \frac{0.57d - 0.5d}{0.285}$

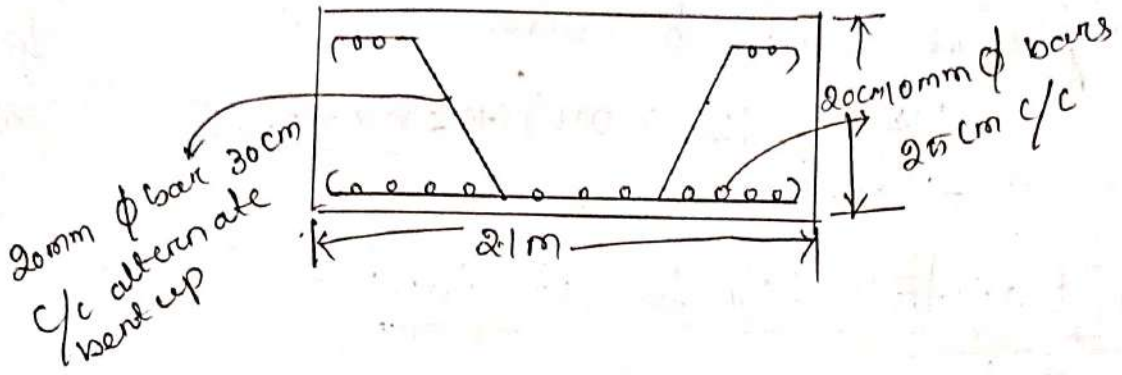
$= \frac{d(0.57 - 0.5)}{0.285} = \frac{0.07}{0.285} = 0.24d \simeq 0.25d$

for 2 Side bentup additional length = $2 \times 0.25d$
$= 0.5d$

Dt - 1.2.16

Pro-1

Prepair A detailed Estimate of RCC Slab culvert

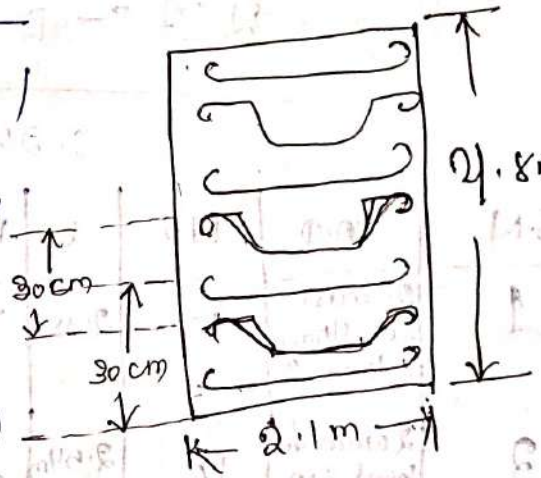


Sol"

20 mm ϕ Straight bar :—

No of bar = $\frac{4.8 - 2\times0.04}{0.3} + 1$

$= 16.73 \simeq 17$



Length of 20mm bar :→

$2.1 - 2\times0.04 + (18 \times 0.12)$

$\Rightarrow$ 2.38m.

20 mm dia bentup bar :=

No of bar = 17 - 1 = 16 nos

Length of 20mm bar :→

$2.1 - 2\times0.04 + (2\times9\times0.02) + d$

$= 2.38 + \{0.2 - (2\times0.02)\}$

$= 2.54$m.

10 mm ϕ distribution bar at bottom :-

$$\text{No of bar} = \frac{2.1 - (2 \times 0.04)}{0.25} + 1$$

$$= 9.08 \simeq 9 \text{ nos}$$

Length of 10mm ϕ bars =

$$4.8 - (2 \times 0.04) + (2 \times 9 \times 0.01)$$

$$= 4.9 \text{ m.}$$

10mm ϕ distribution bar at top :-

$$\text{No of bar} - \rightarrow \frac{\frac{2.1}{4} - 0.16 - 0.04}{0.25} + 1 = 2.3 \simeq 2 \text{ nos}$$

DI-8.2.16

S.N	P.O.I	NO	L	B	D	Q	Expl' note
1	20 mm dia straight bar	17	2.38m	—	—	40.46 m	
2	20mm dia bent cap bar	16	2.54m	—	—	40.64 m	

Total = 81.1m

Area of 20mm dia bar = $\pi/4 \times (0.02)^2$

$= 0.000314 m^2$

quantity or volume of 20mm dia bar =

Area X Length

$= 0.000314 \times 81.1$

$= 0.025 m^3$

$1 m^3$ Steel wt = 7850 kg

$0.025 m^3$ steel wt = $7850 \times 0.025 = 196.25$ kg

S.N	P.O.I	NO	L	B	D	Q	Expn Note
3	10mm dia distribu-tion bar at bottom	9	4.9			44.1m	
4	10mm dia distribu-tion bar at top	24	4.9			19.6m	
						Total = 63.7m	

Area of 10mm dia bar = $\pi/4 \times (0.01)^2$

$= 0.0000785 m^2$

quantity or volume of 10mm dia bar

= Area x length

$= 0.005 m^3$

$1 m^3$ steel wt = 7850 kg

$0.005 m^3$ steel wt = 39.27 kg

Total wt = 39.27 + 196.25

= 235.52 kg //

quantity of steel including 10% wastage:-

10% wastage = $235.52 \times \frac{10}{100}$

= 23.55

Total quantity of steel including 10% wastage.

235.52 + 23.55

= 259.072 kg

quantity of binding wire:-

Area of slab = L x B = 4.8 x 2.1 = 10.08 m^2

for 10 m^2 slab binding wire required = 2.7 kg

for 1 m^2 slab binding wire required = $\frac{2.7}{10}$

= 0.27 kg

for 10.08 m^2 slab " " " = 0.27 x 10.08

= 2.72 kg ..

Quantity of steel per m3 of concrete :—

volume of slabs = L × B × d = 4.8 × 2.1 × 0.2
= 2.02 m3

For 2.01 m3 RCC work steel required
= 259.072 kg

For 1 m3 RCC work steel required
$= \frac{259.072}{2.01}$
= 128.89 kg

Pro-2 Estimate,

(a) the quantity of steel including 10% wastage.

(b) quantity of binding wire

(c) quantity of steel per m3 of concrete

Data given :—

A RCC slab of 3.5 m clear span & 5m long & thickness of slab = 12 cm.

Main bar = 10 mm dia bar 30 cm c-t-c with alternate bent up.

Distribution bar = 6mm dia bar 20 cm c-t-c

Assume any other data.

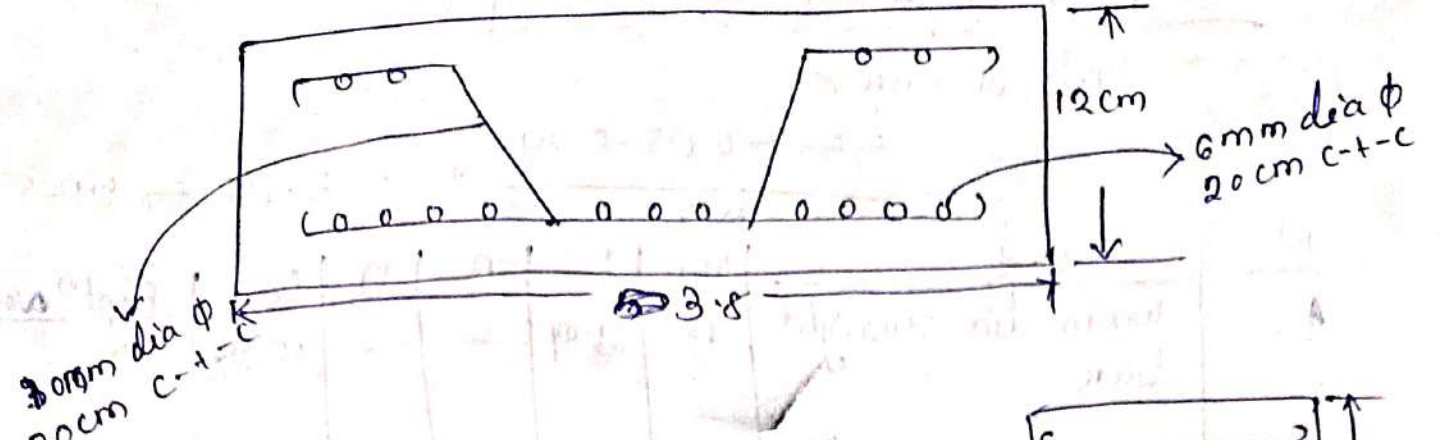
Sol^n Let,

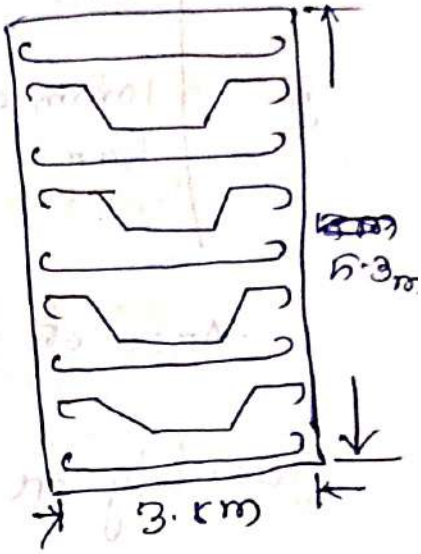
thickness of wall = 30 cm

~~effective span = 3.5~~

$L = 5 + \frac{.3}{2} + \frac{.3}{2} = 5.3\ m$

$B = 3.5 + \frac{.3}{2} + \frac{.3}{2} = 3.8\ m$





Cal^n 10mm ϕ Straight bar :—

No. of bar = $\frac{5.3 - 2\times0.04}{0.3} + 1$

= 18.4 ≅ 18nos

Length of 10mm bar :→

3.8 − 2×0.04 + (18×0.02)

= 3.98m.

10mm ϕ dia Distribution bar :—

No of bar = 18 − 1 = 17 nos

Length of 10mm bar :→

= 3.8 − 2×0.04 + (2×9×0.02) + d

= 3.8 + (0.12 − (2×0.02))

= 3.98m

6mm distribution bar at bottom :—

No of bar = $\frac{3.8 - (2\times0.04)}{0.20} + 1$

= 19.6 ≅ 19nos

Length of 6mm ϕ bars.

5.3 − (2×0.04) + (2×9×0.006)

= 5.32m

6mm ϕ destribution bar at top :=

No of bar :=

$$\frac{3.8}{4} - 0.08 - 0.04 + 1 = 5.15 \simeq 5 \text{ nos}$$

0.2

S.N	P.O.T	NO	L	B	D	Q	Expln Not
1	10mm dia straight bar	18	3.94	—	—	70.99 m	
2	10mm dia bentup bar	19	3.98	—	—	67.66 m	
					Total =	137.86	

Area of 10 mm dia bar = $\pi/4 \times (0.01)^2$

$= 0.0000785 \text{ mm}^2$

Quantity or volume of 10mm dia bar,

Area x length

$= 0.0000785 \times 137.86$

$= 0.011 \text{ m}^3$

1m3 Steel wt = 7850 kg

0.011 m^3 steel wt = $7850 \times 0.011 = 78.5$ Kg

S.N	P.O.T	NO	L	B	D	Q	Expln Note
3.	6mm dia distribution bar at bottom	19	5.32	—	—	101.08	
4.	6mm dia distribution bar at top	10	5.32	—	—	53.2	
					Total =	154.28m	

Area of 6 mm dia bar = $\pi/4 \times (0.006)^2$

$= 0.0000282 \text{ mm}^2$

quantity or volume of 16mm dia bar = Area x length

$= 0.0000282 \times 154.28$

$= 0.0043\ m^3$

$1m^3$ steel wt = 7850 kg

$0.0043 m^3$ steel wt = 0.0043×7850

$= 33.75$ kg

Total wt = $78.5 + 33.75$

$= 112.25$ kg

quantity of steel including 10% wastage :=

10% wastage $= 112.250 \times \frac{10}{100}$

$= 11.25$

Total quantity of steel including 10% wastage

$= 112.250 + 11.25$

$= 123.5$ kg

quantity of binding wire :=

Area of slabs = $L \times B = 5.3 \times 3.8 = 20.14\ m^2$

for $10m^2$ slab binding weir required = 2.7 kg

for $1m^2$ " " " = $\frac{2.7}{10} = 0.27$ kg

for $20.14m^2$ slab binding weir required = 0.27×20.14

$= 5.43$ kg

quantity of steel per m^3 of concrete :=

volume of slab = $L \times B \times d = 5.3 \times 3.8 \times 0.12$

$= 2.41\ m^3$

for $2.41m^3$ rcc work steel required = 123.5 kg

for $1m^3$ rcc work steel required = $\frac{123.5}{2.41}$

$= 51.24$ kg (Ans)

V.V.G 800

11/02/16

Ch-4 :- PWD ACCOUNTS WORK :-

Work :-

For any original work, the engg. department Prepares a proposal on the basic of preliminary estimate from the requirements and information supplied by the department concerned concerned.

Classification of work :-

classification of work according to there nature :-

The works according to their nature are classified into following 2 types.

(a) Original work
(b) Repair work

(a) Original Work :-

The original work may be of following types.

→ Entirely new construction as construction of new building, bridge, road or any project etc.

→ Addition & alteration to the existing works which will increase the value of property.

Ex :- addition of room or rooms, Conversion of a ~~baranda~~ barandah into rooms, dividing a big room into 2 rooms etc.

→ Special work for renovation or for thorow repaires of damaged works.

Ex :- Changing of door or window, changing of floor.

(b) Repair Work :-

Repair work may be of following types.

→ The repairs required to maintain the work in proper condition as annual repairs.

Ex :- White washing, Colour washing etc.

→ Minor addition & alteration with in certain Monitary limit. (say Rs 200).

Ex :- Providing Lintels, opening a door, providing shelves.

→ special repair.

Classification of work according to their cost :-

According to their cost works are classified in to following 3 types.

(a) Major work
(b) Minor work
(c) Petty work

(a) Major Work :-

The work costing more than 2 lakhs is known as major work.

And the estimate for such work is known as major estimate.

(b) Minor Work :-

The work costing more than Rs. 50,000 but not exceeding 2 lakhs is known as minor work.

And the estimate for such work is known as minor work estimate.

(c) Petty work :=
The work which cost doesn't exceed Rs 50,000 is known as petty work.
And the estimate for such work is known as petty estimate.

Different types of repair work :=
There are 3 types of repair work
(i) Annual repair
(ii) Quadrennial repair
(iii) special repair

(i) Annual repair :=
All works & structure are repaired & maintened in a proper condition!
→ The repair which is done annualy i.e once in a year is known as annual repair.
→ The annual repairs work are executed by the department concerned as medical department buildings are maintened by the medical department & police department buildings are maintened by police department
ex :— white washing, colour washing etc.

(b) Quadrennial repair :=

Besides annual repair of work such as white washing, colour washing the repair works are done.

→ The repair which is done every 4th year is known as quadrennial repair work.

ex:= Repainting of door & window, patch repair of plastering etc.

(c) Special Repair :=

Special repair work consist of renovation or renewals of structures or damaged works.

ex:= Renewal of floor & other items of work, involving replacement occuring at long intervals.

Repair of Moonsoon or flood damage work

Date :- 25-02-2016

Earnest Money deposit :=

→ While submitting a tender the contractor is to deposite a certain amount, about 2% of the estimated cost with the department as earniest money as guarante of the tender.

→ this amount is for a check so that the contractor may not refuse to accept the work or keep away when his tender is accepted.

→ In case of the contractor refuses to take up the work his earniest money is forfeited.

→ Earnest Money of the tender whose tender has not been accepted is refundable.

Security Money deposit :-

→ On acceptance of the tender, the contractor has to deposite 10% of the tendered amount as security Money with the department which is inclusive with the earnest money already deposited.

→ This amount is kept as a check so that the contractor fullfills all the terms & condition of the contract & carries out the work satisfactorily. According to the specification and complete the work in time.

→ If the contractor fails to fullfill the term of contract his pole or part of the security money is forfeited by the department.

→ The security Money is refundable to the contractor after the satisfactorily completion of the whole work after a specified time.

Contractor :-

A person who undertakes any type of contract is known as contractor.

Contract :-

An undertaking by a person to do any work under some terms & conditions is known as contract.

→ The work may be supplied of labour, supply of Material, construction or maintenance & repairs etc.

Tender :-

Tender is an offer in writting to exicute some specified work at certain rates with in a fixed time under certain. Conditions of contract & aggrement bet^n a contractor & department.

Types of Contract :-

There are 4 types of Contract :-

(a) Lumpsum contract
(b) Laboier contract
(c) Item rate contract
(d) Cost plus percentage contract.

Dt :- 26.02.2016

(a) Lumpsum Contract :-

→ In Lumpsum contract the contractor undertakes the exicusion or construction of a specific work with all its contigencies to complete it in all respect with in a specified time for a fixed amount.

→ The detail specification of all items of works pertaining to the hole work, plans & drawing & deposite of 10% sequerity money, progress & other condition of contracts included in the contract aggrement

→ The general specification of different parts of the building with the demensions where required are included.

The quantities of different items of work are not provided; the contractor shall have to complete the work as per plan & specification within fixed rate fixed time.

→ On completion of the work no detail measurement of different items of work is required but the whole work is compared & checked with plans & drawings.

(b) Labour contract :—

In this type of contract the contractor undertakes the contract for the labour only. All materials for the construction are arranged & supplied at the site of work by the department.

→ The labour contract engages labour & gets the work done according to the specification.

→ The contract is on item rate basis for labour person only & contractor is to paid the ~~the~~ quantities of work done at ~~at~~ ~~set~~ stipulated rate.

→ Materials for scaffolding, centring and shuttering & other similar materials are supplied by the department.

→ Contractor use his own tools for working, but plans & machineries are arranged by the department or owner.

(C) Itemrate Contract :—

In this contract the contractor undertakes the construction of work on the item rate basis.

→ the amount, the contractor is to receive depends upon the quantities of various items of work actualy done.

→ The Contract aggreement includes quantities, rates & amount for various items of work, date of completion & other condition of Contract.

→ The payment to the contractor is made by detail measurement of different items of work actualy done by the contractor.

This system is used for all work.

(d) Cost plus percentage contract :=

→ In this type of contract, the contractor is given some percentage over the actual cost of construction as his profit.

→ contractor arrange materials & labour at his cost & keeps proper account & is paid by the department, the whole cost together with certain percentage say 10%. as his profit.

→ An aggreement is propaered is prepared with all condition of contract in advance.

→ In this case proper control in the perchese of materials & in labour shall have to be exercise by the department.

Advantage payment :=

→ this means the payment maid on a running account to a contractor, for work done by him is not measured

→ Advance payment is not generaly maid to the contractor but may be made under some special cases when

the work is sufficiently progressed.

On-account payment or running payment:=

This means the payment made on a running account to a contractor for works done or supplies made by him duly measured & entered in M.B.

→ When only a part of the whole coork or supplies has been done & the work is in progress, during the progress of the work contractor is paid time to time.

Intermediate payment:=

Any payment on running account in bet' 1st & last payment to a contractor is known as intermediate payment.

Final payment:=

This term indicates a single payment, made for a job or contract on its completion. It this case the payment finished by one payment after completion of the work. This is usually applicable for small work.

Bill:=

→ Bill is the account of work done or supply of materials made & includes the particulars or quantities of work done or material supplied, their rates & amount due.

final bill:→

The bill on which final payment is made is known as final bill.

Running or on account bill:→

The bill on which the running or on account payment is made is known as running bill or on account bill.

Regular establishment:=

→ Bothe permanent & temporary employes of the depa-rtment are included in the regular establish-ment.

→ Their salaries are drawn monthly on regular pay bills from the treasury.
→ The payment to each is made after taking receipt (stamped signature) on the pay bill.
→ The salary is not from the budget grant under the head establishment.

Temporary Establishment :—

→ The temporary establishment are employed when the work is increased & extraload cannot carry by the existing permanent employes.

⇒ their services can be terminated at any time with proper notice as per as rules.

⇒ These posts are sanctioned usually for six or twelve months.

Cash :—

Cash includes all legal tender coins, currency notes, demand, drafts, cheques, payable on demand, revenue stamps etc re-cognised by reserve bank of India.

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

TEMPORARY ADVANCE :—

⇒ Temporary advance is also known as temporary imprest.

⇒ Temporary imprest is the amount which is advanced by a disbursing officer to a subordinate officer. to enable him to make a number of specific payments out of a muster roll or any other voucher which has already been passed for pay-ment.

⇒ The amount of temporary advance should be closed as soon as possible.

⇒ The temporary advance amount is advance for payment of passed bells, while the permanent.

100 Imprest amount is advanced for payment of un passed bells as & when required.

ISSUE RATE:—

⇒ An issue rate is fixed for each article of stock on the basis of actual cost plus other expenses including storage charges.

⇒ The issue rate is fixed on the principle that there may not be ultimate profit or loss in the stock account & the rate should include the actual cost.