LECTURE NOTE

ESTIMATION AND COST EVALUATION-II

5th SEMESTER

Diploma (Civil Engineering)

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ESTIMATION AND COST EVALUATION - II

chapters	Name of topics
1.	Detailed estimate of culvert and bridges
2.	Estimate of Irrigation structures
3.	Detailed estimate of road
4.	Detailed estimate of miscellaneous works
5.	PWD accounts Works

1. Detailed estimate of Culverts and Bridges.

1.1. Detailed estimate of a RCC slab culvert with right angled wing walls with bar bending schedule

1.2 RCC Hump pipe with splayed angled wing wall.

2. Estimate of Irrigation structures

2.1 Detailed estimate of simple type of vertical fall to given specification.

2.2 Detailed estimate of drainage syphon to given specification.

3. Detailed estimate of roads

3.1 Detail estimate of a Water bound macadam road

3.2 Detailed estimate of a flexible pavement in cutting / filling

3.2 Detailed estimate of septic tank and soak pit for 50 users.

4. Miscellaneous estimates

4.1 Tube well, piles and pile cap, isolated and Combined footings.

5. PWD Accounts Works :-

5.1 Works

5.1.1 classification of work - Original, major, petty, repair work, annual repair, special repair, quadrantal repair.

5.1.2 Concept of Method of execution of works through the contractors and department, contract and aggrement, work orders, types of contract, piece work aggrement.

5.2 Accounts of works

5.2.1 Explanation of various terms

Administrative approval, technical Sanction, tender, preparation of notice inviting tender, quotations, earnest money, E-tendering, Security deposit, advance payement, Intermediate payment, final payment, running bill, final bill, regular and temporary establishment, cash, major & Subhead of account, temporary advance (imprest money), Supervision charges, suspens account, debit, Credit, book transfer, vouchers and related accounts.

5.2.2 Measurement book use & maintenance, procedure of marking entries of measurement of work and supply of materials, labour employed, standard measurement books and common irregularity

5.2.3 Muster roll : Its preparation & use for making payement of pay and wages.

5.2.4 Acquittance Roll : Its preparation and use for making payment of pay and wages.

5.2.5 Labour and labour Report, Method of labour payment, use of forms and necessity of submission.

5.2.6 classification of stores, receipt/ issue statement on standard forem, method of preparation of stock account, preparation and submission of returns, Verification of stocks, shortage and excess.

5.3 Building BYLAWS and REGULATORY Bodies, Development authorities, types and their levels, RERA etc.

Syallabus coverage upto I.A
chapter 1, 2, 3

R.C.C. SLAB CULVERT 1.5 METRE SPAN

Example — Prepare a detailed estimate of a slab culvert of 1.50 metre span and ... roadway from the given drawing (Fig. 8.5). The general specifications are as follows.

Foundation concrete shall be of cement concrete 1 : 3 : 6 with stone ballast and coarse sand. Masonry shall be of first class brickwork 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 masonry shall be cement pointed 1 : 2. Road shall be provided with 10 cm thick wearing coat of 1 : 2 : 4 cement concrete. Assume suitable rates.

R.C.C. SLAB CULVERT 1.50 m SPAN with standard modular bricks

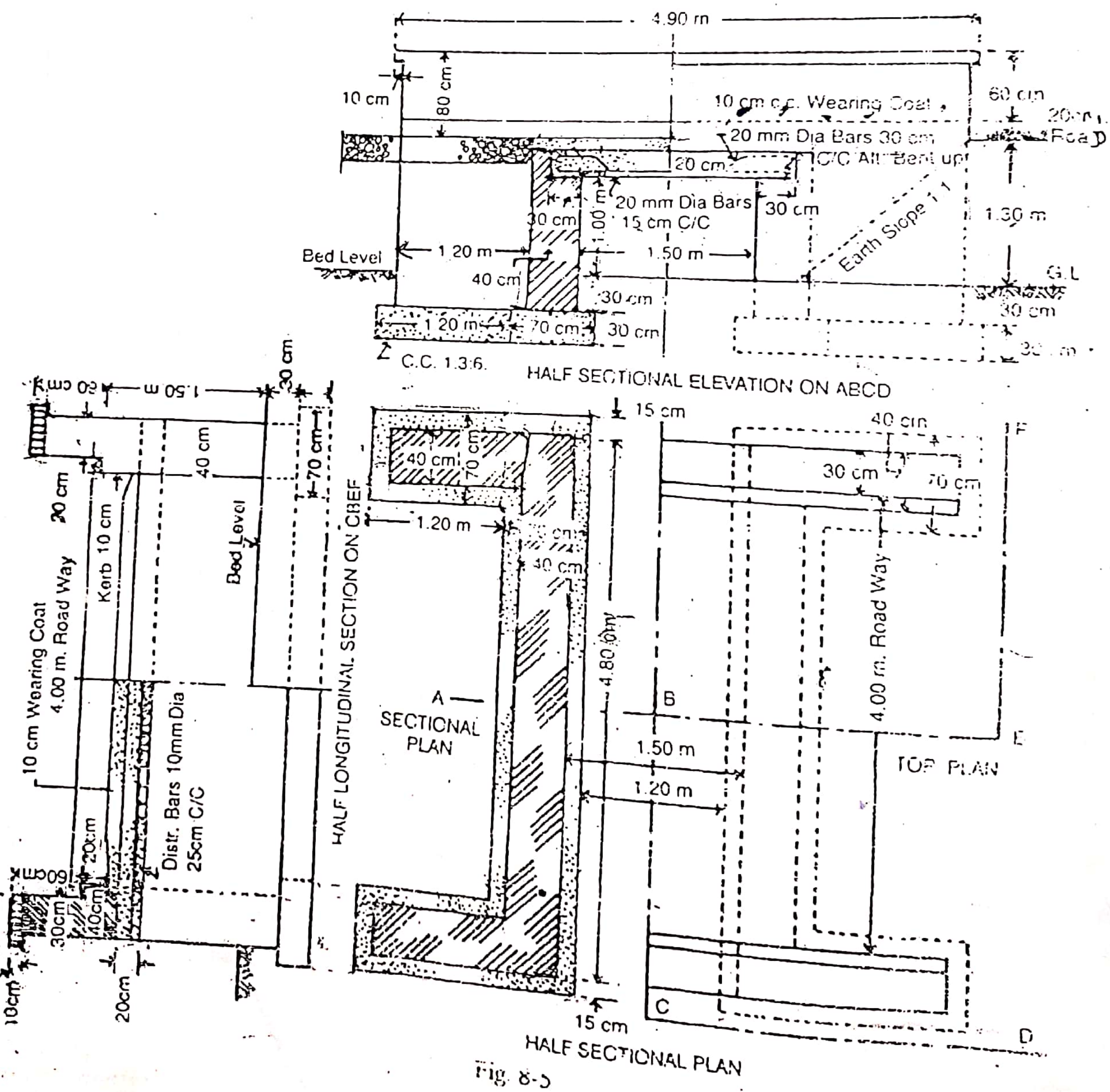
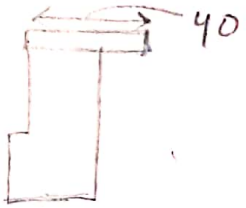


Fig. 8-5

R.C.C SLAB CULVERT

Item no	Description of Item	NO	L	B	H	Quantity	Explanatory notes
1.	Earthwork in excavation in foundation						
	Abutment	2	5.1	0.7	0.6	4.28	L = 4.8 + 0.15 + 0.15
	wing wall	4	1.2	0.7	0.6	2.01	H = 0.3 + 0.3
				Total		6.29 m^3	
2.	cement concrete work 1:3:6 with stone ballast						
	Abutment	2	5.1	0.7	0.3	2.14	L = 4.8 + 0.15 + 0.15
	wing wall	4	1.2	0.7	0.3	1.01	
				Total		3.15 Cum.	
3.	1st class brick work in 1:4 cement mortar						
	Abutment	2	4.8	0.4	1.5	5.76	H = 0.3 + 1 + 0.2
	wing wall	4	1.2	0.4	1.5	2.88	

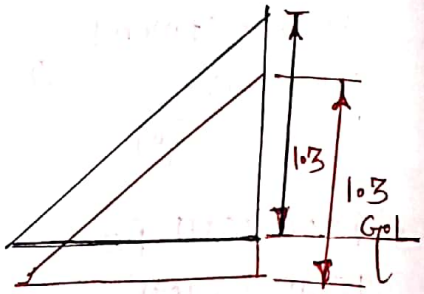
Item no	Description of Item	NO	L	B	H	Q	Explanatory Notes
→	Parapet wall upto curve or kerb parapet wall 40cm wide	2	4.7	0.4	0.3	1.128	L = 4.9 − 0.1 − 0.1 H = 0.1 + 0.2
→	Parapet wall above curve or kerb parapet wall 30cm wide	2	4.7	0.3	0.15	1.41	L = 4.9 − 0.1 − 0.1 H = 0.6 − 0.1
→	coping	2	4.9	0.4	0.1	0.392	
				Total		11.57 m³	
→	Deduction for bearing of RCC deck slab in abutment	2	4.8	0.3	0.2	0.576	
				Net Total		10.994 m³	
4.	R.C.C work 1:2:4 in deck Slab excluding reinforcement	1	4.8	2.1	0.2	2.016	B = 1.5 + 0.3 + 0.3
5.	wearing coat with cement concrete 1:2:4	1	4	2.3	0.1	0.92	L = 4.8 − 0.4 − 0.4 on 4m roadway B = 1.5 + 0.4 + 0.4

Item No	Description of Item	NO	L	B	H	Q	Explanatory Note
6.	cement pointing 1:2 in wall						
→	Inner face of abutment with 10cm below G.L	2	4.08	-	1.1	10.56	H = 1+0.1 = 1.1
→	face wall from 10cm below GL up to bottom of coping	2	4.7	-	2.1	19.47	L = 4.9 − 0.1 − 0.1 H = 0.5 + 0.2 + 1.3 + 0.1 or 0.1 + 1.3 + 0.2 + 0.6 − 0.1
→	Inner face of parapet Excluding coping	2	4.7	-	0.8	7.52	H = 0.2 + 0.1 + 0.5
→	coping Inner edge, Top, outer edge and bottom	2	4.9	-	0.7	6.86	H = 0.1 + 0.4 + 0.1 + 0.1 
→	coping side bottom Projection	4	0.3	0.1		0.12	
→	Ends of Parapet 40cm	4		0.4	0.3	0.48	
→	Ends of Parapet 30cm	4		0.3	0.5	0.6	
→	Ends of coping	4		0.4	0.1	0.16	
					Total	45.77 m^2	

Item No	Description of Item	No	L	B	H	Q
→	Deduction for rectangular opening	2	1.5		1.03	3.09
→	Triangular earth slope	4	1/2	1.03	1.03	3.38
				Total deduction		7.028
				Net total		38.49 m^2

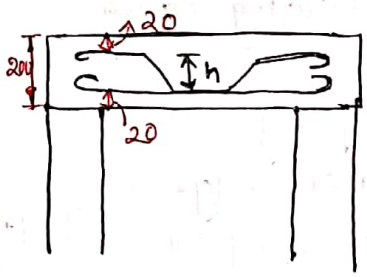
Explanatory Note

$H = 1 + 0.1 + 0.2$



7.	Steel bars including bending in R.C.C work 20mm ϕ main bent up bar	16	2.54			43.18
		@ 2.046 kg/m				106.24 kg

main reinforcement → short span



$NO = \frac{4800 - 40 - 40}{150} + 1$

$= 32.07 = 33$ Nos.

17 Nos will be bent up and 16 Nos will be straight

$L = 2100 - 40 - 40 + 2 \times 9 \times 20 + h$

$L = 2100 - 40 - 40 + 2 \times 9 \times 20 + 160$

$= 2.54$ m.

40mm = side cover

h = 200 - 20 - 20 = 160

⇒ 20mm ϕ reinforcement 2.54m, weight →

① v x sp. weight = W

A x L x 7850 kg/m³

$\frac{\pi}{4}(0.02)^2 \times 2.54 \times 7850$

= 6.264 for 1 No

6.264 x 17 = 106.481 kg

7850 kg x L x A

$\frac{7850\ kg}{m^3} \times 2.54 m. \times \frac{\pi}{4}(0.02)^2 m^2$

$\approx$ x 17 = 106.481 kg

② $\frac{D^2}{162}$ D = mm

$= \frac{20^2}{162}$ = 2.46 kg wt for 1m. length

2.46 x 43.18 = 106.24 kg

20mm ϕ main straight bare	17	2.38	40.46	L = 2100 - 40 - 40 + 2 x 9 x ϕ
		$\approx$ 2.46 kg/m	99.53 kg	= 2100 - 40 - 40 + 2 x 9 x 20
				= 2380 mm = 2.38 m.

10mm ϕ Distribution bars at bottom 25cm c/c	10	4.9	49	
	@ 0.617 kg/m		30.24 kg	

Dis. bars 10mm dia 25cm c/c

$NO = \frac{2100-40-40}{250} + 1$

$= 9.08 = 10$ NOS.

$L = 4800 - 40 - 40 + 2 \times 9 \times 10$

$= 4900 = 4.9$ m

$W = \frac{D^2}{162} = \frac{10^2}{162} = 0.617$

Distribution bars at top	4	4.9	19.6	
	@ 0.617 kg/m		12.09 kg	

BAR BENDING SCHEDULE

Q1.

1. The dimension of R.C.C slab is 4.00m x 5.00m x 15 cm deep. Reinforcement of 10mm dia are placed in short span @ 15cm c/c. Of the total no of bars 17 nos. have been cranked and hooked at the ends. Other rods are straight and hooked at the ends. To hold the cranked portion 4 nos 8mm dia straight and hooked rods have been used. The 8mm dia rods are placed in a direction of long span @ 20cm c/c and all are straight and hooked at the ends. The covers are 1.5cm at bottom and 3c.m. on all sides. Assume any other dimension not given. Estimate the total weight of steel required for reinforcement of the slab.

Ans

Short span 4m.

Long span 5m.

Total No of main reinforcement $\frac{5000-30-30}{150}+1$

$= 33.82 = 34$ Nos

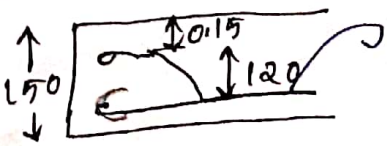
17 Nos will bent up and 17 will be straight.

cutting length of each main bent up bar = $4000-30-30+2\times9\times10+120$

$= 4240$mm

$= 4.24$m.

150 = (200-15-15)



17 Nos length = 17×4.24

$= 72.08$ m

weight $= 72.08 \times \frac{D^2}{162}$

$= 72.08 \times \frac{10^2}{162} = 44.49$ kg

Cutting length of main straight bar

$4000 - 30 - 30 + 2 \times 9 \times 10$

$= 4120$

$= 4.12$ m.

17 Nos. length $= 17 \times 4.12 = 70.03$ m.

weight $= 70.03 \times \frac{D^2}{162}$

$= 70.03 \times \frac{10^2}{162} = 43.23$ kg

Total 10mm ϕ bar weight =

$44.49 + 43.23 = 87.72$ kg

10% $= 87.72 + 87.72 \times \frac{10}{100} = 96.492$ kg

No. of distribution bar $= \frac{4000 - 30 - 30}{200} + 1$

$= 20.13 = 21$ Nos

Cutting length of each distribution bar at bottom

$= 5000 - 30 - 30 + 2 \times 9 \times 8$

$= 5.084$ m.

21 Nos. length $= 21 \times 5.084$

$= 106.66$ M

$$\text{Weight} = 106.66 \times \frac{D^2}{162}$$

$$= 106.66 \times \frac{8^2}{162} = 42.13 \text{ kg}$$

Distribution bars at top / Top bars / Hangers bar / holding bar

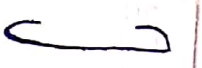
$= 4 \times 5.084 = 20.32 \text{ m}$

$$\text{Weight} = 20.32 \times \frac{8^2}{162} = 8.02 \text{ kg}$$

Total weight of 8 mmϕ $= 42.13 + 8.02$

$= 50.15 \text{ kg}$

BAR BENDING SCHEDULE

Description of bars	Shape	Length of each m.	NO	Total length (m)	weight (kg)
10mmϕ main bent up bars		4.24	17	72.08	44.49
10mmϕ main straight bar		4.12	17	70.04	43.23
8mmϕ distribution bars bottom		5.08	21	106.66	42.13
8mmϕ distribution bars at top		5.08	4	20.32	8.02

OR

Table format

Item no	Description of Item	NO	L	B	H	Q	Explanatory Notes
	Steel bars including bending in RCC work 10mmϕ main bent up bar	17	4.24			72.08	NO = $\frac{5000-30-30}{150}+1$ = 34 NOS. 17 will be bent up and 17 will straight
		@ 0.617 kg/m				44.47 kg	L = 4000-30-30+2x9x10 +120 = 4240 = 4.24m
	10mmϕ main straight bars	17	4.12			70.04	L = 4000-30-30+ 2x9x10 = 4120 = 4.12m
		@ 0.617 kg/m				43.21 kg	
	8mmϕ distribution bars at bottom 20cm c/c	21	5.08			106.68	NO = $\frac{4000-30-30}{200}+1$ = 20.7 = 21 NOS.
		@ 0.395 kg/m				42.13 kg	L = 5000-30-30 +2x9x8 = 5084 = 5.08
	Distribution bars at top	4	5.08			20.32	
		@ 0.395 kg/m				8.02 kg	

⇒ calculate the quantity of steel including 10% wastage

10mmϕ total weight = 44.49 + 43.234
= 87.724 kg

10% wastage
87.724 × 1.1 = 96.49 kg

8mmϕ total weight = 42.176 + 8.033 = 50.209

10% wastage 50.209 × 1.1 = 55.229 kg

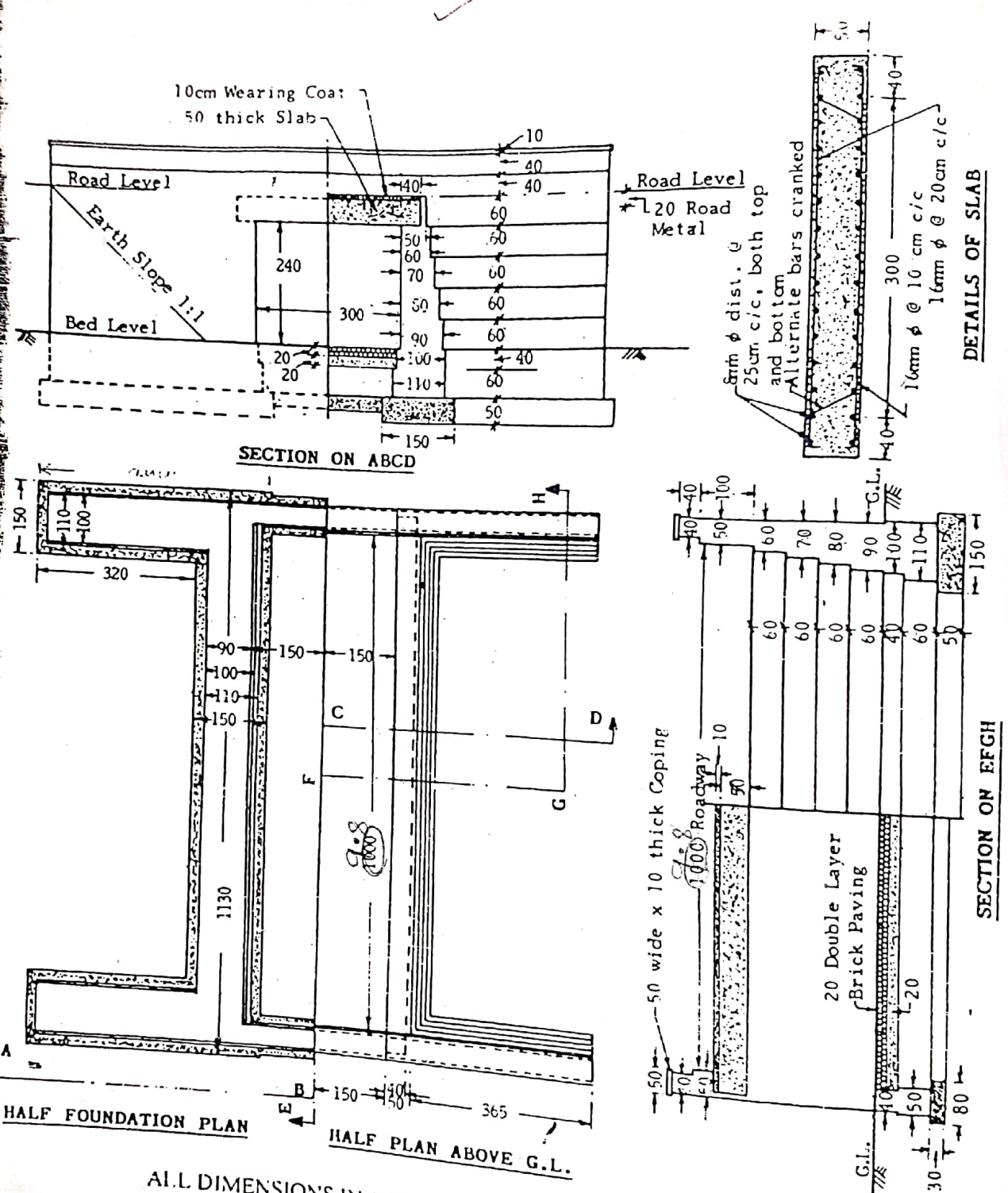
⇒ calculate the quantity of binding wire

@ 0.26 kg/m² of slab

20m² slab = 20 × 0.26 = 5.2kg

0.05 kg/kg of reinforcement

137.933 × 0.05 = 6.89kg.

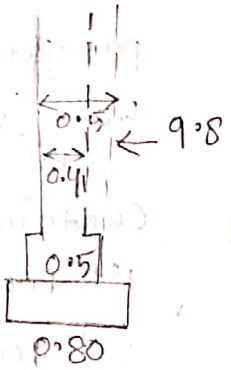


ALL DIMENSIONS IN CENTIMETRE

FIG. 10-27

3. STEP CULVERT

Item No	Description of item	No	Length (L)	Breadth (B)	Height (H)	Q	Explanatory Notes
1.	Earthwork in excavation						
	(a) abutment	2	11.3	1.5	1.05	50.85	L = 11.3 given H = 0.4+0.6+0.5 = 1.05
	(b) wing wall	4	3.2	1.05	1.05	28.8	
	(c) curtain wall	2	2.3	0.8	1.3	4.784	L = 3 − 2(0.05+0.1+0.2) H = 0.4+0.6+0.3
	(d) floore	1	9.6	2.3	0.4	8.832	L = 9.8 − 0.1 − 0.1 = 9.6 or 11.2 − 1.6 = 9.6
					Total	93.266 m^3	L = 9.8+0.5×2 − 0.4×2 − 0.05×2 − 0.15×2
2.	cement concrete work in foundation 1:2:3						
	Abutment	2	11.3	1.05	0.5	16.95	
	wing wall	4	3.2	1.05	0.5	9.60	
	Curtain wall	2	2.3	0.8	0.3	1.104	
	flooring	1	10.00	2.9	0.2	0.58	
					Total	28.234	L = 9.8+0.1+0.1
3.	1st class brick work in cement mortar 1:4						
	Abutment						
	1st footing	2	10.9	1.1	0.6	14.388	L = 11.3 − 0.20 − 0.20
	2nd footing	2	10.9	0.1	0.4	0.872	
	3rd footing	2	10.8	0.9	0.6	11.664	



Item NO	Description of Item	NO	L	B	H	Q	Explanatory Notes
	4th footing	2	10.8	0.8	0.6	10.368	
	5th footing	2	10.8	0.7	0.6	9.072	
	6th footing	2	10.8	0.6	0.6	7.776	
	7th footing	2	10.8	0.5	0.6	6.480	
	wing wall						
	1st footing	4	3.2	1.1	0.6	8.448	
	2nd footing	4	3.2	1.0	0.6	7.680	
	3rd footing	4	3.25	0.9	0.6	7.020	L=3.2+0.05
	4th footing	4	3.35	0.8	0.6	6.432	L=3.25+0.1
	5th footing	4	3.45	0.7	0.6	5.796	L=3.35+0.1
	6th footing	4	3.55	0.6	0.6	5.112	
	7th footing	4	3.65	0.5	0.6	4.38	
	parapet wall 50cm width	2	11.3	0.5	0.6	6.780	
	parapet wall 40cm width	2	11.3	0.4	0.4	3.616	
	coping	2	11.5	0.5	0.1		L=11.3+0.1x2
	Curtain wall						
	1st footing	2	2.7	0.7	0.6	1.620	L=2.3+0.2+0.2
	2nd footing	2	2.9	0.4	0.4	0.928	L=3-0.05-0.05
				Total			
	Deduction for bearing of slab	2	10.8	0.4	0.6	5.184	

Item No	Description of Item	NO	L	B	H	Q	Explanatory Notes
4.	cement Concrete for RCC work	1	10.8	3.8	0.5	20.520	L = 9.8 + 0.5 + 0.5 L = 3 + 0.8 + 0.8
5.	10cm thick wearing coat	1	9.8	3.8	0.1	3.724 m^3	3.4 = 3 ~~+~~ 0.4 + 0.4.
6.	10cm thick cement Concrete 1:2:4 Coping finished with cement plaster 1:4	2	11.5	0.5	0.1	1.150 m^3	L = 11.3 + 0.1 + 0.1
7.	Double layer brick flooring	1	10.00	2.9	-	29 m^2	L = 9.8 + 0.~~5~~ + 0.~~5~~ − 0.4 − 0.4 or 9.8 + 0.1 + 0.1 B = 3 − 0.05 − 0.05
8.	Shuttering	1	10.8	3		32.4 m^2	
9.	pointing with cement mortar 1:3						
	~~[illegible]~~ (1) Inner side of ~~[illegible]~~ Abutment	2	10.8	-	2.4	51.840	

Scanned with CamScanner

Item No	Description of Item	NO	L	B	H	Q	Explanatory Notes
(II)	face wall 10cm below G.L	2	11.3	-	3.9	88.140	B = 5×0.6+2×0.4 +0.1
	Or face wall not considering 10cm below G.L	2	11.3	-	3.08		
(III)	Inner side of parapet	2	11.3		0.9	20.34	H = 0.4+0.5+0.1
(IV)	ends of parapet 50cm width	4	-	0.5	0.4	0.8	
(V)	ends of parapet 40cm width	4	-	0.4	0.4	0.64	
(VIII)	ends of coping	4		0.5	0.1		
			Total			961.76	
	Deduction for rectangular opening	2	3		2.5	15	
	If not considering 10cm below GL in facewall	2	3		2.4		
	Ends of slab	2	3.8		0.5	3.8	
	Triangular portion below side slope	4	$\frac{1}{2}$×3×3			18	
			Total Deduction			36.8	
			Net total			924.96 m³	

(iv)	coping inner edge, outer edge, top bottom of inner edge and outer edge or inner bottom edge and outer bottom edge	2	11.5	0.8	L = 11.3 + 0.1 + 0.1 H = 0.1 + 0.1 + 0.5 + 0.05 + 0.05
(v)	coping side bottom projection	4	0.4	0.1	-