

LECTURE NOTE
ESTIMATING & COST EVALUATION-II
5TH SEMESTER
Diploma (Civil Engineering)



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ESTIMATION AND COST EVALUATION - II

Chapter	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 agreement, work orders, types of contract, piece work agreement.

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 payment, intermediate payment, final payment, running bill, final bill, regular and temporary establishment, cash, major & subhead of account, temporary advance (imprest money), supervision charges, suspense 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

5.2.03

Musters roll : Its preparation & use for making payment of pay and wages.

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

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

5.2.06 Classification of stores, receipt/issue statement on standard form, 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.

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

R.C.C SLAB CULVERT

R.C.C SLAB CULVERTS - 1.50 METRE SPAN

Example 1. Prepare a detailed estimate of a slab culvert of 1.50 metre span and 4.00 m wide roadway from the given drawing (Fig. 8-5). The general specifications are as follows:

Foundation concrete shall be of cement concrete 1 : 2 : 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

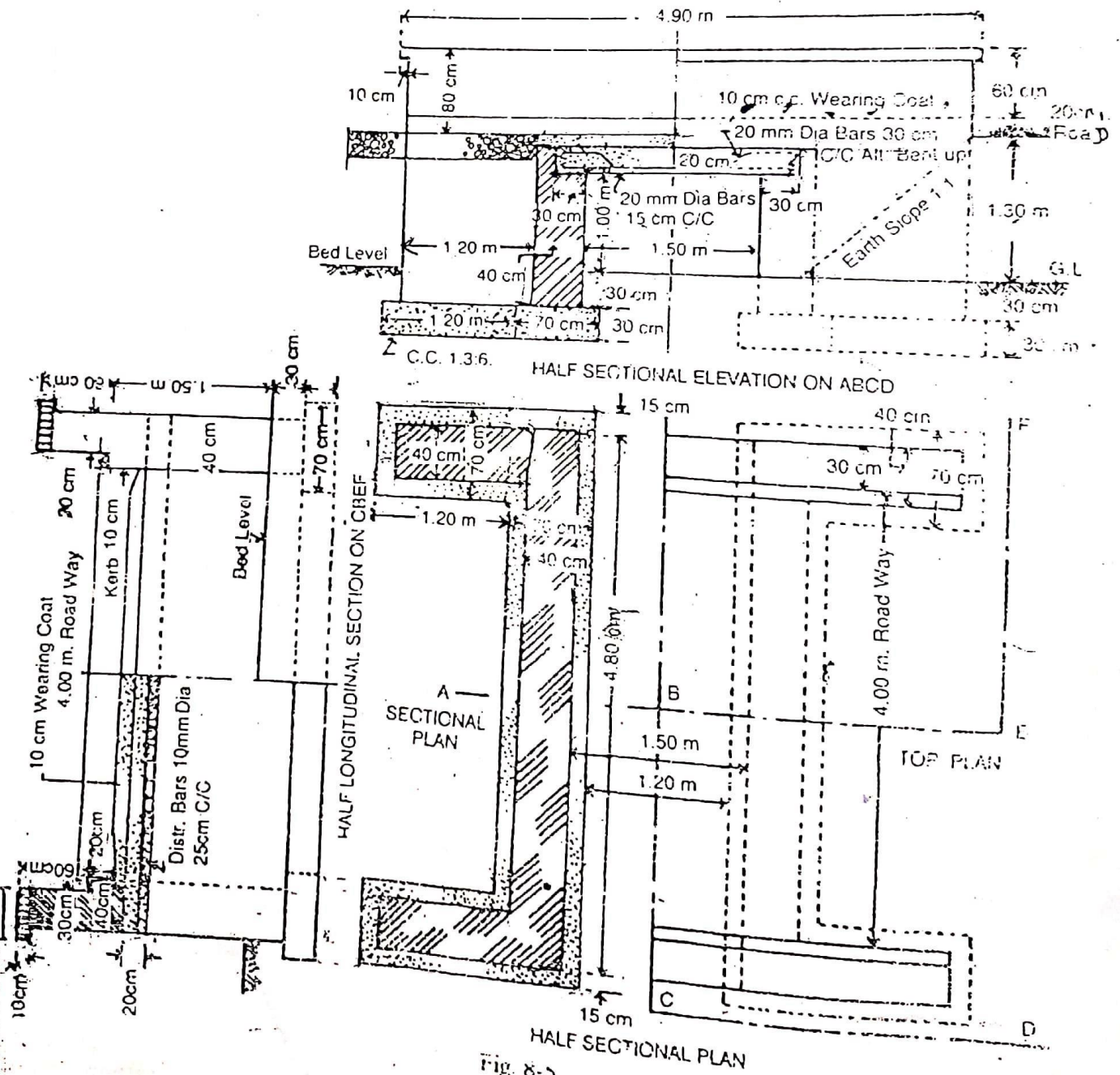


Fig. 8-5

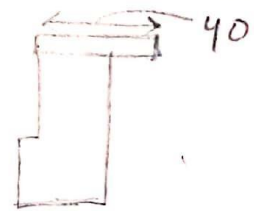
R.C.C SLAB CULVERT

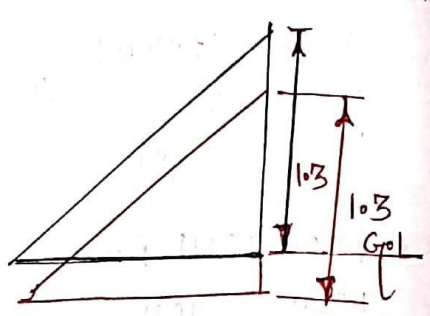
Item no	Description of Item	No	L	B	H	Quantity	Explanatory notes
1.	Earthwork in excavation in foundation						
	Abutment	2	5.1	0.7	0.6	4.028	$L = 4.8 + 0.15 + 0.15$ $H = 0.3 + 0.3$
	Wing wall	4	1.2	0.7	0.6	2.01	
			Total			6.29	
						m ³	
2.	Cement concrete work 1:3:6 with Stone ballast						
	Abutment	2	5.1	0.7	0.3	2.014	$L = 4.8 + 0.15 + 0.15$
	Wing wall	4	1.2	0.7	0.3	1.01	
			Total			3.015	
						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 parapet wall 30cm wide	2	4.7	0.3	0.5	1.041	$L = 4.9 - 0.1 - 0.1$ $H = 0.6 - 0.1$
→	coping	2	4.9	0.4	0.1	0.392	
Total						11.57 m ³	
→	Deduction for bearing of RCC deck slab in abutment	2	4.8	0.3	0.2	0.576	
Net Total						10.994 m ³	
A.	R.C.C work 1:2:4 in deck slab excluding reinforcement	1	4.8	2.1	0.2	2.016	$B = 1.5 + 0.3 + 0.3$
B.	wearing coat with cement concrete 1:2:4	1	4	2.3	0.1	0.92	$L = 4.8 - 0.4 - 0.4$ or 4m roadway $B = 1.5 + 0.4 + 0.4$



Item No	Description of Item	N	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 G.L up to bottom of coping	2	4.07	-	2.1	19.47	$L = 4.09 - 0.1 - 0.1$ $H = 0.5 + 0.2 + 1.3 + 0.1$ OR $0.1 + 1.3 + 0.2 + 0.6 - 0.1$
→	Inner face of parapet excluding coping	2	4.07	-	0.8	7.52	$H = 0.2 + 0.1 + 0.5$
→	coping inner edge, top, outer edge and bottom	2	4.09	-	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

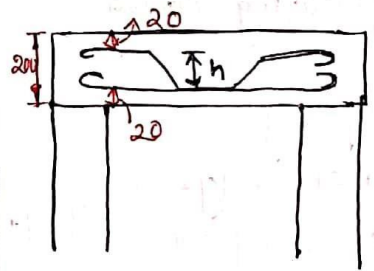


Item No	Description of Item	No	L	B	H	Q	Explanatory Note
→	Deduction for rectangular opening	2	1.5		1.03	3.9	$H = 1 + 0.1 + 0.2$
→	Triangular earth slope	4	$\frac{1}{2} \times 1.03 \times 1.03$			3.38	
Total deduction						7.28	
Net total						38.49	m^2

7. Steel bars including bending in R.C.C work
20mm ϕ main bent up bars

16	2.54	43.18
@ 2.46 kg/m		106.24 kg

main reinforcement
→ short span



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

$$= 32.07 = 33 \text{ Nos.}$$

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

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

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

$$= 2.54 \text{ m.}$$

40mm = side cover

$$h = 200 - 20 - 20 = 160$$

→ 20mm ϕ reinforcement
2.54m weight →

$$\textcircled{1} v \times \text{sp. weight} = W$$

$$A \times L \times 7850 \text{ kg/m}^3$$

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

$$= 6.264 \text{ for 1 No}$$

$$6.264 \times 17 = 106.481 \text{ kg}$$

$$7850 \text{ kg} \times L \times A$$

$$\therefore \frac{7850 \text{ kg}}{\text{m}^3} \times 2.54 \text{ m}$$

$$\times \frac{\pi}{4} (0.02)^2 \text{ m}^2$$

$$\times 17 = 106.481 \text{ kg}$$

$$\textcircled{2} \frac{D^2}{162} \quad D = \text{mm}$$

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

$$2.46 \times 43.18 = 106.24 \text{ kg}$$

20mm ϕ
main straight
bars

17 2.38

40.46

2.46 kg/m 99.53 kg

$$L = 2100 - 40 - 40$$

$$+ 2 \times 9 \times \phi$$

$$= 2100 - 40 - 40$$

$$+ 2 \times 9 \times 20$$

$$= 2380 \text{ mm} = 2.38 \text{ m.}$$

10mm ϕ
Distribution
bars at bottom
25cm c/c

10 4.9

49

@ 0.617 kg/m

30.24
kg

Distribution
bars
at top

4 4.9

19.6

@ 0.617 kg/m

12.09 kg

Dis. bars 10mm dia
25cm c/c

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

$$= 9.08 = 10 \text{ NOS.}$$

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

$$= 4900 = 4.9 \text{ m}$$

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

BAR BENDING SCHEDULE

Q1

1. The dimension of R.C.C slab is $4.00\text{m} \times 5.00\text{m} \times 15\text{cm}$ 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 3cm on all sides. Assume any other dimension not given. Estimate the total weight of steel required for reinforcement of the slab.

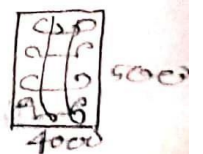
Ans

Short span 4m .

Long span 5m .

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

$$= 33.82 = 34 \text{ Nos}$$



17 Nos will bent up and 17 will be straight.

cutting length of each main bent up

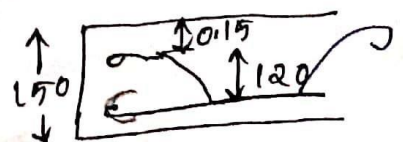
$$\text{bar} = 4000 - 30 - 30 + 2 \times 9 \times 10 + 120$$

$$= 4240\text{mm}$$

$$= 4.24\text{m}$$



$$180 = (200 - 15 - 15)$$



$$17 \text{ Nos length} = 17 \times 4.24 \\ = 72.08 \text{ m}$$

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

Cutting length of main straight bar

$$4000 - 30 - 30 + 2 \times 9 \times 10 \\ = 4120 \\ = 4.12 \text{ m}$$

$$17 \text{ Nos. length} = 17 \times 4.12 = 70.03 \text{ m}$$

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

Total 10mm ϕ bar weight =

$$44.49 + 43.23 = 87.72 \text{ kg}$$

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

$$\text{No. of distribution bar} = \frac{4000 - 30 - 30}{200} + 1 \\ = 20.13 = 21 \text{ Nos}$$

Cutting length of each distribution bar at bottom

$$= 5000 - 30 - 30 + 2 \times 9 \times 8 \\ = 5.084 \text{ m}$$

$$21 \text{ Nos. length} = 21 \times 5.084 \\ = 106.66 \text{ m}$$

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

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





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

$$= 4 \times 5.084 = 20.324$$

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

$$\text{Total weight of } 8 \text{ mm } \phi = 42.13 + 8.02 = 50.15 \text{ kg}$$

BAR BENDING SCHEDULE

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

or

Table format

Item no.	Description of Item	N ₀	L	B	H	Q	Explanatory Notes
	Steel bars including bending in RCC work 10mm φ main bent up bar	17	4.24			72.08	$N_0 = \frac{5000 - 30 - 30}{150} + 1$ $= 34 \text{ NOS}$ <p>17 will be bent up and 17 will straight</p>
							$L = 4000 - 30 - 30 + 2 \times 9 \times 10 + 120$ $= 4240 = 4.24 \text{ m}$
	10mm φ main straight bar	17	4.12			70.04	$L = 4000 - 30 - 30 + 2 \times 9 \times 10$ $= 4120 = 4.12 \text{ m}$
							$Q = 0.617 \text{ kg/m} \times 43.21 \text{ kg}$
	8mm φ distribution bar at bottom 20cm c/c	21	5.08			106.68	$N_0 = \frac{4000 - 30 - 30}{200} + 1$ $= 20.7 = 21 \text{ NOS.}$
							$L = 4000 - 30 - 30 + 2 \times 9 \times 8$ $= 5084 = 5.08$
	distribution bar at top	4	5.08			20.32	
							$Q = 0.395 \text{ kg/m} \times 8.02 \text{ kg}$

⇒ calculate the quantity of steel including 10% wastage

$$10\text{mm}\phi \text{ total weight} = 44.49 + 43.234 \\ = 87.724 \text{ kg}$$

10% wastage

$$87.724 \times 1.1 = 96.49 \text{ kg}$$

$$8\text{mm}\phi \text{ total weight} = 42.176 + 8.033 = 50.209$$

$$10\% \text{ wastage } 50.209 \times 1.1 = 55.229 \text{ kg}$$

⇒ calculate the quantity of binding wire

@ 0.26 kg/m² of slab

$$20\text{m}^2 \text{ slab} = 20 \times 0.26 = \underline{5.2 \text{ kg}}$$

0.05 kg/kg of reinforcement

$$137.933 \times 0.05 = 6.89 \text{ kg.}$$

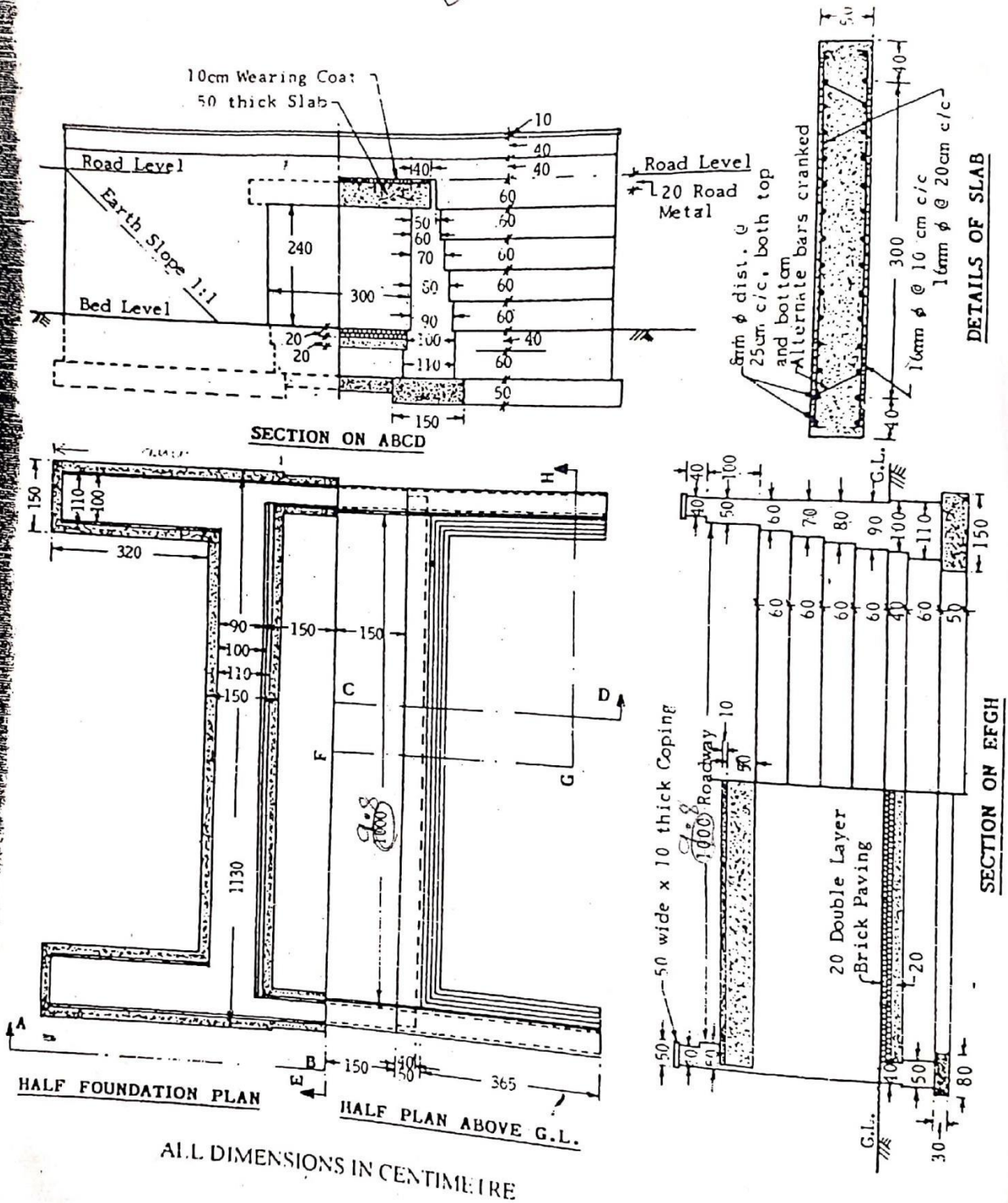
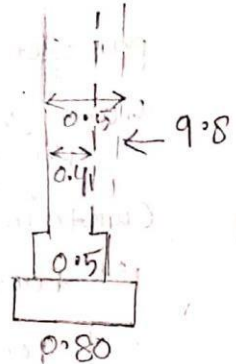


FIG. 10-27

3. STEP CULVERT

Item No	Description of Item	N	Length (L)	Breadth (B)	Height (H)	Q	Explanatory Notes
1	Earthwork in excavation						
	(a) abutment	2	11.3	1.5	1.5	50.85	L = 11.3 given
	(b) wing wall	4	3.2	1.5	1.5	28.8	H = 0.4 + 0.6 + 0.5 B = 1.5
	(c) curtain wall	2	2.3	0.8	1.3	4.784	L = 3 - 2(0.05 + 0.1 + 0.2)
	(d) floor	1	9.6	2.3	0.4	8.832	H = 0.4 + 0.6 + 0.3 L = 9.8 - 0.1 - 0.1 = 9.6 or 11.2 - 1.6 = 9.6
						<u>Total</u>	93.266 m ³ L = 9.8 + 0.5 x 2 - 0.4 x 2 - 0.05 x 2 - 0.15 x 2
2.	Cement concrete work in foundation 1:2:3						
	Abutment	2	11.3	1.5	0.5	16.95	
	wing wall	4	3.2	1.5	0.4	9.60	
	curtain wall	2	2.3	0.8	0.3	1.104	
	flooring	1	10.00	2.9	0.2	0.58	
						<u>Total</u>	28.234 L = 9.8 + 0.1 + 0.1
3.	1st class brickwork 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	7.776 6.480		
	Wing wall							
	1st footing	4	3.2	1.0	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		
	copings	2	11.5	0.5	0.1		$L = 11.3 + 0.1 \times 2$	
	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	20.920	$L = 9.8 + 0.5 + 0.5$ $L = 3 + 0.8 + 0.8$
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						
(1)	Face work Inner side of retaining wall Abutment	2	10.8	-	2.7	51.840	

Item No	Description of Item	N	L	B	H	Q	Explanatory notes
(i)	face wall 10cm below G.L	2	11.3	-	3.9	88.140	$B = 5 \times 0.6 + 2 \times 0.4 + 0.1$
	one face wall not considering 10cm below G.L	2	11.3	-	3.8		
(ii)	inner side of parapet	2	11.3		0.9	20.34	$H = 0.4 + 0.5 + 0.1$
(iii)	ends of parapet 50cm width	4	-	0.5	0.4	0.8	
(iv)	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 G.L in face wall	2	3		2.4		
	Ends of slab	2	3.8		0.5	3.8	
	Triangular portion below side slope	4	$\frac{1}{2} \times 3 \times 3$			18	
Total Deduction						36.8	
Net total						924.96 m ²	

(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

$$L = 11.3 \pm 0.1 \pm 0.1$$

$$H = 0.1 \pm 0.1 \pm 0.5 \pm$$

$$0.05 \pm 0.05$$

(v) coping side
 bottom
 projection

4

0.4

0.1

-