LECTURES NOTE ON
ESTIMATION AND COST EVALUATION-II (Th .04)
5th SEMESTER (3rd YEAR) –CIVIL ENGINEERING

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Estimating is the technique of calculating or computing the various quantities and the expected Expenditure to be incurred on a particular work orproject. In case the funds available are less than the estimated cost the work isdone in part or by reducing it or specifications are altered, the following requirementare necessary for preparing
an estimate.
Drawings like plan, elevation and sections of important points.
Detailed specifications about workmanship& properties of materials etc.
Standard schedule of rates of the current year.

UNITS OF MEASUREMENTS

The units of measurements are mainly categorized for their nature, shape and size and for making payments to the contractor and also. The principle of units of measurements normally consists the following:
Single units work like sanitary fittings,Electrical points, electrical appliences, etc., is expressed in numbers.
Works consists linear measurements involve length like cornice, fencing, hand rail, pipe length with details,bands of specified width and skirting etc., are expressed in running meters (RM)
Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness, glass of specified thickness, flooring upto the thickness of 40mm, Tiles flooring, wall tile finishing,painting of doors and windows, A.C Sheet roofing, Weathering tiles,Doors and windows shutter with required specifications, Half brick work, Honey comb Brick work, Brick on edge work etc., are expressed in square meters (m2)
Works consists cubical contents which involve volume like earth work, Earth fill,cement concrete, Masonry etc are expressed in Cubic metres.
Steel for RCC works is expressed in Killogram, Killonewton or tonne.

RULES FOR MEASUREMENT

The rules for measurement of each item are invariably described in IS- 1200. However some of the general rules are listed below.
Measurement shall be made for finished item of work and description of each item shall include materials, transport, labor, fabrication tools and plant and all types of overheads for finishing the work in required shape, size and specification.
In booking, the order shall be in sequence of length, breadth and height or depth or thickness
All works shall be measured subject to the following tolerances.
linear measurement shall be measured to the nearest 0.01m.
Areas shall be measured to the nearest 0.01 sq.m
Cubic contents shall be worked-out to the nearest 0.01 cum and Wood for door and window frames to the accuracy of 0.0001 mt.
Killogram to the accuracy of 0.01
Same type of work under different conditions and nature shall be measured separately under separate items.
The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.

In case of masonry (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described:
From foundation to plinth level
From plinth level to first floor level
From Fist floor to second floor level and so on.

REQUIREMENTS OF ESTIMATION AND COSTING

Estimate gives an idea of the cost of the work and hence its feasibility can be determined i.e. whether the project could be taken up with in the funds available or not.
Estimate gives an idea of time required for the completion of the work.
Estimate is required to invite the tenders and Quotations and to arrange contract.
Estimate is also required to control the expenditure during the execution of work.
Estimate decides whether the proposed plan matches the funds available or not.

1.3.1.TYPES OF ESTIMATES

Prilimanry Estimate
Detailed estimate
Abstract
Estimation Costing &
Revised Estimate

Prilimanary Estimate: The estimate is a rough estimate which is nornmally be estimated on approximate square feet rate. In this estimate the specifications and Area are
only for the temparary purpose. Some times the cost may differ upto 50%.

Detailed Estimate: The estimate which is in detail be provided with specifcations of material, method of duing the work, Details measurements and drawings. The quantities of
the item ofthe works may vary upto 10%

Abstract: The estimate which includes only the the total quantities of the item of works, Rates either as per PWD schedule or market values and total cost of the project

Revised Estimate: The revised estimate is the estimate which includes revised quantities
or specifications and Rates.
The conditions for the preparation of Revised estimates are
1. When the area or measurements of the approved plan changes
2.When the specification of materialof method of construction changes
3.When the rates of the material, labour changes over and above 10%
4. When the location of the work changes

STEPS OR PROCEDURE OF ESTIMATION

Estimating involves the following operations
Preparing detailed Estimate.
Calculating the rate of each unit of work
Preparing abstract of estimate

REQUIR4MENTS TO PREPARE AN ESTIMATE

Drawings i.e. plans, elevations, sections etc. with complete measurements
Detailed Specifications if possible with brand name
Scheduled Rates or Market rates

DRAWINGS

If the drawings are not clear and without complete dimensions the preparation of estimation become very difficult. So, it is very essential before preparing an estimate

SPECIFICATIONS

General Specifications: This gives the nature, quality, class and work and materials in general terms to be used in various parts of wok. It helps no form a general idea of building.

Detailed Specifications: These gives the detailed description of the various items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

RATES

For preparing the estimate the unit rates of each item of work are required as given below

The rates of various materials to be used in the construction.

The cost of transport materials.

The wages of labor, skilled or unskilled of masons, carpenters, Amador, etc.,

LUMPSUM

While preparing an estimate, it is not possible to work out in detail in case of petty items. Items other than civil engineering such items are called lump sum items or simply L.S.Items.

The following are some of L.S. Items in the estimate.

Water supply and sanitary arrangements.

Electrical installations like meter, motor, etc.,

Architectural features.

Contingencies and unforeseen items.

In general, certain percentage on the cost of estimation is allotted for the above L.S.Items Even if sub estimates prepared or at the end of execution of work, the actual cost should not exceed the L.S.amounts provided in the main estimate.

WORK CHARGED ESTABLISHMENT:

During the construction of a project considerable number of skilled supervisors, work assistance, watch men etc., are employed on temporary basis. The salaries of these persons are drawn from the L.S. amount allotted towards the work charged establishment or in the category of contigencies

That is, establishment which is charged directly to work. An L.S.amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.

Detailed estimate of culverts and bridges

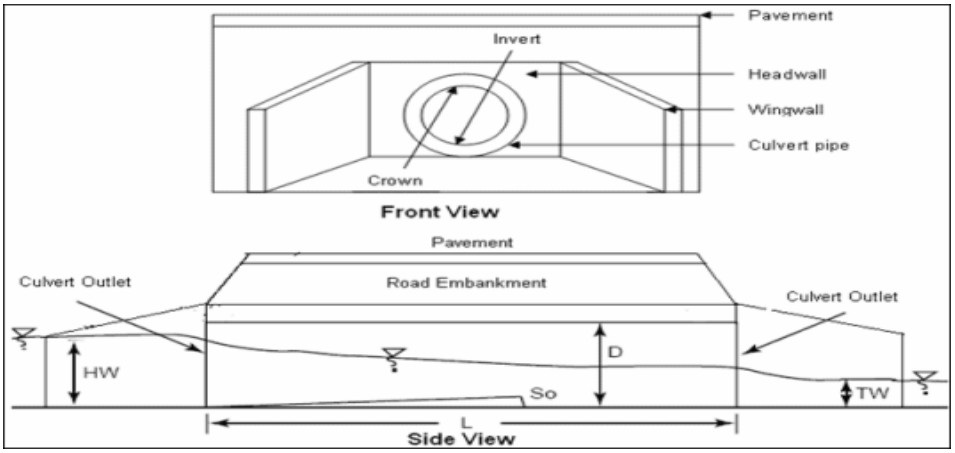
DEFINITION:-

A culvert is a tunnel structure that allows running water to pass under a roadway or railway. Culvert is also useful for water drainage or bridging the gap over a physical obstruction.

According to IRC specification, a linear waterway having 6m length is termed as culvert. The waterway having more than 6m length but less than 30m span is termed as minor bridge. and the linear waterway having more than 30m span is considered as major bridge.

COMPONENTS:-

- Pavement
- Road Embankment
- Headwall
- Wingwall
- Apron
- Crown
- Culvert Pipe
- Culvert Inlet
- Culvert Outlet
- Culvert Foundation



SOME COMMON TERMS:-

ABUTMENT

The end supports of a bridge superstructure are known as abutments. Abutments are built either with brick masonry, stone masonry, mass concrete, precast concrete blocks or RCC.

WINGWALL

Wing walls provide smooth entry of water into the bridge site and provide support and protect the embankment. Wing walls can serve as buttresses to support walls. They can also be purely decorative.

RETURN WALL

A return wall is a retaining wall built parallel to the centre line of a road to retain the embankment.

APRON

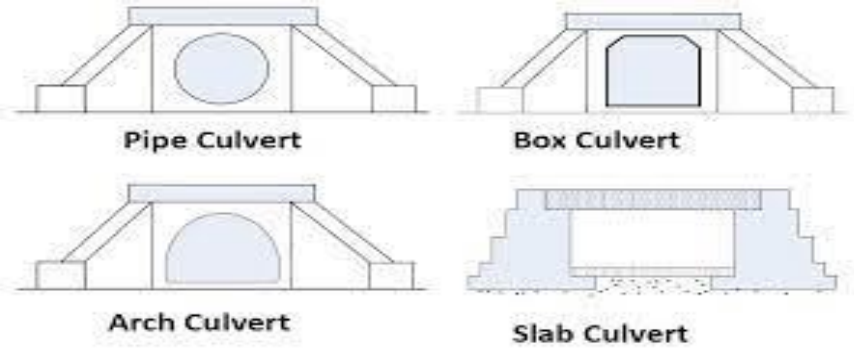
A smooth (generally concrete) surface that is placed between culvert and channel to improve capacity and reduce erosion.

CURTAIN WALL

Cross walls are built across the stream on the up-stream or down-stream in order to protect the structure from erosion due to strong current of water induced by the restriction of free passing of water through the water way.

TYPES OF CULVERT:-

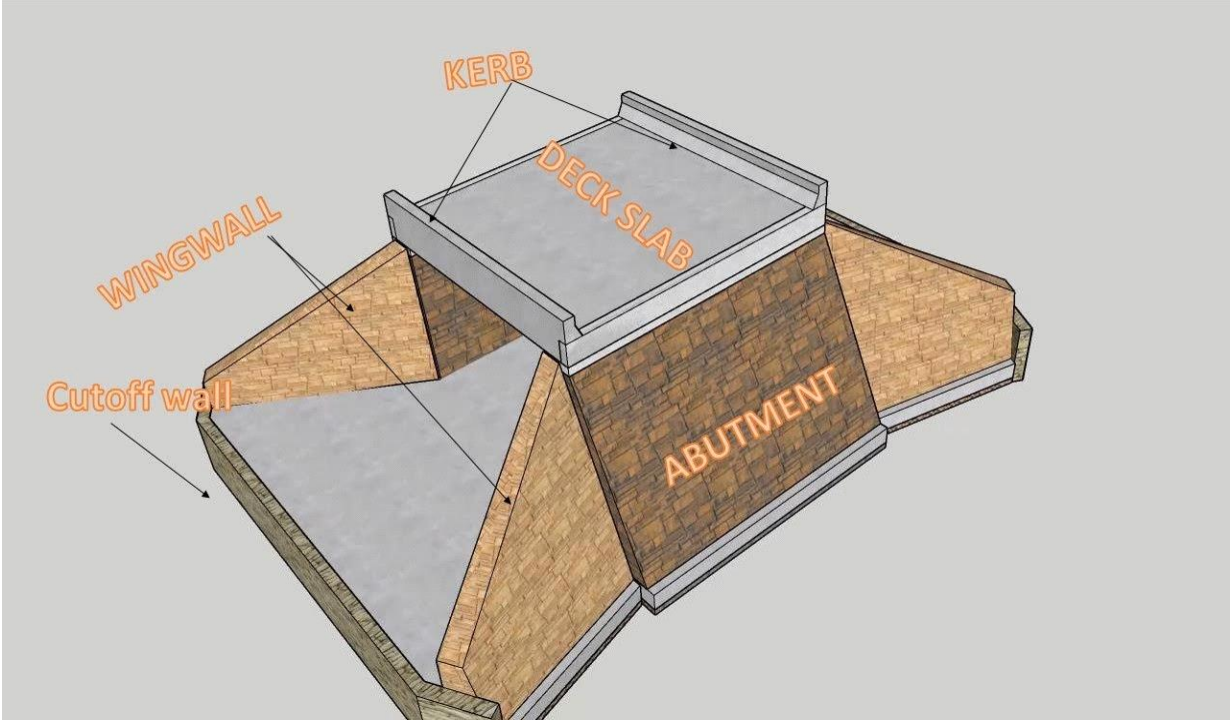
- Slab Culvert
    1. Right angle wing wall
    2. Splayed wing wall
- Box Culvert
- Pipe Culvert
- Arch Culvert



DETAILED ESTIMATE OF SLAB CULVERT

While constructing the slab culvert, a series of slabs are laid to form the bridge-like structure. After that, a pavement surface is placed on top to serve the purpose as the road.

- While constructing the slab culvert, a series of slabs are laid to form the bridge-like structure. After that, a pavement surface is placed on top to serve the purpose as the road.
- The standard span length ranges from 8’ to 48'. ASTM C 1504 design code is followed to design the slab culvert.

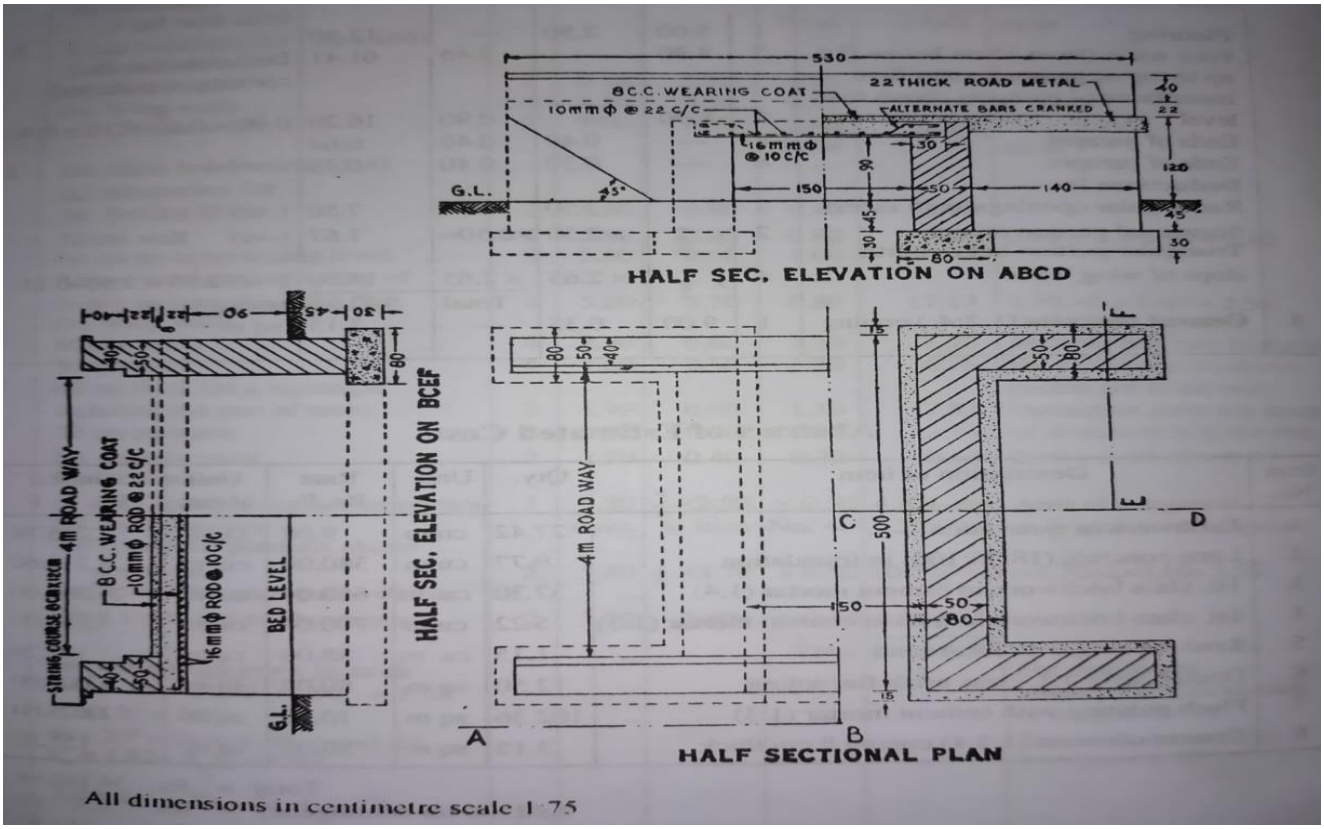


QUESTION NO. 1:-

Prepare a quantity survey for a slab culvert of 1.5m clear span and 4m road way as shown in figure. The general specifications are as follows.

Foundation shall be of cement concrete 1:2:4. Brickwork shall be of 1st class in cement mortar

1:4. Exposed surfaces of RCC shall be given a smooth finish during centering, and no plastering shall be allowed. The string courses shall be 8cm deep and 12mm thick with cement mortar 1:3 finished with neat cement .(Steel of 16mm and 10mm dia. bars are 1.58kg and 0.62kg respectively per 1m.)



DETAILS OF MEASUREMENT AND QUANTITIES:-

SL NO.	ITEM DESCRIPTION	NO	LENGTH	BREADTH	HEIGHT / DEPTH	QUANTITY	REMARK
1	**EARTHWORK IN EXCAVATION**						
	ABUTMENT	2	5.3	0.8	0.75	6.36cum	L = 5+0.15+0.15= 5.3m H = 0.3+0.45 = 0.75m
	WINGWALL	4	1.4	0.8	0.75	3.36cum	
					TOTAL	**9.72CUM**	
2	**1:2:4 CEMENT CONCRETE IN FOUNDATION**						
	ABUTMENT	2	5.3	0.8	0.3	2.54cum	
	WINGWALL	4	1.4	0.8	0.3	1.34cum	
					TOTAL	**3.88CUM**	

3	**1st CLASS BRICK WORK WITH 1:4 CEMENT MORTAR**						
	ABUTMENT	2	5.00	0.50	1.57	7.85	H=0.45+1.2-0.08=1.57m
	WINGWALL	4	1.40	0.50	1.57	4.39	
	PARAPET WALL EXCLUDING KERB	2	5.30	0.40	0.60	2.54	H = 0.22+0.08+0.4-0.1 = 0.60m
	KERB	2	5.30	0.10	0.30	0.32	
	COPING	2	5.30	0.48	0.12	0.61	B= 0.4+0.08 = 0.48m
					TOTAL	15.71CUM	
	DEDUCT:- BEARING OF SLAB ON ABUTMENT	2	5.00	0.30	0.22	0.66	
					NET TOTAL	**15.05CUM**	
4	**RCC WORK IN DECK SLAB INCLUDING CENTERING, SHUTTERING AND EXCLUDING REINFORCEMENT & IT'S BENDING**	1	5.00	2.10	0.22	**2.31CUM**	B = 1.5+0.3+0.3 =2.1m No deduction for volume of steel.
5	**STEEL BARS INCLUDING BENDING**						
	16mm dia MAIN BAR @ 10mm C/C.						NO.= $\frac{5-2\times0.025}{0.1}$ +1 = 51
	STRAIGHT BAR	26	2.34			60.84m	Take clear cover 25mm and hooks @ 9d for each side. L = 2.1 - (2×0.025) + (2×9×0.016) = 2.34m
	BENT UP BAR	25	2.53			63.25	Take length of bent up= effective depth d=0.22-0.025-$\frac{1}{2}$×0.016 = 0.187m L = 2.1 - (2×0.025) + (2×9×0.016) + 0.187 = 2.53m
					TOTAL	**124.09m @ 1.58Kg/m = 196.kg**	W = $\frac{16^2}{162}$ = 1.58kg/m

	10mm dia bottom distribution bar @ 22mm C/C.	11	5.13			56.43m	NO. = $\frac{2.1-2\times0.025}{0.22}$ = 11 L = 5 - (2*0.025) + (2*9*0.001) = 5.13
	10mm dia TOP BAR	4	5.13			20.52m	
					TOTAL	**76.95m @ 0.62Kg/m = 47.71Kg**	W = $\frac{10^2}{162}$ = 0.62kg/m
6	**8cm CC wearing coat over RCC slab**	1	4.00	2.50	0.08	**0.80CUM**	
7	**1:3 cement plaster over exposed surface**						
	Face wall from 10cm below G.L upto parapet wall	2	5.30	-	1.80	19.08	H=0.1+1.2+0.22+0.4-0.12 = 1.8m
	Coping	2	5.30	0.80	-	8.48	B=0.12+0.48+0.12+0.08= 0.8m
	Innerside of kerb and parapet wall	2	5.30	-	0.60	6.36	H = 0.22+0.1+0.4-0.12 = 0.6m
	End side of Parapet	4	-	0.40	0.58	0.93	H=0.08+0.22+0.4-0.12=0.58m
	End side of kerb	4	-	0.1	0.30	0.12	H = 0.08+0.22 = 0.3m
	End side of coping	4	-	0.48	0.12	0.23	
					Total	35.20SQM	
	Deduct:-						
	Rectangular opening on both side of Facewall	2	1.50	-	1.22	3.66	H = 0.1+1.2-0.08 = 1.22m
	Triangular portion of Side slope	4	1/2*	1.22*	1.22	2.98	
					Total	(-)6.64SQM	
					Net Total	**28.56SQM**	

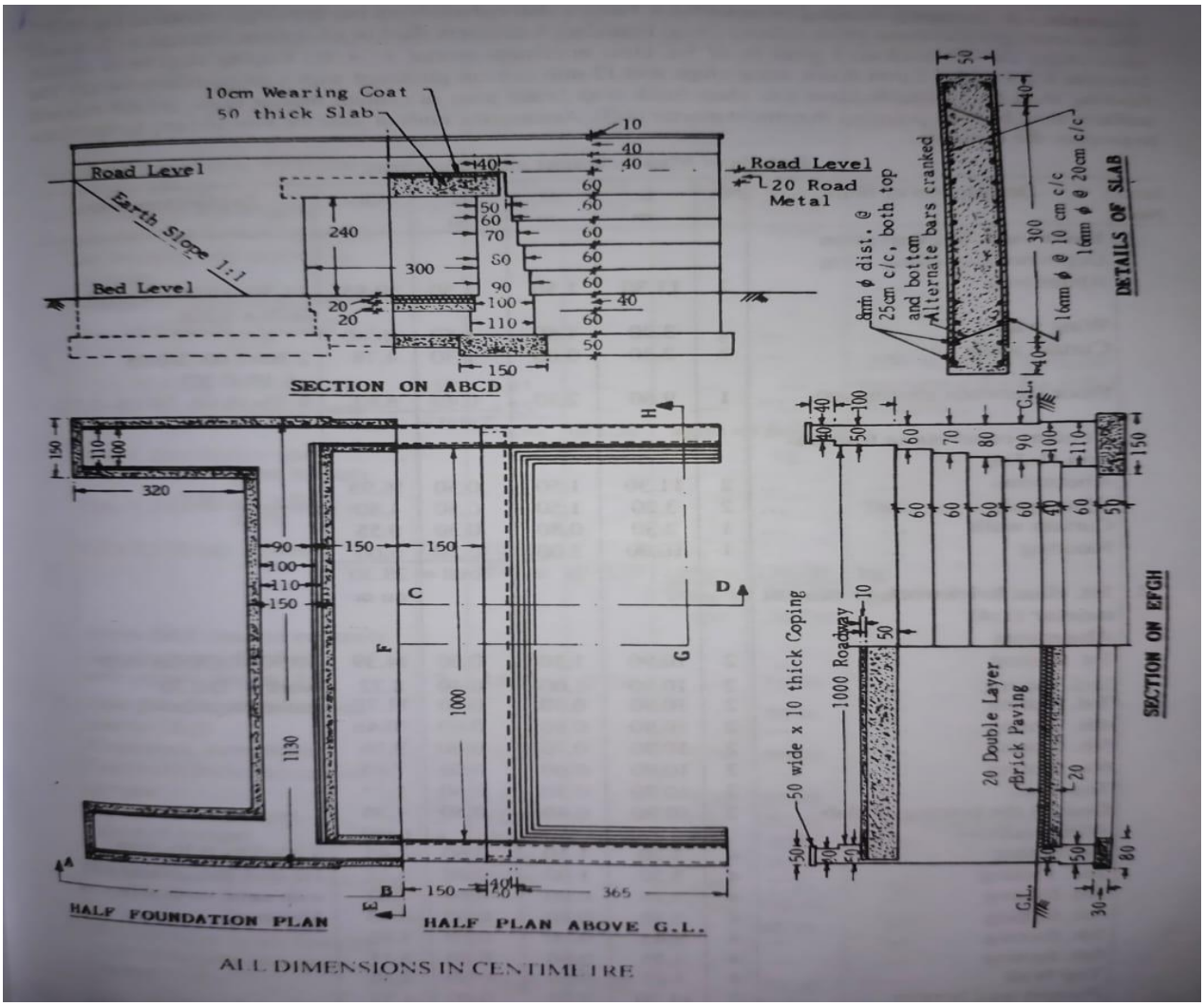
ABSTRACT OF ESTIMATED COST:-

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	RATE	UNIT OF RATE	AMOUNT
1	Earthwork in Excavation in Foundation	9.72	CUM		CUM	
2	1:2:4 Cement concrete with stone chips in Foundation	3.88	CUM		CUM	
3	First class brickwork in 1:4 Cement mortar	15.05	CUM		CUM	

4	1:2:4 RCC work excluding reinforcement but including centering, shuttering and binding	2.31	CUM		CUM	
5	Mild steel bar for reinforcement including bending and binding	2.44	QUINTAL		QUINTAL	
6	8cm CC wearing coat over RCC slab	0.80	CUM		CUM	
7	1:3 Cement plastering	28.56	SQM		SQM	
					TOTAL	
					GRAND TOTAL	

QUESTION NO. 2:-

Prepare a detailed estimate for a 3m slab culvert from the drawings shown in fig. The general specifications are as follows. (a) Foundation concrete shall be Cement concrete 1:3:6 with stone chips. (b) All brickwork shall be of 1st class in cement mortar 1:4. (c) Coping shall be of cement concrete 1:2:4 with 12mm down stone chips and 12mm cement plastered with a proportion 1:4 . (d) The flooring shall be of double layer 1st class brick with brake joint in cement mortar (1:6). (e) All exposed surfaces shall be Rule pointing in cement mortar (1:3). Assume any other data if necessary to prepare the estimate.



DETAILS OF MEASUREMENT AND QUANTITIES:-

SL NO.	ITEM DESCRIPTION	NO	LENGTH	BREADTH	HEIGHT/ DEPTH	QUANTITY	REMARK
1	**EARTHWORK IN EXCAVATION**						
	ABUTMENT	2	11.50	1.50	1.50	51.75	L=10+2(0.5+0.05+0.2) =11.50m
	WINGWALL	4	3.20	1.50	1.50	28.80	
	CURTAIN WALL	2	2.30	0.80	1.30	4.78	L=3-2(0.05+0.1+0.2) =2.3m H = 0.3+0.6+0.4 =1.3m
	FLOOR	1	9.70	2.30	0.40	8.92	L = 10-(2×0.15) = 9.7m
					TOTAL	**94.25CUM**	
2	**1:3:6 CEMENT**						

	CONCRETE IN FOUNDATION						
	ABUTMENT	2	11.50	1.50	0.50	17.25	
	WINGWALL	4	3.20	1.50	0.50	9.60	
	CURTAIN WALL	2	2.30	0.80	0.30	1.10	
	FLOOR	1	10.00	2.90	0.20	5.80	B=3-(2×0.05) = 2.9m
					TOTAL	**33.75CUM**	
3	**1st CLASS BRICK WORK WITH 1:4 CEMENT MORTAR**						
	ABUTMENT:-						
	1st Footing	2	10.90	1.10	0.60	14.39	L = 11.3-(2×0.2)= 10.9m
	2nd Footing	2	10.90	1.00	0.40	8.72	
	3rd Footing	2	10.90	0.90	0.60	11.77	
	4th Footing	2	10.90	0.80	0.60	10.46	
	5th Footing	2	10.90	0.70	0.60	9.16	
	6th Footing	2	10.90	0.60	0.60	7.85	
	Top wall	2	10.90	0.50	0.60	6.54	H = 0.6-0.1 = 0.5m
	WINGWALL:-						
	1st Footing	4	3.20	1.10	0.60	8.45	
	2nd Footing	4	3.20	1.00	0.40	5.12	
	3rd Footing	4	3.25	0.90	0.60	7.02	L = 3.2+0.05 = 3.25m
	4th Footing	4	3.35	0.80	0.60	6.43	
	5th Footing	4	3.45	0.70	0.60	5.80	L = 3.25+(2*0.1) = 3.45m
	6th Footing	4	3.55	0.60	0.60	5.11	
	Top wall	4	3.65	0.50	0.60	4.38	
	Parapet wall	2	11.30	0.40	0.80	7.23	
	Kerb	2	11.30	0.10	0.40	0.90	
	CURTAIN WALL:-						
	1st Footing	2	2.70	0.50	0.60	1.62	
	Top Wall	2	2.90	0.40	0.40	0.93	

					TOTAL	**121.88CUM**	
	DEDUCT:-						
	Bearing of Slab on abutment	2	10.90	0.40	0.50	4.36cum	
					Net Total	**117.52CUM**	
4	**1:2:4 RCC work excluding steel and it's bending**	1	11.00	3.80	0.50	**20.90CUM**	
5	**Shuttering and Staging**	1	11.00	3.00	-	**33.00SQM**	
6	**Steel bar including bending and placing in position**						
	16mm dia straight bar at top and bottom @ 20cm C/C	112	4.01	-	-	449.12	NO. = $2\times(\frac{11-2\times0.04}{0.2}+1)$ = 112 L=3.8- (2×0.04) + (2×9×0.016) = 4.01m
	16mm dia bent up bar	56	4.35	-	-	243.60	L=4.01+2×(0.42×(0.5-2×0.04-1×0.016)) = 4.35m
					TOTAL	**692.72m @ 1.58kg/m = 1094.50kg**	W = $\frac{16^2}{162}$ = 1.58Kg/m
	8mm dia distribution bar at top and bottom @ 25cm C/C	32	11.06	-	-	353.92	NO. = $2\times(\frac{3.8-2\times0.04}{0.25}+1)$ = 32 L=11- (2×0.04) + (2×9×0.008) = 11.06m
					TOTAL	353.92m @ 0.39kg/m = 138.03kg	W = $\frac{8^2}{162}$ = 0.39kg/m
					GRAND TOTAL	**1232.53kg = 12.32quintal**	
7	**10cm thick cement concrete (1:2:4) coping finished with cement plaster (1:4)**	2	11.50	0.50	-	**11.50SQM**	L=3.65+0.5+1.5+1.5+0.5+3.65+2×0.1 = 11.5m
8	**Double layer brick flooring with brake joint in 1:6 cement mortar**	1	10.00	3.00	-	**30.00SQM**	
9	**Rule pointing with 1:3 cement mortar**						
	Inner side of Abutment wall	2	11.00	-	2.40	52.80	L = 10+2×0.5 = 11m

	Face wall upto parapet height	2	11.30	-	3.80	85.88	L=3.65+0.5+1.5+1.5+0.5+3.65 = 11.3m H = 5×0.6+0.4+0.4 = 3.8m
	Inner side of Parapet wall	2	11.30	-	0.90	20.34	H = 0.4+0.1+0.4 = 0.9m
	Ends of parapet wall	4	-	0.40	0.80	1.28	H = 0.4+0.4 = 0.8m
	Ends of kerb	4	-	0.10	0.40	0.16	
					TOTAL	160.46SQM	
	Deduct:-						
	Rectangular opening	2	3.00	-	2.40	14.40	
					NET TOTAL	**146.06SQM**	

ABSTRACT OF ESTIMATED COST:-

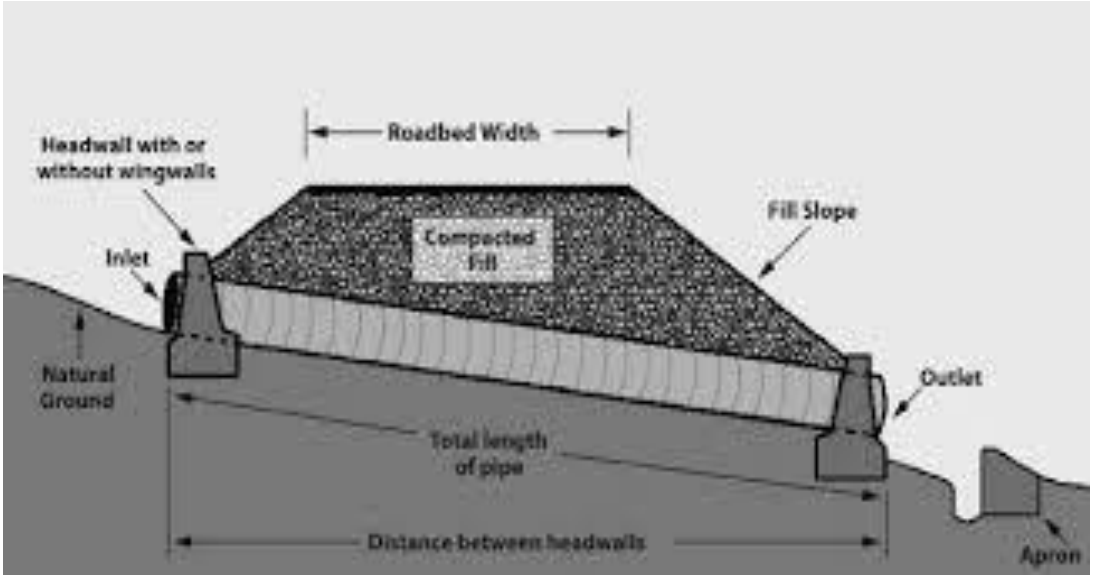
ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	RATE	UNIT OF RATE	AMOUNT
1	Earthwork in Excavation in Foundation	93.26	CUM		CUM	
2	1:3:6 Cement concrete with stone chips in Foundation	33.65	CUM		CUM	
3	First class brickwork in 1:4 Cement mortar	117.52	CUM		CUM	
4	1:2:4 RCC work excluding reinforcement but including centering, shuttering and binding	20.90	CUM		CUM	
5	Shuttering and Staging	33.00	SQM		SQM	
6	Steel bar including bending and placing in position	12.32	QUINTAL		QUINTAL	
7	10cm thick cement concrete (1:2:4) coping finished with cement plaster (1:4)	11.50	SQM		SQM	
8	Double layer brick flooring with brake joint in 1:6 cement mortar	30.00	SQM		SQM	
9	Rule pointing with 1:3	146.06	SQM		SQM	

	cement mortar					
					TOTAL	
					GRAND TOTAL	

PIPE CULVERT

The culvert having a single in number or multiple pipes are placed side by side over a base of concrete below the embankment of a railway track or roadways by fixing there both ends into masonry walls is called pipe culvert.

- The pipes culvert is made from R.C.C., cast iron, steel, etc.
- The pipe culverts are widely used, it is very easy for installation is at a competitive price.
- Pipe culverts are available in different shapes such as circular, elliptical, and pipe arch and their shape selection depend on on-site conditions
- These culverts may be used of single in number or multiple, if the width of the span or channel is greater, we will go for multiple pipe culverts. Generally, they are used for a larger flow, and an installation of a single pipe culvert, we can use the larger diameter size culvert.
- The range of diameter of the pipe culvert is between 1Meter to 6m.
- The pipe culvert is chosen for smaller types of drainage works, which pass through the embankment of road or railway.



Advantages of Pipe Culvert

The main advantages of pipe culverts are:

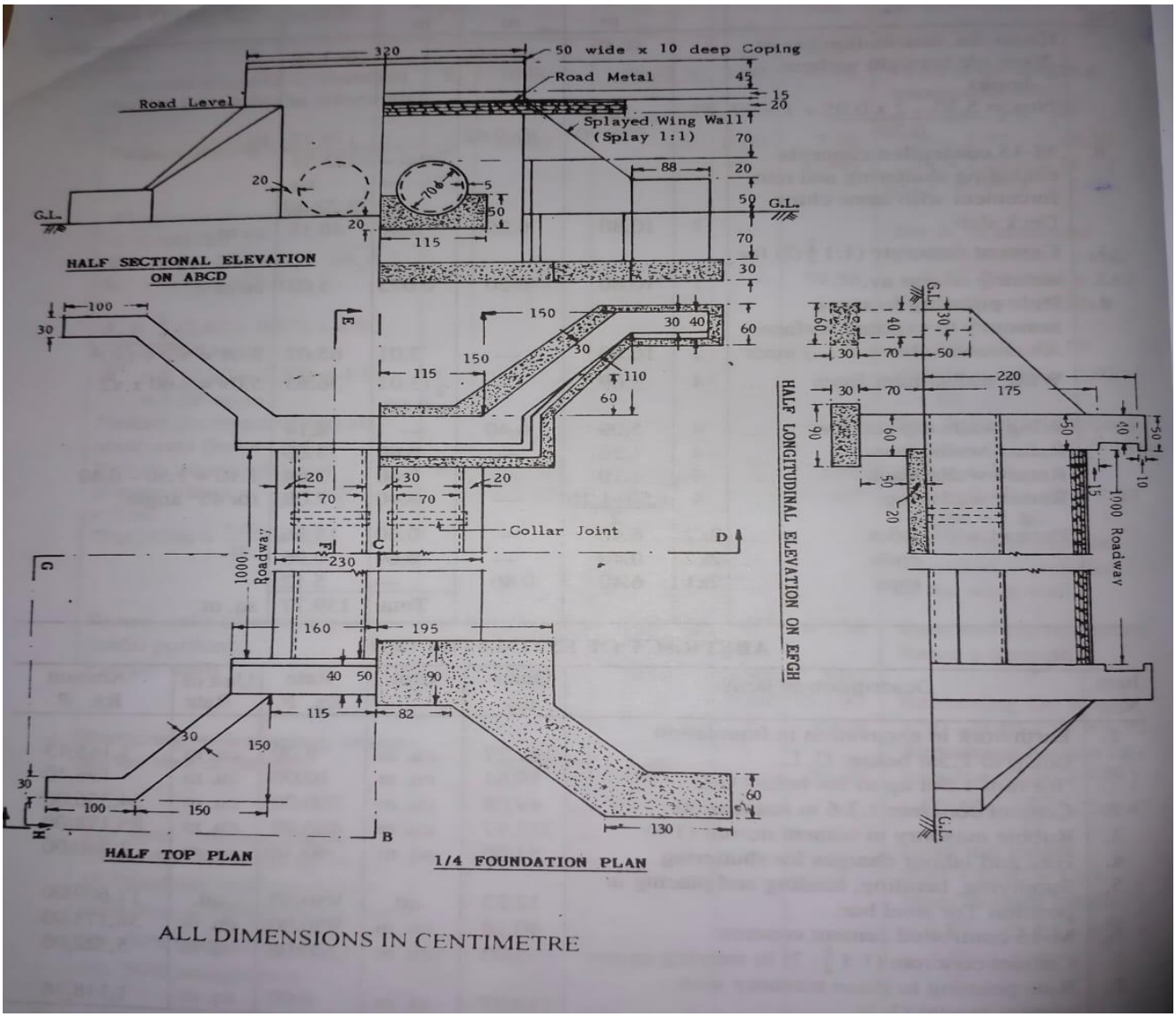
- Any desired strength is achievable by proper mix design, thickness, and reinforcement.
- Economical.
- Easy to Install.
- Pipe culvert can withhold high tensile stresses and compressive stresses.
- As pipe culverts don't create barriers in the path, they provide a continuous surface over the pipe.

Disadvantages of Pipe Culvert

- Crown corrosion. When the crown is corroded because of bacteria 's organic attack and release of harmful gas, it is known as crown corrosion.

QUESTION:-

Prepare a detailed estimate of R.C. pipe culvert with splayed wing walls from the figure. All brickworks shall be first class with 1:6 cement mortar. The concrete work in foundation and pipe bedding shall be of 1:3:6 cement concrete with stone chips. All exposed surfaces of brickwork shall be flush pointed with cement mortar (1:3). Assume suitable rates.



DETAILS OF MEASUREMENT AND QUANTITIES:-

SL NO.	ITEM DESCRIPTION	NO	LENGTH	BREADTH	HEIGHT / DEPTH	QUANTITY	REMARK
1	**EARTHWORK IN EXCAVATION FOR FOUNDATION**						
	FACEWALL	2	3.90	0.90	1.00	7.02	L = 2×1.95 = 3.90
	WINGWALL (UPTO END OF RETURN WALLS)	4	$\frac{2.12+1.56}{2}$	$\frac{1.13+0.85}{2}$	1.00	7.29	$\sqrt{1.5^2+1.5^2}$ = 2.12 $\sqrt{1.1^2+1.1^2}$ = 1.56 1.95 – 0.82 = 1.13 0.6×$\sqrt{2}$ = 0.85
	RETURN WALL	4	$\frac{0.7+1.3}{2}$	$\frac{0.85+0.6}{2}$	1.00	2.90	1.3 – 0.6 = 0.7

	PIPE BEDDING	1	9.50	2.30	0.20	4.37	L = 10 – 2×(0.1 + 0.15) = 9.5
					TOTAL	**21.58CUM**	
2	**1:3:6 CEMENT CONCRETE IN FOUNDATION**						
	FACE WALLS	2	3.90	0.90	0.30	2.11	
	WINGWALLS	4	$\frac{2.12+1.56}{2}$	$\frac{1.13+0.85}{2}$	0.30	2.19	
	RETURN WALLS	4	$\frac{0.7+1.3}{2}$	$\frac{0.85+0.6}{2}$	0.30	0.87	
	PIPE BEDDING	1	10.00	2.30	0.50	11.50	
					TOTAL	16.67CUM	
	DEDUCT:-						
	VOLUME OCCUPIED DUE TO PIPE SEGMENTAL PORTION	2	10×	$\frac{2}{3}$×0.78×	0.30	3.12	h = 0.5 – 0.2 = 0.3 2×$\sqrt{0.4^2-(0.4-0.3)^2}$ = 0.78
					NET TOTAL	**13.55CUM**	
3	**FIRST CLASS BRICKWORK WITH 1:6 CEMENT MORTAR**						
	FACE WALLS:-						
	60cm wide footing	2	3.60	0.60	0.50	2.16	L = 2×(1.95 – 0.15) = 3.6
	50cm wide wall	2	3.40	0.50	1.95	6.63	L = 2×(1.95 – 0.15 – 0.1) = 3.4
	40cm parapet wall	2	3.20	0.40	0.45	1.15	L = 2×1.6 = 3.2
	WINGWALL:-						
	Core part of wingwall	4	$\frac{2.12+1.56}{2}$	0.30	$\frac{1.2+2.3}{2}$	4.14	
	Outside offset below G.L.	4	$\frac{1}{2}$×1.1×$\sqrt{2}$	0.20	0.70	0.44	
	Outside offset above G.L.	4	$\frac{1}{2}$×0.6×$\sqrt{2}$	0.10	0.70	0.99	
	RETURN WALL:-						
	40cm wide footing	4	$\frac{1.0+0.6}{2}$	0.40	0.70	0.90	
	30cm wide wall above	4	$\frac{1+0.7}{2}$	0.30	0.50	0.51	

	G.L.						
					TOTAL	16.58CUM	
	Deduct:-						
	Bearing of pipe into the face wall	2×2	0.5×	$\frac{\pi}{4}\times$	0.8^2	1.01	
					NET TOTAL	**15.57CUM**	
4	**1:3:6 CEMENT CONCRETE WITH STONE CHIPS OF COPING**	2	3.4	0.50	0.10	**0.34CUM**	L = 3.2+(2×0.1) = 3.4
5	**FLUSH POINTING IN CEMENT MORTAR (1:3) TO BRICKWORK**						
	Exposed surfaces of face walls upto road level	2	2.30	-	1.60	7.36	H = 0.5+0.2+0.7+0.2 = 1.6
	Outer side of Parapet wall	2	3.20	-	0.60	3.84	H = 0.15+0.45 = 0.6
	Inner side of Parapet wall	2	3.20	-	0.70	4.48	H = 0.15+0.1+0.45 = 0.7
	Ends of parapet	4	-	0.50	0.60	1.20	
	Outer side of wingwall	4	2.12	-	$\frac{1.6+0.5}{2}$	8.90	
	Top surface of wingwall	4	2.40	0.30	-	2.88	L = $\sqrt{2.12^2+1.2^2}$ = 2.4
	Two sides of return wall	4	1.30	-	0.50	2.60	
	Top surface of return wall	4	$\frac{1+0.7}{2}$	0.30	-	1.02	
					TOTAL	32.28SQM	
	Deduct:-						
	Face area of Pipes	2	$\frac{\pi}{4}\times$	0.80^2	-	1.01	
					NET TOTAL	**31.27SQM**	
6	**70cm dia R.C. pipe including supplying and joining with collars**	2	11.00			**22.00m**	L = 10+(2×0.5) = 11

ABSTRACT OF ESTIMATED COST:-

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	RATE	UNIT OF RATE	AMOUNT
1	Earthwork in Excavation in Foundation	21.58	CUM		CUM	
2	1:3:6 CEMENT CONCRETE IN FOUNDATION	13.55	CUM		CUM	
3	FIRST CLASS BRICKWORK WITH 1:6 CEMENT MORTAR	15.57	CUM		CUM	
4	1:3:6 CEMENT CONCRETE WITH STONE CHIPS OF COPING	0.34	CUM		CUM	
5	FLUSH POINTING IN CEMENT MORTAR (1:3) TO BRICKWORK	31.27	SQM		SQM	
6	70cm dia R.C. pipe including supplying and joining with collars	22.00	Meter		QUINTAL	
					TOTAL	
					GRAND TOTAL	

IRRIGATION WORKS

Siphon Aqueduct • In a hydraulic structure where the canal is taken over the drainage, but the drainage water cannot pass clearly below the canal. It flows under siphonic action. So, it is known as **siphon aqueduct**. This structure is suitable when the bed level of canal is below the highest flood level.

Example-1.0- Prepare a detailed estimate of a siphon aqueduct from the given figure. The general specifications:- Cement concrete in foundation shall be of 1:4 with brick ballast. Brickwork shall be of 10 cm thick dry brick pitching shall be provided for both U/S and D/S sides. Assume suitable rates of the different items of work at your locality.

DRAINAGE SYPHON ACROSS A MINOR

Example 7. —Prepare a detailed estimate of a Drainage Syphon across a minor from the given drawing, Figs. 9-8 and 9-9.

Foundation concrete shall be of 1 : 4 : 8 cement concrete with brick ballast. All brickwork shall be of 1 : 4 cement mortar. Exposed surfaces of brickwork shall be struck pointed with 1 : 2 cement mortar. Brick pitching shall be of dry brick with straight over burnt bricks.

Assume suitable rates for the different items of work.

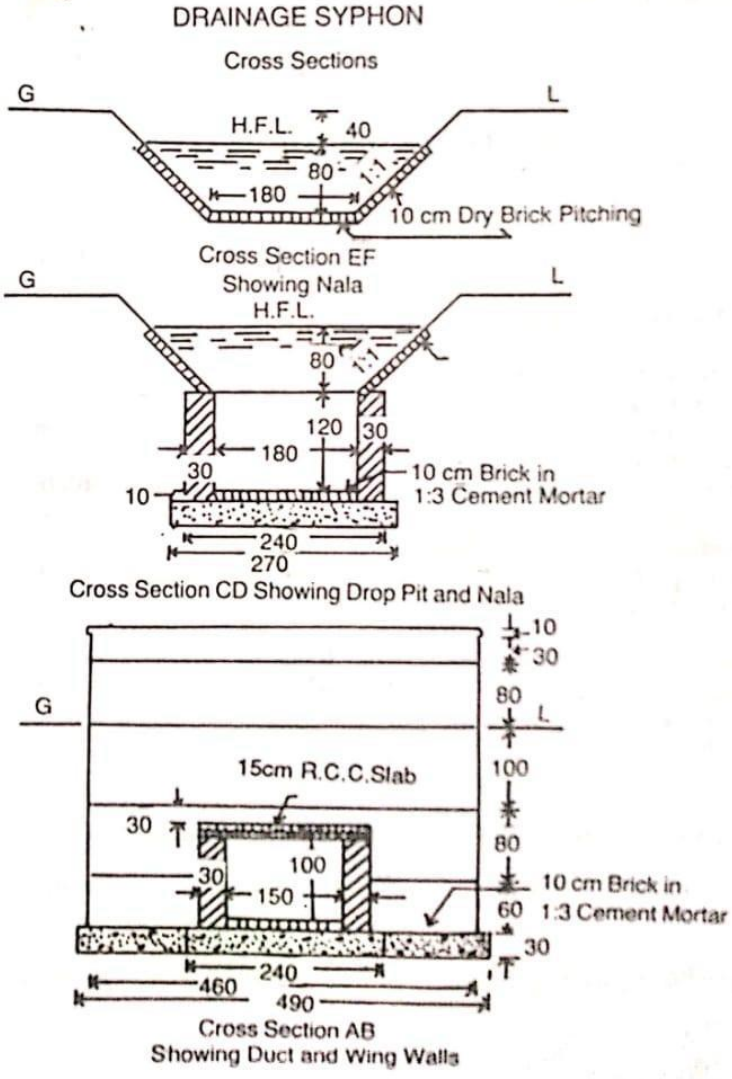


Fig. 9-8

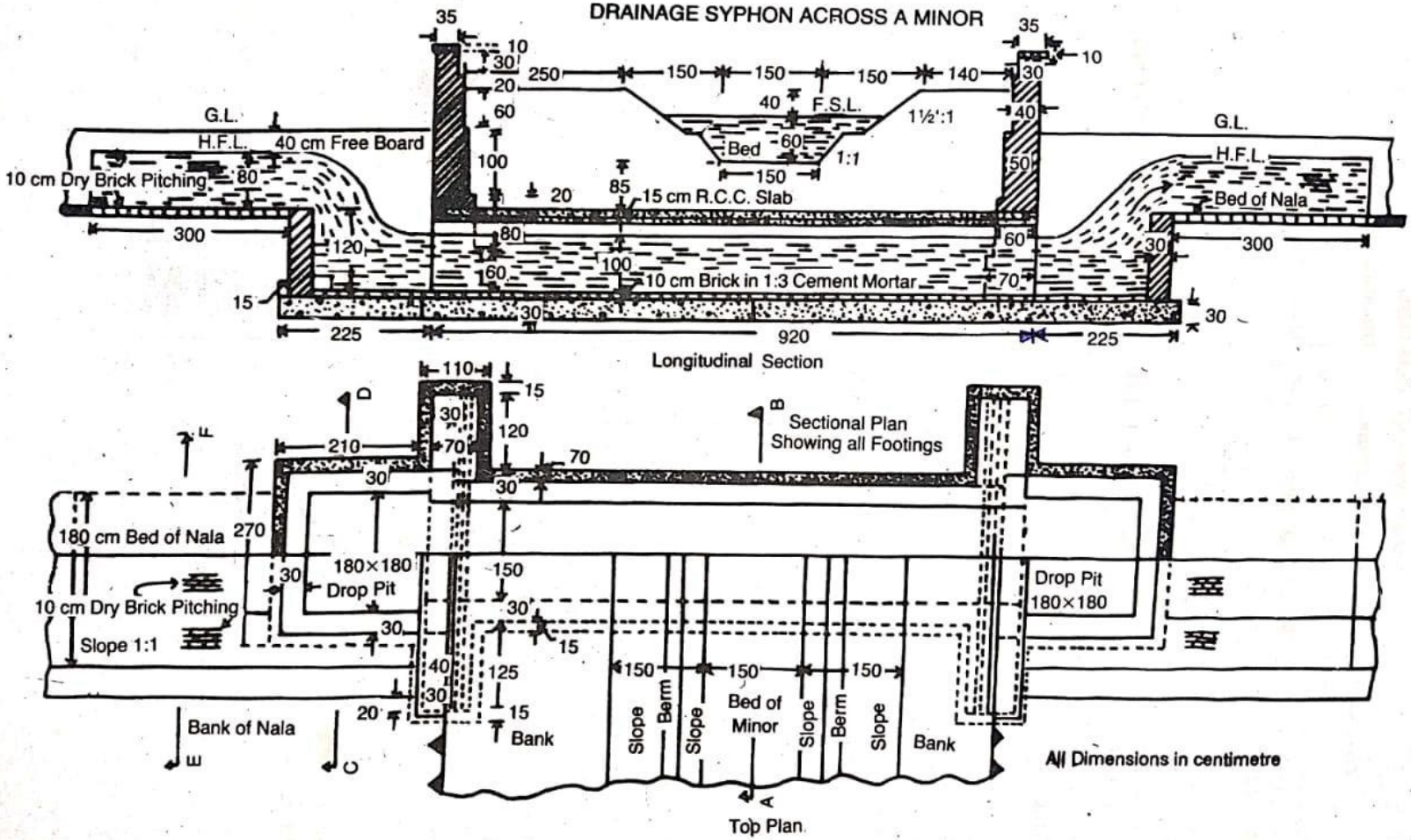

DRAINAGE SYPHON ACROSS A MINOR
G.L.
H.F.L.
40 cm Free Board
10 cm Dry Brick Pitching
F.S.L.
Bed
1½':1
1:1
15 cm R.C.C. Slab
10 cm Brick in 1:3 Cement Mortar
Bed of Nala
Longitudinal Section
Sectional Plan
Showing all Footings
180 cm Bed of Nala
Drop Pit
180×180
Slope 1:1
Bank of Nala
Bank
Slope
Berm
Bed of
Minor
All Dimensions in centimetre
Top Plan

Fig. 9 9

Details of Measurement and Calculation of Quantities (Ex. 7)

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
1	Earthwork in excavation in foundation—						
	Syphon duct ...	1	9.50	2.40	1.60	36.48	*For bed level of nala.*
	Drop pit ...	2	2.10	2.70	1.60	18.14	
	Wing walls ...	4	1.25	1.10	1.60	8.80	
					Total	63.42 cu m	
2	Cement concrete 1 : 4 : 8 with brick ballast—						
	Syphon duct ...	1	9.50	2.40	0.30	6.84	
	Drop pit ...	2	2.10	2.70	0.30	3.40	
	Wing walls ...	4	1.25	1.10	0.30	1.65	
					Total	11.89 cu m	
3	First class brickwork in 1 : 4 cement mortar—						
	Syphon duct side walls	2	9.20	0.30	1.30	7.18	
	Drop pit walls ...	2×2	2.10	0.30	1.30.	3.28	
	Wing walls—	2	1.80	.30	1.30	1.40	
	1st step 70 cm walls	4	1.25	0.70	0.70	2.45	
	2nd step 60 cm walls	4	1.25	0.60	0.60	1.80	Upto top of slab.
	2nd step 60 cm walls above slab	2	4.60	0.60	0.20	1.10	
	3rd step 50 cm wall	2	4.60	0.50	1.00	4.60	
	4th step 40 cm wall	2	4.60	0.40	0.80	2.94	
	5th step 30 cm wall (parapet)	2	4.60	0.30	0.30	0.83	
	Coping	2	4.70	0.35	0.10	0.33	
					Total	25.91 cu m	

Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
4	R.C.C. slab of syphon duct including steel reinforcement complete work	1	9.20	2.10	0.15	2.90 cu m	
5	10 cm thick brick floor in 1 : 3 cement mortar including 1 : 2 cement pointing —						
	Floor of syphon duct	1	9.20	1.50	—	13.80	
	Floor of drop pit ...	2	1.80	1.80	—	6.48	
					Total	20.28 sq m	
6	Cement struck pointing 1 : 2 –						
	Syphon duct inner faces	2	9.20	—	1.00	18.40	
	Drop pit 3 vertical faces	2×3	1.80	—	1.20	12.96	
	Drop pit 3 top faces	2	5.70	—	0.30	3.42	L=2×180+210 =570 cm
	Parapet wall inner face top and outer face up to G.L.	2	4.60	—	2.30	21.16	Ht.=20+10+30+10 +35+10+5+110 =230 cm
	Outer face of wing wall above slab ...	2	1.80	—	1.20	4.32	
	Triangular portion of outer face of wing wall	2×2	(½×.8	×.8)	=	1.28	
					Total	61.54 sq m	
7	10 cm dry brick pitching with straight over burnt bricks—						*Thin piching, unit in area basis.*
	Bed of nala	2	3.00	1.80	—	10.80	*Up and down streams.*
	Side slopes of nala	2×2	3.00	1.13	—	13.56	*Sloping breadth=* $\sqrt{.8^2+.8^2}$=1.13 m
					Total	24.36 sq m	

Item No.	Particulars	Quantity	Unit	Rate Rs. P.	Per	Amount Rs. P.
1	Earthwork in excavation ...	63.42	cu m	350.00	% cu m	221.97
2	Cement concrete 1 : 4 : 8 with brick ballast ...	11.89	cu m	375.00	/. cu m	4458.75
3	First class brickwork in 1 : 4 cement mortar ...	25.91	cu m	365.00	/ cu m	9457.15
4	R.C.C. slab including steel reinforcement complete work ...	2.90	cu m	775.00	/ cu m	2247.50
5	10 cm thick brick floor in 1 : 3 cement mortar with 1 : 2 cement pointing ...	20.28	sq m	40.00	/ sq m	811.20
6	Cement struck pointing with 1 : 2 cement mortar in walls ...	61.54	sq m	5.60	/ sq m	344.62
7	10 cm dry brick pitching with straight over burnt brick ...	24.36	sq m	12.00	/sq m	292.32
					Total ...	17833.51
					Add 5% for Contingencies and Workcharged Establishment ...	891.68
					Grand Total ...	18725.19