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Subject Hydraulic Structure

Section B

Submitted To . Engr Adeed

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Q# 1.

(a) Differentiate between Culvert & Causeway.

⇒ Culvert :-

Culvert is a tunnel Structure Constructed under roadways or railways to Provide Cross drainage or to take electrical or other Cables From One Side to other.

While

⇒ Causeways

is a road Paved dip which allows The Floods to Pass over it. It may have or may not have opening or Went to allow low water to Flow.

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Cross Drainage Work.

In an Irrigation Project, when The network of main Canals, branch Canal distributries e.t.c are Provided Then These Canal may have to Cross The natural drainage like rivers, Streams, nallahs, e.t.c at different Points within The Command area of The Project. The Crossing of The Canals with Such Obstacle Cannot be Avoided So, Suitable Structures must be Constructed at The Crossing Point For The easy Flow of Water of The Canal and drainage in The respective directions. The Structures are Known as Cross-drainage Works.

Necessity OF Cross Drainage Work.

- The Water-Shed Canals do not Cross natural drainages But in actual Orientation of The Canal network, This Ideal Condition may not be available and the obstacle like natural drainage may be Present across The Canal So, The Cross-drainage work must be Provided For running The Irrigation System.

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(3)

- At the Crossing Point, the water of the Canal and the drainage get Intermixed So, For the Smoth running of The the Canal with its design discharge the Cross drainage works are required.

- The Site Condition of the Crossing Point may be Such That without any Suitable Structure, The water of the Canal and drainage Can be diverted to Their natural directions So, The Cross drainage works must be Provided to maintian Thier natural direction of Flow.

Types of Cross Drainage Works.

• Types.

(Irrigation Canal Passes Over The drainage)

(a) Aqueduct
(b) Siphon Aqueduct.

TYPE 2:

(Drainage Passes Over the Irrigation Canal)

(a) Super Passage
(b) Siphon Super Passage.

TYPE 3:

(Drainage and Canal Intersection each other of the Same level)

(a) Level Crossing.
(b) Inlet and Outlet.

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Q#2

(a) Differentiate b/w Weir & Barrage.

⇒ **Weir**

- Low Cost.
- Low Control On Flow
- No Provision For transport Communication across The River.
- Chances of Silting On The Upstream is more.
- Afflux Created is high due to relatively high weir Crests.

⇒ **Barrage :-**

- High Cost
- Relatively high Control on Flow and water level by Operation of gates

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- Usually, a road or a rial Can be Conveniently and economically Combined with a barrage wherever necessory.

- Silting may be Controlled by Judicial Operation of gates.

- Due to low Crest of The weirs (The Ponding being done mostly by Gate operation), The afflux, during high floods is low. Since The Gates may be lifted up fully, even above The high Flood level.

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Q No 2 (B)

REYNOLD Number

DEF:

Reynold number Can be define as " The ratio of an Inertial Force to Viscous forces "

→ Reynold number is also use to Preduct if a flow Condition will be liminar or turbulant or transition.

Formula

$$Re = \frac{\text{Interial force}}{\text{Viscous force}}.$$

Liminar flow:

The flow in which The Reynold number is less The 2000

$$Re < 2000$$

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Turbulent Flow

$Re > 4000$

The Flow In which Reynold number is Greater Than 4000.

Transition Flow:

→ The Flow at which The Reynold number is greater Than 2000 and less Than 4000.

$Re > 2000$ and < 4000.

Darsi Notes

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⇒ Lower Critical Velocity:-

The Velocity at which Flow changes from Laminar to transition is Called Critical Velocity.

⇒ Higher Critical Velocity:

The Velocity at which Flow Changes From transition to turbulent is Called Higher Critical Velocity.

(10)

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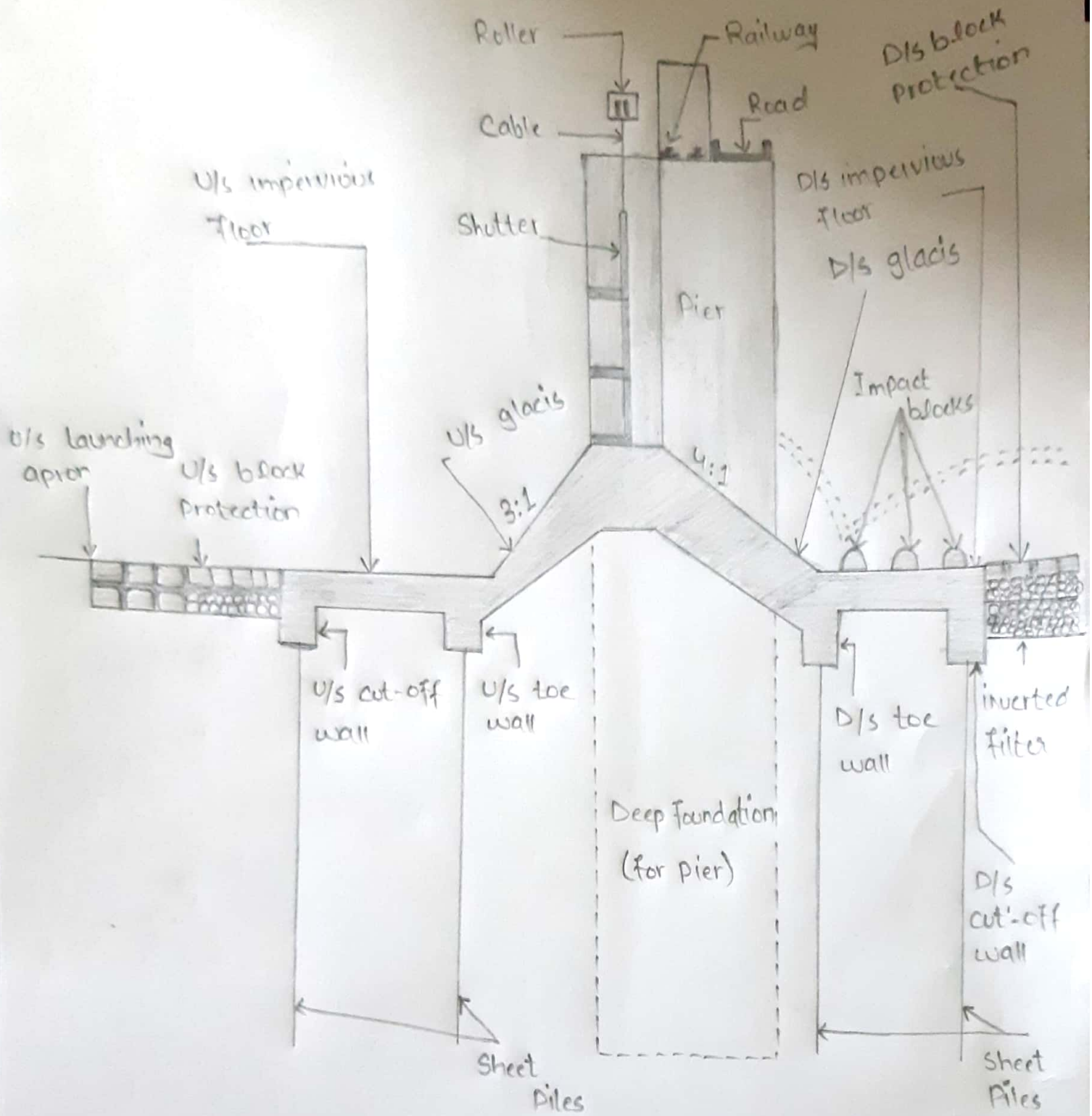

Component Parts Of Barrage

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Q3 (b) Scour around bridge Piers

Several formula based on Experiments results have been Proposed to Predict the maximum or equilibrium Scour depth (i.e. below general bed level) around bridge Piers. In general These assume the relationship

$$Y_s/b' = \phi(y_o/b', F_r, d/b')$$

where b' is Pier width

y_o upstream Flow depth

d is Sediment size

F_r Flow Froude Number

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Laussen (1962) experimental result underestimate the Scour depth compared to many Indian experiment which Suggest the Formula

$$Y_s/b' = 4.2 (y_o/b')^{0.78} Fr^{0.52}.$$

The Indian Field data also Suggest the

The Scour depth Should be taken as twice In case of live beds the Formula

$$Y_s/Y_o = (B/b')^{5/7} - 1$$

Predict the maximum equilibrium Scour depth

In a relatively deep Flow a First-order estimate of may be obtained by

$$Y_s = 2.3 K_a b'$$

where K_a = angularity Co-effient which is function of Pier alignment (i.e)

Angle of attack of Approch flow.

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Q #4.

Given data

Thickness = 0.92 = 3ft

Culvet dimension = 15'x15'

L.L = 1.5 kip/Ft^2 = 1500 lb/Ft^2

D.L = 300 lb/Ft^2

Unit wt of Soil = 100 lb/Ft^3

Angle repose = 30°

For 1:2:4 Rec Concrete = 156 lb/Ft.

Fy = 60 ksi

Required

Design A Culvet

Dars Notes

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Step # 1.

Self wt of Slab = Thickness x unit wt of RCC

= 36 X 156
= 468 lb/ft²

Total load = Live load + Dead load + Self wt of slab

= 1500 + 300 + 468

= 2268 lb/ft²

Step # 02.

Co-effient of Earth Pressure

$$\frac{1-\sin\phi}{1+\sin\phi} = \frac{1-\sin 30}{1+\sin 30} = 0.33$$

Step # 03

Lateral Pressure

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M T W T F S

(I) Vertical Lateral Pressure at top

(L.L. + D.L) ko.

(1500 + 300) 0.33 = 594 lb/Ft^2

(ii) Pressure of Soil

Ka x h x unit WT of Soil

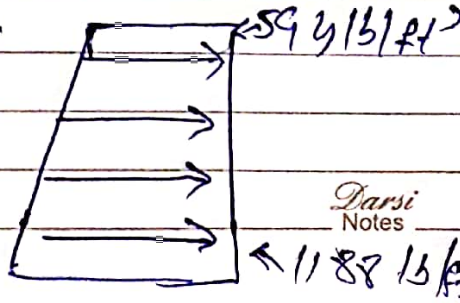
0.33 x (15+3) x 100

0.33 x (18) x 100 = 594 lb/Ft^3

(iii) Pressure at top 594 lb/Ft^2

(iv) Pressure at Botom (Top + lateral soil Pressure)

= 594 + 594 = 1188 lb/Ft^2.



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