Name S. Mutasim Billah

ID 7725

Section C

Subject Hydraulic Structure

Teacher Engr Adeed

Q1 (A) Differentiate between Culvert and Causeway ?

Ans

Culvert :- A Culvert is a Structure that allows water to flow under a road, rail road, Trail, or Similar obstruction from one side to the other. Typically embedded so as to be Surrounded by Soil, a Culvert may be made from a pipe reinforced Concrete or other material.

Causeway :- The Causeway is a track road or railway on the upper point of an embankment across "a low, or wet place, or piece of Water" it can be Constructed of earth, masonry, wood or Concrete.

(b) Define Cross drainage work. Why it is necessary? Explain different types of Cross drainage work in detail.

Ans **Cross drainage work :-**

In an irrigation project, When the network of main Canals, branch Canals, distributaries, etc are provided, then these Canals may have to Cross the natural drainages like rivers Streams, nallahs etc at different point 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. These Structures are known as Cross-drainage work.

Necessity of Cross Drainage works :-

- 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 obstacles like natural drainage may be present across the Canal. So the Cross drainage works must be provided for running the irrigation Sy.stem.

- At the crossing point, the water of the Canal and the drainage get intermixed. So, for the smooth running of 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 ~~way~~ water of the Canal and drainage cannot be diverted to their natural directions So, the Cross drainage Works must be provided to maintain their natural direction of flow.

Types of Cross Drainage works

Type 1 :-
(Irrigation Canal passes over the drainage)

- (a) Aqueduct
- (b) Siphon Aqueduct

Aqueduct :-
The hydraulic Structure in which the irrigation Canal is taken over the drainage (Such as river, Stream etc) is known as aqueduct. This Structure is suitable when bed level of Canal is above the highest flood level of drainage. In this case, the drainage water passes clearly below the Canal.

- **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.

Type II :- (Drainage passes over the irrigation canal.)

- Super passage
- Siphon Super passage.

Super passage :- the hydraulic structure in which the drainage is taken over the irrigation cannal is known as super passage. the structure is suitable when the bed level of drainage is above the full supply level of the canal. the water of the canal passes clearly below the drainage.

Siphon Supper passage :- the hydraulic structure in which the drainage is taken over the irrigation canal but the canal water passes below the drainage under siphonic action is known as siphon supper passage.

- **Type III :-** (Drainage and Canal intersect each other at the same level)

- **Level Crossing :-** When the bed level of Canal and the Stream are approximately the same and quality of water in Canal and Stream is not much different, the Cross drainage work Constructed is Called level crossing.

- **Inlet and out let :-** When the irrigation Canal meets a Small Stream or drain at same level, drain is allowed to enter the Canal as in inlet. At Some distance from this inlet point, a part of water is allowed to drain as outlet which eventually meets the original Stream. Stone pitching is required at the inlet and outlet.

Q2(a) Differentiate blw weir and barrage.

Ans

Weir :-

Wiers are barrier across the width of a river that alters the flow characteristics of water and usually results in a change in the height of the river level. they are also used to control of the flow of water for outlets of lakes ponds and reservoirs.

Barrage :-

it is an artificial barrier across a river or estuary to prevent flooding, aid irrigation or navigation, or to generate electricity by tidal power.

Part(b)

Ans

Reynolds Number :-

The product of density times length divided by viscosity coefficient.

This is proportional To the ratio of inertial forces and viscous forces in a fluid flow.

Laminar :-

the flow in a pipe is laminar if the reynolds number is less than 400.

Turbulant :- if the reynold number is greater than 4000 than it is turbulant.

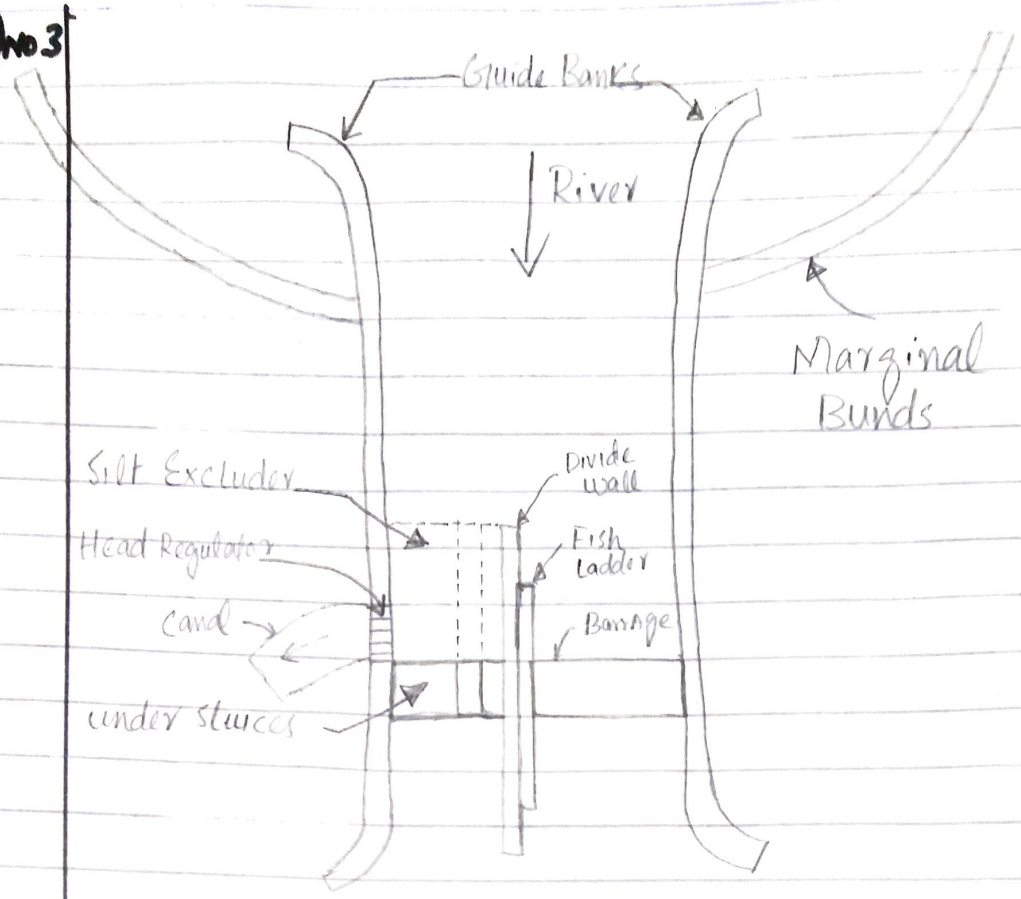
Neither laminar nor turbulant flow :-

When the Reynold number is blw 2000 and 2800, the flow is neither laminar nor turbulant.

Low Critical velocity :- The velocity at which flow changes from Laminar to Transition is called lower Critical velocity.

Higher Critical velocity :- The velocity at which flow changes from transition to turbulant is called Higher Critical velocity.

Q No 3
(A)



Sketch of Barrage with Components

Q 3
Part(b) **Answer:-**

if the Contracted width (i.e the bridge length, L) is less than the regime width, W the normal Scour depth, DN, under the bridge is given by

$$Dy = R_2 (W/L)^{0.61}$$

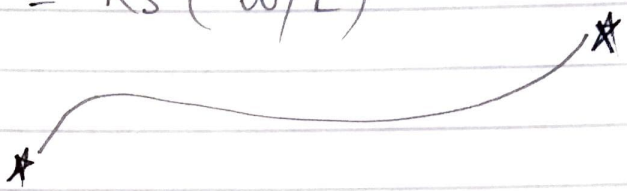
where R_1 is The regime Scour depth.

The maximum Scour depth in a Single-span bridge (no piers) With a Straight approach is about 25% more than the normal Scour given by equation Where as in the Case of multi plane

P.T.O

Structure with a Curved approach reach it is 100%. more than the normal Scour. if the Constriction is predominant, the maximum Scour depth is the maximum of Case 1 or Case 2, or The value given by

$$D_{max} = R_s (w/L)^{1.56}$$



Q No 4

Given Data

$L.L = 1.5\ Kip/ft^2$

$D.L = 300\ lb/ft^2$

$\phi = 30$

Unit Weight of Soil $= 100\ lb/ft^3$

Dimensions $= 15' \times 15'$

$f_y = 60$ Ksi Steel

Concrete $= 1:2:4 = M_{15}$

Sol

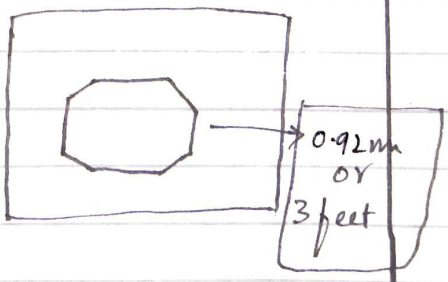
(1) Load Calculation :-

Total load on top = Self weight + L.L + D.L

Consider thickness is 0.92m

Self wt $= 3 \times 15 = 45\ KN/m^2$

$45\ KN/m^2 = 0.939\ Kip/ft^2$



w = total load $= 1.5 + 0.939 + 0.3$

$$w = 2.739\ Kip/ft^2$$

(2) Coefficient of earth pressure :-

$$K_a = \frac{1 - \sin\phi}{1 + \sin\phi} = \frac{1 - \sin(30)}{1 + \sin(30)}$$

$$K_a = 0.33$$

Lateral pressure due to (D.L + L.L)

= Total vertical load (L.L + D.L) × Ka

= (1.5 + 0.3) 0.33

= 0.594 Kip/ft² or 28.4 KN/m²

Lateral Pressure due to Soil :-

= Ka × γsoil × h

= 0.33 × 0.1 × 18

= 0.594 Kip/ft² or 28.4 KN/m²

Lateral Pressure at top :-

Lateral Pressure due To (L.L + D.L)

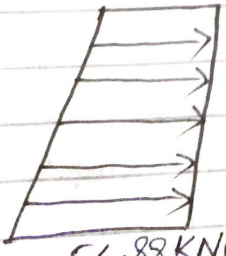
= 0.594 Kip/ft² or 28.4 KN/m²

at Bottom Lateral Pressure due to (L.L + D.L) + lateral pressure due to Soil

= 0.594 + 0.594

= 1.188 Kip/ft² or 56.88 KN/m²

28.4 KN/m²



56.88 KN/m²