Quiz / Assignment No 2

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QNo 1 ⓐ **Culvert:-**

An opening through an embankment for the conveyance of water by mean of pipe or an enclosed channel.

→ A culvert is constructed ~~wel~~ when water needs to be conveyed through tunnels or channels under a roadway.

→ Some culverts like box culverts, have sharp corners that are unsuitable for high-velocity vehicles.

→ A culvert can be constructed to accommodate roadway both over and under the deck (e.g a culvert built over another road or railway).

→ Culvert are built are less then 20 feet high over the obstruction.

→ The length of culverts is typically not more than 6 meters.

⇒ **Causeway:-**

In modern usage, a causeway is a road or railway on top of an embankment usually across a broad body of ~~way~~ water or wetland.

A causeway is a paved dip which allows floods to pass over it. It may not have opening or vents for low water to flow.

Cause is road built up on an embankment. In common use, a causeway is a bridge or railway.

b: **Cross Drainage works:-**

In an irrigation project, when the network of main branch canals, distributaries, ect. are provided, then these canals may have to cross the natural drainages like rivers, streams, nallahs, etc. at different point within the commond area of the project. The crossing of the canals with such obstacle cannot be avoided. So suitable structure must be constructed at the crossing point for the easy flow of water of the canal and drainage in the respective directions. These structure are known as cross-drainage works.

A cross drainage work is a structure carrying the discharge from a natural stream across a canal intercepting the stream.

Necessity of cross Drainage works:-

The water-shed cannals do not cross natural drainages. But in actual orientation of the canal network, this ideal condition may not be available and obstacles like natural drainages may be present across the canal. So the cross drainage work must be provided for running the irrigation system.

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 work are required.

Types of Cross Drainage Works:-

Type 1 (Irrigation canal passes over the drainage)

(a) 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:-

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 super 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 super passage. This structure is suitable when the bed level of drainage is below the full supply level of the canal.

Type-III: Drainage and canal interest each other at the same level:-

Level Crossing:-

When the bed level of canal at 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. Where water of canal and stream is allowed to mix. With the help of regulators both in canal and stream, water is disposed through canal and stream in required quantity. Level crossing consists of following components (i) crest wall (ii) stream regulator (iii) canal regulator.

(•) **Inlet and outlet:-**

• When irrigation canal meets a small stream or drain at same level, drain is allowed to enter the canal as in inlet. At same distance from this inlet point, a port of water is allowed to drain as outlet which eventually meets the original stream. Stone pitching is required at the inlet and outlet. The bed and banks between inlet and outlet are also protected by stone pitching. This type of CDW is called inlet and outlet.

Q No2: (a) **Weir:-**

A Weir is an impervious barrier constructed across a river to raised the water level on the upstream side. The water is raised upto required height and then flow over the weir. Weir have traditionally been used to create mill pond.

Weir are also used to prevent flooding, measure discharge and help render a river navigable the crest of an overflow spillways on large dam is often called weir. Weir can be build of wood concrete or moraine material (rock, gravel).

Barrage:-

A river barrage is low headed diversion dam that is build to allow diversion of part of the water flow. A barrage determines a little increase of upstream water profile and a little upstream reservoir. The purpose of barrage is essentially to stabilized the upstream water level and river profile in order to ensure a long technical life to the diversion facilities. We can often see mountain river.

(b) **Reynolds number:-**
It is the ratio of ~~inder~~ inertial forces to viscous forces within a fluid flow.

⇒ **Laminar:-**
If Reynolds number is less than 2000, then it is laminar flow.

⇒ **Turbulant:-**
If Reynolds number is greater than 4000 than it is turbulant flow.

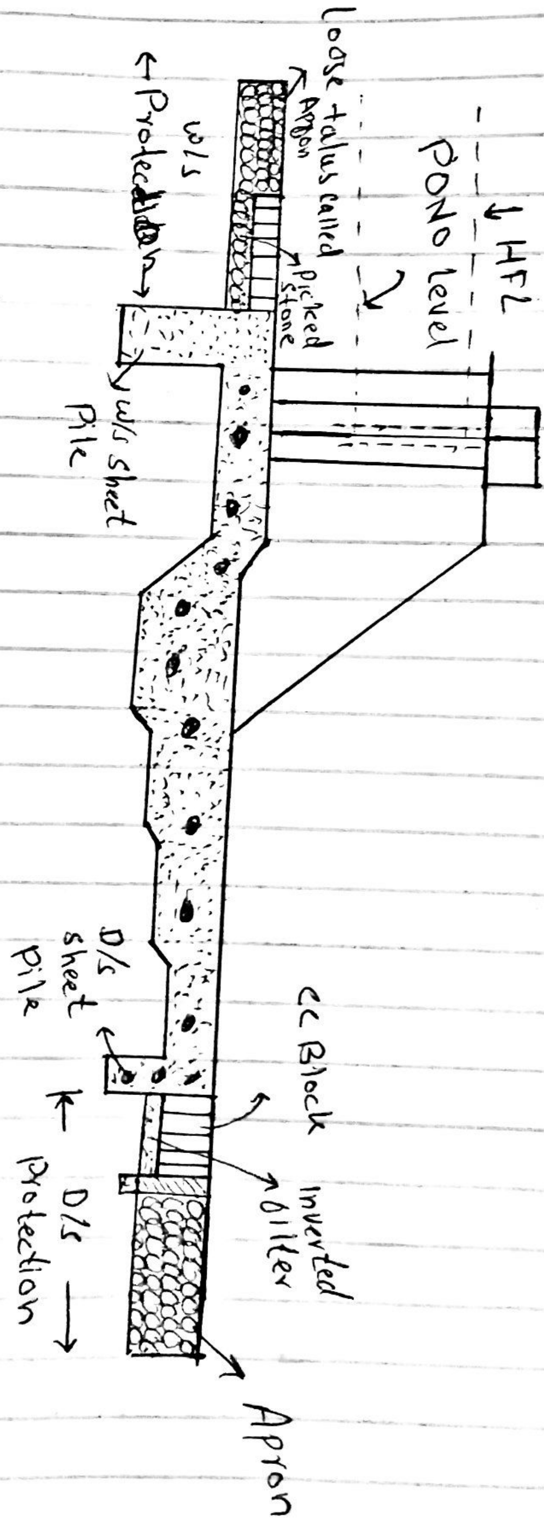
⇒ **Neither laminar nor turbulant flow:-**
When the Reynolds number is between 2000 and 2800, the flow is neither laminar nor turbulant.

⇒ **Lower Critical Velocity:-**
The velocity at which flow change from laminar to transition is called lower critical velocity.

⇒ **Higher Critical Velocity:-**
A velocity in which flow change from transition to turbulant flow is known as higher critical velocity.

Q No3 Part (A)

~~Rigid~~ ~~Rotor~~ Barrage stetch:-



Part B

We can predict the maximum equilibrium scour depth around bridge piers from ~~severals~~ several formulas based on experimental results which assume the relationship as;

$$y_s/b' = \phi\left(y_o/b', F_r, d/s'\right)$$

Where b' is the pier width, y_o is the upstream flow depth, d is the sediment size and F_r is the flow froude number.

Lawrsen's Experiment:-

Lawrsen's (1962) experiment result's underestimate the scour depth compared to many Indian experiment's which suggested the formula (approch flow is normal to the bridge pier.

$$\frac{y_s}{b'} = 4.2\left(\frac{y_o}{b'}\right)^{0.78} F_r^{0.52}$$

Indian field data:-

The Indian field data also suggested that the scour depth should be taken as twice the regime scour depth. In case of line beds (a stream with bed load transport) the formula:

$$y_s/y_o = \left(B/b'\right)^{5/7} - 1$$

Q No 4^ Given data:-

Inside dimension = 15ft x 15ft

live load = 1.5 kg/ft^2 = 1500 lb/ft^2

Dead load = 300 lb/ft^2

unit weight of soil = 100 lb/ft^3

Angle of repose = 30°

use concrete of 1:2:4 ratio

f_y = 60 ksi

Thickness = 0.92m = 3ft.

Required

Design a box calvert = ?

Solution:-

1. **Load calculation:-**

Total load carry on top slab =

= Self weight of slab + L.L + D.L

Self wt of slab = 3 x 150

= 450 lb/ft^2.

W_u = 450 + 1500 + 300 = 2250 lb/ft^2

2. Co-efficient of earth pressure:

$$ka = \frac{1 - \sin\phi}{1 + \sin\phi}$$

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

$$ka = 0.33$$

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

= Total vertical load (L.L + D.L) x ka

= (1500 + 300) x 0.33

= 594 lb/ft^2

4. Lateral pressure due to soil:

= ka x γh

= 0.33 x 100 x 18

= 594 lb/ft^2

5. Lateral Pressure:

ⓐ Top;

= lateral pressure due to (D.L + L.L)

= 594 lb/ft².

ⓑ Bottom;

= lateral pressure due to (D.L + L.L) + lateral pressure due to soil.

= 594 + 594

= 1188 lb/ft² Ans.