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Section - "C"

Department - Bs-civil

Subject - Hydraulic structure.

Exam - Final Term

Submitted To Sir Adeed Khan.

QNO - 01 (a)

Culvert :-

Culvert is define as tunnel structure constructed under roadway or railways to provide cross drainage or to take electrical or other cable from one side to other. it is totally enclosed by soil or ground. Pipe culvert box culvert and arch culvert are common types used under road way and railways.

The design of culvert is based on hydraulic water surface elevation and roadway height and other condition.

→ Culvert are build at less than 20 feet high over the obstruction.

→ Culvert are simpler in structure and design, so it can be constructed with less time and Labor.

→ Culvert are usually embedded in soil which bear the major portion of culvert load.

→ The length of culvert is typically not mor than 6 meter.

→ No deep foundation is Required for culvert.

Q No - 01 (a) continue

Causeway :-

→ In modern usage, a Causeways is a road or railway on the top of an embankment usually across a abroad body of water or wetland.

→ A road that is raised, so as to be above water and similar Low-lying Obstacle. originally causeway were much like dykes. generally pierced to let water through where many causway are more like bridges.

→ A causeway is paved dip which allow flood to pass over it. it may not have opening or vent for low water to flow.

→ A causeway is road build up on an embankment. In common use a causeway is bridge or railways.

Q No - 01 (b)

Cross Drainage Work :-

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

→ In an irrigation project when the work of main Channel, branch canal, distributes etc, are provided, then these Canal may have to cross the natural Drainage like river stream. At different point with in command area of the

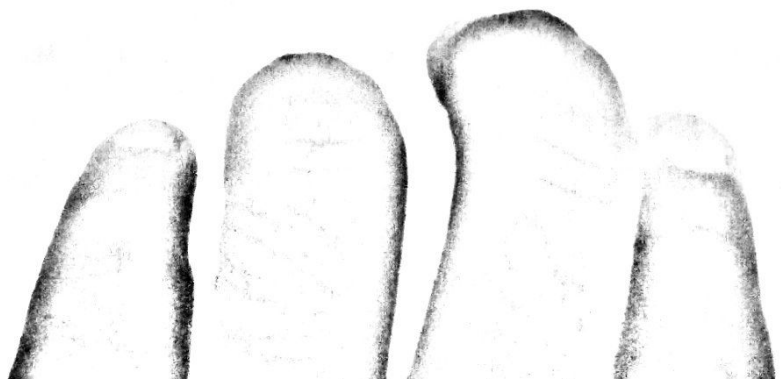
Project. The crossing of Canal with such obstacle cannot be avoided. So, suitable structure must be constructed at crossing point for easy flow of water of canal and drainage in respective direction. These structure are known as cross-drainage works.

Necessity :-

→ The water-shed canal do not cross natural drainage but an actual orientation of canal network. this Ideal condition may not available

and obstacles like natural drainage may be present across the canal. So, the Cross drainage work must be provided for running irrigation System.

→ At crossing point, the water of Canal and drainage get intermixed. So for Smooth — running of the canal with if design discharge the Cross drainage works.



⇒ Types of Cross Drainage Work :-

→ Types-I Irrigation Canal Passes over the Drainage :-

This condition involved the construction of following.

* Aqueduct :-

The hydraulic structure inwhich the irrigation canal is taken over the drainage is known as aqueduct. the structure is suitable when bed 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 flow under Siphonic action, it is known as Siphon Aqueduct.

⇒ Type-II Drainage passes over the irragation Canal :-

★ Super Passage :-

The hydraulic structure in which the drainage is taken over irragation canal is known as super Passage.

⇒ Siphon Super Passage:-

The structure in which drainage is taking over the irrigation Canal but the Canal water passes below the drainage under Siphonic action is known as Siphon Super Passage.

⇒ **Type - III Drainage and Canal intersect each other at same level :-**

★ Level Crossing :-

When the bed level of canal and 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 outlet :-

When irrigation canal meet a small stream or drain at same level, drain is allowed to enter canal as in inlet.

→ Stone pitching is required at inlet and outlet. This types of CDW is called inlet and Outlet.

Q2 (a): Difference between Weir and Barrage ?

Q2 (a)

ANS:

Weir :-

A weir is an impervious barrier constructed across a river to raised the water level on the upstream side. the water is raised up to 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 upsteam Reservior. The purpose of barrage is essentially to stabilize 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.

Weir	Barrage
→ Low cost	→ High cost
→ Low controle on Flow.	→ Relatively high control on flow and water level by operation of gate.
→ No provision for transport communication across the river.	→ Usually, a road or a rail bridge can be conventiently and economically combine with barrage wherever necessary.
→ chances of sitting on upstream is more	→ sitting may be controlled by Judical operation of gates.

QNO-02(b)

Reynold's Number :-

It is ratio of inertial force to viscous forces with in fluid flow.

⇒ **Laminor :-**

If the Reynolds number is less than 2000 then it will be laminor flow.

⇒ **Turbulant :-**

If Reynold Number is greater than 4000 then it will be Turbulant flow.

Neither Laminor nor turbulant flow:-

When the Reynald's Number is between 2000 and 2800, the flow is neither laminor nor turbulant.

⇒ Lower Critical Velocity:-

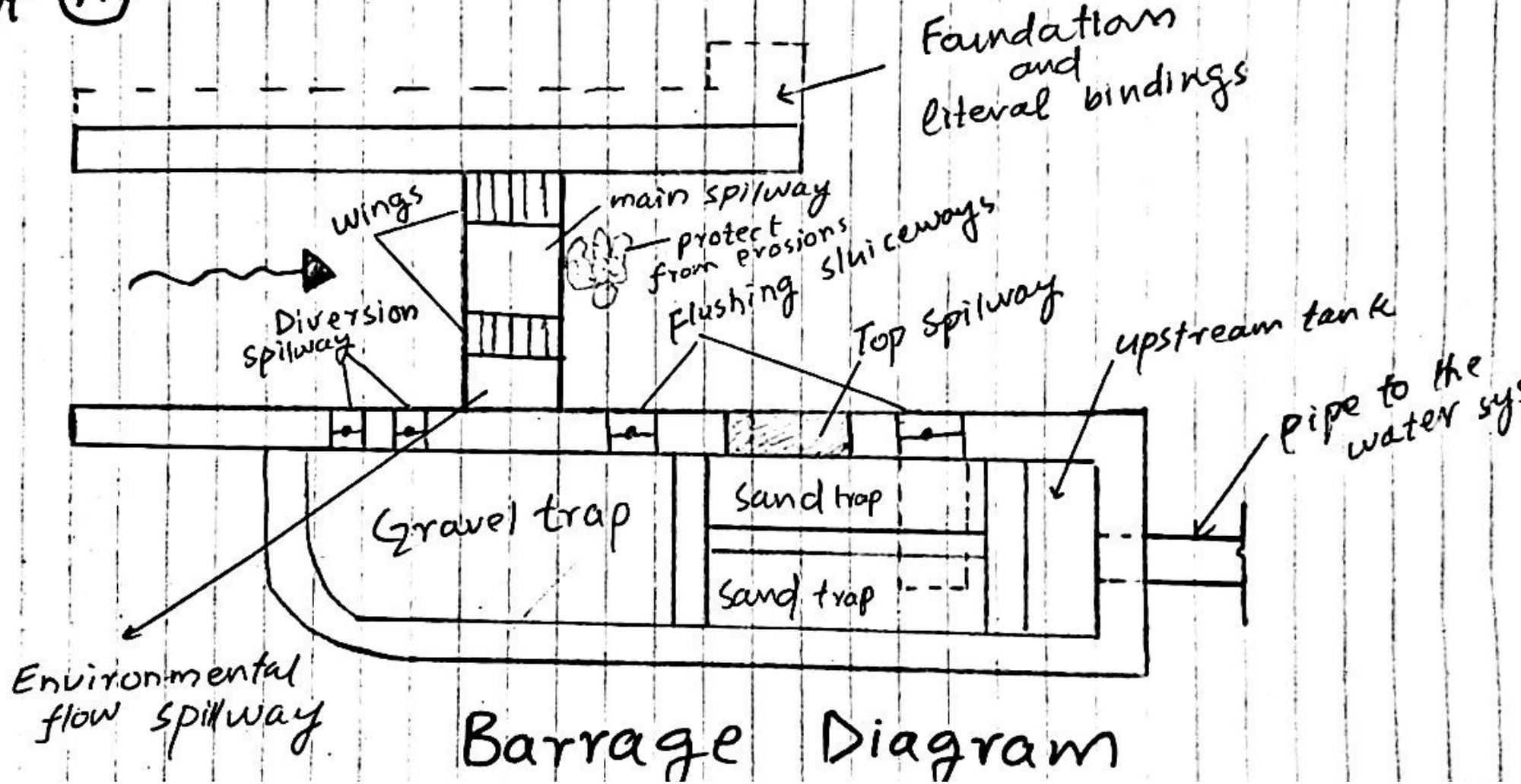
The velocity at which flow change from laminar to transition is called lower Critical Velocity.

⇒ Higher Critical Velocity:-

A velocity in which flow change from transition to turbulant flow is known as higher Critical Velocity.

Q No: 3

Part (A)



Barrage Diagram

QNO-03(b)

We can predict the Maximium equilibrium scour depth around bridge pier from several formula's; based on envirnmental Result which assume the relationship as;

$$y_s/b' = Q\left(\frac{y_o}{b'}, F_r, \frac{d}{b'}\right)$$

where b' is pier width, y_o is upstream flow depth, d is Sediment size and Fr is the flow of Froude Number.

Lawerance Experiment:-

Lawarance (1962) Experimental result's underestimate the scour depth compared to many Indian

Experiment which suggest the formula :-

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

Indian field Data :-

The Indian field data also suggest that score depth should be taken as twice regime scour depth.

In case of line bed (a stream with bed load transport) The formula' as;

$$\frac{Y_s}{Y_0} = \left(\frac{B}{b'}\right)^{5/7} - 1$$

Q No - 04

Given Data :-

Inside dimension = 15 ft x 15 ft

live load = $1.5 \frac{kg}{ft^2} = 1500 \frac{lb}{ft^2}$

Dead load = $300 \, lb/ft^2$

Unit weight of soil = $100 \, lb/ft^3$

Angle of response = 30°

Use concrete of 1:2:4 ratio

f_y = 60 ksi

Thickness = 0.92 m = 3 ft.

Required :-

Design a box culvert =?

Solution :-

1. Load Calculation :-

Total load carrying on

Top slab = self weight + L.L + D.L

: self weight of slab = 3 x 150

= 450 lb/ft^2

2. Co-efficient of Earth pressure :-

$$K_a = \frac{1 - \sin d}{1 + \sin d}$$

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

$$K_a = 0.33$$

3. Lateral pressure due to (DL+LL)

= Total Vertical load (LL+DL) × Ka

= (1500 + 300) × 0.33

= 594 lb/ft².

4. Lateral Pressure due to Soil:-

= Ka × γh

= 0.33 × 100 × 18

= 594 lb/ft²

5. Lateral Pressure:-

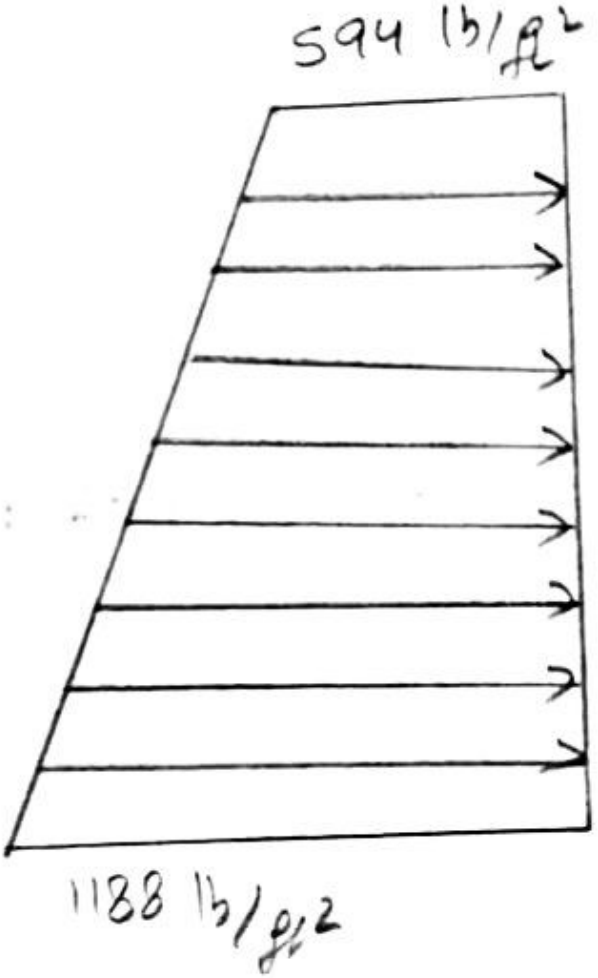
(a) Top; lateral pressure due to (DL+L.L)

= 594 lb/ft²

b) Bottom;-

lateral pressure due to (DL+L.L) + lateral pressure due to soil.

= 594 + 594 = 1188 lb/ft² Ans—


594 lb/ft²
1188 lb/ft²