HYDRAULIC STRUCTURE

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Question No. 1

Q: Differentiation of Culvert and cause way:-

Culvert:

culvert is describe as a tunnel System installed from one side to the other under roads or railways to provide cross drainage in order to carry water, electric or other cables.

Its design depend upon the hydralic, water surface elevation, road height and other factors. This is completely surrounded by earth or dirt. The form's used under the road way's and railways are the pipe culvert, box culvert and arch culvert.

Causeway:-

causeway is a road built up on an embankment. In common use, a causeway is a bridge or railway on top of an embankment usually over a large body of water or wet-land.

Originally causeways were more like dykes, generally pierced to allow pass water, while other modern causeway look much the same as bridges or viaducts.

b) cross drainage work.

Cross drainage work is basically a structure which is built in a condition when a canal and natural drain comes to cross each other without interrupting the continuous supplies of both.

Necessity:-

On the basis of water Quality:

The necessity of cross drainage work is that if there is no cross-drainage work then the water of cannel mixed with water of natural drainage which is very bad in condition when both qualities are different.

On the basis of water Quantity

Similarly canal is design for fixed quantity i.e having a fixed peak flow, so as the water of both canal and natural drain mixed at crossing point then the quantity get disturbed which cause floods as well as hydralic structure failure etc.

Types of cross Drainage work:-

There are various types of cross Drainage work depending on crossing condition of natural drain and canal, which are;

- By Passing the canal over the drainage.
- By Passing the canal below the drainage.
- By Passing the drain through the cannel.

By passing the canal over the drainage:-

This may be accomplished either through

Aqueduct

Syphon-aqueduct

Aqueduct:

when the highest flow level of the drain is sufficiently below the bottom of the canal, so the drainage water flows freely under gravity, the structure is known as aqueduct

Syphon aqueduct:-

when the highest flow level of the drain is above the canal bed and water passes through the aqueduct barrels under syphonic action such is called Syphon-aqueduct.

. By Passing the canal below the drain.

This may be accomplished either through

- Super passage
- Syphon supper passage.

Super passage:-

when the flow surface level of the canal is sufficiently below the bottom of drain trough, so that the canal water flows freely under gravity. such is called supper passage.

Syphon super passage:.

when the flow surface level of the cannal is sufficiently above the

the bed level of the drain trough So that the flow of canal is under syphonic action, such structure is called syphon super.

- **By Passing drain through cannel.**

By passing the drain through canal, so that the canal water and drainage water are allowed to intermingle with each other.

This may accomplished through.

- A level crossing
- Inlets and outlets

Question No 2:-

a) Differentiation b/w weir and barrage

weir	Barrage
• A law dam built accross a river to raise the level of water stream or regulete it's flow	• An artifical barrier accross a river or estuary to prevent flooding and irrigation or navigation or to generate electricity by tidal power.
• weir has high crest	• Barrage has low crest.
• In weir shutter in part length, has hight of 2m	• In barrage gates over entire length and greater hight.
• In weir shutter's are dropped to pass flood	• In barrage gate's are raised clear of the high flood to pass flood.
• In weir operation of shutter is slow and take more time	In Barrage gate convenient to operate.

weir	Barrage
• In weir excess afflux in high flood	• In barrage has very minimum afflux problem
• Raished creast causes silting upstream	• Less silting upstream Due to Low crest
• Shorter construction Period	• Longer construction Period.
• No mean for silt disposed	• Silt removal is done through under Sluices
• No Possible to provide Rail- Road Bridge in weir	• Rail-Road Bridge can be constructed in Barrage.

b) Reynold's Number

The reynold's number is defined as the product of density times velocity times length divided by the viscosity co-efficient.

This is proportional to the ratio of interial force and viscous force (force resistance to change and heavy and glued forces) in a fluid flow.

limit of reynold's number

For laminar flow.

In case of laminar flow the Reynold number limit is less than 2000

$$Re < 2000$$

For turbulent flow

In case of turbulent flow the Reynold number limit is greater than 4000

$$Re > 4000$$

For transition flow

In case of transition flow the reynold number limit is between 2000 and 4000.

$$2000 \leq Re \leq 4000$$

Lower critical velocity

→ A velocity at which laminar flow stops

OR

→ The velocity at which the flow enter's from laminar to transition Period is known as lower critical velocity.

Higher critical velocity

A velocity at which turbulent flow starts.

OR

A velocity in which flow enter's from transition Period to turbulent flow is known as ~~turbulent~~ higher critical velocity.

Qeustion No # 3

(a)

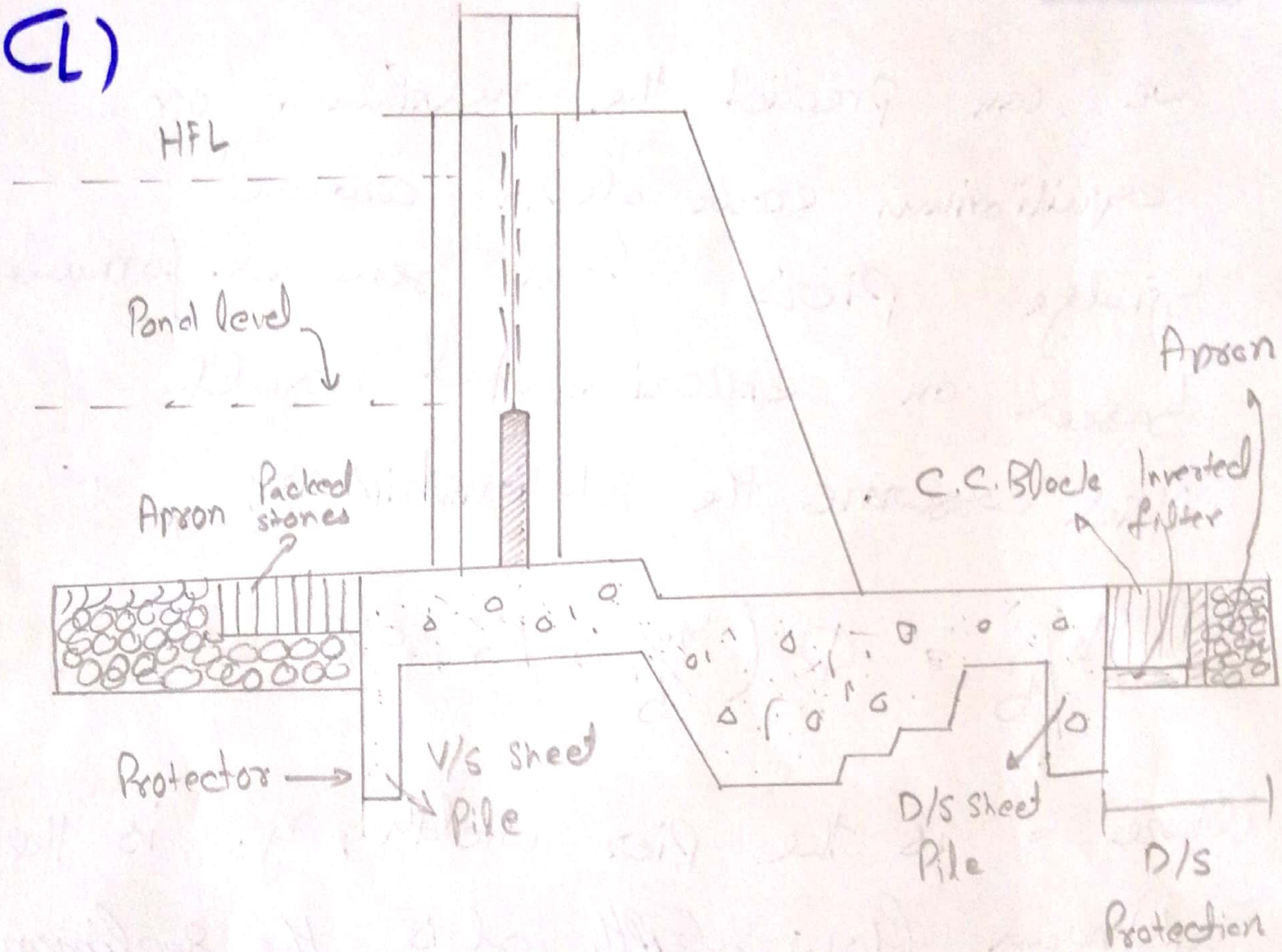


Diagram of Barrage

Qeustion No # 3

part b

we can predict the maximum or equilibrium scour depth around bridge pier's from several formules; based on experimental results which assume the relationship as;

$$y_s/b' = \Phi\left(y_o/b', Fr, d/b'\right)$$

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

Laursen's Experiment:-

Laursen's (1962) experimental result's underestimate the scour depth's, compared to many Indian experiment's which suggested the formula (approch flow is nomal to the bridge pier:

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

Scanned with CamScanner

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 load beds (a stream with bed load transport) the formula

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

Question #04

Given data:-

Inside dimension = 15 ft x 15 ft

live load = 1.5 K/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 = 0.92 m = 3 ft

Required data:-

Design a box culvert = ?

Solution:

1. Load calculation,

Total load carry on top slab =

= self weight of slab + LL + DL

self weight of slab = 3×150

= $450\ lb/ft^2$

$W = 450 + 1500 + 300 = 2250\ lb/ft^2$

2. Co-efficient of Earth Pressure

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

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

$$K_a = 0.33$$

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

= Total vertical load (L.L + DL) × Ka

= $(1500 + 300) \times 0.33$

= 594 lb/ft²

4 Lateral pressure due to soil:

= $K_a \times \gamma h$

= $0.33 \times 100 \times 18$

= 594 lb/ft²

5 Lateral pressure:

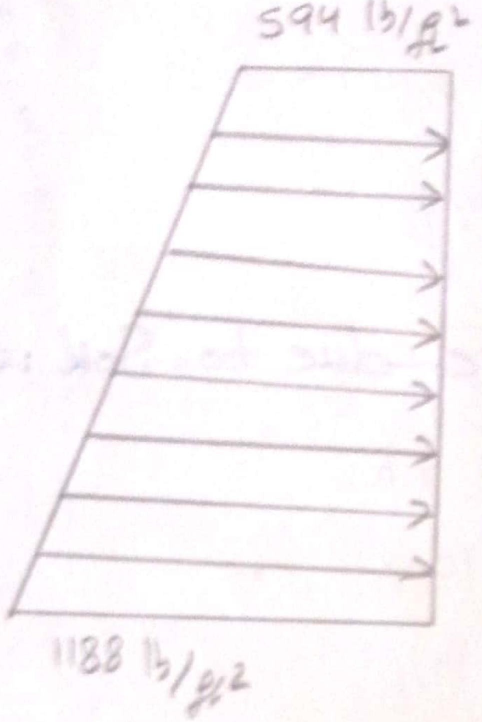
@ Top:- = lateral pressure due to (DL+L.L)

594 lb/ft²

@ Bottom;

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

= $594 + 594 = 1188$ lb/ft² Ans.


594 lb/ft²
1188 lb/ft²