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Section A

Subject Hydralic Structure

Q No 1 (a)

Differevite between culvert and cause way ?

Ans

Culvets:-

A small bridge having total length of span 6m or less than it b/w the faces of abodment.

These are permanent drainge structure constructed to carry Road way oR Rail way track over small streamed or canals.

- Culvert is mode for the passage of water.
- Culvert is made over small stream or canals.
- culvert is usally rectangular or circular in cross section having roof walls and a floor.
- It work as a bridge to pass on it.

Cause way

A bridge having its floor flush or little above the bed of the stream which allows flood water to pass alway over its floor.

Cause way provided when heavy discharge in the stream flows Only for small duration genrally not more than 72 hrs at a time

When natural width of stream carrying little or no water throughout the year.

Provided in hilly region where number of small stream cross the Roads.

It is not a bridge because it support a road way between piers.

Q No# 1 (b)

Define cross drainge Work. Why it necessary? Explain different types of cross drainge Work in detail.

Cross drainge Work is a structure constructed when there is a crossing of canal and natural drain to prevent the drain of water from mixing into channel water.
This type of structure is costiler one and needs to be avoide as much as possible.
They are avided in two ways.

1) By changing the alighment of chanel water way.

2) By mixing two & three streams into one cross drainge work to be constructed making the structure economical.

Why It necessary

It is necessary is required to dispose of the draince water so that the ~~canal~~ canal supply water remins Uninterapted.

Types

There are three types of Cross drainge work structure.

Type 1:- **Iregation canal passes over the drainge.**

a) ~~a~~queduct
b) Siphon Aqueduct.

a) Aqueduct

The canal which bed level is above the drainge bed level so canal is to be constructed above drainge.

The canal water is referred as full supply level (FSL) and drainge water level is high Flood level (HFL). The (HFL) is ~~above~~ below the canal bed level

(b) Syphon Aqueduct

In syphon Aqueduct the canal is taken over the drainge. but the drainge water cannot passes clerly below the canal.
The drainge Water flow under syphonic action and there is no atmospheric presere in the natural drain;

High flood level (HFL) of drainge is above the canal trough.

~~Typ~~

Type II (drainge passe over iregation)

a) Super passage.
It is a hydralic structure Which the drainge is taken over the iregation canal is known as super passage.

It carries drainge above canal at the bed level is below drainge bed level.

The full supply level of canal is bellow the drainge trough in the structure.

The water in canals flow under gravity and passes the atmospheric pressure.

b) Siphon super passage

This is a hydralic structure which the drainge is taken over the irregation canal. The canal water passes below the drainge under the siphonic action known as siphon super passage.

Its structure is sutible when bed level of drainge is below the full supply level of the canal.

=> Type III (Drainage and canal intersect each other at the same level)

a) Level Crossings

- When the bed level of canal is equal to the drainage bed level. Then level crossing is to be constructed.

Construction of weir to stop drainage water behind it.

Construction of canal regulator across a canal.

Construction of head regulator across drainage.

b) Inlet and out let

When irrigation canal mets a small small stream or drain at same level drain is allowed to enter the canal an inlet.

The bed and bank b/w inlet and out let are also protected by stone pitching this type of CDW is called inlet and outlet.

Q2 (a)

Ans

Weir	Barrage
• Its low cost	Its high cost
• Its low control of flow	Reletivly high control flow of water level by operation of gates
No provision for transport communication acros river.	Usally a roade or rail bridge can be used conviniently.
Chance of silting on the upstream is more	Silting may be controlled by Judical opration of gates.

Q2 (b)

(a) Reynold's Number

It's defined as the product of density times velocity time length divided by the velocity of coefficent

This is proportional to the ration of inertial force and viscous force (force resistant to change and heavy and glued force in a fluid flow.

Limits of Reynold's Number

For Laminar Flow

In case of Laminar flow the Reynold No limits is less then 2000.

$$Re < 2000$$

For turbulent Flow

In case of turbulent flow the reynold No limits is grether than 4000

$$Re > 4000$$

For transition flow

In case of transition flow the reynold's No limits is between 2000 and 4000

$$2000 \leq Re \leq 4000$$

Lower Critical Velocity

A velocity at which laminar flow stops.

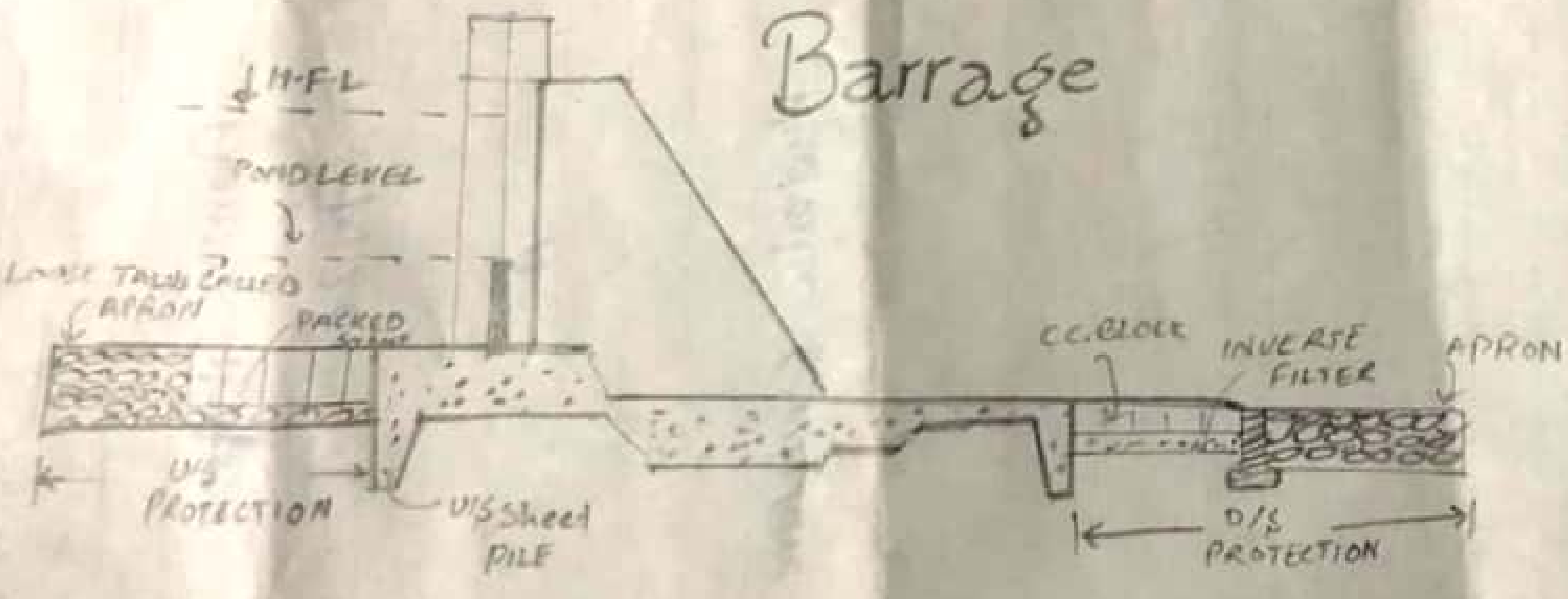
higher Critical Velocity

A velocity at which turbulent flow starts.

OR

A velocity in which flow enter from transition period to turbulent flow is known as higher critical velocity.

Q3 (a) (LO (II))



Barrage
H.F.L
POND LEVEL
TALUS CALLED
APRON
PACKED
U/S PROTECTION
U/S Sheet PILE
CC BLOCK
INVERTE FILTER
APRON
D/S PROTECTION

Q # 3(b)

Sevral formula based on experimental result have been proposed to predict the maximum or earibrium scour depth (y below general bed level) around bridge piers, In general these assume the relation ship

$$y_s / b' = \phi(y_0/b', F_r, d/b')$$

where b' is the pear width y_0 is upstream flow depth d is the sediment size and Fr is the flow froud Number.

Laursen's (1962) experimented results under estimate the scour depth compared to many Experiments (inglis 1948) which suggest the formula approach flow is normal to bridge pairs

$$y_c/b' = 4.2 (y_0/b')^{0.78} F_r^{0.52}$$

The indian field data also suggest that the scour depths should be taken as twice the regime scour depth.

In case of live beds (a stream with local bed transport) the formula:

$$y_0 / y_a = (B/b')^{5/7} - 1$$

predicts the max equilibrium scour depth.

In relatively deep flow a first order estimate of clear local scour (around pier) may be obtained by

$$y = 2.3 K_\alpha b'$$

Where K_α = angularity coefficient which is a function of the pier alignment i.e angle of attack of approach flow.

Q No 4

Solution:-

Give Data

Inside dimension = 15ft × 15ft
Live Load = 1.5 K/ft = 1500 lb/ft^3
Angle of repose = 30°

Use concrete of 1:2:4 ratio

f_y = 60 ksi

Thickness = 0.92m = 3ft

Required Data

Design box culvert

As we know that

1) Load Calculation

Total load carry on top slab

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

Self weigt of slab = 3 × 150 = 450 lb/ft²

W = 450 + 1500 + 300 = 2250 lb/ft²

2. Co-efficent of Earth pressure

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

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

$$K_a = 0.33$$

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

Total vertical load (L.L + D.L) × 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

L.P due to (D.L + L.L)

594 lb/ft²

(a) Bottom

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

594 + 594

= 1188 lb/ft² Ans