Syed Jawwad

7386

Hydraulic Structure

BARRAGE

- It's an artificial Barrier across the river
- It is arranged in a way that it consist of adjustable shutters at different tires over the weir.
- It is constructed to alter water level when required to different levels at different time, especially to be raised on up stream side of weir.
- It is relatively an expensive structure to built

WEIR

- Weir is constructed to uplift the water level of rivers as Perennial rivers has the continous flow throughout the year. It cannot be re-directed to irrigational Canal. The level of Canal could be higher as Compare to river water level. ~~It is made/Constru~~
- It is made / Constructed across the river
- Surplus water pass over the Crest of weir water.
- Adjustable shutters are Provided to up lift the water level on Crest ~~to~~ to Some required height.
- It is relatively Cheap to ~~build~~ built.

Q No 7- (B)

Cross Drainage Works

Definition:-

The water reaches to crop field through irrigational canals. It doesnt reach directly. It has too pass natural drainage streams before, for the safety of this purpose we build a structure called cross-drainage works.

We also focus on the bed levels of drainages and Canals. As it's different everywhere we Construct Cross-drainage System accordingly also give different names.

Necessity Of Cross Drainage Works:-

1. CDW are required with Canals because when water of irrigational canals has to cross natural drainage, streams, So there are higher chances of inter-mixing of waters respectively.
2. Water of Irrigational Canals and natural Streams needs CDW. So that they flow in right natural orientation/Direction.
3. (CDW) Cross Drainage works is also required for functioning of irrigational System as Certain Canals donot Cross Easily.

Types of Cross Drainage works:-

- Type 1 (Irrigation Canal Passes over the drainage).
  - (a) Aqueduct
  - (b) Siphon Aqueduct
- Type II (Drainage Passes Over the Irrigation Canal).
  - (a) Super Passage
  - (b) Siphon Super Passage.

TYPE III (Drainage and Canal Intersection each other of the same level.

- (a) Level Crossing.
- (b) Inlet and Outlet

TYPES OF CROSS DRAINAGE WORKS.

- TYPE-I Irrigation Canal Passes over the Drainage.

This Condition involves the construction of following

- AQUEDUCT:-

It is an Hydraulic structure in which the Irrigation Canal takes Place over the drainage water. There is no Problem of flow, the drainage water flows the Canal Easily. The Structure is built underneath or it works best when bed level of Canal is above the highest flood level of drainage.

SIPHON AQUEDUCT:-

This ~~Aqued~~ Aqueduct has got its name because of the siphonic action involvement in it. Canals take control of the water of drainage but it doesnt flow underneath the Canal easily. The flow is ~~n~~ than done under the ~~Canal Easily the flow~~ siphonic action. This structure is made when the bed level of Canal is below highest flood level.

TYPE II (DRAINAGE PASSES OVER THE IRRIGATION CANAL)

(a) Super Passage
(b) Siphon Super Passage

(a) SUPER PASSAGE:-

It's the opposite of Aqueduct. In this drainage takes control of irrigation Canals. This is a hydraulic structure which works the best when the bed level of drainage is above full Supply level of Canal. There is no Problem of flow, the Canal water flow below the drainage water Easily.

(b) SIPHON SUPER PASSAGE:-

The Siphon indicates about the involvement of Siphonic Action. In this the drainage takes place of the irrigational Canal. The flow is not smooth under Siphonic Action. The Canal water Passes underneath the drainage. This hydraulic structure is appropriate for the Condition in which the bed level of drainage is below the full Supply level of Canal.

TYPE III (Drainage and Canal Intersection each other of the same Level).

(a) Level Crossing

(b) Inlet and Outlet

(a) LEVEL CROSSING:-

It is a type of Cross Drainage works formed for the intermixing of Canal and Stream water. The bed levels and their quality of water doesnt have much difference. The action of Intermixing is done by regulators of Canal and Stream respectively. Level Crossing Consists of following Components.

1. Canal Regulator
2. Stream Regulator
3. Crest wall.

(B) INLET AND OUTLET:-

It's a type of Cross Drainage works in which inlet can be any small stream which has a common drain level as irrigation Canal. It eventually becomes Part of Canal and known as inlet while as outlet. it is a Point farther from Inlet. where water drains and meets the original Stream. Their bed and banks are kept safe by Stone Pitching. It is mandatory.

Q No. (2)(a) (6)

CULVERT	CAUSEWAY
1) It carries a stream of water under a ~~water~~ road or railway being a tunnel shaped curvature	1) It is a raised roadway and is built as an embankment
2) It works as a bridge	2) Earth or stone is used to support it.
3) It is normally used to control the flow of water.	3) It is not considered as a bridge, Instead used as a roadway.

Q No 2 (B)

REYNOLD'S NUMBER:-

The Product of density times length divided by viscosity (co-efficient).

$$\frac{\text{length}}{\text{viscosity (co-efficient)}}$$

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

LAMINAR:-

If the Reynold's Number less than 2100, the flow in the pipe will be laminar.

TURBULANT:-

If the Reynold's number is greater than 4000, it is said to be turbulant.

NEITHER LAMINAR NOR TURBULANT:-

A flow is called neither laminar nor turbulant when the Reynold number is between 2000 and 2800.

LOWER CRITICAL VELOCITY:-

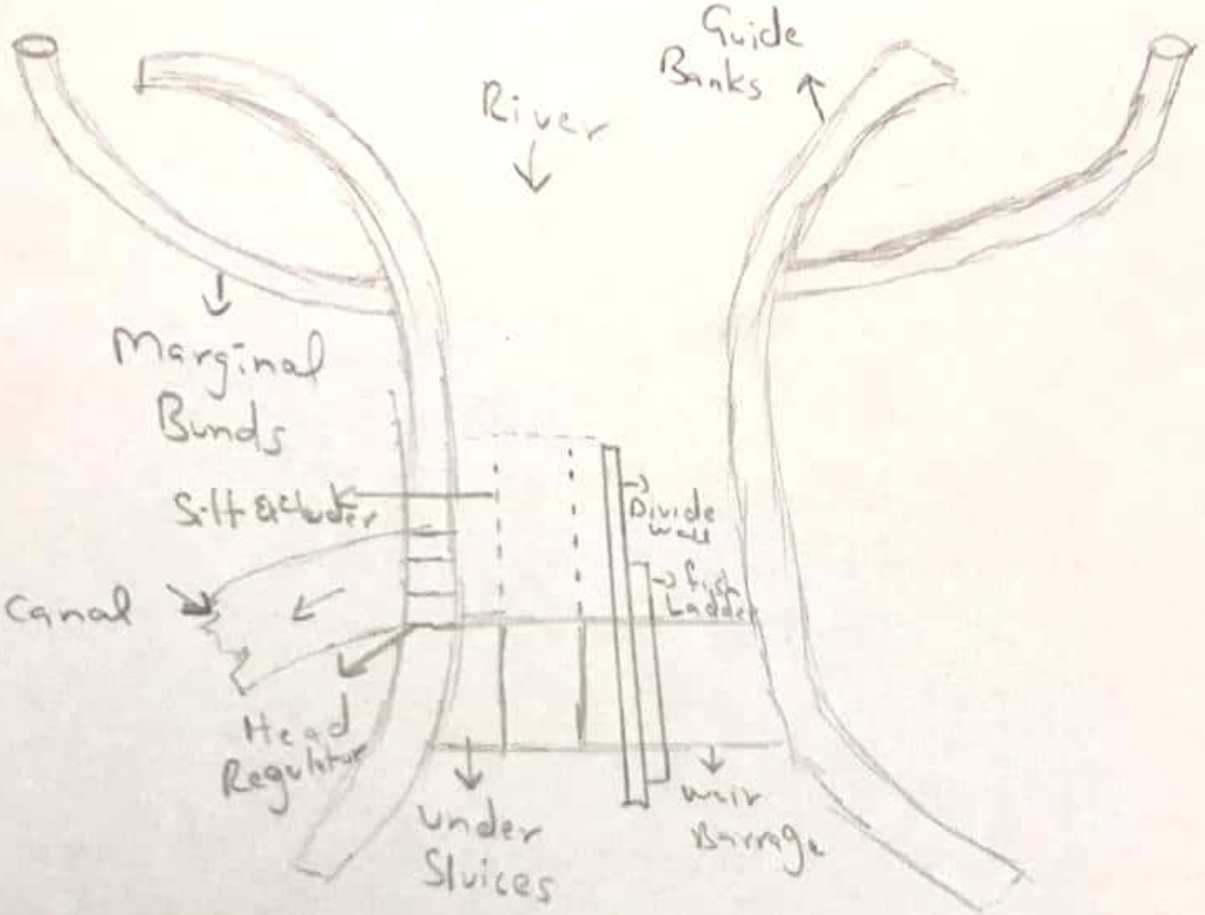
The flow in which the velocity changes from Laminar to transition is called Lower Critical Velocity.

HIGHER CRITICAL VELOCITY:-

The flow at which velocity changes from transition to turbulant is called higher Critical velocity.

Q3(A)

BARRAGE DIAGRAM:-



Q3b (10)

If the contracted width (such that the bridge length, L) is less than the regime width, W, the normal scour depth, D_N, under the bridge is given by $D_N = R_s \left(\frac{W}{L}\right)^{0.61}$ where R_s is the regime scour depth.

- In case 1, the maximum scour depth would be about 25% more than the normal scour depth. In this case the depth of single span bridge (no piers) with a straight approach is structure.
- In case 2, the maximum scour depth would be about 100% more than the normal scour depth. In this case, the structure is multi span with a curved approach.

The maximum scour depth is maximum of case 1 or case 2 or value given by $D_{max} = R_s \left(\frac{W}{L}\right)^{1.86}$ If the constriction is predominant.

Q#4

Given Data:-

Inside Dimension = 15ft x 15ft

Live Load = 1.5 k/ft² = 1500 lb/ft²

Dead Load = 300 lb/ft²

Unit weight of soil = 100 lb/ft³

Angle of Response = 30°

Use of Concrete = 1:2:4 ratio

f_y = 60ksi

Thickness = 0.92m = 3ft

Required Data:-

Design a box Culvert:

Sol:-

1: Load Calculation:

Total load Carry on Top Slab =

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

Self weight of Slab = 3x150

= 450 lb/ft²

w = 450 + 1500 + 300 = 2250 lb/ft²

(2) Co-efficient 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) Lateral Pressure Due to (D.L + L.L)

∴ Total Vertical Load (LL+DL) × K_a

$= (1500 + 300) \times 0.33$

$= 594 \text{ lb/ft}^2$

(4) Lateral Pressure due to Soil

$= K_a \times \gamma h$

$= 0.33 \times 100 \times 18$

$= 594 \text{ lb/ft}^2$

(5) Lateral Pressure

(1) Top :-

= Later Pressure due (D.L + L.L)

(2) Bottom

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

$= 594 + 594$

$= 1188 \text{ lb/ft}^2$