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QNo 1 . (a)

Difference between Culvert and Causeway.

Culvert;

Culvert may be define as an opening through an embankment for the conveyance of water by mean of pipe or an enclosed channel.

(OR)

Culvert is a tunnel carrying a stream under a road or railway.

It is transverse and totally enclosed channel drain under a road or railway.

Causeway;

It is a track, road or railway on the upper point of embankment across a wet or low places is known as causeway.

(2)

Causeway also define as, Causeway is a road that is constructed across and above water and marchland etc.

Simply Causeway is a route raised up on an embankment.

Q No 1 (b)

Cross drainage work;

Cross drainage work is define as an Irrigational canal while carrying water from head work to drop field have to cross few natural drainage stream, nallans etc. To cross those drainage safely by the canals some suitable structures are required to construct work required, to construct to cross the drainage are called cross drainage work.

(3)

Why cross drainage work is necessary;

(1) The water shed canal do not cross natural drainage but in actual orientation of the canal network, this ideal condition may not be available and obstacle like natural drainage may be present across the canal. So, the cross drainage works must be provide for running the irrigation system.

(2) That point at which canal and drainage water are intermiated, So for the smooth running of the canal with its design discharge, the cross drainage worke are required.

(3) The site condition of the crossing point may be such that without any suitable structure, the water of the canal & drainage cannot be delivered to their natural directions. So, the cross drainage work must be provided to maintain their natural direction of flow.

(4)

Types of Cross drainage Works;

(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.

(b) 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

(2) Drainage Passes over the Irrigation canal;

(a) ~~Level Crossing~~ :
Super Passage : The hydraulic structure in which the drainage is taken over the Irrigation

Canal is known as Super Passage.

(b) 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.

(3) Drainage and Canal Intersection each other of the Same level.

(a) Level Crossing :
When the bed level of canal and 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.

(b) 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 some distance from this Inlet point, a part of water is allowed to drain as outlet.

Q No 2. (a)

Differentiat between Weir and barrage;

Weir;

(1) Weir is a structure constructed across the river to rise the level of water

(2) Weir are cheaper structure.

(3) Weir is mostly constructed in hilly areas only to rise the level of Water.

(4) In Weir after some settling problems occur.

Barrage;

(1) Barrage is a structure constructed across a river in which adjustable gates (sluice gates) are installed

over a dam to maintain the water surface different level at different time.

(2) Barrage in much expansive than Weir.

(3) Barrage is constructed near the city which controlled the flow of water with the help of gates.

(4) In barrage no settling problem occurs due to gates.

Q No 2 (b)

Reynold Number ;

Reynold number is defined as It is the ratio of inertial forces and viscous forces.

It has dimension less quantity because it is the ratio of two similar quantity.

It is represented by 'Rn'.

Formula of Rn

$$Rn = \rho v d / \mu$$

ρ = density
V = velocity
d = diameter
μ = Viscosity.

Laminar flow;
The flow which Reynold number value less than 2000 is known as laminar flow.

Turbulant Flow;
The flow which have Reynold number greater than 4000 is known as turbulant flow.

Neither Laminar Nor Turbulant;
The flow which have Reynold number range 2000 – 4000 is known as neither Laminar nor turbulant.
It is also called transitional flow.

Lower Critical Velocity;
It is also called sub critical velocity, which have

(11)

Froude number less than 1 is known as lower critical velocity.

$Cr < 1$ lower critical velocity

Higher critical velocity:

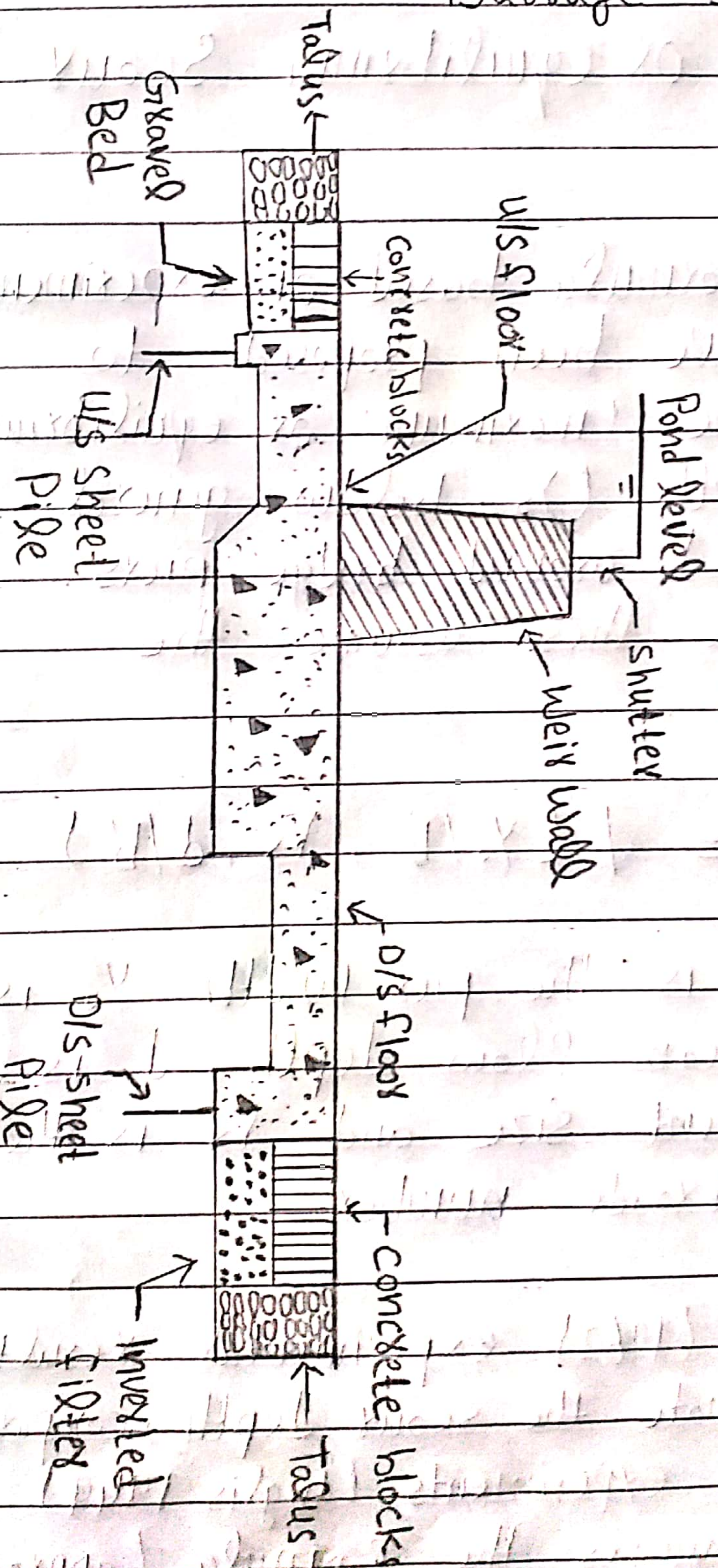
The flow which have froude number greater than 1 is known as higher critical velocity.

It is also called super critical flow.

$Cr > 1$ Super critical flow.

Q No 3 (a)

Barrage Sketch;



Q No 3 (b)

Maximum or equilibrium Scour depth ;

Several formula based on experimental results have been proposed to predict the 'maximum' or 'equilibrium' scour depth (Y_s , below general bed level) around bridge piers. In general these assume the relationship.

$$Y_s / b' = \phi (Y_o / b' , Fr , d / b')$$

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 (1962) experimental result underestimate the scour depth, compared to many experiments (Inglis 1949) which sugges the formula (approach flow is normal to the bridge piers.

$$Y_s / b' = 4.2 \, (Y_o / b')^{0.78} \cdot F_r^{0.52}$$

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

In the case of live beds (a stream with bed load transport) the formula.

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

Predicts the maximum equilibrium scour depth

(151)

Q No 4

Given data ;

Dimension = 15 ft x 15 ft
Live load = 1.5 kips/ft^2 = 1500 lb/ft^2
Dead load = 300 lb/ft^2
Unit of soil = γ_s = 100 lb/ft
Angle of repose = 30°
Grade of concrete = 1:2:4 = M15
fy = 60 ksi
Thickness of slab = 0.92 ft

Required ;
Design the box culvert.

Solution ;

(1) Load Calculation :

As we know that ;

Total load carrying on top slab = Self wt of slab + L.L + D.L
(1)

Self Wt of top slab = Thickness x grade of concrete.

$= 0.92 \times 15 \times 3.28$

$= 45.3\ lb/ft^2$

Now Put in eq (i)

$= 300 + 1500 + 45.3 = 1845.3\ lb/ft^2$

(iii) Co-efficient of earth Pressure.

$$K_a = \frac{1 - \sin\theta}{1 + \sin\theta} = \frac{1 - \sin 30^\circ}{1 + \sin 30^\circ}$$

$= 0.33$.

Lateral Pressure due to dead Load and Live load.

= Total Vertical Load (D.L + L.L) x Ka

$= (300 + 1500) \times 0.33$

$= 594\ lb/ft^2$

(17)

Lateral Pressure due to Soil;

$K_a \times \gamma h$

$= 0.33 \times 100 \times 15 \times 0.92 \times 3.28$

$= 1493.72 \ lb/ft^2$

Lateral Pressure due to top;

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

$= 594.36 + 1493.72$

$= 2088.312 \ lb/ft^2$