Q. Differentiate b/w culvert and causeway.

Ans :- Culvert:

A culvert is a structure that allows water to flow under a road, railroad, trail or similar obstruction from one side to the other. Typically embedded so as to be surrounded by soil a culvert may be made from a pipe, reinforced concrete or other material.

Causeway:

A causeway is a track, road or railway on the upper point of an embankment across a low or wet place or piece of water. It can be constructed of earth masonry, wood or concrete.

Q Define cross drainage work. why it is necessary? Explain types of cross drainage

Ans: Irrigational canals while carrying water from headworks to crop field have to cross few natural drainage streams, nallahs etc. To cross those drainages safely by the canal some suitable structures are required to construct. Work required to construct to cross the drainage are called cross drainage works.

Necessary of cross drainge works:

=> The water shed canals do not cross natural drainage. but in actual orientation of the canal network, this ideal condition may not be available and the obstacles like natural drainage may be present across the canals. So the cross drainge works must be provided for running the irrigation system

=> At the crossing point the water of canal and the drainage get intermixed. So for the smooth running of the canal with its design discharge the cross drainage works are required

=> The site condition of the crossing point may be such that without any suitable structure, the water of the canal and drainage can not be diverted to their natural direction So the cross drainage works must be provided to maintain their natural direction of flow.

Types of Cross Drainage Works.

Type I (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.

Type I

(a) Aqueduct:

The hydraulic structure in which the irrigation canal is taken over the drainage i.e (river, stream) etc. is known as aqueduct. This structure is sutible when bed level of canal is above the highest flood level of drainage.

(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 know as siphon aqueduct.

Type II

(a) Super Passage.

The hydrolic structure in which the drainage is taken over the irrigation canal is known as super passage.

(b) Siphon Super passage.

The hydrolic structure in which the drainage is taken over the irrigation canal but the canal water passes below the drainage under the siphonic action is known as Siphon Super passage

Type III

(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.

(b) Inlet and outlet:

When irrigation canal meets a small stream or drain at same level, drain is allowed to enter the canal in inlet. At some distance from this inlet point a part of water is allowed to drain as outlet. which eventually meets the original stream.

Q Differentiate between weir and Barrage?

Ans

| | Weir | Barrage. |
| --- | --- | --- |
| ① | Low cost | High cost. |
| ② | Low control on flow | Relatively high control on flow and water levels by operation of gates. |
| ③ | No provision for transport communication across the river | Usually a road or a rail bridge can be conveniently and economically combined with a barrage wherever necessary. |
| ④ | Chances of silting on the upstream is more | Silting may be controlled by judicial operation of gates. |
| ⑤ | Afflux created is high due to relatively high weir crest. | Due to low crest of the weir the flux during high floods is low. Since the gates may be lifted up fully even above the high flood level. |

Q, Define Reynold's number. What will be the limit of reynold's number for laminar, turbulent and neither laminar nor turbulent flow? Also define lower and higher critical velocity.

Ans Reynold's number:

The Reynold's number is the ratio of inertial forces to viscous forces within a fluid which is subjected to relative internal movement due to different fluid velocities.

If the reynold's number is less than 2000, the flow is considered to be laminar. and is turbulent if it is greater than 4000.

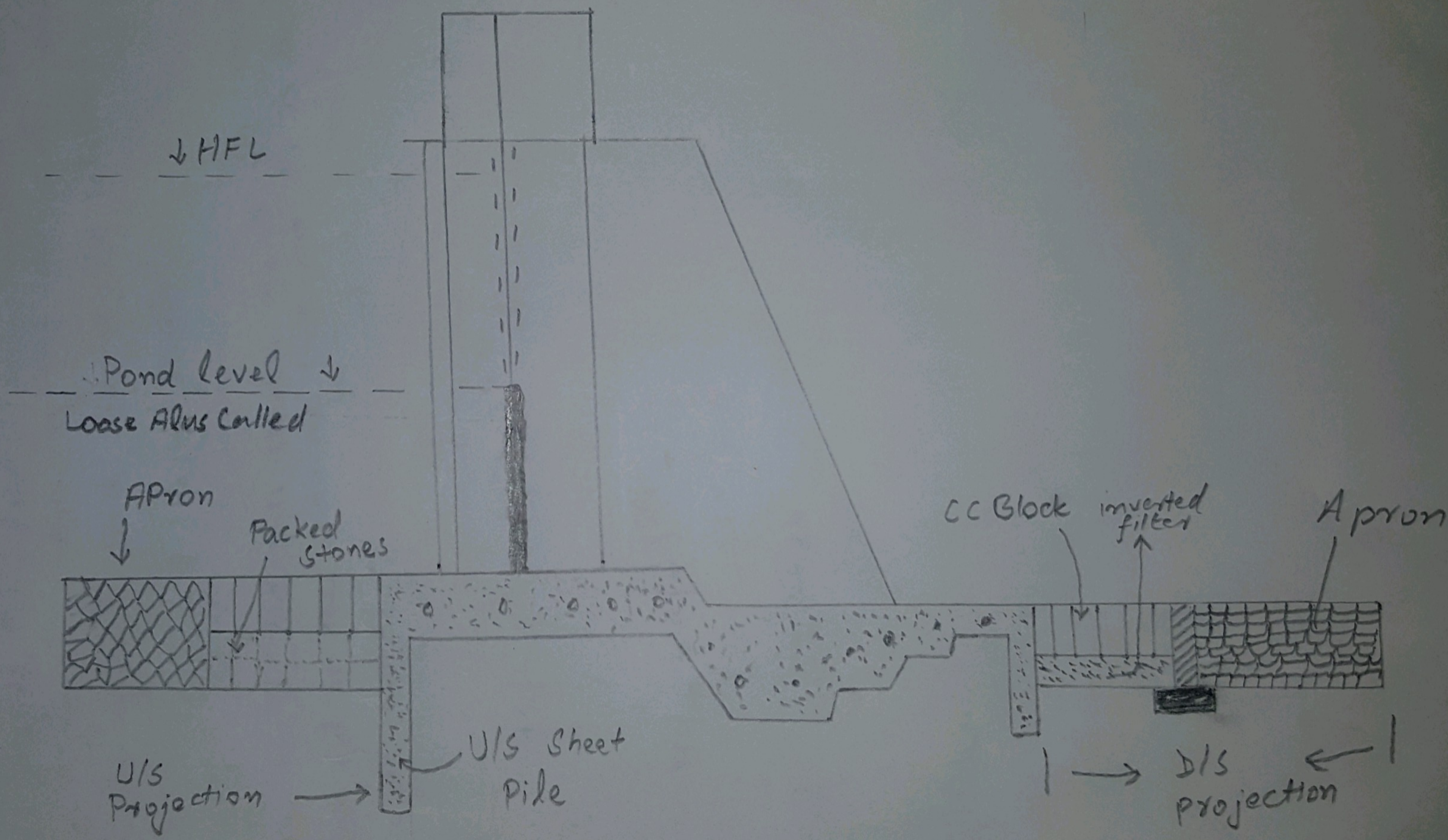
When flow occurs between the laminar and Turbulent flow condition (Re 2300 to Re 4000) the flow condition is known as critical and is difficult to predict. Here the flow is neither wholly laminar nor wholly turbulent.

Lower and higher critical velocity:

The velocity at which the flow enters from laminar to transition period is known as lower critical velocity. The transition period in between laminar and turbulent flow.

higher critical velocity: A velocity at which turbulent flow starts. or the velocity in which flow enters from transition period to turbulent flow is known as upper or higher critial velocity.

## ⇒ BARRAGE


HFL
Pond level
Loose Alus Called
APron
Packed stones
U/S Projection
U/S Sheet Pile
CC Block
inverted filter
Apron
D/S projection

Q How would you predict / analyse maximum or equilibrium scour depth based on experimential formulas

Ans Several formulae based on experimental results have been proposed to predict the maximum or equilibrium scour depth ($y_s$ below general bed Level) around bridge pier. In general these assume the relationship

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

where $b'$ is the pier width $y_0$ is the upstream flow depth, $d$ is the sediment size and $Fr$ is the flow Froude number.

$$y_s / b' = 4.2 \, (y_0 / b')^{0.78} \, Fr^{0.52}$$

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

$$y_s = 2.3 K \alpha b'$$

Q4 Given data:

$L.L = 1.5 kip/ft^2 = 1500 lb/ft^2$

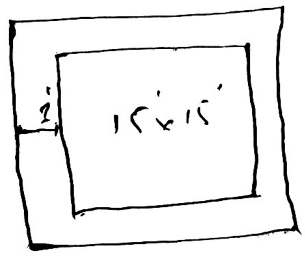
$D.L = 300 lb/ft^2$

$\gamma w = 100 lb/ft^3$

$\phi = 300$

Use = 1:2:4 Concrete = $M_{15}$

$fy = 60 ksi$




(1) $w = D.L + L.L +$ self wt of slab

Self wt of top slab = $1 \times 1 T = 15 lb/ft^2$

$w = 1500 + 300 + 15 = 1815 lb/ft^2$

(2) $Ka = \frac{1 - \sin \phi}{1 + \sin \phi}$

$= \frac{1 - \sin(300)}{1 + \sin(300)}$

$Ka = \frac{1.866}{0.133} = 14.03'$

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

= (L.L + D.L) × Ka

= (1500 + 300) × 14.03

= 25254 lb/ft²

= **25.254 kip/ft²**

(4) Lateral pressure due to soil

= Ka × γh

= 14.03 × 100 × 16

= 22448 lb/ft²

= **22.448 kip/ft²**

(5) lateral pressure @ top = Lateral pressure due to (D.L + L.L) = **25.254 kip/ft²**

~~(D.L + L.L) = 25.2~~

(6) Lateral pressure @ bottom = lateral pressure due to (D.L + L.L) + total pressure due to soil.

= 25.254 + 22.448

= **47.702 kip/ft²**

Digram