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Subject Hydraulic structure

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Q No 1

"a" Different between culvert and cause way.

ans:- Culvert:-

A culvert is a structure that can allows water to flow under a road, railroad trail or similar obstruction from one side to the other side.

A culvert may be made from a pipe reinforced concrete or other material.

Cause way:-

A road that is raised so as to be above water, marshland and similar low-lying obstacles.

A raised way across wet ground or water.

Q No 1 :-

b Define cross drainage work. why it is necessary? Explain different types of cross drainage work in detail.

ans:- Cross drainage :-

The crossing of the canals with such obstacle cannot be avoided so, suitable structures must be constructed at the crossing point for the easy flow of water of the canal and drainage in the respective direction. These structure are known as cross-drainage works.

Necessity of Cross-Drainage work

The cross drainage work must be provided for Running the irrigation system.

At the crossing point. the water of the canal and the drainage get intermixed. so, for the smooth running of the canal with its design discharge the cross drainage work are required.

Types of Cross Drainage work

* **Type I :-**

"a". Aqueduct :-

The hydralic structure in which the irrigation canal takes over the drainage.

"b" Siphon Aqueduct :-

where the canal is taken over the drainage but the drainage water cannot pass clearly below the canal. if flow under the siphon action.

* **Type II :-**

"a" super passage :-

where the drainage is taken over the irrigation canal.

"b" Siphon super passage :-

where the drainage is taken over the irrigation canal. but the canal water passes below the drainage under siphon action.

Type "III"

"a" Level crossings

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" Intel and outlet:-

when the irrigation canal meet a small stream or drain at same level. drain is allow to enter the canal as inlet and the water is allowed to drain as outlet.

Q No.2

"a" Differentiate between weir and barrage.

ans:- Weir:-

A weir is a diversion headwork constructed across a river to raise the water level on the upstream side. like barrage its main aim to divert water as it does not have a storage reservoir. The water is raised up to the required height and the water then flows over the weir.

Barrage:-

A barrage is a diversion headwork. its main aim is to divert the flow of river it does not have a storage reservoir on its up stream side. the main difference from the weir is that it has adjustable gates installed on top of it. water level can be maintained using these gates

Q No 2:

"b" Define Reynod number. what will be the limit of reynold's number for laminar, turbulent and neither laminar nor turbulent flow? Also defin lower and higher critical velocity.

ans:- Reynod number:-

The Reynolds number is the ratio of inertial forces to viscous forces. It is the dimensionless number comprised of the physical character of the flow. An increasing Renolds number indicates an increased turbulence of flow.

$$Re = \frac{VD}{\nu}$$

Limit of reynolds number:-

Laminar flow

i) $Re < 2000$

ii) low velocity.

iii) fluid particales move in

straight lines.

iv) The average flow velocity is approximately one half of the maximum velocity.

Turbulent flow:-

i) $Re > 4000$

ii) high velocity.

iii) The flow is characterized by the irregular movement of particles of the fluid.

iv) The average flow velocity is approximately equal to the velocity at the center of the pipe.

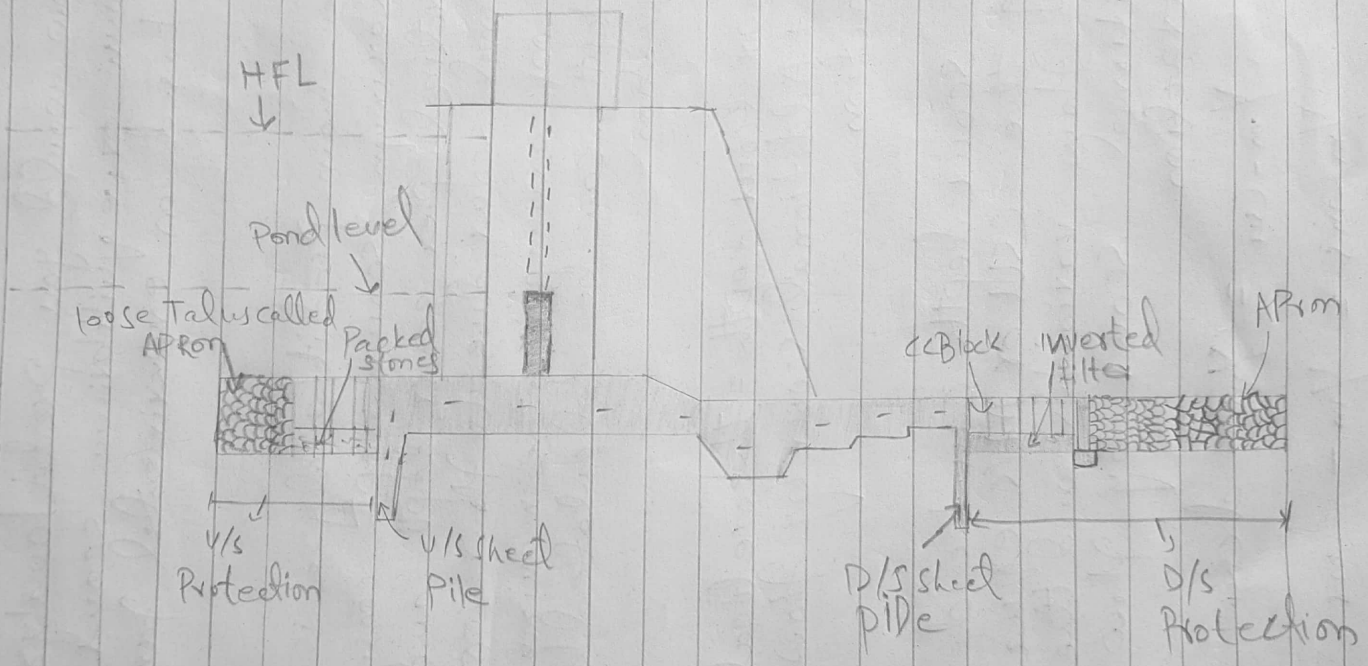
neither laminar and turbulent flow

Therefore when Reynolds number is between 2000 and 2800, the flow is neither laminar nor turbulent. The velocity corresponding to Reynolds number of 2000 is called lower critical velocity and the velocity corresponding to Reynold's number of 2800, is called higher critical velocity.

Q No 3

"a"

Barrage



QNo3

"b" How would you predit/analyze maximum or, equilibrium scour depth based on experimental formula.

Ans:-

The main predit/analyze is that the maximum scour depth consist of theoretical pier scour depth and additional scour due to flow contraction Based on assumption, the maximum scour depth can be calculated by equation.

max scour depth = theoretical pier scour + Additional scour by flow contraction

the scour depth can be decided using the CSU or MS equation and flow variables and the Additional scour by flow contraction.

$$y_{m-CSU} = y_m - d_{CSU}$$

$$y_{m-MS} = y_m - d_{MS}$$

Predict the maximum "or" equilibrium scour depth

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

Q No 4 Given data

L.L = 1.5 kip/ft

D.L = 300 lb/ft² = 0.3 kip/ft²

Length = 15 ft

width = 5 ft

unit wt of soil) = γ = 100 lb/ft³

γ = 0.1 kip/ft³

Angle = θ = 30°

mix design = 1:2:4

steel fy = 60 psi

Thickness = 0.93 m

= 3.02 ft

Required :- Design Culvert.

Solution:-

As we know that

for

1) self wt of slab = γ x h

= 150 x 3.02

= 453 lb/ft²

= 0.453 kip/ft²

Total load

$$W = 1.5 + 0.3 + 0.413$$

$$W = 2.213 \text{ kip/ft}^2$$

ii) Coefficient of earth Pressure

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

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

$$\boxed{K_a = 0.333}$$

iii) Lateral Pressure due to Dead load and live load.

$$= L.L + D.L \times K_a$$

$$= (1.5 + 0.3) \times (0.333)$$

$$= 0.5994 \text{ kip/ft}^2$$

iv) Lateral pressure due to Soil

$$= K_a \times \gamma \times h$$

$$= 0.333 \times 0.1 \times 18.02$$

$$= 0.6 \text{ kip/ft}^2$$

a) top = lateral pressure due to (D.L+L.L)

Top = 0.5994 kip/ft2

b) Bottom = lateral pressure due to loads + lateral pressure due to soil

Bottom = 0.5994 + 0.6

Bottom = 1.2 kip/ft2