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Subject Hydraulic structures

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Q1 (A) Differentiate between culvert and cause way.

Difference between causeway and culvert is that causeway is a road that is raised, as to be above water, Marshland etc while culvert is a transverce channel under a road or railway for the draining of water.

Q1 (b) Define cross drainage work.

On an irrigation Project when the network of Main canals, branch canals, distributaries etc are Provided then these canals may have to cross the natural drainages like rivers, streams nallahs, etc. at different Points within the command area of the Project. The crossing of the canals with such obstacle cannot be avoided. So suitable structures Must easy flow of water of the canal and drainage in the respective directions. These structures are know as cross- drainage work.

Why it is necessary.

The water-shed canals do not cross natural drainages but in actual orientation of the canal network this ideal condition May not be available and the obstacles like natural drainages May be Present across the canal, so the cross drainage work Must be Provided.

for running the irrigation system.

Types of cross Drainage work:

Type 1 irrigation canal Passes over the Drainage.

* Aqueduct:-

The hydraulic structure in which the irrigation canal is taken over the drainage such as river strem etc. is know as aqueduct.

* Siphon Aqueduct:

In a hydraulic structure where the canal is taken over the drainage but the drainage water cannot pass clerly below the canal. It flows under siphonic action.

Type II
Drainage passes over the irrigation canal.

Super Passage.
The hydraulic structure in which the drainage is taken over the irrigation canal is know as super passage

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 know as siphon super passage.

Type III
Drainage and canal intersect each other at the same level.

Level crossings.
When the bed level

of canal and the stream are approximately the same quality of water in canal and stream is not much different cross drainage work constructed is ~~att~~ called level crossing.

* Inlet and outlet.

when irrigation canal meets a small stream or drain at some level drain is allowed to enter the canal as in inlet.

Q2 Defferentiate between weir
(a)
and barrage.

Weir	Barrage.
Low cost	high cost
Low control on flow	Relatively high control on flow and water level by operation of gates.
No Provision for transport communication across the river	usually a road or a rail bridge can be conveniently and economically combined with a barrage wharever nesessary.
chances of silting on the upstream is More	silting may be controlled by judicial operation of gates.
Afflux created is high due to relatively high weir crests	Due to low crest of the weirs The Ponding being done mostly by gate operation.

Q2 Define Reynods Number.
(b)

The Reynods Number is the ratio of inertial forces to viscous forces. The Reynolds Number is a dimensionless Number used to ~~cat~~ categorize the fluids ~~s~~ system in which the effect of viscosity is important in controlling the velocities or the flow pattern of a fluid.

~~Math~~ Mathematically
N_{Re} is defined as.

Kinematic viscosity $- \nu = \frac{u}{\rho}$

Reynolds Number = Re

$Re = \text{ratio} = \frac{\text{Inertia force}}{\text{viscous force}}$

~~Re = ratio =~~

$$Re = \frac{\rho v \, dv / dx}{u \, d^2 v / dx^2}$$

$$Re = \frac{\rho V V / L}{\mu V / L^2}$$

$$Re = \frac{\rho V V / L}{\mu V / L^2}$$

$$Re = \frac{\rho V L}{\mu}$$

Reynolds Number is dimensionless

$$Re \frac{VL}{\nu}$$

Ref = Reynolds Number Per foot

$$Ref = \frac{V}{\nu}$$

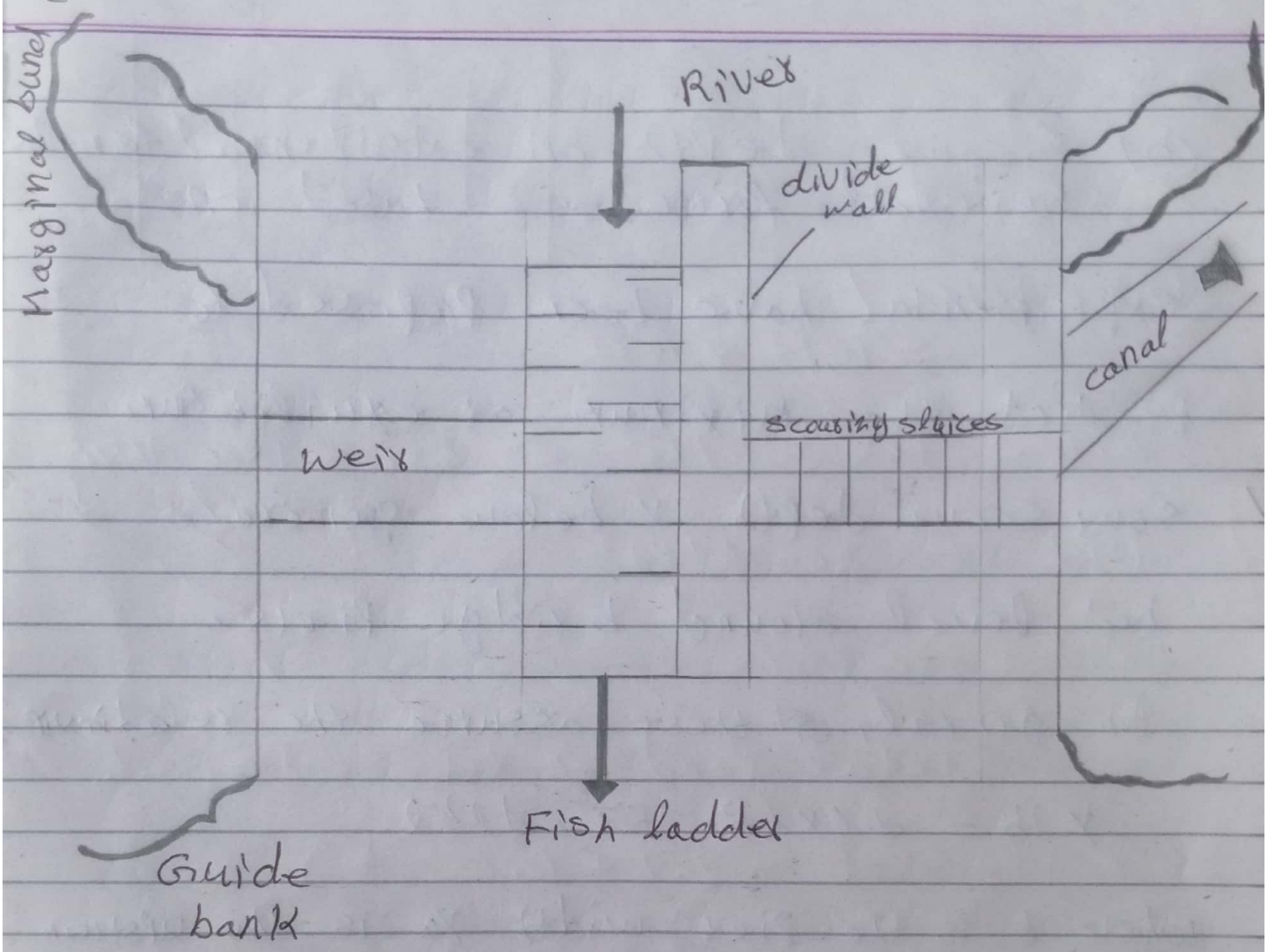
What will be the limit of reynolds and nieither laminar turbulent flow.

Turbulent flow occurs when the Reynolds number calculation exceeds 4000, when flow occurs between the Laminar and Turbulent flow conditions Re 2300 to Re 4000 The flow conditions is know as a critical and is difficult to predict here the flow is neither wholly laminar nor wholly turbulent.

Define lower and higher critical velocity-

The velocity is which flow changes from laminar to transition is called lower critical velocity and that at which transition changes to turbulent is alled higher crictical velocity.

Q3 Barrage componets.
(A)



Q.3
(b) Scour depth on experimental formulas
several formulae based on
experimental have been proposed to
predict the mixinum or equilibrium
~~Sour~~ scour depth y below general
bed level around bridge piers.
In genral, ~~Sh~~ these assume the relationship

$y\,ib = \phi(y\,d\,b^{2}, Fr, d\,l\,b^{2})$

where b is the pier width ya is the upstream
flow depth d is the sediment size, and
Fr is the flow froude number.
~~Lauff~~ Laursen's 1962 experimental result
underestimate the scour depth compared
to many indian experiment (inglis 1949)
which suggest the formula.

$$y\,db' = 4.2\,(y\,db')^{0.78}\,Fr^{0.52}$$

In the case of live beds. A stream with bedload transport the formula:

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

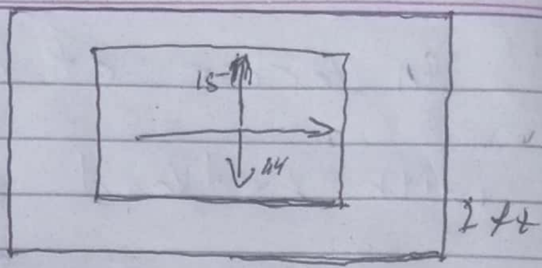
Predicts the maximum equilibrium scour depth.

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

$Y_s = 2.3\ K_\alpha b^2$

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

Q4.



Given data

Dimensions

= 15ft x 15ft

L.L = 1.5 Kip/ft^2 => L.L = 1500 lb/ft^2

D.L = 300 lb/ft^2

Load calculations.

Total load on top slab = self wt of slab + L.L + D.L

self wt of top slab = 0.3 x 750 = 225 lb/ft^2

w = Total load = 225 + 1500 + 300 = 2025 lb/ft^2

(2) Co-efficient of Earth pressure.

$$Ka = \frac{1 - \sin\theta}{1 + \sin\theta} = \frac{1 - \sin 300}{1 + \sin 300} = 13.92$$

=> Lateral Pressure due to (D.L + L.L)

= Total vertical load (L.L + D.L) x Ka

= (300 + 1500) (13.92)

= 25056 lb/ft^2 = 25.056 Kip/ft^2

Scanned with CamScanner

Lateral Pressure due to soil = Ka x γh

= 13.92 x 100 x 16

= 22272.1 lb/ft^2

= 22.2 kip/ft^2

Lateral Pressure @ top = lateral pressure due (D.L + L.L)

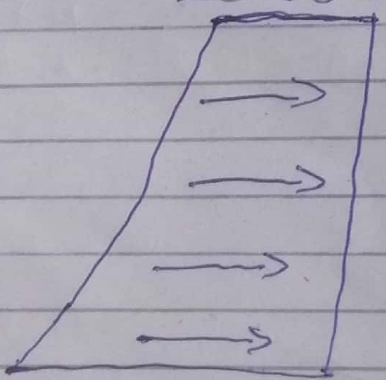
= 25.058 kip/ft^2

Lateral Pressure @ bottom

= 25.058 + 22.2

= 47.258 kip/ft^2

25.058 kip/ft^2



47.258 kip/ft^2