SUBMITTED TO

ENGR ADEED.

SUBMITTED BY

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SECTION "B"

SUBJECT HYDRAULIC STRUCTURE.

Qno1 (A)

CULVERT	CAUSEWAY
⇒ Culvert is define as. Tunnel structure constructed under road way, or railways to provide cross drainage or to take electrical or other cable from one side to other.	⇒ A causeway is of course a raised road it as build an Embankment.
⇒ It is totally enclosed by soil or ground pipe culvert, box culvert and arch culvert are common type of used under roadways and railways.	⇒ And it is not a bridge because it support a roadway between piers.
⇒ It is normally used for natural flow of water for controlling it.	⇒ It can be constructed of earth, masonry, wood or concrete for track. road or railway.

Q no 1 : (b)

Cross Drainage Works:

A Structure that is constructed, when a crossing of cannal and natural drains, For preventation of one another that is not mixed drain water into cannal water.

⇒ Mixing of ~~more~~ then two or two streams into one and only one cross drainage work to be constructed.

NECESSITY ^ CROSS DRAINAGE WORK.

→ The water shed cannal do not cross the natural drainages but in actual orientation of cannal networks this condition may not be available and the ~~obst~~ obstacles like natural drainages may be present across the cannal, so the cross drainage works must be provided for running of Irrigation system.

⇒ The water of the canal and drainage get intermixed when the water cross, For smooth running (cannal) to design discharge the cross drainage works.

⇒ cross drainage work, it requires to dispose of drainage water so the cannal supply water remains undisturbed.

TYPES OF CROSS DRAINAGE WORK:

Such type of drainage works are.

1) Irrigation canal passes over drainage

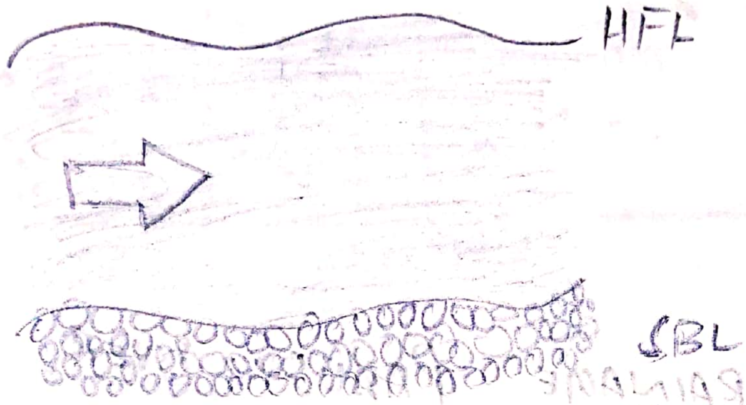
AQUEDUCT:

DEF: The hydraulic structure in which the irrigation canal is taken over the drainage is called aqueduct.

⇒ This structure is suitable for, when the bed level.

greater or above the highest flood level of drainage.

In this case the drainage water passes clearly below the canal.

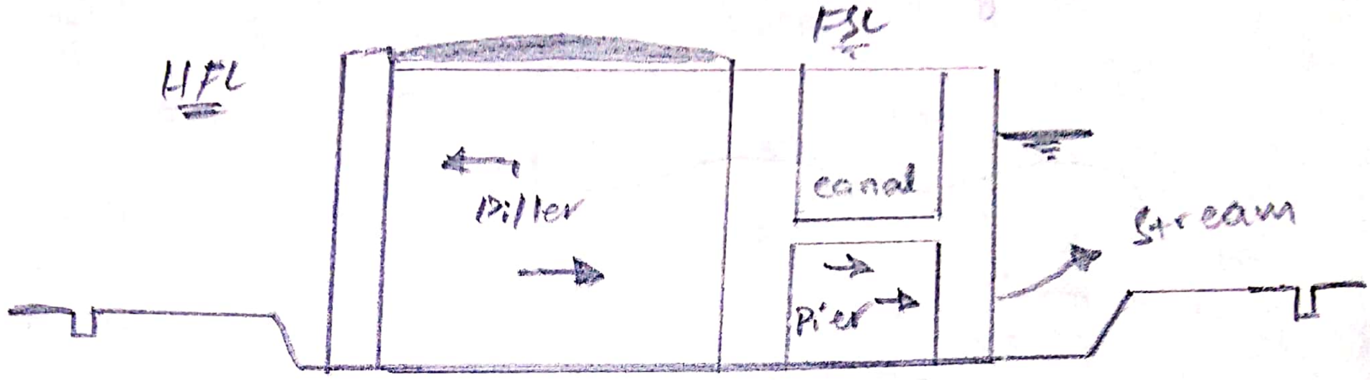


→ FSL = full supply level
→ CBL = Canal Bed level
→ HFL = High flood level
→ SBL = Stream bed level.

2) Siphon Aqueduct:-

① Definition: In a hydraulic structure where the cannal is taken over the drainage but the drainage cannot passes clearly below the canal. It flows under siphon action. So it is called aqueduct.

Siphon aqueduct is suitable when the bed level of cannal is below the



TYPE II : DRAINAGE PASSES OVER THE IRRIGATION CANAL.

Supper passage :

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

⇒ It is suitable when the bed level of drainage is above the full supply level of canal.

⇒ The water of cannal passes clearly below the drainage.

Siphon Super Passage:

The hydraulic structure in which drainage is taken over the irrigation canal, but canal (Drainage) under siphonic action is called Siphon Super passage.

⇒ It is suitable when the bed level of drainage is below the full supply level of canal.

Type III "Drainage And Canal Intersect Each Other At The Same Level"

Level Crossing: When the bed level of canal and stream are approximately same and quality of water in canal and stream is not much different the cross drainage work constructed are known as level crossing.

⇒ Water of canal and stream allowed to mix with help of regulator both in

Canal and stream.

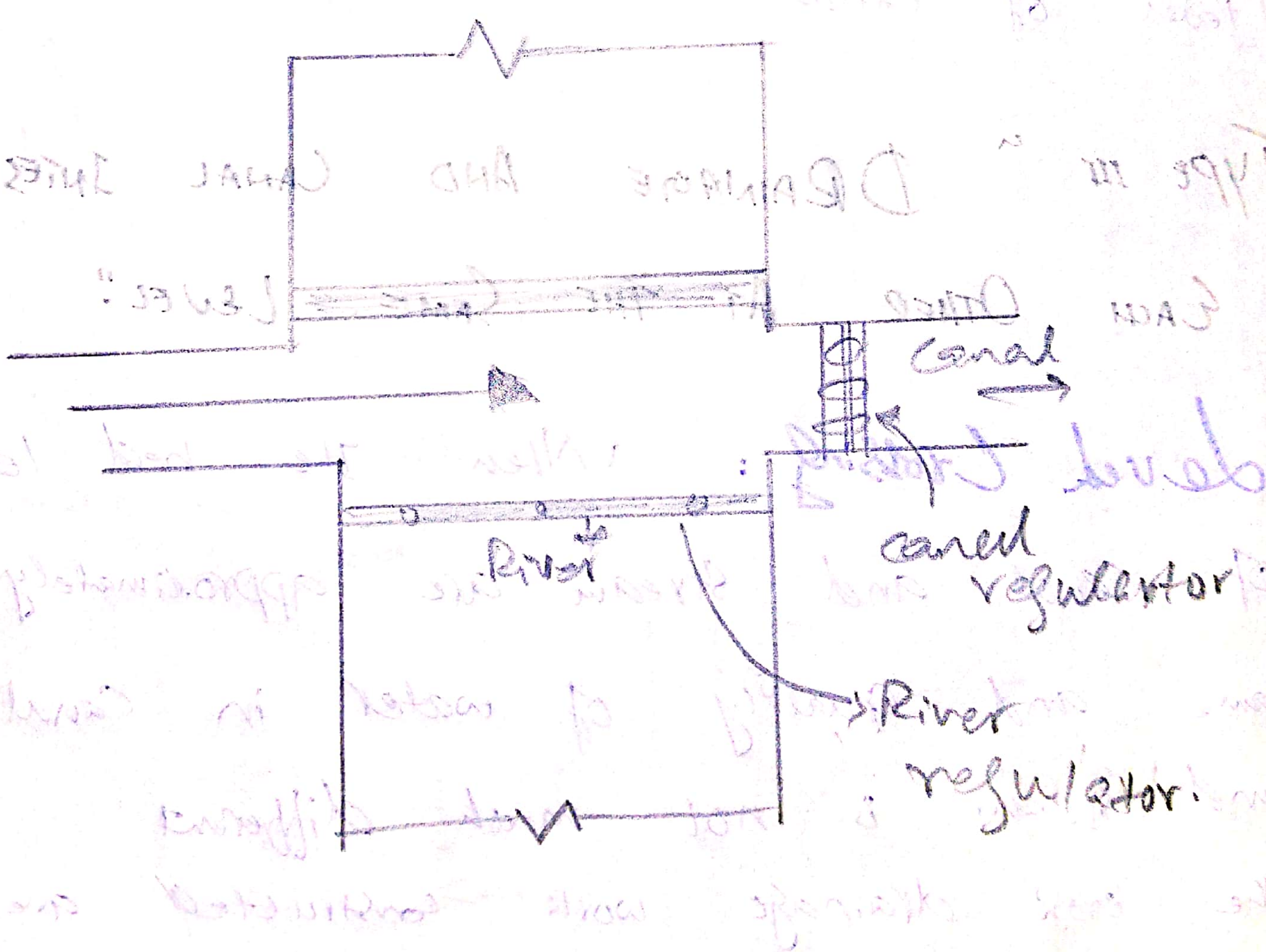
⇒ water is disposed through canal and stream is required quantity.

⇒ level crossing consist of

→ crest wall.

→ stream regulator

→ Canal regulator



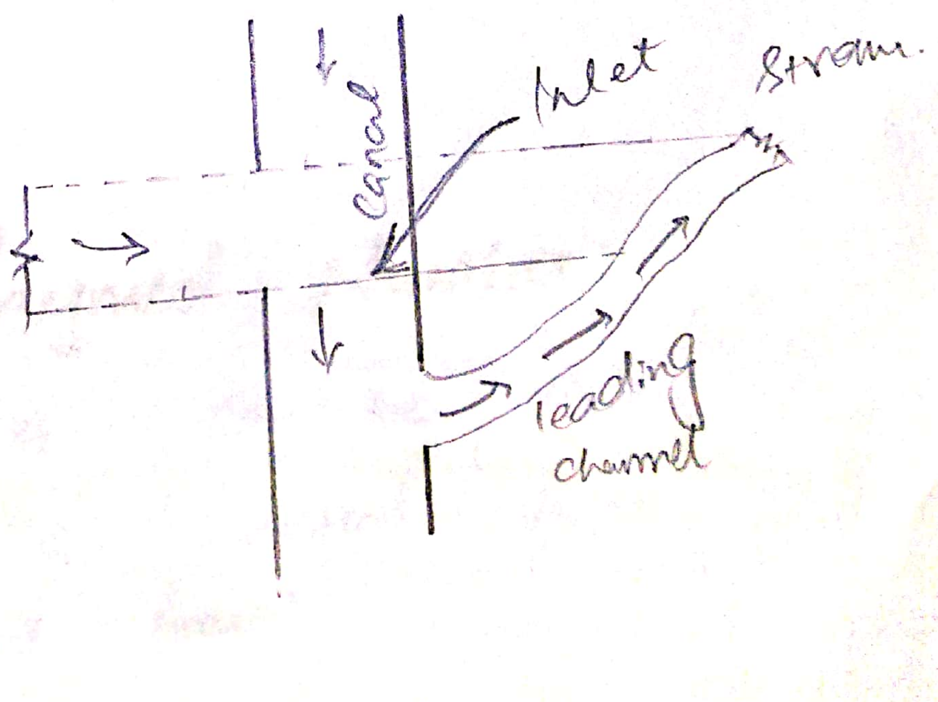
Inlet and Outlet:

When irrigation canal meets a small streams or drain at same level, drain is allowed to enter canal an inlet,

At some distances from this inlet point a part of water is allowed to drain as outlet.

Eventually meets original stream. Stone pitching is required at inlet and outlet

The bed and blanks between inlet and outlet are also protected by stone pitching this type of CDW is known inlet and outlet.



Qno 2 (a)

Difference between Weirs & Barrage:

BARRAGE	WEIR
→ Gates are at greater height.	→ Shutter are of smaller height, 2m.
→ High flood can be passed with minimum afflease.	→ Excessive afflease is high flood.
→ Low set crest.	→ High set crest.
→ Gated over entire length.	→ Shutter are part length.
→ Ponding is done by means of gate.	→ Ponding is done against the raised crest and parity by shutter.
→ Perfect control on river flow.	→ No control of river in low floods.
→ Longer construction Period.	Shorter construction period.
→ Silt removal is done	→ No means for silt disposal.

Qno 2 (B)

Reynold Number:

Reynold number can be define as "The ration of an inertial forces to viscous forces."

⇒ Reynold number is also use for predict if a flow condition will be laminar or turbulent or transidion.

Formula:- $Re = \frac{\text{Initial forces}}{\text{Viscous forces}}$

Laminar Flow:-

The flow in which the Reynold number is less then 2000.

$Re < 2000$.

Turbulent Flow:-

The flow in which the reynold number is greater then 4000

$Re > 4000$.

Transition Flow:-

The flow at which the Reynold number is greater than 2000 and less than 4000.

⇒ $Re > 2000$ and < 4000.

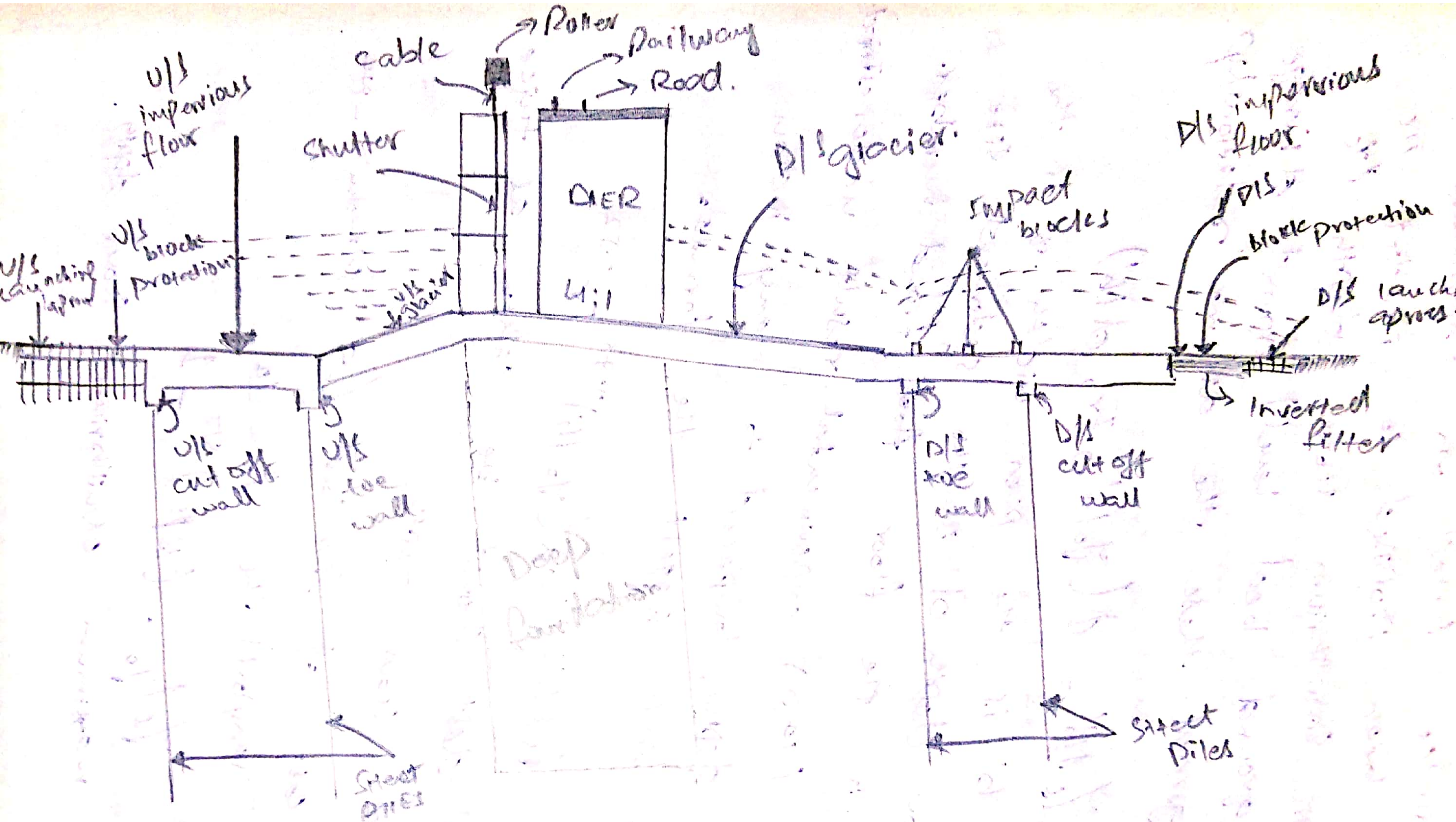
Lower Critical Velocity:

The flow which changed from Laminar to transition state.

Higher Critical Velocity:

The flow which changes from transition to turbulent flow. called higher critical velocity.

Q3 Part (A)



Components Of BARRAGE.

Qno3 PART (B)

Serval formulae based on Experiment result have been proposed to predict the maximum or Equilibrium scour depth $(Y_s$ below the ground bed level) around a bridge piers, In gernal these the assume 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 floor ~~flood~~ froud number.

⇒ Laursen's (1962) experimental result underestimate the scour depth, compared to many indian experiments which suggest the formulae

$$Y_s/b' = 4.2(y_0/b')^{0.78} Fr^{0.52}$$

The scour depth should be taken as twice the regime scour depth.

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

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

predicts the maximum equilibrium scour depth.

In relatively deep flow a first order estimate of local scour may obtained by.

$$y_s = 2.3\, K_a b'$$

⇒ Where K_a = angularity coefficient, which is a function of the pier alignment i.e angle of attack of approach flow.

⇒ The best estimate will be achieved with the appropriate coefficient for flow depth, alignment - etc.

⇒ The live bed may contribute to an appreciable reduced local scour depth. if the sediment bed is distinctly less then the local (layer and lower layer of thickness) scour depth the overall scouring phenomenon is Quite different.

⇒ The stopped scour depth. in lowering layer, it is given by $H = n(y_2 - y_1)$

y_1 and y_2 are uniform flow depth over a flat bed of grain roughness corresponding the upstream surface particles (d_1) and the underlying surface final particles (d_2) respectively.

coefficient of non riffle forming sediments.

$n = 2.6$ for design purpose.

→ The total scour depth may lead to a gross under estimate if the lower layer is of very fine material.

Scanned with CamScanner

Q no 4:

Given data:

Inside dimension = 15' x 15'

Live Load = L.L = 1.5 k/ft²

D.L = 300 lb/ft²

Unit wt of soil = 100 lb/ft³

Angle of repose = 30°

use concrete of 1:2:4 ratio

f_y = 60 ksi

Thickness = 0.92 m = 3 ft

Required: Design culvert = ?

Sol:

Load calculation:

Total Load carry on top slab

= Self wt of slab + L.L + D.L

Self wt of slab = 3 x 150

= 450 lb/ft²

$W = 450 + 1500 + 300 = 2250 \ lb/ft^2$

Coefficient of earth pressure:

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

$$Ka = \frac{1 - \sin 30}{1 + \sin 30}$$

$$Ka = 0.33$$

Lateral pressure Due to (D.L + L.L)

total vertical load (L.L + D.L) × Ka

$(1500 + 300)\ 0.33$

$= 594 \ lb/ft^2$

Lateral pressure due to soil.

$= Ka \times V_n$

$= 0.33 \times 100 \times 18$

$= 594 \ lb/ft^2$

Lateral pressure:

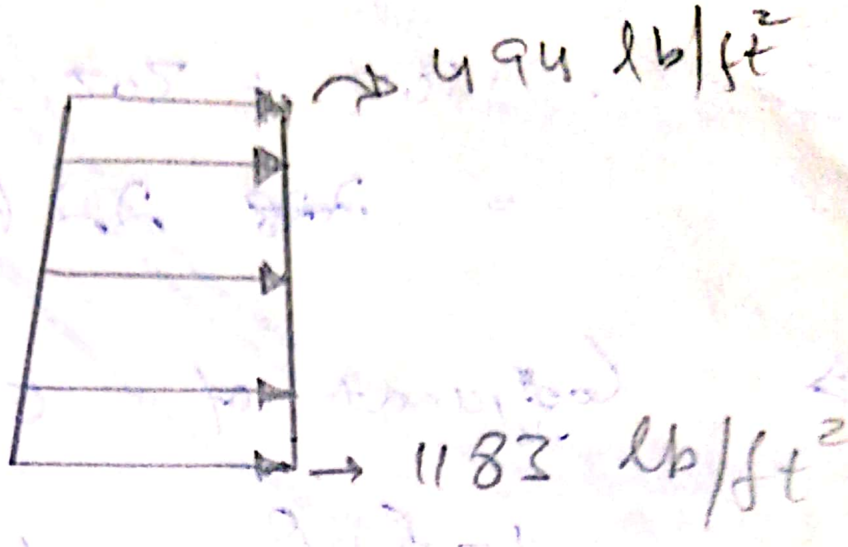
Top, Lateral pressure due to (D.L + L.L)

$594 \ lb/ft^2$

Bottom: Lateral pressure due to (D.L + L.L) + Lateral pressure due to ~~to~~ soil.

$594 + 594$

$= 1183 \ lbs/ft^2$


494 lb/ft²
1183 lb/ft²