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Section : "C"
Assignment : Hydraulic structure
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Question No. 01 part (a)

Answer Q.No (01) part (a)

Difference between Culvert and Cause way:

A culvert a structure that allows water to flow under a road rail road trail or similar obstruction from one side to the other side. while A cause way is of course a raised road usually built on embankment often running across water or swampy land.

- Cause ways is a road that raised as to above water and marshland etc. while culvert is transverse channel under raad or railway for the draining of water.

- Culvert works as a bridge pass on it. While causway is not a bridge because it supports a roadway between piers.

Question No. 02 part (b)

Answer question No. 02 part (b)

CROSS DRAINAGE WORK:

Cross drainage work is a structure constructed when there is a crossing of canal and natural drain to prevent the drain water from mixing into canal water.

By mixing two or three streams into one and only one cross drainage work to be constructed making the structure economical.

Necessity of Cross Drainage:

The cross drainage work is required to despose off the drain water so that the canal supply uninterecepted.

The canal at a cross drainage work is generally taken either over or below the drainage.

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

TYPES OF DRAINAGE WORK:

Type - I

Irrigation Canal passes over the Drainage:

Aqueduct: The hydraulic structure in which the irrigation canal is taken over the drainage (such as river, stream etc. is known as aqueduct.

Siphon Aqueduct:

- In a hydraulic structure where the canal is taken over the drainage but the drainage water can't pass clearly below the canal. It flow under siphonic action. So it is called siphon aqueduct.

Type II

Drainage passes over the irrigation canal:

- Super passage:
  - The hydraulic structure in which the drainage is taken over the irrigation canal is known as super passage. The structure is suitable when the bed level of drainage is above the fully supply level of the canal. The water of the canal passes clearly below the drainage.

Siphon Super Passage:

- The hydraulic structure in which the drainage is taken over the irrigation canal but the canal water passes below the drainage water under siphonic action is known as siphonic 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 and quality of water in canal and stream is not much different the cross drainage work constructed is called level crossing where water of canal mix.

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. At some distance from this inlet poin, a part of water is allowed to drain as outlet which eventually meets the origional stream.

Question No. 02 part (a)

Answer question No. (02) part (a)

Differentiate between weir and barrage.

* A weir is a concrete or masonary structure. which is constructed across open channel. while barrage is a special kind of dam which consists of a line of large gates that canbe opened or closed to control the amount of water.

* A weir is an impermeable barrier that is built across a river to rise the water level at upstream side. on the other hand barrage involves adjustable gates installed over a dam to maintain the water level.

* Barrage are built near the cities so that the amount of water flowing in the river can be controlled by opening and closing the gates.
While the weir is contructed is built near those are where tourist distination and preservation area to allow fish into swim upstream.

Question No. (02) Part (b)

Answer Question No. 02 Part (b)

Reynold's number:

It is the ratio of Inertia force to the viscous force of the flowing fluid.

$$Re = \left(\frac{\rho V L}{\mu}\right)$$

Limits of reynold's number:

- When the Reynolds's number is less than (2000) the flow is laminar. This is also known as viscous flow.

When the Reynold's number is between (2000) and (4000) the flow is transition. nor laminar and nor turbulent.

When the Reynold's number

is greater than (4000) the Flow is turbulent.

* Lower critical velocity.

when Froud number $Fr < 1$ then such type of Flow is called lower critical flow in this case critical depth is lower than scour depth $y > y_c$ and $V > V_c$ while velocity is lower critical velocity.

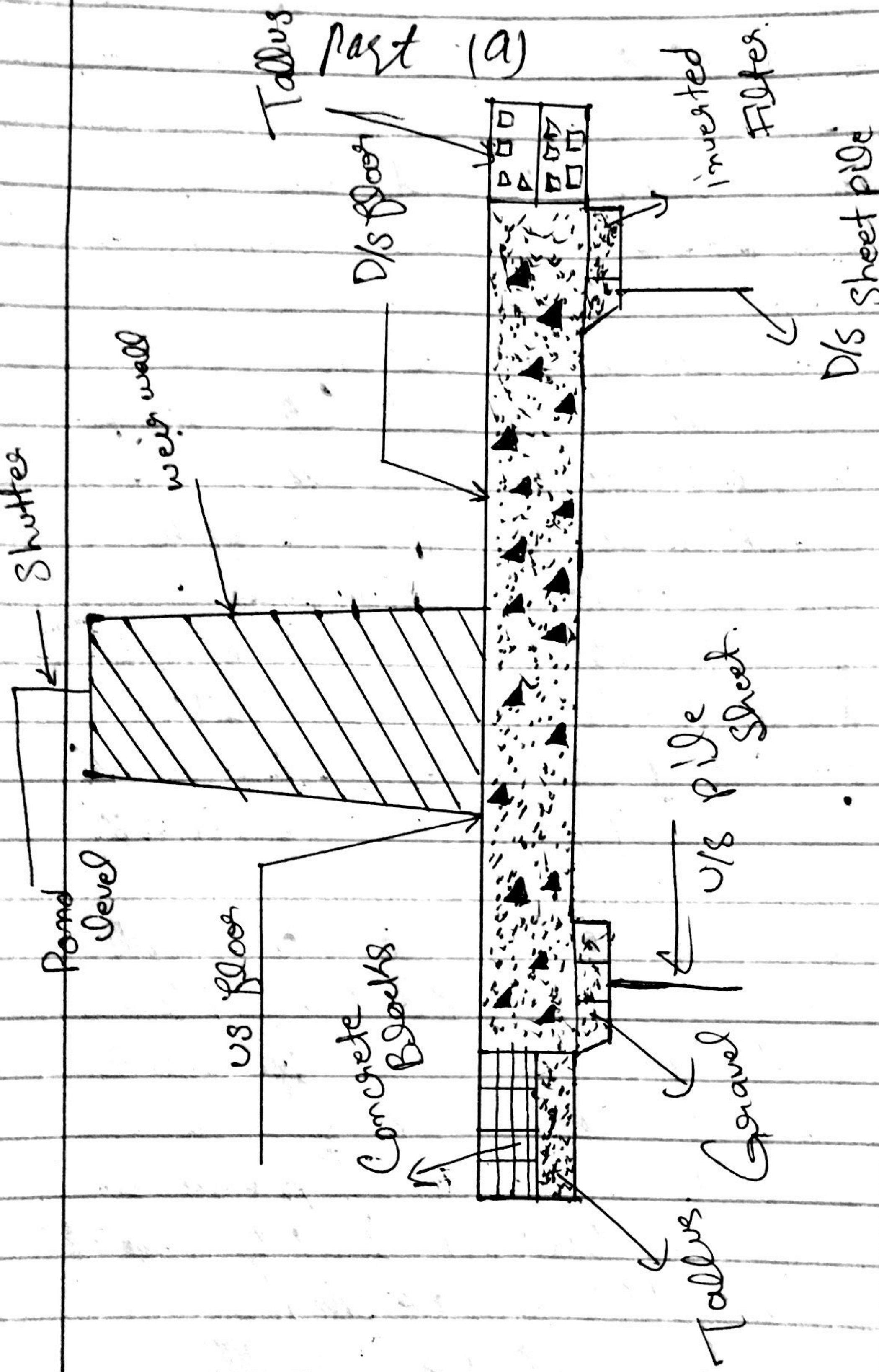
* Higher critical velocity:

when $Fr > 1$ then such Flow is called higher critical Flow at this point critical depth is greater than scour depth $y_c > y$ and velocity is called high critical velocity.

Question No (03) Part (a)

Answer Question No (03)

Part (a)



Question No. (03) part (b)

Answer Question No. (03) Part (b)

Scour around bridge piers:

Formula based on experimental result have been proposed to predict the maximum and equilibrium scour depth (y_s below ~~given~~ 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.

Larsen's experimental results underestimate the scour depth compared to many Indian experiment. which suggest the formula (approch flow is normal to the bridge piers).

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

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 bedload transport the formula.

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

predict the maximum scour depth.

Question No. (04)

Answer Question No. (04)

Solution:

Given Data:

Dimension = 15×15

L.L = 1.5 Kip/ft² → 1500 lb/ft²

D.L = 300 lb/ft²

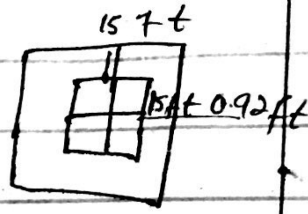
Unit weight of soil = 100 lb/ft²

Required:

ratio 1:2:4

fy = 60 ksi

① Load calculation:



Total load carrying on top slab.

= 0.92 × 15

= 13.8

Total Load

Live Load + D.L + 13.8

= 1500 + 300 + 13.8

= 1813.8 lb/ft²

Coefficient of earth pressure:

$$Ka = \frac{1-\sin\phi}{1+\sin\phi} = \frac{1-\sin 30}{1+\sin 30} = 0.33$$

(i) Lateral pressure due to (L.L + DL)

Total vertical Load × Ka

= 1800 × 0.33

= 594 lb/ft²

(ii) Lateral pressure due to soil = Ka × γh

= 0.33 × 15.92 × 100

= 525 lb/ft²

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

= 594 lb/ft²

Bottom = Lateral pressure due to D.L + L.L + Lateral pressure due to soil.

= 594 + 525

= 1119 lb/ft²