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Sec "B"

Subject Hydraulic Structure

Teacher Name

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Q NO#1 Part "a"

Ans: Differentiate b/w culvert and causeway:.

Culvert is a tunnel structure constructed und roadways or railways to provide cross drainage or to take electrical or other.

While causeway is a road paved dip which allow the floods to pass over it. It may have or may not have opening or vent to allow low water flow.

Q1 - Part "b"

Cross Drainage works:-

→ In 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 obstacls cannot be avoided so, suitable structure must be constructed at the crossing point for the easy flow of water of the canal and drainage in the respective directions. These structures are known as cross-drainage works.

=> Irrigational canals while carrying water from headworks to crop field have to cross few natural drainage streams, nallaha. etc. To cross those drainages safely by the canals. Some suitable structure are required to construct. Works required to construct to cross the drainage are called cross drainge works. At the meeting points of canals and drainages bed levels may not be same Depending on their bed levels different structures are constructed and accordingly they are designated by different names.

Necessity of Cross Drainage works:-

=> 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 drainage may be present across the canal. So the cross draiage works 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 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 directions. So the cross drainage work 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 Irrigation canal passes over the Drainage,

This condition involves the construction of following,

★ Aqueduct:-

The hydraulic structure in which the irrigation canal is taken over the drainage (such as river stream etc). is known as aqueduct. This structure is suitable when bed level of canal is above the highest flood level of drainage. in this case, the drainge water passes clearly below the canal.

Siphon Aqueduct:

⇒ In a hydraulic structure where the canal is teken over the drainage, but the drainge water cannot pass clearly below the canal. It flows under siphonic action, So, it is known as siphon aqueduct. This structure is suitable when the bed level of canal is below the highest flood level.

* Type II Drainage passes over the irrigation canal.

⇒ Super passage

The hydraulic structure in which the drainge is taken over the irrigation canal is known as Super passage. The structure is suitable when the bed level of drainage is above the full 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 under siphonic action is known as siphon super passage. This structure is suitable when the bed level of drainage is below the full supply level of the canal.

Types III Drainage and canal intersect each other at the same level:

* 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, the cross change work Constructed is called level crossing where water of canal and stream is allowed to mix. with the help of regulators bath in canal and stream water is disposed through canal and stream in required quantity. level Crossing consists of following Components (i) crest wall (ii) stream regulator (iii) canal regulator.

* **Inlet and outlet:**

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

Stone pitching is required at the inlet and outlet. The bed and banks between inlet and outlet are also protected by ston pitching. This type of CDW is called inlet and outlet.

Q NO # 02

Weir	Barrage
-> low cost	-> High cost
-> Low Control on flow	-> Relatively high controls on flow and water level by operation of gates.
-> No provision for transport Communication across the river.	-> Usually, a road or a rail brige can be conveniently and economically combined with a barrage whereever necessary.
-> Chances of silting on the upstream is more	-> Silting may be controlled by judicial operation of gates
-> Afflux created is high due to relative high weir crests.	-> Due to low crest of the weirs (the ponding being done mostly by gate operation). the afflux during high floods is low. Since the gates may be lifted up fuly even above the high flood level.

QNO 2 = Part "b"

Ans:

Reynolds Number:-

The Reynold number is the ratio of inertial forces to viscous force. The Reynold number is a demensionless number used to categorize the fluids system in which the effects of viscosity is important in controlling the velocities or flow pattern of a fluid.

For Laminar flow:-

The Reynold number is less then 2000. the velocity is low. Fluid particles moves in straight lines.

For Turbulent flow:

The Reynold number is greater than 4000. The velocity is high flow.

Transitional Flow:

A Reynolds Numbers between about 2000 and 4000 the flow is unstable as a result of the one set of turbulence. These flows are some time refered to as transitional flows.

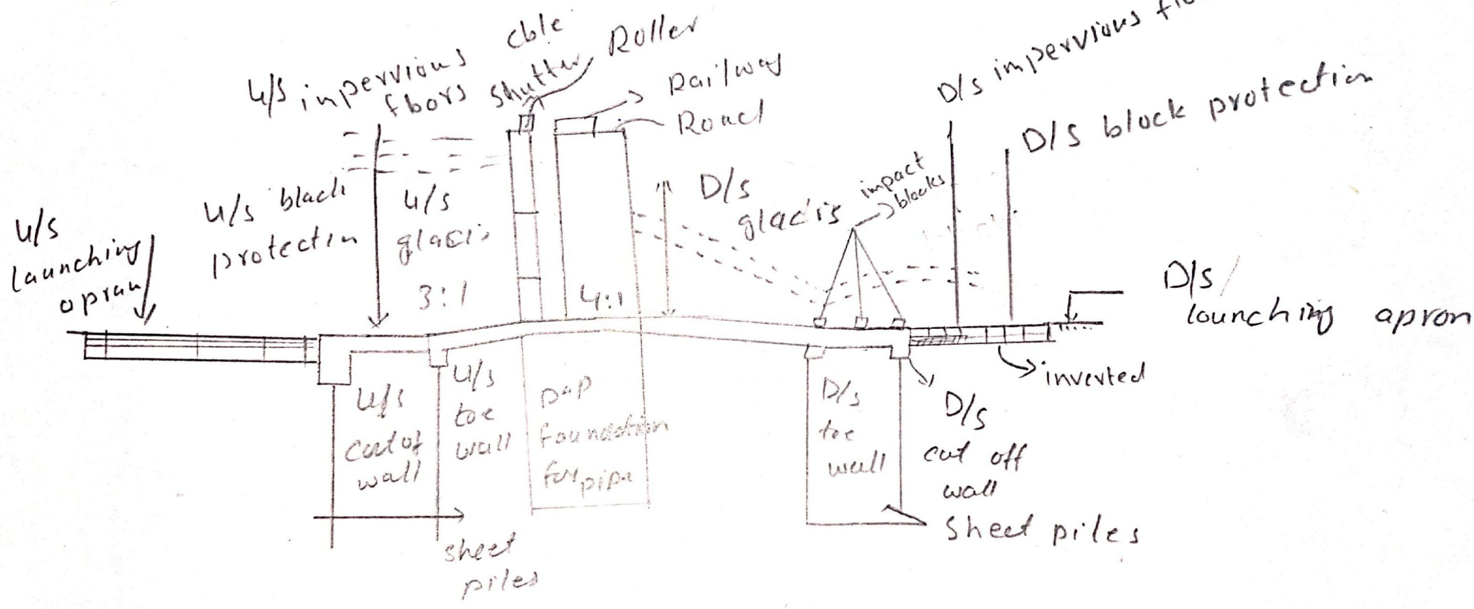
Lower critical velocity:

The velocity at which the flow enters from laminar to ~~turb~~ transition period is known as lower critical velocity.

Higher critical velocity:

A velocity in which flow enters from transition Period toturbulent flow is known as upper or higher critical velocity.

Q No=3 part "A"



Component parts of barrage.

Q NO:3 "B"

Ans: Several formulae based on experimental result have been proposed to predict the 'maximum' or 'equilibrium' scour depth (y_s below general bed level) around bridge piers. 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 Froud number.

Laursen's (1962) experimental result underestimate the source depths, compared to many Indian experiments (Inglis 194') which suggest the formula (approach flow is normal to the bridge piers).

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

The Indian field data also suggest that the source depth should be taken as twice the regime scour depth.

In the case of live beds (a stream with bedload transport) the formula.

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

Predicts the maximum equlibrium scour depth.

In a relatively deep flow a first-order estimate of (clear) local scoure (around pier) may be obtained by

$$Y_s = 2.3 K_a b'$$

where K_{α} = angularity co-efficient which is a function of the pier alignment i.e angle of attack of approach flow.

Q No # 04

Given Data

L.L = 1500 lb/ft^2

D.L = 300 lb/ft^2

Section = 15' x 15'

thickness = 0.92m = 3 ft

unit wt of soil = 100 lb/ft^3

$Q = 30°$

unit wt of concrete = 156 lb/ft^3

fy = 60 ksi

Sol:

self wt of slab

Thickness x unit wt of R.C.C. concrete

$3 \times 156 = 468 \ lb/ft^2$

Total load

$(L.L + D.L + \text{self wt})$

$1500 + 300 + 468)$

$= 2268 \ lb/ft^2$

Coefficient of earth pressur

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

$= 0.33$

letral pressure

(i) vertical pressure at Top

$(L.L + D.L) \ k_a$

$(1500 + 300) \ 0.33 = 594 \ lb/ft^2$

(ii) Pressure of soil

Ka x h x unit wt of soil

$0.33 \times (15\times3) \times 100 = 594 \ lb/ft^3$

(iii) pressure at top 594 lb/ft^2

(iv) Pressure at Bottom

Top + letral soil pressure

$= 594 + 594 = 1188 \ lb/ft^2$