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Subject:- HYDRAULIC STRUCTURE

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QNo 1:-

a):- Ans:- Culvert:-
Culverts is a tunnel carying a stream under a road or railway. A culvert may act as a bridge for traffic to pass on it. They are typically in natural flow of water and serves the purpose of bridge or a current flow controller.

Causeway:-
A causeway is a track, road or raily way on the upper point of an embankment across, a low or wet place, or piece of water. It can be constructed of earth, masonry, wood or concrete.

b):- Cross driange work:-
In an irrigation project, when the network of main canals, branch canals, distributaries etc— are provided then these canal

may have to cross the natural driange like rivers. streams, nallahs etc. at different points within commond area of the project. The crossing of the canals with such obstacle cannot be avoided so suitable structure must be constructed at the crossing point for easy flow of water of the canal and driange in the respective directions these structure are called cross-driange.

Necessity of Cross-Driange work:-

★ The water-shed canals do not cross natural drianges. But in actual orientation of canal network this ideal condition may not be availble & the obstacle like natural drianges may be present across the canal. So the cross-driange work must be provided for running the irrigation system.

★ At the crossing point the water

of the canal and the driange get intermixed. so for the Smooth running of canal with the design discharge the cross driange work are required.

★ Cross driange are requiyed to maintain their natural flow direction.

★ Types of Cross Driange Work ★

★ Type-I Irrigation canal passes over the Driange:-

This condition involves the construction of following:-

★ Aqueduct:-

The hydraulic structure in which the irrigation canal is taken over the driange (such as river stream etc). is known as aqueduct. This structure is suitable when bed level of canal is above the highest flood of level of driange.

★ Siphon Aqueduct:

In a hydraulic

structure where the canal is taken over the drainage, but the drainage water cannot pass clearly below the canal it flows under siphon action known as Siphon Aqueduct.

Type - II Drainage passes over the irrigation canals-

★ Super passage :-

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

★ Siphon Super passage :-

The hydraulic structure in which the can is taken over the irrigation canal, but the canal water passes below the drainage under siphon action called siphon as super passage.

Type - III Drainage & Canal Intersect each other at Same level:-

★ Level crossing :-

when a bed level of canal and the stream are approximately the same and quality of water in canal and stream is not too much different the cross drainage work constructed is called Level crossing.

★ Inlet & 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 the inlet point a part of water is allowed to drain as outlet which eventually meets the original stream.

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QNo2 :-

a):- Weir :-

As weir or low head dam is a barrier across the width of a river that alters the flow characteristics of water and usually result in a change of height of river level known as weir.

Barrage :-

A barrage is type of low head, diversion dam which consists of a number of large gates that can be opened or closed to control the amount of water passing through known as Barrage.

b):- Reynold's Number :-

It is the ratio of inertial forces to viscous forces. The Reynold's number is a dimensionless number used to categorize the fluid system in which the effect of viscosity is important in controlling the velocity.

Limit for Laminar flow :-

* Re < 200
* low velocity
* Fluid particles move in straight line
* Layers of water flow over one another at different speeds with virtually no mixing b/w layers.
* The average flow velocity is approximately one half of the maximum velocity.
* Simple mathematically analysis is possible.

Turbulant Flow :-

* Re > 400.
* High velocity
* Average motion is in direction of flow.

*** Neither Laminar nor Turbulant:-**

when the Reynolds number is between 2000 & 2800 then the flow is neither laminar nor Turbulant.

*** Lower critical velocity:-** The velocity at which flow changes from laminar to transition is called lower critical velocity.

*** Higher critical velocity:-** The velocity at which flow changes from transition to turbulant is called Higher critical velocity.

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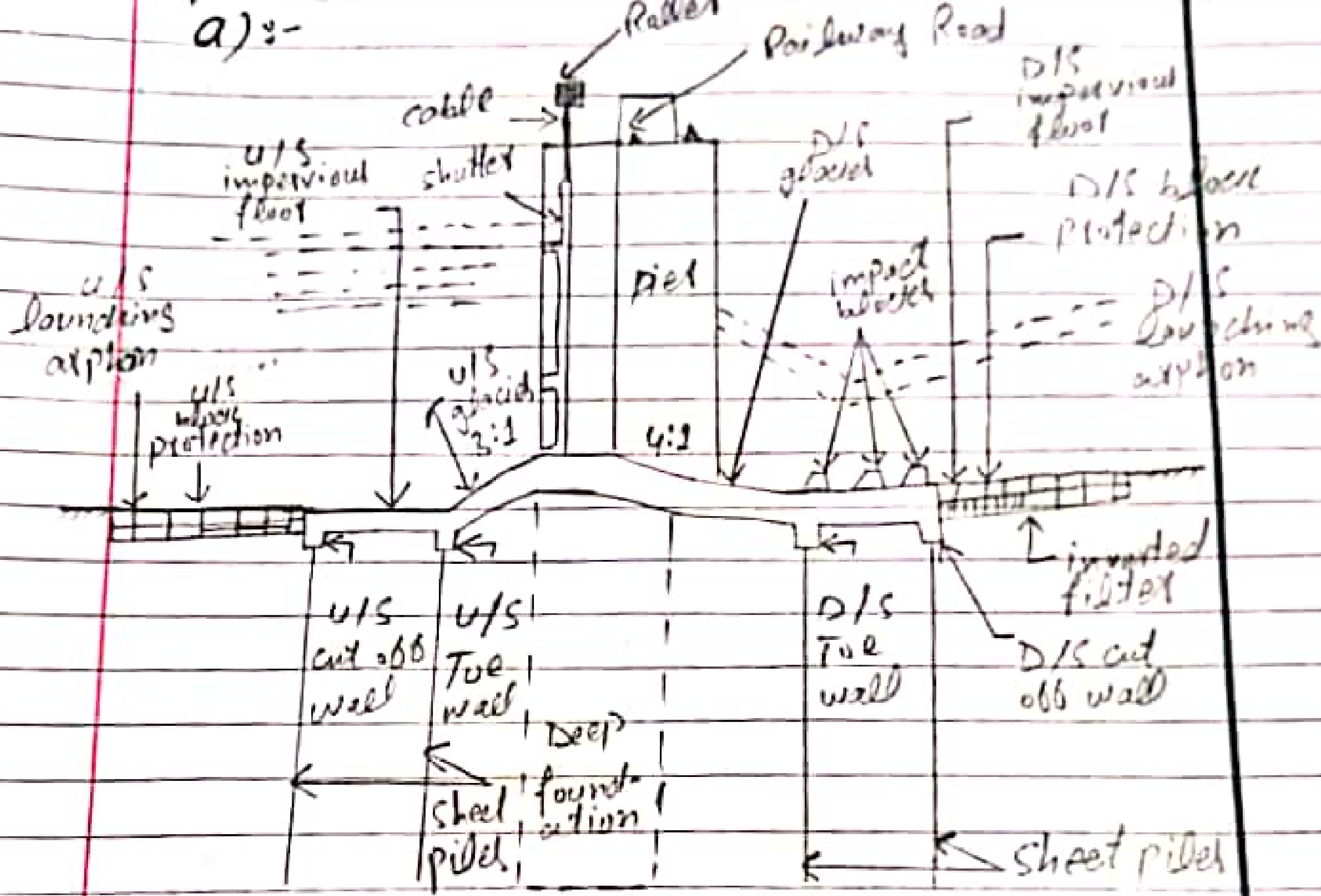
sketch of barrage:-

QNo 3:-

a):-



b:- Scour depth under bridge:-

If the contracted width (i.e bridge length L) is less than the regime width, w (equation normal depth DN. under the bridge is given by:-

$$D_N = R_s (w/L)^{0.61}$$

where Rs is the regime Scour depth in a single-span bridge (no piers) with a straight approach is about 25% more than the normal scour. whereas in the case of a multiplispan structure with a curved approach reach it is 100% more than normal scour.
If the construction is predomiant the maximum Scour depth is the maximum.

$$D_{max} = R_s (w/L)^{1.56}$$

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QNo 4:-

Given data:

$L.L = 1.5\ kip/ft^2$

$D.L = 300\ lb/ft^2 = 0.3\ kip/ft^2$

$\theta = 30°$

$\gamma = 100\ lb/ft^3 = 0.1\ kip/ft^2$

mix Design = 1:2:4 = M_{15} = 15Mpa

= 2175 psi = 2.17 kips

= $26\ kip/ft^2$

Solution:-

(1) Load calcultation

self wt of slab = $0.3 \times M_{15}(1:2:4)$

$= 0.3 \times 26 = 7.8\ kip/ft^2$

Total wt carrying slab = self wt + D.L + L.L

Total wt or load = $7.8 + 0.3 + 1.5 =$ $9.6\ kip/ft^2$

(2) coefficient of earth pressure

$$Ka = \frac{1-\sin\theta}{1+\sin\theta} = \frac{1-\sin 30^\circ}{1+\sin 30^\circ} = 0.33$$

(3) Lateral pressure due to D.L + L.L

Total vertical Load (L.L + D.L) x Ka

$= (1.5 + 0.3) \times 0.33$

$= \boxed{0.60\ kip/ft^2}$

(4) Lateral pressure due to soil $= Ka\gamma h$

$= Ka\gamma h$

$= 0.33 \times 0.1 \times 15.3$

$= \boxed{0.50\ kip/ft^2}$

(5) Lateral pressure at Top =

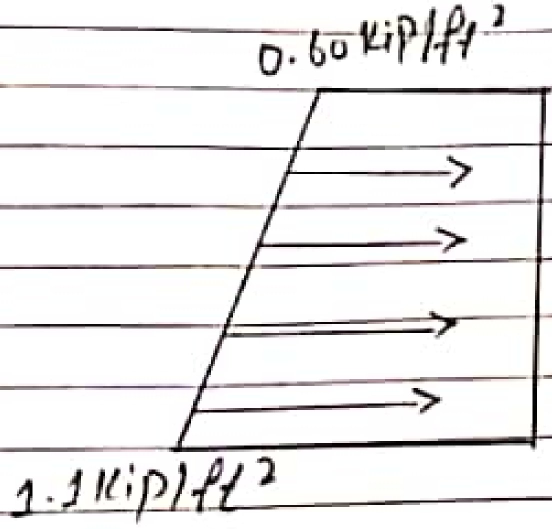
(D.L + L.L) Ka

$= (0.3 + 1.5) \times 0.33 = \boxed{0.60\ kip/ft^2}$

(b) Lateral pressure at bottom

= Lateral pressure Top + Lateral pressure Soil

0.60 + 0.50 = **1.1 Kip/ft²**



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