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Section : B

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Paper : Hydraulic Structure

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Q 1:-

Part (a)

Differentiate b/w culvert and causeway.

culvert	causeway
→ Culvert of a tunnel shape carying a stream of water under a road or railway.	→ A causeway of course a raised road, it is built on an embankment.
→ It works as a bridge to pass an it.	→ It is supported mostly by earth or stone.
→ It is normally uses for natural flow of water for controlling it.	→ And it is not a bridge because it support a roadway b/w piers.

Q 1:-

Part (b)

=> Cross Drainage work:

Cross Drainage work is a structure carring the discharge from a natural stream across a canal intercepting the stream.

=> Necessary:

It is required to dispose of the drainage water so that the canal supply water remains uninterrupted.

⇒ Types:

Some types of cross drainage are following.

1) Adequate:

It carries an irrigation canal over a drain.

2) Super Passage:-

It carries a drain an irrigation canal.

3) Level Crossing:-

This structure makes it possible to dispose off drain

water safely at same level as that of a canal.

4) Inlet and outlet :-

when possible drain water is taken in the canal to be discharged afterwards into a drain at suitable location.

5) Economic consideration:

The cost of construction of cross drainage works should be justified with respect to the project cost and over all benifits of the project.

6) Discharge of the drainge:-
Practically the discharge of the drainage is very uncertain in rainy season. So, the structure should be carefully selected so that it may not be destroyed due to unexpected heavy discharge of the rivers or drainage.

7) construction Problem:-
Different types of constructional Problems may arise at the site such as sub soil water, construction materials, communication, availibility

of land etc so the type of works should be selected according to the site condition.

Q No 2:

Part (a)

weir & Barrage:

Ans:-

weir:-

It is impervious barrier which is constructed accross a river to raise the water level on the up stream side is known as a weir. Here, the water level is raised

up to the required height and the surplus water is allowed to flow over the weir. Generally it is constructed across an inundation river.

Barrage :-

when adjustable gates are installed over a weir to maintain the water surface at different levels at different time is known as a barrage. The water level is adjusted by operating the gates or shutters. The gates are

Supported on piers at both ends. The distance b/w the pier to pier is known as Bay.

Q2:- Part (B)

Reynold's Number:

The Product of density times length divided by viscosity coefficient.

This is proportional to the ratio of initial forces and viscous forces in a fluid flow.

=> Laminar Flow:-

The flow in a Pipe is laminar if the reynolds number is less than 2100.

=> Turbulant Flow:-

If the Reynolds number is greater than 4000 Then it is turbulant.

=> Neither laminar / turbulant flow:-

when the Reynolds number is b/w 2000 and 2800, the flow is neither laminar nor turbulant.

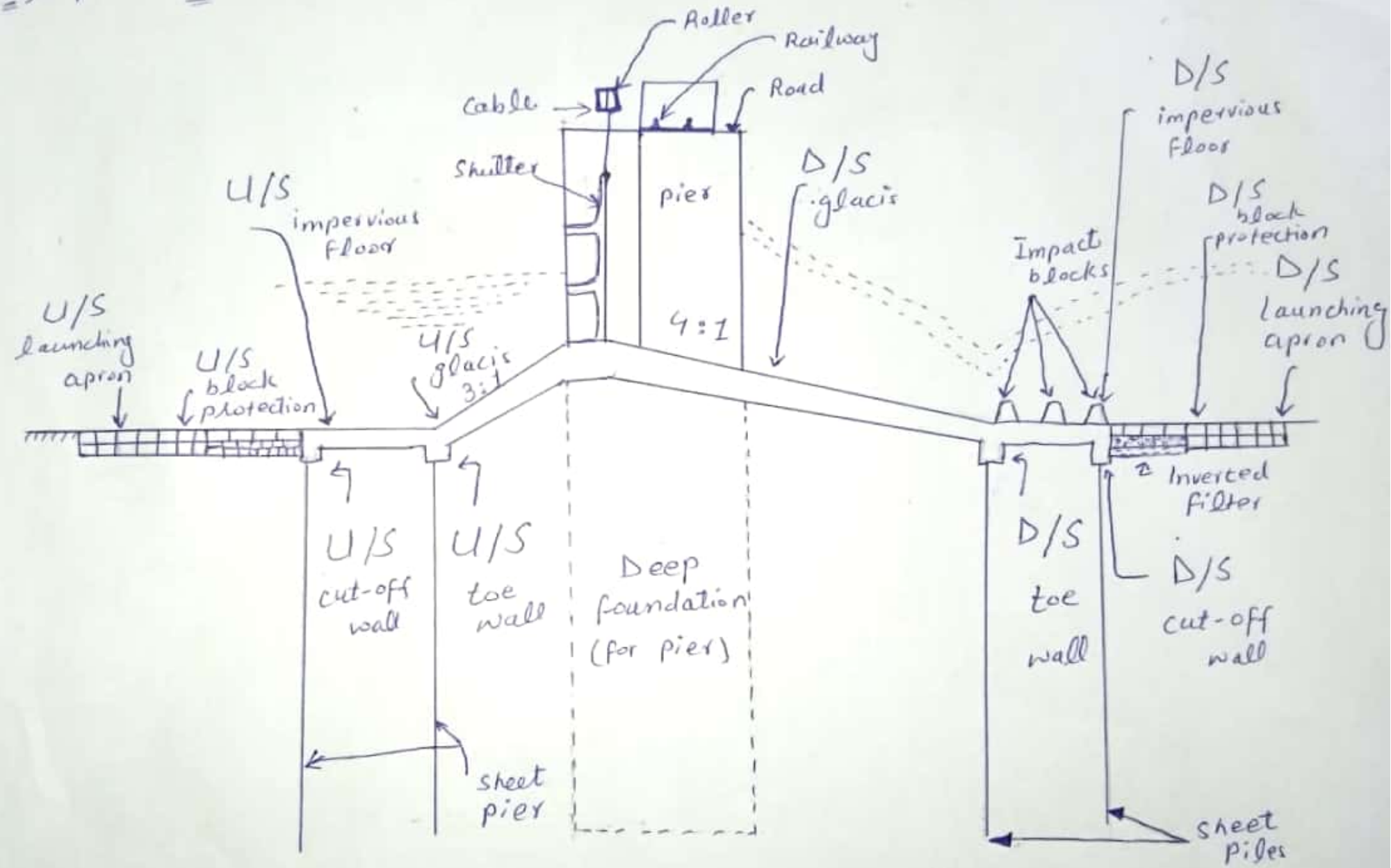
=> lower critical velocity:-

The velocity at which flow drainges from laminar to transition is called lower critical velocity.

=> Higher critical velocity:-

The velocity at which flow changes from transition to turbulant as called Higher critical velocity.

Q3) Part (A)



Component parts of barrage

Q3:-

Part (b)

Ans:- several formulae based on experimental have been proposed to predict the maximum or equilibrium source depth below general bed level around bridge piers in general, these assume the relationship.

$$y/b = \phi(y/b, Fr, d/b)$$

Laursen's (1962) experimental results underestimate the scour depths, compared to many indian experimenti (Inglis, 1949) which suggest the formula (approach flow is normal to the bridge piers)

$$Y/b^2 = 4.2\,(Y/b)^{0.76}\,Fr^{0.52}$$

Predicts the maximum equilibrium scour depth.

in a relatively deep flow a first-order estimate of (clear) local scour (around pier) may be obtained by.

$$Y = 2.3\,K\,b$$

The flow penetrates the covering layers, triggering its disintegration the disintegration of the covering layer may at times take places only in the downstream direction, leaving a

Stepped scour Just upstream of The Pier followed by a further local Pier scour at its bottom The steeped scour depth in The covering layer, H, is given by.

$$H = n(y_2 - y_1)$$

x x

Q No. 4:

=> Given Data:

L.L = 1.5 kip/ft²

D.L = 300 lb/ft²

Q. 30°

unit weight of soil = 100 lb/ft³

Dimension = 15' x 15'

fy = 60 ksi Steel

concrete = 1:2:4 = M15

Sol:-

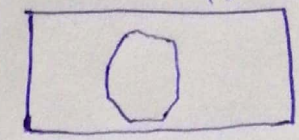
① Load calculation:

Total load on Top = Self wt + L.L + D.L

Self wt = 3 x 15 = 45 kN/m²

45 KN/m² = 0.939 Kip/ft²

"Consider thickness is 0.92m"



0.92 m or 3 feet

w = Total load =

= 1.5 + 0.939 + 0.3

$$w = 2.739 \text{ Kip/ft}^2$$

(2) Coefficient of earth Pressure:-

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

$$Ka = 0.33$$

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

= Total vertical load (LL + DL) x Ka

= (1.5 + 0.3) 0.33

= 0.594 Kip/ft² or 28.4 KN/m²

Lateral Pressure due to soil.

$= Ka \times \gamma_{soil} \times h$

$= 0.33 \times 0.1 \times 18$

$= \boxed{0.59 \text{ Kip/ft}^2}$ or $\boxed{28.4 \text{ KN/m}^2}$

Lateral Pressure at top.

lateral Pressure due to (L.L + D.L)

$= \boxed{0.594 \text{ Kip/ft}}$ or $\boxed{28.4 \text{ KN/m}^2}$

at Bottom: lateral Pressure due to (L.L + D.L) + lateral Pressure due to soil

$= 0.594 + 0.594$

$= \boxed{1.188 \text{ Kip/ft}^2}$ or $\boxed{56.88 \text{ KN/m}^2}$