I.D :- 7278

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PAPER :- Hydraulic Structure

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Q1-

(a) Differentiate b/w culverts & cause way?

Ans CULVERTS:-	CAUSE WAY:-
Culvert is of a tunel shape carrying stream of water under a road or railway. T	A cause way is of course a raised road, it as built on an am bankment.
It works as a bridge to pass on it	It is supported mostly by earth or stone.
It is normally uses for natural flow water for controlling it.	And it is not a bridge because it support a road way between piers

b) Ans CROSS DRAINAGE 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 drainage like rivers, streams, nallahs etc at different point with in the command area of the project. The crossing of the canals with such obstacle cannot be avoided. So suitable structures must

be constructed at the crossing point. for the easly flow of water of the canals & drainage in the respective direction.

NECESSITY of CROSS DRAINAGE works:-

- The water-shed canals do not cross natural drainages. But in actual orientation of the canal network the idea condition may not be available & obstacles like natural drainage may be present across the canals so the cross draing e works must be provided by running the irragation system.
- At the crossing point, the water of the canals & the drainage get intermixed. so for smoth running of the canal with its design discharge the cross drainage works are required.
- The site condition of a crossing point may be such that with out any sutiable structure, the water of canals & drainage can not be diverted to their natural directions. so the cross drainage works 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 & canal intersection each other of the same level)
  - (a) level crossing
  - (b) Inlet & outlet.

Type I :-

• 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 drainage water passes clearly below the canal.

• SIPHON AQUEDUCT :-

In a hydraulic structure where the canal is taken over the drainge, but the drainage water cannot pass clearly below the canal It flow under siphonic action. so it is know as siphon aquenduct The structure is suitable when the bed level of canal is below the highest food level.

TYPE II

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 full ~~canal passes~~ 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 irrigation canal but the canal water passes below the drainage under siphonic action is known as below the full supply level of canals.

TYPE III

LEVEL CROSSING:-

When the bed level of canals & the stream are approximately the same & quality of water in canal & stream is not much different the cross drainage work constructed is called level crossing where water of canal & stream is allowed to mix with the help of regulators both in canals & stream.

Water is disposed through canal & stream in required quantity. level crossing consists of following components
(i) crest wall ~~wall~~ (ii) stream regulator
(iii) canal regulator.

INLET & OUTLET:-

when irrigations canal meets a small stream or drain at same level drain is allowed to enter the canal as inlet. At some distance from this inlet points a part of water is allowed to drain as outlet which eventually meets the original stream. stone pitching is required at the inlet & outlet are also protected by stone pitching This types of CDW is called Inlet & out let.

Q No. 2:-

(a) Differentiate between weir & barrage?

Ans WEIRS:-

1) High set crest
2) Ponding is done against the raised crest or partly against crest partly by shutters.
3) shutters in parts height.
4) Shutters are of smaller height, 2m.
5) No control of river in low floods

6) Excessive afflux in high floods

BARRAGE:-

1) low set crest.
2) Ponding is done by means of gates.
3) Gated over entire height.
4) Gates are of greater height
5) Perfect control on river flow
6) High floods can passed with minimum afflux

Q2 (b)

Ans REYNOLD NUMBER:-

The reynolds number is defined as the product of density times velocity times height divided by the viscosity coefficient. This is proportional to the ratio of inter-ial forces & viscous forces (forces resistant to change the heavy & gwey forces in a fluid flows.

LIMIT of REYNOLD NUMBER for Liminar & turbulent flow:-

The reynold number is used to study fluid as they flow. The reynold number determines wheather a fluid flow is a laminar or turbulent. flowing fluid normally follow

along stream lines. If a flow is laminar fluid will move along smooth stream lines. If the flow is turbulent these stream lines break up & fluid will move in an irregular manners. The flow in a pipe is neither laminar nor turbulent when reynold number is between 2000 & 2800.

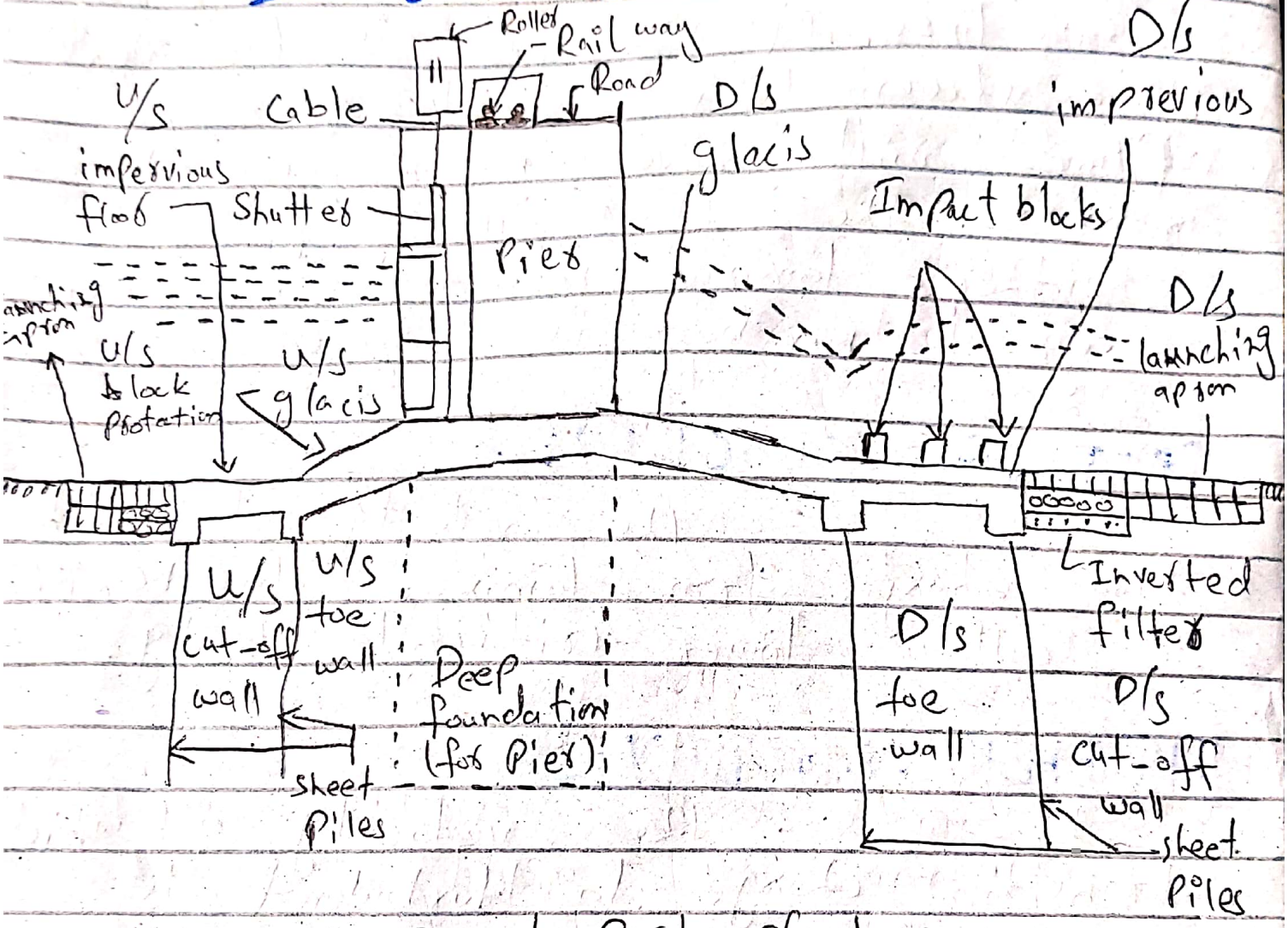
CRITICAL VELOCITY:-

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

HIGHER VELOCITY:-

The velocity at which transition change to turbulent is called higher velocity.

Q No. 3:→ SKETCH of BARRAGE & ITS COMPONENTS:→



Component Parts of barrage

Q3(b) SCOUR DEPTH UNDER THE BRIDGE:-

If the contracted width (i.e the bridge length L) is less than the regime width, W (equation) (9.9)) the normal scour depth D_N under the Bridge is given by

$$D_N = R_s \left(W/L\right)^{0.61}$$

where R_s is the regime scour depth.

The maximum scour depth in single-span bridge (no piers) with a straight approach (case I) is about 25% more than the normal scour given by equation where in the case of a multispan structure with a curved approach reach it is 100% more than the normal scour

If the constriction is predominant, the maximum scour depth is the maximum of case 2, or value given by

$$D_{max} = R_s \left(W/L\right)^{1.50}$$

Q4

Ans GIVEN DATA:-

L.L = 1.5 kip/ft²

D.L = 300 lb/ft²

θ = 30°

unit weight of soil = 100 lb/ft²

Dimension = 15' x 15'

fy = 60 ksi steel

Concrete = 1 : 2 : 4 = M15

D = 0.92 m thickness

Sol:-

(1) load:-

Total load on top = self weight + L.L + D.L

self weight = 3 x 15 = 45 kN/m²

45 kN/m² = 0.939 kip/ft²

w = 1.5 + 0.939 + 0.3

w = 2.739 kip/ft²

(2) Coefficient of Earth Pressure:

$$k_a = \frac{1-\sin\theta}{1+\sin\theta}$$

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

$$\boxed{k_a = 0.331}$$

(3) Lateral Pressure due to (Dead load + live load)

= total verticle load x ka

= (L.L + D.L) x ka

= (1.5 + 0.3) x 0.33

$= 0.594 \text{ kip/ft}^2$

or

28.4 kN/m^2

4 lateral pressure due to soil:

$= ka \times \gamma soil \times h$

$= 0.33 \times 0.1 \times 18$

$= 0.594 \text{ kip/ft}^2$

or

$= 28.4 \text{ kN/m}^2$

(5) lateral pressure at top due to L.L + D.L $= 0.594 \text{ kip/ft}^2$

$= 28.4 \text{ kN/m}^2$

(6) lateral pressure at Bottom:

lateral pressure due to (L.L + D.L) + lateral pressure due to soil

$= 0.594 + 0.594$

$= 1.188 \text{ kip/ft}^2$ or

$= 56.88 \text{ kN/m}^2$