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SECTION : A

MODULE : 8^{TH} SEMESTER

INSTRUCTOR : ENGG. ADEED KHAN

(Q1)

(a)

Culverts	Causeway
① Small bridge having total length of span 6m or less than it between the faces of abutment-	① Bridge having its floor flush or little above the bed of the stream which allows flood water to pass always over its floor-
② Permanent drainage structure, constructed to carry roadway or railway track over small streamed or canals-	② Natural width of stream carrying little or no water. through out the year-
③ It is normally used for natural flow of water for controlling it-	③ It is not a bridge because it supports a roadway between piers-

(Q1)

(b)

Cross Drainage Work:

Definition: A cross drainage work is a structure carrying the discharge from a natural stream across a canal intercepting the stream. Canals comes across obstructions like rivers, natural drains and other canals. The various type of structures that are built to carry the canal water across the above mentioned obstructions or vice versa are called cross drainage works.

Necessity Of Cross Drainage Works:

CD works are required to dispose of the drainage water so that the canal supply remains uninterrupted. The canal at a cross drainage work is generally taken either over or below the drainage. However, it can also be at the same level as the drainage.

It is not possible to avoid the drainages in the initial reach of a main canal because it takes off from a diversion headworks located on a river which is a valley. In this initial reach the canal is usually a contour canal and it intercepts a number of natural drainages flowing from the watershed to the river. After the canal has mounted the watershed, no cross-drainage work will normally be required, because all the drainage originate

from the watershed and flow away from it. It maybe necessary for the canal to leave the watershed for a short distance where the watershed takes a sudden small loop and it is not possible to align the canal along the loop.
In that case, the canal intercepts the drainages which carry the water of the pocket between the canal and the watershed and hence the cross-drainage works are required.

Types Of Cross Drainage Work:

There are three types of cross drainage works structures:

Type-1: Cross Drainage Work carrying canal over the drain:

The structures falling under this type are:

⇒ Aqueduct:

In an aqueduct the canal bed level is above the drainage bed level so canal is to be constructed above drainage.

⇒ Syphon Aqueduct:

In a syphon aqueduct, canal water is carrier above the drainage but the high flood level (HFL) of drainage is above the canal through, the drainage water flows under syphonic action.

Type - 2 : Drainage Over Canal:

⇒ Super Passage: Super Passage structure carries drainage above canal as the canal bed level is below drainage bed level. This is simply a reverse of Aqueduct structure.

⇒ Canal Syphon:

In a canal syphon, drainage is carried over

canal similar to a super passage but the full supply level of canal is above than the drainage trough.
This structure is a reverse of Syphon Aqueduct.

Type - 3: Drainage Admitted into canal

In this type, the silt clearance and maintainance of canal water becomes really difficult.

⇒ Level Crossing:

When the bed level of canal is equal to the drainage bed level, then level crossing is to be constructed. This consists of following steps:

1. Construction of weir to stop drainage water behind it.

2. Construction of canal regulator across a canal.

3. Construction of head regulator across

a Drainage-

⇒ **Canal Inlets:**

In a canal inlet structure, the drainage water to be admitted into canal is very less. The drainage is taken through the banks of a canal at inlet. Hence this type of structure is rarely constructed.

⟷

(Q2)
(a)

Weir and Barrage:

Following is the comparison between weir and barrage:

Weir	Barrage
⇒ A low dam built across a river to raise the level of water upstream or regulates its flow.	⇒ Artificial barrier across a river to prevent flooding aid irrigation to generate electricity by tidal power.
⇒ Weir has crest	⇒ Barrage has low crest.
⇒ Weir shutter in part length has height of 2M	⇒ Barrage gates over Entire length and greater height.
⇒ In Weir shutters are dropped to pass flood.	⇒ Gates are raised clear off the high flood.

Weir	Barrage
⇒ No control of river in low floods	⇒ Perfect control on river flow.
⇒ Operation of shutter is slow and take more time	⇒ In Barrage gates convenient to operate.
⇒ Weir excess Afflux in high flood.	⇒ Barrage has very minimum Afflux problem.
⇒ Raised crest causes silting upstream.	⇒ Less silting upstream due to low crest.

(Q2)
(b)

Reynold's Number:

Reynolds number is the ratio of inertial forces to viscous forces. The Reynolds number is a dimensionless number used to categorize the fluid systems important in controlling the velocities or flow pattern of a fluid.

Mathematically:

$$N_{Re} = \frac{\rho v d}{\mu}$$

Limit for Laminar Flow:

Whenever the reynold's number is less than about 2000, flow in a pipe is generally laminar.

Limit For Turbulent Flow:

Whenever the reynold's

number based on diameter of the pipe is greater than 4000 is reffered to known as turbulent flow.

⇒ The flow is

↳ Laminar when $Re < 2300$

↳ Turbulent when $4000 < Re$

⇒ The flow in a pipe is neither laminar nor turbulent when reynold number is between 2000 and 2800.

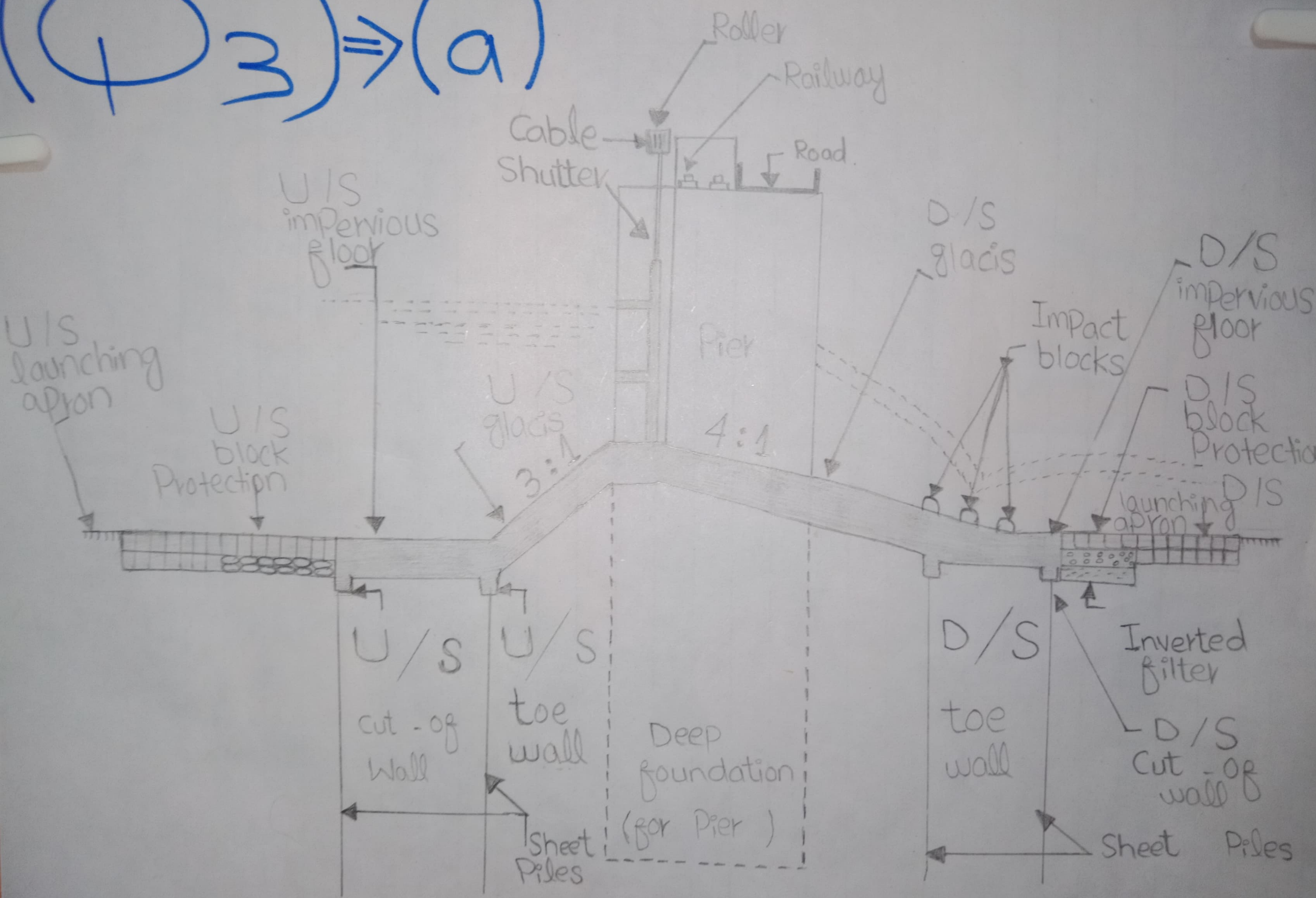
Lower Critical Velocity:

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

Higher Critical Velocity:

Velocity in which flow enters from transition period to turbulent flow is known as upper or higher critical velocity.

(Q3) ⇒ (a)



Component Parts of barrage

(Q3)
(b)

Scour Depth:

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

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

Where R_s is the regime scour depth.

The maximum scour depth in a single span bridge (no piers) with a straight approach (case 1) is about 25% more than the normal scour given by equation, whereas in the case of a multispan structure with a curved approach reach (case 2) it is 100% more than the normal scour, If the construction is predominant, the maximum scour depth is the maximum of case 1 or case 2, or the value given by

$$D_{max} = R_s \left(\frac{\omega}{L} \right)^{1.56}$$

Q NO: 4
ANS:

GIVEN DATA :-

L.L = 1.5 kip / ft^2.

D.L = 300 lb / ft^2

Unit weight of soil = 100 lb/ ft^2.

Dimensions = 15' x 15'

fy = 60 ksi Steel

Concrete = 1:2:4 = M15

D = 0.92m thickness.

SOLUTION:-

① Load:

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

Self weight = 3 x 15 = 45 KN/m^2

45 KN = 0.939 kip / ft^2

W = 1.5 + 0.939 + 0.3

W = 2.739 Kip / ft^2

(2) Coefficient of Earth pressure:-

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

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

$$\boxed{Ka = 0.33}$$

(3) Lateral pressure due to (Dead load + live load):

= Total vertical load x Ka

= (LL + DL) x Ka

= (1.5 * 0.3) x 0.33

= 0.594 Kip/ft².

OR :-

= 284 KN/m²

(4) Lateral pressure due to Soil :-

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

$= 0.33 \times 0.1 \times 18$

$= 0.594$ Kip / ft^2.

OR

$= 28.4$ KN / m^2

(5) Lateral pressure at top due to L.L + DL

$= 0.594$ kip / ft^2

$= 28.4$ KN / m^2

(6) Lateral pressure at Bottom:

= Lateral pressure due to (LL + DL) + lateral pressure due to soil.

$= 0.594 + 0.594$

$= 1.188$ kip / ft^2

OR:

$= 56.88$ KN / m^2.