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Section	NO # B
Paper	Hydrualic Stoucture
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University => Iqra National university Peshawer Hyatabad phase II

QNo(1)(a):

(1) Culvert

The culvert is a Structure that constructed below the Roadway. The main purpose of culvert is to pass the Rainwater / Flood up to design limit safely.

- Culvert can be in form of pipe or Small bridge.

- it can be circular, square or in arch shape.

- it is constructed from concrete or Rainforced concrete.

(2) Causeway

=> The causeway is a Section of road or Railway Track across the Water ~~body~~. body. In this Section the road or Railway track level or Raised.

it can be constructed in the form of of berm or embankment.

The construction material can be earthfill, wood or concrete.

QNo(2)(b):.

Cross Drainage Work

- Cross drainage work structure is constructed on natural drain or canal.
- The main purpose of cross drainage water is to seperate the drain water from canal water.

① Types of Cross Drainage Works.

Depending upon the Relative level & discharge, cross Drainage work may be classified as follows.

(1) Canal Over Drainage :-

This type is used to when High flood level is less than full supply level.

it can be in two types.

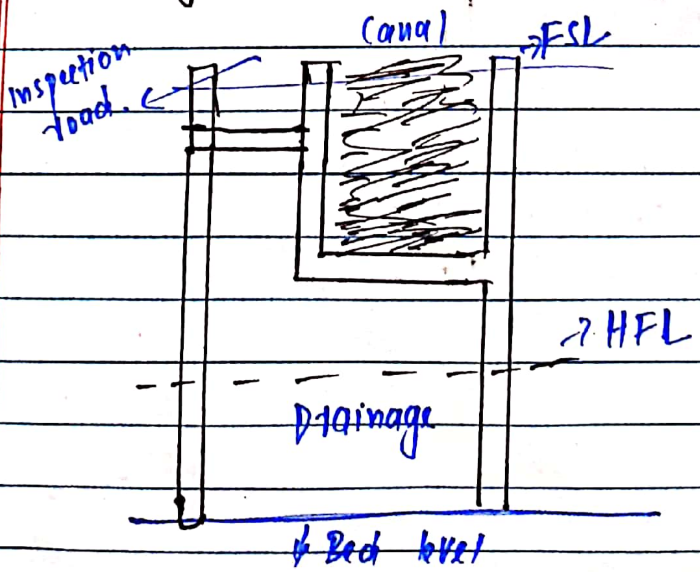
(a) Aqueduct.
(b) syphon Aqueduct.

(a) Aqueduct.

⇒ In an Aqueduct, the canal bed level is above the drainage bed level. So canal is above the drainage.

⇒ It is similar to bridge.

(1) Figure :-

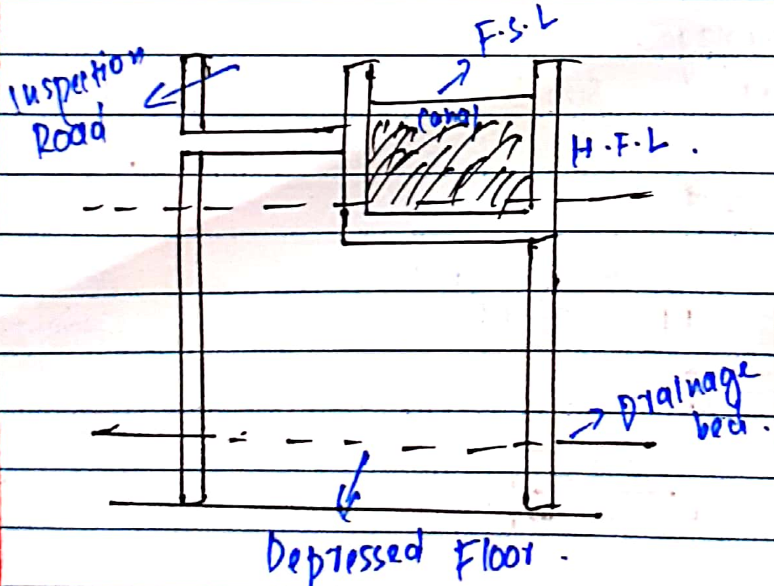


① Syphon Aqueduct ①.

⇒ In this canal water is above the Drainage but the High flood level is above the canal bed.

⇒ it is more costly and have better performance than simple Aqueduct.

⇒ Figure:



(2) Drainage Over Canal ①.

This type of cross Drainage works is constructed when H.F.L > F.S.L.

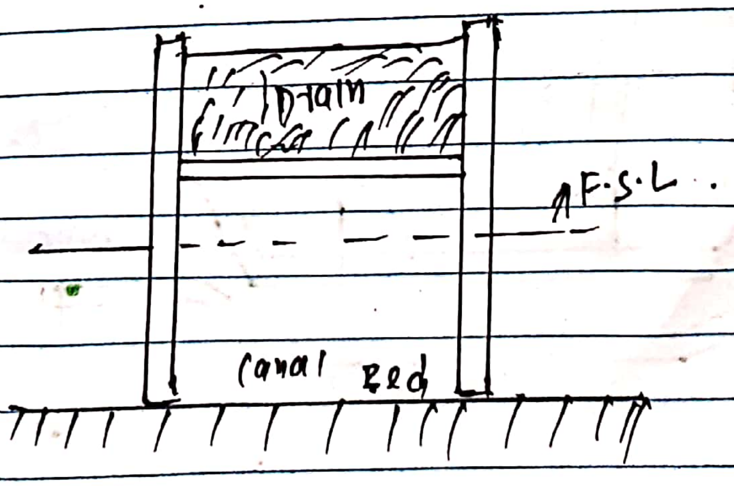
it has two types
(a) super passage.
(b) canal syphon.

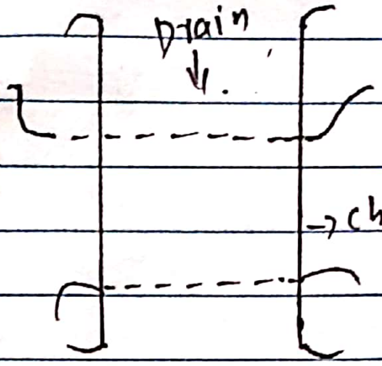
H.F.L ↓ High Flood level
F.S.L ⇒ Full supply level.

(a) super passage ①.

In super passage, the drainage channel is above the canal. but F.S.L is below the drainage channel bed.

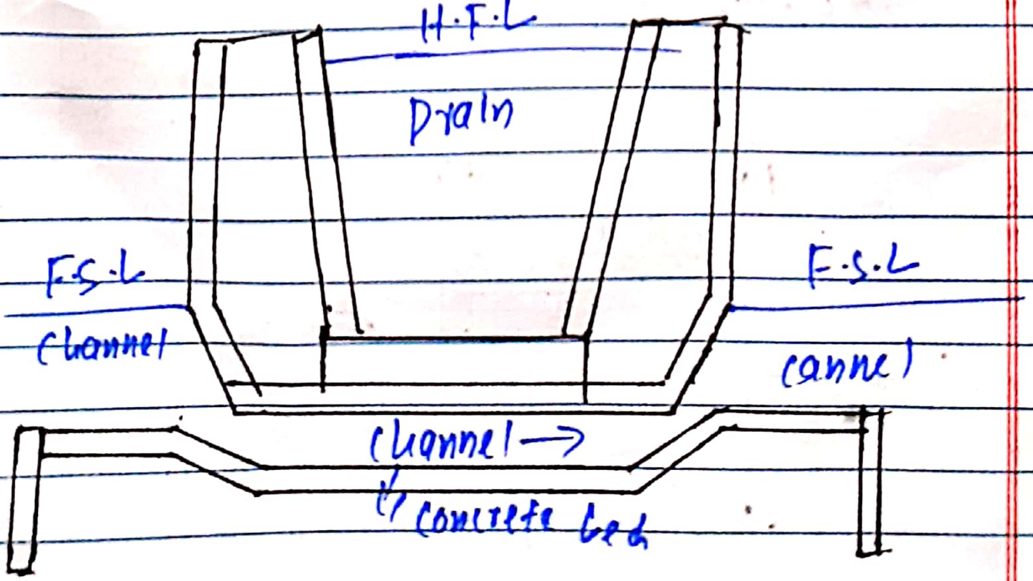
① Figure ①.





(b) Canal syphon :->.

This is similar to ~~two~~ the super passage but in this the channel Full supply level is above the drainage channel bed. As shown in Figure.



(3) Drainage admitted into canall's.

This used when H.F.L = F.S.L.
it have two types.

(a) level crossing.
(b). canal crossing.

(a) level crossing.

This is constructed the bed of Bota drainage channel and canal are level.

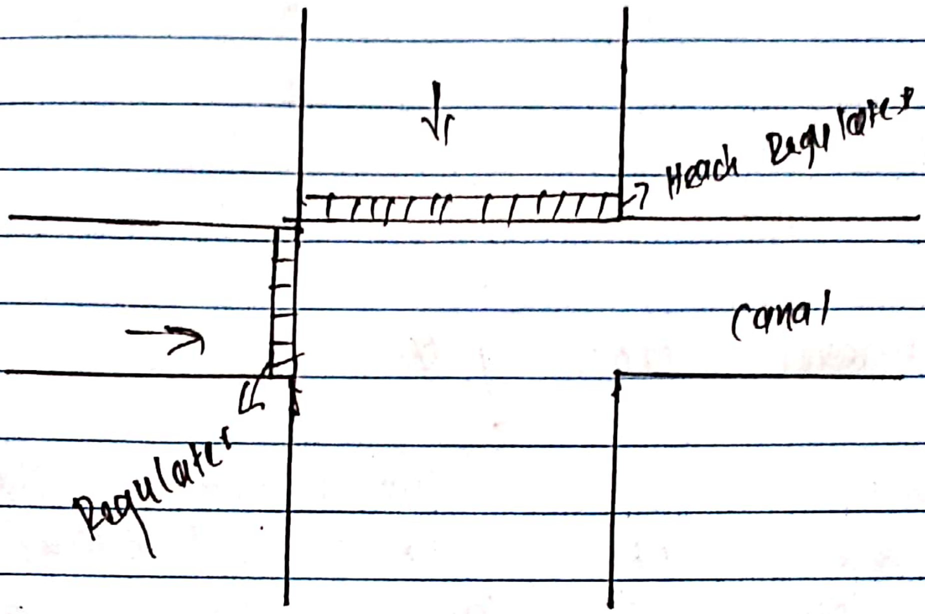
To construct level crossing following three steps are used.

(1) construction of Weir
(2) construction of canal Regulater
(3) construction of head Regulater.

The construction of weir is used to stop drainage water.

During peak supply both the Regulaters are open to clear the Drainage water.
After clearing Drainage

Water head Regulator have be enclosed.



Canal Inlets.

In a canal inlet structure, the drainage water is to be discharge into canal b/c it is very less. The drainage water is then taken out through the outlet where suction pressure is created by pumps.

⇒ The disadvantage of this type is that it may be pollute that canal water.

Q NO (02) (a):-

⊛ Weir ⊛.

A Weir is a barrier across the horizantal width of a river that alters the flow characteristics of the water and usually results in a change in a vertical height of the river level.

⊛ Barrage ⊛:.

A barrage is a type of low- head, diversion dam which consist of a number of large gates that can be opened or closed to control the amount of water passing through, this allows the structure to regulate and stabilize river water elevation upstream for use in irrigation and other system.

Weir	Barrage.
① High set crest ponding is done against the raised crest or partly again crest & partly by shutters	① Low set crest
② Shutters in part length.	② Ponding is done by means of gates
③. Shutters are of smaller height, 2m	③ Gated over entire length.
④. No control of river in low floods	④ Gates are of greater height.
	⑤ perfect control on river flow.

QNO (02) (b)

(⊕ Reynold's Number ⊗.

A dimension quantity used to find out the flow direction in different fluid flow situation.

It can also be defined as Ratio of Inertial force to viscous force.

Mathematically, the ~~Re~~ Reynolds number is defined as.

$$N_{Re} = \rho u D/\mu = \rho D/\nu.$$

Where.

ρ = is the density of the fluids (SI units : kg/m3).

U = is the diameter flow speed (m/s).

D = is the diameter of the tube (m).

μ = is the dynamic viscosity of the fluid (pa-s or N-s/m² or kg/m-s).

V = is the Kinematic Viscosity of the fluid (m²/s).

The Reynold's Number is used to determine

Whether a fluid is in laminar or turbulent flow. it is assumed that a Reynold's number less then or equal to 2,200 Indicates laminar flow, and a Reynold's number greater than 2100 indicates turbulent flow.

laminar flow - $N_{Re} < 2100$
Transition ~~Critical~~ flow - $N_{Re} > 2100$ and $N_{Re} < 4000$
Turbulent flow - $N_{Re} > 4000$

① Critical Velocity ①

The velocity at which the flow Transition occur from laminar to turbulent is known as critical velocity.

① Lower critical Velocity ①.

A Velocity at which laminar flows stops.
or
The velocity at which the flows enters from laminar to transition period.

There is a transition period in b/w laminar & turbulent flow. it has been experimentally found that when a laminar flow changes into turbulent, it does not change abruptly. But there is transition period b/w two types of flows.

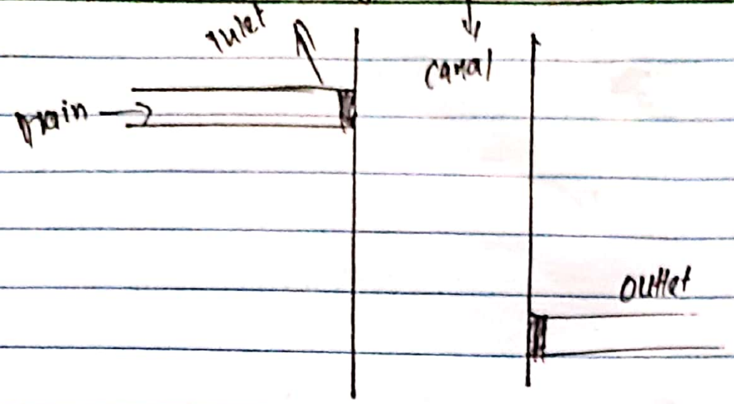
Upper Critical Flow

A Velocity at which turbulent flow starts.

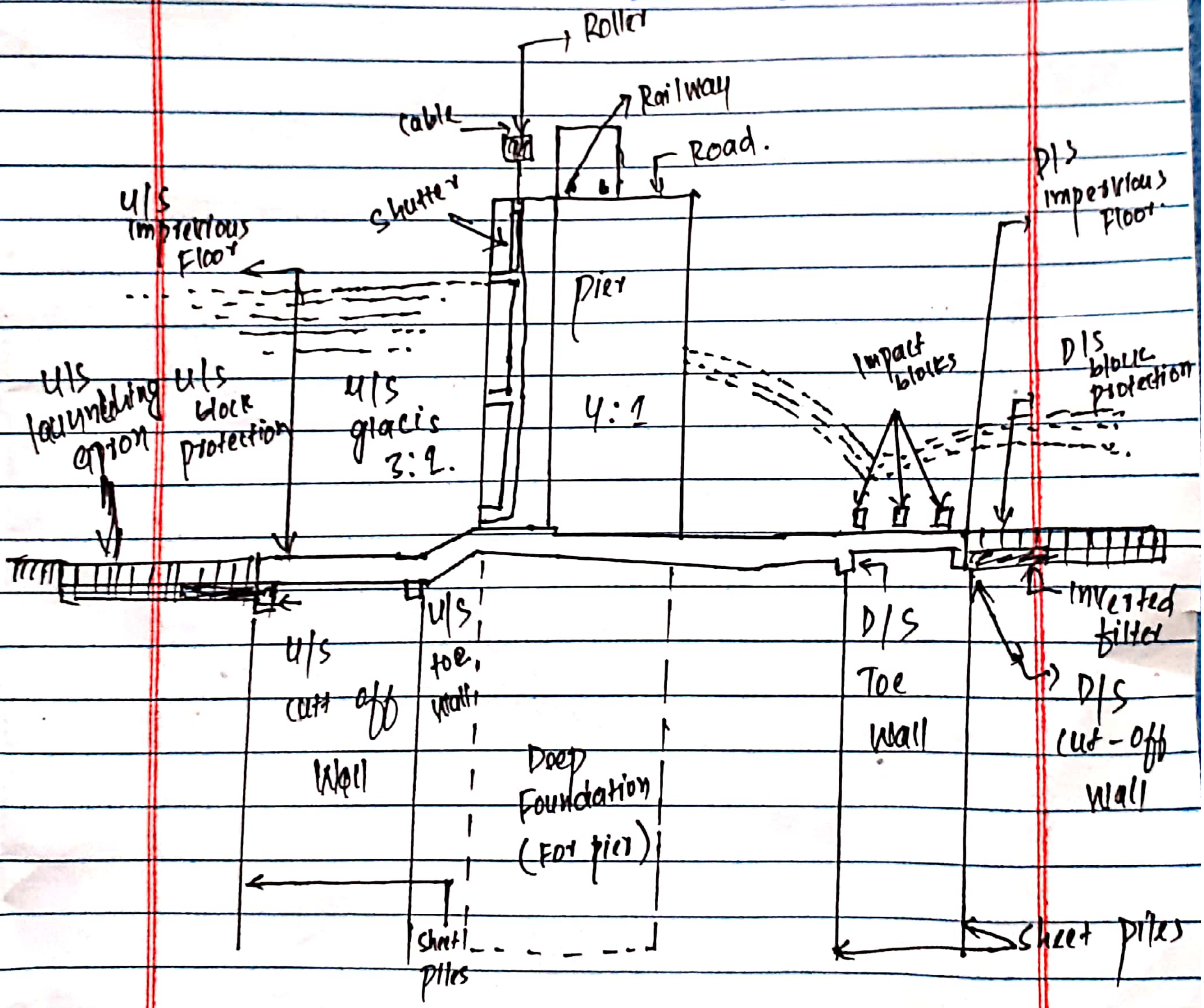
or

Velocity at which transition changes to turbulent.

Figure ·



Q NO (03) (a): Sketch of Barrage



Components parts of barrage.

Day: M T W T F S Date:__/__/__

Q NO (03(part (b) ·).

Once again, the best estimate will be achieved with the appropriate co-efficient for flow depth, alignment etc. ~~The~~ (see Breusers & Raud kivi (1991) for further information). The live bed, however, contributes to an appreciably reduced local scour depth. if the sediment bed is distinctly layered and the covering layer is of a thickness less than the local scour depth the overall scouring phenomenon is quite different.

The flow penetrates the covering layer, triggering its disintegration. The disintegration of the covering layer may at times take place 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 stepped scour depth in the covering layer, H, is given by

$$H = \eta(y_2 - y_1).$$

Where y_1 and y_2 are the uniform flows depths over a flat bed of grain roughness corresponding to the upstream surface particles (d_1) and the underlying surface fine particles (d_2) respectively. the coefficient for non-ripple-forming sediments $\eta = 2.6$ for design purposes. The total scour depth may lead to a gross underestimate if the lowler layer is of very fine material (which may go into suspenshion)

Several formulas based on experimental results have been proposed to predict the 'maximum' 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 Froude Number.

Laursen's (1962) experimatal results underestimate the scour depth, compared to many India experiements (Ingils 1949) which suggest the formula .

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

The India Field data also suggest that the scour depth should be taken as twice the regime scour depths.

In the case of live beds the formula.

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

predict the maximum scour depth.

In a relatively deep flow a first - oder estimate of local scour may be obtained by

$$Y_0 = 2.3 K_\alpha b'$$

where K_α = angularity co-efficient which is a function of the Piers

Q No (4):-

Given Data:-

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

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

$\theta = 30^\circ$

unit weight of soil = $100\ lb/ft^3$

Dimension = 15' x 15'

f_y = 60 KSI Steel.

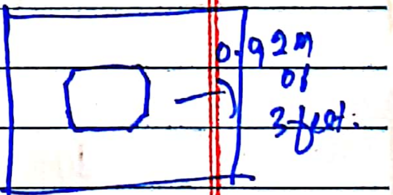
concret = 1:2:4 = M_{15}.

Sol:- (1) Load calculation.

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

Self wt = 3x15 = 45 KN/m^2

45 KN/m^2 = 0.939 kip/ft^2



W = total load = 1.5 + 0.939 + 0.3.

$$\boxed{W = 2.739\ kip/ft^2}$$

(2) Co-efficient of earth pressure:

~~$K_a = 0.33$~~ $K_a = \frac{1-\sin\theta}{1+\sin\theta}$

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

$\boxed{K_a = 0.33}$

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

= Total Vertical load (L.L+D.L) x Ka.

$= (1.5+0.3) \times 0.33$

$\boxed{= 0.59\ kip/ft^2}$ or $\boxed{28.4\ kN/m^2}$

lateral pressure due to soil.

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

$= 0.33 \times 0.1 \times 18$

$\boxed{= 0.59\ kip/ft^2}$

Or

$\boxed{28.4\ kN/m^2}$

Lateral pressure at top.

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

= 0.59 kip/ft or 28.4 kN/m²

⊛ 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

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