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Subject: Hydraulic Structure

Q No: 1

Culvert

Culvert is transverse Channel under a road or railway for the draining of water

Causeway

Causeway is a road that is raised as to be raised water, marsh land etc.

i) Cross drainage works

Irrigation canal while carrying water from headworks to crop field have to cross few natural drainages stream, nallahs etc. to cross those drainages safely by the canals. Some suitable structures are required to construct works required to construct to cross the drainage are c/d cross drainage works.

Why it is nessecary

① the water shed canals do not cross natural drainage. but it actual oreintation of the canal network. this ideal condition may not available and the obstacle like natural drainage may be present across the canal

(2) At the crossing point water of the canal and the drainage get intermixed so for the smooth running canal with its designs discharge the cross drainage work are ~~required~~ required

(3) the site condition of the crossing point may be such that without any suitable structure the water of the canal and drainage can not be diverted to their ~~channel~~ natural direction. So the cross drainage work must be provided to maintane their natural direction flow.

Types of cross drainage

Type 1 = irrigation canal passes over drainage
① Aqueduct
② ~~Sti~~ Siphon Aqueduct

Aqueduct:-

the hydraullic structure in which the irrigation canal is taken over drainage is known as aqueduct this structure is suitable when bed level of canal is above the highest flood level drainage. in this case the drainage water passes clearly below canal

Siphon Aqueduct:

the hydraullic structure in which the the canal is taken over the drainage but the drainage water cannot p pass Clearly below the Canal. It flow under siphonic action. So it is Known as Siphon ~~Aqt~~ Aqueduct. the Structure is Suitable the bed level of Canal is below the highest flood level.

Types II: (Drainage passes over the irrigation Canal)

① Super passage
② Siphon super passage

Super passage:

the hydraulic Structure in which the drainage is taken over the irrigation Canal is Known as Supper passage. the Structure is Suitable the bed level of drainage is above full supply level of the Canal. the water passess clearly below the drainage

Siphon Super passage

the hydraulic Structure in which the drainage is taken over the irrigation Canal but the Canal Water passes below the drainage under Siphonic action is Known as Siphon Supper paccage. the bed level of drainage is below the full supply level of the Canal.

Types III: (Drainage and Canal intersect each other at the Same level)

① Level Crossings:

When the bed level of canal and the Stream are approximately the Same and quality of water in Canal

and stream is not much different the cross drainage work constructed is c/d level crossing
level crossing consist of following components
(1) crest wall (2) stream regulator (3) canal regulator

(2) inlet and outlet
when irrigation canal meet a small stream or drain at same level, drain is allowed to inter the canal as in inlet. At some distance from the inlet point a part of water is allowed to drain as outlet.
the bed and banks b/w inlet and outlet are also protected by stone pitching. this type of CDW is c/d inlet and outlet

Differentiate b/w weir and barrage

Weir	Barrage
① low cost	① high cost
② low controll on flow	② relatively high controll on flow and water levels by operation of gates.
③ No provision for transport communication across the river	③ usually a road or a rail bridge can be convenientally and economicaly combined with a barrage wherever nessecary.
④ Chances of silting on the upstream is more.	④ Silting may be controlled by judicial operation of gates
⑤ Afflux created is high due to relatively high weir cross	

Reynold number:

It is the ratio of ~~inter~~ inertial forces to viscous forces the reynolds number is the dimensionless number used to categorized the fluids system in which effect on viscosity is important in controlling the velocities.

NRe.

It is also found that a flow in pipe is laminar if the reynold number is less than 2100 is laminar and if greater than 4000 is turbulent.

Reynold number neither laminar nor turbulent when reynold number is ~~less th~~ ~~less than~~ ~~2000~~ b/w 2000 and 2800 ~~more than 2800~~

lower critical velocity

the velocity at which the flow enters from laminar totranistion period is known as lower critical velocity

higher critical velocity

the velocity at which flow enters from turbulent totranistion period is known as ~~cri~~ high critical velocity

CL No: 3

Barrage component

(a) Guide bank

Guide bank direct the main river bank flow as centrally as possible to the diversion structure. they also safeguard the barrage from erosion and may be desined. so that a desirable curvature is induced to the flow for silt exclusion from the canals. the side slope of the guide bank must be protected by stone pitching with a sufficient self launching apron at the lowest feasible level.

(b) Wings ~~walls~~ walls:

Wing walls flanking the barrage end supporting the abutting earth bunds are desined a retaining walls. cut of walls below the wing and abutment walls at both sides. in addition to upstream and downstream sheet pile cut off across the river form and enclosed compartment providing good weir foundation condition

(c) Gates.

gates used on barrage are the same type as those used on spillway crest vertical lift and tainter gates are most frequently used to controll the flow rate over the crest of a barrage. the discharge capacity of a gated crest depends on the condition of free or submerged flow below the gate

d) Regulators

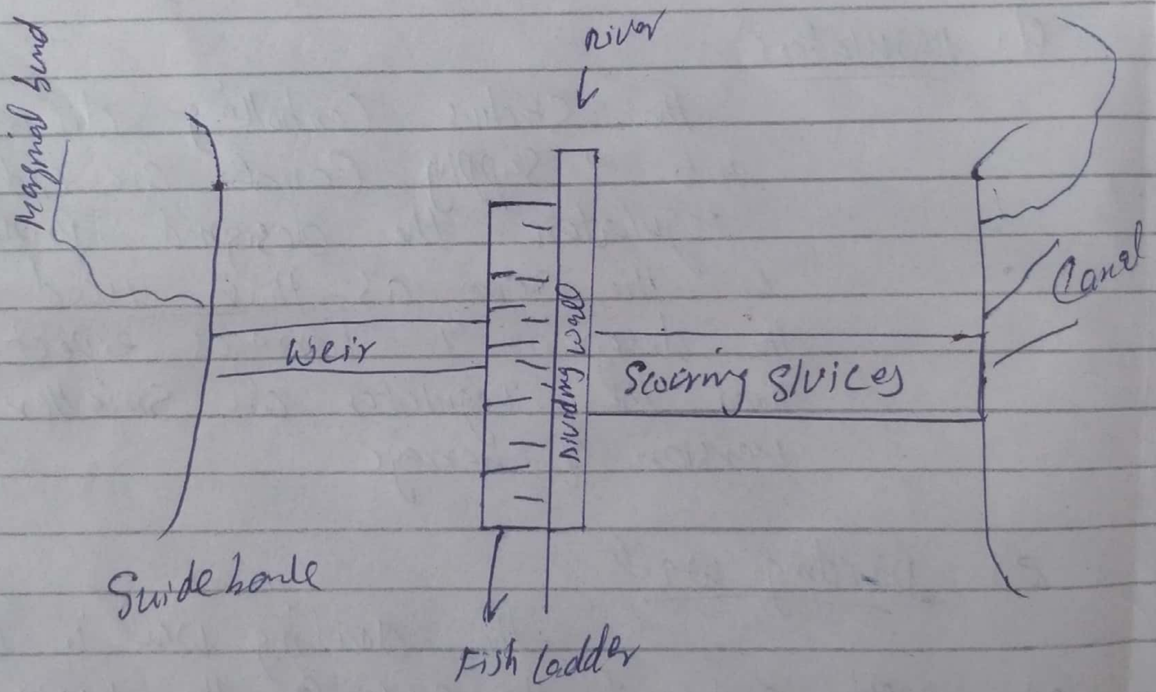
the structure controlling diversion into a supply canal. are c/d regulators. the designed principal is the same as those used in the designed of barrages expect that the regulator are smaller version of barrage.

e) Dividing wall

the dividing wall is built at right angles to the axis of the weir separating the weir and the undersluices. It is usually extends upstream beyond the begening of the regulator and downstream to the launching apron. the sluice bay floor level is generally kept as low as possible to create pool conditions and the dividing wall separate the two floor level of the weir

(9) Weir block and stilling basin

The weir block of the barrage is designed either as a gravity structure or as non-gravity structure it may be different form thinner, resist the uplift bending) e.g sloping weir with stream and downstream glacis a vertical drop weir, or ogee weir or labyrinth weir.



QNO:3 (ii) Predicted equations for local scour depth

Empirical equations that were devolped on bridge pier scour attempted to predict eqillibrium scour depth using the various variable.

Fluid Properties:
density, kinematic viscocity, temp
which is not a primary concern in the lab

Time:
Scour is the temporal process

Flow properties:
water depth, energy slope, shear stress
in uniform flow angle of attack,

Pier Characteristics: pier diameter, shape, surface
condition, pier condition

Scour around bridge piers

Several formula based on experimental result have been proposed to predict the maximum or equilibrium scour depth around bridge pair in general these assume relationship

$$y_s/b' = \phi(y_0/b', F_r, d/b')$$

Where b is the pier width, y_0 is the upstream flow ~~size~~ depth, d is the sediment size and F_r is the flow froud number
Laursen experimental result underestimate the scour depth, compared to many indian experiment which suggest the formula

$$y_s/b' = 4.2(y_0/b')^{0.78} F_r^{0.52}$$

the indian field data also suggest that the scour depth should be taken as twice the regime scour depth in the case of live beds the formula

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

predicts the maximum equilibrium scour depth in a relatively deep flow a 1st-order estimate may be obtained by

$$y = 2.3 K a^b$$

Q NO: 4

Given data

dimension = 15ft x 15ft

L.L = 1500 lb/ft^2

D.L = 300 lb/ft^2

① Load:

Total loads on top slap = Self wt + L.L + D.L

Self wt of top slap = 0.3 x 750 = 225 lb/ft^2

W = total load = 225 + 1500 + 300 = 2025 lb/ft^2

② Co-efficient of earth pressure

$$K_0 = \frac{1 - \sin\theta}{1 + \sin\theta} = \frac{1 - \sin 300}{1 + \sin 300} = 13.92$$

13.92

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

= total vertical load (L.L + D.L) x K_a

=> (300 + 1500) (13.02)

= 25056 lb/ft^2 = 25.056 kip/ft

Lateral Pressure due to Soil = $K_a \gamma h$

$= 13.92 \times 100 \times 16$

$= 22272.1\ lb/ft^2$

$= 22.2\ kip/ft^2$

Lateral Pressure @ top = lateral pressure due to (D.L + L.L)

$= 25.056\ kip/ft^2$

Lateral Pressure @ bottom.

$= 25.056 + 22.2$

$= 47.256\ kip/ft^2$