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Section B
7758
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Hydraulic structures
Assignment 1

Ans "Stage discharge relationship for a conterete rectangutay box welvert?

Given Data?

Width = 1.4m
Height = 0.9m
Legth = 26m
Slope = 1:1000
manning, n = 0.013
Square edged entrance, ke = 0.5
Rang = 0-3m

"Solution"

H/D ≤ 1.4m
H = 0.9m

Discharge is given by,

$$Q = 2.92\, y_0 \left[1.2 y_0 / 1.2 + 2 y_0\right]^{2/3} A$$

y_0 (m)	Q ($m^3 s^{-1}$)	y_c (m)
0.3	0.299	0.166
0.6	0.785	0.317
0.9	1.330	0.451

By putting values of "y_0" we will get the corresponding discharge.

- $Q_1 = 2.92(0.3)\left[1.2(0.3)/1.2+2(0.3)\right]^{2/3}$

  $= 0.299\ m^3/s$

- $Q_2 = 2.92(0.6)\left[1.2(0.6)/12+2(0.6)\right]^{2/3}$

  $= 0.785\ m^3/s$

- $Q_3 = 2.92(0.9)\left[1.2(0.9)/12+2(0.9)\right]^{2/3}$

  $= 1.330\ m^3/s$

"Critical depth"

$$y_c = (q^2/g)^{1/3} \quad \text{—— "A"}$$

$$q = Q/B \quad \text{—— "B"}$$

By putting values in eq "B"

$$q_1 = Q_1/B = \frac{0.299}{1.4} = 0.213$$

$$q_2 = Q_2/B = \frac{0.785}{1.4} = 0.561$$

$$q_3 = Q_3/B = \frac{1.330}{1.4} = 0.95$$

Now by putting values in eq "A"

$$y_{c_1} = \left(\frac{q_1^2}{g}\right)^{1/3} = \left(\frac{(0.213)^2}{9.81}\right)^{1/3} = 0.166m$$

$$y_{c_2} = \left(q_2^2/g\right)^{1/3} = \left(\frac{0.561^2}{9.81}\right)^{1/3} = 0.317m$$

$$y_{c_3} = \left(q_3^2/g\right)^{1/3} = \left(\frac{0.95^2}{9.81}\right)^{1/3} = 0.451$$

At the inlet overy a short ramp

"$H = Y_0 + \frac{V^2}{2g} + K_2 \cdot \frac{V^2}{2g}$"

$V_1 = 1.1428 m/s$

<u>So,</u>

$H_1 = Y_{0_1} + \frac{V^2}{2g} + K_e \frac{V_2}{2g}$

$= 0.3 + \frac{(1.142)^2}{2(9.81)} + 0.5\left(\frac{(1.142)^2}{2(9.81)}\right)$

1 $= \boxed{0.399m}$

$H_2 = 0.06 + \frac{(1.142)^2}{2(9.81)} + 0.5\left(\frac{(1.142)^2}{2(9.81)}\right)$

$= \boxed{0.699m}$

$H_3 = 0.9 + \frac{(1.142)^2}{2(9.81)} + 0.5\left(\frac{(1.142)^2}{2(9.81)}\right)$

$= \boxed{0.999m}$

Y_0 (m)	H (m)	[redacted] (m^3/s)
0.63	0.399	0.288
0.6	0.699	0.785
0.9	0.999	1.330
orifice 1.2 D"	1.08 →	1.477 by interpolation

"2" $H/D \geq 1.4$

"a", for orifice flow,

$$Q = Cd\,(1.4 \times 0.9)\left[(2g(H - D/2)\right]^{1/2}$$

$$Q = 0.62(1.4 \times 0.9)\left[(2(9.81)(1.08 - \frac{0.9}{2})\right]^{1/2}$$

$$\boxed{Q = 2.746\ m^3/s}$$

Scanned with CamScanner

The fallowing result are obtained

H (m)	Q ($m^3 s^{-1}$)	X (m)
1.08	2.746	20.9

no orifice flow exists

"B" For Pipe Flow the energy equation gives,

$$H + S_0 L = D + H_c$$

where,,

$$h_1 = k_e \frac{V^2}{2g} + (V n)^2 \frac{L}{R^{4/3}} + \frac{V^2}{2g}$$

Thus =

$$Q = 2.08 (H - 0.57)^{1/2}$$

During rising stages the barrel flows full from H = 1.08 m and during falling stages the flow becomes free-surface flow when H = 0.999 m.

The following table summarize the result?

H(m)	Q (m³/s)	Types of flow
Rising stages		
0.399	0.299	open channel
0.699	0.785	open channel
0.999	1.330	open channel
1.080	1.477	Pipe flow
2.000	2.487	Pipe flow
3.000	3.242	Pipe flow
Falling stages		
2.000	2.487	Pipe flow
1.080	1.477	pipe flow
0.999	1.330	pipe flow
0.699	0.785	open channel
0.399	0.299	open channel

LOADS ON BRIDGE Foundation Due scouring-:

Maximum amount of load to cause failure in fandation. The folldown can not be expected due to inadequate Beearing capacity but by seorning and leading of motes Joints of well foundation. The meseared moments due to MBG loading would Grade more bending sheen in the steing Sspeuty in the cap and setining in the Jumstion. In the event of talive of well foundation the well lap made of stone masmasp would be Joind in bending.

MECHANGIN AND WORKING

A sgrintant amount of work has been londucted on bridge sroun. Such thought can be classifed into two major categares.

(1) Science
(2) Enginering

Engineering Mechanigin-:

The enginerring mechnigin of bridge foundation is based of its caminution teachiging.

The 6No of bar are driven to the well and camenttud to the well cap and pier by dowel bars world the become fush same have opinel that enven in the Event of failure of well the damb bars amount to well cap upto haight of 1.70m above the well GD would given rise to a lot of friction and Prevent the Pier from lolapsing friction would geonete when there is normal rechain Perpendiclar to the moment of Pier.