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7758
SECTION B
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Hydraulic Structures

Assignment

Ans "Stage disshange relationship for a contesle rectangutag box welvast ?

Given Data ?

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

"Solution"

H/D < 1.4m
H < 0.9m

Discharge is given by

$$Q = 2.99 \, y_0 \left[1.2 y_0 / 1.2 + 2y_0 \right]^{2/3} - A$$

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

By Putting values of =e% we will get the corresponding discharge.

- $Q1 = 2.92(0.3)\left[1.2(0.3)/1.2+2(0.3)\right]^{2/3}$

  $= 0.299\ m^{3}/3$

- $Q2 = 2.92(0.6)\left[1.2(0.6)\right]/12+2(0.6)^{2/3}$

  $= 0.785\ m^{3}/5$

- $Q3 = 2.92(0.9)\left[1.2(0.9)/12+2(0.9)\right]^{2/3}$

  $= 1.330\ m^{3}/5$

"Critical depth"

$Y_c = (q^2/g)^{1/3}$ ___ "A"

$q = Q/B$ ___ "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'

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

$Y_{c_2} = (q_2^2/g)^{1/3} = \left(\frac{0.561^2}{9.8}\right)^{1/3} = 0.317m$

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

At the inlet over a short reach:

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

$V_1 = 1.1428 \, m/s$

<u>SO,</u>

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

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

$H_1 = \boxed{0.399 \, m}$

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

$= \boxed{0.699 \, m}$

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

$= \boxed{0.999 \, m}$

X_o (m)	H (m)	Q ($m^3 s^{-1}$)
0.3	0.399	0.299
0.6	0.699	0.785
0.9	0.999	1.330
orifice > 0.9 "1.2D"	1.08 →	1.477 By interpolation

"2" $H/D \geq 1.4$

"a", For orifice flow.

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

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

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

The following results are obtained

H (m)	Q ($m^3 s^{-1}$)	y_o (m)
1.08	2.746	> 0.9

→ no orifice flow exists

"b" For pipe flow the energy equation gives.

$$H + S_o L = D + h_2$$

where,

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

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 summarizes the result:

H (m)	Q (m^3/s)	Type 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 Seouring :-

Maximum annout of loael to care farlive in fanlation. The fallountion can not be expecteal due to indequate Becaning capecity but by seosming and leading of moter Jounts of well foundtion. The meseasel moments due to MBG loading world. Great more bending shesn in the steing sepesting in the cap and setining in the Jumstion. In the event of talion of well foundation the well lap made of stone masmasp would be Joindin bending.

Mechanisin And working

A sgrintant amound of work has been leanductal on bridge srow. such thought can bedassifeal into two major categares.

① science
② Engineering

Engineering Mechanigin:

The engineering mechnigin of bridge coundation is based or its counnation teachiging.

The 6No of bar are driven to the well and comentfund to the well cap and Pier by doul bars world the becom such some hawe opiral that enven in the Event of failure of well the dowlls bars amount to well cap upto hight of 1.70m above the well bod, would given rise to a lot of frichun and Prevent the Peir from lolapasing frichuion would germute when there is noomd rechain Perpendular to the moment of Pier.