

Assignment No # 02

submitted by
Hanif Ullah

ID 7684

section
B

subject
hydraulic structure

date
03/07/2020

submitted to
Engr. Adeed

Q1

Establish the stage discharge relationship for a concrete rectangular box culvert use suitable data your own choice.

Given Data:

$$\text{Height} = 0.35 \text{ m}$$

$$\text{Depth} = 0.3 \text{ m}$$

$$\text{width} = 1.2 \text{ m}$$

$$\text{Length} = 40 \text{ m}$$

$$\text{slope} = 1 \text{ in } 1000$$

$$\text{minning} = n = 0.0013$$

0.3m ~~and~~ neglect the velocity approach.

required:

design of culvert = ?

Solution:-

First of all we find
H/D ratio

① $H/D \leq 0.35$ i.e. for open
channel

$$H/D = 0.35 / 0.3 = 1.16 < 1.2$$

Free open channel condition

② critical depth

$$y_c = \frac{2}{3} H = \frac{2}{3} (0.1) = 0.067 \text{ m}$$

③ critical ~~depth~~ velocity.

$$V_c = \sqrt{g y_c} \quad \text{which come}$$

from

$$Fr = \frac{V_c}{\sqrt{g y_c}}$$

for critical flow

$$Fr = 1$$

so

$$1 = \frac{V_c}{\sqrt{g y_c}}$$

$$V_c = \sqrt{g y_c} =$$

put value

$$V_c = \sqrt{9.81 \times 0.06}$$
$$= 0.19 \text{ m/sec}$$

④ critical slope P_c

$$S_c = 0.00424$$

⑤ discharge = Q

as we know that

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

y_0	y_c	y_c
0.1	0.057	0.06
0.2	0.165	0.124
0.3	0.3	0.185

$$y_c = \left(\frac{q^2}{g} \right)^{1/3}$$

at the inlet over short reach

$$H = y_0 + \frac{v^2}{2g} + K_e \frac{v^2}{2g} \quad \text{--- (1)}$$

entrance loss coefficient
 K_e is follow

- ① For square edge = 0.5
 ② Flat = 0.25
 ③ Rounded = 0.05

So we used $K = 0.25$
 for rectangular box
 culvert

So the K value 0.5
 put in equation 1

Y_0	H	Φ
0.1	0.119	0.057
0.2	0.2	0.165
0.3	0.3	0.3
For orifice $H/D > 1.2$	0.4	0.9

the above discharge is find through following formula:

$$Q = C_d (1.2 \times 0.6) \left[2g \left(H - \frac{D}{2} \right) \right]^{1/2}$$

here

C_d = co-efficient discharge and

its value is 0.62

From energy equation discharge find from this formula

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

Q2

describe load on bridge foundation due to Scour and their working mechanism?

Ans

load on bridge foundation due to Scour and the working mechanism

Scour of sediments around bridge foundation by the stream is the most significant contributing factor for bridge failure.

The scour failure tend to occur without prior warning and have led to fatalities and

and economic loss every year. A significant amount of work has been conducted on bridge scour. Such effort can be broadly classified into two major categories namely science driven and engineering driven.

① Science driven

The science driven research focuses on understanding the scour mechanism and aims to explain the cause of scour due to different factors.

② Engineering driven

Engineering driven

Focuses on estimation,
monitoring and
countermeasures of bridge
scour.
