

Assignment # 02

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Section # B

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Subject # Hydraulic Structure.

Q No 01

Given data

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

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

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

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

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

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

0.3 neglected the velocity approach.

Required

Design of culvert = ?

Solution

First of all we find H/D ratio

$$\textcircled{1} \text{ H/D} \leq 1.2 \text{ for open channel}$$

$$\text{H/D} = \frac{0.35}{0.3} = 1.6 < 1.2$$

Free open channel condition.

(2) Critical depth

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

(3) Critical velocity

$V_c = \sqrt{gy_c}$  which come from

$$Fr = \frac{V_c}{\sqrt{gy_c}} \quad \text{for critical flow}$$

$$Fr = 1$$

$$1 = \frac{V_c}{\sqrt{gy_c}}$$

$$V_c = \sqrt{gy_c} \Rightarrow \sqrt{9.81 \times 0.067}$$

$$V_c = 0.19 \text{ m/sec}$$

(4) Critical slope

$$S_c = 0.00424$$

(5) dis charge @

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

$Y_0$	$\phi$	$Y_c$
0.1	0.57	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.

$$H = Y_0 + \frac{v^2}{2g} + \frac{K_e v^2}{2g} \quad \text{--- (1)}$$

entrance loss co-efficient  $K_e$  is follow

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

We used  $K_e = 0.5$   
for rectangular box culvert.

So The  $K_e$  value 0.5 put the  
in equation L

$Y_0$	$H$	$Q$
0.1	0.119	0.057
0.2	0.2	0.165
0.3	0.3	0.3
1.2	0.4	0.9

For orifice

$$H/D \geq 1.2$$

The above discharge is found through following formula.

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

$Cd$  = coefficient

discharge and its value is 0.62

from energy equation discharge

find from this formula.

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

Q No 02

Describe loads on bridge ~~due~~ foundation due to scour and their working mechanism?

Answer:-

Scour is an erosional process that can occur in rivers due to the interaction between any type of structure located underwater and the river flow. It is by far the leading cause of bridge failure worldwide, resulting in significant direct losses and disruption to road network, petrol etc.

Bridge scour is the removal of sediment such as sand and gravel from around bridge abutments or piers. Scour caused by swiftly moving

water can scoop out scour holes, compromising the integrity of a structure.

## Working mechanism

① The science driven research focuses on understanding scour mechanism and aims to explain the cause of scour due to different factors.

② Engineering driven focuses on estimation monitoring and counter measure of bridge scour.

Scour of sediment around bridge foundation by the system is the most significant contributing factor for bridge failure. The scour failure tend to occur without prior warning and have led to fatalities and economic loss every year.

Bridge Scour has been an important subject of interest to people from the time -