

Iqra National University Peshawar

ID 7727

Name Waqar Ul Muq

Department BE (civil)

Section 'B'

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Subject Hydraulic structure

Submitted to Engr Aheed Khan

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Question # 1

Given data;

$$H = 0.48$$

$$D = 0.42$$

$$W = 1.5$$

$$L = 30 \text{ m}$$

$$\text{slope} = 1 \text{ in } 100$$

$$\text{Manning} = n = 0.0014$$

0-3 m neglect the velocity approach

Solution;

$$H/D = 0.48/0.42 = 1.14 < 1.2$$

* Free open channel condition

Critical depth;

$$Y_c = \frac{2}{3} H = \frac{2}{3} (0.15) = 0.1 \text{ m}$$

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

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$$V_c = \sqrt{9.81 \times 0.1}$$

$$V_c = 0.31 \text{ m/sec}$$

$$S_c = \frac{Vc^2}{R^{4/3}} = 0.00424$$

* Discharge ;

$$Q = 2.92 Y_0 \left[\frac{1.2 Y_0}{1.2 + 2 Y_0} \right]^{2/3}$$

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

$$q = Q/w$$

	Y_0	Q	Y_c
(1)	0.15	0.11	0.09
(2)	0.3	0.3	0.185
(3)	0.48	0.53	0.27

(3)

* At the inlet over short reach.

$$H = Y_0 + \frac{V^2}{2g} + \frac{K_e V^2}{2g}$$

Entrance loss coefficient K_e is follow

For square edge = 0.5

flat = 0.25

Rounded edge = 0.05

So, we used $K_e = 0.5$ for rectangular box culvert

$$H = Y_0 + \frac{V^2}{g} + K_e \frac{V^2}{2g}$$

	Y_0	H	$\frac{V^2}{g}$
(1)	0.15	0.17	0.11
(2)	0.3	0.32	0.3
(3)	0.48	0.47	0.53
		0.5	0.91

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For orifice $H/D = 1.2$

$$C_d = 0.62$$

$$Q = C_d (1.2 \times 0.62) (2g(H - d/2))^{1/2}$$

Energy equation discharge find through this equation

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

Question # 2

Answer ;

Source of sediment around bridge foundation by the stream is the most significant contributing factors for bridge failure. The source failure tend to occur without prior warning & have led to fatalities and economic loss every year. A significant

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1/2 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. The science driven research focuses on understanding the scour mechanism & aim to explain the cause of scour due to different factors. Meanwhile engineering driven research focuses on estimation, monitoring and counter measures of bridge scour.

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