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Submitted to; Engr - Adeed

Subject ; Hydraulic - Structure

Assignment ; 02

Question # 01

Q1; Establish the Stage discharge relationship for a concrete rectangular box culvert suitable data your own choice?

* Given data

$$H = 0.45$$

$$D = 0.40$$

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

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

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

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

0-3 m neglect the velocity approach

* Solution;

$$H/D = \frac{0.450}{0.4} = 1.12 < 1.2$$

* Free Open channel condition

(iv) Critical Depth;

$$Y_c = \frac{2}{3} H$$

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

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

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

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

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

* Discharge;

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

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

$$q = \frac{Q}{w}$$

	Y_0	Q	Y_c
1;	0.15	0.11	0.09
2;	0.3	0.3	0.185
3;	0.45	0.53	0.27

* 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 = 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	q
1;	0.15	0.17	0.11
2;	0.3	0.32	0.3
3;	0.45	0.47	0.53

For orifice $H/D = 1.2$ 0.5 0.91
 $C_d = 0.62$

$$Q = C_d (1.2 \times 0.6) (2g(H - d/2))^{1/2}$$

Energy equation discharge find through this equation

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

Q2; Describe loads on bridge foundation due to scour and their working mechanisms?

Ans; Scour of sediments around bridge foundation by the stream is the most significant contributing factor for bridge failure. The scour failures tend to occur without prior warning and have led to fatalities 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. The science driven research focuses on understanding the scour

mechanism and aims to explain the cause of scour due to different factors. Meanwhile engineering driven research focuses on estimation, monitoring and countermeasures of bridge scours.