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Section A

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Sessional Assignment

Problem:;

Given data:-

Dimension of concrete rectangular box culvert are;

$$\text{Width, } w = 1.2 \text{ m}$$

$$\text{Height, } H = 0.60 \text{ m}$$

$$\text{Length, } L = 24 \text{ m}$$

$$\text{Slope, } s = 1 \text{ in } 700 = 0.00143$$

$$\text{Manning's } n = 0.013$$

Range of head water level for investigation =  $0 - 3 \text{ m} = y_0$

Required data:-

Establish the stage-discharge relationship

Solution:-

We know that.

$$Q = A \times V \longrightarrow \textcircled{a}$$

According to Manning equation  
we have,

Area  $A = \text{width} \times \text{hydraulic depth}$

$$A = W \times y_0$$

$$A = 1.2 y_0 \longrightarrow \textcircled{b}$$

wetted perimeter = width  $\times 2$  [Hydraulic depth]

$$P = W + 2[y_0]$$

$$P = 1.2 + 2y_0 \longrightarrow \textcircled{c}$$

So,

$$R = \frac{A}{P}$$

$$R = \frac{1.2 y_0}{1.2 + 2y_0} \longrightarrow \textcircled{d}$$

Hence we get velocity which is;

$$V = \frac{l}{n} R^{2/3} \sqrt{S}$$

$$V = R^{2/3} \frac{\sqrt{S}}{n}$$

putting values we get;

$$V = \left[ \frac{1.2 y_0}{1.2 + 2 y_0} \right]^{2/3} \frac{\sqrt{0.00143}}{0.013}$$

$$V = 2.91 \left[ \frac{1.2 y_0}{1.2 + 2 y_0} \right]^{2/3} \rightarrow \textcircled{e}$$

By substituting eq<sup>n</sup> (b) and (e) we get.

$$Q = [1.2 y_0] \times \left[ 2.91 \left( \frac{1.2 y_0}{1.2 + 2 y_0} \right)^{2/3} \right]$$

So;

$$Q = 3.492 y_0 \left[ \frac{1.2 y_0}{1.2 + 2 y_0} \right]^{2/3} \text{ Ans.}$$

## Loads on bridge foundation due to Scour:-

Scour is one of the greatest reason that leads to bridge failure. In the United states more than 60% of the bridge failure happen due to Scour. Scour causes complex effects on bridge foundation and on the entire bridge structure.

Bridge Scour is the removal of sediment such as sand and rock from around bridge abutments or piers, which normally in the range of  $0-6.5\text{m}$ . Scour, losses the soil and reduces the bed level around the piers as well as due to erosion phenomena, it exerts

the bridge foundation.

Bridge is the design for a fixed and estimated bearing capacity of soil, but coz of scouring phenomena which reduces the bearing capacity of soil as a result bridge load over on the soil bearing capacity which cause failure of bridges.

### Mechanism of Scour:-

Vertex  
System formed in front of the obstruction, and has the form of horseshoe. River of the ~~vortex~~ flow and boundary condition give rises to the energy of the vertex increased shear stress. Commence local sediment transport.