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FS30

Assignment

Hydraulic Structure

Sir Engr Adced

Loads on Bridge foundation & their working mechanism.

⇒ Bridge scour is the removal of sediment such as sand & gravel from around bridge abutments. Scour is caused by the swiftly moving water. It can scoop out scour holes comprising the integrity of structure.

⇒ Bridge scour is one of the main cause of bridge failure. It has been estimated that 60% of all bridge failures results from Scour.

Mechanism of Scour:-

All the obstruction in form of Pier abutment or abutment the unidirectional flow changes into three dimensional as the water pile up in form face of the obstruction & flow accelerate around the nose.

This phenomenon results in formation of vortex. At the base of pier known as horse shoe vortex.

⇒ The pile up of water due to obstruction because of deceleration of flow due to stagnation pressure of water cause a downward flow result in horse shoe vortex.

Q2 Establish the stage discharge ---
use own data.

A2 Let suppose one data first.

Supposing data.

width = 1.2 m

height = 0.6 m

Length = 30 m

Slope = 1 in 1000

$n = 0.013$

sd

$$Q = 1.2 y_0 \left[\frac{1.2 y_0}{1.2 + 2 y_0} \right]^{2/3} (0.0001)^{1/2} / 0.013$$
$$= 2.92 y_0 \left[\frac{1.2 y_0}{1.2 + 2 y_0} \right]^{2/3}$$

$$H = y_0 + \frac{v^2}{2g} + k_c \frac{v^2}{2g}$$

$k = 0.5$ for square edged entry

$k = 0.25$ for flared entry

$k = 0.05$ for rounded entry.

| Y_0 (cm) | H (cm) | Q (m^3/s) |
|--|----------|-----------------|
| 0.2 | 0.236 | 0.165 |
| 0.4 | 0.467 | 0.451 |
| 0.6 | 0.691 | 0.785 |
| orifice $> 0.6 \leftarrow (1.2D) = 0.72$ | | 0.871 |

a) $H/D \geq 1.2$

for orifice flow

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

with $c_d = 0.62$ following results

| H (cm) | Q (m^3/s) | Y_0 (cm) |
|----------|-----------------|------------|
| 0.72 | 1.29 | > 0.6 |

(b) For pipe flow the energy eq. gives

$$H + S_w L = D + h_L$$

where $h_L = k_c \frac{V^2}{2g} + (Vn)^2 \frac{L}{R^{4/3}} + \frac{V^2}{2g}$

where

$$h_L = k_c \frac{V^2}{2g} + (Vn)^2 \frac{L}{R^{4/3}} + \frac{V^2}{2g}$$

Thus

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

For H

$$Y_L = 0.6$$

| H (m) | Q (m ³ /s) |
|-------|-----------------------|
| 0.691 | 0.723 |
| 0.72 | 0.805 |
| 1.00 | 1.364 |
| 2.00 | 2.487 |
| 3.00 | 3.242 |