HYDRAULIC STRUCTURE

Submitted by:

Mansoor Kamal Khan

ID: 7715

Section : A

Submitted to:

Engr. Adeed Khan

IQRA NATIONAL UNIVERSITY PESHAWAR

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 peirs, which normally in the range of 0 - 4.5m. Scour, losses the soil and reduces the bed level around the peir as well as due errosion phenomina, it erouts the bridge foundation.

Generally bridge is design for a fixed and estimated bearing capacity of soil, but coz of scouring phenomina which reduces the bearing capecity of soil as a result Bridge load overs on the soil bearing capacity which cause failour of Bridges.

Mainly there's been investigated the load carry capacity of piles, buckling risk and additional moment on piles, ~~buckling risk~~ due to increasing water height as effect of scour which destabilation of foundation which cause failour of Bridge structure.

Mechanism of Scour:

Vortex System formed in front of the obstruction, and has the form of horseshoe. River flow and boundary condition give rise to the energy of the vortex increased shear stress commence local sediment transports.

Problem:

Selected data:

The dimensions of concrete rectangular box culvert are;

W = Width = 1.4 m

H = Height = 0.65 m

L = length = 27 m

S = Slop = 1 in 900

Manning's $n = 0.013$

Range of head water level for investigation = 0 – 3 m = y_o

Required data:

Establish the stage-discharge relation ship = ?

Solution:

As we know that;

$$Q = A \times V \longrightarrow (1)$$

According to Manning equation we have;

Area = A = Width × Hydralic depth

$$A = W \times y_o$$

$$A = 1.4 \times y_o \longrightarrow (2)$$

Wetted Parameter = Width + 2 [Hydralic depth]

$= W + 2[y_0)$

$P = 1.4 + 2y_0 \longrightarrow (b)$

Also;

$$R = \frac{A}{P} = \frac{1.4\,y_0}{1.4 + 2y_0}$$

$$R = 1.4\,y_0 / 1.4 + 2y_0 \longrightarrow (c)$$

Hence we get velocity which is;

$$V = \frac{1}{n} R^{2/3} \sqrt{S}$$

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

By putting values we get;

$$V = \left[\frac{1.4\,y_0}{1.4 + 2y_0}\right]^{2/3} \frac{[0.0011]^{1/2}}{0.013}$$

$$V = 2.56 \left[\frac{1.4\,y_0}{1.4 + 2y_0}\right]^{2/3} \longrightarrow (3)$$

By substituting eq(2) and eq(3) in eq(1) we get;

$$Q = [1.4\,y_0] \times \left[2.56 \left(\frac{1.4\,y_0}{1.4 + 2y_0}\right)^{2/3}\right]$$

$$Q = 3.584\,y_0 \left[\frac{1.4\,y_0}{1.4 + 2y_0}\right]^{2/3}$$