HYDRAULIC STRUCTURE

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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 cause complex effect on bridge effect 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 pier as well as the due errasion phenomina it erauts the bridge foundation.

Generally bridge is design for a fixed and estimated bearing capacity of soil, but because of scouring Phenomina which reduces the bearing capacity of soil as a result bridge ~~result~~ load overs on the soil bearing capacity which cause failure of bridges.

Mainly there's been investigated the load carry capacity of piles, buckling risk and additional moment on piles due to increasing water height as effect of scour which destabila-tion of foundation which cause failure 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 = 1.3 m

H = Height = 0.62 m

L = length = 25 m

S = slop = 1 in 800 = 0.00125

Manning's n = 0.013

Range of head water level for investigation = y_0 = 0 - 3 m

Required data;-

Establish the stage-discharge relation ship.

Solution:-

As we know that;

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

According to manning equation we have;

Area = A = width × Hydralic depth.

$$A = w \times y_0$$

$$A = 1.3\, y_0 \rightarrow (2)$$

Now wetted parameter:

wetted parameter = width + 2[Hydraulic depth]

$$P = 1.3 + 2y_0 \rightarrow (b)$$

Also

$$R = \frac{A}{P} = \frac{1.3\, y_0}{1.3 + 2y_0} \rightarrow (c)$$

Hence we get velocity which is;

$$V = \frac{1}{n} R^{2/3} \sqrt{S_0}$$

$$V = \frac{R^{2/3} \sqrt{S_0}}{n}$$

By Putting values

$$V = \left[\frac{1.3 y_0}{1.3 + 2y_0}\right]^{2/3} \frac{(0.00125)^{1/2}}{0.013}$$

$$V = \left[\frac{1.3 y_0}{1.3 + 2y_0}\right]^{2/3} 2.72 \quad - (3)$$

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

$$Q = 1.3 y_0 \left[2.72 \left[\frac{1.3 y_0}{1.3 + 2y_0}\right]^{2/3}\right]$$

$$Q = 3.536 y_0 \left[\frac{1.3 y_0}{1.3 + 2y_0}\right]^{2/3}$$