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Assignment #

Hydraulic Structures

=> Scour :-

INTRODUCTION :-

First of all we discuss about the introduction of scour. The erosion caused by flowing water resulting in removal of sand, earth or silt from the bottom of the river is called scour. The scour around obstruction in water way is called local scour. The scour due to contraction of water way is called construction scour.

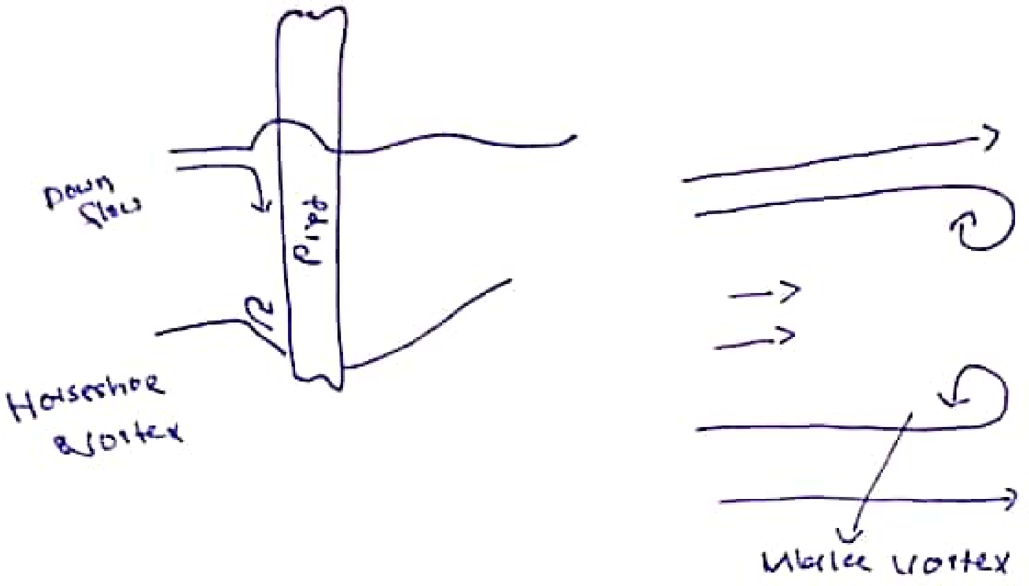
The scour remove the bed materials around the foundation of bridge which result in expose of the foundation and endager the stability of bridge.

The scour is accountable for about 60% of bridge failure "lagasse et al., 1997." resulting is loss of huge economic losses. The cost of reconstruction the cost of maintance and monitoring of existing structure. But As for soil profile is similar for this part of country a case study has been done. For the case study to alalysis lost load carry capacities Mat bridge has been selected. This bridge was built in 1979 and its Foundation are friction piles. The study pretends to give a general indiction a responsible departments how scour depth. effect the load carry capacity of piles.

MECHANISM OF SCOUR :-

AT The Obstruction in Form of pier The unidirectional Flow changes into Three dimensional as The water pileup in Front Face of The Obstruction and the Flow accelerates around The nose. This phenomena results in Formation of Vortex at The base of The pier known as horseshoe vortex and The vortex From of The vertical direction downstream of The pier known as wake vortex as explain in Figure.

Figure 1 presentation Vortex around a circular pier



The pileup of water due to obstruction b/c of dederations of flow due to stagen pressure of water causes a downward flow result in horseshoe vortex. The vertical component of the downward flow causes erision around the base of pier.

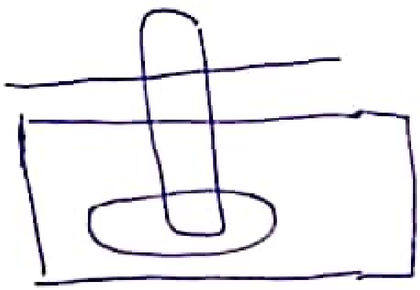
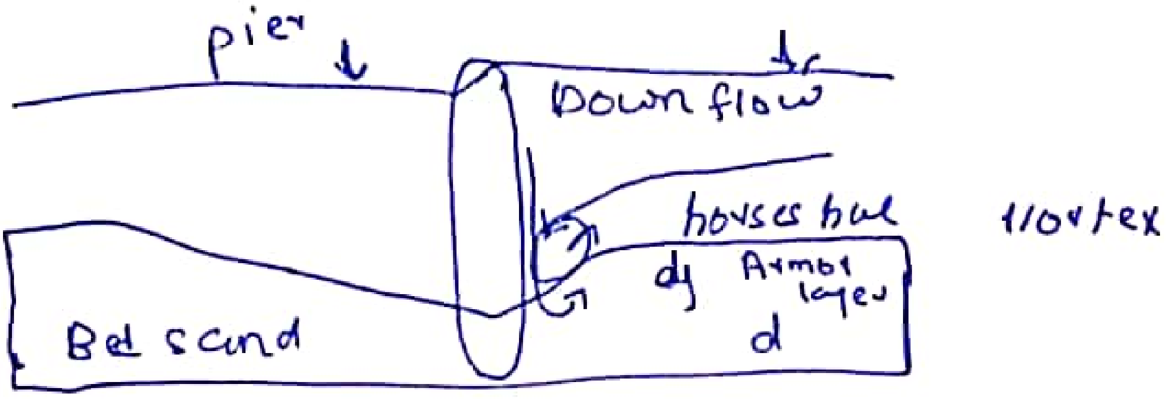


Figure 2. System vortex at bridge pier.

Due to rolling of unstable shaer layers at the surface of the pier wake vortex are generated at the separation line and move forward with flow. downstream of the pier.

In practical case the river bed is generally composed of mixture of different size material. Due to washing out of finer material an armor layer is formed of coarser material which protects the underlying finer particle from further scour. presence of armor layer the clear water ragime can be extended as the value of critical velocity increases.. shown in figure 3. (2004)

Figure #03



problem # 01

Given Data :-

$L = 29m$

$Slop = 1:1000$

$\eta = 0.013$

$H = 0.11m$

$W = 1.7m$

Solution :-

$H/D \leq 1.1m$

$H < 0.11m$

$\phi = 2.92\ y_0\ [1.2\ y_0 / 1.2 + 2\ y_0] \longrightarrow A$

$\phi_1 = 2.92(0.2)\ [1.2\ (0.2) / 1.2 + 2(0.2)]$

$Q_2 = 2.92\,((0.4)\,[1.2(0.4)\,[1.2 + 2(0.2)]]$

$Q_3 = 2.92\,(0.6)\,[1.2(0.6)\,/\,1.2 + 2(0.6)]]$

$Q_1 = 3.05\ m^3/s$

$Q_2 = 0.311\ m^3/s$

$Q_3 = 0.572\ m^3/s.$

$y_c = (q^2/g)^{1/3}$

By This Formula we can

Find Further process.

$q = Q/B.$

$q_1 = Q_1/B \quad = 3.05/1.1 \quad = 2.77$

$q_2 = Q_2/B = 0.311/1.1 \quad = 0.287$

$q_3 = Q_3/B = 0.572/1.1 = 0.52$

Now!

$y_{c1} = ((2.77)^2/9.81)^{1/3}$

$y_{c1} = 0.921.$

$y_{c2} = ((0.287)^2/9.81)^{1/3}$

$y_{c2} = 0.199$

$y_{c3} =$

$((0.52)^2/9.81)^{1/3}$

$y_{c3} = 0.302.$

y_c	$Q\ (m^3 s^{-1})$	$y_c\ (m)$
0.3	3.05	0.921
0.4	0.311	0.199
0.6	0.572	0.302

Now:
$$H = Y_0 + V^2/2g + K_e V^2/2g$$

$V = 1.142$ m/s so

$$H_1 = Y_0 + \frac{V^2}{2g} + K_e V^2/2g$$

$$= 0.2 + \left[\frac{(1.142)^2}{2(9.81)}\right] + 0.013 \frac{(1.142)}{2(9.81)}$$

$H_1 = 0.266m$

$H_2 = 0.466m$

$H_3 = 0.66m$

Y_0	H (m)	Q ($m^3 s^{-1}$)
0.2	0.66	3.05
0.4	0.466	
0.6	0.66	0.3.11
~~0.6~~		0.572
1.20	0.72	

$Q = cd\,(1.1 \times 0.8)\left[2g(H - D/2)\right]^{1/2}$

$Q = 0.62\,(1.1 \times 0.8)(2(9.81)(0.72 - \frac{0.8}{2})$

$0.5456\,(19.62)(0.32)^{1/2}$

$Q = 0.5456\,(19.62)(0.56)$

$Q = 5.99\ m^3/s$

As a result

H (cm)	Q m^3/s	Xo (m)
0.72	5.99	70.6

For pipe flow the energy equation

H + S + L = Dthe

Where :-

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

Thus $Q = 2.P8 \quad (H = 0.57)^{1/2}$

During rising stages The barrel flow full from H= 0.72 m and during falling Stages The flow become free structures flow when

H= 0.466

END.