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CLASS : BE(C)

SECTION: A

SUBJECT : HYROULIC STRUCTURE

LECTURE: ENGR. ADEED

ASSIGNMENT:

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Problem:-

GIVEN DATA:-

The dimension of concrete rectangular box culvert are;

W = width = 1.6m
H = Height = 0.75m
L = Length = 30m

S = Slop = 1 in 1000

Manning's = n = 0.013

Range of head water level for investigation:- 0-3m-ys

Required

Establish the Stage discharge relationship:-?

SOLUTION:

As we know that

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

According to Manning eq we have

$$A = W \times y_o$$

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$$A = 1.6 \times y_o \rightarrow (2)$$

Wetted Parameter = width + 2[hydraulic depth]

$$= W + 2[y_o]$$

$$P = 1.6 + 2y_o \rightarrow (b)$$

Also;

$$R = \frac{A}{P} = \frac{1.6y_o}{1.6 + 2y_o}$$

$$R = \frac{1.6y_o}{1.6 + 2y_o} \quad \text{—— (C)}$$

Hence we get velocity which is;

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

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

By putting values we get;

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$$V = \left[\frac{1.6y_o}{1.6+2y_o}\right]^{2/3} \frac{[0.001]^{1/2}}{0.013}$$

$$V = 2.43\left[\frac{1.6y_o}{1.6+2y_o}\right]^{2/3} \longrightarrow (3)$$

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

$$Q = [1.6y_o] \times \left[2.43\left(\frac{1.6y_o}{1.6+2y_o}\right)^{2/3}\right]$$

$$Q = 3.888y_o\left[\frac{1.6y_o}{1.6+2y_o}\right]^{2/3}$$

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Describe loads on bridge foundation due to scour and their working mechanism.

Mechanism of scour on Bridge

Initial phase:

The scour process starts showing erosional pattern on the lateral sides of the cylinder pier.

Progressing phase:

The erosional pattern progress from the lateral side to the front of pier from the moment the two scour pattern coincide at the front of the pier, the deepest scour depth is achieved.

Developing phase:

The scour process develops and the scour rate slows down.

Equilibrium phase:

Erosion inside the scour hole is negligible At the obstruction in from of pair of abotment the undirectional flow changes into three dimensional as the water pileup in front face of the obstruction and the flow accelerates around the nose. The phenomena results The pile up of water due to obstruction because of decelerations of flow due to stagnation pressure of water causes

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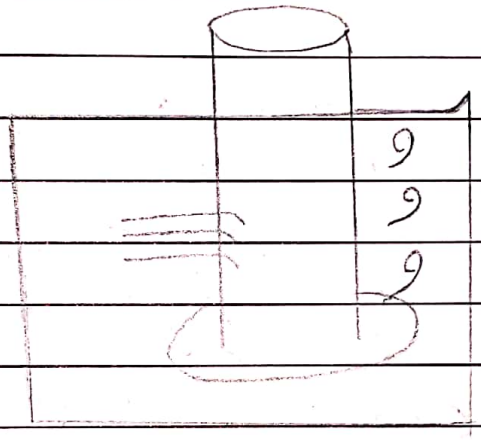
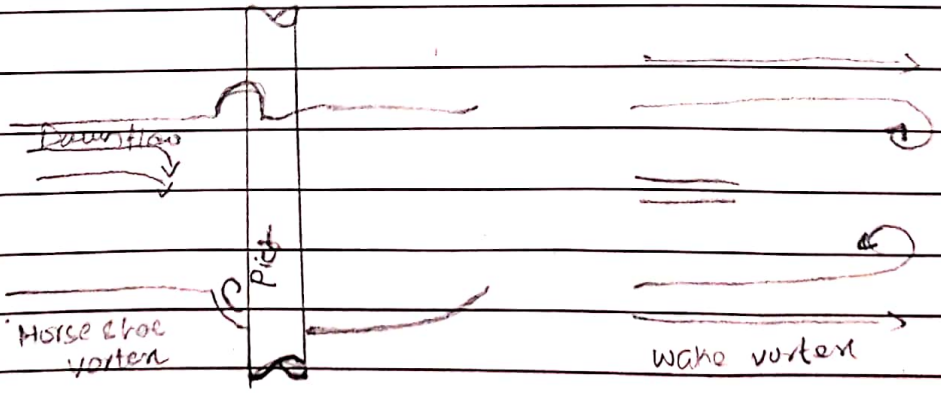
a down ward flow results horse vortex. The vertical component of the downward flow causes erosion around the base of the pier.



Information of the vorten at the base of the pier known as horse shoe vorten and the vorten from in the vertical direction downstream of the pier known as wake vorten as shown in figure.



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Presentation of vorter around a circular path.

Due to rolling of unstable layer at the surface of the pier wake vorter are generated at the separation and moves towards with flow downstream of the pier. It can be shown in the practical case the river bed is generally composed of mixture of different size of material due to washing out of finer material and armor layer is formed of coarser materials which protect the underlying finer particles from further scour.

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Scour:

Scour is an erosional process that can occur in rivers to the interaction between any of structure located underwater and the river flow.

OR

Scour is an erosional that can occurs due to natural and man made events.
Natural erosional process take place in rivers because they acts for as conduits for movements of water sediment. Man made scour can be caused instance by legal or illegal sediment extraction dam operation and the influence in general of any structure placed into the river stream

Different types of scour:

Natural scour:

Natural scour occurs due to the Natural variability of river stream flow and sediment ragime, considering the influence from the catchment to the river scale Gradation of the river bed, lateral channel migration, bend and confluence scour are part of natural scour

Local scour:

Local scour emerges due to a local concentration turbulence generated by structures that obstruct and split the flow (e.g bridge piers

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and abutments local scours around these structure because of the limited influence range they have on the river flow

Constraction Scour:

Constraction scour occurs due to flow contraction when flow velocity and thus shear stressess increase, for instance between bridge abutments constraction scour normally take place with in the complete river stream width.

Total Scour:

Total scour is defined as the sum of effects of all the scour process that take place at the given location.