ASSNGNMENT

Submitted To Engr. Nadeem.

Submitted by HAMAD

SECTION "B"

SUBJECT HYDRULLIC STRUCTURE

S.ID 7747

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DEPT Civil Engr

WORKING EXAMPLE :

Establish the Stage (headwater level) - discharge relationship for a concrete rectangular box culvert. Use the following data
width = 1.2m,
Height = 0.6m
slope = 1 in 1000
length = 30m
Manning's n = 0.013
Square edged entrance condition
free outlet flow range of head water level for investigation = 0.3m ; neglect the velocity of approach.

Solution :

H/D ≤ 1.2 For H < 0.6m Free flow open channel condition prevail Referring to fig and assuming that a steep slope entry give entrance control i-e the depth at the inlet is critical, for H = 0.2m ignoring entry loss $y_c = (2/3)0.2$ = 0.133m and V_c = 1.142m s^{-1} This gives the critical slope $(Vn)^2/R^{4/3}$ = 0.00424. Therefore

the slope of the culvert is mild and hence subcritical flow the analysis gives the following results.

$$Q = 1.2y_0\left[(1.2y_0/1.2+2y_0)\right]^{2/3}\frac{(0.0012)}{0.0013}^{1/2}$$

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

CROSS DRAINAGE & DROP STRUCTURE

Y_0 (m)	Q (m)^{3}S^{-1} Equation 1	Y_c(m)
0.2	0.165	0.124
0.4	0.451	0.243
0.6-D	0.785	0.352

At the inlet over a short reach.

$$H = y_0 + V^2/2g + k_c V^2/2g$$

The entrance loss co-efficient, k_c, is a follows

for a square-edged entry, 0.5

For a Flared entry $C_d = 0.62$
For a rounded entry $C_d = 0.65$

Y_o (m)	H(m) Eq (ii)	$Q(m^3s^{-1})$
0.2	0.236	0.165
0.4	0.467	0.451
0.6	0.691	0.785
Orifice ←	0.72	0.817 (by interpolation)
> 0.6 →		
(1.2D =		

2) $H/D \geq 1.2$

a) For orifice flow

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

with $C_d = 0.62$ the following result are obtained.

H(m)	$Q\ (m^3s^{-1})$	Y_o (m) eq(i)
0.72	1.29	> 0.6 → no orifice flow exists.

The following table summarize the result.

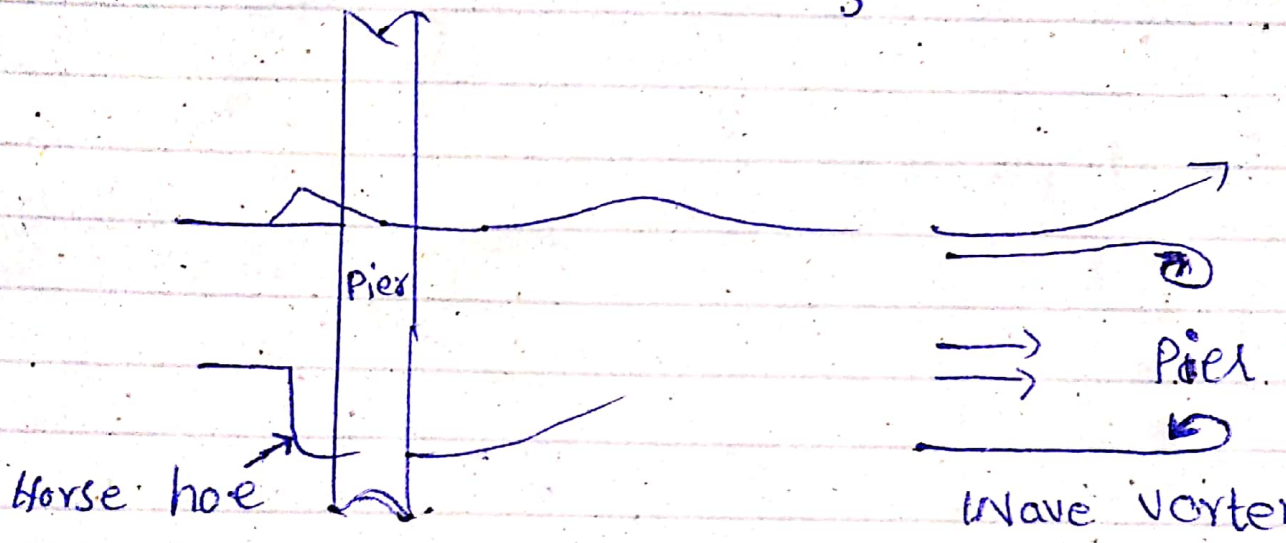
H(m)	Q m^3s^{-1}	TYPE OF FLOW
Raising Stage		
0.236	0.165	open channel
0.467	0.451	open channel
0.691	0.785	open channd
0.720	0.805	Pipe flow
1.00	1.364	pipe flow
2.00	2.487	Pipe flow
3.00	3.242	Pipe flow
Falling Stage		
2.08	2.487	Pipe flow
1.00	1.364	Pipe flow
0.72	0.805	Pipe flow
0.691	0.785	Pipe flow
0.691	0.785	open chanel
0.467	0.451	open chamel
0.236	0.165	open channel

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 from face to the obstruction and the flow accelerate around the nose this phenomina result in formation of vertex at the base of the pier known ~~of vortex~~ as horsehoe vortex and the vortex from in the vertical direction down-stream of the pier know as wake vortex as show in figure 1 taken from the pileup of water due to obstraction & declaration of flow due to stagration preisure of water cause a downward flow result in horsehoe vortex. The vertical componet ~~of the down stream vortex~~ flow cause evosion around

the base of the peir.

3



Figel 1 Presentation of vorten around a circular Pier