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Experimental Investigation on the Influence of Density of Fluid On Efficiency of V- Notch

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ABSTRACT

In open waterway flows, the data of the water discharge is a key parameter and a range of measurement technique was developed. Numerous procedures rely on some practical coefficients and there is a need to acquire new exact physical information to supplement the existing evidence. Stream measuring structures in waterworks, waterways and wastewater plants comprise basically of flumes and thin plate weirs .Thin-plate weirs empower a precise release estimation with straightforward instrument. These weirs ordinarily utilized as measuring gadgets in flumes and channels which empowers an exact release estimation with basic instruments. The calibration formulae of such gadgets depend upon some experimental coefficients and there is a need to acquire new exact physical information to adjust the current confirmation. In the present study, the discharge calibration of a large 90º V-notch with thin plate weir was used to find out the various coefficients with different density like clean water, mud water etc. The V-notch weir was initially closed by a fast-opening gate. The sudden opening induced an initial phase of the water motion dominated by the freefall motion of amount of liquefied in the locality of the weir, followed by a gradually-varied phase. The connection between water release and upstream water height was derived from the integral form of the continuity equation based upon high-frequency water elevation recordings. The outcomes yielded a dimensionless release coefficients Cd = 0.58 which is close to 90º V-notch weirs, as well as a string of unsteady orifice flow experiments. The results shows unsteady discharge calibration of the V-notch barrier yielded which enabling a relatively rapid calibration of the wall. Another advantage is the ability to test relatively large flow rates, when the water supply cannot sustain such large stable flow rates.

***Keywords**: 90º V-notch weirs, water discharge, thin-plate weir.*

1. INTRODUCTION

The Thin-plate barrier is broadly used for measuring the flow of liquids in flumes and open channels. It is Simple in devise and easily made for available materials, it is expensive, convenient to use, and easy to maintain. In portable form it is frequently used to measure the flow of water in laboratories & small natural streams. When several forms of weirs or flumes are used. The triangular-notch barrier is often preferred because of its greater precision at low flows or its lesser sensitivity to approach-channel geometry and velocity distribution. In the range of conditions for which verification data are adequate, reasonable care in construction, installation. The thin-plate weir is a generally exact instrument. The triangular-score weir has been the subject of extensive exploratory research. In any case, the greater part of the lab examinations have been confined to a limited scope of scratch points and channel geometries. The 90°-indent weir has been most widely ascertained. Deficiencies in these formulas are concealed with numerous limits of applicability which greatly restrict their usefulness.

1.1 Description Of The V-Notch Weir

The wall which is the subject in this study is a equal. The line which bisects the angle of the notch is vertical and equidistant from the sides of the approach channel. The weir plate is smooth, plane, and perpendicular to the sides as well as the bottom of the approach channel. The crest surfaces of the weir notch are plane surfaces which are sharp, right-angle corners at their intersection with the upstream face of the weir plate. The width of the crest surface varies between 1/32 and 1/16 inch. If the weir plate is thicker than 1/16inch, the downstream edges of the notch are chamfered to make an angle of not less than 45° with the surface of the crest. Ideally, the channel upstream from the weir is straight, smooth, horizontal, and rectangular with sufficient length to develop the normal (uniform flow) turbulence and velocity distribution for all discharges. Usually it is less than ideal, and baffles or screens are provided in order to simulate a normal velocity supply. conduit and tail water with downstream from the weir are measured such as to permit a free, fully ventilated flow from the notch. Provisions for ventilation ensure that pressure on the nappe surfaces is atmospheric

2. BASIC EQUATION OF DICHARGE

a. Triangular-Notch Weirs

The traditional equation of release for triangular-notch weirs is derived on the basis of an assumed analogy between the weir and orifice. In this derivation, an approximate velocity equation is integrated over assumed area limits of the nappe in the plane of the weir. The results are useful mainly because it is dimensionally correct.

$$Q_{th} = \frac{8}{15}\tan\left(\frac{\theta}{2}\right)\cdot\sqrt{2g}\cdot H_w^{2.5}$$

b. Dimension Analysis

The principal variables needed to define the discharge individuality of a triangular-notch Q, discharge *B,* the width of the approach channel *P,* the height of the notch vertex with respect to the floor of the approach channel *h,* the head on the weir, referred to the vertex of the notch. The angle included between the sides of the notch p, the density of the liquid *n,* the viscosity of the liquid *a,* the surface tension of the liquid and the specific weight of the liquid.

c. Symbols

A= exponent in equation

b =width of rectangular notch

B =width of approach channel

C =coefficient of discharge

Ce =coefficient of discharge (based on effective head)

g = acceleration due to gravity

h =piezometric head referred to vertex of notch

he =effective head

L a= length

M= coefficient in equation

M= exponent in equation

N =coefficient in equation

N= exponent in equation

P= height of weir notch above bottom of channel

Q =discharge

S =slope of sides of notch

W= Weber number

p =density

d. Units

The actual discharge,

Q act = a x h / t

Where; a = area of measuring tank in cm^2

h = level difference of water in the measuring tank in cm.

Tm = the mean time to collect water for a height difference of h cm, measured in seconds (tm = 60 to 120 s), the theoretical discharge is calculated by noting the 'head' (H) over the notch plate, measured with the help of a hook gauge.

For a v-notch,

$$Q_{th} = \frac{8}{15}\tan\left(\frac{\theta}{2}\right)\cdot\sqrt{2g}\cdot H_w^{2.5}$$

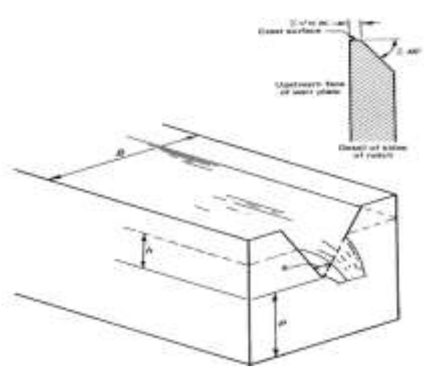
Where; Qt= Theoretical discharge

H = Head of water over the notch

θ = Angle of the notch

g =Acceleration due to gravity=981cm/s co-efficient of discharge= Q act / Q

e. Equation



3. COEFFICIENT OF DISCHARGE FOR ONE LIQUID

In equation of the dependent variable is proportional to the coefficient of discharge. The independent variables include three geometric ratios and two fluid-property ratios. As explained in the preceding section, one of the geometric ratios, hIB, can be replaced with P/B, which is more convenient because it is a constant for a given weir installation. For one fluid over a limited temperature range, /A, a, and p can be understood to be constants. Under these circumstances, the effects of viscosity and surface tension are related to the absolute magnitude of hal one. Thus, both R and W in equation can be replaced with the quantity. It follows that, for one liquid and a limited range of temperatures

4.0 RESULTS AND DISCUSSIONS

4.1 SAMPLE-1 (CLEAR WATER)

Increasing discharge

Density of sample=979 kg/m^3

Table 1.1 Clear water for increasing discharge				
Si.no	***VOL= A*H(CM^3)***	***Qact= V/t(CM^3/S)***	***Qt***	***Cd= Q act/Qt***
1	11500	100.07	121.62	0.82
2	11500	161.58	212.47	0.76
3	11500	289.38	383.66	0.75
4	11500	380.54	553.51	0.68
5	11500	576.15	881.42	0.65
6	11500	769.74	1304.59	0.59
Average value		379.58	576.21	0.66

Co-efficient of discharge = 0.6

4.2 SAMPLE -1 (CLEAR WATER

Decreasing discharge

Density of sample =979kg/m3

Co- efficient of discharge

Table 1.2 Clear water for decreasing discharge				
si.no	***VOL= A*H(CM^3)***	***Qact= V/t(CM^3/S)***	***Qt***	***Cd= Q act/Qt***
1	11500	623.30	1104.24	0.56
2	11500	539.90	923.59	0.58
3	11500	420.93	761.94	0.55
4	11500	212.31	383.66	0.55
5	11500	130.06	230.62	0.56
6	11500	98.58	163.26	0.60
	Average value	337.51	594.55	0.57

Co efficient of discharge

Average co-efficient of discharge of sample-1=0.61

4.3 SAMPLE-2 (MUD WATER)

Increasing discharge

Density of sample=1050 kg/m^3

Temperature of sample =25 degrees

Table 1.3 Mud water for increasing discharge

Si.No	***VOL= A*H(CM^3)***	***Qact= V/t(CM^3/S)***	***Qt***	***Cd= Q act/Qt***
1	11500	171.10	312.36	0.55
2	11500	302.71	585.50	0.52
3	11500	399.16	724.41	0.55
4	11500	505.05	881.45	0.57
5	11500	610.40	1104.24	0.55
6	11500	742.41	1357.83	0.55
	Average value	455.14	827.63	0.55

Co-efficient of discharge=0.55

4.4 SAMPLE-2 (MUD WATER)

Decreasing discharge

Density of sample=1050kg/m^3

Temperature of sample=25 degrees

Table 1.4 Mud water for decreasing discharge

Si.No	***VOL= A*H(CM^3)***	***Qact= V/t(CM^3/S)***	***Qt***	***Cd= Q act/Qt***
1	11500	635.00	1201.9	0.53
2	11500	545.02	1057.2	0.52
3	11500	429.10	840.43	0.51
4	11500	365.07	688.01	0.53
5	11500	230.18	436.16	0.53
6	11500	98.77	178.80	0.55
Average value		383.86	733.76	0.53

Co-efficient of discharge = 0.53

Average co-efficient of discharge of sample-2 = 0.54

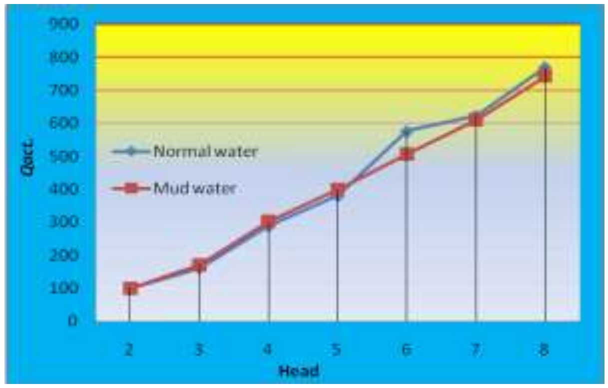


Figure 1.1 Relationship between Head and Qact for increasing and decreasing discharg

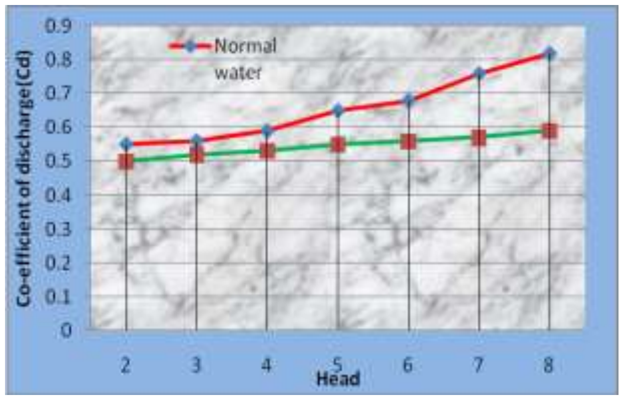


Figure 1.2 Relationship between Head and co-efficient discharge for increasing and decreasing discharge

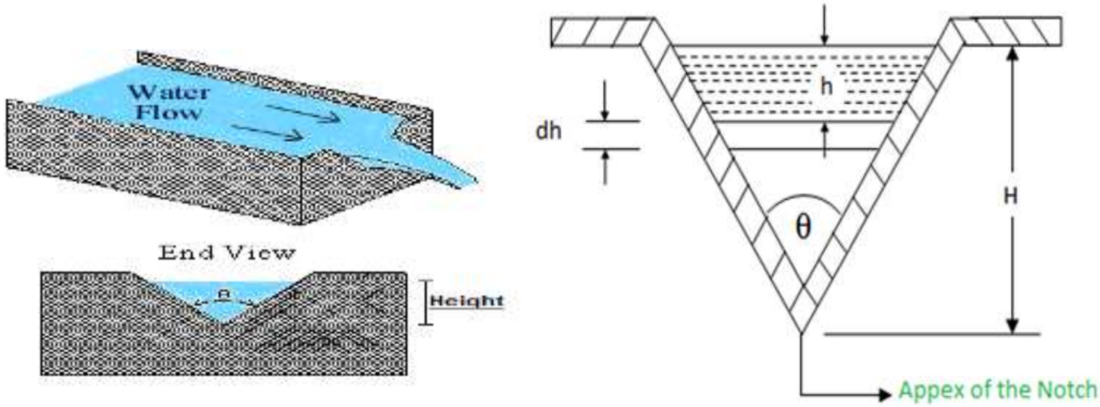


Figure 1.3 Water Flow in V-Notch weir

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