Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 5, No. 6, June, 2019

Laboratory Investigation on Discharge Coefficient of Trapezoidal Piano Key Side Weirs

Minasadat Seyedjavad [a*], Seyed Taghi Omid Naeeni [b], Mojtaba Saneie [c]

[a] *PhD Student, Department of Civil Engineering, University of Tehran, Tehran, Iran.*

[b] *Associate Professor, Department of Civil Engineering, University of Tehran, Tehran, Iran.*

[c] *Associate Professor, Soil Conservation and Watershed Management Research Institute, Agricultural Research Education and Extension Organization, P.O. Box 13445-1136, Tehran, Iran.*

Received 02 February 2019; Accepted 23 May 2019

Abstract

A spillway is a hydraulic structure used to provide the controlled release of surplus waters and floods from a dam into a downstream area. A side weir is a multipurpose hydraulic structure which is constructed in water conveyance systems with a height lower than that of the canal wall. When the water surface level goes up, the side weir regulates the discharge and controls the water surface in the main canal. Besides, the side weir controls and diverts floods in dam reservoirs, diverts the flow and protects the structure against the river inundations. In this research, a laboratory investigation is performed with 16 Type-A piano key weirs and three different pier heights of 10, 15 and 20cm. These weirs are studied for two cases of 1 and 2. The results show that the weirs with 15cm and 20cm heights in both cases 1 and 2 have the highest discharge coefficient C_M in dimensionless ratios of 0.2 <H/P <0.4 and H/P>0.5 respectively. Having reviewed previous studies, it could be concluded that the trapezoidal piano key side weir is capable of releasing a flow 1.2 times more than that of the linear trapezoidal labyrinth weir with 12 degrees angle and 1.87 times more than the one with 6 degrees angle, and 1.5 times more than that of the triangular labyrinth weir.

Keywords: Discharge Coefficient; Side Weir; Piano Key.

1. Introduction

Side weirs are multipurpose hydraulic structures which are constructed in water conveyance systems. This type of structure is used in the irrigation and drainage networks to divert the surplus water or function as the water intake. The side weir is constructed with a height lower than that of the canal wall. When the water surface increases, the side weir regulates the discharge and controls the water surface in the main canal. Besides, the side weir controls and diverts floods in dam reservoirs, diverts the flow and protects the structure against the river inundations. Figure1 depicts a general view of the side weir in whichy_1 and y_2 are the water depths upstream and downstream the weir, W is the weir height, B is the canal width, L is the weir length, $Q_1$and $Q_2$are the flow discharge values before and after the weir, $Q_S$is the weir discharge, $V_1$and $V_2$are the flow velocity values before and after the weir [1].

Labyrinth weir is the basis for piano key weirs. They are often constructed with vertical walls and are much more efficient than the linear weirs. Nevertheless, the flow, especially the bottom flow, enters this type of weirs and passes

* Corresponding author: minamfsj@gmail.com

http://dx.doi.org/10.28991/cej-2019-03091335