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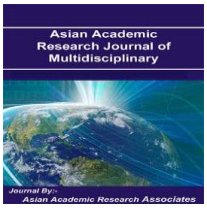

EXPERIMENTAL INVESTIGATION OF CRITICAL FLOW AND ENERGY DISSIPATION IN BROAD CRESTED WEIR

E. E. NYAH[1]; E. G. EWAH[2]; S. E. UBI[3]; J. G. EGBE[4]; O. O. EWA[5]

[1,2,3,4,5]Civil Engineering Department, Cross River University of Technology, Calabar, Nigeria

Abstract

This paper experimentally investigates critical flow and energy dissipation in broad crested weir. The experiments were carried out on the horizontal open channel provided in the fluid mechanics/hydraulic laboratory of the Cross River University of Technology, Calabar-Nigeria. The experiment results obtained show that there was flow continuity since the discharge through any point of the channel is uniform. Critical flow will occur over a weir as far as there is flow continuity and the flow rate is great enough to ensure that $\frac{y_o}{y_c}$ ratio ≥ 1 in order to create and maintain the upstream subcritical flow and critical overflow conditions. Irrespective of critical overflow discharge rate and critical depth y_c value, the energy head loss due to overflow is constant circa 0.075m for this weir. Also, irrespective of overflow discharge rate, $\frac{y_o}{y_c}$ ratio is constant and $y_o = \frac{3}{2}y_c$. Froude number is a function of discharge and increases as discharge increases. Upstream of weir, the Froude numbers range from 0.075 to 0.103 ($0.075 < F_{r1} < 0.103$) showing that the flows were subcritical. The weir overflow Froude number was unity ($F_{r2}=1$) showing that the flows were critical.

Keywords: Open Channel, Weir, Critical Flow, Critical Depth, Froude Number, Specific Energy.

References

1. Harrawood, P. (1956). Correlation of weir crest depth, Froude number, H/P ratio, weir thickness.

2. Jalil, S. A., Sarhan, S. A., & Yaseen, M. S. (2015). Hydraulic Jump Properties Downstream a Sluice Gate with Prismatic Sill. Research Journal of Applied Sciences, Engineering and Technology, 11(4), 447-453.

3. Li, C.-F. (1995). Determining the location of hydraulic jump by model test and HEC-2 flow routing. Ohio University.

3. Abrahams, A. D., Li, G., & Atkinson, J. F. (1995). Step-pool streams: Adjustment to maximum flow resistance. Water Resources Research, 31(10), 2593-2602.

4. Chanson, H. (2009). Development of the Bélanger equation and backwater equation by Jean-Baptiste Bélanger (1828). Journal of Hydraulic Engineering, 135(3), 159-163.

5. Leutheusser, H. J., & Birk, W. M. (1991). Drownproofing of low overflow structures. Journal of Hydraulic Engineering, 117(2), 205-213.

6. Te Chow, V. (1959). Open-channel hydraulics (Vol. 1): McGraw-Hill New York.

7. Leutheusser, H. J., & Fan, J. J. (2001). Backward flow velocities of submerged hydraulic jumps. Journal of Hydraulic Engineering, 127(6), 514-517.