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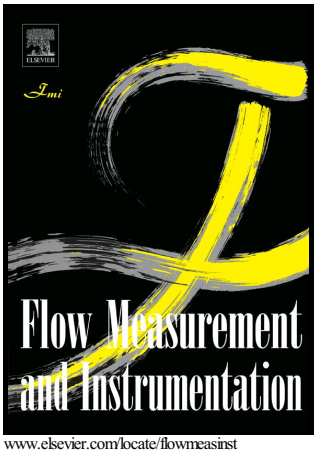

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Flow through lateral circular orifice under free and submerged flow conditions

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Abstract

Open channels, with flow diversion structures such as orifices, weirs and sluice gates; are prevalent in irrigation systems, both for conveying water from the source to the irrigated areas, and for distributing the water within the irrigated area. The present study was broadly aimed at to investigate the flow characteristics of sharp-crested side circular orifices under free and submerged flow conditions through analytical and experimental considerations. It was also intended to develop relationships for coefficient of discharge for orifices under free and submerged flow conditions. The computed discharges using developed relationships were within ±5% and ±10% of the observed ones for free and submerged orifices, respectively. Sensitivity analysis reveals that the discharge through side orifice is more sensitive to the low head above the center of the orifice. Various parameters affecting the jet angles have been identified and relevant parameters are used for proposing relationships for the jet angle under different flow conditions.

Notations

B	Width of the main channel, m
C_d	Coefficient of discharge
D	Diameter of the orifice, m
Fr	Froude number
g	Acceleration due to gravity, m/s^2
H	Head of water above the centerline of the orifice, m
Q	Discharge through the orifice, m^3/s
Q_m	Discharge in the main channel, m^3/s
T	Length of the elemental strip, m
V_1	Velocity in the main channel, m/s
W	Sill height, m
Y_m	Depth of flow in the main channel, m

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