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Although the triangular shape of the central baffle minimises the flume size and weight, according to Kolavani *et al.* (2019), it might be more sensitive to submergence than the typical cases with a longer baffle length. Such a disadvantage should be considered, especially when the tailwater depth cannot be adjusted. Hence, to ensure a free flow condition, during the installation of the portable TCB flume, it is suggested to make the soil bed slightly deeper at the tailwater section to see a free overfall and a free flow condition, as shown in Figure 3B and C.

## Conclusions

For the free flow hydraulic condition, the central baffle flume was investigated by both laboratory and field investigations. The laboratory tests demonstrated that contraction ratio values of less than 0.39 would ensure that the floor height ratio did not affect the flow capacity through the TCB flume. The laboratory analysis also demonstrated that an entrance ramp could only increase the discharge capacity when the contraction ratio was more significant than 0.39. According to the laboratory tests, an optimised portable flow measurement flume was proposed, and the associated stage-discharge formula was developed. Field application of the proposed portable TCB flume demonstrated that the proposed stage-discharge curve could be used accurately to determine the flow through an unlined ditch. Finally, the distinguishing condition curve and the submergence thresholds were discussed in this paper. It is strongly advised to use the proposed portable flume for free-flow conditions in which the critical flow state must occur at the throat section. Note that the proposed rating curve is only valid within the ranges of the calibrated dimensionless parameters.

## Notations

$a, c, d, n, l$ , and  $\alpha$  = empirical coefficients;

$B$  = the approaching channel width;

$b$  = the baffle width;

$B_c = B - b$ ;

$g$  = acceleration due to gravity;

$h$  = Upstream depth;

$h_{th}$  = the maximum permitted tailwater depth to allow the free flow condition;

$H_1$  = total upstream head;

$H_c$  = specific energy at the critical flow section;

$L_s$  = Sill length;

$p$  = floor height;

$Q$  = discharge;

$Q_{BR}$  = flow rate of a venturi flume;

$Q_{BR}$  = flow rate of a bed-rise structure;

Re = Reynolds number;

$r$  ( $B_c/B$ ) = contraction ratio;

$\beta$  = entrance ramp slope angle;

$f, f_1$ , and  $f_2$  = functional symbols;

$\mu$  = water viscosity.

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