310/C

Accuracy of discharge measurements in open channels using double ‘v’ notch, compound sharp-crested weirs

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Although the combination of a rectangular notch and a ‘V’ notch weir is commonly used, the continuity of flow and precision of this type of compound sharp-crested weirs are reported to be poor in the transition region between the two sections. As an improvement, a compound sharp-crested weir (Figure 1), composed of two triangular parts with different notch angles has been designed and experimentally validated which proved to be accurate in measuring a wide range of discharges without any discontinuity. The discharge over the designed Compound sharp-crested weir is

estimated by adding the flow through the triangular areas 1 & 2 and subtracting the flow through the relevant intersected triangular area as shown in Figure 1. Several methods are proposed to estimate the flow over the double 'V' notch, compound sharp-crested weir by changing the position of the intersection triangle (upper/lower) and the discharge coefficient of the intersection triangle. From a detailed analysis, one method is identified as most suitable to measure the discharge over the weir in partially contracted flow conditions

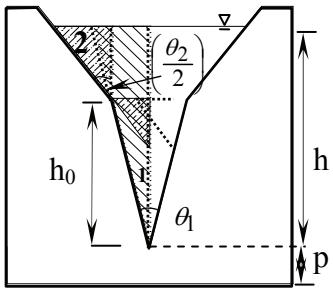

Figure 1- Typical cross section of the compound sharp-crested weir

According to the method selected (figure 2), the discharge measurements are accurate when the intersection triangle is in the upper 'V' notch and the discharge coefficient of that part is taken as the discharge coefficient of the upper 'V' notch. It is observed that the accuracy of the measurements is nearly the same as single 'V' notches, which form the compound weir while the continuity of flow over the compound weir exists. Standard 'V' notch equation is used to estimate the flow over the weir when $h<h_0$ and when $h>h_0$, the discharge is computed by using the proposed equation as follows;

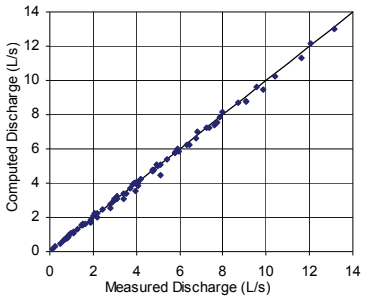

Figure 2- Measured Vs computed discharges using proposed method

$$Q = \frac{8}{15} C_{dc} \sqrt{2g}\, h^{2.5}$$ Where,

$$C_{dc} = C_{d1} \tan\left(\frac{\theta_1}{2}\right) + C_{d2}\left[\tan\left(\frac{\theta_2}{2}\right) - \tan\left(\frac{\theta_1}{2}\right)\right]\left(1 - \frac{h_0}{h}\right)^{2.5}, \quad C_{d1} \& \quad C_{d2}$$

are the discharge coefficients of lower and upper 'V' notches, respectively.

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