14.7 The broad- crested weir

A broad- crested weir is an overflow structure with a horizontal crest above which non hydrostatic pressure distribution occurs and may be neglected. In other words, the streamlines are merely straight and parallel. To obtain this condition the length of weir crest (L) should be related to the total energy head over the weir crest as $0.05 \leq H_1/L \leq 0.08$. The upper limit as $H_1/L \geq 0.08$ is fixed otherwise the energy losses over the weir crest cannot be neglected and undulations may occur on the crest; On the other hand the lower limit $H_1/L \leq 0.05$, is fixed such that hydrostatic pressure distribution may be assumed.

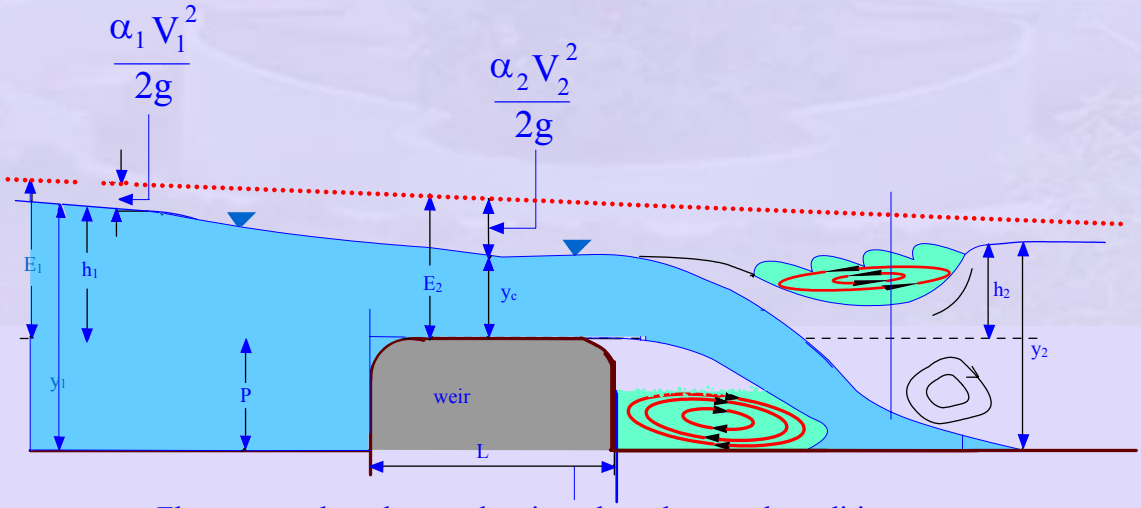
Such a measuring structure will have insignificant energy losses in the zone of acceleration upstream of the control section, accordingly (specific energy E) equation may be written as $E_1 = E_2$

$$h_1 + \alpha_1 \frac{\overline{V}_1^2}{2g} = E_2 = y_2 + \alpha_2 \frac{\overline{V}_2^2}{2g}$$

In other words

$$V = \left\{2g\left(E_1 - y_2\right)\right\}^{0.5} \alpha^{-0.50}$$

In which E_1 equals the upstream specific energy over the weir crest.



Flow over a broad crested weir under submerged condition

substituting $Q = \overline{V}A$ and putting $\alpha_2 = 1.0$ gives

$$Q = A\left\{2g\left(E_1 - y_2\right)\right\}^{0.5}$$

If the critical flow occurs at the control section ($y = y_c$), a head -discharge relationship for various throat geometries can may be derived from

$$Q = A_c \left\{ 2g \left(E_1 - y_c \right) \right\}^{0.50}$$