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Weirs and flumes

Weirs and flumes provide a means for measuring the flow rate of water and suspensions in open channels. They are easy to install and are suitable for the measurement of whitewater, effluent and other low viscosity liquid flows. The basic principle is that the discharge flow rate is a function of the water depth (head) upstream of the device and it can be easily measured using conventional methods. The accuracy of the flow rate calculation is typically 5% or better.

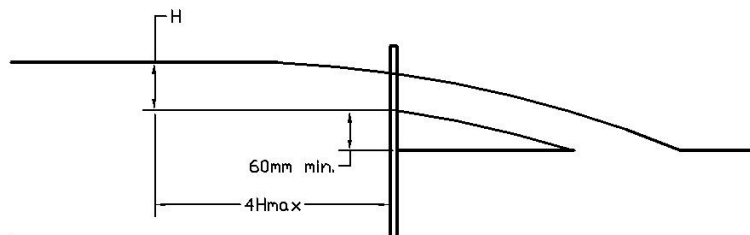
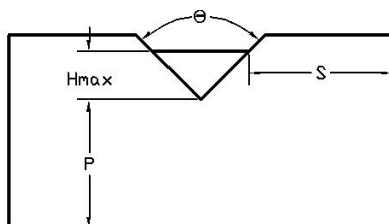
Weirs are inexpensive to construct and relatively easy to analyze, but they can be subject to upstream accumulation of sediments. Compared to weirs, flumes can handle greater flow rates, have less headloss and are self-scouring. They are more complicated to build and more complex to analyze than weirs.

Weirs

There are three common types of weirs; triangular (V-notch), rectangular, and trapezoidal (Cippoletti) weirs. These weirs can be partially contracted or fully contracted. The information provided in this TIP is valid for fully contracted weirs only. For a weir to be fully contracted, the side and bottom dimensions must adhere to the constraints listed with the figures below. The references should be consulted for information on partially contracted weirs. Listed below are guidelines to be used for all types of weirs (1-3).

- The head (H) should be between 60 mm (0.2 ft) and 600 mm (2 ft).
- The head (H) should be measured $2H_{\max}$ to $6H_{\max}$ upstream of the weir ($4H_{\max}$ is preferred).
- A straight approach with no obstructions for a distance of $20H_{\max}$ upstream of the weir is recommended.
- The weir is to be plumb, smooth and perpendicular to the axis of the channel.
- The surface of the flow downstream of the weir should be at least 60 mm (0.2 ft) below the crest or notch of the weir.
- Velocity of the approach should be less than 0.1 m/s (0.3 ft/s).
- Weir plate thickness at the crest should be 0.5 mm (0.020 in) to 2 mm (0.080 in) wide.

Triangular (V-notch) weir (2-4)



Metric Units $Q = 42.6 \times 10^{-6} \tan\left(\frac{\theta}{2}\right) H^{\frac{5}{2}}$ $Q \rightarrow \frac{\ell}{\text{sec}}, H \rightarrow \text{mm}$

English Units $Q = 2.44 \tan\left(\frac{\theta}{2}\right) H^{\frac{5}{2}}$ $Q \rightarrow \frac{\text{ft}^3}{\text{sec}}, H \rightarrow \text{ft}$

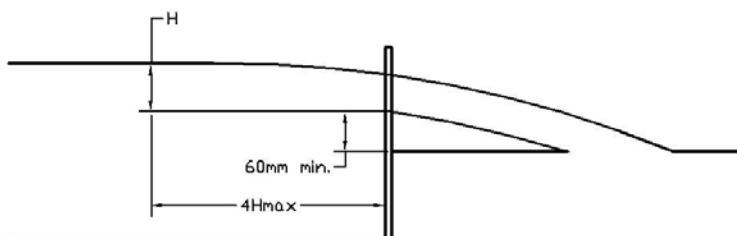
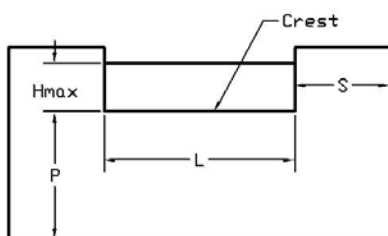
TIP Category: Automatically Periodically Reviewed (Five-year review)



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Special Guidelines for Fully Contracted Triangular Weirs

- Θ should be between 25° and 100° , most common triangular weirs are 60° and 90° .
- Maximum head (H) should be 381 mm (1.25 ft).
- $S \geq 2.5 H_{\max}$
- $P > 2 H_{\max}$

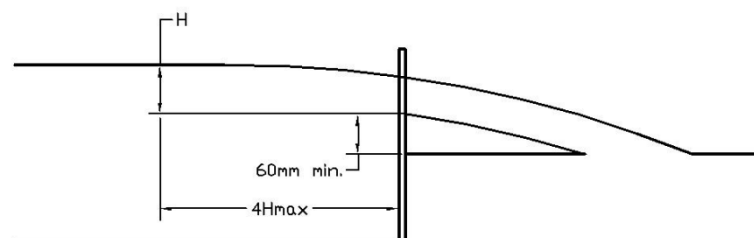
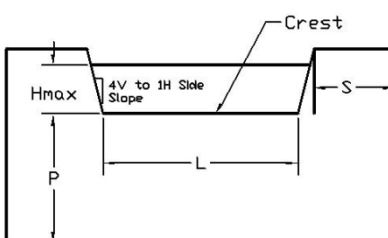
Rectangular weir (1-4)

Metric Units $Q = 5.81 \times 10^{-5} (L - 0.2H) H^{\frac{3}{2}}$ $Q \rightarrow \frac{\ell}{\text{sec}}, H \rightarrow \text{mm}$

English Units $Q = 3.33 (L - 0.2H) H^{\frac{3}{2}}$ $Q \rightarrow \frac{ft^3}{\text{sec}}, H \rightarrow ft$

Special Guidelines for Fully Contracted Rectangular Weirs

- $L > 3H_{\max}$
- $S > 2H_{\max}$
- $P > 2H_{\max}$
- Crest to be level

Trapezoidal (Cippoletti) weir (1,2)

Metric Units $Q = 5.88 \times 10^{-5} L H^{\frac{3}{2}}$ $Q \rightarrow \frac{\ell}{\text{sec}}, H \rightarrow \text{mm}$

English Units $Q = 3.37 L H^{\frac{3}{2}}$ $Q \rightarrow \frac{ft^3}{\text{sec}}, H \rightarrow ft$

Special Guidelines for Fully Contracted Trapezoidal Weirs

- Slope of the side should be 4 to 1 (4 vertical to 1 horizontal)
- $L > 3H_{\max}$
- $S > 2H_{\max}$
- $P > 2H_{\max}$
- Crest to be level
- Cippoletti weirs tend to be slightly less accurate than triangular or rectangular weirs ($\pm 5\%$).