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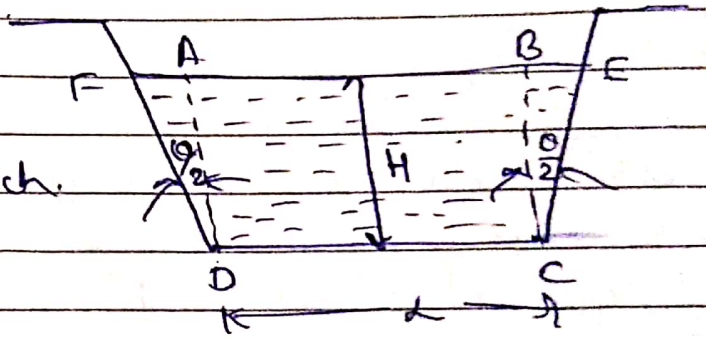
TRAPEZOIDAL NOTCH or WEIR.

A Trapezoidal notch is a combination of a rectangular notch and triangular notch or weir.

total discharge will be equal to the sum of discharge through a rectangular weir or notch or triangular weir or notch.

Let H = Ht of water over notch

L = Length of the crest of the Notch.



C_{d_1} = Co-efficient of discharge for rectangular portion ABCD

C_{d_2} = Co-efficient of discharge for triangular Portion [FAD and BCE]

$$Q_1 = \frac{2}{3} \times C_d \times L \times \sqrt{2g} \times H^{3/2}$$

Discharge through rectangular notch FDA & BCE is equal to the discharge through single triangular

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Notch of angle θ

$$Q_2 = \frac{8}{15} \times C_{d_2} \times \tan\frac{\theta}{2} \times \sqrt{2g} \times H^{5/2}$$

Discharge through trapezoidal notch

$$= \frac{2}{3} \times C_{d_1} \times \sqrt{2g} \times H^{3/5} + \frac{8}{15} \times C_{d_2} \times \tan\frac{\theta}{2} \times \sqrt{2g} \times H^{5/2}$$

Q Find the discharge through a trapezoidal notch which is 1 m wide at the top and 0.40 m at the bottom and is 30 cm in ht. the head of water on the notch is 20 cm. assume C_d for rectangular portion = 0.62 while for triangular = 0.60

Sol Given that

Top width AF = 1m

Base width CD = b = 0.4m

Head of water H = 0.20m

for Rect. portion $C_{d_1} = 0.62$

for Triang. portion $C_{d_2} = 0.60$

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From $\triangle ABC$,

$$\tan\frac{\theta}{2} = \frac{AB}{BC}$$

$$= \frac{(AE-CD)/2}{H}$$

$$= \frac{(1-0.4)/2}{0.3}$$

$$= 1$$

Discharge through trapezoidal notch

$$Q = \frac{2}{3} C_{d_1} \times \sqrt{2g} \times L \times H^{3/2} + \frac{8}{15} \times C_{d_2} \times \sqrt{2g} \times \tan\frac{\theta}{2} \times H^{5/2}$$

$$= \frac{2}{3} \times 0.62 \times 0.4 \times \sqrt{2 \times 9.81} \times (0.2)^{3/2} + \frac{8}{15} \times 0.60 \times 1 \times \sqrt{2 \times 9.81} \times (0.2)^{5/2}$$

$$= 0.06549 + 0.02535$$

$$= 0.09084 \text{ m}^3/\text{s}$$

$$\boxed{Q = 90.84 \text{ l/sec}}$$

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* Effect of discharge over a notch or weir due to error in the measurment of Head

→

* for Rectangular weir or notch

$$Q = \frac{2}{3} \times C_d \times L \times \sqrt{2g} \times H^{3/2}$$

$$Q = K \cdot H^{3/2} \quad \text{--- (i)}$$

differentiating above eqn

$$dQ = K \times \frac{3}{2} \times H^{1/2} \cdot dH \quad \text{--- (ii)}$$

divided (ii) by (i)

$$\frac{dQ}{Q} = \frac{K \times 3/2 \times H^{1/2} \cdot dH}{K H^{3/2}}$$

$$\boxed{\frac{dQ}{Q} = \frac{3}{2} \cdot \frac{dH}{H}}$$

NOTE :- Error of 1% in measuring H will produce 1.5% error in discharge over a rectangular weir

Similarly triangular Notch

$$\boxed{\frac{dQ}{Q} = \frac{5}{2} \cdot \frac{dH}{H}}$$

NOTE :-

An Error of 1% in measuring H will Produce 1.5% error over a triangular notch