



Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas

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Examples!

Conversions!

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List of 27 Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas

Area-Velocity and Ultrasonic Method of Streamflow Measurement

Area-Velocity Method 2

1) Flow Velocity

fx $V_{\mathrm{f}} = V \cdot \sin(heta)$

Open Calculator 🗗

 $ext{ex} \ 7.660444 ext{m/s} = 10 ext{m/s} \cdot ext{sin} (50\degree)$

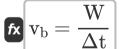
2) Moving Boat Velocity 🗗

fx $v_b = V \cdot cos(\theta)$

Open Calculator

 $ext{ex} \ 6.427876 ext{m/s} = 10 ext{m/s} \cdot ext{cos}(50\degree)$

3) Moving Boat Velocity given Width between Two Verticals 🛂



Open Calculator

= $6.382979 \mathrm{m/s} = rac{300 \mathrm{m}}{47 \mathrm{s}}$





4) Partial Discharge in Sub-Area between Two Verticals given Flow Velocity

 $\Delta extstyle Q_{ ext{i}} = \left(rac{ ext{y}_{ ext{i}} + ext{y}_{ ext{i}+1}}{2}
ight) \cdot ext{W} + 1 \cdot ext{V}_{ ext{f}}$

Open Calculator 🚰

 $\boxed{ 1057.6 \mathrm{m}^{\scriptscriptstyle 3}/\mathrm{s} = \left(\frac{3\mathrm{m} + 4\mathrm{m}}{2}\right) \cdot 300\mathrm{m} + 1 \cdot 7.6\mathrm{m/s} }$

5) Partial Discharge in Sub-Area between Two Verticals given Resultant Velocity

fx

Open Calculator

 $\Delta ext{Q}_{ ext{i}} = \left(rac{ ext{y}_{ ext{i}} + ext{y}_{ ext{i}+1}}{2}
ight) \cdot ext{V}^2 \cdot \sin(heta) \cdot \cos(heta) \cdot \Delta ext{t}$

6) Resultant Velocity given Flow Velocity

 $V = rac{V_{
m f}}{\sin(heta)}$

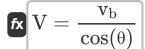
Open Calculator

$$= 2.921095 \text{m/s} = \frac{7.6 \text{m/s}}{\sin(50°)}$$





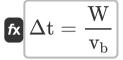
7) Resultant Velocity given Moving Boat Velocity



Open Calculator 🗗

 $= 2.987747 \text{m/s} = \frac{6.42 \text{m/s}}{\cos(50°)}$

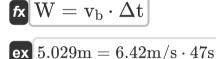
8) Time of Transit between two Verticals given Width between Verticals



Open Calculator

 $ext{ex} egin{aligned} 46.72897 ext{s} &= rac{300 ext{m}}{6.42 ext{m/s}} \end{aligned}$

9) Width between Two Verticals



Open Calculator

Measurement of Velocity 🗗

weasurement or velocity &

10) Average Stream Velocity given Minimum Weight $v = \frac{N}{50 \cdot d}$

Open Calculator 🚰

$$\boxed{ 20 \mathrm{m/s} = \frac{3300 \mathrm{N}}{50 \cdot 3.3 \mathrm{m}} }$$







11) Average Velocity in Moderately Deep Streams

 $\left|\mathbf{v} = rac{\mathbf{v}_{0.2} + \mathbf{v}_{0.8}}{2}
ight|$

Open Calculator

 $oxed{ex} 20 \mathrm{m/s} = rac{26 \mathrm{m/s} + 14 \mathrm{m/s}}{2}$

12) Average Velocity obtained by using Reduction Factor

fx $v = K \cdot v_s$

Open Calculator

 $\texttt{ex} \left[20.9 \text{m/s} = 0.95 \cdot 22 \text{m/s} \right]$

13) Depth of Flow at Vertical given Sounding Weights

 $extbf{d} = rac{ ext{N}}{50 \cdot ext{v}}$

Open Calculator 🗗

$= 3.3 \mathrm{m} = \frac{3300 \mathrm{N}}{50 \cdot 20 \mathrm{m/s}}$

14) Distance Travelled given Surface Velocity

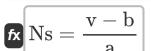


 $extbf{ex}$ $110 ext{m} = 22 ext{m/s} \cdot 5 ext{s}$





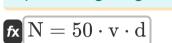
15) Revolutions per Second of Horizontal Axis Meter given Stream Velocity



Open Calculator

$$\boxed{ 32 = \frac{20 \text{m/s} - 0.8}{0.6} }$$

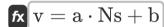
16) Sounding Weights



Open Calculator

ex
$$3300 ext{N} = 50 \cdot 20 ext{m/s} \cdot 3.3 ext{m}$$

17) Stream Velocity at Instrument Location



Open Calculator 🗗

$$m ex \ 20.6m/s = 0.6 \cdot 33 + 0.8$$

18) Surface Velocity



$$\boxed{22 \text{m/s} = \frac{110 \text{m}}{5 \text{s}}}$$



19) Surface Velocity given Average of Velocity

 $\left| \mathbf{v}_{\mathrm{s}}
ight| = rac{\mathrm{v}}{\mathrm{K}}$

Open Calculator

 $m ex = 21.05263 m/s = rac{20 m/s}{0.95}$

20) Time of Distance Travelled given Surface Velocity



Open Calculator 🗗

21) Velocity Distribution in Rough Turbulent Flow



Open Calculator



Ultrasonic Method

22) Average Velocity along Path AB at certain Height above Bed

fx

Open Calculator 🗗

$$\mathrm{v}_{\mathrm{avg}} = \left(\left(rac{\mathrm{L}}{2}
ight) \cdot \mathrm{cos}(\mathrm{ heta})
ight) \cdot \left(\left(rac{1}{\mathrm{t}_1}
ight) - \left(rac{1}{\mathrm{t}_2}
ight)
ight)$$

ex

$$2.351318 \mathrm{m/s} = \left(\left(\frac{3000 \mathrm{m}}{2} \right) \cdot \cos(50^\circ) \right) \cdot \left(\left(\frac{1}{2.02 \mathrm{s}} \right) - \left(\frac{1}{2.03 \mathrm{s}} \right) \right)$$

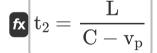
23) Elapse Time of Ultrasonic Signal sent by A



Open Calculator

$$oxed{ex} 2.020188 ext{s} = rac{3000 ext{m}}{1480 ext{m/s} + 5.01 ext{m/s}}$$

24) Elapse Time of Ultrasonic Signal sent by B 💪



Open Calculator 🗗

$$ext{ex} \ 2.033912 ext{s} = rac{3000 ext{m}}{1480 ext{m/s} - 5.01 ext{m/s}}$$



25) Length of Path for Elapse Time of Ultrasonic Signal 🗗

fx $L = t_1 \cdot (C + v_p)$

fx $L = t_1 \cdot (C - v_p)$

Open Calculator

 $2999.72m = 2.02s \cdot (1480m/s + 5.01m/s)$

26) Length of Path given Elapse Time of Ultrasonic Signal 🗗

Open Calculator

 $2979.48m = 2.02s \cdot (1480m/s - 5.01m/s)$

27) Velocity of Sound in Water given Elapse Time of Ultrasonic Signal sent bv A

 $\left| \mathbf{L} \right| \mathbf{C} = \left(rac{\mathbf{L}}{\mathbf{t}_1}
ight) - \mathbf{v}_{\mathrm{p}}$

Open Calculator

 $m = 1480.139 m/s = \left(rac{3000 m}{2.02 s}
ight) - 5.01 m/s$



Variables Used

- a Constant a
- b Constant b
- C Velocity of Sound in Water (Meter per Second)
- d Depth of Flow in Vertical (Meter)
- K Reduction Factor
- k_s Equivalent Sand-Grain Roughness
- L Length of Path from A to B (Meter)
- **N** Minimum Weight (Newton)
- Ns Revolutions per Second of Meter
- S Distance Travelled (Meter)
- t Time Taken to Travel (Second)
- t₁ Elapse Time t1 (Second)
- t₂ Elapse Time t2 (Second)
- V Average Velocity in Vertical (Meter per Second)
- V Resultant Velocity (Meter per Second)
- V_{0.2} Velocity at 0.2 Times Depth of Flow (Meter per Second)
- V_{0.8} Velocity at 0.8 Times Depth of Flow (Meter per Second)
- Vavq Average Velocity along Path (Meter per Second)
- V_b Boat Velocity (Meter per Second)
- V_f Flow Velocity (Meter per Second)
- V_p Component of Flow Velocity in Sound Path (Meter per Second)
- V_S Surface Velocity of River (Meter per Second)





- V_{shear} Shear Velocity (Meter per Second)
- **W** Width between Two Verticals (*Meter*)
- **y** Height above Bed (Meter)
- **y**_i Depth 'yi' of Flow in Sub-Area (*Meter*)
- **y**_{i+1} Depth 'i+1' of Flow in Sub-Area (*Meter*)
- ΔQ_i Partial Discharges (Cubic Meter per Second)
- Δt Time of Transit between Two Verticals (Second)
- θ Angle (Degree)





Constants, Functions, Measurements used

- Function: cos, cos(Angle)

 Trigonometric cosine function
- Function: log10, log10(Number)
 Common logarithm function (base 10)
- Function: sin, sin(Angle)

 Trigonometric sine function
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Time in Second (s)
 Time Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Volumetric Flow Rate in Cubic Meter per Second (m³/s)

 Volumetric Flow Rate Unit Conversion





Check other formula lists

- Abstractions from Precipitation
 Formulas
- Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas
- Indirect Methods of Streamflow Measurement Formulas
- Losses from Precipitation Formulas
- Measurement of
 Evapotranspiration Formulas
 Precipitation Formulas

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