



## Inlet Currents and Tidal Elevations Formulas

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## List of 28 Inlet Currents and Tidal Elevations Formulas

## Inlet Currents and Tidal Elevations C



fx 
$$A_{avg} = rac{A_b \cdot d_{Bay}}{V_{avg}}$$
  
ex  $8.000533m^2 = rac{1.5001m^2 \cdot 20}{3.75m/s}$ 

2) Average Area over Channel Length using King's Dimensionless Velocity

fx 
$$A_{\mathrm{avg}} = rac{\mathrm{V'_m} \cdot 2 \cdot \pi \cdot \mathrm{a_o} \cdot \mathrm{A_b}}{\mathrm{T} \cdot \mathrm{V_m}}$$

Open Calculator 🕑

Open Calculator

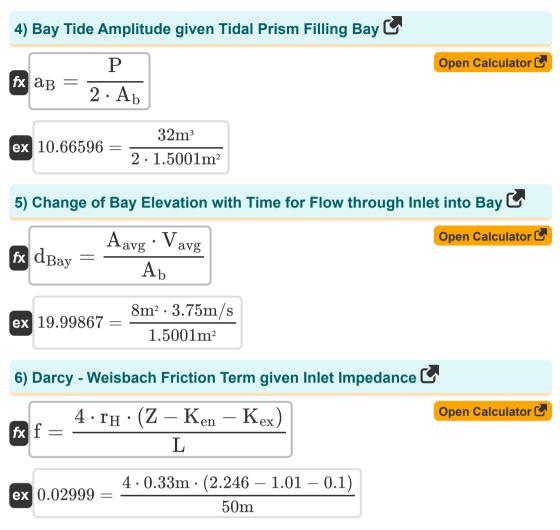
Open Calculator

ex 7.780823m<sup>2</sup> = 
$$\frac{110 \cdot 2 \cdot \pi \cdot 4.0 \text{m} \cdot 1.5001 \text{m}^2}{130 \text{s} \cdot 4.1 \text{m/s}}$$

3) Average Velocity in Channel for Flow through Inlet into Bay

fx 
$$V_{avg} = rac{A_b \cdot d_{Bay}}{A_{avg}}$$
  
ex  $3.75025 \mathrm{m/s} = rac{1.5001 \mathrm{m}^2 \cdot 20}{8 \mathrm{m}^2}$ 







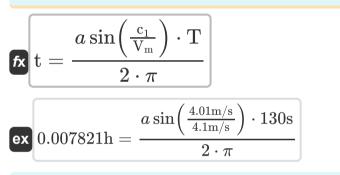
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# 7) Dimensionless Parameter Function of Hydraulic Radius and Manning's Roughness Coefficient

$$f_{\rm X} = \frac{116 \cdot n^2}{R_{\rm H}^{\frac{1}{3}}}$$
Open Calculator (2)
$$0.029811 = \frac{116 \cdot (0.0198)^2}{R_{\rm H}^{\frac{1}{3}}}$$

#### 8) Duration of Inflow given Inlet Channel Velocity 🕑

 $(3.55m)^{\frac{1}{3}}$ 



#### 9) Entrance Energy Loss Coefficient given Inlet Impedance 🕑

$$\mathbf{K}_{\mathrm{en}} = \mathrm{Z} - \mathrm{K}_{\mathrm{ex}} - \left(\mathrm{f}\cdot rac{\mathrm{L}}{4\cdot\mathrm{r}_{\mathrm{H}}}
ight)$$

ex 
$$1.009636 = 2.246 - 0.1 - \left(0.03 \cdot \frac{50 \mathrm{m}}{4 \cdot 0.33 \mathrm{m}}\right)$$





10) Exit Energy Loss Coefficient given Inlet Impedance 🕑

fx 
$$\mathbf{K}_{\mathrm{ex}} = \mathbf{Z} - \mathbf{K}_{\mathrm{en}} - \left(\mathbf{f}\cdot rac{\mathbf{L}}{\mathbf{4}\cdot\mathbf{r}_{\mathrm{H}}}
ight)$$

ex 
$$0.099636 = 2.246 - 1.01 - \left(0.03 \cdot \frac{50 \mathrm{m}}{4 \cdot 0.33 \mathrm{m}}\right)$$

11) Hydraulic Radius given Dimensionless Parameter 🕑

Open Calculator 🕑

Open Calculator

fx 
$$\mathrm{R_{H}} = \left(116 \cdot rac{\mathrm{n}^2}{\mathrm{f}}
ight)^3$$

ex 
$$3.483384 \mathrm{m} = \left(116 \cdot rac{\left(0.0198
ight)^2}{0.03}
ight)^3$$

### 12) Inlet Channel Velocity

fx 
$$\mathbf{c}_1 = \mathbf{V}_{\mathrm{m}} \cdot \sin\!\left(2\cdot \pi \cdot rac{\mathrm{t}}{\mathrm{T}}
ight)$$

$$4.070106 \mathrm{m/s} = 4.1 \mathrm{m/s} \cdot \sin \left( 2 \cdot \pi \cdot \frac{1.2 \mathrm{h}}{130 \mathrm{s}} \right)$$





### 13) Inlet Friction Coefficient given Keulegan Repletion Coefficient

fx 
$$K_1 = \frac{1}{\left(K \cdot K_2\right)^2}$$
  
ex  $28.44444 = \frac{1}{\left(0.75 \cdot 0.25\right)^2}$ 

# 14) Inlet Friction Coefficient Parameter given Keulegan Repletion

fx 
$$K_2 = rac{\sqrt{rac{1}{K_1}}}{K}$$
 ex  $0.248452 = rac{\sqrt{rac{1}{28.8}}}{0.75}$ 

#### 15) Inlet Hydraulic Radius given Inlet Impedance 🕑

$$\mathbf{f_X} \mathbf{r}_{\mathrm{H}} = \frac{\mathbf{f} \cdot \mathbf{L}}{4 \cdot (\mathbf{Z} - \mathbf{K}_{\mathrm{ex}} - \mathbf{K}_{\mathrm{en}})}$$

$$\mathbf{e_X} 0.330106\mathrm{m} = \frac{0.03 \cdot 50\mathrm{m}}{4 \cdot (2.246 - 0.1 - 1.01)}$$

Open Calculator 🕑



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#### 16) Inlet Impedance 🗹

fx 
$$\mathbf{Z} = \mathrm{K}_{\mathrm{en}} + \mathrm{K}_{\mathrm{ex}} + \left( \mathrm{f} \cdot rac{\mathrm{L}}{4 \cdot \mathrm{r}_{\mathrm{H}}} 
ight)$$

$$\begin{array}{l} \begin{array}{l} \begin{array}{l} \textbf{2.246364} = 1.01 + 0.1 + \left( 0.03 \cdot \frac{50 \text{m}}{4 \cdot 0.33 \text{m}} \right) \end{array} \end{array}$$

### 17) Inlet Length given Inlet Impedance 🕑

fx 
$$\mathbf{L} = 4 \cdot \mathbf{r}_{\mathrm{H}} \cdot rac{\mathbf{Z} - \mathbf{K}_{\mathrm{ex}} - \mathbf{K}_{\mathrm{en}}}{\mathrm{f}}$$

Open Calculator 🕑

Open Calculator

Open Calculator

$$49.984 \mathrm{m} = 4 \cdot 0.33 \mathrm{m} \cdot rac{2.246 - 0.1 - 1.01}{0.03}$$

## 18) Keulegan Repletion Coefficient 子

fx 
$$\mathrm{K} = rac{1}{\mathrm{K}_2} \cdot \sqrt{rac{1}{\mathrm{K}_1}}$$

$$ex \ 0.745356 = \frac{1}{0.25} \cdot \sqrt{\frac{1}{28.8}}$$

### 19) King's Dimensionless Velocity

fx
$$\mathbf{V'_m} = rac{\mathbf{A}_{avg} \cdot \mathbf{T} \cdot \mathbf{V_m}}{2 \cdot \pi \cdot \mathbf{a_o} \cdot \mathbf{A_b}}$$

ex 
$$113.0986 = \frac{8 \text{m}^2 \cdot 130 \text{s} \cdot 4.1 \text{m/s}}{2 \cdot \pi \cdot 4.0 \text{m} \cdot 1.5001 \text{m}^2}$$

Open Calculator 🕑



e



20) Manning's Roughness Coefficient using Dimensionless Parameter 💪

fx 
$$n = \sqrt{f \cdot \frac{R_H^{\frac{1}{3}}}{116}}$$
  
ex  $0.019863 = \sqrt{0.03 \cdot \frac{(3.55m)^{\frac{1}{3}}}{116}}$ 

21) Maximum Cross-Sectionally Averaged Velocity during Tidal Cycle 🗹

fx 
$$V_{\mathrm{m}} = rac{\mathrm{V'_{\mathrm{m}}} \cdot 2 \cdot \pi \cdot \mathrm{a_o} \cdot \mathrm{A_b}}{\mathrm{A_{\mathrm{avg}}} \cdot \mathrm{T}}$$

ex 
$$3.987672 \text{m/s} = \frac{110 \cdot 2 \cdot \pi \cdot 4.0 \text{m} \cdot 1.5001 \text{m}^2}{8 \text{m}^2 \cdot 130 \text{s}}$$

22) Maximum Cross-Sectionally Averaged Velocity during Tidal Cycle given Inlet Channel Velocity

fx 
$$V_{\rm m} = rac{c_1}{\sin\left(2\cdot\pi\cdotrac{{
m t}}{{
m T}}
ight)}$$
  
ex  $4.039452 {
m m/s} = rac{4.01 {
m m/s}}{\sin\left(2\cdot\pi\cdotrac{1.2 {
m h}}{130 {
m s}}
ight)}$ 

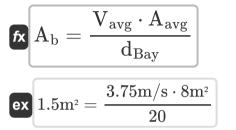
Open Calculator 🕑





23) Ocean Tide Amplitude using King's Dimensionless Velocity 🕑

24) Surface Area of Bay for Flow through Inlet into Bay 🕑



25) Surface Area of Bay given Tidal Prism Filling Bay 🗹

fx 
$$A_b = \frac{P}{2 \cdot a_B}$$
 Open Calculator   
ex  $4.324324m^2 = \frac{32m^3}{2 \cdot 3.7}$ 

26) Surface Area of Bay using King's Dimensionless Velocity

fx 
$$\mathbf{A}_{\mathrm{b}} = rac{\mathbf{A}_{\mathrm{avg}}\cdot\mathbf{T}\cdot\mathbf{V}_{\mathrm{m}}}{\mathbf{V'}_{\mathrm{m}}\cdot2\cdot\pi\cdot\mathbf{a}_{\mathrm{o}}}$$

ex 
$$1.542356 \mathrm{m}^2 = rac{8 \mathrm{m}^2 \cdot 130 \mathrm{s} \cdot 4.1 \mathrm{m/s}}{110 \cdot 2 \cdot \pi \cdot 4.0 \mathrm{m}}$$



Open Calculator

## 27) Tidal Period using King's Dimensionless Velocity 子

$$fx T = \frac{2 \cdot \pi \cdot a_o \cdot A_b \cdot V'_m}{A_{avg} \cdot V_m}$$
Open Calculator (\*)
$$fx T = \frac{2 \cdot \pi \cdot a_o \cdot A_b \cdot V'_m}{A_{avg} \cdot V_m}$$
Open Calculator (\*)
$$fx 126.4384s = \frac{2 \cdot \pi \cdot 4.0m \cdot 1.5001m^2 \cdot 110}{8m^2 \cdot 4.1m/s}$$
28) Tidal Prism Filling Bay (\*)
$$fx P = 2 \cdot a_B \cdot A_b$$
Open Calculator (\*)
$$fx 11.10074m^3 = 2 \cdot 3.7 \cdot 1.5001m^2$$





## Variables Used

- **A**avg Average Area over the Channel Length (Square Meter)
- **a**<sub>B</sub> Bay Tide Amplitude
- Ab Surface Area of Bay (Square Meter)
- **a**o Ocean Tide Amplitude (Meter)
- C<sub>1</sub> Inlet Velocity (Meter per Second)
- d<sub>Bav</sub> Change of Bay Elevation with Time
- f Dimensionless Parameter
- K Keulegan Repletion Coefficient [dimensionless]
- K<sub>1</sub> King's Inlet Friction Coefficient
- K<sub>2</sub> King's 1st Inlet Friction Coefficient
- Ken Entrance Energy Loss Coefficient
- Kex Exit Energy Loss Coefficient
- L Inlet Length (Meter)
- n Manning's Roughness Coefficient
- P Tidal Prism Filling Bay (Cubic Meter)
- **r<sub>H</sub>** Hydraulic Radius (Meter)
- R<sub>H</sub> Hydraulic Radius of the Channel (Meter)
- **t** Duration of Inflow (Hour)
- **T** Tidal Period (Second)
- Vavg Average Velocity in Channel for Flow (Meter per Second)
- V<sub>m</sub> Maximum Cross Sectional Average Velocity (Meter per Second)



- **V'm** King's Dimensionless Velocity
- Z Inlet Impedance





## **Constants, Functions, Measurements used**

- Constant: pi, 3.14159265358979323846264338327950288 Archimedes' constant
- Function: **asin**, asin(Number) The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **sin**, sin(Angle) Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: sqrt, sqrt(Number) A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: Length in Meter (m) Length Unit Conversion
- Measurement: Time in Second (s), Hour (h) Time Unit Conversion
- Measurement: Volume in Cubic Meter (m<sup>3</sup>) Volume Unit Conversion
- Measurement: Area in Square Meter (m<sup>2</sup>) Area Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
   Speed Unit Conversion



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## Check other formula lists

- Bay Superelevation, Effect of
   Inlet Currents and Tidal Freshwater Inflow, Multiple Inlets and Wave-Current Interaction Formulas 🚰
- Elevations Formulas

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