



# **Inlet Currents and Tidal Elevations Formulas**

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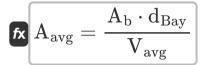




## List of 28 Inlet Currents and Tidal Elevations Formulas

## Inlet Currents and Tidal Elevations

1) Average Area over Channel Length for Flow through Inlet into Bay



Open Calculator 🗗

$$8.000533 \mathrm{m}^{_2} = rac{1.5001 \mathrm{m}^{_2} \cdot 20}{3.75 \mathrm{m/s}}$$

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

$$\texttt{fx} \boxed{ A_{avg} = \frac{V'_m \cdot 2 \cdot \pi \cdot a_o \cdot A_b}{T \cdot V_m} }$$

Open Calculator 🗗

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

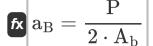
$$extbf{K} egin{equation} V_{avg} = rac{A_b \cdot d_{Bay}}{A_{avg}} \end{aligned}$$

$$ext{ex} 3.75025 ext{m/s} = rac{1.5001 ext{m}^2 \cdot 20}{8 ext{m}^2}$$





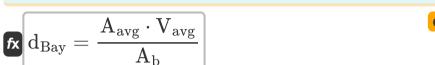
## 4) Bay Tide Amplitude given Tidal Prism Filling Bay



Open Calculator

$$= 10.66596 = \frac{32 m^3}{2 \cdot 1.5001 m^2}$$

5) Change of Bay Elevation with Time for Flow through Inlet into Bay



Open Calculator

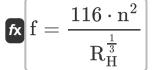
ex 
$$19.99867 = \frac{8 \mathrm{m}^2 \cdot 3.75 \mathrm{m/s}}{1.5001 \mathrm{m}^2}$$

6) Darcy - Weisbach Friction Term given Inlet Impedance

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

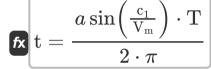


## 7) Dimensionless Parameter Function of Hydraulic Radius and Manning's Roughness Coefficient



Open Calculator 🗗

## 8) Duration of Inflow given Inlet Channel Velocity



Open Calculator

$$egin{aligned} \mathbf{ex} \ 0.007821 \mathrm{h} = rac{a \sin \left(rac{4.01 \mathrm{m/s}}{4.1 \mathrm{m/s}}
ight) \cdot 130 \mathrm{s}}{2 \cdot \pi} \end{aligned}$$

## 9) Entrance Energy Loss Coefficient given Inlet Impedance

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

$$oxed{ex} 1.009636 = 2.246 - 0.1 - \left(0.03 \cdot rac{50 ext{m}}{4 \cdot 0.33 ext{m}}
ight)$$



## 10) Exit Energy Loss Coefficient given Inlet Impedance

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

Open Calculator 🗗

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

## 11) Hydraulic Radius given Dimensionless Parameter

 $m R_H = \left(116 \cdot rac{n^2}{f}
ight)^3$ 

Open Calculator 🖸

ex 3.483384m =  $\left(116 \cdot \frac{(0.0198)^2}{0.03}\right)^3$ 

## 12) Inlet Channel Velocity

 $\left[ \mathbf{c}_{1} = \mathrm{V}_{\mathrm{m}} \cdot \sin \! \left( 2 \cdot \pi \cdot rac{\mathrm{t}}{\mathrm{T}} 
ight) 
ight]$ 

Open Calculator 🖒

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



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

$$\mathbf{K}_1 = rac{1}{\left(\mathbf{K}\cdot\mathbf{K}_2
ight)^2}$$

### 14) Inlet Friction Coefficient Parameter given Keulegan Repletion Coefficient

$$\mathbf{K}_{2}=rac{\sqrt{rac{1}{\mathrm{K}_{1}}}}{\mathrm{K}_{2}}$$

ex 
$$0.248452 = rac{\sqrt{rac{1}{28.8}}}{0.75}$$

## 15) Inlet Hydraulic Radius given Inlet Impedance 🗗

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

ex 
$$0.330106 \mathrm{m} = rac{0.03 \cdot 50 \mathrm{m}}{4 \cdot (2.246 - 0.1 - 1.01)}$$



Open Calculator

Open Calculator

Open Calculator

Open Calculator

## 16) Inlet Impedance

$$\mathbf{Z} = \mathrm{K_{en}} + \mathrm{K_{ex}} + \left( \mathrm{f} \cdot rac{\mathrm{L}}{4 \cdot \mathrm{r_H}} 
ight)$$

 $\left[ 2.246364 = 1.01 + 0.1 + \left( 0.03 \cdot \frac{50 ext{m}}{4 \cdot 0.33 ext{m}} 
ight) 
ight]$ 

## 17) Inlet Length given Inlet Impedance 🗗

 $extbf{L} = 4 \cdot ext{r}_{ ext{H}} \cdot rac{ ext{Z} - ext{K}_{ ext{ex}} - ext{K}_{ ext{en}}}{ ext{f}}$ 

## 18) Keulegan Repletion Coefficient 🗗

 $K = rac{1}{K_2} \cdot \sqrt{rac{1}{K_1}}$ 

 $\boxed{ \mathbf{ex} \, 0.745356 = \frac{1}{0.25} \cdot \sqrt{\frac{1}{20.0}} }$ 

## 19) King's Dimensionless Velocity

 $extbf{K} extbf{V'}_{ ext{m}} = rac{ ext{A}_{ ext{avg}} \cdot ext{T} \cdot extbf{V}_{ ext{m}}}{2 \cdot \pi \cdot ext{A}_{ ext{a}} \cdot ext{A}_{ ext{b}}}$ 

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



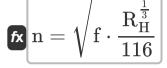




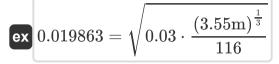


## 20) Manning's Roughness Coefficient using Dimensionless Parameter 💪

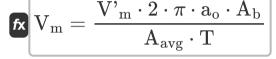




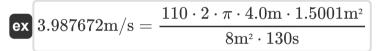
Open Calculator 🗗



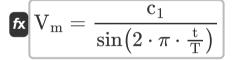
## 21) Maximum Cross-Sectionally Averaged Velocity during Tidal Cycle



Open Calculator 🗗



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



$$ext{ex} egin{aligned} 4.039452 ext{m/s} &= rac{4.01 ext{m/s}}{\sin \left( 2 \cdot \pi \cdot rac{1.2 ext{h}}{130 ext{s}} 
ight)} \end{aligned}$$



## 23) Ocean Tide Amplitude using King's Dimensionless Velocity 🗗

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

Open Calculator 2

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

 $\mathbf{K} \mathbf{A}_{\mathrm{b}} = rac{\mathbf{V}_{\mathrm{avg}} \cdot \mathbf{A}_{\mathrm{avg}}}{\mathbf{d}_{\mathrm{Bav}}}$ 

Open Calculator

 $1.5 \mathrm{m}^2 = rac{3.75 \mathrm{m/s} \cdot 8 \mathrm{m}^2}{20}$ 

## 25) Surface Area of Bay given Tidal Prism Filling Bay 🖸

 $\left|\mathbf{K}
ight|\mathbf{A}_{\mathrm{b}}=rac{\mathbf{P}}{2\cdot\mathbf{a}_{\mathrm{D}}}
ight|$ 

Open Calculator

4.324324m<sup>2</sup> =  $\frac{32$ m<sup>3</sup>

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

 $\mathbf{K} \mathbf{A}_{\mathrm{b}} = rac{\mathbf{A}_{\mathrm{avg}} \cdot \mathbf{T} \cdot \mathbf{V}_{\mathrm{m}}}{\mathbf{V'}_{\mathrm{m}} \cdot 2 \cdot \pi \cdot \mathbf{a}_{\mathrm{o}}}$ 

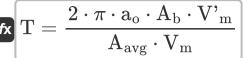
Open Calculator

 $oxed{ex} 1.542356 \mathrm{m}^{_2} = rac{8 \mathrm{m}^{_2} \cdot 130 \mathrm{s} \cdot 4.1 \mathrm{m/s}}{110 \cdot 2 \cdot \pi \cdot 4.0 \mathrm{m}}$ 





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



Open Calculator

ex 
$$126.4384 \mathrm{s} = rac{2 \cdot \pi \cdot 4.0 \mathrm{m} \cdot 1.5001 \mathrm{m}^2 \cdot 110}{8 \mathrm{m}^2 \cdot 4.1 \mathrm{m/s}}$$

### 28) Tidal Prism Filling Bay



$$\textbf{ex} \ 11.10074 \text{m}^{_3} = 2 \cdot 3.7 \cdot 1.5001 \text{m}^{_2}$$



#### Variables Used

- Aavg Average Area over the Channel Length (Square Meter)
- a<sub>B</sub> Bay Tide Amplitude
- A<sub>b</sub> Surface Area of Bay (Square Meter)
- a 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)
- V<sub>avg</sub> Average Velocity in Channel for Flow (Meter per Second)
- V<sub>m</sub> Maximum Cross Sectional Average Velocity (Meter per Second)





- **V'<sub>m</sub>** 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 (m³)

  Volume Unit Conversion
- Measurement: Area in Square Meter (m²)
   Area Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
   Speed Unit Conversion





#### 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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