Important Minimum Velocity to be Generated in Sewers Formulas PDF

Formulas
Examples
with Units

List of 29
Important Minimum Velocity to be Generated in Sewers Formulas

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1) Chezy's Constant given Friction Factor Formula

Formula

$$C = \sqrt{\frac{8 \cdot [g]}{f'}}$$

Example with Units

$$15.0147 = \sqrt{\frac{8 \cdot 9.8066_{m/s^2}}{0.348}}$$

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2) Chezy's Constant given Self Cleansing Velocity Formula

Formula

$$C = \frac{v_s}{\sqrt{k \cdot d' \cdot (G - 1)}}$$

Example with Units

$$15.0208 = \frac{0.114_{m/s}}{\sqrt{0.04 \cdot 4.8_{mm} \cdot (1.3 - 1)}}$$

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3) Cross Sectional Area of Flow given Hydraulic Mean Radius of Channel Formula

Formula

$$A_w = (m \cdot P)$$

Example with Units

$$120_{m^2} = (10_m \cdot 12_m)$$

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4) Friction Factor given Self Cleansing Velocity Formula

Formula

$$f' = \frac{8 \cdot [g] \cdot k \cdot d' \cdot (G - 1)}{(v_s)^2}$$

Example with Units

$$0.3477 = \frac{8 \cdot 9.8066_{m/s^2} \cdot 0.04 \cdot 4.8_{mm} \cdot (1.3 - 1)}{(0.114_{m/s})^2}$$

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5) Rugosity Coefficient given Self Cleansing Velocity Formula

Formula

$$n = \left(\frac{1}{v_s}\right) \cdot (m)^{\frac{1}{6}} \cdot \sqrt{k \cdot d' \cdot (G - 1)}$$

Example with Units

$$0.0977 = \left(\frac{1}{0.114_{m/s}}\right) \cdot (10_m)^{\frac{1}{6}} \cdot \sqrt{0.04 \cdot 4.8_{mm} \cdot (1.3 - 1)}$$

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6) Unit Weight of Water given Hydraulic Mean Depth Formula ⮌

Formula

$$\gamma_w = \frac{F_D}{m \cdot \bar{S}}$$

Example with Units

$$9983.3333 \, \text{N/m}^3 = \frac{11.98 \, \text{N}}{10 \, \text{m} \cdot 0.00012}$$

7) Diameter of Grain Formulas ⮌

7.1) Diameter of Grain for given Friction Factor Formula ⮌

Formula

$$d' = \frac{\left(v_s \right)^2}{\frac{8 \cdot [g] \cdot k \cdot (G - 1)}{f'}}$$

Example with Units

$$4.8039 \, \text{mm} = \frac{\left(0.114 \, \text{m/s} \right)^2}{\frac{8 \cdot 9.8066 \, \text{m/s}^2 \cdot 0.04 \cdot (1.3 - 1)}{0.348}}$$

7.2) Diameter of Grain given Rugosity Coefficient Formula ⮌

Formula

$$d' = \left(\frac{1}{k \cdot (G - 1)} \right) \cdot \left(\frac{v_s \cdot n}{(m)^{\frac{1}{6}}} \right)^2$$

Example with Units

$$0.1131 \, \text{mm} = \left(\frac{1}{0.04 \cdot (1.3 - 1)} \right) \cdot \left(\frac{0.114 \, \text{m/s} \cdot 0.015}{(10 \, \text{m})^{\frac{1}{6}}} \right)^2$$

7.3) Diameter of Grain given Self Cleaning Invert Slope Formula ⮌

Formula

$$d' = \frac{sL_I}{\left(\frac{k}{m} \right) \cdot (G - 1)}$$

Example with Units

$$4.8 \, \text{mm} = \frac{5.76\text{E-}6}{\left(\frac{0.04}{10 \, \text{m}} \right) \cdot (1.3 - 1)}$$

7.4) Diameter of Grain given Self Cleansing velocity Formula ⮌

Formula

$$d' = \frac{\left(\frac{v_s}{C} \right)^2}{k \cdot (G - 1)}$$

Example with Units

$$4.8133 \, \text{mm} = \frac{\left(\frac{0.114 \, \text{m/s}}{15} \right)^2}{0.04 \cdot (1.3 - 1)}$$

8) Drag Force Formulas 📱

8.1) Angle of Inclination given drag force Formula 📱

Formula

Evaluate Formula 📱

$$\alpha_i = ar\sin\left(\frac{F_D}{\gamma_w \cdot (G - 1) \cdot (1 - n) \cdot t}\right)$$

Example with Units

$$59.8342° = ar\sin\left(\frac{11.98\,\text{N}}{9810\,\text{N/m}^3 \cdot (1.3 - 1) \cdot (1 - 0.015) \cdot 4.78\,\text{mm}}\right)$$

8.2) Bed Slope of Channel given Drag Force Formula 📱

Formula   **Example with Units**

Evaluate Formula 📱

$$\bar{S} = \frac{F_D}{\gamma_w \cdot m}$$ $$0.0001 = \frac{11.98\,\text{N}}{9810\,\text{N/m}^3 \cdot 10\,\text{m}}$$

8.3) Drag Force Exerted by Flowing Water Formula 📱

Formula

Evaluate Formula 📱

$$F_D = \gamma_w \cdot (G - 1) \cdot (1 - n) \cdot t \cdot \sin(\alpha_i)$$

Example with Units

$$12.0001\,\text{N} = 9810\,\text{N/m}^3 \cdot (1.3 - 1) \cdot (1 - 0.015) \cdot 4.78\,\text{mm} \cdot \sin(60°)$$

8.4) Drag Force or Intensity of Tractive force Formula 📱

Formula   **Example with Units**

Evaluate Formula 📱

$$F_D = \gamma_w \cdot m \cdot \bar{S}$$ $$11.772\,\text{N} = 9810\,\text{N/m}^3 \cdot 10\,\text{m} \cdot 0.00012$$

8.5) Rugosity Coefficient given Drag Force Formula 📱

Formula

Evaluate Formula 📱

$$n = 1 - \left(\frac{F_D}{\gamma_w \cdot (G - 1) \cdot t \cdot \sin(\alpha_i)}\right)$$

Example with Units

$$0.0167 = 1 - \left(\frac{11.98\,\text{N}}{9810\,\text{N/m}^3 \cdot (1.3 - 1) \cdot 4.78\,\text{mm} \cdot \sin(60°)}\right)$$

8.6) Thickness of Sediment given Drag Force Formula ➦

Formula

Evaluate Formula ➦

$$t = \left(\frac{F_D}{\gamma_w \cdot (G - 1) \cdot (1 - n) \cdot \sin(\alpha_i)} \right)$$

Example with Units

$$4.772 \, \text{mm} = \left(\frac{11.98 \, \text{N}}{9810 \, \text{N/m}^3 \cdot (1.3 - 1) \cdot (1 - 0.015) \cdot \sin(60°)} \right)$$

8.7) Unit Weight of Water given Drag Force Formula ➦

Formula

Evaluate Formula ➦

$$\gamma_w = \left(\frac{F_D}{(G - 1) \cdot (1 - n) \cdot t \cdot \sin(\alpha_i)} \right)$$

Example with Units

$$9793.5649 \, \text{N/m}^3 = \left(\frac{11.98 \, \text{N}}{(1.3 - 1) \cdot (1 - 0.015) \cdot 4.78 \, \text{mm} \cdot \sin(60°)} \right)$$

9) Hydraulic Mean Depth Formulas ➦

9.1) Hydraulic Mean Depth given Self Cleaning Invert Slope Formula ➦

Formula   **Example with Units**

Evaluate Formula ➦

$$m = \left(\frac{k}{sL_I} \right) \cdot (G - 1) \cdot d'$$ $$10 \, \text{m} = \left(\frac{0.04}{5.76\text{E-}6} \right) \cdot (1.3 - 1) \cdot 4.8 \, \text{mm}$$

9.2) Hydraulic Mean Depth given Self Cleansing Velocity Formula ➦

Formula   **Example with Units**

Evaluate Formula ➦

$$m = \left(\frac{v_s \cdot n}{\sqrt{k \cdot d' \cdot (G - 1)}} \right)^6$$ $$0.0001 \, \text{m} = \left(\frac{0.114 \, \text{m/s} \cdot 0.015}{\sqrt{0.04 \cdot 4.8 \, \text{mm} \cdot (1.3 - 1)}} \right)^6$$

9.3) Hydraulic Mean Depth of Channel given Drag Force Formula ➦

Formula   **Example with Units**

Evaluate Formula ➦

$$m = \frac{F_D}{\gamma_w \cdot \bar{S}}$$ $$10.1767 \, \text{m} = \frac{11.98 \, \text{N}}{9810 \, \text{N/m}^3 \cdot 0.00012}$$

10) Self Cleansing Velocity Formulas ⤤

10.1) Self Cleaning Invert Slope Formula ⤤

Formula

$$sL_I = \left(\frac{k}{m} \right) \cdot (G - 1) \cdot d'$$

Example with Units

$$5.8\text{E-}6 = \left(\frac{0.04}{10\,\text{m}} \right) \cdot (1.3 - 1) \cdot 4.8\,\text{mm}$$

10.2) Self Cleansing Velocity Formula ⤤

Formula

$$v_s = C \cdot \sqrt{ k \cdot d' \cdot (G - 1) }$$

Example with Units

$$0.1138\,\text{m/s} = 15 \cdot \sqrt{ 0.04 \cdot 4.8\,\text{mm} \cdot (1.3 - 1) }$$

10.3) Self Cleansing Velocity given Friction Factor Formula ⤤

Formula

$$v_s = \sqrt{ \frac{8 \cdot [g] \cdot k \cdot d' \cdot (G - 1)}{f'} }$$

Example with Units

$$0.114\,\text{m/s} = \sqrt{ \frac{8 \cdot 9.8066\,\text{m/s}^2 \cdot 0.04 \cdot 4.8\,\text{mm} \cdot (1.3 - 1)}{0.348} }$$

10.4) Self Cleansing Velocity given Rugosity Coefficient Formula ⤤

Formula

$$v_s = \left(\frac{1}{n} \right) \cdot (m)^{\frac{1}{6}} \cdot \sqrt{ k \cdot d' \cdot (G - 1) }$$

Example with Units

$$0.7427\,\text{m/s} = \left(\frac{1}{0.015} \right) \cdot (10\,\text{m})^{\frac{1}{6}} \cdot \sqrt{ 0.04 \cdot 4.8\,\text{mm} \cdot (1.3 - 1) }$$

11) Specific Gravity of Sediment Formulas ⤤

11.1) Specific Gravity of Sediment given Drag Force Formula ⤤

Formula

$$G = \left(\frac{F_D}{\gamma_w \cdot (1 - n) \cdot t \cdot \sin (\alpha_i)} \right) + 1$$

Example with Units

$$1.2995 = \left(\frac{11.98\,\text{N}}{9810\,\text{N/m}^3 \cdot (1 - 0.015) \cdot 4.78\,\text{mm} \cdot \sin (60°)} \right) + 1$$

11.2) Specific Gravity of Sediment given Friction Factor Formula ➦

Formula

$$G = \left(\frac{(v_s)^2}{\frac{8 \cdot [g] \cdot k \cdot d}{f'}} \right) + 1$$

Example with Units

$$1.3002 = \left(\frac{(0.114 \, \text{m/s})^2}{\frac{8 \cdot 9.8066 \, \text{m/s}^2 \cdot 0.04 \cdot 4.8 \, \text{mm}}{0.348}} \right) + 1$$

11.3) Specific Gravity of Sediment given Self Cleaning Invert Slope Formula ➦

Formula

$$G = \left(\frac{sL_I}{\left(\frac{k}{m} \right) \cdot d'} \right) + 1$$

Example with Units

$$1.3 = \left(\frac{5.76\text{E-}6}{\left(\frac{0.04}{10 \, \text{m}} \right) \cdot 4.8 \, \text{mm}} \right) + 1$$

11.4) Specific Gravity of Sediment given Self Cleansing Velocity Formula ➦

Formula

$$G = \left(\frac{\left(\frac{v_s}{C} \right)^2}{d' \cdot k} \right) + 1$$

Example with Units

$$1.3008 = \left(\frac{\left(\frac{0.114 \, \text{m/s}}{15} \right)^2}{4.8 \, \text{mm} \cdot 0.04} \right) + 1$$

11.5) Specific Gravity of Sediment given Self Cleansing Velocity and Rugosity Coefficient Formula ➦

Formula

$$G = \left(\frac{1}{k \cdot d'} \right) \cdot \left(\frac{v_s \cdot n}{(m)^{\frac{1}{6}}} \right)^2 + 1$$

Example with Units

$$1.0071 = \left(\frac{1}{0.04 \cdot 4.8 \, \text{mm}} \right) \cdot \left(\frac{0.114 \, \text{m/s} \cdot 0.015}{(10 \, \text{m})^{\frac{1}{6}}} \right)^2 + 1$$

Variables used in list of Minimum Velocity to be Generated in Sewers Formulas above

- A_w Wetted Area *(Square Meter)*
- C Chezy's Constant
- d' Diameter of Particle *(Millimeter)*
- f' Friction Factor
- F_D Drag Force *(Newton)*
- G Specific Gravity of Sediment
- k Dimensional Constant
- m Hydraulic Mean Depth *(Meter)*
- n Rugosity Coefficient
- P Wetted Perimeter *(Meter)*
- $\bar{S}$ Bed Slope of a Sewer
- sL_I Self Cleaning Invert Slope
- t Volume per Unit Area *(Millimeter)*
- v_s Self Cleansing Velocity *(Meter per Second)*
- $α_i$ Angle of Inclination of Plane to Horizontal *(Degree)*
- $γ_w$ Unit Weight of Fluid *(Newton per Cubic Meter)*

Constants, Functions, Measurements used in list of Minimum Velocity to be Generated in Sewers Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- Functions: **arsin**, arsin(Number)
  Arcsine 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.
- Functions: **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.
- Functions: **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 Millimeter (mm), Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area 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: **Specific Weight** in Newton per Cubic Meter (N/m³)
  Specific Weight Unit Conversion

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