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Proportionate Hydraulic Elements for Circular Sewers Formulas

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List of 27 Proportionate Hydraulic Elements for Circular Sewers Formulas

Proportionate Hydraulic Elements for Circular Sewers

Area of Cross Section of Circular Sewer

1) Area of Cross-section for Full Flow given Discharge Ratio

Open Calculator

fx $$A = \frac{a}{\frac{qsQ_{ratio}}{\left(\frac{N}{n_p}\right)\cdot\left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{1}{6}}}}$$

ex $$5.416502\text{m}^2 = \frac{3.8\text{m}^2}{\frac{0.532}{\left(\frac{0.74}{0.9}\right)\cdot\left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{1}{6}}}}$$

2) Area of Cross-section for Full Flow given Hydraulic Mean Depth and Discharge Ratio

Open Calculator

fx $$A = \frac{a}{\frac{qsQ_{ratio}}{\left(\frac{N}{n_p}\right)\cdot(R)^{\frac{1}{6}}}}$$

ex $$5.408574\text{m}^2 = \frac{3.8\text{m}^2}{\frac{0.532}{\left(\frac{0.74}{0.9}\right)\cdot(0.61)^{\frac{1}{6}}}}$$

3) Area of Cross-Section for Full Flow given Hydraulic Mean Depth Ratio

Open Calculator

fx $$A = \frac{a}{\frac{q}{Q}}{\left(\frac{N}{np}\right)\cdot(R)^{\frac{1}{6}}}$$

ex $$5.349786\text{m}^2 = \frac{3.8\text{m}^2}{\frac{17.48\text{m}^3/\text{s}}{32.5\text{m}^3/\text{s}}}{\left(\frac{0.74}{0.9}\right)\cdot(0.61)^{\frac{1}{6}}}$$

4) Area of Cross-Section for Partial Flow given Discharge Ratio

Open Calculator

fx $$a = A\cdot\left(\frac{qsQ_{ratio}}{\left(\frac{N}{n_p}\right)\cdot\left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{1}{6}}}\right)$$

ex $$3.788423\text{m}^2 = 5.4\text{m}^2\cdot\left(\frac{0.532}{\left(\frac{0.74}{0.9}\right)\cdot\left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{1}{6}}}\right)$$

5) Area of Cross-section for Partial Flow given Hydraulic Mean Depth and Discharge Ratio

Open Calculator

fx $$a = A \cdot \left(\frac{qsQ_{ratio}}{\left(\frac{N}{n_p} \right) \cdot (R)^{\frac{1}{6}}} \right)$$

ex $$3.793976\text{m}^2 = 5.4\text{m}^2 \cdot \left(\frac{0.532}{\left(\frac{0.74}{0.9} \right) \cdot (0.61)^{\frac{1}{6}}} \right)$$

6) Area of Cross-Section for Partial Flow given Hydraulic Mean Depth Ratio

Open Calculator

fx $$a = A \cdot \left(\frac{\frac{q}{Q}}{\left(\frac{N}{n_p} \right) \cdot (R)^{\frac{1}{6}}} \right)$$

ex $$3.835668\text{m}^2 = 5.4\text{m}^2 \cdot \left(\frac{\frac{17.48\text{m}^3/\text{s}}{32.5\text{m}^3/\text{s}}}{\left(\frac{0.74}{0.9} \right) \cdot (0.61)^{\frac{1}{6}}} \right)$$

Bed Slope of Circular Sewer

7) Bed Slope for Full Flow given Bed Slope for Partial Flow

Open Calculator

fx $$s = \frac{s_s \cdot r_{pf}}{R_{rf}}$$

ex $$0.001108 = \frac{0.0018 \cdot 3.2\text{m}}{5.2\text{m}}$$

8) Bed Slope for Full Flow given Velocity Ratio

Open Calculator

fx $$s = \frac{s_s}{\left(\frac{vsV_{ratio}}{\left(\frac{N}{n_p}\right)\cdot\left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{2}{3}}}\right)^2}$$

ex $$0.001103 = \frac{0.0018}{\left(\frac{0.76}{\left(\frac{0.74}{0.9}\right)\cdot\left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{2}{3}}}\right)^2}$$

9) Bed Slope for Partial Flow

Open Calculator

fx $$s_s = \frac{R_{rf} \cdot s}{r_{pf}}$$

ex $$0.001625 = \frac{5.2\text{m} \cdot 0.001}{3.2\text{m}}$$

10) Bed Slope for Partial Flow given Velocity Ratio

Open Calculator

fx $$s_s = s \cdot \left(\frac{vsV_{ratio}}{\left(\frac{N}{n_p}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{2}{3}}} \right)^2$$

ex $$0.001632 = 0.001 \cdot \left(\frac{0.76}{\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{2}{3}}} \right)^2$$

11) Ratio of Bed Slope given Velocity Ratio

Open Calculator

fx $$S = \left(\frac{vsV_{ratio}}{\left(\frac{N}{n_p}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{2}{3}}} \right)^2$$

ex $$1.63225 = \left(\frac{0.76}{\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{2}{3}}} \right)^2$$

Discharge and Discharge Ratio through Circular Sewer

12) Discharge of Full Flow given Hydraulic Mean Depth for Partial flow

Open Calculator

fx $$Q = \frac{q}{\left(\frac{N}{n_p}\right) \cdot \left(\frac{a}{A}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{1}{6}}}$$

ex $$32.75704\text{m}^3/\text{s} = \frac{17.48\text{m}^3/\text{s}}{\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.8\text{m}^2}{5.4\text{m}^2}\right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{1}{6}}}$$

13) Discharge of Full Flow given Hydraulic Mean Depth Ratio

Open Calculator

fx $$Q = \frac{q}{\left(\frac{N}{n_p}\right) \cdot \left(\frac{a}{A}\right) \cdot (R)^{\frac{1}{6}}}$$

ex $$32.80505\text{m}^3/\text{s} = \frac{17.48\text{m}^3/\text{s}}{\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.8\text{m}^2}{5.4\text{m}^2}\right) \cdot (0.61)^{\frac{1}{6}}}$$

14) Discharge Ratio given Hydraulic Mean Depth for Full Flow

Open Calculator

fx $$qsQ_{ratio} = \left(\frac{N}{n_p}\right) \cdot \left(\frac{a}{A}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{1}{6}}$$

ex $$0.533626 = \left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.8\text{m}^2}{5.4\text{m}^2}\right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{1}{6}}$$

15) Discharge Ratio given Hydraulic Mean Depth Ratio

Open Calculator

fx $$qsQ_{ratio} = \left(\frac{N}{n_p}\right) \cdot \left(\frac{a}{A}\right) \cdot (R)^{\frac{1}{6}}$$

ex $$0.532845 = \left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.8m^2}{5.4m^2}\right) \cdot (0.61)^{\frac{1}{6}}$$

16) Self Cleansing Discharge given Hydraulic Mean Depth for Full Flow

Open Calculator

fx $$q = Q \cdot \left(\left(\frac{N}{n_p}\right) \cdot \left(\frac{a}{A}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{1}{6}}\right)$$

ex $$17.34284m^3/s = 32.5m^3/s \cdot \left(\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.8m^2}{5.4m^2}\right) \cdot \left(\frac{3.2m}{5.2m}\right)^{\frac{1}{6}}\right)$$

17) Self Cleansing Discharge given Hydraulic Mean Depth Ratio

Open Calculator

fx $$q = Q \cdot \left(\left(\frac{N}{n_p}\right) \cdot \left(\frac{a}{A}\right) \cdot (R)^{\frac{1}{6}}\right)$$

ex $$17.31745m^3/s = 32.5m^3/s \cdot \left(\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.8m^2}{5.4m^2}\right) \cdot (0.61)^{\frac{1}{6}}\right)$$

Flow Velocity through Circular Sewer

18) Self Cleansing Velocity given Bed Slope for Partial Flow

Open Calculator

fx $$V_s = V \cdot \left(\left(\frac{N}{n_p} \right) \cdot \left(\frac{r_{pf}}{R_{rf}} \right)^{\frac{2}{3}} \cdot \sqrt{\frac{s_s}{s}} \right)$$

ex $$4.796573\text{m/s} = 6.01\text{m/s} \cdot \left(\left(\frac{0.74}{0.9} \right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}} \right)^{\frac{2}{3}} \cdot \sqrt{\frac{0.0018}{0.001}} \right)$$

19) Self Cleansing Velocity given Hydraulic Mean Depth for Full Flow

Open Calculator

fx $$V_s = V \cdot \left(\frac{N}{n_p} \right) \cdot \left(\frac{r_{pf}}{R_{rf}} \right)^{\frac{1}{6}}$$

ex $$4.557445\text{m/s} = 6.01\text{m/s} \cdot \left(\frac{0.74}{0.9} \right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}} \right)^{\frac{1}{6}}$$

20) Self Cleansing Velocity given Hydraulic Mean Depth Ratio

Open Calculator

fx $$V_s = V \cdot \left(\frac{N}{n_p} \right) \cdot (R)^{\frac{1}{6}}$$

ex $$4.550775\text{m/s} = 6.01\text{m/s} \cdot \left(\frac{0.74}{0.9} \right) \cdot (0.61)^{\frac{1}{6}}$$

21) Self Cleansing Velocity using Ratio of Bed Slope

Open Calculator

fx $$V_s = V \cdot \left(\left(\frac{N}{n_p} \right) \cdot \left(\frac{r_{pf}}{R_{rf}} \right)^{\frac{2}{3}} \cdot \sqrt{S} \right)$$

ex $$4.796573\text{m/s} = 6.01\text{m/s} \cdot \left(\left(\frac{0.74}{0.9} \right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}} \right)^{\frac{2}{3}} \cdot \sqrt{1.8} \right)$$

22) Velocity of Full Flow given Hydraulic Mean Depth for Full Flow

Open Calculator

fx $$V = \frac{V_s}{\left(\frac{N}{n_p} \right) \cdot \left(\frac{r_{pf}}{R_{rf}} \right)^{\frac{1}{6}}}$$

ex $$6.066118\text{m/s} = \frac{4.6\text{m/s}}{\left(\frac{0.74}{0.9} \right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}} \right)^{\frac{1}{6}}}$$

23) Velocity of Full Flow given Hydraulic Mean Depth Ratio

Open Calculator

fx $$V = \frac{V_s}{\left(\frac{N}{n_p} \right) \cdot (R)^{\frac{1}{6}}}$$

ex $$6.07501\text{m/s} = \frac{4.6\text{m/s}}{\left(\frac{0.74}{0.9} \right) \cdot (0.61)^{\frac{1}{6}}}$$

24) Velocity Ratio given Hydraulic Mean Depth Ratio

Open Calculator

fx $$vsV_{ratio} = \left(\left(\frac{N}{n_p}\right) \cdot (R)^{\frac{1}{6}}\right)$$

ex $$0.7572 = \left(\left(\frac{0.74}{0.9}\right) \cdot (0.61)^{\frac{1}{6}}\right)$$

25) Velocity Ratio given Ratio of Bed Slope

Open Calculator

fx $$vsV_{ratio} = \left(\frac{N}{n_p}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{2}{3}} \cdot \sqrt{S}$$

ex $$0.798099 = \left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{2}{3}} \cdot \sqrt{1.8}$$

26) Velocity when Running Full using Bed Slope for Partial Flow

Open Calculator

fx $$V = \frac{V_s}{\left(\frac{N}{n_p}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{2}{3}} \cdot \sqrt{\frac{s_s}{s}}}$$

ex $$5.763699\text{m/s} = \frac{4.6\text{m/s}}{\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{2}{3}} \cdot \sqrt{\frac{0.0018}{0.001}}}$$

27) Velocity when Running Full using Ratio of Bed Slope

Open Calculator

fx $$V = \frac{V_s}{\left(\frac{N}{n_p}\right) \cdot \left(\frac{r_{pf}}{R_{rf}}\right)^{\frac{2}{3}} \cdot \sqrt{S}}$$

ex $$5.763699\text{m/s} = \frac{4.6\text{m/s}}{\left(\frac{0.74}{0.9}\right) \cdot \left(\frac{3.2\text{m}}{5.2\text{m}}\right)^{\frac{2}{3}} \cdot \sqrt{1.8}}$$

Variables Used

- **a** Area of Partially Full Sewers *(Square Meter)*
- **A** Area of Running Full Sewers *(Square Meter)*
- **N** Roughness Coefficient for Running Full
- n_p Roughness Coefficient Partially Full
- **q** Discharge when Pipe is Running Partially Full *(Cubic Meter per Second)*
- **Q** Discharge when Pipe is Running Full *(Cubic Meter per Second)*
- qsQ_{ratio} Discharge Ratio
- **R** Hydraulic Mean Depth Ratio
- r_{pf} Hydraulic Mean Depth for Partially Full *(Meter)*
- R_{rf} Hydraulic Mean Depth while Running Full *(Meter)*
- **s** Bed Slope of Channel
- **S** Bed Slope Ratio
- s_s Bed Slope of Partial Flow
- **V** Velocity While Running Full *(Meter per Second)*
- V_s Velocity in a Partially Running Sewer *(Meter per Second)*
- vsV_{ratio} Velocity Ratio

Constants, Functions, Measurements used

- 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: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion

Check other formula lists

- **Flow Velocity in Sewers and Drains Formulas**
- **Hydraulic Mean Depth Formulas**
- **Minimum Velocity to be Generated in Sewers Formulas**
- **Proportionate Hydraulic Elements for Circular Sewers Formulas**
- **Roughness Coefficient Formulas**

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