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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

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

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

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



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



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

Open Calculator

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

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

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

Open Calculator

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



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

[Open Calculator !\[\]\(dfbd6b3763a6d1d9afaa974f64e2e4b5_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(ec9132f1d27c8919987d92907322654d_img.jpg\)](#)

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

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



Bed Slope of Circular Sewer

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

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

[Open Calculator !\[\]\(74d4806277d7e73349d8e8c0897931e9_img.jpg\)](#)

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

8) Bed Slope for Full Flow given Velocity Ratio

$$fx \quad s = \frac{S_s}{\left(\frac{v_s V_{ratio}}{\left(\frac{N}{n_p} \right) \cdot \left(\frac{r_{pf}}{R_{rf}} \right)^{\frac{2}{3}}} \right)^2}$$

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

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

9) Bed Slope for Partial Flow

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

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)


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



10) Bed Slope for Partial Flow given Velocity Ratio [Open Calculator](#) 

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

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

11) Ratio of Bed Slope given Velocity Ratio [Open Calculator](#) 

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

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



Discharge and Discharge Ratio through Circular Sewer

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

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

[Open Calculator !\[\]\(83f22ed94ec5517769dd76d702c6bfd8_img.jpg\)](#)

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

13) Discharge of Full Flow given Hydraulic Mean Depth Ratio

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

[Open Calculator !\[\]\(3cb60d42b10e53f9522bb0b392c1c4cd_img.jpg\)](#)

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


14) Discharge Ratio given Hydraulic Mean Depth for Full Flow

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

[Open Calculator !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

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



15) Discharge Ratio given Hydraulic Mean Depth Ratio 

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

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)


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

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

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

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

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

17) Self Cleansing Discharge given Hydraulic Mean Depth Ratio 

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

[Open Calculator !\[\]\(4688aadfd656ded00cd6bdfae55089a9_img.jpg\)](#)

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



Flow Velocity through Circular Sewer

18) Self Cleansing Velocity given Bed Slope for Partial Flow

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

[Open Calculator !\[\]\(d66ff64371a51729ac8c1cdaa685ba6f_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0_img.jpg\)](#)

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

20) Self Cleansing Velocity given Hydraulic Mean Depth Ratio

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

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822_img.jpg\)](#)

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



21) Self Cleansing Velocity using Ratio of Bed Slope

[Open Calculator !\[\]\(99f58673407353e96a019fbca558fd72_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

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

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


23) Velocity of Full Flow given Hydraulic Mean Depth Ratio

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

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

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




24) Velocity Ratio given Hydraulic Mean Depth Ratio 

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)


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

25) Velocity Ratio given Ratio of Bed Slope 

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

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



27) Velocity when Running Full using Ratio of Bed Slope [Open Calculator](#) 

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

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







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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