Important Sewers their Construction , Maintenance and Required Appurtenances Formulas PDF

Formulas
Examples
with Units

List of 20
Important Sewers their Construction , Maintenance and Required Appurtenances Formulas

1) Pressure Due to External Loads Formulas

1.1) Change in Temperature given Elongation in Pipes Formula

Evaluate Formula

Formula

$$\Delta T = \frac{\Delta}{L_0 \cdot \alpha}$$

Example with Units

$$50\,\text{K} = \frac{0.375\,\text{mm}}{5000\,\text{mm} \cdot 0.0000015\,\text{K}^{-1}}$$

1.2) Change in Temperature given Stress in Pipe Formula

Evaluate Formula

Formula

$$\Delta T = \frac{\sigma}{\alpha_{thermal} \cdot e}$$

Example with Units

$$16\,\text{K} = \frac{1200\,\text{Pa}}{1.5\,°\text{C}^{-1} \cdot 50\,\text{Pa}}$$

1.3) Coefficient of Expansion of Material given Stress in Pipe Formula

Evaluate Formula

Formula

$$\alpha_{thermal} = \frac{\sigma}{\Delta T \cdot e}$$

Example with Units

$$0.48\,°\text{C}^{-1} = \frac{1200\,\text{Pa}}{50\,\text{K} \cdot 50\,\text{Pa}}$$

1.4) Coefficient of Thermal Expansion given Elongation in Pipes Formula

Evaluate Formula

Formula

$$\alpha = \frac{\Delta}{L_0 \cdot \Delta T}$$

Example with Units

$$1.5\text{E-}6\,\text{K}^{-1} = \frac{0.375\,\text{mm}}{5000\,\text{mm} \cdot 50\,\text{K}}$$

1.5) Compressive Stress Produced when Pipe is Empty Formula

Evaluate Formula

Formula

$$\sigma_c = \frac{W + W'}{t}$$

Example with Units

$$23.3333\,\text{kN/m}^2 = \frac{22\,\text{kN/m} + 6.0\,\text{kN/m}}{1.2\,\text{m}}$$

1.6) Distance of Top of Pipe to below Surface of Fill given Unit Pressure Formula

Evaluate Formula

Formula

$$H = \left(\frac{P_t \cdot 2 \cdot \pi \cdot \left(h_{Slant} \right)^5}{3 \cdot P} \right)^{\frac{1}{3}}$$

Example with Units

$$2.9413\,\text{m} = \left(\frac{16\,\text{Pa} \cdot 2 \cdot 3.1416 \cdot \left(1.5\,\text{m} \right)^5}{3 \cdot 10\,\text{N}} \right)^{\frac{1}{3}}$$

1.7) Elongation in Pipes given Change in Temperature Formula

Evaluate Formula

Formula

$$\Delta = L_0 \cdot \alpha \cdot \Delta T$$

Example with Units

$$0.375\,\text{mm} = 5000\,\text{mm} \cdot 0.0000015\,\text{K}^{-1} \cdot 50\,\text{K}$$

1.8) External Diameter of Pipe given Load Per Unit Length for Pipes Formula

Evaluate Formula

Formula

$$D = \sqrt{\frac{W}{C_p \cdot \gamma}}$$

Example with Units

$$3.9087\,\text{m} = \sqrt{\frac{22\,\text{kN/m}}{1.2 \cdot 1.2\,\text{kN/m}^3}}$$

1.9) Load Per Unit Length for Pipes given Compressive Stress Formula

Evaluate Formula

Formula

$$W = \left(\sigma_c \cdot t \right) - W'$$

Example with Units

$$54\,\text{kN/m} = \left(50\,\text{kN/m}^2 \cdot 1.2\,\text{m} \right) - 6.0\,\text{kN/m}$$

1.10) Load Per Unit Length for Pipes Resting on Undisturbed Ground on Cohesion Less Soil Formula

Evaluate Formula

Formula

$$W = C_p \cdot \gamma \cdot \left(D \right)^2$$

Example with Units

$$5.76\,\text{kN/m} = 1.2 \cdot 1.2\,\text{kN/m}^3 \cdot \left(2\,\text{m} \right)^2$$

1.11) Pipe Coefficient given Load Per Unit Length for Pipes Formula

Evaluate Formula

Formula

$$C_p = \left(\frac{W}{\gamma \cdot \left(D \right)^2} \right)$$

Example with Units

$$4.5833 = \left(\frac{22\,\text{kN/m}}{1.2\,\text{kN/m}^3 \cdot \left(2\,\text{m} \right)^2} \right)$$

1.12) Slant Height of considered Point given Unit Pressure Formula

Evaluate Formula

Formula

$$h_{Slant} = \left(\frac{3 \cdot P \cdot \left(H \right)^3}{2 \cdot \pi \cdot P_t} \right)^{\frac{1}{5}}$$

Example with Units

$$1.5179\,\text{m} = \left(\frac{3 \cdot 10\,\text{N} \cdot \left(3\,\text{m} \right)^3}{2 \cdot 3.1416 \cdot 16\,\text{Pa}} \right)^{\frac{1}{5}}$$

1.13) Specific Weight of Fill Material given Load Per Unit Length for Pipes Formula

Evaluate Formula

Formula

$$\gamma = \frac{W}{C_p \cdot (D)^2}$$

Example with Units

$$4.5833\,\text{kN/m}^3 = \frac{22\,\text{kN/m}}{1.2 \cdot (2\,\text{m})^2}$$

1.14) Superimposed Load given Unit Pressure Formula

Evaluate Formula

Formula

$$P = \frac{2 \cdot \pi \cdot P_t \cdot (h_{Slant})^5}{3 \cdot (H)^3}$$

Example with Units

$$9.4248\,\text{N} = \frac{2 \cdot 3.1416 \cdot 16\,\text{Pa} \cdot (1.5\,\text{m})^5}{3 \cdot (3\,\text{m})^3}$$

1.15) Thickness of Pipes given Compressive Stress Formula

Evaluate Formula

Formula

$$t = \frac{W' + W}{\sigma_c}$$

Example with Units

$$0.56\,\text{m} = \frac{6.0\,\text{kN/m} + 22\,\text{kN/m}}{50\,\text{kN/m}^2}$$

1.16) Unit Pressure Developed at any Point in Fill at Depth Formula

Evaluate Formula

Formula

$$P_t = \frac{3 \cdot (H)^3 \cdot P}{2 \cdot \pi \cdot (h_{Slant})^5}$$

Example with Units

$$16.9765\,\text{Pa} = \frac{3 \cdot (3\,\text{m})^3 \cdot 10\,\text{N}}{2 \cdot 3.1416 \cdot (1.5\,\text{m})^5}$$

1.17) Flexible Pipes Formulas

1.17.1) Load Per Unit Length for Flexible Pipes Formula

Evaluate Formula

Formula

$$W = C \cdot \gamma \cdot w \cdot D$$

Example with Units

$$8.244\,\text{kN/m} = 1.5 \cdot 1.2\,\text{kN/m}^3 \cdot 2.29\,\text{m} \cdot 2\,\text{m}$$

1.17.2) Specific Weight of Fill Material given Load Per Unit Length for Flexible Pipes Formula

Evaluate Formula

Formula

$$\gamma = \left(\frac{W}{C \cdot D \cdot w}\right)$$

Example with Units

$$3.2023\,\text{kN/m}^3 = \left(\frac{22\,\text{kN/m}}{1.5 \cdot 2\,\text{m} \cdot 2.29\,\text{m}}\right)$$

1.17.3) Width of Trench given Load Per Unit Length for Flexible Pipes Formula

Evaluate Formula

Formula

$$w = \left(\frac{W}{C \cdot D \cdot \gamma}\right)$$

Example with Units

$$6.1111\,\text{m} = \left(\frac{22\,\text{kN/m}}{1.5 \cdot 2\,\text{m} \cdot 1.2\,\text{kN/m}^3}\right)$$

1.18) Rigid Pipes Formulas

1.18.1) Width of Trench given Load Per Unit Length for Rigid Pipes Formula

Evaluate Formula

Formula

$$w = \sqrt{\frac{W}{\gamma \cdot C}}$$

Example with Units

$$3.496\,\text{m} = \sqrt{\frac{22\,\text{kN/m}}{1.2\,\text{kN/m}^3 \cdot 1.5}}$$

Variables used in list of Sewers their Construction , Maintenance and Required Appurtenances Formulas above

- Δ Elongation *(Millimeter)*
- ΔT Change in Temperature *(Kelvin)*
- **C** Coefficient of Fill
- C_p Pipe Coefficient
- **D** External Diameter *(Meter)*
- **e** Elastic Modulus *(Pascal)*
- **H** Distance between Pipe and Fill *(Meter)*
- h_{Slant} Slant Height *(Meter)*
- L_0 Original Length *(Millimeter)*
- **P** Superimposed Load *(Newton)*
- P_t Unit Pressure *(Pascal)*
- **t** Thickness *(Meter)*
- **w** Width *(Meter)*
- **W** Load per unit Length *(Kilonewton per Meter)*
- W' Total Load per Unit Length *(Kilonewton per Meter)*
- α Thermal Expansion Coefficient *(1 Per Kelvin)*
- $\alpha_{thermal}$ Coefficient of Thermal Expansion *(Per Degree Celsius)*
- γ Specific Weight of Fill *(Kilonewton per Cubic Meter)*
- σ Stress *(Pascal)*
- σ_c Compressive Stress *(Kilonewton per Square Meter)*

Constants, Functions, Measurements used in list of Sewers their Construction , Maintenance and Required Appurtenances Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- 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: **Pressure** in Pascal (Pa), Kilonewton per Square Meter (kN/m²) *Pressure Unit Conversion*
- Measurement: **Force** in Newton (N) *Force Unit Conversion*
- Measurement: **Temperature Difference** in Kelvin (K) *Temperature Difference Unit Conversion*
- Measurement: **Surface Tension** in Kilonewton per Meter (kN/m) *Surface Tension Unit Conversion*
- Measurement: **Temperature Coefficient of Resistance** in Per Degree Celsius (°C⁻¹) *Temperature Coefficient of Resistance Unit Conversion*
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³) *Specific Weight Unit Conversion*
- Measurement: **Thermal Expansion** in 1 Per Kelvin (K⁻¹) *Thermal Expansion Unit Conversion*
- Measurement: **Stress** in Pascal (Pa) *Stress Unit Conversion*

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