Important Singly Reinforced Sections Formulas PDF

Formulas
Examples
with Units

List of 12
Important Singly Reinforced Sections Formulas

1) Singly Reinforced Flanged Sections Formulas

1.1) Moment Resistance of Concrete given Flange Thickness Formula

Evaluate Formula

Formula

$$M_c = \frac{1}{2} \cdot f_c \cdot W_b \cdot t_f \cdot \left(d_{eff} - \left(\frac{t_f}{2} \right) \right)$$

Example with Units

$$53.0617\,\text{kN*m} = \frac{1}{2} \cdot 15\,\text{MPa} \cdot 18\,\text{mm} \cdot 99.5\,\text{mm} \cdot \left(4\,\text{m} - \left(\frac{99.5\,\text{mm}}{2} \right) \right)$$

1.2) Moment Resistance of Steel Formula

Evaluate Formula

Formula

$$M_s = \left(T \cdot r \cdot d_{eff} \right) + \left(A \cdot f_{TS} \cdot r \cdot d_{eff} \right)$$

Example with Units

$$99.1257\,\text{kN*m} = \left(100.01\,\text{N} \cdot 10.1 \cdot 4\,\text{m} \right) + \left(10\,\text{m}^2 \cdot 24\,\text{kgf/m}^2 \cdot 10.1 \cdot 4\,\text{m} \right)$$

1.3) Total Compressive Force given Area and Tensile Steel Stress Formula

Evaluate Formula

Formula

$$C = A \cdot f_{TS}$$

Example with Units

$$240\,\text{kN} = 10\,\text{m}^2 \cdot 24\,\text{kgf/m}^2$$

2) Singly Reinforced Rectangular Sections Formulas

2.1) Bending Moment given Stress in Concrete Formula

Evaluate Formula

Formula

$$Mb_R = \frac{f_{concrete} \cdot K \cdot W_b \cdot D_B^{\,2}}{2}$$

Example with Units

$$66.23\,\text{N*m} = \frac{1553\,\text{MPa} \cdot 0.65 \cdot 18\,\text{mm} \cdot 2.7\,\text{m}^2}{2}$$

2.2) Depth of Heavy Beams and Girders Formula

Evaluate Formula

Formula

$$D_B = \left(\frac{I_n}{12}\right) + \left(\frac{I_n}{10}\right)$$

Example with Units

$$1.8352\,\text{m} = \left(\frac{10.01\,\text{m}}{12}\right) + \left(\frac{10.01\,\text{m}}{10}\right)$$

2.3) Depth of Light Beams Formula

Evaluate Formula

Formula

$$D_B = \frac{I_n}{15}$$

Example with Units

$$0.6673\,\text{m} = \frac{10.01\,\text{m}}{15}$$

2.4) Depth of Roof and Floor Slabs Formula

Evaluate Formula

Formula

$$D_B = \frac{I_n}{25}$$

Example with Units

$$0.4004\,\text{m} = \frac{10.01\,\text{m}}{25}$$

2.5) Moment Resistance of Steel given Steel Ratio Formula

Evaluate Formula

Formula

$$M_s = f_{TS} \cdot \rho_{\text{steel ratio}} \cdot r \cdot W_b \cdot \left(d_{\text{eff}}\right)^2$$

Example with Units

$$25.9469\,\text{kN*m} = 24\,\text{kgf/m}^2 \cdot 37.9 \cdot 10.1 \cdot 18\,\text{mm} \cdot \left(4\,\text{m}\right)^2$$

2.6) Moment Resistance of Steel given Stress and Area Formula

Evaluate Formula

Formula

$$M_s = \left(f_{TS} \cdot A_s \cdot r \cdot d_{\text{eff}}\right)$$

Example with Units

$$96.96\,\text{kN*m} = \left(24\,\text{kgf/m}^2 \cdot 100.0\,\text{mm}^2 \cdot 10.1 \cdot 4\,\text{m}\right)$$

2.7) Stress in Concrete Formula

Evaluate Formula

Formula

$$f_{\text{concrete}} = 2 \cdot \frac{Mb_R}{K \cdot j \cdot W_b \cdot D_B^2}$$

Example with Units

$$1553.4686\,\text{MPa} = 2 \cdot \frac{53\,\text{N*m}}{0.65 \cdot 0.8 \cdot 18\,\text{mm} \cdot 2.7\,\text{m}^2}$$

2.8) Stress in Steel Formula

Evaluate Formula

Formula

$$f'_s = \frac{M_t}{A \cdot j \cdot D_B}$$

Example with Units

$$0.0014\,\text{MPa} = \frac{0.03\,\text{N*m}}{10\,\text{m}^2 \cdot 0.8 \cdot 2.7\,\text{m}}$$

2.9) Stress in Steel given Cross-Sectional Reinforcing Tensile Area to Beam Area Ratio Formula

Evaluate Formula

Formula

$$f'_s = \frac{Mb_R}{m_{Elastic} \cdot j \cdot W_b \cdot D_B^2}$$

Example with Units

$$841.4622\,\text{MPa} = \frac{53\,\text{N*m}}{0.6 \cdot 0.8 \cdot 18\,\text{mm} \cdot 2.7\,\text{m}^2}$$

Variables used in list of Singly Reinforced Sections Formulas above

- **A** Area of Tension Reinforcement *(Square Meter)*
- **A_s** Area of Steel required *(Square Millimeter)*
- **C** Total Compressive Force *(Kilonewton)*
- **D_B** Depth of Beam *(Meter)*
- **d_{eff}** Effective Depth of Beam *(Meter)*
- **f_c** 28 Day Compressive Strength of Concrete *(Megapascal)*
- **$f_{concrete}$** Stress in Concrete *(Megapascal)*
- **f'_s** Stress in Compressive Steel *(Megapascal)*
- **f_{TS}** Tensile Stress in Steel *(Kilogram-Force per Square Meter)*
- **l_n** Length of Span *(Meter)*
- **j** Constant j
- **K** Constant k
- **M_c** Moment Resistance of Concrete *(Kilonewton Meter)*
- **$m_{Elastic}$** Modular Ratio for Elastic Shortening
- **M_s** Moment Resistance of Steel *(Kilonewton Meter)*
- **M_t** Moment in Structures *(Newton Meter)*
- **Mb_R** Bending Moment *(Newton Meter)*
- **r** Ratio of Distance between Centroids
- **T** Total Tension *(Newton)*
- **t_f** Flange Thickness *(Millimeter)*
- **W_b** Width of Beam *(Millimeter)*
- **$\rho_{steel\ ratio}$** Steel Ratio

Constants, Functions, Measurements used in list of Singly Reinforced Sections Formulas above

- Measurement: **Length** in Millimeter (mm), Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²), Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Kilogram-Force per Square Meter (kgf/m²), Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Energy** in Newton Meter (N*m)
  Energy Unit Conversion
- Measurement: **Force** in Newton (N), Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Torque** in Kilonewton Meter (kN*m)
  Torque Unit Conversion
- Measurement: **Moment of Force** in Newton Meter (N*m)
  Moment of Force Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Download other Important Analysis Using Working Stress Method PDFs

- Important Doubly Reinforced Rectangular Sections Formulas
- Important Singly Reinforced Sections Formulas

Try our Unique Visual Calculators

- Percentage growth
- LCM calculator
- Divide fraction

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

English Spanish French German Russian Italian Portuguese Polish Dutch

7/9/2024 | 5:14:29 AM UTC