Important Base and Bearing Plates Formulas PDF

Formulas
Examples
with Units

List of 20
Important Base and Bearing Plates Formulas

1) Bearing Plates Formulas

1.1) Actual Bearing Pressure under Plate Formula

Evaluate Formula

Formula

$$f_p = \frac{R}{B \cdot N}$$

Example with Units

$$9.7917\,\text{MPa} = \frac{235\,\text{kN}}{150\,\text{mm} \cdot 160\,\text{mm}}$$

1.2) Allowable Bearing Stress on Concrete when Full Area is used for Support Formula

Evaluate Formula

Formula

$$F_p = 0.35 \cdot f_{c'}$$

Example with Units

$$9.8\,\text{MPa} = 0.35 \cdot 28\,\text{MPa}$$

1.3) Allowable Bearing Stress on Concrete when Less than Full Area Used for Support Formula

Evaluate Formula

Formula

$$F_p = 0.35 \cdot f_{c'} \cdot \sqrt{\frac{A_1}{A_2}}$$

Example with Units

$$9.7959\,\text{MPa} = 0.35 \cdot 28\,\text{MPa} \cdot \sqrt{\frac{23980\,\text{mm}^2}{24000\,\text{mm}^2}}$$

1.4) Allowable Bending Stress given Plate Thickness Formula

Evaluate Formula

Formula

$$F_b = \left(\frac{\left(\left(\frac{1}{2}\right) \cdot B - k\right) \cdot \sqrt{3 \cdot f_p}}{t} \right)^2$$

Example with Units

$$2.9297\,\text{MPa} = \left(\frac{\left(\left(\frac{1}{2}\right) \cdot 150\,\text{mm} - 70\,\text{mm}\right) \cdot \sqrt{3 \cdot 10\,\text{MPa}}}{16\,\text{mm}} \right)^2$$

1.5) Beam Reaction given Actual Bearing Pressure Formula

Evaluate Formula

Formula

$$R = f_p \cdot B \cdot N$$

Example with Units

$$240\,\text{kN} = 10\,\text{MPa} \cdot 150\,\text{mm} \cdot 160\,\text{mm}$$

1.6) Beam Reaction given Area Required by Bearing Plate Formula

Evaluate Formula

Formula

$$R = A_1 \cdot 0.35 \cdot f_{c'}$$

Example with Units

$$235.004\,\text{kN} = 23980\,\text{mm}^2 \cdot 0.35 \cdot 28\,\text{MPa}$$

1.7) Bearing Plate Area for Full Concrete Area Support Formula

Evaluate Formula

Formula

$$A_1 = \frac{R}{0.35 \cdot f_{c'}}$$

Example with Units

$$23979.5918\,\text{mm}^2 = \frac{235\,\text{kN}}{0.35 \cdot 28\,\text{MPa}}$$

1.8) Bearing Plate Area for Less than Full Concrete Area Formula

Evaluate Formula

Formula

$$A_1 = \left(\frac{R}{0.35 \cdot f_{c'} \cdot \sqrt{A_2}}\right)^2$$

Example with Units

$$23959.201\,\text{mm}^2 = \left(\frac{235\,\text{kN}}{0.35 \cdot 28\,\text{MPa} \cdot \sqrt{24000\,\text{mm}^2}}\right)^2$$

1.9) Minimum Bearing Length of Plate using Actual Bearing Pressure Formula

Evaluate Formula

Formula

$$N = \frac{R}{B \cdot f_p}$$

Example with Units

$$156.6667\,\text{mm} = \frac{235\,\text{kN}}{150\,\text{mm} \cdot 10\,\text{MPa}}$$

1.10) Minimum Width of Plate given Plate Thickness Formula

Evaluate Formula

Formula

$$B = 2 \cdot t \cdot \sqrt{\frac{F_b}{3 \cdot f_p}} + 2 \cdot k$$

Example with Units

$$150.1193\,\text{mm} = 2 \cdot 16\,\text{mm} \cdot \sqrt{\frac{3\,\text{MPa}}{3 \cdot 10\,\text{MPa}}} + 2 \cdot 70\,\text{mm}$$

1.11) Minimum Width of Plate using Actual Bearing Pressure Formula

Evaluate Formula

Formula

$$B = \frac{R}{f_p \cdot N}$$

Example with Units

$$146.875\,\text{mm} = \frac{235\,\text{kN}}{10\,\text{MPa} \cdot 160\,\text{mm}}$$

1.12) Plate Thickness Formula

Evaluate Formula

Formula

$$t = \left(\left(\frac{1}{2}\right) \cdot B - k\right) \cdot \sqrt{3 \cdot \frac{f_p}{F_b}}$$

Example with Units

$$15.8114\,\text{mm} = \left(\left(\frac{1}{2}\right) \cdot 150\,\text{mm} - 70\,\text{mm}\right) \cdot \sqrt{3 \cdot \frac{10\,\text{MPa}}{3\,\text{MPa}}}$$

2) Column Base Plates Formulas

2.1) Area Required by Base Plate Formula

Evaluate Formula

Formula

$$A_1 = \frac{C_l}{0.7 \cdot f_{c'}}$$

Example with Units

$$23979.5918\,\text{mm}^2 = \frac{470\,\text{kN}}{0.7 \cdot 28\,\text{MPa}}$$

2.2) Bearing Pressure given Plate Thickness Formula

Evaluate Formula

Formula

$$f_p = \left(\frac{t}{2 \cdot p}\right)^2 \cdot F_y$$

Example with Units

$$10\,\text{MPa} = \left(\frac{16\,\text{mm}}{2 \cdot 40\,\text{mm}}\right)^2 \cdot 250\,\text{MPa}$$

2.3) Column Depth using Plate Length Formula

Evaluate Formula

Formula

$$d = \frac{N - \left(\sqrt{A_1}\right) + \left(0.80 \cdot B\right)}{0.95}$$

Example with Units

$$131.7318\,\text{mm} = \frac{160\,\text{mm} - \left(\sqrt{23980\,\text{mm}^2}\right) + \left(0.80 \cdot 150\,\text{mm}\right)}{0.95}$$

2.4) Column Flange Width given Plate Length Formula

Evaluate Formula

Formula

$$B = \frac{0.95 \cdot d - \frac{N - \sqrt{A_1}}{0.5}}{0.80}$$

Example with Units

$$153.3869\,\text{mm} = \frac{0.95 \cdot 140\,\text{mm} - \frac{160\,\text{mm} - \sqrt{23980\,\text{mm}^2}}{0.5}}{0.80}$$

2.5) Column Load for given Base Plate Area Formula

Evaluate Formula

Formula

$$C_l = A_1 \cdot 0.7 \cdot f_{c'}$$

Example with Units

$$470.008\,\text{kN} = 23980\,\text{mm}^2 \cdot 0.7 \cdot 28\,\text{MPa}$$

2.6) Plate Length Formula

Evaluate Formula

Formula

$$N = \sqrt{A_1} + \left(0.5 \cdot \left(\left(0.95 \cdot d\right) - \left(0.80 \cdot B\right)\right)\right)$$

Example with Units

$$161.3548\,\text{mm} = \sqrt{23980\,\text{mm}^2} + \left(0.5 \cdot \left(\left(0.95 \cdot 140\,\text{mm}\right) - \left(0.80 \cdot 150\,\text{mm}\right)\right)\right)$$

2.7) Thickness of Plate Formula

Evaluate Formula

Formula

$$t = 2 \cdot p \cdot \sqrt{\frac{f_p}{F_y}}$$

Example with Units

$$16\,\text{mm} = 2 \cdot 40\,\text{mm} \cdot \sqrt{\frac{10\,\text{MPa}}{250\,\text{MPa}}}$$

2.8) Thickness of Plate for H shaped Column Formula

Evaluate Formula

Formula

$$t = T_f \cdot \sqrt{\frac{3 \cdot f_p}{F_b}}$$

Example with Units

$$15.8114\,\text{mm} = 5\,\text{mm} \cdot \sqrt{\frac{3 \cdot 10\,\text{MPa}}{3\,\text{MPa}}}$$

Variables used in list of Base and Bearing Plates Formulas above

- A_1 Area required by Bearing Plate *(Square Millimeter)*
- A_2 Full Cross Sectional Area of Concrete Support *(Square Millimeter)*
- **B** Width of Plate *(Millimeter)*
- C_l Column Load *(Kilonewton)*
- **d** Column Depth *(Millimeter)*
- F_b Allowable Bending Stress *(Megapascal)*
- $f_{c'}$ Specified Compressive Strength of Concrete *(Megapascal)*
- f_p Actual Bearing Pressure *(Megapascal)*
- F_p Allowable Bearing Stress *(Megapascal)*
- F_y Yield Stress of Steel *(Megapascal)*
- **k** Distance from Beam Bottom to Web Fillet *(Millimeter)*
- **N** Bearing or Plate Length *(Millimeter)*
- **p** Limiting Size *(Millimeter)*
- **R** Concentrated Load of Reaction *(Kilonewton)*
- **t** Minimum Plate Thickness *(Millimeter)*
- T_f Flange Thickness of H Shaped Columns *(Millimeter)*

Constants, Functions, Measurements used in list of Base and Bearing Plates Formulas above

- 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)
  Length Unit Conversion
- Measurement: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

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