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Timber Beams and Columns Formulas

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List of 19 Timber Beams and Columns Formulas

Timber Beams and Columns

Beams

1) Beam Depth for Extreme Fiber Stress in Rectangular Timber Beam

Open Calculator

fx $$h = \sqrt{\frac{6 \cdot M}{f_s \cdot b}}$$

ex $$199.92\text{mm} = \sqrt{\frac{6 \cdot 2500\text{N*m}}{2.78\text{MPa} \cdot 135\text{mm}}}$$

2) Beam Depth given Horizontal Shearing Stress

Open Calculator

fx $$h = \frac{3 \cdot V}{2 \cdot b \cdot H}$$

ex $$199.9818\text{mm} = \frac{3 \cdot 660000\text{N}}{2 \cdot 135\text{mm} \cdot 36.67\text{MPa}}$$

3) Beam Width given Extreme Fiber Stress for Rectangular Timber Beam

Open Calculator

$$b = \frac{6 \cdot M}{f_s \cdot (h)^2}$$

$$134.8921\text{mm} = \frac{6 \cdot 2500\text{N*m}}{2.78\text{MPa} \cdot (200.0\text{mm})^2}$$

4) Beam Width given Horizontal Shearing Stress

Open Calculator

$$b = \frac{3 \cdot V}{2 \cdot h \cdot H}$$

$$134.9877\text{mm} = \frac{3 \cdot 660000\text{N}}{2 \cdot 200.0\text{mm} \cdot 36.67\text{MPa}}$$

5) Bending Moment using Extreme Fiber Stress for Rectangular Timber Beam

Open Calculator

$$M = \frac{f_s \cdot b \cdot (h)^2}{6}$$

$$2502\text{N*m} = \frac{2.78\text{MPa} \cdot 135\text{mm} \cdot (200.0\text{mm})^2}{6}$$

6) Extreme Fiber Stress for Rectangular Timber Beam given Section Modulus

Open Calculator

fx $$f_s = \frac{M}{S}$$

ex $$2.777778\text{MPa} = \frac{2500\text{N*m}}{900000\text{mm}^3}$$

7) Extreme Fiber Stress in Bending for Rectangular Timber Beam

Open Calculator

fx $$f_s = \frac{6 \cdot M}{b \cdot h^2}$$

ex $$2.777778\text{MPa} = \frac{6 \cdot 2500\text{N*m}}{135\text{mm} \cdot (200.0\text{mm})^2}$$

8) Horizontal Shearing Stress in Rectangular Timber Beam

Open Calculator

fx $$H = \frac{3 \cdot V}{2 \cdot b \cdot h}$$

ex $$36.66667\text{MPa} = \frac{3 \cdot 660000\text{N}}{2 \cdot 135\text{mm} \cdot 200.0\text{mm}}$$

9) Horizontal Shearing Stress in Rectangular Timber Beam given Notch in Lower Face

Open Calculator

$$H = \left(\frac{3 \cdot V}{2 \cdot b \cdot d_{notch}}\right) \cdot \left(\frac{h}{d_{notch}}\right)$$

$$38.57112\text{MPa} = \left(\frac{3 \cdot 660000\text{N}}{2 \cdot 135\text{mm} \cdot 195\text{mm}}\right) \cdot \left(\frac{200.0\text{mm}}{195\text{mm}}\right)$$

10) Modified Total End Shear for Concentrated Loads

Open Calculator

$$V_1 = \frac{10 \cdot P \cdot (l_{beam} - x) \cdot \left(\left(\frac{x}{h}\right)^2\right)}{9 \cdot l_{beam} \cdot \left(2 + \left(\frac{x}{h}\right)^2\right)}$$

$$46.50982\text{N} = \frac{10 \cdot 15000\text{N} \cdot (3000\text{mm} - 15\text{mm}) \cdot \left(\left(\frac{15\text{mm}}{200.0\text{mm}}\right)^2\right)}{9 \cdot 3000\text{mm} \cdot \left(2 + \left(\frac{15\text{mm}}{200.0\text{mm}}\right)^2\right)}$$

11) Modified Total End Shear for Uniform Loading

Open Calculator

$$V_1 = \left(\frac{W}{2}\right) \cdot \left(1 - \left(\frac{2 \cdot h}{l_{beam}}\right)\right)$$

$$43.33333\text{N} = \left(\frac{100\text{N}}{2}\right) \cdot \left(1 - \left(\frac{2 \cdot 200.0\text{mm}}{3000\text{mm}}\right)\right)$$

12) Section Modulus given Height and Breadth of Section

Open Calculator

fx $$S = \frac{b \cdot h^2}{6}$$

ex $$900000\text{mm}^3 = \frac{135\text{mm} \cdot (200.0\text{mm})^2}{6}$$

13) Total Shear given Horizontal Shearing Stress

Open Calculator

fx $$V = \frac{2 \cdot H \cdot h \cdot b}{3}$$

ex $$660060\text{N} = \frac{2 \cdot 36.67\text{MPa} \cdot 200.0\text{mm} \cdot 135\text{mm}}{3}$$

Columns

14) Allowable Unit Stress at Angle to Grain

Open Calculator

fx $$c' = \frac{c \cdot c_\perp}{c \cdot \left(\sin(\theta)^2\right) + c_\perp \cdot \left(\cos(\theta)^2\right)}$$

ex $$1.806513\text{MPa} = \frac{2.0001\text{MPa} \cdot 1.4\text{MPa}}{2.0001\text{MPa} \cdot \left(\sin(30^\circ)^2\right) + 1.4\text{MPa} \cdot \left(\cos(30^\circ)^2\right)}$$

15) Allowable Unit Stress on Timber Columns for Single Member

Open Calculator

fx $$P|A = \frac{3.619 \cdot E}{\left(\frac{L}{k_G}\right)^2}$$

ex $$0.000724\text{MPa} = \frac{3.619 \cdot 50\text{MPa}}{\left(\frac{1500\text{mm}}{3\text{mm}}\right)^2}$$

16) Allowable Unit Stress on Timber Columns of Circular Cross Section

Open Calculator

fx $$P|A = \frac{0.22 \cdot E}{\left(\frac{L}{d}\right)^2}$$

ex $$0.195556\text{MPa} = \frac{0.22 \cdot 50\text{MPa}}{\left(\frac{1500\text{mm}}{200\text{mm}}\right)^2}$$

17) Allowable Unit Stress on Timber Columns of Square or Rectangular Cross Section

Open Calculator

fx $$P|A = \frac{0.3 \cdot E}{\left(\frac{L}{d}\right)^2}$$

ex $$0.266667\text{MPa} = \frac{0.3 \cdot 50\text{MPa}}{\left(\frac{1500\text{mm}}{200\text{mm}}\right)^2}$$

18) Elasticity Modulus given Allowable Unit Stress of Square or Rectangular Timber Columns

Open Calculator

fx $$E = \frac{P|A \cdot \left(\left(\frac{L}{d}\right)^2\right)}{0.3}$$

ex $$333.75\text{MPa} = \frac{1.78\text{MPa} \cdot \left(\left(\frac{1500\text{mm}}{200\text{mm}}\right)^2\right)}{0.3}$$

19) Elasticity Modulus using Allowable Unit Stress of Circular Timber Columns

Open Calculator

fx $$E = \frac{P|A \cdot \left(\left(\frac{L}{d}\right)^2\right)}{0.22}$$

ex $$455.1136\text{MPa} = \frac{1.78\text{MPa} \cdot \left(\left(\frac{1500\text{mm}}{200\text{mm}}\right)^2\right)}{0.22}$$

Variables Used

- **b** Width of Beam *(Millimeter)*
- **c** Allowable Unit Stress Parallel to Grain *(Megapascal)*
- **c'** Allowable Unit Stress at Angle to Grain *(Megapascal)*
- $c_{\perp}$ Allowable Unit Stress Perpendicular to Grain *(Megapascal)*
- **d** Least Dimension *(Millimeter)*
- d_{notch} Depth of Beam above Notch *(Millimeter)*
- **E** Modulus of Elasticity *(Megapascal)*
- f_s Maximum Fiber Stress *(Megapascal)*
- **h** Depth of Beam *(Millimeter)*
- **H** Horizontal Shearing Stress *(Megapascal)*
- k_G Radius of Gyration *(Millimeter)*
- **L** Unsupported Length of Column *(Millimeter)*
- l_{beam} Span of Beam *(Millimeter)*
- **M** Bending Moment *(Newton Meter)*
- **P** Concentrated Load *(Newton)*
- **P|A** Allowable Unit Stress *(Megapascal)*
- **S** Section Modulus *(Cubic Millimeter)*
- **V** Total Shear *(Newton)*
- V_1 Modified Total End Shear *(Newton)*
- **W** Total Uniformly Distributed Load *(Newton)*
- **x** Distance from Reaction to Concentrated Load *(Millimeter)*
- **θ** Angle between Load and Grain *(Degree)*

Constants, Functions, Measurements used

- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Volume** in Cubic Millimeter (mm^3)
  Volume Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Moment of Force** in Newton Meter (N*m)
  Moment of Force Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- **Adjustment Factors for Design Values Formulas**
- **Adjustment of Design Values for Connections with Fasteners Formulas**
- **Laboratory Recommendations, Roof Slope and Oblique Plane Formulas**
- **Timber Beams and Columns Formulas**

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