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Webs under Concentrated Loads Formulas

Calculators!

Examples!

Conversions!

List of 16 Webs under Concentrated Loads Formulas

Webs under Concentrated Loads

1) Beam Depth for given Column Load

Open Calculator

fx $$D = \frac{N \cdot \left(3 \cdot \left(\frac{t_w}{t_f}\right)^{1.5}\right)}{\left(\frac{R}{\left(67.5 \cdot t_w^{\frac{3}{2}}\right) \cdot \sqrt{F_y \cdot t_f}} - 1\right)}$$

ex $$147.9322\text{mm} = \frac{160\text{mm} \cdot \left(3 \cdot \left(\frac{100\text{mm}}{15\text{mm}}\right)^{1.5}\right)}{\left(\frac{235\text{kN}}{\left(67.5 \cdot (100\text{mm})^{\frac{3}{2}}\right) \cdot \sqrt{250\text{MPa} \cdot 15\text{mm}}} - 1\right)}$$

2) Clear Distance from Flanges for Concentrated Load with Stiffeners

Open Calculator

fx $$h = \left(\frac{6800 \cdot t_w^3}{R}\right) \cdot \left(1 + \left(0.4 \cdot r_{wf}^3\right)\right)$$

ex $$121.5319\text{mm} = \left(\frac{6800 \cdot (100\text{mm})^3}{235\text{kN}}\right) \cdot \left(1 + \left(0.4 \cdot (2)^3\right)\right)$$

3) Length of Bearing for Applied Load at least Half of Depth of Beam

Open Calculator

fx $$N = \left(\frac{R}{\left(67.5 \cdot t_w^{\frac{3}{2}}\right) \cdot \sqrt{F_y \cdot t_f}} - 1 \right) \cdot \frac{D}{3 \cdot \left(\frac{t_w}{t_f}\right)^{1.5}}$$

ex $$130.8707\text{mm} = \left(\frac{235\text{kN}}{\left(67.5 \cdot (100\text{mm})^{\frac{3}{2}}\right) \cdot \sqrt{250\text{MPa} \cdot 15\text{mm}}} - 1 \right) \cdot \frac{121\text{mm}}{3 \cdot \left(\frac{100\text{mm}}{15\text{mm}}\right)^{1.5}}$$

4) Length of Bearing if Column Load is at Distance of Half Beam Depth

Open Calculator

fx $$N = \left(\frac{R}{\left(34 \cdot t_w^{\frac{3}{2}}\right) \cdot \sqrt{F_y \cdot t_f}} - 1 \right) \cdot \frac{D}{3 \cdot \left(\frac{t_w}{t_f}\right)^{1.5}}$$

ex $$262.1256\text{mm} = \left(\frac{235\text{kN}}{\left(34 \cdot (100\text{mm})^{\frac{3}{2}}\right) \cdot \sqrt{250\text{MPa} \cdot 15\text{mm}}} - 1 \right) \cdot \frac{121\text{mm}}{3 \cdot \left(\frac{100\text{mm}}{15\text{mm}}\right)^{1.5}}$$

5) Length of Bearing when Load applied at Distance Larger than Depth of Beam

Open Calculator

fx $$N = \left(\frac{R}{f_a \cdot t_w} \right) - 5 \cdot k$$

ex $$135.29\text{mm} = \left(\frac{235\text{kN}}{10.431\text{MPa} \cdot 100\text{mm}} \right) - 5 \cdot 18\text{mm}$$

6) Reaction of Concentrated Load applied at least Half of Depth of Beam

Open Calculator

fx $$R = 67.5 \cdot t_w^2 \cdot \left(1 + 3 \cdot \left(\frac{N}{D} \right) \cdot \left(\frac{t_w}{t_f} \right)^{1.5} \right) \cdot \sqrt{\frac{F_y}{\frac{t_w}{t_f}}}$$

ex $$286.3864\text{kN} = 67.5 \cdot (100\text{mm})^2 \cdot \left(1 + 3 \cdot \left(\frac{160\text{mm}}{121\text{mm}} \right) \cdot \left(\frac{100\text{mm}}{15\text{mm}} \right)^{1.5} \right) \cdot \sqrt{\frac{250\text{MPa}}{\frac{100\text{mm}}{15\text{mm}}}}$$

7) Reaction of Concentrated Load given Allowable Compressive Stress

Open Calculator

fx $$R = f_a \cdot t_w \cdot (N + 5 \cdot k)$$

ex $$260.775\text{kN} = 10.431\text{MPa} \cdot 100\text{mm} \cdot (160\text{mm} + 5 \cdot 18\text{mm})$$

8) Reaction of Concentrated Load when Applied at distance at least Half of Beam Depth

Open Calculator

fx $$R = 34 \cdot t_w^2 \cdot \left(1 + 3 \cdot \left(\frac{N}{D} \right) \cdot \left(\frac{t_w}{t_f} \right)^{1.5} \right) \cdot \sqrt{\frac{F_y}{\frac{t_w}{t_f}}}$$

ex $$144.2539\text{kN} = 34 \cdot (100\text{mm})^2 \cdot \left(1 + 3 \cdot \left(\frac{160\text{mm}}{121\text{mm}} \right) \cdot \left(\frac{100\text{mm}}{15\text{mm}} \right)^{1.5} \right) \cdot \sqrt{\frac{250\text{MPa}}{\frac{100\text{mm}}{15\text{mm}}}}$$

9) Relative Slenderness of Web and Flange

Open Calculator

fx $$r_{wf} = \frac{\frac{d_c}{t_w}}{\frac{l_{max}}{b_f}}$$

ex $$1.077564 = \frac{\frac{46\text{mm}}{100\text{mm}}}{\frac{1921\text{mm}}{4500\text{mm}}}$$

10) Required Stiffeners if Concentrated Load exceeds Load of Reaction R

Open Calculator

fx $$R = \left(\frac{6800 \cdot t_w^3}{h} \right) \cdot \left(1 + \left(0.4 \cdot r_{wf}^3\right)\right)$$

ex $$234.0984\text{kN} = \left(\frac{6800 \cdot (100\text{mm})^3}{122\text{mm}} \right) \cdot \left(1 + \left(0.4 \cdot (2)^3\right)\right)$$

11) Slenderness of Web and Flange given Stiffeners and Concentrated Load

Open Calculator

fx $$r_{wf} = \left(\frac{\left(\frac{R \cdot h}{6800 \cdot t_w^3} \right) - 1}{0.4} \right)^{\frac{1}{3}}$$

ex $$2.003364 = \left(\frac{\left(\frac{235\text{kN} \cdot 122\text{mm}}{6800 \cdot (100\text{mm})^3} \right) - 1}{0.4} \right)^{\frac{1}{3}}$$

12) Stress for Concentrated Load Applied at Distance Larger than Depth of Beam

Open Calculator

fx $$f_a = \frac{R}{t_w \cdot (N + 5 \cdot k)}$$

ex $$9.4\text{MPa} = \frac{235\text{kN}}{100\text{mm} \cdot (160\text{mm} + 5 \cdot 18\text{mm})}$$

13) Stress when Concentrated Load is Applied Close to Beam End

Open Calculator

fx $$f_a = \frac{R}{t_w \cdot (N + 2.5 \cdot k)}$$

ex $$11.46341\text{MPa} = \frac{235\text{kN}}{100\text{mm} \cdot (160\text{mm} + 2.5 \cdot 18\text{mm})}$$

14) Web Depth Clear of fillets

Open Calculator

fx $$d_c = D - 2 \cdot k$$

ex $$85\text{mm} = 121\text{mm} - 2 \cdot 18\text{mm}$$

15) Web Thickness for Given Stress

Open Calculator

fx $$t_w = \frac{R}{f_a \cdot (N + 5 \cdot k)}$$

ex $$90.116\text{mm} = \frac{235\text{kN}}{10.431\text{MPa} \cdot (160\text{mm} + 5 \cdot 18\text{mm})}$$

16) Web Thickness for given Stress Due to Load near Beam End

Open Calculator

fx $$t_w = \frac{R}{f_a \cdot (N + 2.5 \cdot k)}$$

ex $$109.8976\text{mm} = \frac{235\text{kN}}{10.431\text{MPa} \cdot (160\text{mm} + 2.5 \cdot 18\text{mm})}$$

Variables Used

- b_f Width of Compression Flange *(Millimeter)*
- D Depth of Section *(Millimeter)*
- d_c Web Depth *(Millimeter)*
- f_a Compressive Stress *(Megapascal)*
- F_y Yield Stress of Steel *(Megapascal)*
- h Clear Distance between Flanges *(Millimeter)*
- k Distance from Flange to Web Fillet *(Millimeter)*
- l_{max} Maximum Unbraced Length *(Millimeter)*
- N Bearing or Plate Length *(Millimeter)*
- R Concentrated Load of Reaction *(Kilonewton)*
- r_{wf} Slenderness of Web and Flange
- t_f Flange Thickness *(Millimeter)*
- t_w Web Thickness *(Millimeter)*

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 Millimeter (mm)
  Length Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- **Allowable-Stress Design Formulas**
- **Base and Bearing Plates Formulas**
- **Cold Formed or Light Weighted Steel Structures Formulas**
- **Webs under Concentrated Loads Formulas**

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