

Important Economical Structural Steel Formulas PDF



Formulas Examples with Units

List of 26 Important Economical Structural Steel Formulas

1) Cross-Sectional Area₁ given Material Cost Ratio Formula

Formula

$$A_1 = \frac{A_2 \cdot P_2}{C_{2/C1} \cdot P_1}$$

Example with Units

$$768291.746 \text{ mm}^2 = \frac{720000 \text{ mm}^2 \cdot 25}{0.9011 \cdot 26}$$

Evaluate Formula 

2) Cross-Sectional Area₂ given Material Cost Ratio Formula

Formula

$$A_2 = \frac{C_{2/C1} \cdot A_1 \cdot P_1}{P_2}$$

Example with Units

$$562286.4 \text{ mm}^2 = \frac{0.9011 \cdot 600000 \text{ mm}^2 \cdot 26}{25}$$

Evaluate Formula 

3) Material Cost Ratio Formula

Formula

$$C_{2/C1} = \left(\frac{A_2}{A_1} \right) \cdot \left(\frac{P_2}{P_1} \right)$$

Example with Units

$$1.1538 = \left(\frac{720000 \text{ mm}^2}{600000 \text{ mm}^2} \right) \cdot \left(\frac{25}{26} \right)$$

Evaluate Formula 

4) Material Price p₁ given Material Cost Ratio Formula

Formula

$$P_1 = \frac{A_2 \cdot P_2}{C_{2/C1} \cdot A_1}$$

Example with Units

$$33.2926 = \frac{720000 \text{ mm}^2 \cdot 25}{0.9011 \cdot 600000 \text{ mm}^2}$$

Evaluate Formula 

5) Material Price p₁ using Relative Material Cost Ratio Formula

Formula

$$P_1 = \frac{\left(\frac{F_{y1}}{F_{y2}} \right) \cdot P_2}{C_{2/C1}}$$

Example with Units

$$23.0829 = \frac{\left(\frac{104 \text{ N/mm}^2}{125 \text{ N/mm}^2} \right) \cdot 25}{0.9011}$$

Evaluate Formula 



6) Material Price p2 given Material Cost Ratio Formula

Formula

$$P_2 = \frac{C2/C1 \cdot P_1 \cdot A_1}{A_2}$$

Example with Units

$$19.5238 = \frac{0.9011 \cdot 26 \cdot 600000 \text{ mm}^2}{720000 \text{ mm}^2}$$

Evaluate Formula 

7) Material Price p2 using Relative Material Cost Ratio Formula

Formula

$$P_2 = \frac{C2/C1 \cdot P_1}{\frac{F_{y1}}{F_{y2}}}$$

Example with Units

$$28.1594 = \frac{0.9011 \cdot 26}{\frac{104 \text{ N/m}^2}{125 \text{ N/m}^2}}$$

Evaluate Formula 

8) Relative Cost for Designing Fabricated Plate Girders Formula

Formula

$$C2/C1 = \left(\frac{P_2}{P_1} \right) \cdot \left(\frac{F_{y1}}{F_{y2}} \right)^{\frac{1}{2}}$$

Example with Units

$$0.8771 = \left(\frac{25}{26} \right) \cdot \left(\frac{104 \text{ N/m}^2}{125 \text{ N/m}^2} \right)^{\frac{1}{2}}$$

Evaluate Formula 

9) Relative Cost given Yield Stress Formula

Formula

$$C2/C1 = \left(\frac{P_2}{P_1} \right) \cdot \left(\frac{F_{y1}}{F_{y2}} \right)^{\frac{2}{3}}$$

Example with Units

$$0.8506 = \left(\frac{25}{26} \right) \cdot \left(\frac{104 \text{ N/m}^2}{125 \text{ N/m}^2} \right)^{\frac{2}{3}}$$

Evaluate Formula 

10) Relative Material Cost Ratio Formula

Formula

$$C2/C1 = \left(\frac{F_{y1}}{F_{y2}} \right) \cdot \left(\frac{P_2}{P_1} \right)$$

Example with Units

$$0.8 = \left(\frac{104 \text{ N/m}^2}{125 \text{ N/m}^2} \right) \cdot \left(\frac{25}{26} \right)$$

Evaluate Formula 

11) Relative Weight for Designing Fabricated Plate Girders Formula

Formula

$$W2/W1 = \sqrt{\frac{F_{y1}}{F_{y2}}}$$

Example with Units

$$0.9121 = \sqrt{\frac{104 \text{ N/m}^2}{125 \text{ N/m}^2}}$$

Evaluate Formula 

12) Relative Weight given Yield Stresses Formula

Formula

$$W2/W1 = \left(\frac{F_{y1}}{F_{y2}} \right)^{\frac{2}{3}}$$

Example with Units

$$0.8846 = \left(\frac{104 \text{ N/m}^2}{125 \text{ N/m}^2} \right)^{\frac{2}{3}}$$

Evaluate Formula 



13) Yield Stress F_{y1} given Relative Cost Formula

Formula

$$F_{y1} = \left(C2/C1 \cdot \frac{P_1}{P_2} \right)^{\frac{3}{2}} \cdot F_{y2}$$

Example with Units

$$113.4017 \text{ N/m}^2 = \left(0.9011 \cdot \frac{26}{25} \right)^{\frac{3}{2}} \cdot 125 \text{ N/m}^2$$

Evaluate Formula 

14) Yield Stress F_{y1} given Relative Cost for Designing Fabricated Plate Girders Formula

Formula

$$F_{y1} = \left(C2/C1 \cdot \frac{P_1}{P_2} \right)^2 \cdot (F_{y2})$$

Example with Units

$$109.7799 \text{ N/m}^2 = \left(0.9011 \cdot \frac{26}{25} \right)^2 \cdot (125 \text{ N/m}^2)$$

Evaluate Formula 

15) Yield Stress F_{y1} given Relative Weight Formula

Formula

$$F_{y1} = \left(W2/W1 \right)^{\frac{3}{2}} \cdot (F_{y2})$$

Example with Units

$$106.3713 \text{ N/m}^2 = \left(0.898 \right)^{\frac{3}{2}} \cdot (125 \text{ N/m}^2)$$

Evaluate Formula 

16) Yield Stress F_{y1} given Relative Weight for Designing Fabricated Plate Girders Formula

Formula

$$F_{y1} = \left(W2/W1 \right)^2 \cdot F_{y2}$$

Example with Units

$$100.8005 \text{ N/m}^2 = \left(0.898 \right)^2 \cdot 125 \text{ N/m}^2$$

Evaluate Formula 

17) Yield Stress F_{y2} given Relative Cost Formula

Formula

$$F_{y2} = \frac{F_{y1}}{\left(\frac{P_1}{P_2} \cdot C2/C1 \right)^{\frac{3}{2}}}$$

Example with Units

$$114.6367 \text{ N/m}^2 = \frac{104 \text{ N/m}^2}{\left(\frac{26}{25} \cdot 0.9011 \right)^{\frac{3}{2}}}$$

Evaluate Formula 

18) Yield Stress F_{y2} given Relative Cost for Designing Fabricated Plate Girders Formula

Formula

$$F_{y2} = \frac{F_{y1}}{\left(C2/C1 \cdot \frac{P_1}{P_2} \right)^2}$$

Example with Units

$$118.4188 \text{ N/m}^2 = \frac{104 \text{ N/m}^2}{\left(0.9011 \cdot \frac{26}{25} \right)^2}$$

Evaluate Formula 

19) Yield Stress F_{y2} given Relative Weight Formula

Formula

$$F_{y2} = \frac{F_{y1}}{\left(W2/W1 \right)^{\frac{3}{2}}}$$

Example with Units

$$122.2134 \text{ N/m}^2 = \frac{104 \text{ N/m}^2}{\left(0.898 \right)^{\frac{3}{2}}}$$

Evaluate Formula 



20) Yield Stress F_{y2} given Relative Weight for Designing Fabricated Plate Girders Formula

Formula

$$F_{y2} = \frac{F_{y1}}{W2/W1}^2$$

Example with Units

$$128.9676 \text{ N/m}^2 = \frac{104 \text{ N/m}^2}{0.898}^2$$

Evaluate Formula 

21) Yield Stress of Steel1 using Relative Material Cost Ratio Formula

Formula

$$F_{y1} = \frac{C2/C1 \cdot F_{y2} \cdot P_1}{P_2}$$

Example with Units

$$117.143 \text{ N/m}^2 = \frac{0.9011 \cdot 125 \text{ N/m}^2 \cdot 26}{25}$$

Evaluate Formula 

22) Yield Stress of Steel2 using Relative Material Cost Ratio Formula

Formula

$$F_{y2} = \frac{F_{y1} \cdot P_2}{C2/C1 \cdot P_1}$$

Example with Units

$$110.9755 \text{ N/m}^2 = \frac{104 \text{ N/m}^2 \cdot 25}{0.9011 \cdot 26}$$

Evaluate Formula 

23) Columns Formulas

23.1) Column Buckling Stress F_{c1} given Relative Material Cost Formula

Formula

$$F_{c1} = C2/C1 \cdot \left(\frac{P_1}{P_2} \right) \cdot F_{c2}$$

Example with Units

$$1405.716 \text{ N/m}^2 = 0.9011 \cdot \left(\frac{26}{25} \right) \cdot 1500 \text{ N/m}^2$$

Evaluate Formula 

23.2) Column Buckling Stress F_{c2} given Relative Material Cost Formula

Formula

$$F_{c2} = \frac{F_{c1} \cdot P_2}{C2/C1 \cdot P_1}$$

Example with Units

$$1331.7057 \text{ N/m}^2 = \frac{1248 \text{ N/m}^2 \cdot 25}{0.9011 \cdot 26}$$

Evaluate Formula 

23.3) Relative Material Cost for Two Columns of Different Steels Carrying Same Load Formula

Formula

$$C2/C1 = \left(\frac{F_{c1}}{F_{c2}} \right) \cdot \left(\frac{P_2}{P_1} \right)$$

Example with Units

$$0.8 = \left(\frac{1248 \text{ N/m}^2}{1500 \text{ N/m}^2} \right) \cdot \left(\frac{25}{26} \right)$$

Evaluate Formula 



23.4) Relative Price Factors using Relative Material Cost Ratio and Column Buckling Stress

Formula 

Formula

$$P_{2/P1} = C_{2/C1} \cdot \left(\frac{F_{c2}}{F_{c1}} \right)$$

Example with Units

$$1.0831 = 0.9011 \cdot \left(\frac{1500 \text{ N/m}^2}{1248 \text{ N/m}^2} \right)$$

Evaluate Formula 



Variables used in list of Economical Structural Steel Formulas above

- **A₁** Cross-Sectional Area of Material 1 (Square Millimeter)
- **A₂** Cross-Sectional Area of Material 2 (Square Millimeter)
- **C₂/C₁** Relative Cost
- **F_{c2}** Column Bulking Stress2 (Newton per Square Meter)
- **F_{y1}** Yield Stress 1 (Newton per Square Meter)
- **F_{y2}** Yield Stress 2 (Newton per Square Meter)
- **F_{c1}** Column Bulking Stress1 (Newton per Square Meter)
- **P₁** Material Cost p1
- **P₂** Material Cost p2
- **P₂/P₁** Relative Price Factors
- **W₂/W₁** Relative Weight

Constants, Functions, Measurements used in list of Economical Structural Steel 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:** **Area** in Square Millimeter (mm²)
Area Unit Conversion 
- **Measurement:** **Pressure** in Newton per Square Meter (N/m²)
Pressure Unit Conversion 



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