Important Moving Loads and Influence Lines for Beams Formulas PDF

Formulas
Examples
with Units

List of 32
Important Moving Loads and Influence Lines for Beams Formulas

1) Calculation of Deflection Formulas

1.1) Deflection for Channel or Z Bar when Load in Middle Formula

Evaluate Formula

Formula

$$\delta = \frac{Wp \cdot \left(L^3\right)}{53 \cdot A_{cs} \cdot \left(d_b^2\right)}$$

Example with Units

$$31475.2754\,\text{in} = \frac{1.25\,\text{kN} \cdot \left(10.02\,\text{ft}^3\right)}{53 \cdot 13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2\right)}$$

1.2) Deflection for Channel or Z Bar when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = \frac{W_d \cdot \left(L^3\right)}{85 \cdot A_{cs} \cdot \left(d_b^2\right)}$$

Example with Units

$$15700.765\,\text{in} = \frac{1.00001\,\text{kN} \cdot \left(10.02\,\text{ft}^3\right)}{85 \cdot 13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2\right)}$$

1.3) Deflection for Deck Beam given Load in Middle Formula

Evaluate Formula

Formula

$$\delta = \frac{Wp \cdot \left(L^3\right)}{50 \cdot A_{cs} \cdot \left(d_b^2\right)}$$

Example with Units

$$33363.7919\,\text{in} = \frac{1.25\,\text{kN} \cdot \left(10.02\,\text{ft}^3\right)}{50 \cdot 13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2\right)}$$

1.4) Deflection for Deck Beam when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = \frac{W_d \cdot \left(L^3\right)}{80 \cdot A_{cs} \cdot \left(d_b^2\right)}$$

Example with Units

$$16682.0628\,\text{in} = \frac{1.00001\,\text{kN} \cdot \left(10.02\,\text{ft}^3\right)}{80 \cdot 13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2\right)}$$

1.5) Deflection for Even Legged Angle when Load in Middle Formula

Evaluate Formula

Formula

$$\delta = Wp \cdot \frac{L^3}{32 \cdot A_{cs} \cdot d_b^2}$$

Example with Units

$$52130.9249\,\text{in} = 1.25\,\text{kN} \cdot \frac{10.02\,\text{ft}^3}{32 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}^2}$$

1.6) Deflection for Even Legged Angle when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = \frac{W_d \cdot L^3}{52 \cdot A_{cs} \cdot d_b^2}$$

Example with Units

$$25664.712\,\text{in} = \frac{1.00001\,\text{kN} \cdot 10.02\,\text{ft}^3}{52 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}^2}$$

1.7) Deflection for Hollow Cylinder when Load in Middle Formula

Evaluate Formula

Formula

$$\delta = \frac{Wp \cdot L^3}{24 \cdot \left(A_{cs} \cdot \left(d_b^2\right) - a \cdot \left(d^2\right)\right)}$$

Example with Units

$$69542.3432\,\text{in} = \frac{1.25\,\text{kN} \cdot 10.02\,\text{ft}^3}{24 \cdot \left(13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2\right) - 10\,\text{in}^2 \cdot \left(10\,\text{in}^2\right)\right)}$$

1.8) Deflection for Hollow Cylinder when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = \frac{W_d \cdot L^3}{38 \cdot \left(A_{cs} \cdot \left(d_b^2\right) - a \cdot \left(d^2\right)\right)}$$

Example with Units

$$35137.5353\,\text{in} = \frac{1.00001\,\text{kN} \cdot 10.02\,\text{ft}^3}{38 \cdot \left(13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2\right) - 10\,\text{in}^2 \cdot \left(10\,\text{in}^2\right)\right)}$$

1.9) Deflection for Hollow Rectangle given Load in Middle Formula

Evaluate Formula

Formula

$$\delta = \frac{Wp \cdot L^3}{32 \cdot \left(\left(A_{cs} \cdot d_b^2\right) - \left(a \cdot d^2\right)\right)}$$

Example with Units

$$52156.7574\,\text{in} = \frac{1.25\,\text{kN} \cdot 10.02\,\text{ft}^3}{32 \cdot \left(\left(13\,\text{m}^2 \cdot 10.01\,\text{in}^2\right) - \left(10\,\text{in}^2 \cdot 10\,\text{in}^2\right)\right)}$$

1.10) Deflection for Hollow Rectangle when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = W_d \cdot \frac{L^3}{52 \cdot \left(A_{cs} \cdot d_b^{-a} \cdot d^2 \right)}$$

Example with Units

$$25489.8674\,\text{in} = 1.00001\,\text{kN} \cdot \frac{10.02\,\text{ft}^3}{52 \cdot \left(13\,\text{m}^2 \cdot 10.01\,\text{in}^{-10\,\text{in}^2} \cdot 10\,\text{in}^2 \right)}$$

1.11) Deflection for I Beam when Load in Middle Formula

Evaluate Formula

Formula

$$\delta = \frac{Wp \cdot \left(L^3 \right)}{58 \cdot A_{cs} \cdot \left(d_b^2 \right)}$$

Example with Units

$$28761.8896\,\text{in} = \frac{1.25\,\text{kN} \cdot \left(10.02\,\text{ft}^3 \right)}{58 \cdot 13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2 \right)}$$

1.12) Deflection for I Beam when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = \frac{W_d \cdot \left(L^3 \right)}{93 \cdot A_{cs} \cdot \left(d_b^2 \right)}$$

Example with Units

$$14350.1615\,\text{in} = \frac{1.00001\,\text{kN} \cdot \left(10.02\,\text{ft}^3 \right)}{93 \cdot 13\,\text{m}^2 \cdot \left(10.01\,\text{in}^2 \right)}$$

1.13) Deflection for Solid Cylinder when Load in Middle Formula

Evaluate Formula

Formula

$$\delta = \frac{Wp \cdot L_c^3}{24 \cdot A_{cs} \cdot d_b^2}$$

Example with Units

$$25980.8979\,\text{in} = \frac{1.25\,\text{kN} \cdot 2.2\,\text{m}^3}{24 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}^2}$$

1.14) Deflection for Solid Cylinder when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = \frac{W_d \cdot L_c^3}{38 \cdot A_{cs} \cdot d_b^2}$$

Example with Units

$$13127.3218\,\text{in} = \frac{1.00001\,\text{kN} \cdot 2.2\,\text{m}^3}{38 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}^2}$$

1.15) Deflection for Solid Rectangle when Load in Middle Formula

Evaluate Formula

Formula

$$\delta = \frac{Wp \cdot L^3}{32 \cdot A_{cs} \cdot d_b^2}$$

Example with Units

$$52130.9249\,\text{in} = \frac{1.25\,\text{kN} \cdot 10.02\,\text{ft}^3}{32 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}^2}$$

1.16) Deflection for Solid Rectangle when Load is Distributed Formula

Evaluate Formula

Formula

$$\delta = \frac{W_d \cdot L^3}{52 \cdot A_{cs} \cdot d_b^2}$$

Example with Units

$$25664.712\,\text{in} = \frac{1.00001\,\text{kN} \cdot 10.02\,\text{ft}^3}{52 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}^2}$$

2) Safe Loads Formulas

2.1) Greatest Safe Load for Channel or Z Bar when Load is at Middle Formula

Evaluate Formula

Formula

$$Wp = \frac{1525 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$1.6504\,\text{kN} = \frac{1525 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.2) Greatest Safe Load for Channel or Z Bar when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = \frac{3050 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$3.3009\,\text{kN} = \frac{3050 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.3) Greatest Safe Load for Deck Beam when Load in Middle Formula

Evaluate Formula

Formula

$$Wp = \frac{1380 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$1.4935\,\text{kN} = \frac{1380 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.4) Greatest Safe Load for Deck Beam when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = \frac{2760 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$2.987\,\text{kN} = \frac{2760 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.5) Greatest Safe Load for Even Legged Angle when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = \frac{1.77 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$0.0019\,\text{kN} = \frac{1.77 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.6) Greatest Safe Load for Even Legged Angle when Load is in Middle Formula

Evaluate Formula

Formula

$$Wp = 885 \cdot A_{cs} \cdot \frac{d_b}{L}$$

Example with Units

$$0.9578\,\text{kN} = 885 \cdot 13\,\text{m}^2 \cdot \frac{10.01\,\text{in}}{10.02\,\text{ft}}$$

2.7) Greatest Safe Load for Hollow Cylinder when Load in Middle Formula

Evaluate Formula

Formula

$$Wp = \frac{667 \cdot \left(A_{cs} \cdot d_b - a \cdot d \right)}{L}$$

Example with Units

$$0.7215\,\text{kN} = \frac{667 \cdot \left(13\,\text{m}^2 \cdot 10.01\,\text{in} - 10\,\text{in}^2 \cdot 10\,\text{in} \right)}{10.02\,\text{ft}}$$

2.8) Greatest Safe Load for Hollow Cylinder when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = \frac{1333 \cdot \left(A_{cs} \cdot d_b - a \cdot d \right)}{L}$$

Example with Units

$$1.4419\,\text{kN} = \frac{1333 \cdot \left(13\,\text{m}^2 \cdot 10.01\,\text{in} - 10\,\text{in}^2 \cdot 10\,\text{in} \right)}{10.02\,\text{ft}}$$

2.9) Greatest Safe Load for Hollow Rectangle when Load in Middle Formula

Evaluate Formula

Formula

$$Wp = \frac{890 \cdot \left(A_{cs} \cdot d_b - a \cdot d \right)}{L}$$

Example with Units

$$0.9627\,\text{kN} = \frac{890 \cdot \left(13\,\text{m}^2 \cdot 10.01\,\text{in} - 10\,\text{in}^2 \cdot 10\,\text{in} \right)}{10.02\,\text{ft}}$$

2.10) Greatest Safe Load for Hollow Rectangle when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = 1780 \cdot \frac{A_{cs} \cdot d_b - a \cdot d}{L_c}$$

Example with Units

$$2.673\,\text{kN} = 1780 \cdot \frac{13\,\text{m}^2 \cdot 10.01\,\text{in} - 10\,\text{in}^2 \cdot 10\,\text{in}}{2.2\,\text{m}}$$

2.11) Greatest Safe Load for I Beam when Load in Middle Formula

Evaluate Formula

Formula

$$Wp = \frac{1795 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$1.9426\,\text{kN} = \frac{1795 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.12) Greatest Safe Load for I Beam when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = \frac{3390 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$3.6688\,\text{kN} = \frac{3390 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.13) Greatest Safe Load for Solid Cylinder when Load in Middle Formula

Evaluate Formula

Formula

$$Wp = \frac{667 \cdot A_{cs} \cdot d_b}{L}$$

Example with Units

$$0.7219\,\text{kN} = \frac{667 \cdot 13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.14) Greatest Safe Load for Solid Cylinder when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = 1333 \cdot \frac{A_{cs} \cdot d_b}{L}$$

Example with Units

$$1.4426\,\text{kN} = 1333 \cdot \frac{13\,\text{m}^2 \cdot 10.01\,\text{in}}{10.02\,\text{ft}}$$

2.15) Greatest Safe Load for Solid Rectangle given Load in Middle Formula

Evaluate Formula

Formula

$$Wp = 890 \cdot A_{cs} \cdot \frac{d_b}{L}$$

Example with Units

$$0.9632\,\text{kN} = 890 \cdot 13\,\text{m}^2 \cdot \frac{10.01\,\text{in}}{10.02\,\text{ft}}$$

2.16) Greatest Safe Load for Solid Rectangle when Load is Distributed Formula

Evaluate Formula

Formula

$$W_d = 1780 \cdot A_{cs} \cdot \frac{d_b}{L}$$

Example with Units

$$1.9264\,\text{kN} = 1780 \cdot 13\,\text{m}^2 \cdot \frac{10.01\,\text{in}}{10.02\,\text{ft}}$$

Variables used in list of Moving Loads and Influence Lines for Beams Formulas above

- **a** Interior Cross-Sectional Area of Beam *(Square Inch)*
- **A_{cs}** Cross Sectional Area of Beam *(Square Meter)*
- **d** Interior Depth of Beam *(Inch)*
- **d_b** Depth of Beam *(Inch)*
- **L** Length of Beam *(Foot)*
- **L_c** Distance between Supports *(Meter)*
- **W_d** Greatest Safe Distributed Load *(Kilonewton)*
- **Wp** Greatest Safe Point Load *(Kilonewton)*
- **δ** Deflection of Beam *(Inch)*

Constants, Functions, Measurements used in list of Moving Loads and Influence Lines for Beams Formulas above

- Measurement: **Length** in Inch (in), Foot (ft), Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²), Square Inch (in²)
  Area Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion

Download other Important Structural Analysis PDFs

- **Important Moving Loads and Influence Lines for Beams Formulas**

Try our Unique Visual Calculators

- **Percentage increase**
- **HCF calculator**
- **Mixed 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

7/8/2024 | 11:20:04 AM UTC