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Moving Loads and Influence Lines for Beams Formulas

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List of 32 Moving Loads and Influence Lines for Beams Formulas

Moving Loads and Influence Lines for Beams



Calculation of Deflection

1) Deflection for Channel or Z Bar when Load in Middle



$$\text{fx } \delta = \frac{W_p \cdot (L^3)}{53 \cdot A_{cs} \cdot (d_b^2)}$$

[Open Calculator](#)

$$\text{ex } 31475.28\text{in} = \frac{1.25\text{kN} \cdot ((10.02\text{ft})^3)}{53 \cdot 13\text{m}^2 \cdot ((10.01\text{in})^2)}$$

2) Deflection for Channel or Z Bar when Load is Distributed



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

[Open Calculator](#)

$$\text{ex } 15700.76\text{in} = \frac{1.00001\text{kN} \cdot ((10.02\text{ft})^3)}{85 \cdot 13\text{m}^2 \cdot ((10.01\text{in})^2)}$$



3) Deflection for Deck Beam given Load in Middle

[Open Calculator !\[\]\(4729e517bc6a7cd81c8025b9646574fb_img.jpg\)](#)

$$\text{fx } \delta = \frac{W_p \cdot (L^3)}{50 \cdot A_{cs} \cdot (d_b^2)}$$

$$\text{ex } 33363.79\text{in} = \frac{1.25\text{kN} \cdot ((10.02\text{ft})^3)}{50 \cdot 13\text{m}^2 \cdot ((10.01\text{in})^2)}$$

4) Deflection for Deck Beam when Load is Distributed

[Open Calculator !\[\]\(e474458956c9a37fbf9586ddb60a7fa1_img.jpg\)](#)

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

$$\text{ex } 16682.06\text{in} = \frac{1.00001\text{kN} \cdot ((10.02\text{ft})^3)}{80 \cdot 13\text{m}^2 \cdot ((10.01\text{in})^2)}$$

5) Deflection for Even Legged Angle when Load in Middle

[Open Calculator !\[\]\(4fe57c3593bf1b21d272ae7ac8dfaf77_img.jpg\)](#)

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

$$\text{ex } 52130.92\text{in} = 1.25\text{kN} \cdot \frac{(10.02\text{ft})^3}{32 \cdot 13\text{m}^2 \cdot (10.01\text{in})^2}$$



6) Deflection for Even Legged Angle when Load is Distributed

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

Open Calculator 

$$\text{ex } 25664.71\text{in} = \frac{1.00001\text{kN} \cdot (10.02\text{ft})^3}{52 \cdot 13\text{m}^2 \cdot (10.01\text{in})^2}$$

7) Deflection for Hollow Cylinder when Load in Middle

$$\text{fx } \delta = \frac{W_p \cdot L^3}{24 \cdot (A_{cs} \cdot (d_b^2) - a \cdot (d^2))}$$

Open Calculator 

$$\text{ex } 69542.34\text{in} = \frac{1.25\text{kN} \cdot (10.02\text{ft})^3}{24 \cdot (13\text{m}^2 \cdot ((10.01\text{in})^2) - 10\text{in}^2 \cdot ((10\text{in})^2))}$$

8) Deflection for Hollow Cylinder when Load is Distributed

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

Open Calculator 

$$\text{ex } 35137.54\text{in} = \frac{1.00001\text{kN} \cdot (10.02\text{ft})^3}{38 \cdot (13\text{m}^2 \cdot ((10.01\text{in})^2) - 10\text{in}^2 \cdot ((10\text{in})^2))}$$



9) Deflection for Hollow Rectangle given Load in Middle

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

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 52156.76\text{in} = \frac{1.25\text{kN} \cdot (10.02\text{ft})^3}{32 \cdot \left((13\text{m}^2 \cdot (10.01\text{in})^2) - (10\text{in}^2 \cdot (10\text{in})^2) \right)}$$

10) Deflection for Hollow Rectangle when Load is Distributed

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

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 25489.87\text{in} = 1.00001\text{kN} \cdot \frac{(10.02\text{ft})^3}{52 \cdot (13\text{m}^2 \cdot (10.01\text{in})^{-10\text{in}^2} \cdot (10\text{in})^2)}$$

11) Deflection for I Beam when Load in Middle

$$\text{fx } \delta = \frac{W_p \cdot (L^3)}{58 \cdot A_{cs} \cdot (d_b^2)}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 28761.89\text{in} = \frac{1.25\text{kN} \cdot ((10.02\text{ft})^3)}{58 \cdot 13\text{m}^2 \cdot ((10.01\text{in})^2)}$$



12) Deflection for I Beam when Load is Distributed

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

Open Calculator 

$$\text{ex } 14350.16\text{in} = \frac{1.00001\text{kN} \cdot ((10.02\text{ft})^3)}{93 \cdot 13\text{m}^2 \cdot ((10.01\text{in})^2)}$$

13) Deflection for Solid Cylinder when Load in Middle

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

Open Calculator 

$$\text{ex } 25980.9\text{in} = \frac{1.25\text{kN} \cdot (2.2\text{m})^3}{24 \cdot 13\text{m}^2 \cdot (10.01\text{in})^2}$$

14) Deflection for Solid Cylinder when Load is Distributed

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

Open Calculator 

$$\text{ex } 13127.32\text{in} = \frac{1.00001\text{kN} \cdot (2.2\text{m})^3}{38 \cdot 13\text{m}^2 \cdot (10.01\text{in})^2}$$



15) Deflection for Solid Rectangle when Load in Middle

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

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$\text{ex } 52130.92\text{in} = \frac{1.25\text{kN} \cdot (10.02\text{ft})^3}{32 \cdot 13\text{m}^2 \cdot (10.01\text{in})^2}$$

16) Deflection for Solid Rectangle when Load is Distributed

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

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$\text{ex } 25664.71\text{in} = \frac{1.00001\text{kN} \cdot (10.02\text{ft})^3}{52 \cdot 13\text{m}^2 \cdot (10.01\text{in})^2}$$

Safe Loads 17) Greatest Safe Load for Channel or Z Bar when Load is at Middle

$$\text{fx } W_p = \frac{1525 \cdot A_{cs} \cdot d_b}{L}$$

[Open Calculator !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

$$\text{ex } 1.650435\text{kN} = \frac{1525 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$



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

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

Open Calculator 

$$\text{ex } 3.300869\text{kN} = \frac{3050 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$

19) Greatest Safe Load for Deck Beam when Load in Middle

$$\text{fx } W_p = \frac{1380 \cdot A_{cs} \cdot d_b}{L}$$

Open Calculator 

$$\text{ex } 1.493508\text{kN} = \frac{1380 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$

20) Greatest Safe Load for Deck Beam when Load is Distributed

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

Open Calculator 

$$\text{ex } 2.987016\text{kN} = \frac{2760 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$

21) Greatest Safe Load for Even Legged Angle when Load is Distributed



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

Open Calculator 

$$\text{ex } 0.001916\text{kN} = \frac{1.77 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$



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

$$\text{fx } W_p = 885 \cdot A_{cs} \cdot \frac{d_b}{L}$$

[Open Calculator !\[\]\(71ceb62b681518c82e95d615e7265d66_img.jpg\)](#)

$$\text{ex } 0.957793\text{kN} = 885 \cdot 13\text{m}^2 \cdot \frac{10.01\text{in}}{10.02\text{ft}}$$

23) Greatest Safe Load for Hollow Cylinder when Load in Middle

$$\text{fx } W_p = \frac{667 \cdot (A_{cs} \cdot d_b - a \cdot d)}{L}$$

[Open Calculator !\[\]\(fc3a57079704ef1b99671c8cafae23be_img.jpg\)](#)

$$\text{ex } 0.721504\text{kN} = \frac{667 \cdot (13\text{m}^2 \cdot 10.01\text{in} - 10\text{in}^2 \cdot 10\text{in})}{10.02\text{ft}}$$

24) Greatest Safe Load for Hollow Cylinder when Load is Distributed

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

[Open Calculator !\[\]\(d5831b2ac75eb48b4c49d27e61d24c03_img.jpg\)](#)

$$\text{ex } 1.441927\text{kN} = \frac{1333 \cdot (13\text{m}^2 \cdot 10.01\text{in} - 10\text{in}^2 \cdot 10\text{in})}{10.02\text{ft}}$$

25) Greatest Safe Load for Hollow Rectangle when Load in Middle

$$\text{fx } W_p = \frac{890 \cdot (A_{cs} \cdot d_b - a \cdot d)}{L}$$

[Open Calculator !\[\]\(e97636a3328cdaccd5ffd8fe3bc69ce6_img.jpg\)](#)

$$\text{ex } 0.962727\text{kN} = \frac{890 \cdot (13\text{m}^2 \cdot 10.01\text{in} - 10\text{in}^2 \cdot 10\text{in})}{10.02\text{ft}}$$



26) Greatest Safe Load for Hollow Rectangle when Load is Distributed

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

[Open Calculator !\[\]\(8b57f0e15e7dda24cf9977561475f640_img.jpg\)](#)

$$\text{ex } 2.672964\text{kN} = 1780 \cdot \frac{13\text{m}^2 \cdot 10.01\text{in} - 10\text{in}^2 \cdot 10\text{in}}{2.2\text{m}}$$

27) Greatest Safe Load for I Beam when Load in Middle

$$\text{fx } W_p = \frac{1795 \cdot A_{cs} \cdot d_b}{L}$$

[Open Calculator !\[\]\(ceb7cef9f9d693d102dfe501130037c6_img.jpg\)](#)

$$\text{ex } 1.942643\text{kN} = \frac{1795 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$

28) Greatest Safe Load for I Beam when Load is Distributed

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

[Open Calculator !\[\]\(5a09a9dfd2f1e923eccb8c24714edf51_img.jpg\)](#)

$$\text{ex } 3.668835\text{kN} = \frac{3390 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$

29) Greatest Safe Load for Solid Cylinder when Load in Middle

$$\text{fx } W_p = \frac{667 \cdot A_{cs} \cdot d_b}{L}$$

[Open Calculator !\[\]\(eb1074bfd91059c9cff57cf6b5c22a5b_img.jpg\)](#)

$$\text{ex } 0.721862\text{kN} = \frac{667 \cdot 13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$



30) Greatest Safe Load for Solid Cylinder when Load is Distributed

[Open Calculator !\[\]\(0cc5c4c18dd72a91e21b90220aef9c5d_img.jpg\)](#)

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

$$\text{ex } 1.442642\text{kN} = 1333 \cdot \frac{13\text{m}^2 \cdot 10.01\text{in}}{10.02\text{ft}}$$

31) Greatest Safe Load for Solid Rectangle given Load in Middle

[Open Calculator !\[\]\(3b71157eab31889e641f7620692f0b92_img.jpg\)](#)

$$\text{fx } W_p = 890 \cdot A_{cs} \cdot \frac{d_b}{L}$$

$$\text{ex } 0.963204\text{kN} = 890 \cdot 13\text{m}^2 \cdot \frac{10.01\text{in}}{10.02\text{ft}}$$

32) Greatest Safe Load for Solid Rectangle when Load is Distributed

[Open Calculator !\[\]\(94480c799e843c3a4dcfaf8c99e6db79_img.jpg\)](#)

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

$$\text{ex } 1.926409\text{kN} = 1780 \cdot 13\text{m}^2 \cdot \frac{10.01\text{in}}{10.02\text{ft}}$$



Variables Used

- **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*)
- **W_p** Greatest Safe Point Load (*Kilonewton*)
- **δ** Deflection of Beam (*Inch*)



Constants, Functions, Measurements used

- **Measurement: Length** in Inch (in), Foot (ft), Meter (m)
Length Unit Conversion 
- **Measurement: Area** in Square Meter (m^2), Square Inch (in^2)
Area Unit Conversion 
- **Measurement: Force** in Kilonewton (kN)
Force Unit Conversion 



Check other formula lists

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

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