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Beam Moments Formulas

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List of 24 Beam Moments Formulas

Beam Moments

1) Bending Moment of Cantilever Beam Subjected to UDL at Any Point from Free End

Open Calculator

fx $$M = \left(\frac{w \cdot x^2}{2}\right)$$

ex $$57.0037\text{kN*m} = \left(\frac{67.46\text{kN/m} \cdot (1300\text{mm})^2}{2}\right)$$

2) Bending Moment of Simply Supported Beam Carrying UDL

Open Calculator

fx $$M = \left(\frac{w \cdot L \cdot x}{2}\right) - \left(w \cdot \frac{x^2}{2}\right)$$

ex

$$57.0037\text{kN*m} = \left(\frac{67.46\text{kN/m} \cdot 2600\text{mm} \cdot 1300\text{mm}}{2}\right) - \left(67.46\text{kN/m} \cdot \frac{(1300\text{mm})^2}{2}\right)$$

3) Bending Moment of Simply Supported Beam Subjected to Point Load at Mid-Point

Open Calculator

fx $$M = \left(\frac{P \cdot x}{2}\right)$$

ex $$57.2\text{kN*m} = \left(\frac{88\text{kN} \cdot 1300\text{mm}}{2}\right)$$

4) Fixed End Moment at Left Support Carrying Right Angled Triangular Load at Right Angled End A

Open Calculator

fx $$FEM = \frac{q \cdot (L^2)}{20}$$

ex $$4.394kN*m = \frac{13kN/m \cdot ((2600mm)^2)}{20}$$

5) Fixed End Moment at Left Support with Couple at Distance A

Open Calculator

fx $$FEM = \frac{M_c \cdot b \cdot (2 \cdot a - b)}{L^2}$$

ex $$18.26368kN*m = \frac{85kN*m \cdot 350mm \cdot (2 \cdot 2250mm - 350mm)}{(2600mm)^2}$$

6) Fixed End Moment at Left Support with Point Load at Certain Distance from Left Support

Open Calculator

fx $$FEM = \left(\frac{P \cdot (b^2) \cdot a}{L^2}\right)$$

ex $$3.588018kN*m = \left(\frac{88kN \cdot ((350mm)^2) \cdot 2250mm}{(2600mm)^2}\right)$$

7) Fixed End Moment of Fixed Beam Carrying Three Equi-spaced Point Loads

Open Calculator

fx $$FEM = \frac{15 \cdot P \cdot L}{48}$$

ex $$71.5kN*m = \frac{15 \cdot 88kN \cdot 2600mm}{48}$$

8) Maximum Bending Moment of Cantilever Beam Subjected to Point Load at Free End

Open Calculator

fx $M = P \cdot L$

ex $228.8\text{kN*m} = 88\text{kN} \cdot 2600\text{mm}$

9) Maximum Bending Moment of Cantilever Subject to UDL over Entire Span

Open Calculator

fx $M = \frac{w \cdot L^2}{2}$

ex $228.0148\text{kN*m} = \frac{67.46\text{kN/m} \cdot (2600\text{mm})^2}{2}$

10) Maximum Bending Moment of Overhanging Beam Subjected to Concentrated Load at Free End

Open Calculator

fx $M = -P \cdot l_o$

ex $-132000\text{kN*m} = -88\text{kN} \cdot 1500\text{mm}$

11) Maximum Bending Moment of Simply Supported Beam with Point Load at Distance 'a' from Left Support

Open Calculator

fx $M = \frac{P \cdot a \cdot b}{L}$

ex $26.65385\text{kN*m} = \frac{88\text{kN} \cdot 2250\text{mm} \cdot 350\text{mm}}{2600\text{mm}}$

12) Maximum Bending Moment of Simply Supported Beam with Uniformly Distributed Load

Open Calculator

fx $M = \frac{w \cdot L^2}{8}$

ex $57.0037\text{kN*m} = \frac{67.46\text{kN/m} \cdot (2600\text{mm})^2}{8}$

13) Maximum Bending Moment of Simply Supported Beams with Point Load at Centre

Open Calculator

fx $$M = \frac{P \cdot L}{4}$$

ex $$57.2\text{kN*m} = \frac{88\text{kN} \cdot 2600\text{mm}}{4}$$

14) Maximum Bending Moment of Simply Supported Beams with Uniformly Varying Load

Open Calculator

fx $$M = \frac{q \cdot L^2}{9 \cdot \sqrt{3}}$$

ex $$5.637505\text{kN*m} = \frac{13\text{kN/m} \cdot (2600\text{mm})^2}{9 \cdot \sqrt{3}}$$

15) Moment on Fixed End of Fixed Beam carrying Two Equi Spaced Point Loads

Open Calculator

fx $$FEM = \frac{2 \cdot P \cdot L}{9}$$

ex $$50.84444\text{kN*m} = \frac{2 \cdot 88\text{kN} \cdot 2600\text{mm}}{9}$$

16) Moment on Fixed End of Fixed Beam Carrying Uniform Varying Load

Open Calculator

fx $$FEM = \frac{5 \cdot q \cdot \left(L^2\right)}{96}$$

ex $$4.577083\text{kN*m} = \frac{5 \cdot 13\text{kN/m} \cdot \left((2600\text{mm})^2\right)}{96}$$

17) Moment on Fixed End of Fixed Beam having Point Load at Center

Open Calculator

fx $$FEM = \frac{P \cdot L}{8}$$

ex $$28.6\text{kN*m} = \frac{88\text{kN} \cdot 2600\text{mm}}{8}$$

18) Moment on Fixed End of Fixed Beam having UDL over Entire Length

Open Calculator

fx $$FEM = \frac{w \cdot (L^2)}{12}$$

ex $$38.00247\text{kN*m} = \frac{67.46\text{kN/m} \cdot \left((2600\text{mm})^2\right)}{12}$$

Curved Beams

19) Bending Moment when Stress is Applied at Point in Curved Beam

Open Calculator

fx $$M = \left(\frac{S \cdot A \cdot R}{1 + \left(\frac{y}{Z \cdot (R+y)}\right)}\right)$$

ex $$57\text{kN*m} = \left(\frac{33.25\text{MPa} \cdot 0.04\text{m}^2 \cdot 50\text{mm}}{1 + \left(\frac{25\text{mm}}{2.0 \cdot (50\text{mm}+25\text{mm})}\right)}\right)$$

20) Cross-Sectional Area when Stress is Applied at Point in Curved Beam

Open Calculator

fx $$A = \left(\frac{M}{S \cdot R}\right) \cdot \left(1 + \left(\frac{y}{Z \cdot (R + y)}\right)\right)$$

ex $$0.04\text{m}^2 = \left(\frac{57\text{kN*m}}{33.25\text{MPa} \cdot 50\text{mm}}\right) \cdot \left(1 + \left(\frac{25\text{mm}}{2.0 \cdot (50\text{mm} + 25\text{mm})}\right)\right)$$

21) Stress at Point for Curved Beam as defined in Winkler-Bach Theory

Open Calculator

fx $$S = \left(\frac{M}{A \cdot R}\right) \cdot \left(1 + \left(\frac{y}{Z \cdot (R + y)}\right)\right)$$

ex $$33.25\text{MPa} = \left(\frac{57\text{kN*m}}{0.04\text{m}^2 \cdot 50\text{mm}}\right) \cdot \left(1 + \left(\frac{25\text{mm}}{2.0 \cdot (50\text{mm} + 25\text{mm})}\right)\right)$$

Flitched Beam

22) Equivalent Width of Flitched Beam

Open Calculator

fx $$w_f = m \cdot T_{Beam}$$

ex $$3375\text{mm} = 15 \cdot 225\text{mm}$$

23) Modular Ratio for Equivalent Width of Flitched Beam

Open Calculator

fx $$m = \frac{w_f}{T_{Beam}}$$

ex $$15 = \frac{3375\text{mm}}{225\text{mm}}$$

24) Thickness of Steel given Equivalent Width of Flitched Beam

Open Calculator

fx $$T_{Beam} = \frac{w_f}{m}$$

ex $$225\text{mm} = \frac{3375\text{mm}}{15}$$

Variables Used

- **a** Distance from Support A *(Millimeter)*
- **A** Cross Sectional Area *(Square Meter)*
- **b** Distance from Support B *(Millimeter)*
- **FEM** Fixed End Moment *(Kilonewton Meter)*
- **L** Length of Beam *(Millimeter)*
- l_o Length of Overhang *(Millimeter)*
- **m** Modular Ratio
- **M** Bending Moment *(Kilonewton Meter)*
- M_c Moment of Couple *(Kilonewton Meter)*
- **P** Point Load *(Kilonewton)*
- **q** Uniformly Varying Load *(Kilonewton per Meter)*
- **R** Radius of Centroidal Axis *(Millimeter)*
- **S** Stress *(Megapascal)*
- T_{Beam} Beam Thickness *(Millimeter)*
- **w** Load per Unit Length *(Kilonewton per Meter)*
- w_f Equivalent Width of Flitched Beam *(Millimeter)*
- **x** Distance x from Support *(Millimeter)*
- **y** Distance from Neutral Axis *(Millimeter)*
- **Z** Cross-Section Property

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Surface Tension** in Kilonewton per Meter (kN/m)
  Surface Tension Unit Conversion
- Measurement: **Moment of Force** in Kilonewton Meter (kN*m)
  Moment of Force Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- **Mohr's Circle of Stresses Formulas**
- **Beam Moments Formulas**
- **Bending Stress Formulas**
- **Combined Axial and Bending Loads Formulas**
- **Elastic Stability of Columns Formulas**
- **Principal Stress Formulas**
- **Slope and Deflection Formulas**
- **Strain Energy Formulas**

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