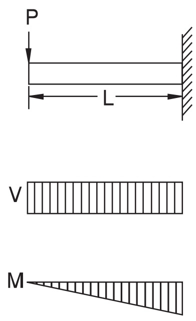
Beam Support Conditions

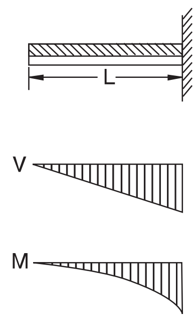
Cantilever Beams



V max. = P

M max. = PL

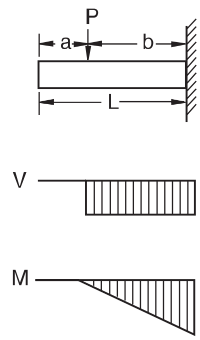
Δmax. = $\frac{PL^3}{3EI}$



V max. = W

M max. = $\frac{WL}{2}$

Δmax. = $\frac{WL^3}{8EI}$

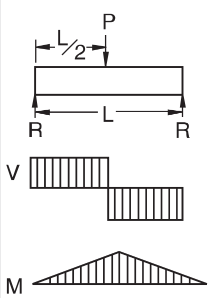


V max. = P

M max. = Pb

Δmax. = $\frac{Pb^2(3L-b)}{6EI}$

Simple Beams

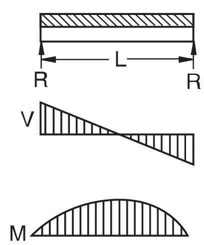


R= $\frac{P}{2}$

V max. = $\frac{P}{2}$

M max. = $\frac{PL}{4}$

Δmax. = $\frac{PL^3}{48EI}$

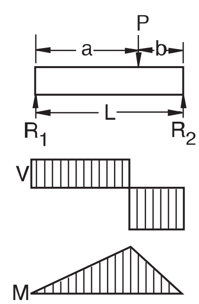


R= $\frac{W}{2}$

V max. = $\frac{W}{2}$

M max. = $\frac{WL}{8}$

Δmax. = $\frac{5WL^3}{384EI}$



R_1= $\frac{Pb}{L}$

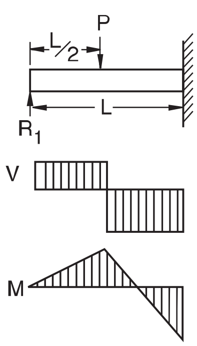
R_2= $\frac{Pa}{L}$

V max. = $\frac{Pa}{L}$

M max. = $\frac{Pab}{L}$

Δmax. = $\frac{Pab(a+2b)\sqrt{3a(a+2b)}}{27EIL}$

Beams Fixed At One End & Supported At The Other



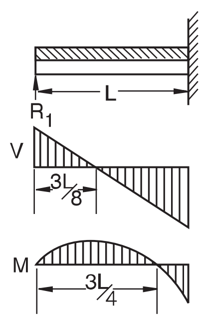
R_1= $\frac{5P}{16}$

V max. = $\frac{11P}{16}$

M max. = $\frac{3PL}{16}$

Δmax. at x = 0.447L

Δmax. = 0.009317$\frac{PL^3}{EI}$



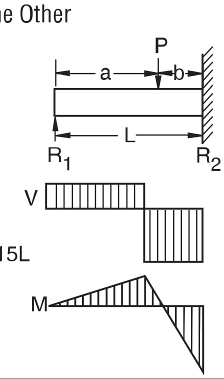
R_1= $\frac{3W}{8}$

V max. = $\frac{5W}{8}$

M max. = $\frac{WL}{8}$

Δmax. at x = 0.4215L

Δmax. = $\frac{WL^3}{185EI}$



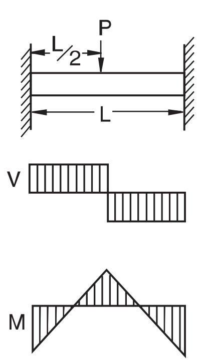
R_1= $\frac{Pb^2}{2L^3}(a+2L)$

R_2= $\frac{Pa}{2L^3}(3L^2-a^2)$

M at point of load = R_1a

M at fixed end = $\frac{Pab}{2L^3}(a+L)$

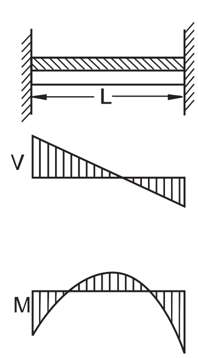
Beams Fixed At Both Ends



V max. = $\frac{P}{2}$

M max. = $\frac{PL}{8}$

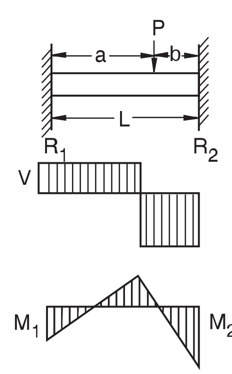
Δmax. = $\frac{PL^3}{192EI}$



V max. = $\frac{W}{2}$

M max. = $\frac{WL}{12}$

Δmax. = $\frac{WL^3}{384EI}$



R_1= $\frac{Pb^2}{L^3}(3a+b)$

R_2= $\frac{Pa^2}{L^3}(a+3b)$

M_1 = $\frac{Pab^2}{L^2}$

M_2 = $\frac{Pa^2b}{L^2}$

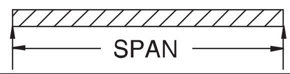
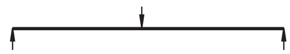
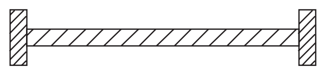
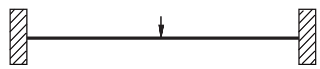
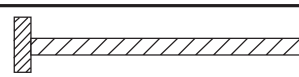
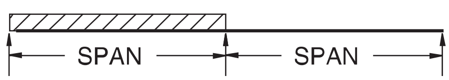
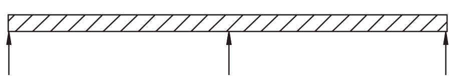
R – Reaction
M – Moment
P – Concentrated Load

W – Total Uniform Load
V – Shear
L – Length

Δ – Deflection
E – Modulus of Elasticity
I – Moment of Inertia

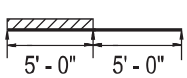
Conversion Factors For Beams With Various Static Loading Conditions

All Beam Load tables are for single-span (simple) beams supported at the ends. These can be used in the majority of the cases. However, there are times when it is necessary to know what happens with other loading and support conditions. Some common arrangements are shown below. Simply multiply the values from the Beam Load tables by factors given below

Load and Support Condition		Load Factor	Deflection Factor
1. Simple Beam, Uniform Load		**1.00**	**1.00**
2. Simple Beam, Concentrated Load at Center		**.50**	**.80**
3. Simple Beam, Two Equal Concentrated Loadcs at 1/4 pts		**1.00**	**1.10**
4. Beam Fixed at Both Ends, Uniform Load		**1.50**	**.30**
5. Beam Fixed at Both Ends, Concentrated Load at Center		**1.00**	**.40**
6. Cantilever Beam, Uniform Load		**.25**	**2.40**
7. Cantilever Beam, Concentrated Load at End		**.12**	**3.20**
8. Continuous Beam, Two Equal Spans, Uniform Load on One Span		**1.30**	**.92**
9. Continuous Beam, Two Equal Spans, Uniform Load on Both Ends		**1.00**	**.42**
10. Continuous Beam, Two Equal Spans, Concentrated Load at Center of One Span		**.62**	**.71**
11. Continuous Beam, Two Equal Spans, Concentrated Load at Center of Each Span		**.67**	**.48**

EXAMPLE I:

Determine load and deflection of a P 1000 beam continuous over one support and loaded uniformly on one span.

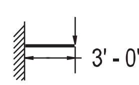


SOLUTION:

A. From load table for P1000 on page 25 load for a 5'-0" span is 680# and deflection is .35".
B. Multiply by factors from Table above.
Load = 680# x 1.30 = 884#
Deflection = .35" x .92 = .32"

EXAMPLE II

Determine load and deflection of a P 5500 cantilever beam with a concentrated load on the end.



SOLUTION:

A. From load table P5500 on page 58 load for a 3'-0" span is 2180# and deflection is .09".
B. Multiply by factors from Table above.
Load = 2180# x .12 = 262#
Deflection = .09" x 3.20 = .29"