Steel Beam Section Modulus and Inertia Required

Maximum moment and shear of a simply supported beam with uniform and central point loads, and the section modulus and second moment of area needed.

Method: Elastic beam selection by strength and stiffness; Gere and Goodno; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Span	6.0000	m
Uniform load	15.000	kN/m
Central point load	20.000	kN
Allowable bending stress	165.00	MPa
Elastic modulus	200.00	GPa
Deflection limit L/n	360.00	

Calculated results

Parameter	Value	Unit
Maximum moment	97.500	kN·m
Maximum shear	55.000	kN
Section modulus needed	590.91	cm³
Second moment of area for deflection	10,294	cm⁴
Allowable deflection	16.667	mm

Notes for this case

• M = wL²/8 + PL/4; Z = M/σ; I from δ = 5wL⁴/384EI + PL³/48EI. Pick a section with both Z and I above these, then check lateral-torsional buckling, web shear and bearing; use service loads for deflection.

Formula and method

$$M = \frac{wL^2}{8} + \frac{PL}{4}, \quad Z_{req} = \frac{M}{\sigma_{all}}, \quad I_{req} = \frac{1}{E\delta_{all}}\left(\frac{5wL^4}{384} + \frac{PL^3}{48}\right)$$

Variables

L	Span	m
w	Uniform load	N/m
P	Central point load	N
σ_{all}	Allowable bending stress	Pa
E	Elastic modulus	Pa
n	Deflection limit L/n	-
M_{max}	Maximum moment	N·m
V_{max}	Maximum shear	N
Z_{req}	Section modulus needed	m³
I_{req}	Second moment of area for deflection	m⁴
δ_{all}	Allowable deflection	m

Method and standards

Beam selection.

Assumptions and limits

- Simply supported prismatic beam; elastic.

References

Elastic beam selection by strength and stiffness, Gere and Goodno, Mechanics of Materials (Cengage)

Report details

Report reference	FCC-2MFF-W1GX (the same inputs always give the same reference)
Generated	23 November 2026, 18:00 UTC
Calculator	Steel Beam Section Modulus and Inertia Required
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/steel/steel-beam-section-selection

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.