

Beam Bending Verification

Sample document with complete example values. It shows the report the purchased export produces for YOUR input - it is not itself a report for any part.

Project: Sample project

Part/Position: no real part

Prepared by: Sample, not released

Overall assessment: not OK - the stress or deflection check is not satisfied.

Load Case and System

Load case	Simply supported beam, point load at midspan
Span or cantilever length L	2,000 mm
Point load F	5,000 N
Beam self-weight	included ($q = 0.151 \text{ N/mm}$)
Modulus of elasticity E	210,000 N/mm ²
Yield strength Re	355 N/mm ²
Required safety factor S_req	1.5
Deflection criterion	$f_{\text{allow}} = L/300$

Cross-section

Cross-section	Round bar, d = 50 mm
Area A	1,963.5 mm ²
Second moment of area I_y	306,796 mm ⁴
Section modulus W_y	12,272 mm ³
Depth in load direction h	50 mm

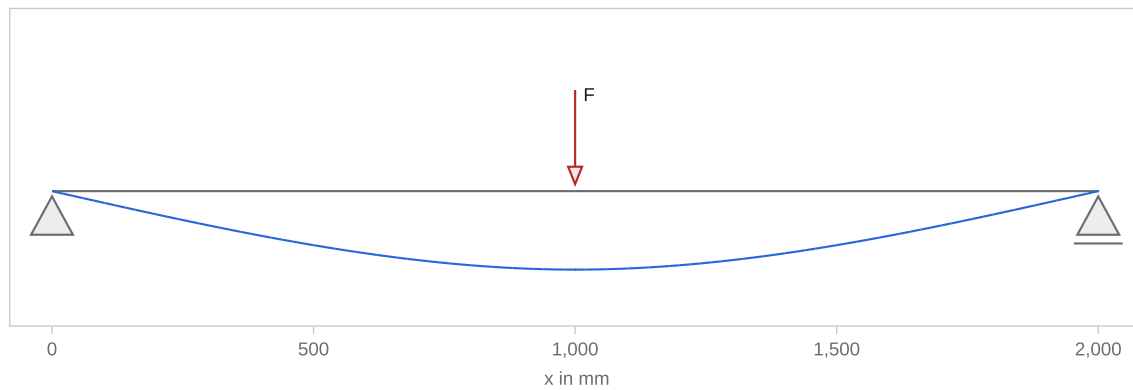
Results

Support reaction A	2,651.21 N
Support reaction B	2,651.21 N
Max. bending moment M _{max}	2,575.6 Nm at x = 1,000 mm
Max. shear force Q _{max}	2,651 N at x = 0 mm
Max. deflection f_max	13.423 mm at x = 1,000 mm
Slope at support A	20.184 mrad = 1.156°
Slope at support B	20.184 mrad = 1.156°
Bending stress σ_b	209.88 N/mm ²
Allowable stress $\sigma_{\text{allow}} = Re/S_{\text{req}}$	236.67 N/mm ²
Allowable deflection f_allow	6.67 mm

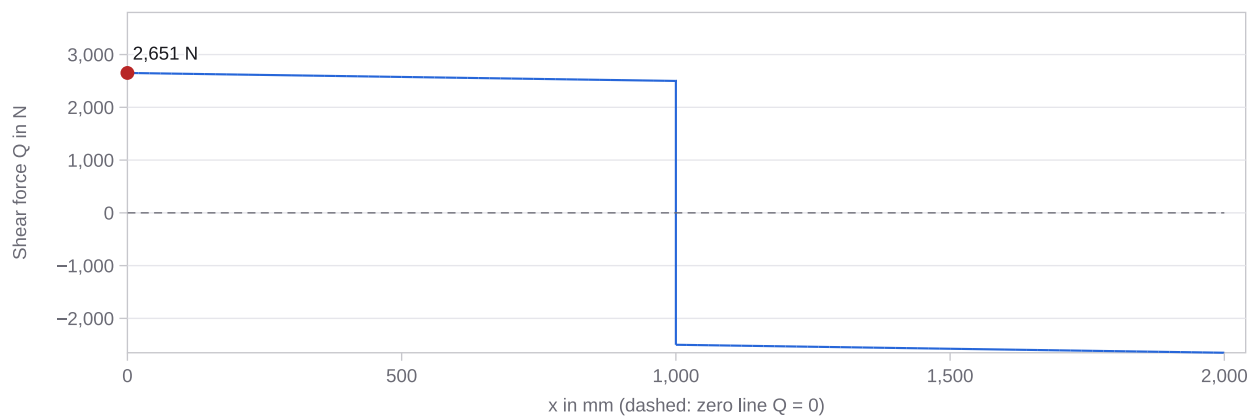
Verifications

Criterion	Value	Limit	Status
Stress verification $S = Re/\sigma_b$	1.69	1.5	● OK
Deflection f_max	13.423 mm	6.67 mm	● not OK

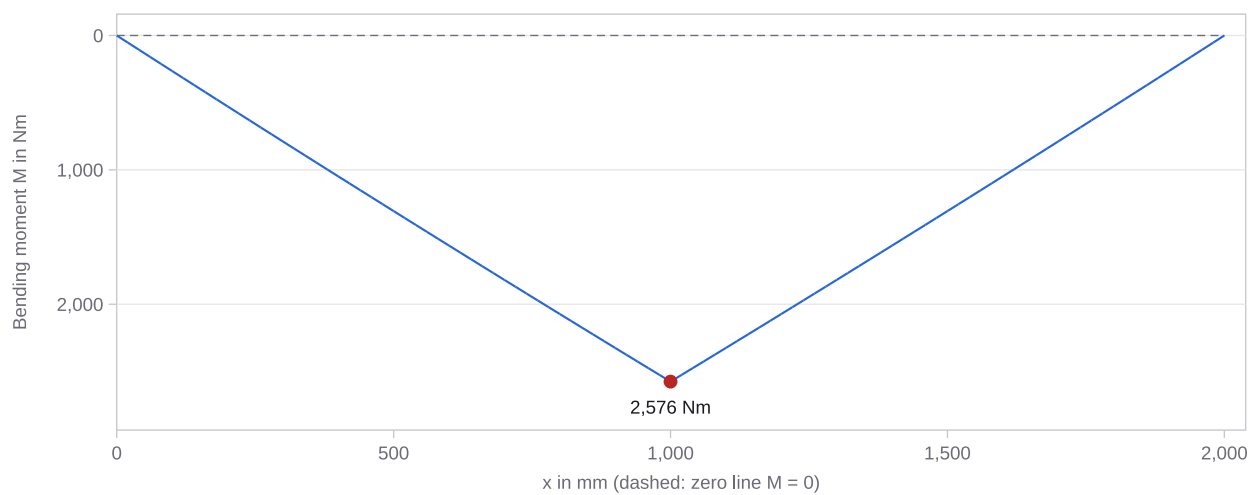
System sketch: supports and load



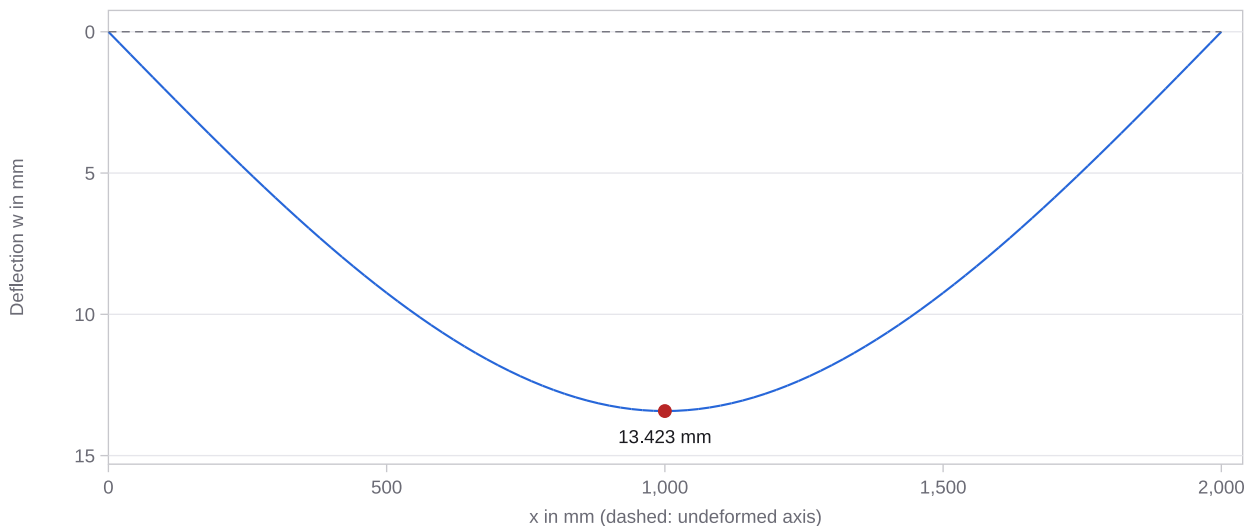
Shear force diagram $Q(x)$



Bending moment diagram $M(x)$



Deflection curve



Convention: deflection and positive bending moment (tension at the bottom) are plotted downwards, so the vertical axis of those two diagrams grows downwards. The shear force is plotted upwards - it is an internal force and has no direction in space. At fixed supports the tension side is on top.

Calculation basis

Beam bending per first-order Euler-Bernoulli beam theory, using closed-form expressions for the standard load cases: support reactions, the bending moment diagram, and the deflection curve follow directly from the load case, span, and flexural rigidity $E \cdot I_y$. If the self-weight is included (see inputs), it is formed as a uniformly distributed load $q = p \cdot g \cdot A$ over the full length and superimposed on the load case; under first-order theory shear force, bending moment and deflection curve add up point by point, and the extreme values reported here are determined anew from the superimposed curves rather than being the sum of the individual maxima. The stress verification compares $\sigma_b = |M|_{\max} / W_y$ with the allowable stress R_e / S_{req} ; the deflection verification compares the maximum deflection with the criterion $f_{\text{allow}} = L/k$. Each is rated by its utilisation: above 1.0 the check counts as not satisfied, between 0.9 and 1.0 as satisfied without appreciable reserve. Shear deformation and second-order theory are not considered.

About this sample

All values on these pages come from a freely chosen example calculation and belong to no real part. The purchased export contains the same sections with your input, your header data (project, part, prepared by) and as searchable text. Pricing and scope: maschinenbaurechner.de/en/pricing

Note: The results are design and orientation aids. They do not replace independent verification, calculation and approval by a qualified person. The terms of use at maschinenbaurechner.de apply.