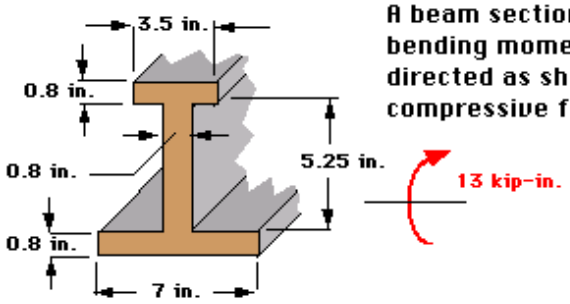
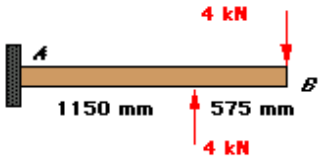
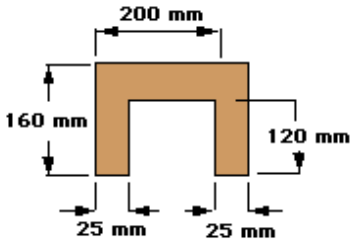
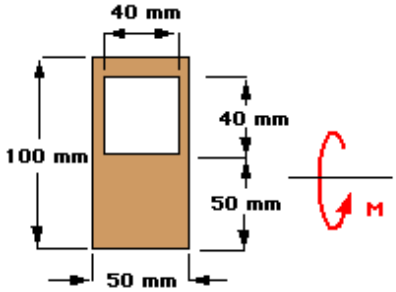


A beam section with the dimensions shown is subjected to a bending moment of 13 kip-in. about its centroidal axis, directed as shown. Determine the maximum tensile and compressive flexure stresses on the section of beam.

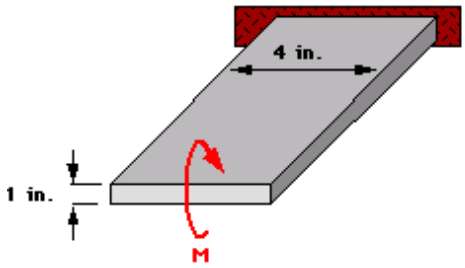


Beam *AB* is subjected to the two 4-kN forces shown. The cross section of the beam has the dimensions shown. Determine the maximum tensile and compressive stresses in the beam.

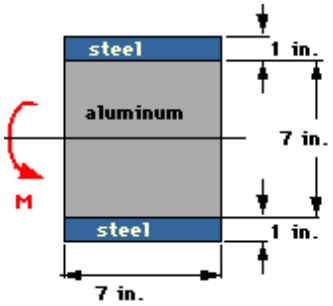




A segment of beam is subjected to pure bending about its horizontal centroidal axis. The cross-section of the beam has the dimensions shown. The allowable tensile and compressive stresses for the beam are 110 MPa and 125 MPa, respectively. Determine the magnitude of the maximum allowable applied moment.

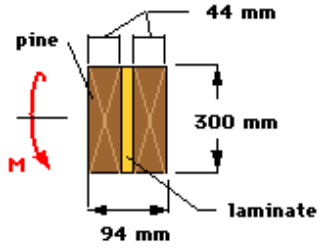


A cantilevered beam is subjected to a bending moment as shown. The normal stress in the beam is 30 ksi. Assume the beam is made from steel, with $E = 29 \times 10^6$ psi. Determine the radius of curvature of the beam.

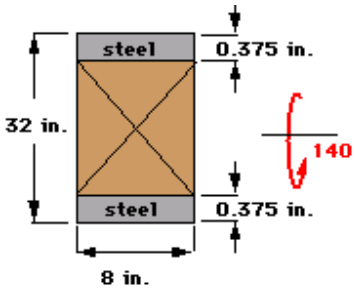


A composite beam is constructed by bonding two steel strips to an aluminum core as shown. The maximum allowable normal stress in the steel is 30 ksi, and in the aluminum it is 18 ksi. Determine the maximum allowable bending moment that can be applied to the beam. Note that

$$E_{Al} = 10 \times 10^6 \text{ psi and } E_{St} = 30 \times 10^6 \text{ psi.}$$

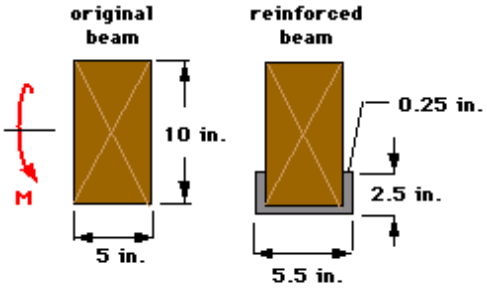


In order to increase the load carrying capability of a pine joist (E = 11 GPa), a 6-mm-wide laminate (E = 35 GPa) is placed between two 44-mm × 300-mm pine timbers. The pine timbers can sustain a maximum normal stress of 17 MPa. Determine the difference between the maximum moment that can be supported by a 94-mm × 300-mm pine beam and the beam section shown (with the laminate).

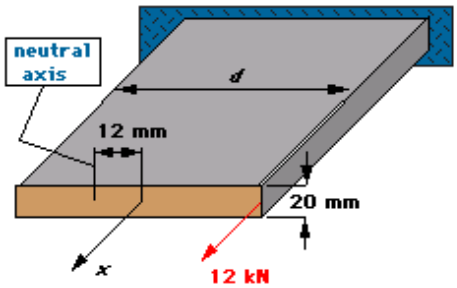


A wooden block is reinforced by steel plates located on the top and bottom surfaces. A 140 kip-ft moment is applied as shown. Determine the tensile stress in the wood and steel reinforcing plates. It is known that

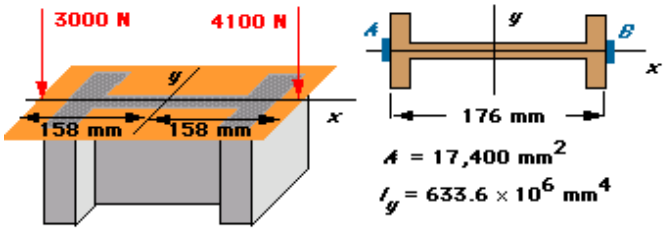
$E_s = 30 \times 10^6$ psi and $E_w = 1.25 \times 10^6$ psi



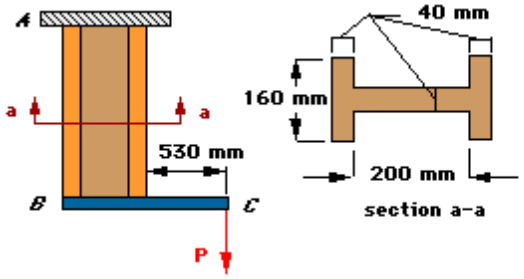
In order to increase the load carrying capability of a wooden beam, a 10.5-in. × 0.25-in. reinforcing strap is bent into the shape of a bracket and placed on the bottom of the beam. A bending moment of 175 kip-in. is applied as shown to each beam. Determine the ratio of the maximum tensile stress in the wood for both beams, $\sigma_{orig.}/\sigma_{reinforced}$. The wood and reinforcement have elastic moduli of $E_w = 1.5 \times 10^6$ psi and $E_{rein.} = 30 \times 10^6$ psi.



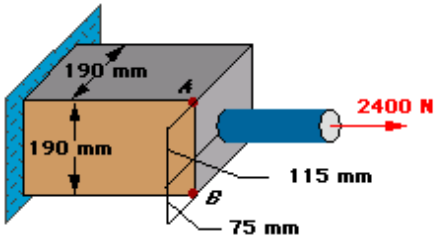
For the cantilevered beam shown, determine the beam width d required so that the neutral axis is located 12 mm to the left of the centroid of the beam.



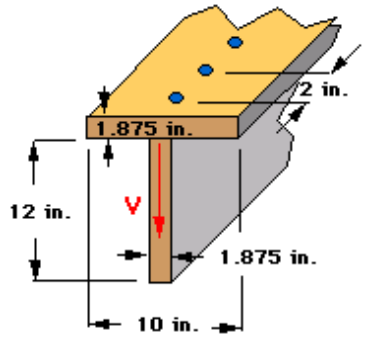
A rigid plate is supported by a beam with the cross-section shown. The plate is loaded with two forces as indicated. Determine the normal strain (in the *z* direction) indicated by strain gages located at *A* and *B* if the elastic modulus of the beam material is 115 GPa.



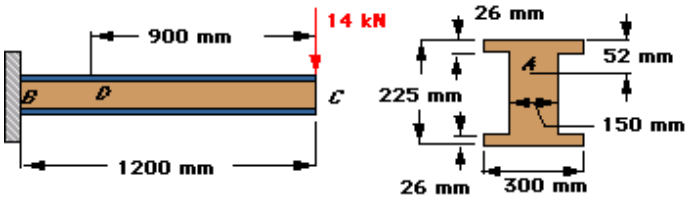
Section *AB* is fixed at *A*, and a load **P** is applied to rigid bar *BC*, as indicated. The allowable tensile and compressive stresses for the material are 180 MPa and 330 MPa, respectively. Find the maximum load **P** that can be applied.



A 2400-N load is applied to a rod, which is fastened to a block as shown. Determine the normal stress at points *A* and *B*.

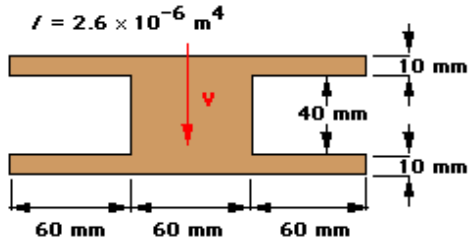


Two wooden planks with the dimensions shown are fastened with nails and subjected to a vertical shear force as indicated. The maximum force supported by each nail is 80 lb. Determine the maximum applied shear force.

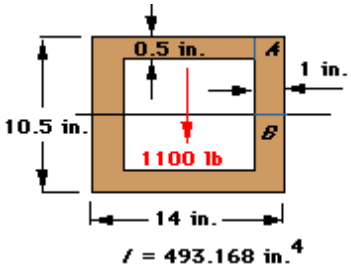


Cantilevered beam *BC* has a 14-kN end load applied as shown. At section *D*, determine the shear stress at point *A* (52 mm below the top of the beam) knowing

$I = 220.04 \times 10^{-6}\ \text{m}^4$



The beam section shown is made from a material that can withstand a maximum shear stress of 55 MPa. Determine the maximum transverse shear force that can be applied to the section.



The beam section shown is subjected to the shear force indicated. The top and bottom walls are 0.5-in. thick and the side walls are 1-in. thick. Determine the shear stress at *A* and *B* (the neutral bending axis).