

Solution

Show all work for full credit. You may work with ONE other person.

Due: End of Class Today

1. A 3-in x 8-in full size rectangular beam has a 16-ft simple span. The beam is subjected a 9 lb/ft uniform load applied to the entire span and a 550 lb concentrated load at midspan. The allowable deflection is 1/360 of the span length. Determine whether the beam is satisfactory for deflection. $E = 1.3 \times 10^3$ ksi

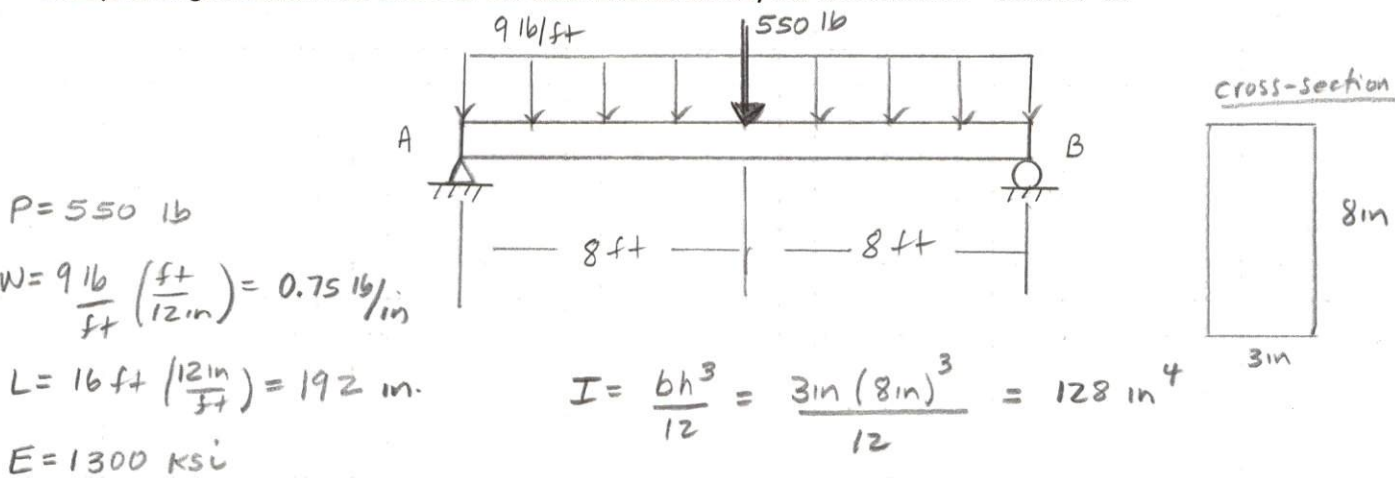


Table 16-1, Case 5 and Case 7

Case 5

$$\delta_{\text{MAX}} = \frac{PL^3}{48EI} = \frac{550 \text{ lb} (192 \text{ in})^3}{48(1,300,000 \text{ psi})(128 \text{ in}^4)} = \frac{3,892,838,400 \text{ in}^3}{7,987,200,000 \text{ in}^2} = 0.487 \text{ in.}$$

Case 7

$$\delta_{\text{MAX}} = \frac{5WL^4}{384EI} = \frac{5 \left(0.75 \frac{\text{lb}}{\text{in}} \right) (192 \text{ in})^4}{384(1,300,000 \text{ psi})(128 \text{ in}^4)} = \frac{5096079360 \text{ in}^3}{6389760000 \text{ in}^2} = 0.0798 \text{ in.}$$

Total Deflection

$$\delta_{\text{MAX}} = 0.487 \text{ in.} + 0.0798 \text{ in.} = 0.567 \text{ in.}$$

$$\delta_{\text{allow}} = \frac{L}{360} = \frac{192 \text{ in}}{360} = 0.533 \text{ in.}$$

$$\delta_{\text{MAX}} = 0.567 \text{ in.} > \delta_{\text{allow}} = 0.533 \text{ in.}$$

\therefore Beam is NOT satisfactory for Deflection.