6.9  This problem asks that we calculate the elongation $\Delta l$ of a specimen of steel the stress-strain behavior of which is shown in Figure 6.21.  First it becomes necessary to compute the stress when a load of 65,250 N is applied using Equation 6.1 as

$$\sigma = \frac{F}{A_0} = \frac{F}{\pi\left(\dfrac{d_0}{2}\right)^2} = \frac{65{,}250 \text{ N}}{\pi\left(\dfrac{8.5 \times 10^{-3} \text{ m}}{2}\right)^2} = 1150 \text{ MPa } (170{,}000 \text{ psi})$$

Referring to Figure 6.21, at this stress level we are in the elastic region on the stress-strain curve, which corresponds to a strain of 0.0054.  Now, utilization of Equation 6.2 to compute the value of $\Delta l$

$$\Delta l = \varepsilon l_0 = (0.0054)(80 \text{ mm}) = 0.43 \text{ mm } (0.017 \text{ in.})$$