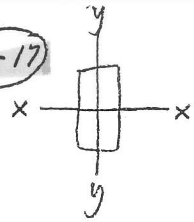
K. Dennehy Ch. 13, Pgs. 679-685: 13-17, 13-18, 13-37 HW

(13-17)



pin-pin: $K = 1.0$

$I_{x-x} = \frac{1}{12}(2in)(4in)^3 = 10.67 in^4$

$I_{y-y} = \frac{1}{12}(4in)(2in)^3 = 2.667 in^4$

$P_{cr} = \frac{\pi^2 EI}{(KL)^2}$, evaluate P_{cr} using I_{y-y} → lower P_{cr}

$(P_{cr})_{y-y} = \frac{\pi^2 (1{,}600 \frac{kip}{in^2})(2.667 in^4)}{((1.0)(10 ft)(\frac{12 in}{1 ft}))^2}$

$= \boxed{2.92 \text{ kip}}$

$\sigma_y = \frac{P}{A}$ → $P = \sigma_y A = 5 \frac{kip}{in^2}((2in)(4in))$

$P = 40 \text{ kip}$ $P_{cr} < P$

will buckle before yielding

(13-18) I_{x-x} and I_{y-y} from above

fixed-pinned: $K = 0.7$

$P_{cr} = (P_{cr})_{y-y} = \frac{\pi^2 (1{,}600 \frac{kip}{in^2})(2.667 in^4)}{((0.7)(10 ft)(\frac{12 in}{1 ft}))^2}$

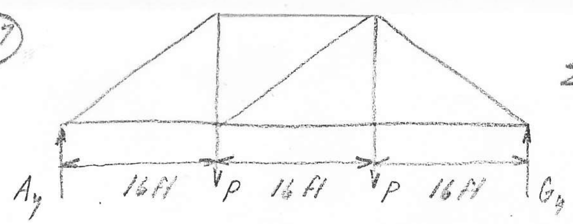
$= 5.969 \text{ kip}$

$\sigma_y = \frac{P}{A}$ → $P = \sigma_y A = (5 \frac{kip}{in^2})(2in)(4in)$

$= 40 \text{ kip}$

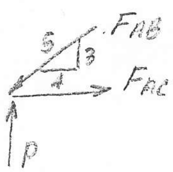
will buckle before yielding, $\boxed{P_{cr} = 5.97 \text{ kip}}$

(13-37)



$\Sigma M_G = 0$, $-A_y(48 ft) + P(32 ft) + P(16 ft) = 0$

$A_y = P$



$\Sigma F_y = 0$, $-\frac{3}{5}F_{AB} + P = 0$ → $F_{AB} = \frac{5}{3}P$ (c)

$P_{cr} = \frac{\pi^2 EI}{(KL)^2}$

pinned-pinned: $K = 1$

$L = \sqrt{(16 ft)^2 + (12 ft)^2}\left(\frac{12 in}{1 ft}\right) = 240 in$

A992 steel: $E = 29{,}000 ksi$

$I = \frac{\pi}{4}(r)^4 = \frac{\pi}{4}(2in)^4 = 4\pi \, in^4$

$P_{cr} = \frac{\pi^2 (29{,}000 \frac{kip}{in^2})(4\pi \, in^4)}{((1)(240 in))^2} = 62.44 \text{ kip}$

$\frac{5}{3}P = 62.44 \text{ kip}$

$\boxed{P = 37.5 \text{ kip}}$