4.7-13 The frame shown in Figure P4.7-13 is unbraced against sidesway. The columns are HSS $6 \times 6 \times 5/8$ (HSS$152.4 \times 152.4 \times 15.9$), and the beams are $W12 \times 22$ ($W310 \times 32.7$). ASTM A500 grade B steel ($F_y = 46$ ksi (315 MPa)) is used for the columns, and $F_y = 50$ ksi (345 MPa) for the beams. The beams are oriented so that bending is about the x-axis. Assume that $K_y = 1.0$.

a. Use the alignment chart to determine K_x for column *AB*. Use the stiffness reduction factor if applicable. For column *AB*, the service dead load is 17 kips (76 kN) and the service live load is 50 kips (220 kN).

SHOW ANSWER

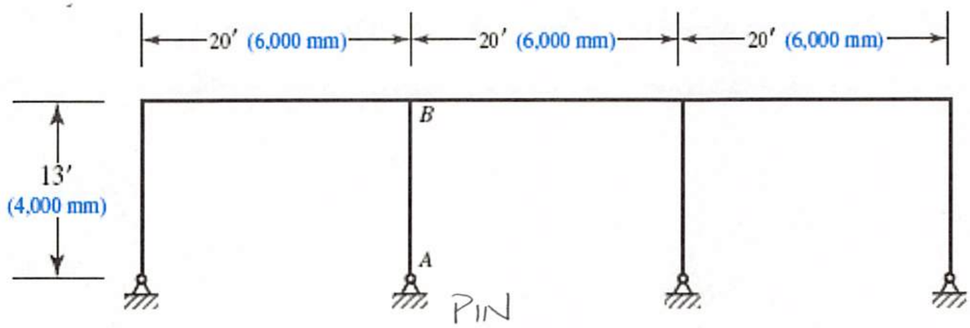
b. Compute the nominal compressive strength of column *AB*.

HSS 6x6x5/8

$A = 11.7\ IN^2$

$I_x = 55.2\ IN^4$

$r_x = 2.17\ in$



W12x22

$I_x = 156\ IN^4$

$I_y = 4.66\ IN^4$

COLUMN AB

$G_A = 10^*$

$$G_B = \frac{55.2/13'}{156 IN^4/20' + 156 IN^4/20'} = 0.27$$

FROM ALIGNMENT CHART TABLE C-A-7.2 $K_x \cong 1.7$

$$\frac{L_{cx}}{r_x} = \frac{1.7(13 ft)(12 in/ft)}{2.17 IN} = 122.21$$

$$4.71\sqrt{E/F_Y} = 4.71\sqrt{\frac{29{,}000 ksi}{46}} = 118.26$$

4.7-13

$$\frac{L_{cx}}{r_x} > 4.71\sqrt{E/F_y}$$ COLUMN IS ELASTIC USE E3-3

$$\frac{L_{cy}}{r} = \frac{K_y L}{r} = \frac{1.0(13\,ft)(12\,in/ft)}{2.17\,in} = 71.89$$

$$\frac{L_{cx}}{r_x} = 122.21$$ CONTROLS *

$$F_e = \frac{\pi^2 E}{(L_{cx}/r)^2} = \frac{\pi^2 (29{,}000\,ksi)}{(122.21)^2} = 19.16\,ksi$$

$$F_n = 0.877 F_e = 0.877(19.16\,ksi) = 16.81\,ksi$$

$$P_n = F_n A = 16.81\,ksi(11.7\,in^2) = \underline{\underline{196.64^k}}$$