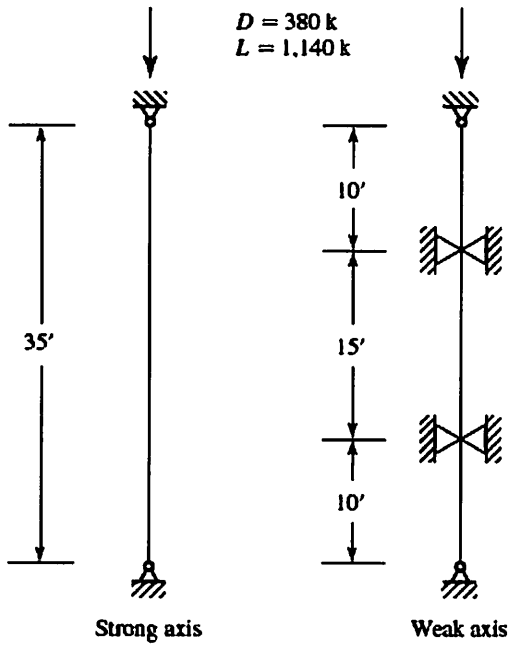
4.7-5 Use A992 steel ($F_y = 50$ Ksi) and select a W shape.

a. Use LRFD.

b. Use ASD.

$K_x = 1.0 \quad K_y = 1.0$

$L_{cx} = 35' \quad L_{cy} = 15'$



a) LRFD $P_u = 1.2D + 1.6L = 1.2(380^k) + 1.6(1,140)$

$= 2,280^k$

* ASSUME WEAK DIRECTION CONTROLS

FROM TABLE 4-1a $L_c = 15' \Rightarrow$ W14 x 211

$\phi_c P_n = 2420^k$

FROM TABLE 1-1 $\begin{cases} r_x = 6.55 \text{ IN} \\ r_y = 4.07 \text{ IN} \end{cases}$

CHECK STRONG AXIS $\dfrac{L_{cx}}{r_x/r_y} = \dfrac{35'}{6.55/4.07} = 21.75 > 15'$

4.7-5 | 2/2

FROM TABLE 4-1a WITH $L_c = 21.75\text{ft} \sim 22\text{ft}$ $\phi_c P_N < 2{,}280^k$

TRY W14 x 233 $\phi_c P_n = 2{,}280^k$

$r_x = 6.63\text{ in}$ $r_y = 4.10\text{ in}$

$$\frac{L_{cx}}{r_x/r_y} = \frac{35\text{Ft}}{6.63/4.1} = 21.64\text{ ft} > 15'$$

$\phi_c P_n \approx 2280^k$ O.K.

USE W14 x 233

b) ASD $P_u = D + L = 380^k + 1{,}140^k = 1{,}520^k$

ASSUME WEAK DIRECTION CONTROLS $L_c = 15'$

FROM TABLE 4-1a $\Rightarrow$ W14 x 211 $\Rightarrow r_x = 6.55\text{ in}$, $r_y = 4.07\text{ in}$

$$L_{cx} = \frac{35\text{ft}}{6.55/4.07} = 21.75\text{ ft}$$

FROM TABLE 4-1a WITH $L_c = 22.75$ W14 x 233

INTERPOLATE $1600 + (1510 - 1600)\frac{1.75}{2} = 1{,}521.25^k$

$$\frac{P_A}{\Omega_c} = 1521.25^k > P_n \quad \text{O.K.}$$

USE W14 x 233

4.7-5 Use A992 steel ($F_y = 50$ Ksi) and select a W shape.

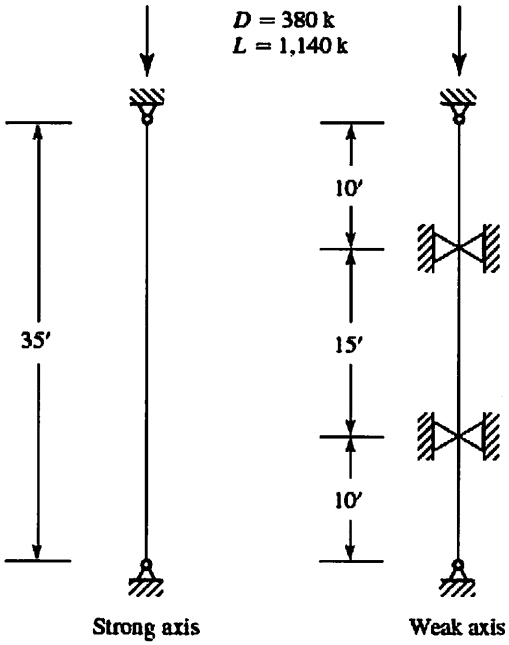
* ALTERNATE SOLUTION

a. Use LRFD.

b. Use ASD.

$K_x = 1.0 \qquad K_y = 1.0$

$L_{cx} = 35\text{ ft} \qquad L_{cy} = 15\text{ ft}$



$$r_x/r_y = \frac{L_{cx}}{L_{cy}} = \frac{35\text{ft}}{15\text{ft}} = 2.33$$

$$* \quad \frac{r_x}{r_y} > 2.33 \qquad L_c = 15\text{ ft}$$

$$\frac{r_x}{r_y} < 2.33 \qquad L_{cx} = \frac{35\text{ ft}}{r_x}$$

USING TABLE 6-1 WITH $L_c = 15$ ft

SECTION	r_x/r_y	ϕP_n(k)	
W44x230[c]	5.10	2,280	
W40x249[c]	4.59	2,680	
W36x231[c]	4.07	2,540	
W33x221[c]	3.93	2,450	
W30x211	3.49	2,310	← LIGHTEST SECTION
W27x217	3.32	2,320	
W24x229	3.11	2,370	
W21x223	3.04	2,320	
W18x234	2.85	2,310	

4.7-5 * ALTERNATE SOLUTION

$r_x/r_y < 2.33$ $\quad L_c = \dfrac{35\,ft}{r_x/r_y}$

W14X233 $\quad L_c = \dfrac{35\,ft}{1.62} = 21.6\,ft$ $\quad \phi P_n \approx 2{,}280$ $(L_c = 22\,ft)$

W12X252 $\quad L_c = \dfrac{35\,ft}{1.81} = 19.4\,ft$ $\quad \phi P_n \approx 2{,}290$ $(L_c = 20\,ft)$

* USE W30X211