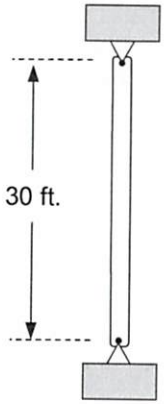
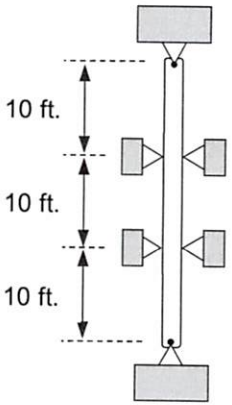
Classroom Problem 4.7-4: The column shown below is subjected to a service dead load of 100 *k* and a service live load of 300 *k*. Use **A992** steel (F_y = 50 *ksi*) and select a **W-shape**.



Support in strong direction



Support in weak direction

$P_u = 1.2D + 1.6L = 1.2(100^k) + 1.6(300^k) = 600^k$

* ASSUME WEAK DIRECTION CONTROLS $L_c = 10\,ft = kL$

1) FROM TABLE 4-1a (4-24) CHECK W8 SECTION

W8 x 58 $\quad \phi_c P_n = 606^k$

CHECK STRONG AXIS: $r_x = 3.65\,in \quad r_y = 2.10\,in$

$$\frac{L_{cx}}{r_x/r_y} = \frac{30\,ft}{3.65/2.10} = 17.26\,ft > 10\,ft \quad \therefore L_{cx} \text{ CONTROL}$$

2) FROM TABLE 4-1a WITH $L_c = 17.26\,ft \sim 18\,ft$

NO W8 SECTIONS

W10 x 77 $\quad L_c = 17\,ft \quad \phi P_n = 651^k$

$L_c = 18\,ft \quad \phi P_n = 617^k$ $\Big] > 600^k$ O.K.

3) LOOK FOR W12 SECTIONS WITH $L_c = 10$ ft W12x58 $\phi_n P_n = 647^k$

$r_x/r_y = 2.1$

CHECK STRONG AXIS $\dfrac{L_{cx}}{r_x/r_y} = \dfrac{30\text{ ft}}{2.1} = 14.29\text{ ft} > 10\text{ ft}$ $\therefore$ L_{cx} CONTROL

FROM TABLE 4-1a WITH $L_c = 14.29$ ft

W12x65

$L_c = 14$ ft $\phi P_n = 685^k$

$L_c = 15$ ft $\phi P_n = 663^k$

$> 600^k$ O.K.

4) LOOK FOR W14 SECTIONS WITH $L_c = 10$ ft W14x61 $\phi P_n = 676^k$

$r_x/r_y = 2.44$

CHECK STRONG AXIS $\dfrac{L_{cx}}{r_x/r_y} = \dfrac{30\text{ ft}}{2.44} = 12.29\text{ ft} > 10\text{ ft}$ $\therefore$ L_{cx} CONTROL

FROM TABLE 4-1a WITH $L_c = 13$ ft

W14x61

$L_c = 12$ ft $\phi P_n = 626^k$

$L_c = 13$ ft $\phi P_n = 599^k$

$> 600^k$ O.K.

USE W14x61