14. a) LRFD W14

$w_u = 1.2(1.2) + 1.6(1.2) = 3.36$ K/ft

$M_u = \frac{3.36(24)^2}{8} = 242$ ft-K

assume $y_2 = 5 - \frac{1}{2} = 4.5$ in ($a = 1.0$ in.)

Try W14×22 PNA #3 $\phi Q_n = 241$ K Table 3-19

$b_{eff} = 72$ in

$a = \frac{241}{0.85(4)(72)} = 0.984$ in. < 1.0 ∴ OK $\phi M_n = 248$ ft-K

$Q_n = 26.1$ K ∴ $\#_{studs} = \frac{241}{26.1} = 9.2$ ∴ 10 studs

USE W14×22 w 20 3/4 in. studs

b) ASD $w = 1.2 + 1.2 = 2.4$ K/ft

$M_a = \frac{2.4(24)^2}{8} = 173$ ft-K

for $y_2 = 4.5$ in

Try W14×22 PNA #2 $\Sigma Q_n = 283$ K $\frac{M_n}{\Omega} = 175$ ft-K

$a = \frac{283}{0.85(4)(72)} = 1.16$ in > 1.0

recalculate $y_2 = 5 - \frac{1.16}{2} = 4.42$

Try W14×22 PNA #1 $y_2 = 4.0$ $\Sigma Q_n = 325$ $\frac{M_n}{\Omega} = 176$ K

$a = \frac{325}{0.85(4)(72)} = 1.33$ and $y_2 = 5 - \frac{1.33}{2} = 4.34 > 4.0$ ∴ OK

$\#\ studs = \frac{325}{26.1} = 12.5$ ∴ 13

USE W14×22 w 26 3/4 in. studs