Steel Frames
Quiz 6
April 3, 2008

A W14 x 82 (A992 Gr50) is used as part of a braced building frame. The frame member is 36' long but is braced every 12' for buckling about the weak axis. The member supports a service axial dead load of 25 kips and a service live axial load of 35 kips. The service bending moment about the strong axis 45 ft-kip dead and 65 ft-kip live. Assume there is no translation of the ends of the column and that the braces do not laterally support the compression flange.

Is the section acceptable based on the AISC Code?

$P_u = 1.2(25) + 1.6(35) = 86^K$

$M_u = 1.2(45) + 1.6(65) = 158\ ft\text{-}K$

$(KL)_y = 12'$

$\frac{(KL)_x}{r_x/r_y} = \frac{36'}{2.44} = 14.75'$ TABLE 6-1 $p = .00134$

$1/p = \phi P_n = 746^K$

TABLE 4-1 $\phi P_n = 746^K$

$\frac{P_u}{\phi P_n} = \frac{86}{746} = 0.116$

$\therefore \frac{P_u}{2\phi P_n} + \frac{M_{ux} B_1}{\phi M_{nx}} < 1.0$ OR $\frac{1}{2} p P_r + \frac{9}{8} b_x M_{rx} < 1.0$

$C_m = .6 - .4\left(\frac{158}{158}\right) = 1.0$ $P_{e1} = \frac{\pi^2 (29000)(881 in^4)}{[36' (12''/ft)]^2} = 1351^K$

$B_1 = \frac{C_m}{1 - \alpha \frac{P_r}{P_{e1}}} = \frac{1}{1 - \frac{86}{1351}} = 1.07$

$\frac{1}{2}(.00134)(86) + \frac{9}{8}(.00304)(1.07)(158) = 0.64 < 1.0$

O.K.