ARCH 614. Assignment #9

Date: 3/27/12, *due 4/3/12* *Pass-fail work*

Problems: all but 9A from Ambrose & Tripeny, Chapter 10, pgs 353, 356, 362, 364, 366, & 237.
*Note: Problems marked with a * have been altered with respect to the problem stated in the text.*

(10%) ***Problem 10.3.A*****. USE US UNITS.** Determine the maximum factored axial compression load (P_u) for a W 10 x 49 column with an unbraced height of 15 ft [4.57 m] *of A36 steel*. Assume K = 1.0. *(LRFD column analysis)*

Partial answers to check with: 358 kips

(20%) ***Problem 10.3.B**** **. USE US UNITS.** Determine the maximum factored axial compression load (P_u) for a W 12 x 120 column with an unbraced height of 22 ft [6.71 m] *of A992 steel (F_y = 50 ksi)*, if both ends are fixed against rotation and horizontal movement. *Use the theoretical K value <u>as well</u> as the recommended design value when ideal conditions are approximated. (LRFD column analysis)*

Partial answers to check with: 1395 kips (theoretical) 1274 kips (design)

(15%) ***Problem 10.3.C*****. USE US UNITS.** Determine the maximum factored axial compression load (P_u) in Problem 10.3.A if the conditions are as shown in Figure 10.5 with L_1 = 15 ft [4.6 m] and L_2 = 8 ft [2.44 m]. *(LRFD column analysis)*

Partial answers to check with: 426 kips (text answer is wrong!)

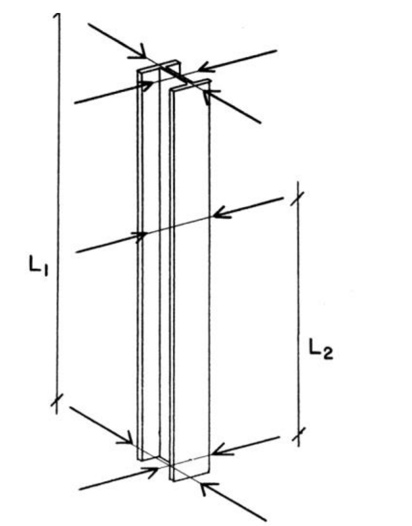

Figure 10.5 Biaxial bracing for steel columns.

(10%) ***Problem 10.4.C*****.* USE US UNITS.** Select a column section using the same data as in Problem 10.4.A (*using table 10.2 with A36 steel and A992 steel, F_y = 50 ksi with K=1.0)* except the dead load is 142 kips [6327 kN] and the live load of 213 kips [947 kN] . The unbraced height about the *x*-axes is 20 ft [6.1 m] and about the *y*-axis is ~~10 ft [3.05 m]~~ 20 ft. *(LRFD column design)*

Partial answers to check with: W 12 x79 (A36: ϕP_n = 512k A992: ϕP_n = 627k)

(10%) ***Problem 10.4.G***. Select the minimum size standard weight steel pipe column for an axial dead load of 20 kips, a live load of 30 kips, and the following unbraced height: 18 ft. *(LRFD column design)*

(10%) ***Problem 10.4.K*****. USE US UNITS.** Using Table 10.5, select the lightest tubing column to carry an axial dead load of 30 kips [133 kN] and a live load of 34 kips [151 kN] if the effective unbraced length is 10 ft [3.05 m]. *(LRFD column design)*

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(10%) ***Problem 10.5.B***. **USE US UNITS.** Check the *A36* section found in Problem 10.5.A *(W 12 x 45: P_u = 230 k, M_u = 15.9 k-ft, unbraced column height of 14 ft, ϕM_n = 204 k-ft)* to see if it complies with the AISC interaction formulas for axial compression and bending. *(LRFD column analysis)*

Partial answers to check with: interaction value = 0.92 < 1, OK

(15%) **9A)** Determine the capacity of this butt splice based on shear, bearing, and tension. The plates are made of A36 steel and the four bolts on each side of the splice are A325-SC with standard round holes. Assume standard hole spacing and slip is a serviceability limit-state. *(LRFD steel connection analysis)*

Partial answers to check with:

ϕR_n = {min of ϕR_v = 76.0 k, ϕR_b = 156.6 k, $\phi P_{t\text{-}gross}$ = 129.6 k, $\phi P_{t\text{-}net}$ = 135.9 k}