ARCH 631. Assignment #4

Date: 9/18/12, *due 10/4/12* *Worth 25 pts.*

Problems:

1. Complete text problem 9.2 on page 404. (*Note: The frame shown has pinned supports, and the answer for V_{max} should be 1636.4 lb.*)

9.2 Using an approximate method of analysis, analyze a single-bay frame of the type generally illustrated in Figure 9.3 that carries a horizontal load of 3000 lb acting at the upper left joint. Assume that $h = 12$ ft and $L = 22$ ft. Draw shear and moment diagrams. Indicate numerical values.

Answer: $M_{max} = 18{,}000$ ft-lb and V_{max} = ~~1500 lb.~~ 1636 lb.

2. Complete text problem 9.4 on page 404.

9.4 Draw a sketch that diagrammatically illustrates possible member-size variations (along the lines of the sketches in Figure 9.18) for the frame analyzed in Question 9.2.

***Partial** Answer*: If the moment is bigger, the section needs to be deeper.

3. For the frame of problem 1 (text problem 9.2), replace the pin supports with fixed support and use an approximate method of analysis to draw the shear and moment diagrams. Indicate numerical values. Describe how the change in support condition affects the shear values and moment distribution. (*Note: The portal frame method is used in the text in Figure 9.5 on page 383.)*

Answer: M_{max} = 9900 lb-ft and V_{max} = 1500 lb.

4. Complete text problem 9.7 on page 404. *Submit the model files (.mfd) on E-learning, and provide a print of the diagrams.* Use the following values:

9.7 A fully fixed single-bay frame has a span of **40 ft** and a height of **12.5 ft** and carries a uniform loading of **3.6 k/ft** on the horizontal beam. Using a computer-based structural analysis program available at your school, analyze the structure (**axial force, shears and moments**) for a situation where the moment of inertia of the beam is (a) equal to that of the columns, (b) **[approximately]** twice that of the columns, and (c) **[approximately]** three times that of the columns. Compare your results **[which means specifically state any noticeable differences]**. (~~Assume any I_c value for the columns that you wish or I_c = 1200 in^4~~ **Use the following sections**).

Section Properties (**American section library**):

sections	A (in^2)	I_x (in^4)	S_x top & bottom (in^3)
Columns: W 10 x 45	13.3	248	49.1
a) Beam: W 10 x 45	13.3	248	49.1
b) Beam: W 18 x 35	10.3	510	57.6
c) Beam: W 16 x 57	16.8	758	92.2

***Partial** answers*: $P_{(in\ column)}$ = 72.0 k; $V_{max\ (in\ beam)}$ = 72.0 k; $V_{max\ (in\ column)}$ = a) 49.5 k, b) 43.2 k, c) 38.7 k; $M_{(at\ beam\ ends)}$ = a) 414.5 k-ft, b) 361.9 k-ft, c) 323.9 k-ft; $M_{(at\ beam\ midspan)}$ = a) 305.5 k-ft, b) 358.1 k-ft, c) 396.1 k-ft; $M_{(at\ supports)}$ = a) 204.7 k-ft, b) 178.2 k-ft, c) 160.4 k-ft

5. With the results found from problem 4-case a), calculate the maximum stress at the ends of both columns from combined bending (M/S) and compression stresses (P/A) and compare to the stress results from the program.

***Partial** answers*: $f_{max\text{-}top}$ = 106.7 ksi, $f_{max\text{-}bottom}$ = 55.5 ksi