ARCH 631. Assignment #6

Date: 10/2/12, *due 10/18/12* *Worth 20 pts.*

Problems:

1. Determine the ultimate moment capacity, $\phi_f M_n$, of a beam with dimensions b = 14 in., $d_{effective}$ = 17.5 in., and h = 20 in., and that has three No. 10 bars (3.81 in.^{2}) of tension-reinforcing steel. F_y = 60 ksi, and f'_c = 4 ksi.

Answer: $\phi_f M_n$ = 258.9 k-ft

2. For the beam of Problem 1 which is simply supported and 32 ft long, and where the loads are dead load = 320 lb/ft (not including self weight) and live load = 185 lb/ft, determine if the beam is adequate in bending. γ = 150 lb/ft^3.

Answer: yes (M_u = 131.8 k-ft)

3. For the beam of Problem 1, check whether the amount of tension steel is within the limits for ductile beam behavior. (*Refer to the table for maximum ρ in Note Set 10.1)*

***Partial** Answer:* yes ($A_{s\text{-}max}$ = 4.43 in.^{2})

4. For the beam of Problem 1 and 2, calculate the shear capacity, $\phi_v V_c$, and determine if the beam will required stirrups.

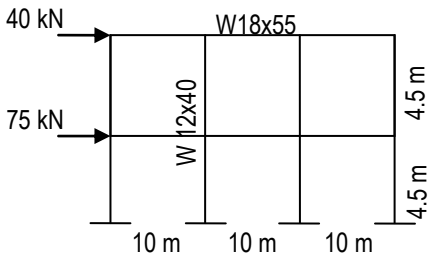
***Partial** Answer:* yes ($V_{max} > \dfrac{\phi_v V_c}{2}$ = 11.6 k)

5. A reinforced concrete column in a rigid frame has a design compression load of P_u = 170 kips, and a design moment of M_u = 34 k-ft. With the interaction diagram provided on the next page, determine the amount of reinforcement (number and size of bars) required for a 10 in. square column.

***Partial** Answer:* more than 4-#7.

6. A two story, three bay portal frame has lateral loads from wind at each story as shown. All columns are W12 x 40's while all beams are W 18 x 55's. Using a computer-based structural analysis program, determine the shear, bending moment and axial load in each member (V, M & P). Identify the column and beam with the critical design values. *Submit the model file (.mfd) on E-learning, and provide a print of the diagrams.*

Partial Answers: V_{max} (2nd windward column, 1st story) = 31.35 kN
V_{max} (1st windward beam, 1st story) = 11.10 kN
P_{max} (1st windward column, 1st story) = 14.89 kN
P_{max} (1st windward beam, 1st story) = 54.19 kN
M_{max} (2nd windward column, 1st story) = 75.76 kN-m
M_{max} (1st windward beam, 1st story) = 60.43 kN-m



7. Is the ultimate tensile capacity of 2-#6 grade 40 reinforcing bars greater than that of 1-#8 grade 60 bar?

***Partial** Answer*: 2-#6 T = 35.2 kips, 1-#8 T = 47.4 kips