

ARCH 614. Assignment #8

Date: 3/19/13, due 3/26/13

Pass-fail work

Problems: all but 8A from Ambrose & Tripeny, Chapter 9, pgs 303, 304, 306, 322, and 243.

*Note: Problems marked with a * have been altered with respect to the problem stated in the text.*

- (20%) **Problem 9.4.D. USE US UNITS.** A beam 30 ft [9 m] long has concentrated live loads of 9 kips [40 kN] each at the third points and also a total uniformly distributed dead load of 20 kips [89 kN] and a total uniformly distributed live load of 10 kips [44 kN]. Design the beam for *plastic flexure*. Use A36 steel and assume that least-weight members are desired. (LRFD beam design)

Partial answers to check with: $Z_x > 111 \text{ in}^3$ including self weight

- (15%) **Problem 9.4.I.* (typographic error) USE US UNITS.** A cantilever beam 12 ft [3.6 m] long has a uniformly distributed ~~dead~~ live load of 600 lb/ft [8.8 kN/m] and a uniformly distributed dead load of 1000 lb/ft. Design the beam for *plastic flexure*. Use A36 steel and assume that least-weight members are desired. (LRFD beam design)

- (15%) **Problem 9.5.A*. USE US UNITS.** A W shape steel is to be used for a uniformly loaded simple beam carrying a total dead load of 27 kips [120 kN] and a total live load of 50 kips [222 kN] on a 45-ft [13.7 m] span. Select the lightest weight shape for unbraced lengths of (1) 10 ft [3.05 m]; (2) 15 ft [4.57 m]; (3) 22.5 ft [6.90 m] with the *Beam Design Moment chart* provided for steel with $F_y = 50 \text{ ksi}$. Show inclusion of self weight in the design moment after selection for case (c). (LRFD beam design and charts)

Partial answers to check with: (1) W 24x76 (2) W 24x84 (3) W 21x101

- (10%) **Problem 9.6.C.** Compute the shear capacity ($\phi_v V_n$) for the following beam of A36 steel: W 10x33. (LRFD shear)

Partial answers to check with: 60.95k

- (10%) **Problem 9.7.B.** Find the maximum deflection in inches for the following simple beam of A36 steel with uniformly distributed load. Find the value using (1) the equation for deflection of a uniformly distributed load, and (2) the curves in Figure 9.11. (*beam diagrams and formulas, and charts*)
W 16 x 36, span = 20 ft, total service load = 2.5 kips/ft [6 m, 36.5 kN/m]

Partial answers to check with: (1) 0.693 in (2) 0.7 in

- (10%) **Problem 9.10.C. USE US UNITS.** Open web steel joists are to be used for a floor with a live load of 50 psf [2.39 kN/m²] and a dead load of 45 psf [2.15 kN/m²] (not including the joist weight on a span of 36 ft [11 m]. Joists are 2 ft [0.61 m] on center, and deflection is limited to 1/360 of the span under live load only and to 1/240 of the span under total load. Select (a) the lightest possible joist and (b) the shallowest depth possible joist. (LRFD design and charts)

Partial answers to check with: (a) 24K4 (b) 20K7 (text answer is wrong)

- (20%) **8A)** If the 36 ft joist of Problem 9.10.B is a 26K9 (having self weight) with 14 panels at 2.5 ft for the top chord, use the *method of sections* to determine the member forces in the top and bottom chord and the web for the section indicated in the figure using factored loads and self weight. (*load tracing*)

Partial answers to check with:

$P_{end} = 494.6 \text{ lb}$, $P_{panel} = 706.6 \text{ lb}$

top chord = 18.5 or 18.7 k (C)

web = 2.04 k (C)



