ARCH 614. Assignment #8

Date: 3/18/14, *due 3/25/14* *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: $Z_x > 111\ in^3$ 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 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)*

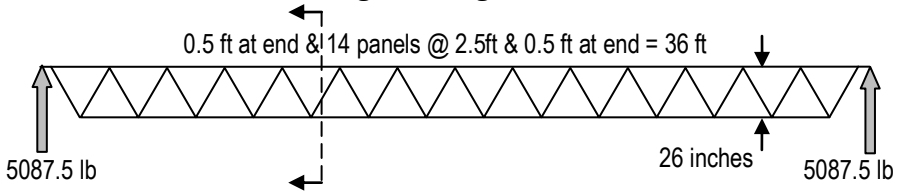
W 16 x 36, span = 20 ft, total service load = 2.5 kips/ft [6 m, 36.5 kN/m]

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/m^2] and a dead load of 45 psf [2.15 kN/m^2] (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 ^{lb}, P_{panel}=706.6 ^{lb}
top chord = 18.5 k (C)
web = 2.04 k (C)

MORE NEXT PAGE

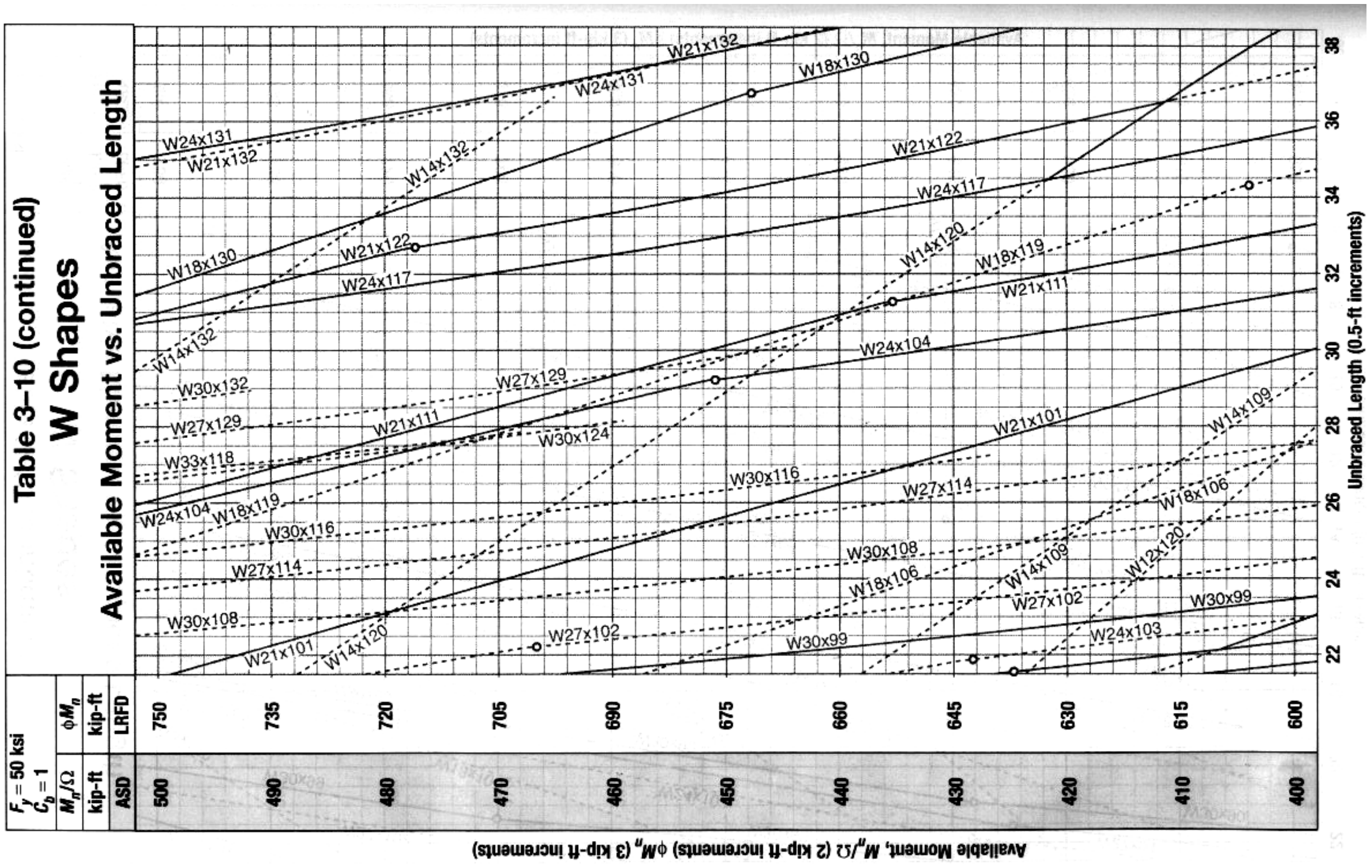
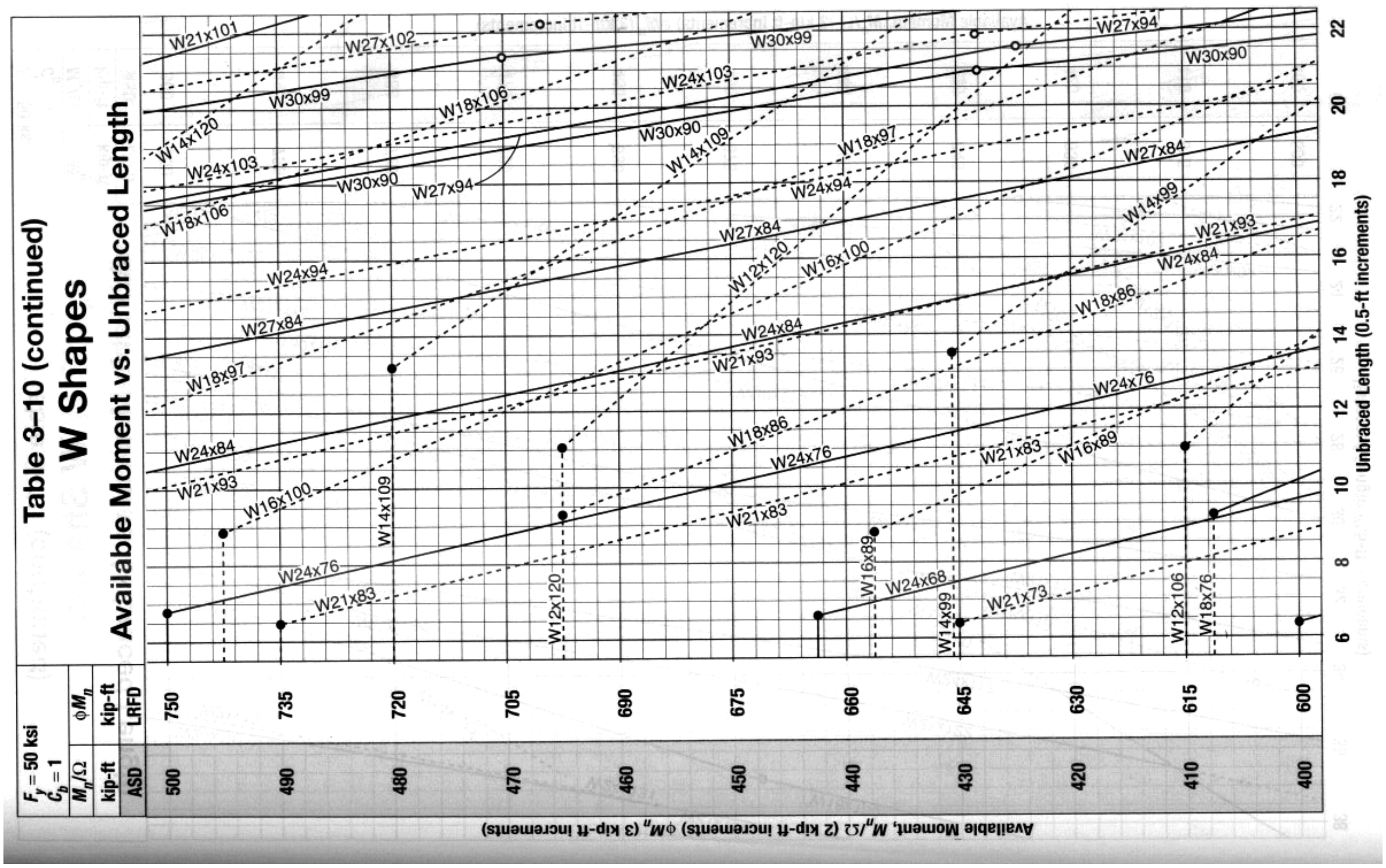


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length
F_y = 50 ksi
C_b = 1
M_n/Ω
ϕM_n
kip-ft
ASD
LRFD
Available Moment, M_n/Ω (2 kip-ft increments) ϕM_n (3 kip-ft increments)
Unbraced Length (0.5-ft increments)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