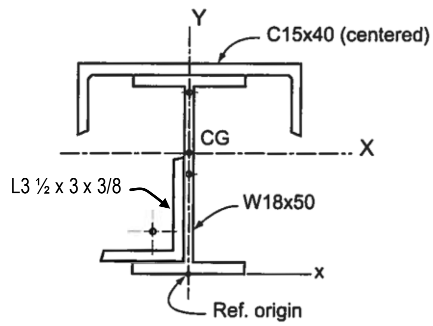
ARCH 331. Assignment #5

Date: 9/26/13, *due 10/3/13* *Pass-fail work*

Problems: from Onouye, Chapters 7 & 9
*Notes: Problems marked with a * have been altered with respect to the problem stated in the text. Multiframe or other methods may be used for V & M diagrams and maximums.*

(20%) ***7.3.4*** A heavily loaded floor system uses a composite steel section as shown. A C15 × 40 channel section is attached to the top flange of the W18x50 <u>and a 3 ½ x 3 x 3/8 angle is attached with the long leg up at the lower left as shown</u>. Determine the location of the centroid, and the I_x and I_y about the major centroidal axes using the cross-sectional properties given in the steel tables for standard rolled shapes (see Appendix). (*centroid and moment of inertia)*

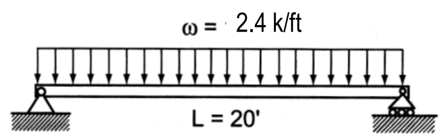
***Also calculate the radius of gyration, r_x and r_y.**



Problem 7.3.4

Partial answers to check with:
$\hat{x} = -0.0805$ *in*, $\hat{y} = 11.99$ *in* ***and must be calculated using the table,***
$I_x = 1578.8$ in.^{4}, $I_y = 393.1$ in.^{4}, $r_x = 7.40$ in, $r_y = 3.69$ in

*(10%)** **9.1.9** Select the lightest ~~14" nominal d~~steel *W* beam to carry the load shown. Assume **A992 steel (F_b = 33 ksi).** (*flexural and shear stress)*

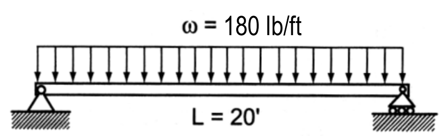


Problem 9.1.9

***The load is changed to 2.4 k/ft and the depth is not restricted. Also find the maximum shear stress, f_v. Assume A992 steel (F_Y = 50 ksi, F_b = 33 ksi).**

Partial answers to check with: $S_{req'd} \geq 43.64$ in.^{3}, $f_v = 5.5$ ksi

*(10%)** **9.1.9** Select the lightest ~~14" nomi~~ sawn timber beam to carry the load shown. ~~Assume A36 steel (F_b = 22 ksi)~~. (*flexural and shear stress)*



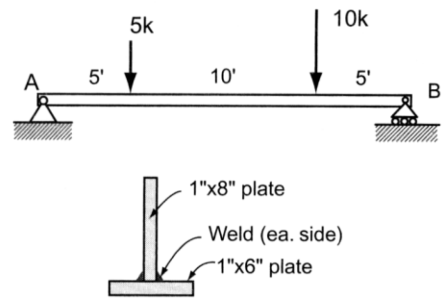
Problem 9.1.9

***The load is changed to 180 lb/ft. Assume Douglas fir-larch No. 2 (F_b = 1450 psi). Also find the maximum shear stress, f_v.**

Partial answers to check with: $S_{req'd} \geq 74.5$ in.^{3}, $f_v = 58.2$ psi

MORE NEXT PAGE

(30%) **9.1.11** Two steel plates (A572, F_y = 50 ksi) are welded together to form an inverted T-beam. Determine the maximum bending stress developed. Also determine the maximum shear stress at the neutral axis (N.A.) of the cross-section and at the intersection where the stem joins the flange. (*section properties, flexural and shear stress)*

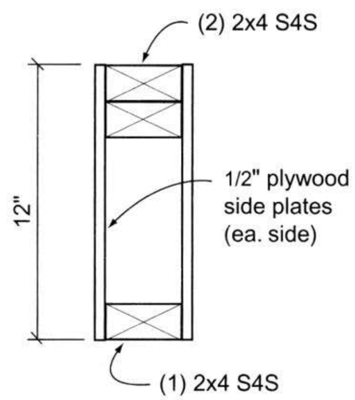


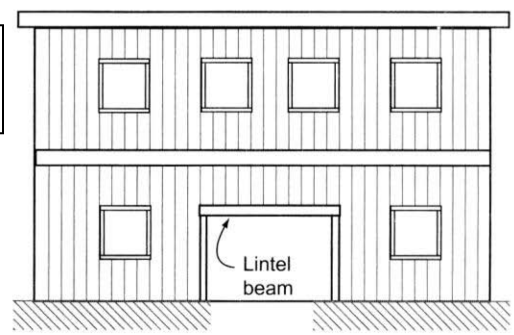
Problem 9.1.11

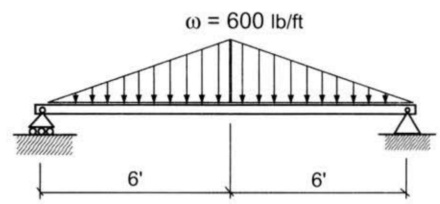
Partial answers to check with: $\hat{y}$ = 3.07 in from bottom,
I_x = 112.6 in.^{4}, f_b = 27.6 ksi,
$f_{v\text{-}max}$ = 1.37 ksi, (Q_{na} = 17.6 in^3),
$f_{v\text{-}joint}$ =1.20 ksi (Q = 15.44 in^3).

(30%) ***9.1.14** A lintel beam 12' long is used in carrying the imposed loads over a doorway opening. Assuming that a built-up box beam is used with a 12" overall depth as shown, determine the maximum bending stress and shear stress developed. (*section properties, flexural and shear stress)*

Use the negative area to find the section properties. Also determine the required pitch spacing for the bottom 2x4 with 1 nail each side (2) with a shear capacity of 300 lb.







Problem 9.1.14

Partial answers to check with: $\hat{y}$ = 6.71 in, I_x = 496.2 in.^{4}, f_b = 1168 psi, f_v = 195 psi (Q = 53.8 in^3), p =5.3 in. (Q = 31.3 in^3)
Note: The negative area method is quicker for finding I_x. There are beam diagram and formula equations for V and M in a text example in Chapter 8.