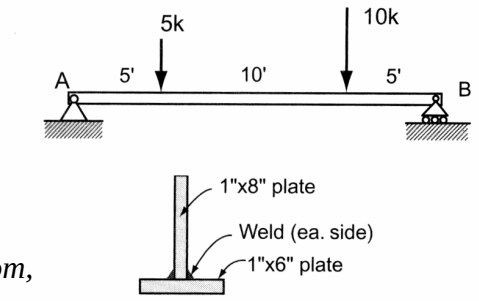
ENDS 231. Assignment #9

Date: 3/27/08, *due 4/3/08* *Pass-fail work*

Problems: from Onouye, Chapter 9.
*Note: Problems marked with a * have been altered with respect to the problem stated in the text. Multiframe4D may be used for V & M diagrams.*

(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. *(flexural and shear stress)*

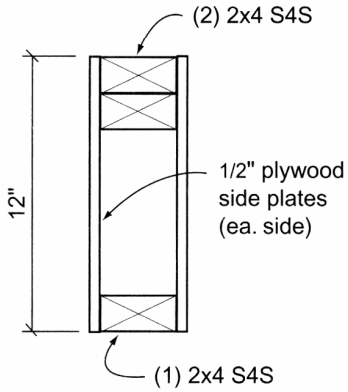


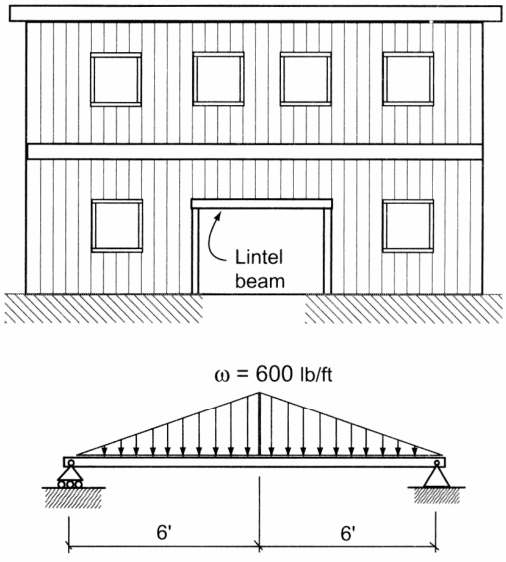
Problem 9.1.11

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. *(flexural and shear stress)*

*** 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.

MORE NEXT PAGE

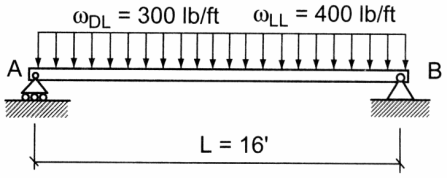
(40%) ***9.1.22** Design a Douglas fir–larch No. 1 beam to support the load shown. (*stress design and deflection)*

$F_b = 1300$ psi

$F_v = 85$ psi ***$\gamma \approx 32$ lb/ft^3 for Douglas fir**

$E = 1.6 \times 10^6$ psi

$\Delta_{allow(LL)} = L/360$



Problem 9.1.22

Partial answers to check with:

*$S_{x\text{-}req'd} = 207$ in.^{3}, $A_{req'd} = 99$ in^2. **With one possible selection**, the self weight is ≈ 25 lb/ft, new $S_{req'd} \approx 214$ in^3, $A_{req'd} \approx 103$ in^2. $\Delta_{(LL)} \approx 0.2$ in.*