

### ARCH 331. Assignment #3

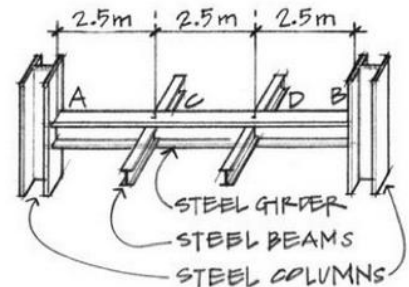
Date: 2/1/18, due 2/8/18

Pass-fail work

**Problems:** supplemental problems (3A, etc.) and from Onouye & Kane, Chapters 2, 3 & 5 (with required format)

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

Draw the appropriate FBD for each of the problems in this section. (equilibrium of rigid bodies)

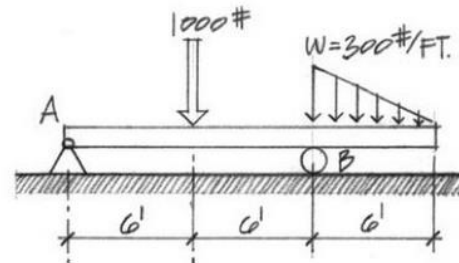


- (15%) 2.35 The girder shown is supported by columns at A and B. Two smaller beams push downward on the girder with a force of 40 kN at C, and two other beams push downward with a force of 50 kN at D. Find the reactions at A and B. (Assume end A to be a pin and end B to be a roller support)

Partial answers to check with:  $A_x = 0 \text{ kN}$ ,  $A_y = 43.3 \text{ kN}$ ,  $B = 46.7 \text{ kN}$

For Problems 3.8 through 3.10, solve for the support reactions at A and B. (Construct a FBD.)

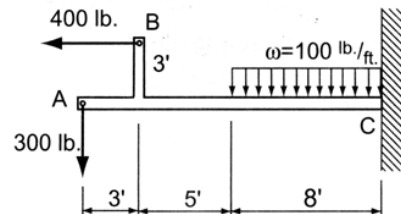
- (15%) 3.8 (equilibrium of rigid bodies)



Partial answers to check with:  $A_x = 0 \text{ lb}$ ,  $A_y = 350 \text{ lb}$ ,  $B = 1550 \text{ lb}$

Construct FBDs and solve for the support reactions in each problem. (equilibrium of rigid bodies)

- (15%) 3A) A cantilever beam has a 3-ft. upturn with a 400-lb. horizontal force applied. Determine the support reactions developed at C.

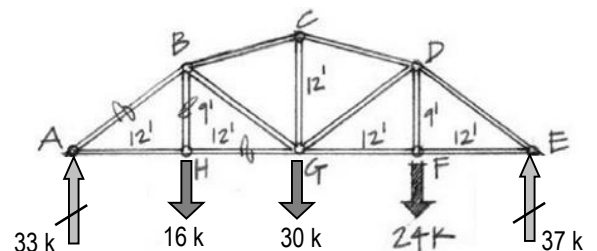


Problem 3A

Partial answers to check with:  $C_x = 400 \text{ lb}$ ,  $C_y = 1100 \text{ lb}$ ,  $M_{RC} = -9200 \text{ lb-ft}$

- (20%) \*3.21 Solve for AB, BH, and HG. Use only one section cut. (method of sections)

Partial answers to check with:  $CD = -51.54 \text{ k}$ ,  $GD = 0.83 \text{ k}$ ,  $GF = 49.33 \text{ k}$ .



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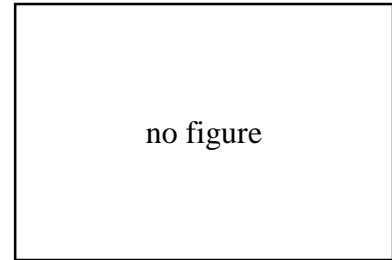
(15%) 5.3 A short steel column supports an axial compressive load of 120,000# and is welded to a steel base plate resting on a concrete footing.

- Select the lightest W8 (wide-flange) section to use if the unit stress is not to exceed 13,500 psi.
- Determine the size of the base plate (square) required if the allowable bearing on concrete is 450 psi.
- Calculate the required size of footing (square) if the allowable soil pressure is equal to 3,000 psf.

Neglect weights of column, base plate, and footing.

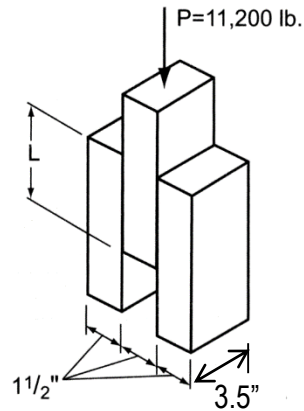
(stress)

Partial answers to check with: a)  $A \geq 8.9 \text{ in.}^2$ ,  
 b)  $A = 266.7 \text{ in.}^2$ , c)  $A = 40 \text{ ft}^2$



(5%) 3B) Three 2x4 S4S blocks are glued together as shown. Assuming the glue has a shear capacity of 80 psi, determine the minimum length  $L$  required. (stress)

Partial answers to check with:  $L = 20 \text{ in.}$

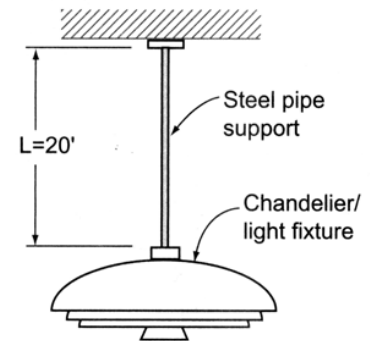


Problem 3B

(5%) 3C) A large chandelier weighing 1500 lb. is suspended from the roof of a theater lobby. The steel pipe from which it hangs is 20 feet long. Determine the diameter of a solid rod necessary to carry the chandelier safely. Use A36 steel. What is the resulting elongation of the pipe? Assume  $F_t = 22 \text{ ksi}$ .

(axial stress, strain and elasticity)

Partial answers to check with:  $d = 0.29 \text{ in.}$ ,  $\delta = 0.18 \text{ in.}$



Problem 3C

(10%) 5.17 An aluminum curtain wall panel 12 feet high is attached to large concrete columns (top and bottom) when the temperature is 65°F. No provision is made for differential thermal movement vertically. Because of insulation between them, the sun heats up the wall panel to 120°F but the column to only 80°F. Determine the consequent compressive stress in the curtain wall.

(strain, axial and thermal stresses)

Partial answers to check with:

$\delta_{restrained} = 0.0884 \text{ in.}$ ,  $f = 6,140 \text{ psi}$

