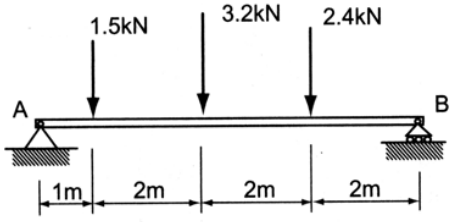
ARCH 331. Assignment #3

Date: 9/12/13, *due 9/19/13* *Pass-fail work*

Problems: from Onouye, Chapters 2, 3 & 6 (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%) **3.2.1** A 7-m span girder supports the reactions from three roof beams. Determine the support reactions at ***A*** and ***B***.

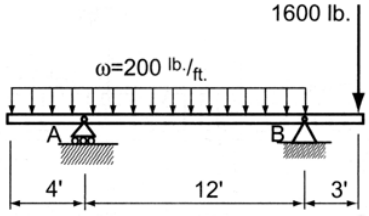


Problem 3.2.1

Partial answers to check with: A_x = 0 kN, A_y = 3.8 kN, B = 3.3 kN

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

(15%) **3.3.1** A double overhang beam is loaded as shown. Solve for the reactions at ***A*** and ***B***.

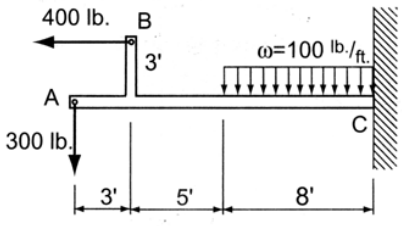


Problem 3.3.1

Partial answers to check with: A = 1733 lb, B_x = 0 lb, B_y = 3067 lb

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

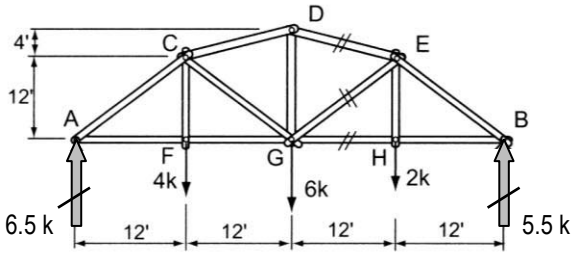
(15%) **3.3.3** A cantilever beam has a 3-ft. upturn with a 400-lb. horizontal force applied. Determine the support reactions developed at ***C***.



Problem 3.3.3

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

(20%) **4.1.15** A bowstring or crescent truss is loaded as shown. Determine the member forces in *DE*, *EG*, and *GH*. *(method of sections)*



Problem 4.1.15

Partial answers to check with: HG = 5.5 k, ED = -7.12 k, EG = 1.77 k.

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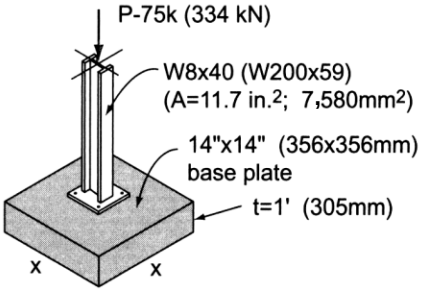
***Use metric units.**

(15%) **6.1.3** A steel column carries a building load of 75 k (334 kN) to a 14" × 14" (356 mm × 356 mm) base plate that is bolted to a concrete footing pad that measures 1 foot (305 mm) in thickness. The column has a cross-sectional area $A = 11.7$ in.^{2} ($A = 7580$ mm$^2 = 7.58 \times 10^{-3}$ m^2). Determine the following:

a. the average compressive stress developed in the W8 × 40 (W200 × 59) column
b. the bearing stress between the steel base plate and the concrete footing
c. the footing size, assuming that the allowable soil bearing pressure is $q = 4$ ksf (191 kPa) and the density of concrete is 150 pcf $\left(2400\,^{kg}/_{m^3} = 23.6\,^{kN}/_{m^3}\right)$

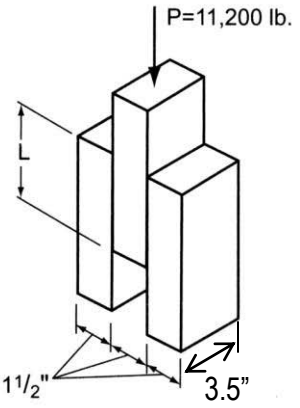
(stress)



Problem 6.1.3

Partial answers to check with: a) 44.1 MPa, b) 2.64 MPa, c) x = 1.35 m

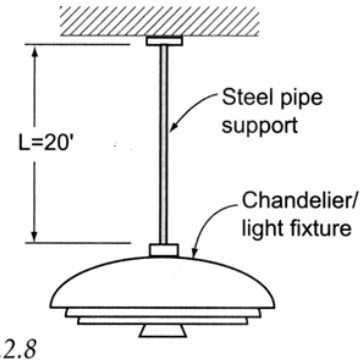
(5%) **6.1.7** Three 2×4 S4S blocks are glued together as shown. Assuming the glue has a shear capacity of 80 psi, determine the minimum length L required. *(stress)*



Problem 6.1.7

Partial answers to check with: L = 20 in.

(5%)* **6.2.8** 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?** ~~Use the section properties table in the Appendix to determine the appropriate pi~~ **Assume F_t = 22 ksi.** *(axial stress, strain and elasticity)*

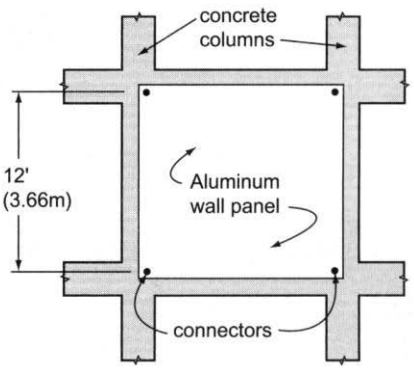


Problem 6.2.8

Partial answers to check with: d = 0.29 in., δ =0.18 in.

***Use US customary units.**

(10%) **6.4.8** An aluminum curtain wall panel 12' (3.66 m) high is attached to large concrete columns (top and bottom) when the temperature is 65°F (18.3°C). No provision is made for differential thermal movement vertically. Because of insulation between them, the sun heats up the wall panel to 120°F (48.9°C) but the column only to 80°F (26.7°C). Determine the consequent compressive stress in the curtain wall. *(strain, axial and thermal stresses)*



Problem 6.4.8

Partial answers to check with:
$\delta_{restrained}$ = 0.0895 in, f = 6,215 psi