

ARCH 614. Assignment #4

Date: 2/11/14, due 2/18/14

Pass-fail work

Problems: from Ambrose & Tripeny, Appendix A & Chapter 3, pgs 654, 662, and 123.

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

(25%) **Problem A.1.D.* USE METRIC UNITS.** Find the location of the centroid for the cross-sectional area shown in Figure A.3d. Use the reference axes indicated and compute the distances from the axes to the centroid, designated as c_x and c_y , as shown in Figure A.3b. Also compute the moment of inertia about the centroid axes. (cross section properties)

Partial answers to check with: $\hat{x} = 32.2 \text{ mm}$, $\hat{y} = 85.2 \text{ mm}$,
 $I_x = 24.7 \times 10^6 \text{ mm}^4$, $I_y = 4.3 \times 10^6 \text{ mm}^4$.

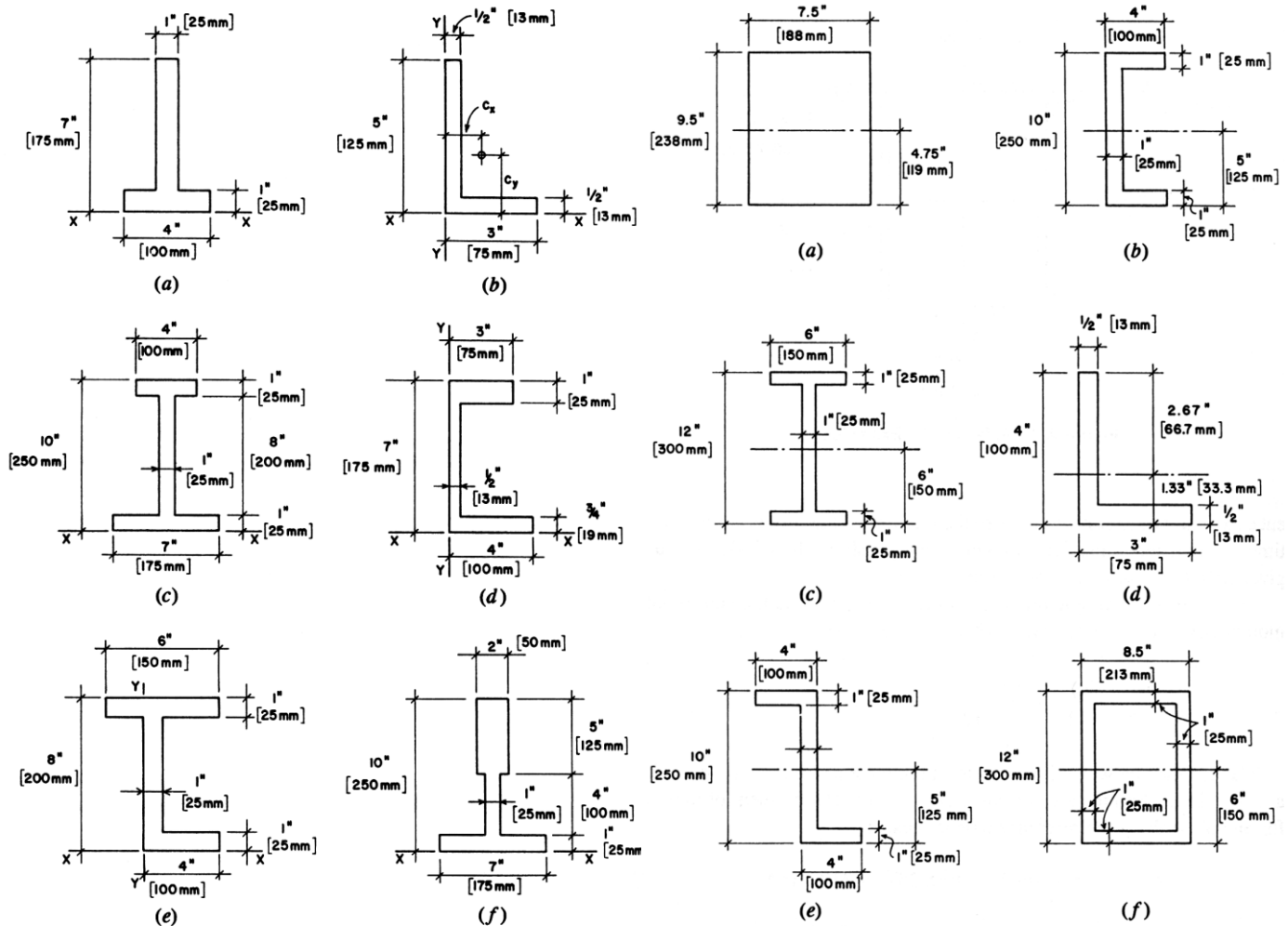


Figure A.3 Reference for Problem A.1.

Figure A.9 Reference for Problem A.3, part 1

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(10%) **Problem A.3.G***. **USE US UNITS.** Compute the moments of inertia with respect to the centroidal X-X axes for the built-up sections in Figure A.10g. Make use of any appropriate data from the tables of properties for steel shapes. *Note: the plate at the bottom is the same as the top, and the W section is not in table A.3. Use a W 10 x 33.* (cross section properties)

Partial answers to check with: $I_x = 431.8 \text{ in}^4$.

Note: The centroid location is obvious

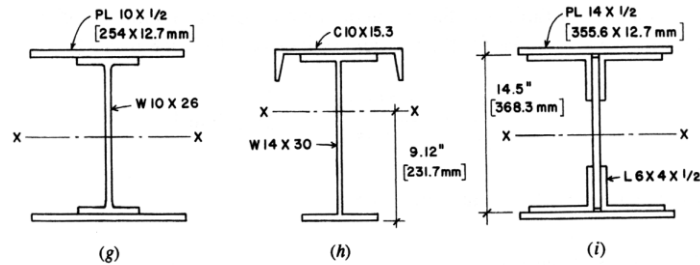


Figure A.10 Reference for Problem A.3, G-I.

(25%) **Problem 3.7.A***. **USE US UNITS.** A beam has an I-shaped cross section with an overall depth of 16 in. [400 mm], a web thickness of 2 in. [50 mm], and flanges that are 8 in. wide [200 mm] and 3 in. [75 mm] thick. Compute the critical *bending and shear stresses* and ~~plot the distribution of shear stress on the cross section~~ if the beam sustains a bending moment of 175 k-ft [237.3 kN-m] and a shear force of 20 kips [89 kN]. (*bending and shear stresses*)

Partial answers to check with: $f_b = 7.53 \text{ ksi}$, $I_x = 2230.7 \text{ in}^4$, $Q_{max} = 181 \text{ in}^3$.

Note: The centroid location is obvious, and the negative area method is quicker for finding I_x .

(40%) **Problem 3.7.B***. **USE METRIC UNITS.** A T-shaped beam cross section has an overall depth of 18 in. [450 mm], a web thickness of 4 in. [100 mm], a flange width of 8 in. [200 mm] and a flange thickness of 3 in. [75 mm]. Compute the critical *bending and shear stresses* and ~~plot the distribution of shear stress on the cross section~~ if the beam sustains a bending moment of 300 k-ft [406.8 kN-m] and a shear force of 12 kips [53.4 kN]. And if there is one connector for the T joint to the stem with a capacity of 6.5 kN, determine the maximum required pitch spacing. (*bending and shear stresses, and shear connectors*)

Partial answers to check with: $\hat{y} = 251.8 \text{ mm}$, $I_x = 988.0 \times 10^6 \text{ mm}^4$, $f_b = 103.6 \text{ MPa}$
 $f_v = 1.7 \text{ MPa}$, $p = 49.9 \text{ mm}$.