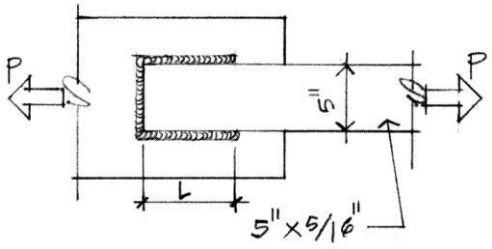
ARCH 614. Assignment #10

Date: 4/1/14, *due 4/8/14* *Pass-fail work*

Problems: all but 10A, B, & C from Ambrose & Tripeny, Chapters 12 & 13, pgs 405, 428 & 429.
*Note: Problems marked with a * have been altered with respect to the problem stated in the text.*

(15%) **10A)** Determine the capacity of the welded connection shown. The weld size is 3/16 in.. Assume the base metal is A36 steel and electrodes are E70XX in each problem. Use L = 4.5". *(LRFD connection analysis)*



Partial answers to check with:
$\phi P_{n\text{-}v}$ = 58.5 k, $\phi P_{n\text{-}t}$ = 50.625 k

(10%) ***Problem 12.2.D***. Using data from Table 12.1, select the lightest steel deck for the Two-span condition, span of 6 ft, total load of 50 psf. *(decking design charts)*

Partial answers to check with: WR22

(15%) **10B)** For the singly reinforced concrete beam sections described below, determine
i) depth of the compressive stress block
ii) acceptability of reinforcement ratio to minimum and maximums
iii) design moment capacity. *(reinforced concrete beam analysis)*

1) f_y = 60 ksi	f'_c = 6000 psi	A_s = 7.07 in^2	b = 16 in	d = 30 in
2) f_y = 60 ksi	f'_c = 5000 psi	A_s = 3.01 in^2	b = 12 in	d = 20 in

Partial answers to check with: 1.i) a = 5.20 in, ii) 0.0039 > ρ = 0.0147 < 0.027,
iii) ϕM_n = 872 k-ft; 2.) a = 3.54 in, ii) 0.0035 > ρ = 0.0125 < 0.024, iii) ϕM_n = 247 k-ft

(15%) ***Problem 13.3.C***. **USE US UNITS.** Find the area of steel reinforcement required and select the bars for the beam in Problem 13.3.A if the section dimensions are b = 16 in [406 mm], and d = 32 in. [813 mm]. *(Problem 13.3.A is listed NEXT.)* *(reinforced concrete beam design)*

Partial answers to check with: 6- #6 (least area)

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(30%) ***Problem 13.3.A****. **USE US UNITS.** A rectangular concrete beam has f'_c = 3000 psi [20.7 MPa] and steel with f_y = 40 ksi [276 MPa]. Select the beam dimensions and reinforcement for a ~~balanced section~~ *maximum reinforcement ratio* if the beam sustains a moment as a result of dead load of 60 k-ft [81.4 kN-m] and a moment as a result of live load of 90 k-ft [122 kN-m]. *The depth of the beam should be approximately twice the width and in whole inches. Use $h \approx 1.1d$ ($b=0.55d$) to get started. Place steel that fit in a single layers of bars. Do not exceed ρ based on a tensile strain of 0.005. If the area is too big for the number of bars to fit, make the beam deeper and wider, but check R_n for a revised reinforcement ratio. (reinforced concrete beam design)*

Partial answers to check with: $R_n \approx 760$ psi of chart (or $\rho_{max} = 0.023$, $d_{needed} \approx 19$ in., $b > 10.5$ in., $h > 21.375$ in., bars won't fit in 11 in., possible number of bars is 3 or 4.

(20%) **10C)** A 24 ft long, simply supported beam carries only a uniform live load, w_L, The beam has the following cross-sectional properties: b = 14", d = 26 in, h = 30", f_y = 60 ksi, f'_c = 3000 psi, A_s = 5 - #8 bars. Determine the maximum distributed <u>service</u> live load the beam can carry. Include the weight of the beam. *(reinforced concrete beam analysis and load factors)*

Partial answers to check with: $w_L \leq 3170$ lb/ft