ARCH 614. Assignment #11

Date: 4/9/13, *due 4/16/13*   *Pass-fail work*

Problems: from Ambrose & Tripeny, Chapters 13, pgs 439, 452, and 467.
*Note: Problems marked with a * have been altered with respect to the problem stated in the text.*

(25%) ***Problem 13.4.B***. **USE US UNITS.** Find the area of steel reinforcement required for a concrete T-beam for the following data: f'_c = 4 ksi [28 MPa], f_y = 60 ksi [414 MPa], d = 32 in. [813 mm], t = 5 in. [127 mm], b_w = 18 in. [457 mm], b_f = 54 in. [1372 mm], and the section sustains a factored bending moment of M_u = 500 k-ft [678 kN-m]. *Note: the effective width does not need to be determined because the flange width is provided. (reinforced concrete beam design)*

  Partial answers to check with: a > 1.1 in., A_s > 3.5 in^2, 8#6's don't work, $A_{s\text{-}min}$ = 1.92 in^2

(25%) ***Problem 13.5.A***. **USE US UNITS.** A one-way solid concrete slab is to be used for a simple span of 16 ft [4.88 m]. In addition to its own weight, the slab carries a superimposed dead load of 40 psf [1.92 kPa] and a live load of 100 psf [4.79 kPa]. Using the strength method with f'_c = 3 ksi [20.7 MPa], and f_y = 40 ksi [276 MPa], design the slab for minimum overall thickness. *(reinforced concrete slab design)*

  Partial answers to check with: t ≈ 8 in, R_n ≈ 256 psi (ρ ≈ 0.007) 5#7's don't work, $A_{temp\text{-}min}$ = 0.192 in^2

(35%) ***Problem 13.6.A***. **USE US UNITS.** A concrete beam similar to that shown in Figure 13.18 *(simply supported)* sustains a uniform live load of 1.5 kips/ft and a uniform dead load of 1 kips/ft on a span of 24 ft [7.32 m]. Determine the layout for a set of No. 3 U-stirrups using the ~~stress~~ *strength* method with f_y = 40 ksi [276 MPa] and f'_c = 3 ksi [20.7 MPa]. The beam section dimensions are b = 12 in. [305 mm] and d = 26 in. [660 mm]. *(reinforced concrete beam shear analysis and design)*

(15%) ***Problem 13.6.C***.* **USE US UNITS.** Determine the layout for a set of No. 3 U-stirrups for a beam with the same data as Problem 13.6.A, except the uniform live load is 0.75 kips/ft and the uniform dead load is 0.5 kips/ft. *(reinforced concrete beam shear analysis and design)*

  Partial answers to check with: $V_{u\text{-}max}$ < ϕV_c so maximum spacing governs with 6 stirrups