

ARCH 614. Assignment #11

Date: 4/8/14, due 4/15/14

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., $A_s > 3.5$ in², 8#6's don't work, $A_{s-min} = 1.92$ in²

(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: $t \approx 8$ in, $R_n \approx 256$ psi ($\rho \approx 0.007$) 5#7's don't work, $A_{temp-min} = 0.192$ in²

(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: $V_{u-max} < \phi V_c$ so maximum spacing governs with 6 stirrups