ARCH 331. Assignment #12

Date: 11/17/16, due 11/29/16

Pass-fail work

Problems: as stated (none from Onouye & Kane)

(22%) 12A) Find the area of steel reinforcement required for a concrete T-beam for the following data: $f'_c = 3$ ksi, $f_y = 60$ ksi, $d = 18$ in., $t = 4.5$ in., $b_w = 10$ in., $b_f = 36$ in., 3/4" aggregate, and the section sustains a total factored bending moment 82 k-ft. Note: the effective width does not need to be determined because the flange width is provided. (reinforced concrete T-beam design)

Partial answers to check with: $a > 0.7$ in, $A_{s-min} = 0.6$ in.$^2$

(22%) 12B) A one-way solid concrete slab is to be used for a simple span of 16 ft. In addition to its own weight, the slab carries a superimposed dead load of 55 lb/ft$^2$ and a live load of 120 lb/ft$^2$. Using $f'_c = 4$ ksi, and $f_y = 60$ ksi, design the slab for minimum overall thickness. (reinforced concrete slab design)

Partial answers to check with: $t \approx 10$ in, $R_n = 179$ psi, so $p_{min}$ governs, $A_z \geq 0.35$ in.$^2$/ft, $A_{temp-min} \approx 0.22$ in.$^2$/ft (transverse direction)

(11%) 12C) At a certain location along the span, a reinforced concrete beam section with $d = 14$ in. and $b = 10$ in. is subject to a design shear of $V_u = 50$ k. Using No. 4 U stirrups, compute the required stirrup spacing at the given location. Assume $f'_c = 3$ ksi, and $f_y = 40$ ksi; $\lambda = 1$. (reinforced concrete beam shear design)

Partial answers to check with: $s_{req'd} = 4.4$ in., $s_{max} = 3.5$ in.

(30%) 12D) A concrete beam that is simply supported sustains a uniform live load of 1.8 kips/ft and a uniform dead load (not including self weight) of 1 kips/ft on a span of 24 ft. Determine the layout for a set of No. 3 U-stirrups with $f_y = 60$ ksi and $f'_c = 3.5$ ksi; $\lambda = 1$. The beam section dimensions are $b = 12$ in., $d = 26$ in., and $h = 28$ in. (reinforced concrete beam shear analysis and design)

Partial answers to check with: $V_{u@d} = 44.25$ k; $V_s$ needed: $s_{req'd} = 15.5$ in., $s_{max} = 13$ in.; $s_{req'd} = 22$ in., $s_{max} = 13$ in., stirrups end after 107.2 in.

(15%) 12E) Determine the layout for a set of No. 3 U-stirrups for a beam with the same data as Problem 12D, except the uniform live load is 0.75 kips/ft and the uniform dead load (not including self weight) 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