ARCH 331. Assignment #12

Date: 11/14/13, *due 11/21/13*   *Pass-fail work*

Problems: as stated (none from Onouye)

(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 <u>factored</u> 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, $A_{s\text{-}min}$ = 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 ≈ 10 in., R_n = 179 psi, so ρ_{min} governs,
$A_s \geq 0.35$ in.^{2}/ft, $A_{temp\text{-}min} \approx 0.22$ in.^{2}/ft (transverse direction)

(11%) 12C)   At a certain location along the span, a reinforce 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.

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