ARCH 331. Assignment #12

Date: 4/14/16, due 4/21/16
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: \( f'_c = 3 \text{ ksi}, f_y = 60 \text{ ksi}, d = 18 \text{ in.}, t = 4.5 \text{ in.}, b_w = 10 \text{ in.}, b_f = 36 \text{ in.}, 3/4'' \text{ aggregate} \), and the section sustains a total factored bending moment \( 82 \text{ k-ft} \). 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: \( a > 0.7 \text{ in.}, A_{s-min} = 0.6 \text{ in.}^2 \)

(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 \( f'_c = 4 \text{ ksi}, \) and \( f_y = 60 \text{ ksi} \), design the slab for minimum overall thickness.
(reinforced concrete slab design)

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

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

Partial answers to check with: \( s_{req'd} = 4.4 \text{ in.}, s_{max} = 3.5 \text{ in.} \)

(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 \( f_y = 60 \text{ ksi} \) and \( f'_c = 3.5 \text{ ksi} \); \( \lambda = 1 \). The beam section dimensions are \( b = 12 \text{ in.}, d = 26 \text{ in.}, \) and \( h = 28 \text{ in.} \).
(reinforced concrete beam shear analysis and design)

Partial answers to check with: \( V_{u@d} = 44.25 \text{ k}; V_s \text{ needed: } s_{req'd} = 15.5 \text{ in.}, s_{max} = 13 \text{ in.}; s_{req'd} = 22 \text{ in.}, s_{max} = 13 \text{ in.}, \) 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