ARCH 331. Assignment #13

Date: 4/23/15, due 4/30/15

Pass-fail work

Problems: (none from Onouye)

(37%) 13A) A solid one-way slab is to be used for a framing system of a one-way slab supported on
beams on girders. Column spacing is 33 ft, with regularly spaced beams occurring at 11 ft
center to center. (Assume the beams are 1 ft wide.) Superimposed dead load on the structures
is 50 psf, and live load is 75 psf. Use $f'_c = 4$ ksi and $f_y = 60$ ksi. Determine the thickness for
the slab and select the size and spacing for the bars in both directions for flexure requirements.
Assuming there is proper bar spacing and cover, determine the minimum development lengths
of the flexural reinforcement chosen.

(frame analysis by coefficients, reinforced concrete slab design, development length)

Partial answers to check with: $V_{u\text{-max}} = 1.5$ k, $\phi V_c = 4.6$ k, $M_{u+\text{end}} = 1.8$ k-ft, $M_{u+\text{mid}} = 1.6$ k-ft,
$M_{u-} = 2.1$ k-ft, $A_{\text{temp-min}} \approx 0.11$ in$^2$, $L_d = 14.25$ (#3 for ex.)

(7%) 13B) Size hollow core planks for the system and loads of problem 13A) when there are only
beams at the columns (33 ft on center). Assume that the inverted T-beams the simply
supported planks will be supported by are 1 ft wide in the stem. Choose the shallowest plank
with the least reinforcement that will span the 32 feet while supporting the loads. Assume 2 in.
of normal weight topping.

(floor span system design)

Partial answers to check with: estimated long term camber of 0.3 in.

(14%) 13C) Select the minimum size square tied column and its reinforcement when the column has a
dead load of 200 k, live load of 150 k, dead load bending moment of 100 k-ft, and live load
bending moment of 100 k-ft. Also determine the axial capacity of the chosen column and
reinforcement if ties are used. Assume $f' c = 5$ ksi and $f_y = 60$ ksi.

(reinforced concrete column design aids)

Partial answers to check with: $e = 7$ in, $\phi P_n = 1078$ kips

(12%) 13D) Select the minimum size round tied column and its reinforcement for the same load and
bending moments of problem 13C). Also determine the axial capacity of the column and
reinforcement chosen if spiral reinforcement is used. Assume $f' c = 5$ ksi and $f_y = 60$ ksi.

(reinforced concrete column design aids)

Partial answers to check with: $\phi P_n = 1295$ kips

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For a 24 in. thick 9.5 ft. square reinforced concrete footing carrying 372 kips dead load and 117 kips live load on a 22 in. square column, determine if the footing thickness is adequate for 3000 psi. A 3 in. cover is required with concrete in contact with soil. Also determine the moment for reinforced concrete design.

Partial answers to check with: one way: \( V_u = 15.2 \) k/1 ft width and OK; two way: \( V_u = 547.6 \) k and OK, \( M_u = 51.6 \) k-ft/1 ft width

### 3.6 Hollow-Core Load Tables (cont.)

**Strand Pattern Designation**

- **48-S**
  - \( S = \) straight
  - Diameter of strand in 16ths
  - Number of strand (4)
  - Safe loads shown include dead load of 10 lb/ft² for untopped members and 15 lb/ft² for topped members.
  - Remainder is live load. Long-time cambers include superimposed dead load but do not include live load.

**Section Properties**

- **A** = 259 in.²
- \( l = 3223 \) in.³
- \( y_v = 5.00 \) in.
- \( y_t = 5.00 \) in.
- \( S_v = 645 \) in.³
- \( S_t = 645 \) in.³
- \( w_{t} = 270 \) lb/ft
- \( DL = 68 \) lb/ft²
- \( V/S = 2.23 \) in.

**Key**

- 210= Safe superimposed service load, lb/ft²
- 0.3 = Estimated camber at erection, in.
- 0.4 = Estimated long-time camber, in.

**Table of safe superimposed service load, lb/ft², and cambers, in.**

| Strand designation code | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
|-------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 48-S                    | 255| 238| 223| 209| 197| 181| 163| 146| 131| 117| 107| 96  | 96  | 96  | 96  | 96  | 96  | 94  | 94  | 92  | 90  | 89  | 89  | 88  | 88  | 87  | 87  | 86  | 86  | 86  | 86  | 86  | 85  | 85  | 84  |
| 58-S                    | 317| 298| 282| 267| 252| 237| 221| 198| 180| 163| 148| 134| 120| 105| 102| 100| 98  | 98  | 96  | 94  | 94  | 92  | 91  | 91  | 90  | 89  | 89  | 88  | 88  | 87  | 87  | 86  | 86  | 86  | 85  | 85  | 84  |
| 68-S                    | 329| 307| 291| 273| 256| 240| 221| 202| 188| 171| 153| 137| 122| 106| 96  | 84  | 74  | 64  | 56  | 46  | 38  | 31  | 26  | 20  | 16  | 13  | 11  | 9   | 7   | 6   | 5   | 4   | 3   | 2   |
| 78-S                    | 330| 313| 297| 279| 267| 252| 240| 229| 218| 205| 192| 180| 165| 150| 136| 122| 108| 97  | 86  | 76  | 67  | 58  | 50  | 42  | 35  | 28  | 22  | 18  | 15  | 12  | 10  | 8   | 6   | 5   | 4   | 3   | 2   |
| 88-S                    | 344| 322| 306| 289| 273| 256| 246| 234| 221| 209| 196| 183| 170| 157| 144| 130| 118| 107| 96  | 87  | 77  | 69  | 60  | 52  | 44  | 37  | 30  | 24  | 20  | 17  | 14  | 12  | 10  | 8   | 6   | 5   | 4   | 3   |

**Strength is based on strain compatibility; bottom tension is limited to \( 7.5 \sqrt{c} \); see pages 3-8 through 3-11 for explanation.**

See Item 3, note 4, Section 3.3.2 for explanation of vertical line.