ARCH 614. Assignment #12

Date: 4/21/15, due 4/28/15

Problems: from Ambrose & Tripeny, Chapters 14 & 15, pgs 487, and 514.

Note: Problems marked with a * have been altered with respect to the problem stated in the text.

(50%) Problem 14.1.B*. USE US UNITS. A solid one-way slab is to be used for a framing system similar to that shown in Figure 14.1 (slab on girder supported beams). Column spacing is 33 ft [10m], with regularly spaced beams occurring at 11 ft [3.33 m] center to center.

Superimposed dead load on the structure is 50 psf [2.39 kPa], and live load is 75 psf [3.59 kPa]. Use \( f'_c = 4 \text{ ksi} \) [28 MPa] and \( f_y = 60 \text{ ksi} \) [414 MPa]. Determine the thickness for the slab and select the size and spacing for the bars. Also, determine the minimum development lengths of the flexural reinforcement chosen using Table 13.9 on page 469.

Partial answers to check with: \( t \approx 5 \text{ in} \) & \( \phi V_{c, \text{enough}} = 2.12 \text{ k-ft} \), \( M_{u+\text{end}} = 1.82 \text{ k-ft} \), \( M_{u+\text{mid}} = 1.59 \text{ k-ft} \), \( M_{u} = 2.12 \text{ k-ft} \), \( A_{s} \geq 0.12 \text{ in}^2 \), \( A_{\text{temp}-\text{min}} \approx 0.11 \text{ in}^2 \), \( L_d = 15 \) or 19 in (#3 or #4)

(20%) Problem 15.3.C*. Using Figures 15.7 - 15.10, select the minimum size square tied column and its reinforcement for the following data. In addition, determine the axial capacity of the column and reinforcement chosen if ties are used (\( f'_{c} = 5 \text{ ksi} \) and \( f_{y} = 60 \text{ ksi} \)).

(reinforced concrete column analysis and charts)

<table>
<thead>
<tr>
<th>Concrete Strength (psi)</th>
<th>Axial Load (kips)</th>
<th>Bending Moment (kip-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live</td>
<td>Dead</td>
</tr>
<tr>
<td>5000</td>
<td>150</td>
<td>200</td>
</tr>
</tbody>
</table>

Partial answers to check with: \( e = 7.0 \text{ in} \), \( \phi P_{n} = 1078 \text{ kips} \)

(15%) Problem 15.3.F. From Figure 15.11, determine the minimum size for a rectangular column for the same data as Problems 15.3.C. Also determine the percentage of savings in reinforcement as compared to the square column (=100\%Area saved/original reinforcement or column area).

In addition, determine the axial capacity of the column and reinforcement chosen if ties are used. (reinforced concrete column analysis and charts)

Partial answers to check with: 51.9% steel saved, ___% concrete saved, \( \phi P_{n} = 793 \text{ kips} \)

(15%) Problem 15.3.I. Using Figure 15.13, pick the minimum size round column and its reinforcing for the load and moment combination in Problem 15.C. In addition, determine the axial capacity of the column and reinforcement chosen if spiral reinforcement is used.

(reinforced concrete column analysis and charts)

Partial answers to check with: \( \phi P_{n} = 1295 \text{ kips} \) (text answer wrong)