ARCH 614. Assignment #7

Date: 3/1/17, due 3/8/17

Pass-fail work

Problems: all but 7A, B & C from Ambrose & Tripeny, Chapter 5, pp. 203, 204, 209, and 220

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

(20%) 7A) The floor framing plan is subject to uniform distributed loads of: dead load = 45 psf, live load = 120 psf. Determine the resulting reactions by the beams & load on the columns. (load tracing)

Partial answers to check with: $R_{B2} = 16706.25\ lb$, \(R_{G3@G1} = 10395\ lb\), $R_{G1@C1} = 12529.7\ lb$, \(P_{onC2} = 20,822.8\ lb\).

(6%) 7B) For the frame of problem 7A, use Multiframe software to find the column loads to verify your work from load tracing by constructing a 3D model (View 3D). Use the standard steel section you have been assigned which is posted in My Grades on eCampus. Submit the data file (.mfd) on eCampus (under Assignments: Assignment 7) and provide a print of the bending moment (M) and axial force (P) diagrams. Be careful to make joints on all the girders at the location of beam supports. Model the column bases as fixed. Do not use panels, but put on linearly distributed loads on G1, B2 and G2 only. Model the beam ends with rotational releases using the member restraint menu and release (check) the major moment resistance, \(M_z\), for each end.

(12%) 7C) The compressive force in a column to each service (unfactored) load are: \(D = 465\ kN\), \(L = 290\ kN\), \(L_r = 65\ kN\), \(W = 110\ kN\), \(E = 245\ kN\). Determine the design load for the column based on LRFD using ASCE-7 load combinations (Note Set 12.1). (load factors)

Partial answers to check with: $\max\{651, 1054.5, \max\{952, 717\}, 990.5, 1093, 528.5, 663.5\} \ kN$.

(15%) Problem 5.4.B A simple beam of Hem Fir, select structural grade, has a span of 18 ft with two concentrated loads of 4 kips each placed at the third points of the span. Neglecting its own weight, determine the size of the beam with the least cross-sectional area based on bending stress. (bending stress and design)

Partial answer to check with: \(S_{req'd} \geq 206 \text{ in}^3\) or \(221.5 \text{ in}^3\) if < 4” wide

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(10%) **Problem 5.5.B**  A 10 x 14 beam of Hem Fir select structural grade is loaded symmetrically with three concentrated loads of 4300 lb, each placed at the quarter points of the span. Is the beam safe for shear? *(shear stress)*

Partial answer to check with: \( f_v = 75.4 \text{ psi} < \text{picked allowable (be careful picking because it is not a 2x!)} \)

(15%) **Problem 5.7.B**  For this problem, **include** the beam weight and consider deflection to be limited to \( L/240 \) of the beam span. The timber density is 29 lb/ft\(^3\). An 8 x 12 beam of Hem Fir No. 1 grade is 12 ft in length and has a concentrated load of 5 kips at the center of the span. Investigate the deflection using superpositioning. *(beam diagrams and formulas)*

Partial answer to check with: \( \Delta_{\text{midspan}} = 0.252 \text{ in} + 0.006 \text{ in} < 0.6, \text{ in OK (Be careful to only convert enough feet to inches!)} \)

(15%) **Problem 5.7.D**  For this problem, **neglect the beam weight and consider deflection to be limited to \( L/240 \) of the beam span.** An 8 x 14 beam of Hem Fir select structural grade has a span of 16 ft and a total uniformly distributed load of 8 kips. Investigate the deflection. *(E = 11,721,500 kPa)* *(beam diagrams and formulas and design)*

Partial answer to check with: \( \Delta_{\text{midspan}} = 0.37 \text{ in.} < 0.8 \text{ in., OK} \)

(7%) **Problem 5.9.C**  Using Douglas fir-larch, No. 2 grade, pick the joist size required from Table 5.10 for the stated conditions. Live load is 40 psf; dead load is 10 psf; deflection is limited to \( L/360 \) of the span under live load only. *(beam diagrams and formulas and design)*

<table>
<thead>
<tr>
<th>Joist Spacing (in.)</th>
<th>Joist Span (ft)</th>
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<tbody>
<tr>
<td>16</td>
<td>16</td>
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Partial answers to check with: maximum span must be larger than 16 ft.