ARCH 331. Assignment #8

Date: 10/17/13, due 10/24/13

Pass-fail work

Problems: supplemental problems (8A, etc.) and from Onouye Chapters 9 & 10

Notes: Problems marked with a * have been altered with respect to the problem stated in the text. Multiframe or other methods may be used for V & M diagrams and maximums when the method is not specified.

*Use superpositioning with the Beam Diagrams and Formulas to get support reactions and to construct the V & M diagrams.

Partial answer to check with: $S_{req'd} \geq 26.4 \text{ in.}^3$, $A_{req'd} \geq 9.8 \text{ in.}^2$, and $\Delta > 0.273 \text{ in.}$

(20%) *9.1.2 The single overhang beam uses a 4x12 S4S (100 x 300 mm) Douglas fir –larch No. 1 member. Determine the maximum bending stress developed. Is it safely designed? (If $F_b = 1200 \text{ psi}$ or 8.37 MPa) most economical member to use assuming a self weight of 10 lb/ft, normal load duration ($C_D = 1$), tabulated stresses of $F_b = 2000 \text{ psi}$ and $F_c = 250 \text{ psi}$, $E = 1.7 \times 10^6 \text{ psi}$. Calculated and locate the maximum deflection due only to the 400 lb/ft for the member found.

Use superpositioning with the Beam Diagrams and Formulas to get support reactions and to construct the V & M diagrams.

(20%) *9.1.22 Design a Douglas fir –larch No. 1 beam to support the load shown. Assume a 7-day live load (construction) duration.

$F_b = 1300 \text{ psi}$

$F_c = 85 \text{ psi}$

$E = 1.6 \times 10^6 \text{ psi}$

$\gamma = 32 \text{ lb/ft}^3$

$\Delta_{allowed(\text{LL})} = L/360$

$\Delta_{\text{allowed}(\text{LL+DL})} = L/240$

Partial answers to check with:

$S_{req'd} \geq 221.1 \text{ in.}^3$, $A_{req'd} \geq 91.4 \text{ in.}^2$. First trial self weight $\approx 23 \text{ lb/ft}$. (Expect more trials). Final sections may have $S > 230 \text{ in.}^3$ and $\Delta_{\text{LL}} \approx 0.3-0.4 \text{ in.}$, and $\Delta_{\text{LL+DL}} \approx 0.5-0.6 \text{ in.}$

(20%) 10.4.3 Determine the axial load capacity of a $6\frac{3}{4}'' \times 10\frac{1}{2}''$ glu-lam column with an area $A = 70.88 \text{ in.}^2$, assuming lateral bracing about the weak axis at the midheight level. Assume pin connections top and bottom in both directions of buckling. ($F_c = 1650 \text{ psi}$; $E = 1.8 \times 10^6 \text{ psi}$) Assume the critical load duration is for one-day live load (wind).

Partial answers to check with:

$(C_D = 1.33) F'c = 1080 \text{ psi}$, $P_a = 76.5 \text{ k}$

MORE NEXT PAGE
6 x

(20%) *10.4.6 Determine the minimum size column (Southern pine dense No. 1) required to support an axial load of \( P = \frac{25 \text{ kips}}{6 \times 12.5 \text{ kips}} = 12.5 \text{ kips} \) assuming an effective column length \( L_e = 16 \text{ ft} \). Assume the load duration is normal. For Southern pine dense No. 1, \( E = 1.6 \times 10^6 \text{ psi} \), and the tabulated compressive stress parallel to the grain, \( F_c = 975 \text{ psi} \). 

\( F'_{c} = 351 \text{ psi}, A_{req'd} \geq 35.6 \text{ in}^2 \) and a section MUST satisfy this requirement

(5%) 8A) Determine the minimum size square column of Douglas Fir Larch, No. 1 grade to support an axial load of 30 k for an effective length of 12 ft under snow load.

\( \text{(timber column design charts)} \)

Partial answers to check with: possible capacities \( \{3.7 \text{ k}, 17.6 \text{ k}, 47.3 \text{ k}\} \)