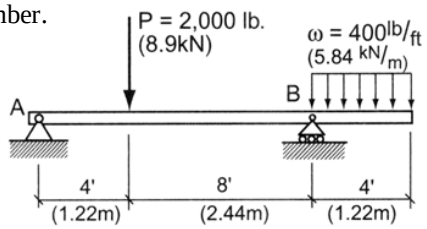
ARCH 331. Assignment #8

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****.*

(20%) ***9.1.2** The single overhang beam ~~uses a 4×12 S4S (100 × 300 mm) Douglas fir–larch No. 1 member~~. Determine the ~~maximum bending stress developed. Is it safely designed? (F_b = 1300 psi or 8.97 MPa)~~ supporting a floor is to be a glue-lam member. 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 psi and F_v = 250 psi, E = 1.7 x 10^6 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.**

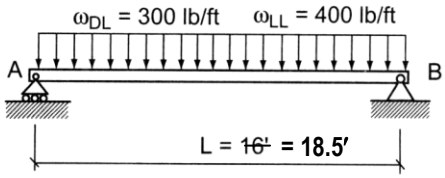
(timber strength design and deflection)

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

(35%)* **9.1.22** Design a ~~Douglas fir–larch No. 1~~ economical beam to support the load shown. Assume a 7-day live load (construction) duration. (*timber beam design)*

$F_b = 1300$ psi
$F_v = 85$ psi
$E = 1.6 \times 10^6$ psi
$\Delta_{allow(LL)} = L/360$

*γ = 32 lb/ft^3
*$\Delta_{allowed\ (LL+DL)} = L/240$



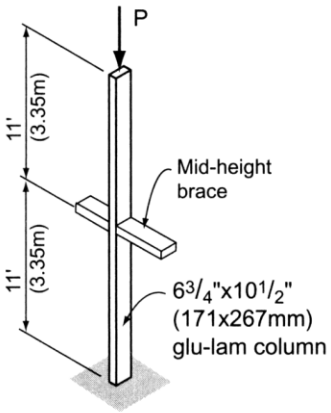
Problem 9.1.22

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

(20%) **10.4.3** Determine the axial load capacity of a $6\frac{3}{4}$" × $10\frac{1}{2}$" *glu-lam column with an area A = 70.88 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 psi; $E = 1.8 \times 10^6$ psi) Assume the critical load duration is for one-day live load (wind).

(*timber column analysis)*

Partial answers to check with:
(C_D = 1.33) F'_c = 1080 psi, P_a = 76.5 k



Problem 10.4.3

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

no figure

Partial answers to check with: $F'_c = 351$ psi, $A_{req'd} \geq 35.6\ in^2$ 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.

(timber column design charts)

Partial answers to check with: possible capacities {3.7 k, 17.6 k, 47.3 k}