ARCH 324 - Structures 2, Winter 2009

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GIVEN: 4 boards each 1" x 6" glued and nailed as a column section.

A) DETERMINE ARRANGEMENT FOR THE STRONGEST SECTION.

B) DETERMINE ALLOWABLE AXIAL LOAD FOR:

\[ L = 10' - 0" \quad 20' - 8" \quad 30' - 0" \]

BRACED AT ENDS ONLY

\[ E = 17,160,000 \text{ psi} \]
\[ E_c = 18,000 \text{ psi} \]
\[ f_c = \frac{3.60E}{(E/E_c)^{2}} \]
\[ f = \left( \frac{E}{E_c} \right)^{2} \leq 170 \]

Placing the material as far as possible from the N.A.,

\[ A = 4(6) = 24 \]

\[ I_x = I_y = \frac{7(7)^{3}}{12} - \frac{5(5)^{3}}{12} = 148.0 \]

\[ r = \frac{\sqrt{148}}{24} = 2.483 \]

\[ F = \frac{3.6\ E}{(k/r)^{2}} = \frac{3.6\ (17,160,000)}{\frac{1}{2.48^{2}}} = \frac{1}{24} (39072000) = \frac{P}{A} \]

\[ P = \frac{1}{24} \ (937728000) \text{ lbs} \]

For \( L = 10' - 0" \):

\[ \frac{P}{F} = \frac{48.4}{120} = 48.4 \leq 170 \quad \text{OK} \]

\[ P_c = \frac{1}{120} (937728000) = 78,140 \text{ lbs} \]

For \( L = 20' - 8" \):

\[ \frac{P}{F} = \frac{248}{120} = 2.48 \leq 170 \quad \text{OK} \]

\[ P_c = \frac{1}{120} (937728000) = 78,140 \text{ lbs} \]

For \( L = 30' - 0" \):

\[ \frac{P}{F} = \frac{360}{120} = 3.0 \leq 170 \quad \text{OK} \]

\[ P_c = \frac{1}{120} (937728000) = 78,140 \text{ lbs} \]