open.michigan

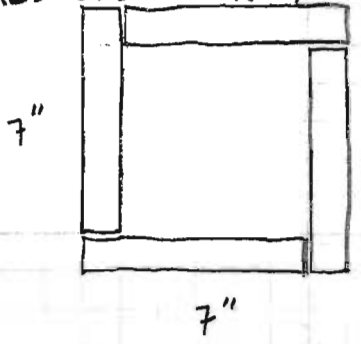
GIVEN: 4 BOARDS EACH 1"x6" GLUED AND NAILED AS A COLUMN SECTION.

A) DETERMINE ARRANGEMENT FOR THE STRONGEST SECTION.

B) DETERMINE ALLOWABLE AXIAL LOAD FOR:
L = 10'-0" 20'-8" 30'-0"
BRACED AT ENDS ONLY

$E = 1760\,000$ PSI
$F_c = 1800$ PSI $\quad f_c = \dfrac{3.60\,E}{(\ell/r)^2} \quad \dfrac{\ell}{r} \leq 170$

PLACING THE MATERIAL AS FAR AS POSSIBLE FROM THE N.A. RESULTS IN A 7" x 7" SQUARE



$A = 4(6) = 24$

$I_x = I_y = \dfrac{7(7)^3}{12} - \dfrac{5(5)^3}{12} = 148.0$

$r = \sqrt{\dfrac{148}{24}} = 2.483$

$$f = \frac{3.6\,E}{(\ell/r)^2} = \frac{3.6\,(1760000)}{\ell^2/2.483^2} = \frac{1}{\ell^2}\,(39072000) = \frac{P}{A}$$

$$P = \frac{1}{\ell^2}\,(937728000)\ \text{lbs}$$

FOR $\ell = 10'\text{-}0"$:

$\ell/r = 120/2.48 = 48.4 < 170$ ✓OK

$P_{cr} = \frac{1}{120^2}(937728000) = 65120$ lbs $\qquad P_y = 1800(24) = \underline{43200}$ lbs

FOR $\ell = 20'\text{-}8"$

$\ell/r = 248/2.48 = 100 < 170$ ✓OK

$P_{cr} = \frac{1}{248^2}(937728000) = \underline{15246}$ lbs < 43200

FOR $\ell = 30'\text{-}0"$

$\ell/r = 360/2.48 = 145.2 < 170$ ✓ OK

$P_{cr} = \frac{1}{360^2}(937728000) = \underline{7235}$ lbs < 43200