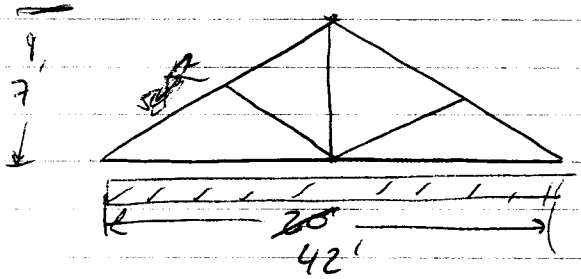
16 psf (2') = 32 lb/ft DEAD

7.7



$L_r = 20 R_1 R_2$

$R_1 = 1$

$R_2 = 1$ (SLOPE = 4"/12")

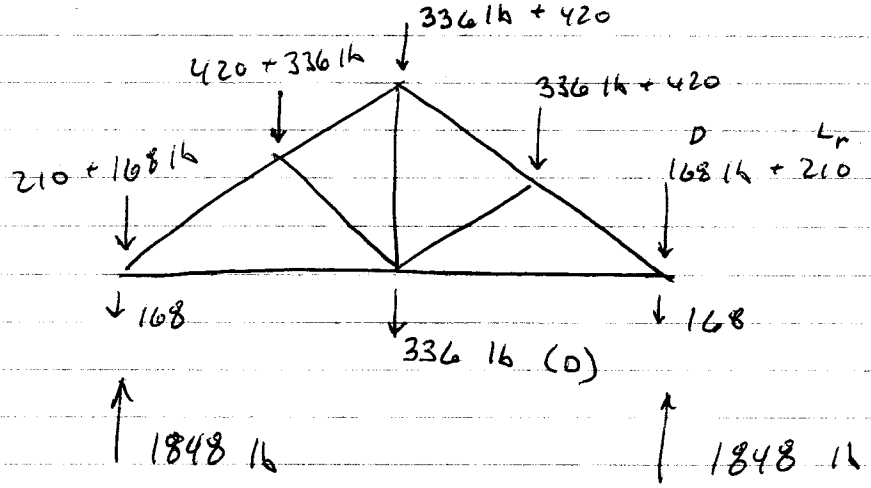
$L_r = 20 psf$

$= 40$ lb/ft

$C_M = 1.0$, $C_t = 1.0$, $C_i = 1.0$

No 2 DF-L

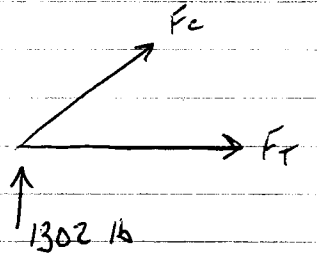
FIND REQUIRED SIZE FOR BOTTOM CHORD



CONTROLLING LOAD COMBINATION FOR TENSION

$\frac{D + D + L_r}{1.25} = 1478$ lb ✓ ; $D = 1008$ lb $= \frac{(32 lb/ft + 16 lb/ft)(42')}{2}$

SOLVING TRUSS FOR TENSION IN LOWER CHORD



$\Sigma F_y = 0 \quad \frac{7}{22.14}(F_C) + 1302 = 0 \quad F_C = 4117$ lb (C)

$\Sigma F_x = 0 \quad \frac{21}{22.14}(F_C) + F_T = 0 \quad F_T =$ 3905 lb

TRY 2 x 8 TENSION CHECK

$F_t' = F_t C_D C_M C_t C_F C_i$
$= 575(1.25)(1.0)(1.0)(1.2)(1.0) = 862.5 \text{ psi}$

$f_t = \frac{3905 \text{ lb}}{10.88 \text{ in}^2} = 359 \text{ psi} < 862.5 \text{ psi}$ O.K. FOR TENSION

BENDING CHECK

$F_b' = F_b C_D C_M C_t C_L C_F C_{fu} C_i C_r C_f$
$= 900(0.9)(1.0)(1.0)(1.0)(1.2)(1.0)(1.0)(1.15)(1.0) = 1117.8 \text{ psi}$

NOTE $C_L = 1.0$ DUE TO LATERAL SUPPORT FROM CEILING
$C_D = 0.9$ DEAD LOAD
$C_r = 1.15$ SPACING 24" OR LESS

$F_b^* = 1117.8 \text{ psi}$

$M = \frac{16 \text{ lb/ft}(21')^2}{8} = 882 \text{ ft-lb} = 10584 \text{ in-lb}$

$f_b = \frac{M}{S} = \frac{10584 \text{ in-lb}}{13.14 \text{ in}^3} = 805.5 \text{ psi}$ O.K. FOR BENDING

COMBINED TENSION & BENDING

$\frac{f_t}{F_t'} + \frac{f_b}{F_b^*} = \frac{359}{862.5} + \frac{805.5}{1.25(1117.8)\frac{0}{.9}} = 0.935$

↑ FACTOR ADDED (C_D) BECAUSE CHECK IS FOR D+D+L_r.

USE A No 2 DF-L 2x8 FOR LOWER CHORD.

7.22 A STUD WALL IS USED AS A BEARING WALL IN A WOOD FRAMED BUILDING. AXIAL LOAD IS CAUSED BY ROOF DEAD & SNOW LOADS.

STUDS - No 2 SOUTHERN PINE 2x6 @ 24" O.C.
SHEATHING BRACES WEAK AXIS OF STUDS
$C_M = 1.0$, $C_t = 1.0$, $C_i = 1.0$

FIND ALLOWABLE LOAD IN lb/ft

a) 10' WALL

$F'_c = F_c C_D C_M C_t C_F C_i C_p$

$F_c^* = 1600(1.15)(1.0)(1.0)(1.0)(1.0) = 1840$ psi

$E = 1.6(10)^6$ $\quad l_u = 10'$ $\quad l_e/d = 120"/5\frac{1}{2}" = 21.82$

$$F_{cE} = \frac{0.3(1.6)(10)^6}{\left(\frac{10'(12"/ft)}{(5\frac{1}{2})}\right)^2} = 1008.3 \text{ psi}$$

$F_{cE}/F_c^* = 0.548$

$$C_p = \frac{1.548}{1.6} - \sqrt{\left(\frac{1.548}{1.6}\right)^2 - \frac{.548}{.8}} = .47$$

$F'_c = .47(1840) = 865$ psi

$P = 865$ psi $(8.25 \text{ in}^2) = 7134$ lb

LOAD ON WALL $= 7134 \text{ lb}/2' = 3567$ lb/ft

14' WALL

A) $F_c^* = 1840$ psi

$$\ell_e/d = \frac{14'(12''/ft)}{5\frac{1}{2}''} = 30.54$$

$$F_{cE} = \frac{0.3(1.6)(10)^6}{(30.54)^2} = 514.5 \text{ psi}$$

$$F_{cE}/F_c^* = 0.280$$

$$C_p = \frac{1.28}{1.6} - \sqrt{\left(\frac{1.28}{1.6}\right)^2 - \frac{0.28}{.8}} = 0.262$$

$$F'_c = 0.262(1840) = 482 \text{ psi}$$

$$P = 482 \text{ psi}\,(8.25 \text{ in}^2) = 3977 \text{ lb}$$

$$w = 1990 \text{ lb/ft}$$

7.23 6x10 SEL STR DF-L

$P = 20\ K\ (D+S)$, $L = 16'$ (WEAK AXIS BRACED)
$w = 200\ lb/ft$
$C_M = 1.0$
$C_t = 1.0$
$C_i = 1.0$

COMPRESSION CHECK

$F'_c = F_c C_D C_M C_t C_F C_i C_p$
$F_c^* = 1100(1.15)(1.0)(1.0)(1.0)(1.0)$
$= 1265\ psi$

$E = 1.6(10)^6\ psi$
$E' = 1.6(10)^6\ psi$

$F_{cE} = \frac{.3(1.6)(10)^6}{(20.21)^2} = 1175\ psi$

$\ell_e/d = \frac{16'(12''/ft)}{9\frac{1}{2}''} = 20.21$

$F_{cE}/F_c^* = \frac{1175\ psi}{1265} = 0.929$

$C_p = \frac{1.929}{1.6} - \sqrt{\left(\frac{1.929}{1.6}\right)^2 - \frac{.929}{.8}} = .665$

$F'_c = .665(1265) = 841\ psi$

$f_c = \frac{20\,000\ lb}{52.25\ in^2} = 382.8\ psi$

BENDING CHECK

$F'_b = F_b C_D C_M C_t C_L C_F C_{fu} C_i C_r C_f$

$= 1600(1.6)(1.0)(1.0)(1.0)(1.0)(1.0)(1.0)(1.0)(1.0)$
$= 2560\ psi$

$M = wL^2/8 = \frac{200\ lb/ft(16')^2}{8} = 6400\ ft\text{-}lb = 76\,800\ in\text{-}lb$

$f_b = M/S = \frac{76,800\ in\text{-}lb}{82.73} = 928.3\ psi$

COMBINED CHECK

$$\left(\frac{f_c}{F_c'}\right)^2 = \left(\frac{382.8 \text{ psi}}{841 \cdot \left(\frac{1.6}{1.15}\right)}\right) = 0.053$$

$$\frac{f_b}{F_b'\left[1 - f_c/F_{cE}\right]} = \frac{928.3}{2560\left[1 - \frac{382.8}{1175}\right]} = 0.537$$

$$\left(\frac{f_c}{F_c'}\right)^2 + \frac{f_b}{F_b'\left[1 - f_c/F_{cE}\right]} = 0.592 < 1.0 \quad \text{SECTION O.K.}$$

7.27 2x6 EXTERIOR STUD WALL 14' TALL. No 1 DF-L STUDS 16" O.C.

VERTICAL LOADS $D = 800$ lb/ft
$L = 800$ lb/ft
$L_r = 400$ lb/ft

WIND LOAD 15 psf $= 15 \text{ psf}(16/12) = 20$ lb/ft

COMPRESSION CHECK

$D+L = 1600$ lb/ft
$D+L_r = 2000$ lb/ft $/ 1.25 = 1600$ lb/ft

$D+L+L_r$ CONTROLS

$F_c^* = F_c C_D C_M C_t C_F C_i$
$= 1500(1.25)(1.0)(1.0)(1.1)(1.0)$
$= 2062.5$ psi

$\ell_e/d = \dfrac{14'(12"/ft)}{5\frac{1}{2}}$
$= 30.54$

$F_{cE} = \dfrac{1.7(10)^6(.3)}{(30.54)^2} = 546.6$ psi

$F_{cE}/F_c^* = 546.6/2062.5 = 0.265$

$C_p = \left(\dfrac{1.265}{1.6}\right) - \sqrt{\left(\dfrac{1.265}{1.6}\right)^2 - \dfrac{.265}{.8}} = 0.249$

$F_c' = .249(2062.5) = 513.6$ psi

$f_c = \dfrac{(800+800+400)\,16/12}{8.25} = 323.2$ psi < 513.6 psi ✓

BENDING CHECK

$$F_b' = F_b C_D C_M C_t C_L C_F C_{fu} C_i C_r C_f$$

$$= 1000\,(1.6)(1.0)(1.0)(1.0)(1.3)(1.0)(1.0)(1.15)(1.0)$$

$$= 2392 \text{ psi}$$

$$f_b = \frac{M}{S} = \frac{20 \text{ lb/ft}\,(14')^2\,(12''/\text{ft})}{8\,(7.563)\text{ in}^3} = 777.5 \text{ psi} \quad < 2392 \quad \text{O.K.}$$

COMBINED STRESS

$$\left[\frac{f_c}{F_c'}\right]^2 + \frac{f_b}{F_b'\left[1 - f_c/F_{cE}\right]} = \left[\frac{323.2 \text{ psi}}{513.6\left(\frac{1.6}{1.25}\right)}\right]^2 + \frac{777.5}{2392\left[1 - \frac{323.2}{546.6}\right]}$$

$$= 0.24 + 0.795 = 1.035$$

$$> 1.0$$

FAILS COMBINED STRESS CHECK.