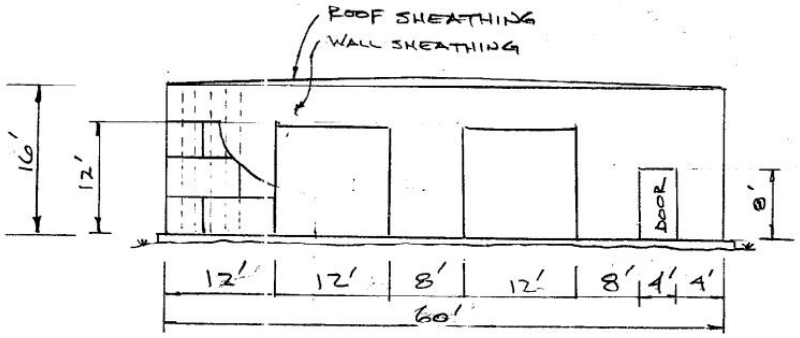
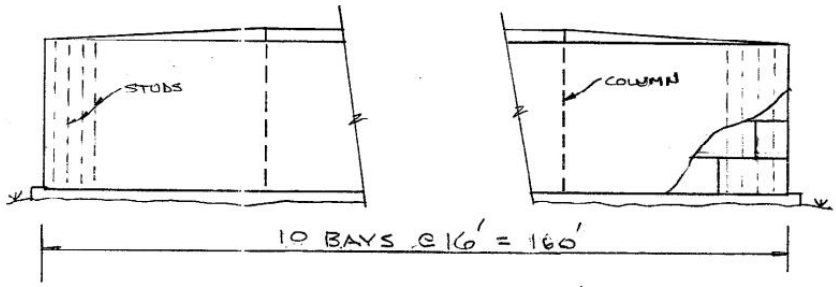
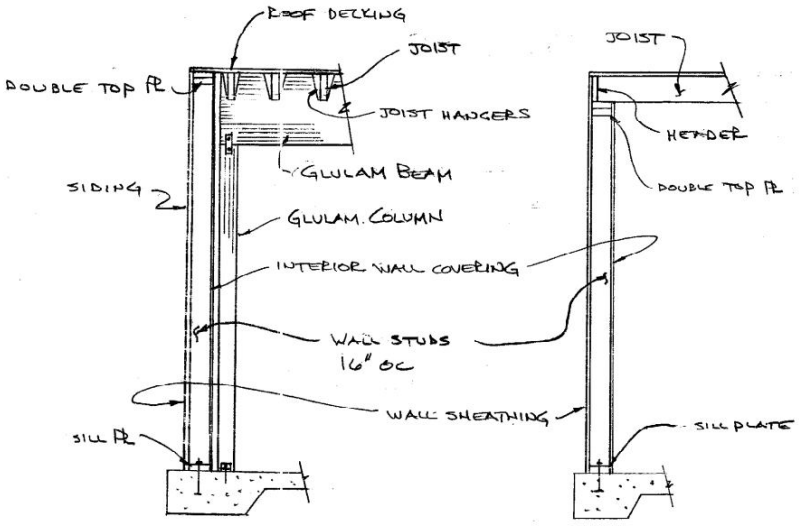
Given:



END ELEVATION



SIDE ELEVATION



SECTION A-A

SECTION B-B

Design Loads for Section B-B:

$H := 16\ ft$ $T_L := 8\ ft$ $T_w := 16\frac{1}{12} = 1.333\ ft$

$A_{Tplan} := T_w \cdot T_L = 10.667\ ft^2$ $A_{Telev} := H \cdot T_w = 21.333\ ft^2$

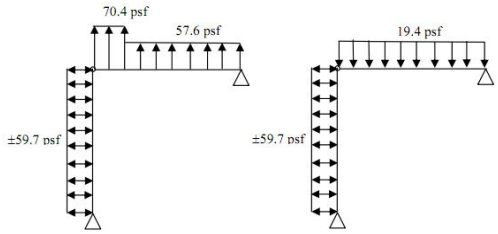
- Dead Load on End Walls: FBC 2005, Appendix A (P. A.1-A.3)

Plywood, rigid insulation, felt and gravel, HVAC, ceiling, and joists:

$D := 3 \cdot \frac{5}{8} + 4 \cdot .75 + 6.5 + 4 + 2 + 7 = 24.375\ psf$

- Wind Load:

59.7 psf inward/outward on all walls
70.4 psf upward on roof joist edge strips
57.6 psf upward on interior portion of roof joists
19.4 psf downward on roof joists



- Roof Live Load:

$L_0 := 20\ psf$

$$R_1 := \begin{cases} 1.0 & \text{if } A_{Tplan} \le 200 \\ \left(1.2 - 0.001 \cdot A_{Tplan}\right) & \text{if } 200 < A_{Tplan} < 600 \\ 0.6 & \text{if } A_{Tplan} \ge 600 \end{cases} \qquad R_1 = 1 \qquad R_2 := 1.0$$

$L_R := L_0 \cdot R_1 \cdot R_2 = 20\ psf$ ASCE 7-10, Eqn. (4.8-1)

- Downward Load Cases (lbs of compression on each stud):

Dead Load Only:

$P_D := A_{Tplan} \cdot D = 260\ lbs$

Dead plus Roof Live:

$P_{D\_Lr} := A_{Tplan} \cdot \left(D + L_R\right) = 473.333\ lbs$

*Dead plus 0.6*Wind:*

$P_{D\_W} := A_{Tplan} \cdot (D + 0.6 \cdot 19.4) = 384.16\ lbs$

*Dead plus 3/4 of (Roof Live plus 0.6*Wind):*

$P_{D\_Lr\_W} := A_{Tplan} \cdot \left[D + 0.75 \cdot \left(L_R + 0.6 \cdot 19.4 \right) \right] = 513.12 \text{ lbs}$

- Estimate Controlling Downward Load Case:

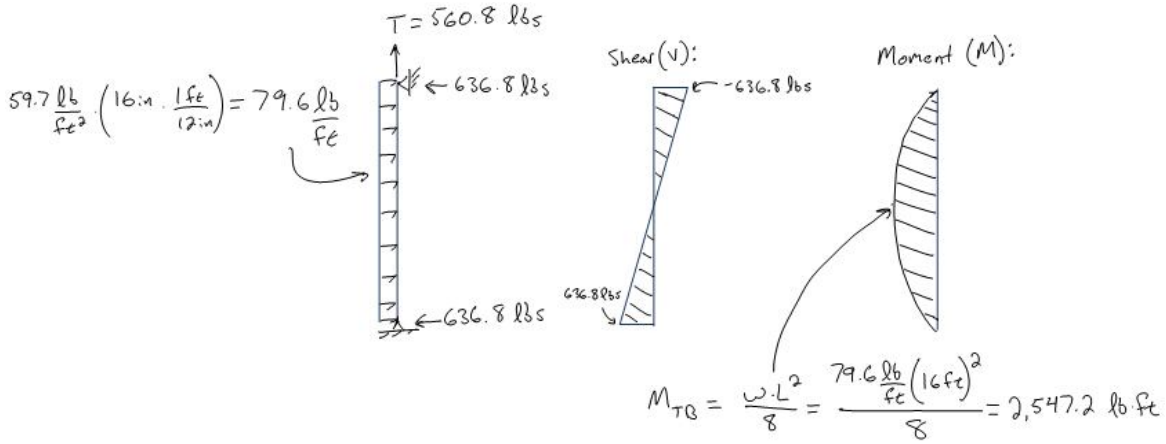
Load Case:	Load (lbs):	C_D:	Load/C_D:
1. D	260	0.9	288.89
2. D + L_R	473.33	1.25	378.66
5. D + 0.6*(W)	384.16	1.6	240.1
6a. D + 0.75*(L_R + 0.6*W)	513.12	1.6	320.7

Therefore, for axial compression use: $P := 473.33 \text{ lbs}$ $C_D := 1.25$

- Upward Load Cases: 0.6*D+W [W-0.6*D upward] C_D=1.6

$T := T_w \cdot 6 \cdot 70.4 + T_w \cdot 2 \cdot 57.6 - A_{Tplan} \cdot 0.6 \cdot D = 560.8 \text{ lbs}$

Check Combined Tension and Bending:



$T = 560.8 \text{ lbs}$ $M_{TB} := 2547.2 \cdot 12 = 3.057 \times 10^4 \text{ lb·in}$

*****Try 2X10, #2 Southern Pine:**

$b := 1.5$ in		2005 NDS Supplement, Table 1B (P. 14)
$d := 9.25$ in		2005 NDS Supplement, Table 1B (P. 14)
$A := 13.88$ in^2		2005 NDS Supplement, Table 1B (P. 14)
$S := 21.39$ in^3		2005 NDS Supplement, Table 1B (P. 14)
$F_b := 1050$ psi		2005 NDS Supplement, Table 4B (P. 38)
$F_t := 575$ psi		2005 NDS Supplement, Table 4B (P. 38)
$E_{min} := 580000$ psi		2005 NDS Supplement, Table 4B (P. 38)
$C_D := 1.6$		NDS 2005, Table 2.3.2 (P.9)
$C_M := 1.0$	$EMC \leq 19\%$	NDS Supplement 2005, Table 4B (P.37)
$C_t := 1.0$		NDS 2005, Table 2.3.3 (P.9)
$C_L := 1.0$	Drywall provided on interior of walls	NDS 2005, Section 4.3.5
$C_F := 1.0$	Table 4B Adjustment Factors	NDS 2005, Section 4.3.6
$C_{fu} := 1.0$	Major Axis Bending	NDS 2005, Section 4.3.7
$C_i := 1.0$	Untreated Lumber	NDS 2005, Section 4.3.8
$C_r := 1.15$	Stud Wall	NDS 2005, Section 4.3.9

Tension Side Check:

$f_t := \frac{T}{A} = 40.403$ psi $\qquad F'_t := F_t \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i = 920$ psi

$f_b := \frac{M_{TB}}{S} = 1.429 \times 10^3$ psi $\qquad \left[F_b{}^x\right] := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.932 \times 10^3$ psi

therefore: $\frac{f_t}{F'_t} + \frac{f_b}{\left[F_b{}^x\right]} = 0.784 < 1.0$ 2005 NDS, Eqn. (3.9-1)

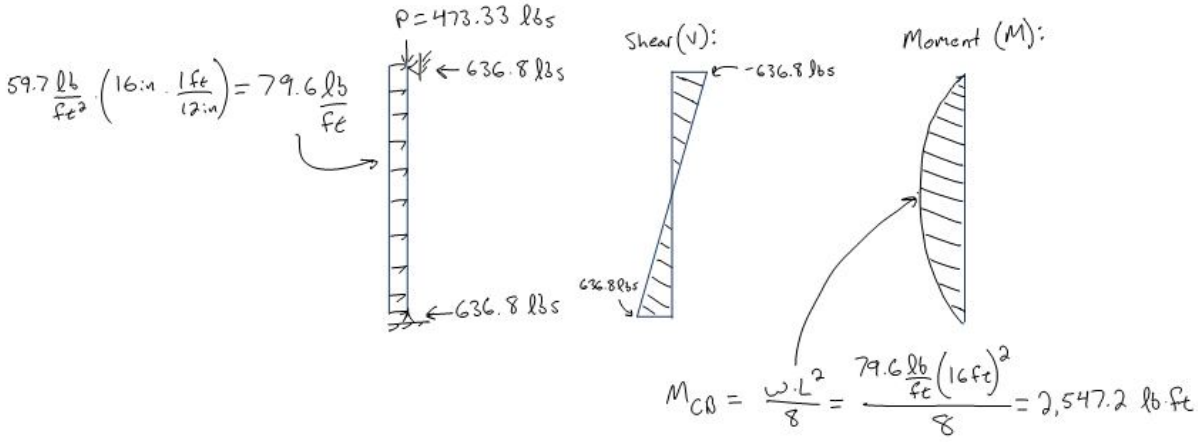
Compression Side Check:

$\left[F_b{}^{xx}\right] := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.932 \times 10^3$ psi

therefore: $\frac{f_b - f_t}{\left[F_b{}^{xx}\right]} = 0.719 < 1.0$ 2005 NDS, Eqn. (3.9-2)

*****2X10, #2 Southern Pine will suffice for combined tension and bending in section B-B.**

Check Combined Compression and Bending:



P = 473.33 lbs

$M_{CB} := 2547.2 \cdot 12 = 3.057 \times 10^4$ lb·in

*****Try 2X10, #2 Southern Pine:**

$d_x := 1.5$ in		2005 NDS Supplement, Table 1B (P. 14)
$d_y := 9.25$ in		2005 NDS Supplement, Table 1B (P. 14)
$A := 13.88$ in^2		2005 NDS Supplement, Table 1B (P. 14)
$S := 21.39$ in^3		2005 NDS Supplement, Table 1B (P. 14)
$F_b := 1050$ psi		2005 NDS Supplement, Table 4B (P. 38)
$F_c := 1500$ psi		2005 NDS Supplement, Table 4B (P. 38)
$E_{min} := 580000$ psi		2005 NDS Supplement, Table 4B (P. 38)
$C_D := 1.25$		NDS 2005, Table 2.3.2 (P.9)
$C_M := 1.0$	EMC ≤ 19%	NDS Supplement 2005, Table 4B (P.37)
$C_t := 1.0$		NDS 2005, Table 2.3.3 (P.9)
$C_F := 1.0$	Table 4B Adjustment Factors	NDS 2005, Section 4.3.6
$C_{fu} := 1.0$	Major Axis Bending	NDS 2005, Section 4.3.7
$C_i := 1.0$	Untreated Lumber	NDS 2005, Section 4.3.8
$C_r := 1.15$	Stud Wall	NDS 2005, Section 4.3.9
$C_P := 1.0$	Drywall provided on interior of walls	NDS 2005, Section 4.3.9

Check Combined Compression and Bending:

$f_c := \frac{P}{A} = 34.102$ psi

$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i \cdot C_P = 1.875 \times 10^3$ psi

$f_{b1} := \frac{M_{CB}}{S} = 1.429 \times 10^3$ psi

$F'_{b1} := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.509 \times 10^3$ psi

$F_{cE1} := \text{infinity}$

$F_{bE} := \text{infinity}$

therefore:

$f_c = 34.102$ psi $<$ $F_{cE1} := \text{infinity}$ $\left[\frac{f_c}{F_{cE1}}\right] := 0$

$f_{b1} = 1.429 \times 10^3$ psi $<$ $F_{bE} := \text{infinity}$

$$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{b1}}{F'_{b1}\cdot\left(1 - \left[\frac{f_c}{F_{cE1}}\right]\right)} = 0.947 < 1.0$$

2005 NDS, Eqn. (3.9-3)

Summary for Section B-B:

The controlling case of Combined Compression and Bending required that 2X10, #2 Southern Pine Studs are to be installed on the end walls of the structure.

Design Loads for Section A-A:

$H := 16\ ft$ $\qquad T_w := 16\frac{1}{12} = 1.333\ ft$

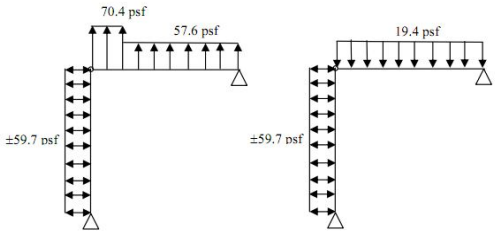
$A_{Telev} := H \cdot T_w = 21.333\ ft^2$

- Dead Load:

  All Dead Load is supported by Glulam Beams and Columns for Section B-B (longitudinal walls).

- Wind Load:

  59.7 psf inward/outward on all walls
  70.4 psf upward on roof joist edge strips
  57.6 psf upward on interior portion of roof joists
  19.4 psf downward on roof joists

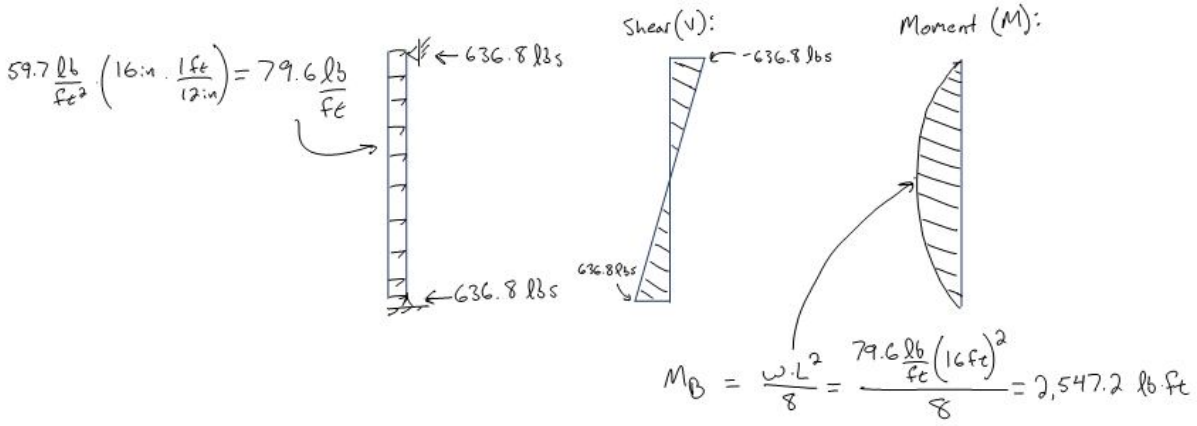


- Roof Live Load:

  All Roof Live Load is supported by Glulam Beams and Columns for Section B-B (longitudinal walls).

- Controlling Load Case:

  59.7 psf inward/outward on all walls $\qquad C_D := 1.6$



$M_B := 2547.2 \cdot 12 = 3.057 \times 10^4\ lb \cdot in$

*****Try 2X10, #2 Southern Pine:**

$d_x := 1.5$ in		2005 NDS Supplement, Table 1B (P. 14)
$d_y := 9.25$ in		2005 NDS Supplement, Table 1B (P. 14)
$A := 13.88$ in^2		2005 NDS Supplement, Table 1B (P. 14)
$S := 21.39$ in^3		2005 NDS Supplement, Table 1B (P. 14)
$F_b := 1050$ psi		2005 NDS Supplement, Table 4B (P. 38)
$E_{min} := 580000$ psi		2005 NDS Supplement, Table 4B (P. 38)
$C_D := 1.6$		NDS 2005, Table 2.3.2 (P.9)
$C_M := 1.0$	EMC ≤ 19%	NDS Supplement 2005, Table 4B (P.37)
$C_t := 1.0$		NDS 2005, Table 2.3.3 (P.9)
$C_L := 1.0$	Drywall provided on interior of walls	
$C_F := 1.0$	Table 4B Adjustment Factors	NDS 2005, Section 4.3.6
$C_{fu} := 1.0$	Major Axis Bending	NDS 2005, Section 4.3.7
$C_i := 1.0$	Untreated Lumber	NDS 2005, Section 4.3.8
$C_r := 1.15$	Stud Wall	NDS 2005, Section 4.3.9

- Determine Actual Bending Stress:

$$f_b := \frac{M_B}{S} = 1.429 \times 10^3 \text{ psi}$$

- Check Bending Strength of Member:

$$F'_b := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.932 \times 10^3 \text{ psi} \quad > \quad f_b = 1.429 \times 10^3 \text{ psi}$$

Summary for Section A-A:

The only load case of lateral wind pressure required that 2X10, #2 Southern Pine Studs are to be installed on the longitudinal walls of the structure.

Design Loads for Large Door Support Columns (sides of door frame):

$H := 16\ ft$ $T_L := 8\ ft$ $T_w := 8\frac{1}{12} + 6 = 6.667\ ft$

$A_{Tplan} := T_w \cdot T_L = 53.333\ ft^2$ $A_{Telev} := H \cdot T_w = 106.667\ ft^2$

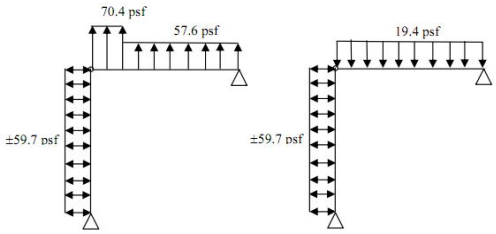
- Dead Load on End Walls: FBC 2005, Appendix A (P. A.1-A.3)

Plywood, rigid insulation, felt and gravel, HVAC, ceiling, and joists:

$$D := 3 \cdot \frac{5}{8} + 4 \cdot .75 + 6.5 + 4 + 2 + 7 = 24.375\ psf$$

- Wind Load:

59.7 psf inward/outward on all walls
70.4 psf upward on roof joist edge strips
57.6 psf upward on interior portion of roof joists
19.4 psf downward on roof joists



- Roof Live Load:

$L_0 := 20\ psf$

$$R_1 := \begin{cases} 1.0 & \text{if } A_{Tplan} \le 200 \\ \left(1.2 - 0.001 \cdot A_{Tplan}\right) & \text{if } 200 < A_{Tplan} < 600 \\ 0.6 & \text{if } A_{Tplan} \ge 600 \end{cases} \qquad R_1 = 1 \qquad R_2 := 1.0$$

$L_R := L_0 \cdot R_1 \cdot R_2 = 20\ psf$ ASCE 7-10, Eqn. (4.8-1)

- Downward Load Cases (lbs of compression on each stud):

Dead Load Only:

$P_D := A_{Tplan} \cdot D = 1.3 \times 10^3\ lbs$

Dead plus Roof Live:

$P_{D\_Lr} := A_{Tplan} \cdot \left(D + L_R\right) = 2.367 \times 10^3\ lbs$

*Dead plus 0.6*Wind:*

$P_{D\_W} := A_{Tplan} \cdot (D + 0.6 \cdot 19.4) = 1.921 \times 10^3\ lbs$

*Dead plus 3/4 of (Roof Live plus 0.6*Wind):*

$P_{D\_Lr\_W} := A_{Tplan} \cdot \left[D + 0.75 \cdot \left(L_R + 0.6 \cdot 19.4 \right) \right] = 2.566 \times 10^3$ lbs

- Estimate Controlling Downward Load Case:

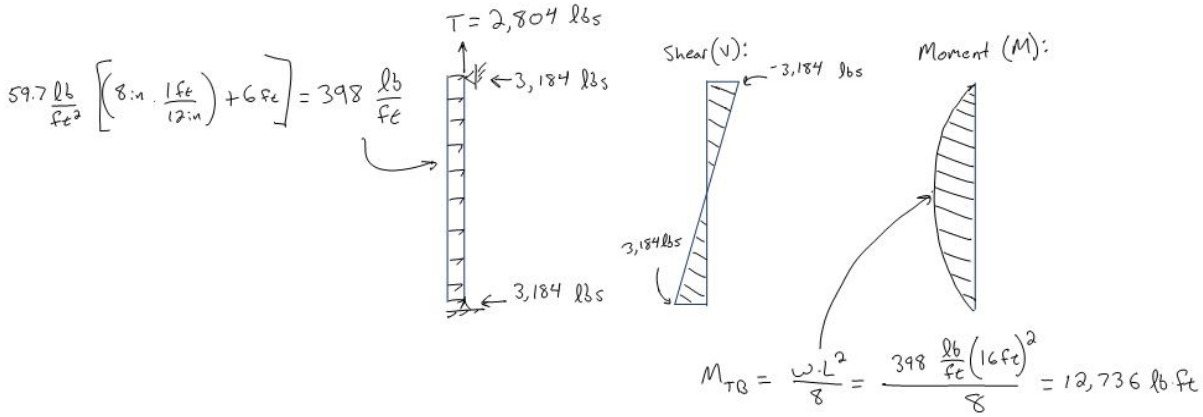
Load Case:	Load (lbs):	C_D:	Load/C_D:
1. D	1300	0.9	1444.44
2. D + L_R	2367	1.25	1893.6
5. D + 0.6*(W)	1921	1.6	1200.6
6a. D + 0.75*(L_R + 0.6*W)	2566	1.6	1603.8

Therefore, for axial compression use: $P := 2367$ lbs $C_D := 1.25$

- Upward Load Cases: 0.6*D+W [W-0.6*D upward] C_D=1.6

$T := T_w \cdot 6 \cdot 70.4 + T_w \cdot 2 \cdot 57.6 - A_{Tplan} \cdot 0.6 \cdot D = 2.804 \times 10^3$ lbs

Check Combined Tension and Bending:



$T = 2.804 \times 10^3$ lbs $M_{TB} := 12736 \cdot 12 = 1.528 \times 10^5$ lb·in

*****Try 4 - 2X10, #2 Southern Pine:**

$b := 4 \cdot 1.5 = 6 \text{ in}$ 2005 NDS Supplement, Table 1B (P. 14)

$d := 9.25 \text{ in}$ 2005 NDS Supplement, Table 1B (P. 14)

$A := b \cdot d = 55.5 \text{ in}^2$ 2005 NDS Supplement, Table 1B (P. 14)

$I := \frac{b \cdot d^3}{12} = 395.727 \text{ in}^4$ $S := \frac{I}{\frac{d}{2}} = 85.563 \text{ in}^3$

$F_b := 1050 \text{ psi}$ 2005 NDS Supplement, Table 4B (P. 38)

$F_t := 575 \text{ psi}$ 2005 NDS Supplement, Table 4B (P. 38)

$E_{min} := 580000 \text{ psi}$ 2005 NDS Supplement, Table 4B (P. 38)

$C_D := 1.6$ NDS 2005, Table 2.3.2 (P.9)

$C_M := 1.0$ EMC ≤ 19% NDS Supplement 2005, Table 4B (P.37)

$C_t := 1.0$ NDS 2005, Table 2.3.3 (P.9)

$C_L := 1.0$ Drywall provided on interior of walls NDS 2005, Section 4.3.5

$C_F := 1.0$ Table 4B Adjustment Factors NDS 2005, Section 4.3.6

$C_{fu} := 1.0$ Major Axis Bending NDS 2005, Section 4.3.7

$C_i := 1.0$ Untreated Lumber NDS 2005, Section 4.3.8

$C_r := 1.15$ Stud Wall NDS 2005, Section 4.3.9

Tension Side Check:

$f_t := \frac{T}{A} = 50.523 \text{ psi}$ $F'_t := F_t \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i = 920 \text{ psi}$

$f_b := \frac{M_{TB}}{S} = 1.786 \times 10^3 \text{ psi}$ $\left[F_b{}^x\right] := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.932 \times 10^3 \text{ psi}$

therefore: $\frac{f_t}{F'_t} + \frac{f_b}{\left[F_b{}^x\right]} = 0.979 < 1.0$ 2005 NDS, Eqn. (3.9-1)

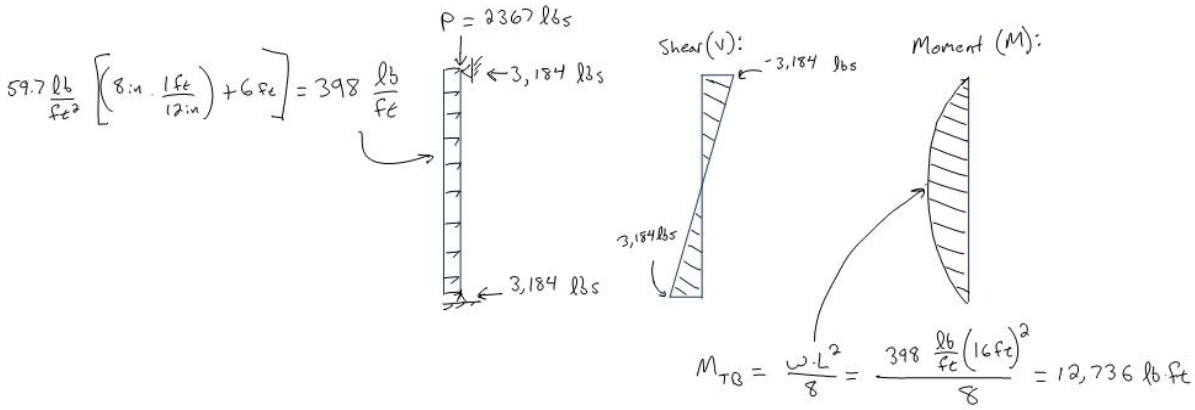
Compression Side Check:

$\left[F_b{}^{xx}\right] := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.932 \times 10^3 \text{ psi}$

therefore: $\frac{f_b - f_t}{\left[F_b{}^{xx}\right]} = 0.898 < 1.0$ 2005 NDS, Eqn. (3.9-2)

*****4 - 2X10, #2 Southern Pine will suffice for combined tension and bending for the large door.**

Check Combined Compression and Bending:



$P = 2.367 \times 10^{3}$ lbs $\qquad M_{CB} := 12736 \cdot 12 = 1.528 \times 10^{5}$ lb·in

*****Try 5 - 2X10, #2 Southern Pine:**

$b := 5 \cdot 1.5 = 7.5$ in — 2005 NDS Supplement, Table 1B (P. 14)

$d := 9.25$ in — 2005 NDS Supplement, Table 1B (P. 14)

$A := b \cdot d = 69.375$ in^2 — 2005 NDS Supplement, Table 1B (P. 14)

$I := \frac{b \cdot d^3}{12} = 494.658$ in^4 $\qquad S := \frac{I}{\frac{d}{2}} = 106.953$ in^3

$F_b := 1050$ psi — 2005 NDS Supplement, Table 4B (P. 38)

$F_c := 1500$ psi — 2005 NDS Supplement, Table 4B (P. 38)

$E_{min} := 580000$ psi — 2005 NDS Supplement, Table 4B (P. 38)

$C_D := 1.25$ — NDS 2005, Table 2.3.2 (P.9)

$C_M := 1.0$ EMC ≤ 19% — NDS Supplement 2005, Table 4B (P.37)

$C_t := 1.0$ — NDS 2005, Table 2.3.3 (P.9)

$C_F := 1.0$ Table 4B Adjustment Factors — NDS 2005, Section 4.3.6

$C_{fu} := 1.0$ Major Axis Bending — NDS 2005, Section 4.3.7

$C_i := 1.0$ Untreated Lumber — NDS 2005, Section 4.3.8

$C_r := 1.15$ Stud Wall — NDS 2005, Section 4.3.9

$C_P := 1.0$ Drywall provided on interior of walls — NDS 2005, Section 4.3.9

Check Combined Compression and Bending:

$f_c := \frac{P}{A} = 34.119$ psi

$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i \cdot C_P = 1.875 \times 10^3$ psi

$f_{b1} := \frac{M_{CB}}{S} = 1.429 \times 10^3$ psi

$F'_{b1} := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.509 \times 10^3$ psi

$F_{cE1} := \text{infinity}$

$F_{bE} := \text{infinity}$

therefore:

$f_c = 34.119$ psi $<$ $F_{cE1} := \text{infinity}$ $\left[\frac{f_c}{F_{cE1}}\right] := 0$

$f_{b1} = 1.429 \times 10^3$ psi $<$ $F_{bE} := \text{infinity}$

$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{b1}}{F'_{b1} \cdot \left(1 - \left[\frac{f_c}{F_{cE1}}\right]\right)} = 0.947 < 1.0$ 2005 NDS, Eqn. (3.9-3)

Summary for Studs on the Side of the Large Door Frame:

The controlling case of Combined Compression and Bending required that 5 - 2X10, #2 Southern Pine boards are to be used to support each side of the large door frame.

Design Loads for Small Door Support Columns (sides of door frame):

$H := 16\ ft$ $T_L := 8\ ft$ $T_w := 8\frac{1}{12} + 2 = 2.667\ ft$

$A_{Tplan} := T_w \cdot T_L = 21.333\ ft^2$ $A_{Telev} := H \cdot T_w = 42.667\ ft^2$

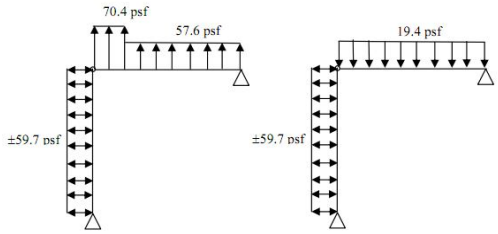
- Dead Load on End Walls: FBC 2005, Appendix A (P. A.1-A.3)

Plywood, rigid insulation, felt and gravel, HVAC, ceiling, and joists:

$$D := 3 \cdot \frac{5}{8} + 4 \cdot .75 + 6.5 + 4 + 2 + 7 = 24.375\ psf$$

- Wind Load:

59.7 psf inward/outward on all walls
70.4 psf upward on roof joist edge strips
57.6 psf upward on interior portion of roof joists
19.4 psf downward on roof joists



- Roof Live Load:

$L_0 := 20\ psf$

$$R_1 := \begin{cases} 1.0 & \text{if } A_{Tplan} \le 200 \\ \left(1.2 - 0.001 \cdot A_{Tplan}\right) & \text{if } 200 < A_{Tplan} < 600 \\ 0.6 & \text{if } A_{Tplan} \ge 600 \end{cases} \qquad R_1 = 1 \qquad R_2 := 1.0$$

$L_R := L_0 \cdot R_1 \cdot R_2 = 20\ psf$ ASCE 7-10, Eqn. (4.8-1)

- Downward Load Cases (lbs of compression on each stud):

Dead Load Only:

$P_D := A_{Tplan} \cdot D = 520\ lbs$

Dead plus Roof Live:

$P_{D\_Lr} := A_{Tplan} \cdot \left(D + L_R\right) = 946.667\ lbs$

*Dead plus 0.6*Wind:*

$P_{D\_W} := A_{Tplan} \cdot (D + 0.6 \cdot 19.4) = 768.32\ lbs$

*Dead plus 3/4 of (Roof Live plus 0.6*Wind):*

$P_{D\_Lr\_W} := A_{Tplan} \cdot \left[D + 0.75 \cdot \left(L_R + 0.6 \cdot 19.4 \right) \right] = 1.026 \times 10^3$ lbs

- Estimate Controlling Downward Load Case:

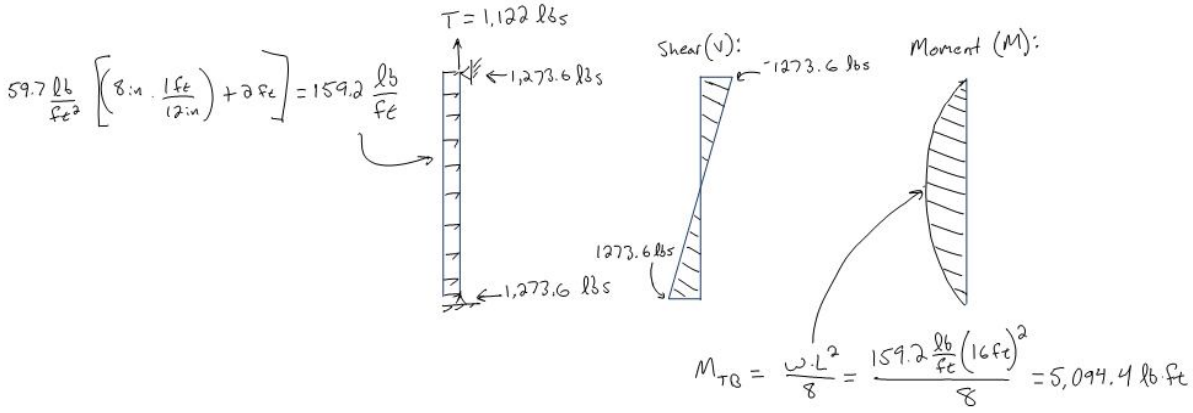
Load Case:	Load (lbs):	C_D:	Load/C_D:
1. D	520	0.9	577.78
2. D + L_R	946.67	1.25	757.34
5. D + 0.6*(W)	768.32	1.6	480.2
6a. D + 0.75*(L_R + 0.6*W)	1026	1.6	641.25

Therefore, for axial compression use: $P := 946.67$ lbs $C_D := 1.25$

- Upward Load Cases: 0.6*D+W [W-0.6*D upward] C_D=1.6

$T := T_w \cdot 6 \cdot 70.4 + T_w \cdot 2 \cdot 57.6 - A_{Tplan} \cdot 0.6 \cdot D = 1.122 \times 10^3$ lbs

Check Combined Tension and Bending:



$T = 1.122 \times 10^3$ lbs $M_{TB} := 5094.4 \cdot 12 = 6.113 \times 10^4$ lb·in

*****Try 2 - 2X10, #2 Southern Pine:**

$b := 2 \cdot 1.5 = 3 \text{ in}$ 2005 NDS Supplement, Table 1B (P. 14)

$d := 9.25 \text{ in}$ 2005 NDS Supplement, Table 1B (P. 14)

$A := b \cdot d = 27.75 \text{ in}^2$ 2005 NDS Supplement, Table 1B (P. 14)

$I := \frac{b \cdot d^3}{12} = 197.863 \text{ in}^4$ $S := \frac{I}{\frac{d}{2}} = 42.781 \text{ in}^3$

$F_b := 1050 \text{ psi}$ 2005 NDS Supplement, Table 4B (P. 38)

$F_t := 575 \text{ psi}$ 2005 NDS Supplement, Table 4B (P. 38)

$E_{min} := 580000 \text{ psi}$ 2005 NDS Supplement, Table 4B (P. 38)

$C_D := 1.6$ NDS 2005, Table 2.3.2 (P.9)

$C_M := 1.0$ EMC ≤ 19% NDS Supplement 2005, Table 4B (P.37)

$C_t := 1.0$ NDS 2005, Table 2.3.3 (P.9)

$C_L := 1.0$ Drywall provided on interior of walls NDS 2005, Section 4.3.5

$C_F := 1.0$ Table 4B Adjustment Factors NDS 2005, Section 4.3.6

$C_{fu} := 1.0$ Major Axis Bending NDS 2005, Section 4.3.7

$C_i := 1.0$ Untreated Lumber NDS 2005, Section 4.3.8

$C_r := 1.15$ Stud Wall NDS 2005, Section 4.3.9

Tension Side Check:

$f_t := \frac{T}{A} = 40.418 \text{ psi}$ $F'_t := F_t \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i = 920 \text{ psi}$

$f_b := \frac{M_{TB}}{S} = 1.429 \times 10^3 \text{ psi}$ $\left[F_b^{\,x}\right] := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.932 \times 10^3 \text{ psi}$

therefore: $\frac{f_t}{F'_t} + \frac{f_b}{\left[F_b^{\,x}\right]} = 0.784 < 1.0$ 2005 NDS, Eqn. (3.9-1)

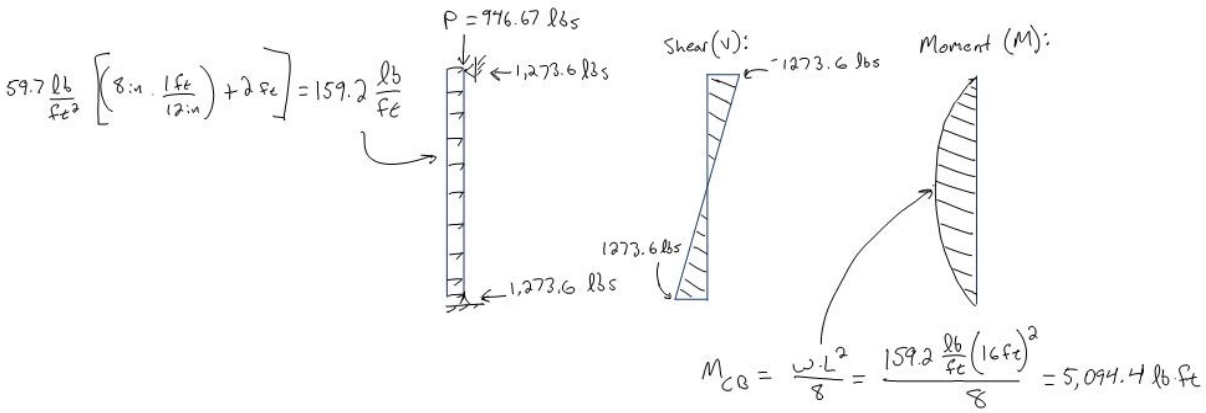
Compression Side Check:

$\left[F_b^{\,xx}\right] := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.932 \times 10^3 \text{ psi}$

therefore: $\frac{f_b - f_t}{\left[F_b^{\,xx}\right]} = 0.719 < 1.0$ 2005 NDS, Eqn. (3.9-2)

*****2 - 2X10, #2 Southern Pine will suffice for combined tension and bending for the large door.**

Check Combined Compression and Bending:



$P = 946.67 \quad lbs$ $M_{CB} := 5094.4 \cdot 12 = 6.113 \times 10^{4}\ lb \cdot in$

*****Try 2 - 2X10, #2 Southern Pine:**

$b := 2 \cdot 1.5 = 3 \quad in$ 2005 NDS Supplement, Table 1B (P. 14)

$d := 9.25 \quad in$ 2005 NDS Supplement, Table 1B (P. 14)

$A := b \cdot d = 27.75 \quad in^2$ 2005 NDS Supplement, Table 1B (P. 14)

$I := \frac{b \cdot d^3}{12} = 197.863 \quad in^4$ $S := \frac{I}{\frac{d}{2}} = 42.781 \quad in^3$

$F_b := 1050\ psi$ 2005 NDS Supplement, Table 4B (P. 38)

$F_c := 1500\ psi$ 2005 NDS Supplement, Table 4B (P. 38)

$E_{min} := 580000\ psi$ 2005 NDS Supplement, Table 4B (P. 38)

$C_D := 1.25$ NDS 2005, Table 2.3.2 (P.9)

$C_M := 1.0$ EMC ≤ 19% NDS Supplement 2005, Table 4B (P.37)

$C_t := 1.0$ NDS 2005, Table 2.3.3 (P.9)

$C_F := 1.0$ Table 4B Adjustment Factors NDS 2005, Section 4.3.6

$C_{fu} := 1.0$ Major Axis Bending NDS 2005, Section 4.3.7

$C_i := 1.0$ Untreated Lumber NDS 2005, Section 4.3.8

$C_r := 1.15$ Stud Wall NDS 2005, Section 4.3.9

$C_P := 1.0$ Drywall provided on interior of walls NDS 2005, Section 4.3.9

Check Combined Compression and Bending:

$f_c := \frac{P}{A} = 34.114 \quad psi$

$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i \cdot C_P = 1.875 \times 10^3 \quad psi$

$f_{b1} := \frac{M_{CB}}{S} = 1.429 \times 10^3 \quad psi$

$F'_{b1} := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_i \cdot C_r = 1.509 \times 10^3 \quad psi$

$F_{cE1} := infinity$

$F_{bE} := infinity$

therefore:

$f_c = 34.114 \quad psi \quad < \quad F_{cE1} := infinity \qquad \left[\frac{f_c}{F_{cE1}}\right] := 0$

$f_{b1} = 1.429 \times 10^3 \quad psi \quad < \quad F_{bE} := infinity$

$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{b1}}{F'_{b1} \cdot \left(1 - \left[\frac{f_c}{F_{cE1}}\right]\right)} = 0.947 \quad < \quad 1.0$ 2005 NDS, Eqn. (3.9-3)

Summary for Studs on the Side of the Small Door Frame:

The controlling case of Combined Compression and Bending required that 2 - 2X10, #2 Southern Pine boards are to be used to support each side of the Small door frame.