



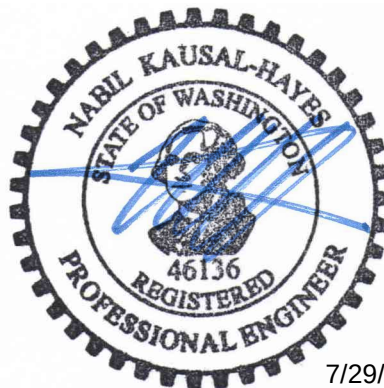
3804 House

Project Number: 22-112

3804 E Mercer Way
Mercer Island, WA 98040

Structural Calculations

Lateral Calculations.....S1 – S104
Gravity Calculations.....S105 – S234



7/29/24

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LATERAL LOAD CALCULATIONS FOR RESIDENTIAL PROPERTY LOCATED AT 3804 Mercer Way

Basis of Design

This document is showing the detail of design and calculations of framing, foundation and shear walls, for gravity and lateral loads according to IRC 2018, NDS 2018, IBC 2018, ASCE7-16, AISC 2015 and ACI 318-14.

The load distribution is as follow:

Floor Dead Load -----	15 psf
Roof Dead Load-----	15 psf
Floor Live Load-----	40 psf
Roof Live Load-----	20 psf
Roof Snow Load-----	25 psf
Deck Live Load-----	60 psf
Deck Dead Load-----	15 psf

The maximum wind speed is assumed 110 MPH per ASCE-7-16 with exposure category B for risk category II per King County.

Ground peak accelerations is 0.607g and seismic design category D2.

The maximum bearing pressure on soil was considered at least 1500 psf . Concrete strength is assumed to be at least 2500 psi

Material Properties for Design $f_c := 2500\text{psi}$ Concrete compressive strength $f_y := 60\text{ksi}$ Yield strength of rebar $f_{\text{soil.bearing}} := 1500\text{psf}$ Minimum soil bearing capacity $\gamma_{\text{concrete}} := 150\text{pcf}$ Concrete unit weight $\gamma_{\text{steel}} := 490\text{pcf}$ Steel unit weight $E_s := 29000\text{ksi}$ Young modulus of steel $E_c := 57000 \cdot \sqrt{\frac{f_c}{\text{psi}}} \cdot \text{psi} = 2.85 \times 10^3 \cdot \text{ksi}$ Young modulus of concrete (ACI-318-14)**Load Assumptions** $LL_{\text{floor}} := 40\text{psf}$ Floor live load $DL_{\text{floor}} := 15\text{psf}$ Floor dead load $DL_{\text{roof}} := 15\text{psf}$ Roof dead load $LL_{\text{roof}} := 20\text{psf}$ Roof live load $SL_{\text{roof}} := 25\text{psf}$ Roof snow load

LATERAL LOAD CALCULATION Parameters (SEISMIC & WIND)

Seismic Force Calculation on Building-ASCE7-16 for Wood Frame Structure

Site Class D was considered for this project according to IBC 1613.3.2

According to USGS Data for the site the seismic parameters are according to the followings

$PGA := 0.607$ Peak Ground Acceleration from USGS site

$S_{DS} := 1.134$ Design short period acceleration

$S_S := 1.418$ Short period spectral

$S_1 := 0.493$ Long Period Spectral

$F_a := 1.2$ Table 11.4.1

$F_v := 1.8$ Table 11.4.2

$S_{MS} := F_a \cdot S_S = 1.702$ 11-4-1

$S_{M1} := F_v \cdot S_1 = 0.887$ 11-4-2

$S_{D1} := \frac{2}{3} \cdot S_{M1} = 0.592$

$T_s := \frac{S_{D1}}{S_{DS}} \cdot s = 0.522 \text{ s}$

$h_{\text{building}} := 30\text{ft}$ Height of building

$W_{\text{ext}} := 12\text{psf}$ Weight of external walls

$$T_a := 0.02 \cdot \left(\frac{h_{\text{building}}}{\text{ft}} \right)^{0.75} \cdot s = 0.256 \text{ s}$$

Fundamental period of structure ASCE 7-16-12.8.7

$$T_L := 6 \text{ s}$$

Long period Transition ACE 7-16- Fig 22-14

$$R := 6.5$$

Seismic Modification factor for light frame ASCE 7-16- Table 12.2.1

$$I := 1.0$$

Importance factor for residential building

$$\frac{T_a}{1.5 \cdot T_s} = 0.328$$

T_a is less than $1.5 T_s$. Equation ASCE 716- 12.8.2 should be used

$$C_S := \frac{S_{DS}}{\left(\frac{R}{I} \right)} = 0.174$$

Seismic Response Factor ASCE 7-16-12.8.1.1

$$C_{S,\min} := .044 S_{DS} \cdot I = 0.05$$

C_S is more than minimum-OK

$$C_{S,\text{Design}} := \max(C_S, C_{S,\min}) = 0.174$$

Force Distribution Along the Height

$$N_{\text{story}} := 3$$

Number of story including roof

$$i := 1..N_{\text{story}}$$

$$j := 1..N_{\text{story}}$$

$$W_1 := 2780 \left(\text{ft}^2 \right) \cdot \text{DL}_{\text{floor}} + W_{\text{ext}} \cdot 248 \text{ ft} \cdot 10 \text{ ft} = 71.46 \cdot \text{kip}$$

Total dead weight of second floor

$$W_2 := 2250 \text{ ft}^2 \cdot \text{DL}_{\text{floor}} + W_{\text{ext}} \cdot (230 \text{ ft}) \cdot 12 \text{ ft} = 66.87 \cdot \text{kip}$$

Total dead weight of second floor

$$W_3 := 2250 \text{ ft}^2 \cdot \text{DL}_{\text{roof}} + W_{\text{ext}} \cdot 208 \text{ ft} \cdot \frac{12 \text{ ft}}{2} = 48.726 \cdot \text{kip}$$

Total dead weight of third floor

$$h_{\text{floor}_1} := 7\text{ft}$$

Height of first floor from ground

$$h_{\text{floor}_2} := h_{\text{floor}_1} + 11\text{ft} = 18\text{ft}$$

Height of second floor from ground

$$h_{\text{floor}_3} := h_{\text{floor}_2} + 12\text{ft} = 30\text{ft}$$

Height of second floor from ground

$$V_{\text{base_EQ.wall}} := C_{S,\text{Design}} \cdot \sum_{i=1}^{N_{\text{story}}} W_i = 32.634 \cdot \text{kip}$$

Total base shear due to
seismic for all building

$$C_{V_i} := \frac{W_i \cdot h_{\text{floor}_i}}{\sum_{i=1}^{N_{\text{story}}} (W_i \cdot h_{\text{floor}_i})}$$

Story force distribution factor-
ASCE7-16-12.8-12

$$C_{V_i} =$$

$$F_i := C_{V_i} \cdot V_{\text{base_EQ.wall}}$$

Seismic force at each floor

$$F_i =$$

·kip

$$V_{\text{story}_j} := \sum_{i=j}^{N_{\text{story}}} F_i$$

Shear at each floor

$$V_{\text{story}_j} =$$

·kip

Wind Force Calculation on Building-ASCE7-16

$$I := 1$$

Risk category II for
residential structure

ASCE7-16-Table 1.5.1

$$V_{\text{wind}} := 110 \frac{\text{mi}}{\text{hr}}$$

Wind speed

ASCE7-16-Fig 26.5.1B

$$K_d := 0.85$$

Wind directionality factor
for buildings

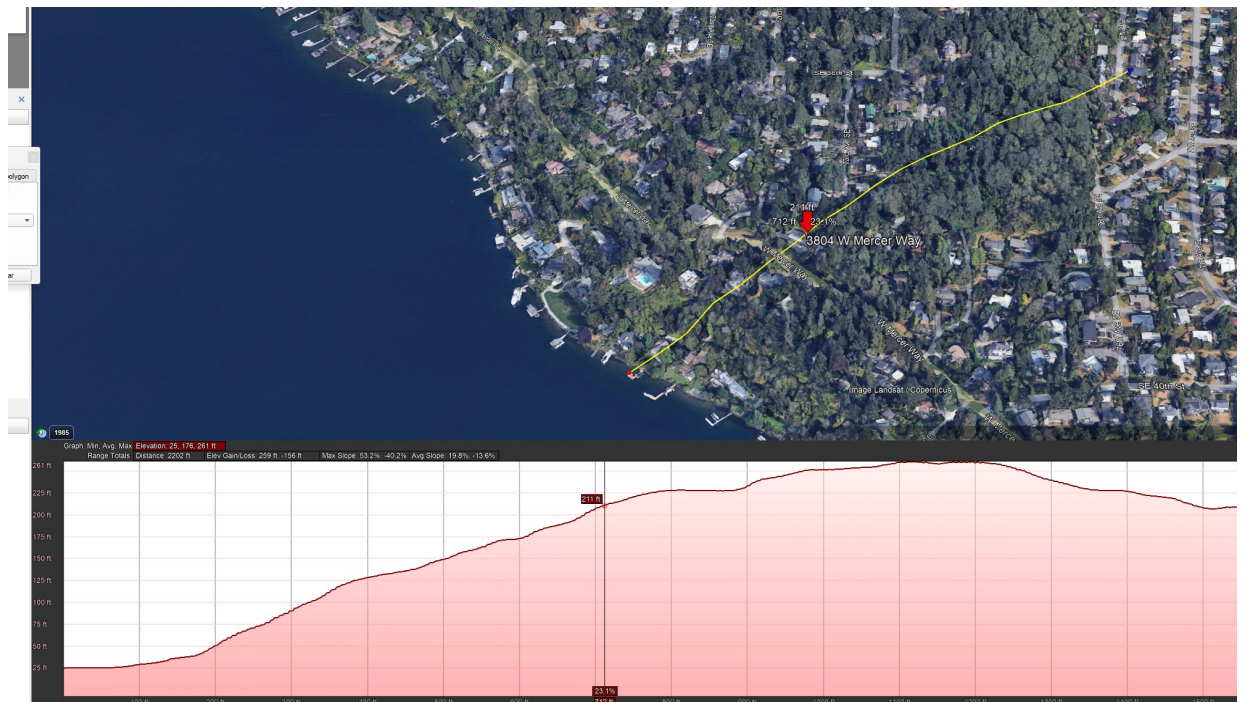
ASCE7-16-Table 26.6-1

Exposure Category B was considered for this design according to king County

$$L_{\text{house}} := 58\text{ft}$$

House foot print dimension

$$W_{\text{house}} := 50.5\text{ft}$$

Topographic Factor

$$H_{zt} := 260\text{ft} - 25\text{ft} = 235\cdot\text{ft}$$

Height of hill from lowest side

$$L_h := 1125\text{ft} - 438\text{ft} = 687\cdot\text{ft}$$

Distance from hill to location with half of hill height

$$K_1 := 0.75 \cdot \frac{H_{zt}}{L_h} = 0.257$$

From table 26.8-1 for Exposure B

$$x := (1125\text{ft} - 708\text{ft}) = 417\cdot\text{ft} \quad \text{Distance from crest to building}$$

$$\mu_{\text{upwind}} := 1.5$$

From table 26.8-1

$$\mu_{\text{downwind}} := 4$$

From table 26.8-1-2D Escapement

$$\gamma := 2.5$$

2D Escapement

$$K_{2_upwind} := 1 - \frac{x}{L_h \cdot \mu_{upwind}} = 0.595$$

$$K_{2_downwind} := 1 - \frac{x}{L_h \cdot \mu_{downwind}} = 0.848$$

$$K_3 := e^{-\gamma \cdot \frac{h_{\text{building}}}{L_h}} = 0.897$$

$$K_{zt,upwind} := \left(1 + K_1 \cdot K_{2_upwind} \cdot K_3\right)^2 = 1.293$$

ASCE7-16- 26.8.2

$$K_{zt,downwind} := \left(1 + K_1 \cdot K_{2_downwind} \cdot K_3\right)^2 = 1.428$$

$$K_{zt} := \max(K_{zt,downwind}, K_{zt,upwind}) = 1.428$$

$$K_e := 1.0$$

Ground elevation factor

ASCE7-16-26.9

$$GC_{pi} := -0.18$$

Internal Pressure Coefficient
for enclosed building

ASCE7-16-Table 26.13-1

$$K_z := 0.7$$

Velocity pressure exposure
coefficient-Assume 25 ft total
height for exposure B

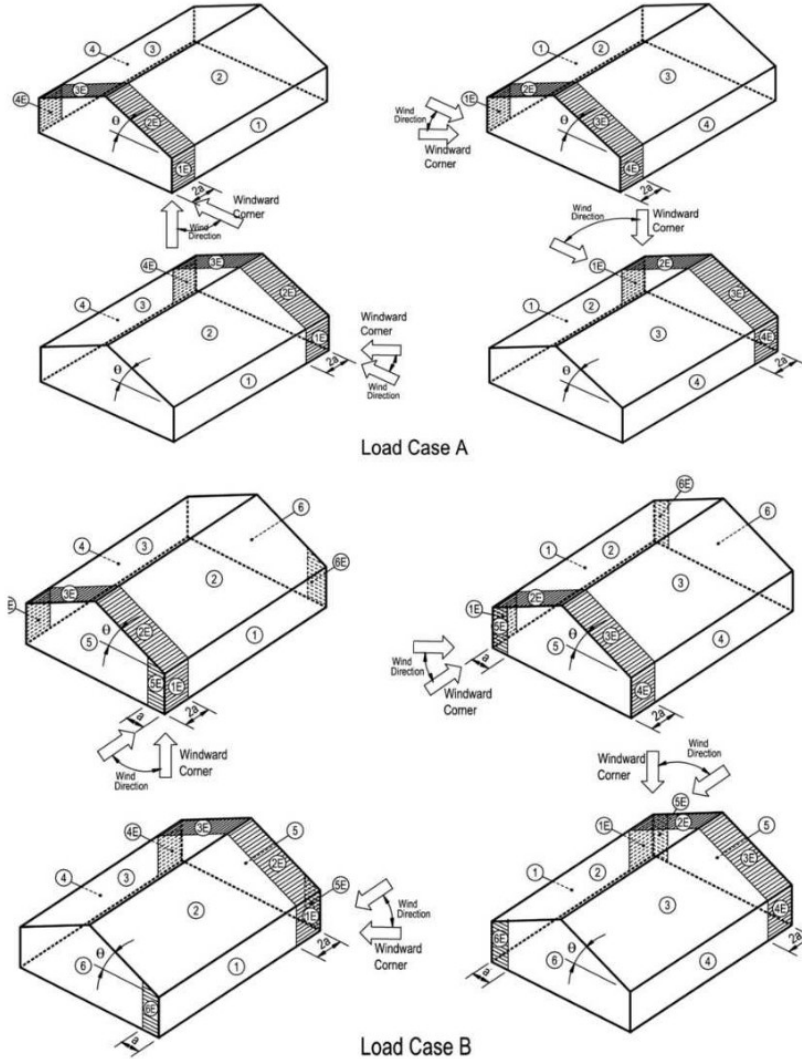
ASCE7-16-Table 26.10-1

$$q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot K_e \cdot \left(\frac{V_{\text{wind}}}{\frac{\text{mi}}{\text{hr}}} \right)^2 \cdot \frac{\text{lbf}}{\text{ft}^2} = 26.325 \cdot \text{psf}$$

$$\theta_{\text{roof}} := \text{atan}\left(\frac{0}{12}\right) = 0 \cdot \text{deg}$$

Approximate roof angle

Wind Load On building Using Envelope Procedure-Chapter 28 ASCE7-16

Diagrams**Notation**

a 10% of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).

Exception: For buildings with $\theta = 0$ to 7° and a least horizontal dimension greater than 300 ft (90 m), dimension a shall be limited to a maximum of 0.8 h .

h Mean roof height, in feet (meters), except that eave height shall be used for $\theta \leq 10^\circ$.

θ Angle of plane of roof from horizontal, in degrees.

$$a := \frac{\max(\min(0.1 \cdot \min(L_{\text{house}}, W_{\text{house}}), 0.4 \cdot h_{\text{building}}), 0.04 \cdot \min(L_{\text{house}}, W_{\text{house}}), 3\text{ft})}{\min(L_{\text{house}}, W_{\text{house}})} = 0.1$$

Load Case A								
Roof Angle θ (degrees)	Building Surface							
	1	2	3	4	1E	2E	3E	4E
0-5	0.40	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43
20	0.53	-0.69	-0.48	-0.43	0.80	-1.07	-0.69	-0.64
30-45	0.56	0.21	-0.43	-0.37	0.69	0.27	-0.53	-0.48
90	0.56	0.56	-0.37	-0.37	0.69	0.69	-0.48	-0.48

Load Case B												
Roof Angle θ (degrees)	Building Surface											
	1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
0-90	-0.45	-0.69	-0.37	-0.45	0.40	-0.29	-0.48	-1.07	-0.53	-0.48	0.61	-0.43

The structure is regular shape and less than 60 ft high, so chapter 28 is applicable to use

Load Case A

External pressure on wall for 10 deg roof
(Conservatively assumed 20 deg)

ASCE7-16-Table 28.3-1

$$\begin{array}{l}
 \text{angle} := \begin{pmatrix} 0 \\ 5 \\ 20 \\ 30 \\ 45 \\ 90 \end{pmatrix} \text{deg} \quad \text{wall}_{p.\text{factor}.1} := \begin{pmatrix} 0.4 \\ 0.4 \\ 0.53 \\ 0.56 \\ 0.56 \\ 0.56 \end{pmatrix} \quad \text{wall}_{p.\text{factor}.2} := \begin{pmatrix} -0.69 \\ -0.69 \\ -0.69 \\ 0.21 \\ 0.21 \\ 0.56 \end{pmatrix} \quad \text{wall}_{p.\text{factor}.3} := \begin{pmatrix} -0.37 \\ -0.37 \\ -0.48 \\ -0.43 \\ -0.43 \\ -0.37 \end{pmatrix} \\
 \\
 \text{wall}_{p.\text{factor}.4} := \begin{pmatrix} -0.29 \\ -0.29 \\ -0.43 \\ -0.37 \\ -0.37 \\ -0.37 \end{pmatrix} \quad \text{wall}_{p.\text{factor}.1E} := \begin{pmatrix} 0.61 \\ 0.61 \\ 0.8 \\ 0.69 \\ 0.69 \\ 0.69 \end{pmatrix} \quad \text{wall}_{p.\text{factor}.2E} := \begin{pmatrix} -1.07 \\ -1.07 \\ -1.07 \\ 0.27 \\ 0.27 \\ 0.69 \end{pmatrix}
 \end{array}$$

$$\text{wall}_{p,\text{factor.3E}} := \begin{pmatrix} -0.53 \\ -0.53 \\ -0.69 \\ -0.53 \\ -0.53 \\ -0.48 \end{pmatrix} \quad \text{wall}_{p,\text{factor.4E}} := \begin{pmatrix} -0.43 \\ -0.43 \\ -0.64 \\ -0.48 \\ -0.48 \\ -0.48 \end{pmatrix}$$

$$\text{wall}_{\text{factor.A.1}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.1}}, \theta)$$

$$\text{wall}_{\text{factor.A.2}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.2}}, \theta)$$

$$\text{wall}_{\text{factor.A.3}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.3}}, \theta)$$

$$\text{wall}_{\text{factor.A.4}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.4}}, \theta)$$

$$\text{wall}_{\text{factor.A.1E}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.1E}}, \theta)$$

$$\text{wall}_{\text{factor.A.2E}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.2E}}, \theta)$$

$$\text{wall}_{\text{factor.A.3E}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.3E}}, \theta)$$

$$\text{wall}_{\text{factor.A.4E}}(\theta) := \text{interp}(\text{angle}, \text{wall}_{p,\text{factor.4E}}, \theta)$$

Weighted averaging along length

Wal pressure ASCE7-16-Table 28.3-1

$$\text{GC}_{p_{\text{wall_windward.A}}} := a \cdot \text{wall}_{\text{factor.A.1E}}(\theta_{\text{roof}}) + (1 - a) \cdot \text{wall}_{\text{factor.A.1}}(\theta_{\text{roof}}) = 0.421$$

$$\text{GC}_{p_{\text{wall_leeward.A}}} := a \cdot \text{wall}_{\text{factor.A.4E}}(\theta_{\text{roof}}) + (1 - a) \cdot \text{wall}_{\text{factor.A.3}}(\theta_{\text{roof}}) = -0.376$$

External pressure for roof ASCE7-16-Table 28.3-1

$$GC_{p_roof_windward.A} := a \cdot wall_{factor.A.2E}(\theta_{roof}) + (1 - a) \cdot wall_{factor.A.2}(\theta_{roof}) = -0.728$$

$$GC_{p_roof_leeward.A} := a \cdot wall_{factor.A.3E}(\theta_{roof}) + (1 - a) \cdot wall_{factor.A.3}(\theta_{roof}) = -0.386$$

Wind pressure for Case A ASCE7-16-28-3-1

$$P_{wind_wall_windward.A} := q_z \cdot (GC_{p_wall_windward.A} + \text{if}(GC_{p_wall_windward.A} > 0, -GC_{pi}, GC_{pi})) = 15.821 \cdot \text{psf}$$

$$P_{wind_wall_leeward.A} := q_z \cdot (GC_{p_wall_leeward.A} + \text{if}(GC_{p_wall_leeward.A} > 0, -GC_{pi}, GC_{pi})) = -14.636 \cdot \text{psf}$$

$$P_{wind_roof_windward.A} := q_z \cdot (GC_{p_roof_windward.A} + \text{if}(GC_{p_roof_windward.A} > 0, -GC_{pi}, GC_{pi})) = -23.903 \cdot \text{psf}$$

$$P_{wind_roof_leeward.A} := q_z \cdot (GC_{p_roof_leeward.A} + \text{if}(GC_{p_roof_leeward.A} > 0, -GC_{pi}, GC_{pi})) = -14.9 \cdot \text{psf}$$

Load Case B

$$GC_{p_wall_windward.B} := a \cdot 0.61 + (1 - a) \cdot 0.4 = 0.421$$

ASCE7-16-Table 28.3-1

$$GC_{p_wall_leeward.B} := -a \cdot 0.43 + -(1 - a) \cdot 0.29 = -0.304$$

$$GC_{p_wall_windward.B_orthogonal} := a \cdot -0.48 + (1 - a) \cdot -0.45 = -0.453$$

ASCE7-16-Table 28.3-1

$$GC_{p_wall_leeward.B_orthogonal} := a \cdot -0.48 + (1 - a) \cdot -0.45 = -0.453$$

External pressure for roof

ASCE7-16-Table 28.3-1

$$GC_{p_roof_windward.B} := a \cdot -1.07 + (1 - a) \cdot -0.69 = -0.728$$

Windward pressure for roof

$$GC_{p_roof_leeward.B} := -a \cdot 0.53 - (1 - a) \cdot .37 = -0.386$$

Leeward pressure for roof

Wind pressure ASCE7-16-28-3-1

$$P_{wind_wall_windward.B} := q_z \cdot \text{if}(GC_{p_wall_windward.B} > 0, -GC_{pi}, GC_{pi}) = 4.738 \cdot \text{psf}$$

$$P_{wind_wall_leeward.B} := q_z \cdot \text{if}(GC_{p_wall_leeward.B} > 0, -GC_{pi}, GC_{pi}) = -4.738 \cdot \text{psf}$$

$$P_{wind_wall_windward.B_orthogonal} := q_z \cdot \left(GC_{p_wall_windward.B_orthogonal} \cdots + \text{if}(GC_{p_wall_windward.B_orthogonal} > 0, -GC_{pi}, GC_{pi}) \right) = -16.663 \cdot \text{psf}$$

$$P_{wind_wall_leeward.B_orthogonal} := q_z \cdot \left(GC_{p_wall_leeward.B_orthogonal} \cdots + \text{if}(GC_{p_wall_leeward.B_orthogonal} > 0, -GC_{pi}, GC_{pi}) \right) = -16.663 \cdot \text{psf}$$

$$P_{wind_roof_windward.B} := q_z \cdot \left(GC_{p_roof_windward.B} \cdots + \text{if}(GC_{p_roof_windward.B} > 0, -GC_{pi}, GC_{pi}) \right) = -23.903 \cdot \text{psf}$$

$$P_{wind_roof_leeward.B} := q_z \cdot (GC_{p_roof_leeward.B} + \text{if}(GC_{p_roof_leeward.B} > 0, -GC_{pi}, GC_{pi})) = -14.9 \cdot \text{psf}$$

ASD load combination used for frame design :

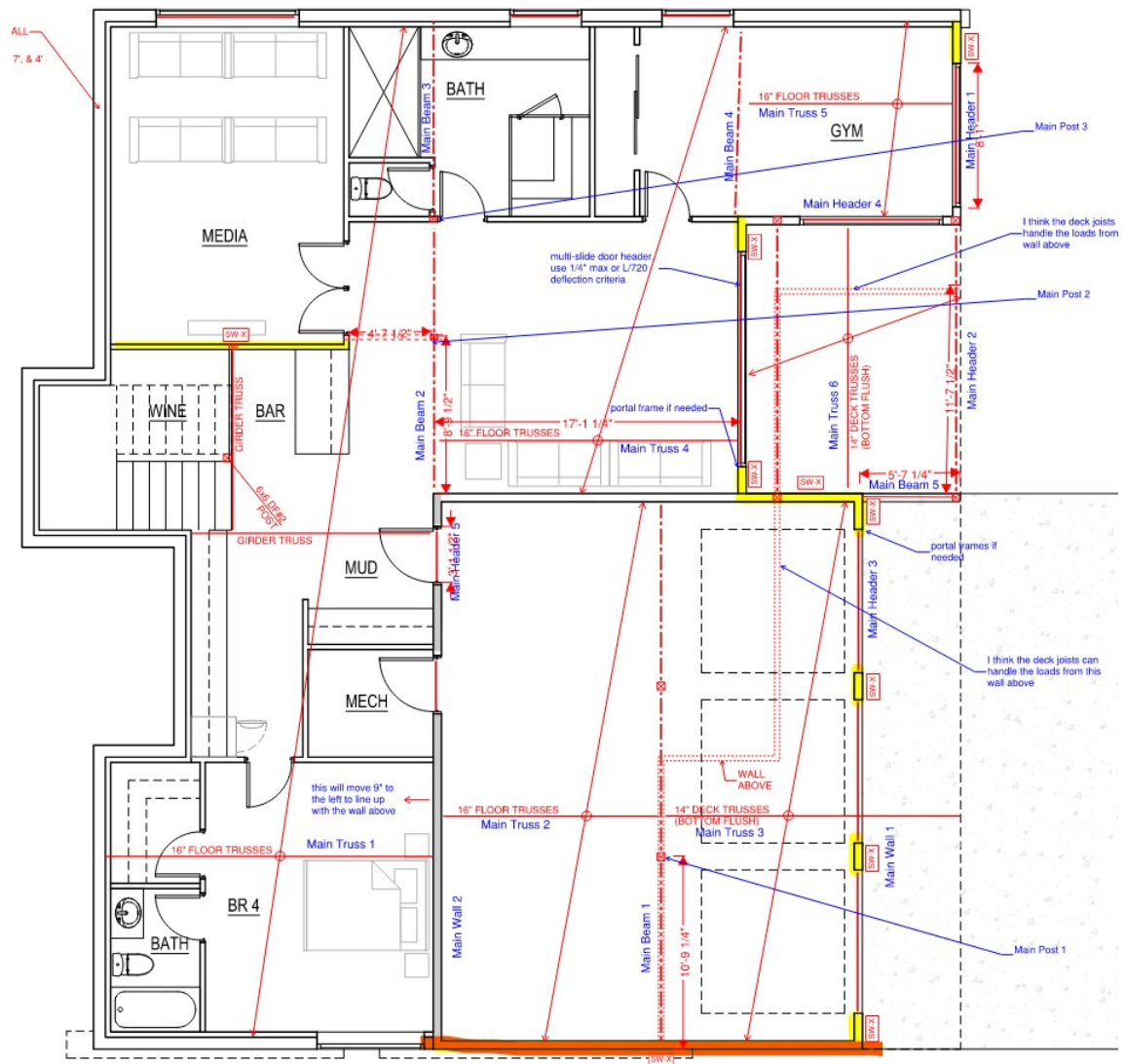
- $D+S$
- $D+0.6W$
- $D+0.7E$
- $D+0.75 \times 0.6W+0.75L+0.75S$
- $D+0.75 \times 0.7 E+0.75L+0.75S$
- $0.6 D+0.6W$
- $0.6D+0.7E$

LRFD load combination for concrete design:

- $1.4D$
- $1.2D+1.6S$
- $1.2D+1.6S+0.5W$
- $1.2D+1.0W+0.5S$
- $1.2D+1.0E+0.2S$
- $0.9D+1.0W$
- $0.9D+1.0E$

Shear Wall Design for Lateral Load in East-West Direction per NDS-SDPWS2015

First Floor- Shear wall



$$V_{EQ} := V_{\text{story}_1} \cdot \frac{750\text{ft}^2}{2780\text{ft}^2} = 8.804 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

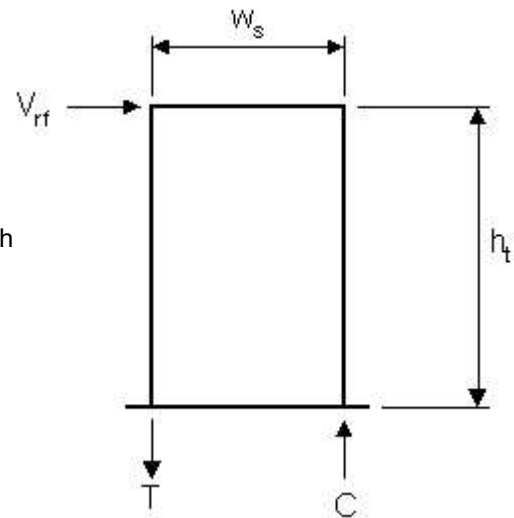
$$V_{\text{wind}} := (P_{\text{wind_wall_windward.A}} - P_{\text{wind_wall_leeward.A}}) \cdot 17.5\text{ft} \cdot h_{\text{floor}_3} = 15.99 \cdot \text{kip}$$

Wind load

$$L_s := 24\text{ft}$$

Wal height

Total shear wall length

**First Segment:**

$$h_t := 9\cdot\text{ft}$$

$$w_s := 24\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 0.375 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{\text{rf},w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{\text{rf},w} = 9.59\cdot\text{kip}$$

$$V_{\text{rf},E} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{\text{rf},E} = 6.16\cdot\text{kip}$$

$$M_{\text{ot},w} := V_{\text{rf},w} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},w} = 86.3\cdot\text{kip}\cdot\text{ft}$$

$$M_{\text{ot},E} := V_{\text{rf},E} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},E} = 55.5\cdot\text{kip}\cdot\text{ft}$$

Resisting Forces

$$P_{rf} := 0 = 0 \cdot \text{lbf}$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 2.592 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 18.662 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 400 \cdot \text{plf}$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 257 \cdot \text{plf}$$

Seismic shear flow

$$w_{all,w} := \frac{(WSP) \cdot v_{w,7} \cdot 16.8d \cdot 4 \cdot n}{\Omega_s} = 490 \cdot \text{plf} \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{all,w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,w}}{w_{all,w}} = 0.816$$

$$\text{check}_{wv} = "OK"$$

$$w_{all,E} := \frac{(WSP) \cdot v_{s,7} \cdot 16.8d \cdot 4 \cdot n}{\Omega_s} = 350 \cdot \text{plf} \quad \text{check}_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{all,E}} > 1.0, "NG", "OK" \right)$$

$$\text{check}_{wE} = "OK"$$

Single Sided 7/16" sheathing w/ 8d @ 4" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Sill Plate Anchorage

$C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness

$dia_a := 0.625\text{in}$ Anchor Diameter

$sp_a := 32\text{in}$ Anchor spacing

$Z_{ll} := v_{A.625_2x} \cdot C_D = 1.488 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := \max(w_{v,w}, w_{v,E}) \cdot sp_a = 1.066 \cdot \text{kip}$ Shear load to each anchor

$Check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.716$

Check_a = "OK"

Use 5/8" Dia. Anchor at 32"o.c. (7" min. embed)

Holdown

$T := \frac{\max(M_{ot,w}, M_{ot,E}) - M_{res}}{w_s} = 2.82 \cdot \text{kip}$

$check_T := \text{if}(T > 150\text{lb}, "HD REQ'D", "NOT REQ'D")$ check_T = "HD REQ'D"

$T_{all} := HDU4 = 4.565 \cdot \text{kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.618$

check_{HD} = "OK"

Anchor

$$d_b := \begin{cases} \frac{5}{8}\text{in} & \text{if } T_{all} = HDU4 \vee T_{all} = HDU5 \\ \frac{7}{8}\text{in} & \text{if } T_{all} = HDU8 \\ 1\text{in} & \text{otherwise} \end{cases}$$
 Bolt diameter

$d_b = 0.625 \cdot \text{in}$

$A_b := \frac{\pi}{4} \cdot (d_b)^2 = 0.307 \cdot \text{in}^2$ Area of bolt including thread

$F_y := 36\text{ksi}$ Nominal strength of bolt-F1554

$\Omega := 1.67$ ASD factor

$T_{a.capacity} := \frac{A_b \cdot F_y}{\Omega} = 6.614 \cdot \text{kip}$

$Check_{anchor} := \left(\text{if}\left(\frac{T}{T_{a.capacity}} \leq 1, "OK", "NG"\right) \right)$ $\frac{T}{T_{a.capacity}} = 0.426$

Check_{anchor} = "OK"

Footing Uplift

$$L_{ftg} := 24\text{ft}$$

Length of footing

$$t_{slab} := 0\text{in}$$

Slab thickness

$$W_{ftg} := 16\text{in}$$

Width of footing

$$\text{trib}_{slab} := 0\text{ft}$$

Slab tributary

$$t_{ftg} := 6\text{in}$$

Thickness of footing

$$t_{stem} := 6\text{in}$$

Stem wall thick

$$\text{trib}_{flr} := 0$$

Floor/deck tributary

$$ht_{stem} := 18\text{in}$$

Stem wall height

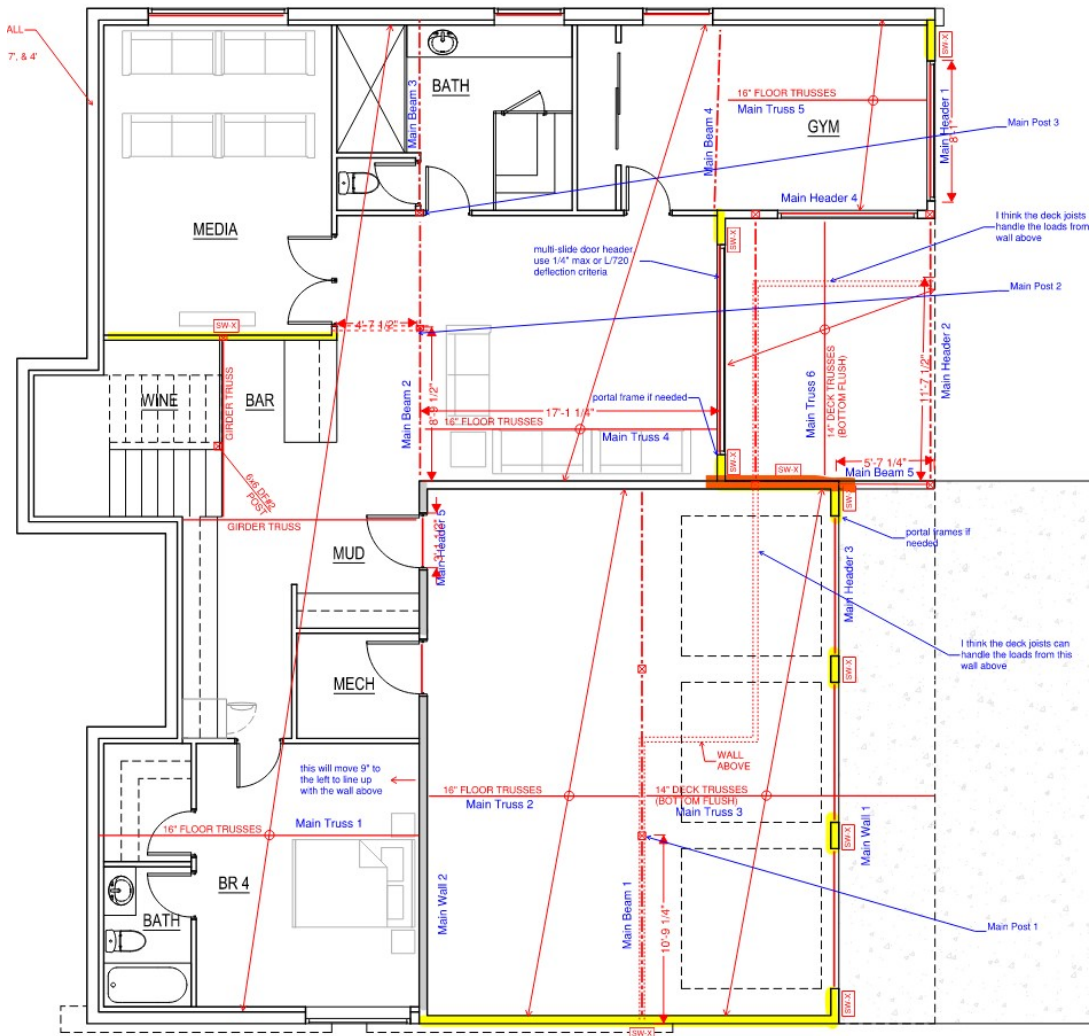
$$w_{t_{resist}} := \left[\left(W_{ftg} \cdot t_{ftg} + t_{slab} \cdot \text{trib}_{slab} + t_{stem} \cdot ht_{stem} \right) \cdot L_{ftg} \cdot 150\text{pcf} + (P_{rf} + P_w) \dots \right] + \left[\left(\frac{W_{ftg} - t_{stem}}{2} \right) \cdot ht_{stem} \cdot L_{ftg} \cdot 120\text{pcf} \right] = 9.492 \cdot \text{kip}$$

$$e_{ftg} := \frac{M_{ot,w}}{w_{t_{resist}}} = 9.097 \cdot \text{ft}$$

$$\text{check}_{ftg} := \text{if} \left(e_{ftg} \leq \frac{L_{ftg}}{2}, \text{"OK"}, \text{"NG-Axial Load is Outside of Footing"} \right)$$

check_{ftg} = "OK"

Use 1'-4"W x 8"D footing w/ (3) #4 Long., #4 @ 10" o.c. Trans



$$V_{EQ} := V_{story_1} \cdot \frac{900\text{ft}^2}{2780\text{ft}^2} = 10.565 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

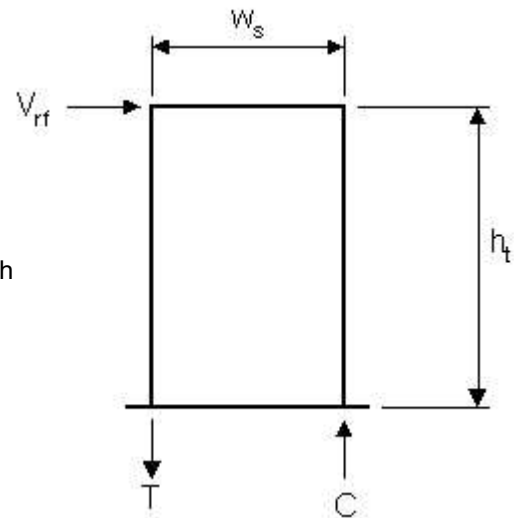
$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot 19\text{ft} \cdot h_{floor_3} = 17.361 \cdot \text{kip}$$

Wind load

$$L_s := 24\text{ft}$$

Wall height

Total shear wall length

**First Segment:**

$$h_t := 9\cdot\text{ft}$$

$$w_s := 24\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 0.375 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{\text{rf},w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{\text{rf},w} = 10.42 \cdot \text{kip}$$

$$V_{\text{rf},E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{\text{rf},E} = 7.4 \cdot \text{kip}$$

$$M_{\text{ot},w} := V_{\text{rf},w} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},w} = 93.7 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot},E} := V_{\text{rf},E} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},E} = 66.6 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := (DL_{floor}) \cdot \left(\frac{15ft}{2} \right) \cdot w_s + 5626lb = 8.326 \times 10^3 \cdot lb$$

Total gravity load on wall

$$P_{rf} = 8.326 \cdot kip$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 2.592 \cdot kip$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 78.61 \cdot kip \cdot ft$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 434 \cdot plf$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 308 \cdot plf$$

Seismic shear flow

$$w_{all,w} := \frac{(WSP) \cdot v_{w,7} \cdot 16.8d.4 \cdot n}{\Omega_s} = 980 \cdot plf \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{all,w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,w}}{w_{all,w}} = 0.443$$

check_{wv} = "OK"

$$w_{all,E} := \frac{(WSP) \cdot v_{s,7} \cdot 16.8d.4 \cdot n}{\Omega_s} = 700 \cdot plf \quad \text{check}_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{all,E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,E}}{w_{all,E}} = 0.44$$

check_{wE} = "OK"

Single Sided 7/16" sheathing w/ 8d @ 4" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Sill Plate Anchorage $C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 0.5\text{in}$ Anchor Diameter $sp_a := 32\text{in}$ Anchor spacing

$Z_{ll} := \phi_{A.625_2x} \cdot C_D = 1.488 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := \max(w_{v,w}, w_{v,E}) \cdot sp_a = 1.157 \cdot \text{kip}$ Shear load to each anchor

$Check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.778$

$Check_a = "OK"$

Use 5/8" Dia. Anchor at 32" o.c. (7" min. embed)

Holdown

$T := \frac{\max(M_{ot,w}, M_{ot,E} \cdot \Omega_o) - M_{res}}{w_s} = 3.658 \cdot \text{kip}$

$check_T := \text{if}(T > 150\text{lbf}, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$

$T_{all} := HDU4 = 4.565 \cdot \text{kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.801$

$check_{HD} = "OK"$

Anchor

$d_b := \begin{cases} \frac{5}{8}\text{in} & \text{if } T_{all} = HDU4 \vee T_{all} = HDU5 \\ \frac{7}{8}\text{in} & \text{if } T_{all} = HDU8 \\ 1\text{in} & \text{otherwise} \end{cases}$ Bolt diameter

$d_b = 0.625 \cdot \text{in}$

$A_b := \frac{\pi}{4} \cdot (d_b)^2 = 0.307 \cdot \text{in}^2$ Area of bolt including thread

$F_y := 36\text{ksi}$ Nominal strength of bolt-F1554

$\Omega := 1.67$ ASD factor

$$T_{a.capacity} := \frac{A_b \cdot F_y}{\Omega} = 6.614 \cdot \text{kip}$$

$$\text{Check}_{\text{anchor}} := \left(\text{if} \left(\frac{\frac{T}{2}}{T_{a.capacity}} \leq 1, \text{"OK"}, \text{"NG"} \right) \right) \frac{\frac{T}{2}}{T_{a.capacity}} = 0.277$$

Check_{anchor} = "OK"

Footing Uplift

$$L_{\text{ftg}} := 12\text{ft}$$

Length of footing

$$t_{\text{slab}} := 4\text{in}$$

Slab thickness

$$W_{\text{ftg}} := 18\text{in}$$

Width of footing

$$\text{trib}_{\text{slab}} := 18\text{ft}$$

Slab tributary

$$t_{\text{ftg}} := 6\text{in}$$

Thickness of footing

$$t_{\text{stem}} := 6\text{in}$$

Stem wall thick

$$\text{trib}_{\text{flr}} := 0$$

Floor/deck tributary

$$\text{ht}_{\text{stem}} := 18\text{in}$$

Stem wall height

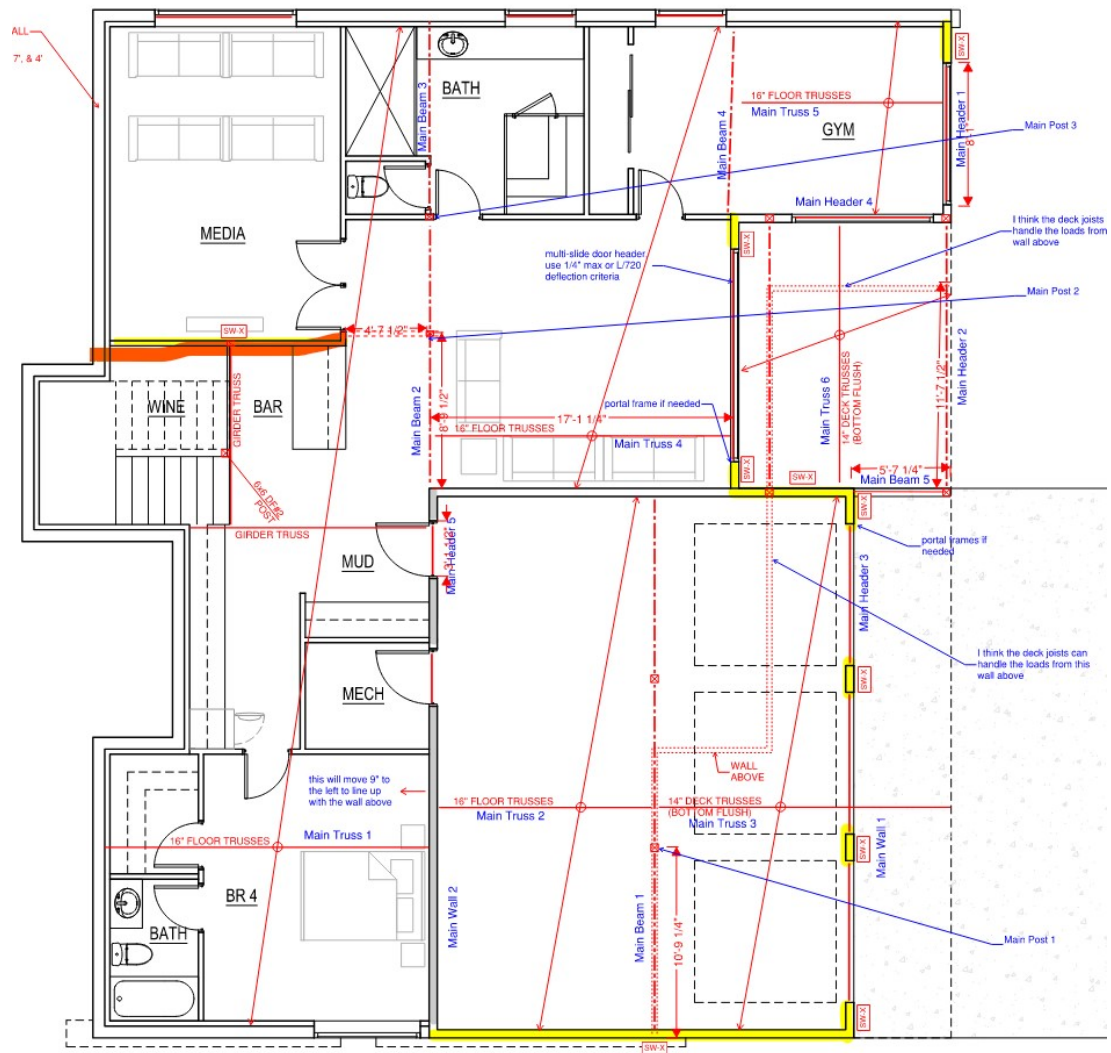
$$w_{t_{\text{resist}}} := \left[\left(W_{\text{ftg}} \cdot t_{\text{ftg}} + t_{\text{slab}} \cdot \text{trib}_{\text{slab}} + t_{\text{stem}} \cdot \text{ht}_{\text{stem}} \right) \cdot L_{\text{ftg}} \cdot 150\text{pcf} + (P_{\text{rf}} + P_{\text{w}}) \dots \right. \\ \left. + \left(\frac{W_{\text{ftg}} - t_{\text{stem}}}{2} \right) \cdot \text{ht}_{\text{stem}} \cdot L_{\text{ftg}} \cdot 120\text{pcf} \right] = 25.498 \cdot \text{kip}$$

$$e_{\text{ftg}} := \frac{M_{\text{ot,w}}}{w_{t_{\text{resist}}}} = 3.677 \cdot \text{ft}$$

$$\text{check}_{\text{ftg}} := \text{if} \left(e_{\text{ftg}} \leq \frac{L_{\text{ftg}}}{2}, \text{"OK"}, \text{"NG-Axial Load is Outside of Footing"} \right)$$

check_{ftg} = "OK"

Use 1'-4"W x 8"D footing w/ (3) #4 Long., #4 @ 10" o.c. Trans



$$V_{EQ} := V_{story_1} \cdot \frac{1000\text{ft}^2}{2780\text{ft}^2} = 11.739 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

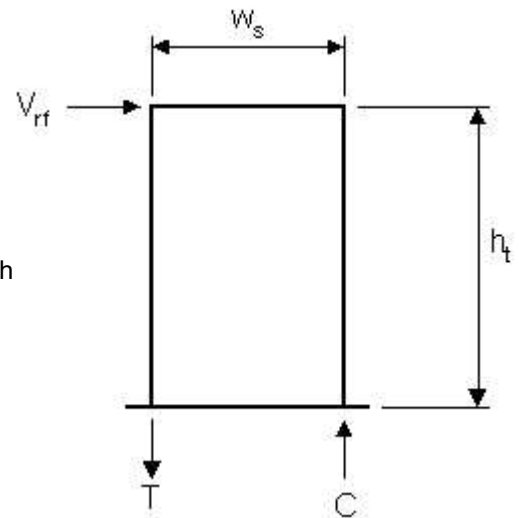
$$V_{wind} := (p_{wind_wall_windward} \cdot A - p_{wind_wall_leeward} \cdot A) \cdot 22\text{ft} \cdot h_{floor_3} = 20.102 \cdot \text{kip}$$

Wind load

$$L_s := 13.5\text{ft} + 12\text{ft}$$

Wall height

Total shear wall length

**First Segment:**

$$h_t := 9\cdot\text{ft}$$

$$w_s := 12\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 0.75 \quad \text{check}_{\text{ratio}} := \text{if}\left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"}\right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if}\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{\text{rf},w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s}\right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{\text{rf},w} = 5.68 \cdot \text{kip}$$

$$V_{\text{rf},E} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s}\right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{\text{rf},E} = 3.87 \cdot \text{kip}$$

$$M_{\text{ot},w} := V_{\text{rf},w} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},w} = 51.1 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot},E} := V_{\text{rf},E} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},E} = 34.8 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0 = 0 \cdot \text{lb} \cdot \text{f}$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{\text{ext}} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 1.296 \cdot \text{kip}$$

$$M_{\text{res}} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{\text{res}} = 4.666 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 473 \cdot \text{plf}$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 322 \cdot \text{plf}$$

Seismic shear flow

$$w_{\text{all},w} := \frac{(WSP) \cdot v_{w,7-16.8d.3} \cdot n}{\Omega_s} = 630 \cdot \text{plf} \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{\text{all},w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,w}}{w_{\text{all},w}} = 0.751$$

$$\text{check}_{wv} = "OK"$$

$$w_{\text{all},E} := \frac{(WSP) \cdot v_{s,7-16.8d.3} \cdot n}{\Omega_s} = 450 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{\text{all},E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,E}}{w_{\text{all},E}} = 0.716$$

$$\text{check}_{wE} = "OK"$$

Double Sided 7/16" sheathing w/ 8d @ 3" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Sill Plate Anchorage

$$C_D := 1.6$$

$$t_{sp} := 1.5\text{in} \quad \text{Sill plate thickness} \quad dia_a := 0.625\text{in} \quad \text{Anchor Diameter} \quad sp_a := 16\text{in} \quad \text{Anchor spacing}$$

$$Z_{ll} := \phi A_{625_2x} \cdot C_D = 1.488 \cdot \text{kip} \quad \text{Allowable load parallel to grain (ref. NDS table 12)}$$

$$V_{sp} := \max(w_{v,w}, w_{v,E} \cdot \Omega_o) \cdot sp_a = 1.074 \cdot \text{kip} \quad \text{Shear load to each anchor}$$

$$Check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK") \quad ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.722$$

$$Check_a = "OK"$$

Use 5/8" Dia. Anchor at 16"o.c. (7" min. embed)

Holdown

$$T := \frac{\max(M_{ot,w}, M_{ot,E}) - M_{res}}{w_s} = 3.868 \cdot \text{kip}$$

$$check_T := \text{if}(T > 150\text{lbf}, "HD REQ'D", "NOT REQ'D") \quad check_T = "HD REQ'D"$$

$$T_{all} := HDU4 = 4.565 \cdot \text{kip} \quad \text{Allowable tension load}$$

$$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right) \quad ratio := \frac{T}{T_{all}} = 0.847$$

$$check_{HD} = "OK"$$

Anchor

$$d_b := \begin{cases} \frac{5}{8}\text{in} & \text{if } T_{all} = HDU4 \vee T_{all} = HDU5 \\ \frac{7}{8}\text{in} & \text{if } T_{all} = HDU8 \\ 1\text{in} & \text{otherwise} \end{cases} \quad \text{Bolt diameter}$$

$$d_b = 0.625 \cdot \text{in}$$

$$A_b := \frac{\pi}{4} \cdot (d_b)^2 = 0.307 \cdot \text{in}^2 \quad \text{Area of bolt including thread}$$

$$F_y := 36\text{ksi} \quad \text{Nominal strength of bolt-F1554}$$

$$\Omega := 1.67 \quad \text{ASD factor}$$

$$T_{a.capacity} := \frac{A_b \cdot F_y}{\Omega} = 6.614 \cdot \text{kip}$$

$$Check_{anchor} := \left(\text{if} \left(\frac{T}{T_{a.capacity}} \leq 1, "OK", "NG" \right) \right) \quad \frac{T}{T_{a.capacity}} = 0.292$$

$$Check_{anchor} = "OK"$$

Footing Uplift

$$L_{ftg} := 13.5 \text{ ft}$$

Length of footing

$$t_{slab} := 4 \text{ in}$$

Slab thickness

$$W_{ftg} := 18 \text{ in}$$

Width of footing

$$\text{trib}_{slab} := 18 \text{ ft}$$

Slab tributary

$$t_{ftg} := 6 \text{ in}$$

Thickness of footing

$$t_{stem} := 6 \text{ in}$$

Stem wall thick

$$\text{trib}_{flr} := 0$$

Floor/deck tributary

$$ht_{stem} := 18 \text{ in}$$

Stem wall height

$$wt_{resist} := \left[\left(W_{ftg} \cdot t_{ftg} + t_{slab} \cdot \text{trib}_{slab} + t_{stem} \cdot ht_{stem} \right) \cdot L_{ftg} \cdot 150 \text{ pcf} + (P_{rf} + P_w) \dots \right. \\ \left. + \left(\frac{W_{ftg} - t_{stem}}{2} \right) \cdot ht_{stem} \cdot L_{ftg} \cdot 120 \text{ pcf} \right] = 17.698 \cdot \text{kip}$$

$$e_{ftg} := \frac{M_{ot,w}}{wt_{resist}} = 2.886 \cdot \text{ft}$$

$$\text{check}_{ftg} := \text{if} \left(e_{ftg} \leq \frac{L_{ftg}}{2}, \text{"OK"}, \text{"NG-Axial Load is Outside of Footing"} \right)$$

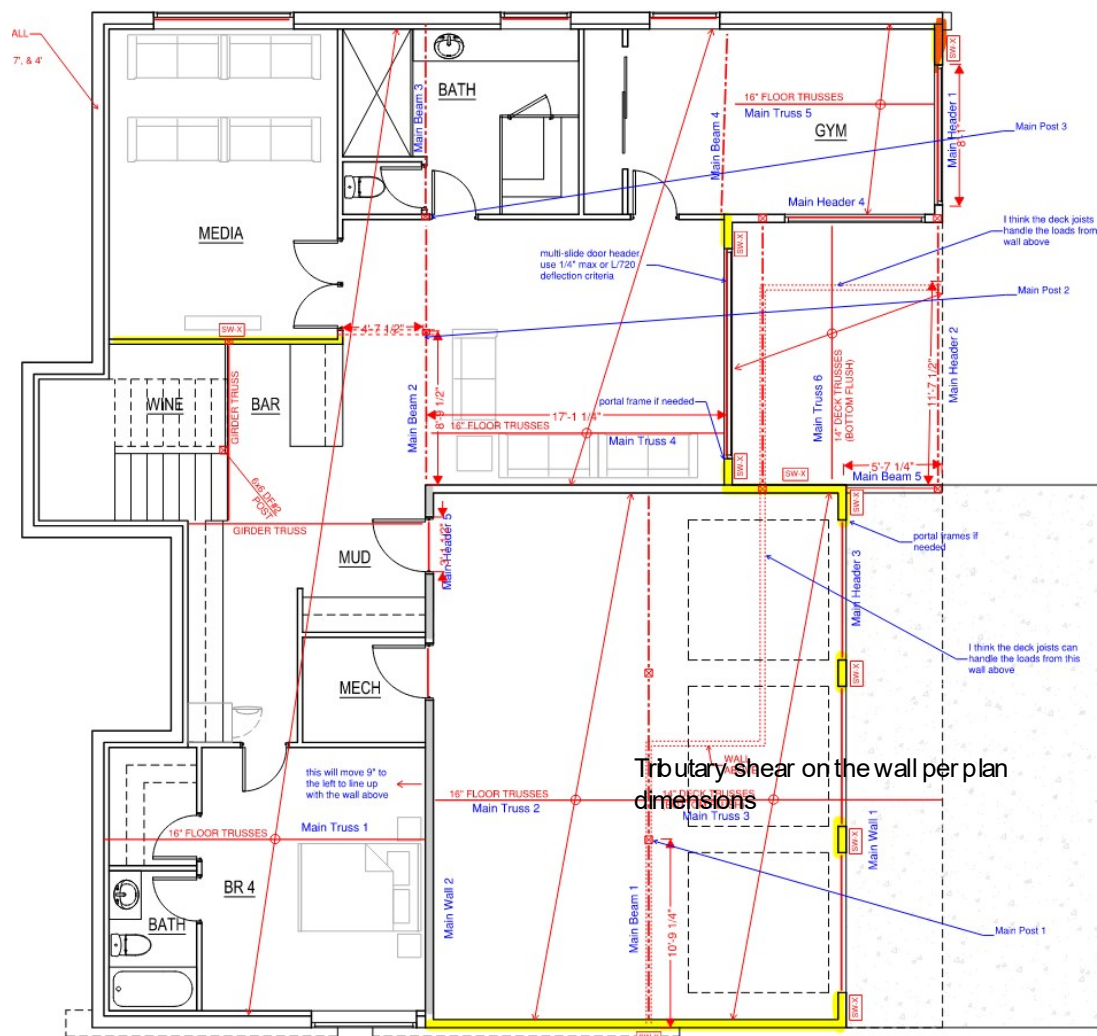
$$\text{check}_{ftg} = \text{"OK"}$$

Use 1'-4"W x 8"D footing w/ (3) #4 Long., #4 @ 10" o.c. Trans

Shear Wall Design for Lateral Load in North-South Direction per NDS-SDPWS2015

Firs Floor- Shear wall

As the retaining wall at west side is high up, it is assumed that the base shear for half of building (west side) will be taken by concrete walls for shear in north-south direction and below would be wood frame wall designed for other half in east side.



$$V_{EQ} := V_{story_1} \cdot \frac{177\text{ft}^2}{2780\text{ft}^2} = 2.078 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot 4\text{ft} \cdot (h_{floor_3}) = 3.655 \cdot \text{kip}$$

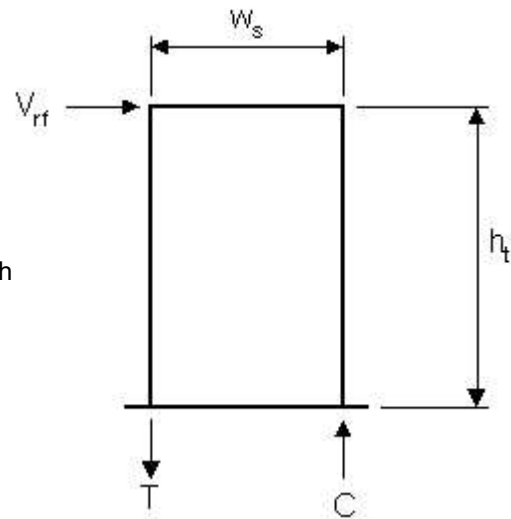
Wind load

$$h_t := 9 \cdot \text{ft}$$

Wall height

$$L_s := 2\text{ft} + 4\text{in}$$

Total shear wall length

**First Segment:**

$$w_s := (3\text{ft} + 8\text{in})$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 2.455 \quad \text{check}_{ratio} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

check_{ratio} = "OK"

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

(WSP) = 0.9

Overturning Forces

$$V_{rf.w} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{rf.w} = 3.45 \cdot \text{kip}$$

$$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{rf.E} = 2.29 \cdot \text{kip}$$

$$M_{ot.w} := V_{rf.w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.w} = 31 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.E} = 20.6 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := (DL_{floor}) \cdot \left(\frac{12 \text{ ft}}{2} \right) \cdot w_s$$

Total gravity load on wall

$$P_{rf} = 0.33 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weight load

$$P_w = 0.396 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 0.799 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 940 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 623 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.4} \cdot n}{\Omega_s} = 924.3 \cdot \text{plf} \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, \text{"NG"}, \text{"OK"} \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 1.017$$

check_{wv} = "NG"It is less than 5%
above-EOR is OK

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.4} \cdot n}{\Omega_s} = 660.2 \cdot \text{plf} \quad \text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, \text{"NG"}, \text{"OK"} \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.944$$

check_{wE} = "OK"

Double Sided 7/16" sheathing w/ 8d @ 4" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Sill Plate Anchorage

$$C_D := 1.6$$

$$t_{sp} := 1.5\text{in} \quad \text{Sill plate thickness} \quad dia_a := 0.5\text{in} \quad \text{Anchor Diameter} \quad sp_a := 12\text{in} \quad \text{Anchor spacing}$$

$$Z_{ll} := v_{A.625_2x} \cdot C_D = 1.488 \cdot \text{kip} \quad \text{Allowable load parallel to grain (ref. NDS table 12)}$$

$$V_{sp} := \max(w_{v.w}, w_{v.E} \cdot \Omega_o) \cdot sp_a = 1.558 \cdot \text{kip} \quad \text{Shear load to each anchor}$$

$$Check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK") \quad ratio_a := \frac{V_{sp}}{Z_{ll}} = 1.047$$

Check_a = "NG"

Use 5/8" Dia. Anchor at 30" o.c. (7" min. embed)

It is less than 5%
above-EOR is OK**Holdown**

$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 13.807 \cdot \text{kip}$$

$$check_T := \text{if}(T > 150\text{lbf}, "HD REQ'D", "NOT REQ'D") \quad check_T = "HD REQ'D"$$

$$T_{all} := 2HDU8 = 13.53 \cdot \text{kip} \quad \text{Allowable tension load}$$

$$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right) \quad ratio := \frac{T}{T_{all}} = 1.02$$

check_{HD} = "NG"It is less than 5%
above-EOR is OK

Anchor

$$d_b := \begin{cases} \frac{5}{8}\text{in} & \text{if } T_{all} = HDU4 \vee T_{all} = HDU5 \\ \frac{7}{8}\text{in} & \text{if } T_{all} = HDU8 \\ 1\text{in} & \text{otherwise} \end{cases} \quad \text{Bolt diameter}$$

$$d_b = 1 \cdot \text{in}$$

$$A_b := \frac{\pi}{4} \cdot (d_b)^2 = 0.785 \cdot \text{in}^2 \quad \text{Area of bolt including thread}$$

$$F_y := 36\text{ksi} \quad \text{Nominal strength of bolt-F1554}$$

$$\Omega := 1.67 \quad \text{ASD factor}$$

$$T_{a.capacity} := \frac{A_b \cdot F_y}{\Omega} = 16.931 \cdot \text{kip}$$

$$\text{Check}_{\text{anchor}} := \left(\text{if} \left(\frac{T}{T_{\text{a.capacity}}} \leq 1, \text{"OK"}, \text{"NG"} \right) \right) \quad \frac{T}{T_{\text{a.capacity}}} = 0.816$$

Check_{anchor} = "OK"

Footing Uplift

$$L_{\text{ftg}} := 12\text{ft}$$

Length of footing

$$t_{\text{slab}} := 4\text{in}$$

Slab thickness

$$W_{\text{ftg}} := 16\text{in}$$

Width of footing

$$\text{trib}_{\text{slab}} := 27\text{ft}$$

Slab tributary

$$t_{\text{ftg}} := 6\text{in}$$

Thickness of footing

$$t_{\text{stem}} := 6\text{in}$$

Stem wall thick

$$\text{trib}_{\text{flr}} := 0$$

Floor/deck tributary

$$\text{ht}_{\text{stem}} := 18\text{in}$$

Stem wall height

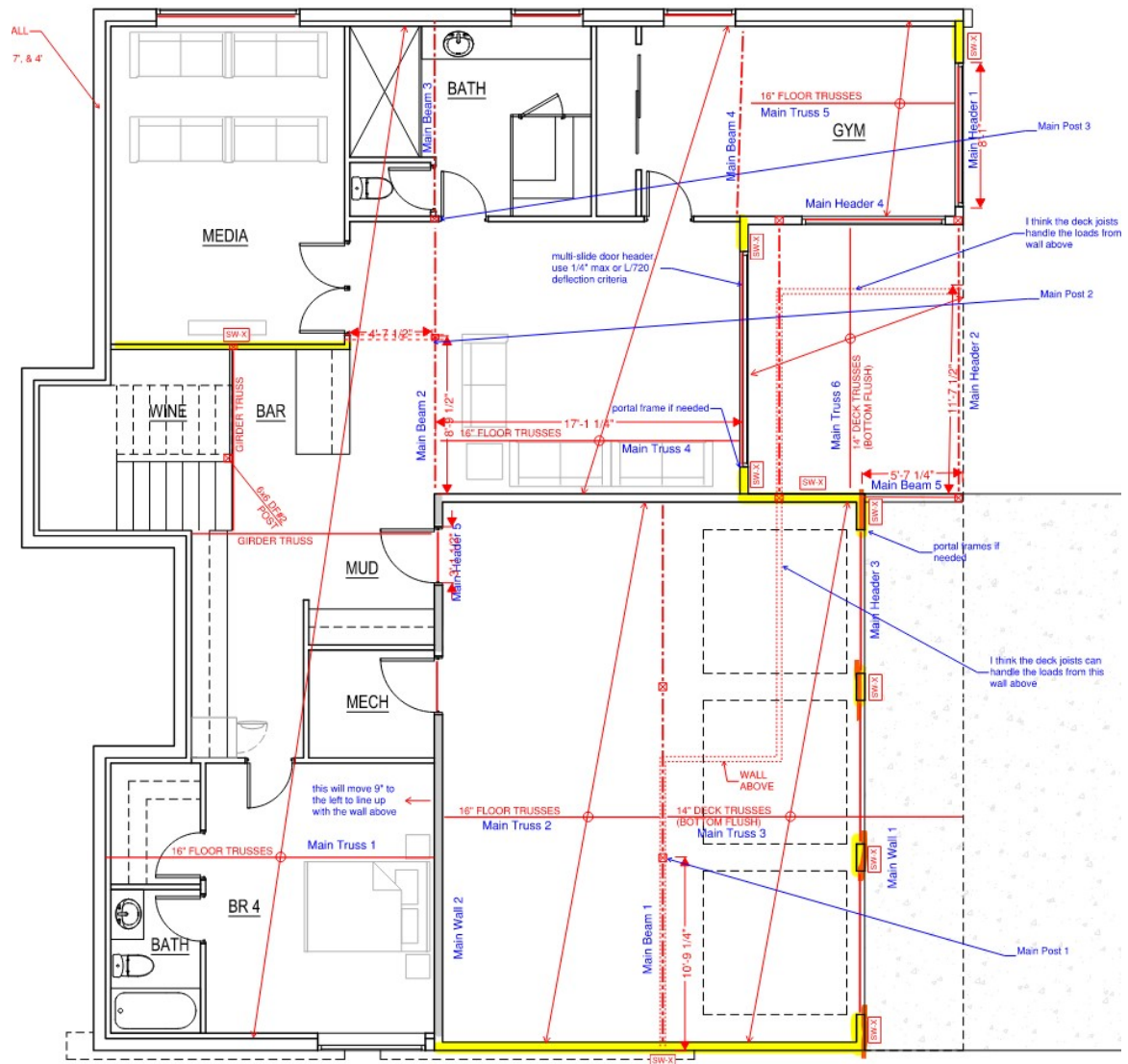
$$w_{\text{t.resist}} := \left[\left(W_{\text{ftg}} \cdot t_{\text{ftg}} + t_{\text{slab}} \cdot \text{trib}_{\text{slab}} + t_{\text{stem}} \cdot \text{ht}_{\text{stem}} \right) \cdot L_{\text{ftg}} \cdot 150\text{pcf} + \left(P_{\text{rf}} + P_{\text{w}} \right) \dots \right. \\ \left. + \left(\frac{W_{\text{ftg}} - t_{\text{stem}}}{2} \right) \cdot \text{ht}_{\text{stem}} \cdot L_{\text{ftg}} \cdot 120\text{pcf} \right] = 20.376 \cdot \text{kip}$$

$$e_{\text{ftg}} := \frac{M_{\text{ot.w}}}{w_{\text{t.resist}}} = 1.522 \cdot \text{ft}$$

$$\text{check}_{\text{ftg}} := \text{if} \left(e_{\text{ftg}} \leq \frac{L_{\text{ftg}}}{2}, \text{"OK"}, \text{"NG-Axial Load is Outside of Footing"} \right)$$

check_{ftg} = "OK"

Use 1'-4"W x 8"D footing w/ (3) #4 Long., #4 @ 10" o.c. Trans



$$V_{EQ} := V_{story_1} \cdot \frac{250ft^2}{2780ft^2} + V_{EQ} = 5.013 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (p_{wind_wall_windward} \cdot A - p_{wind_wall_leeward} \cdot A) \cdot 6ft \cdot (h_{floor_3}) + V_{wind} = 9.137 \cdot kip$$

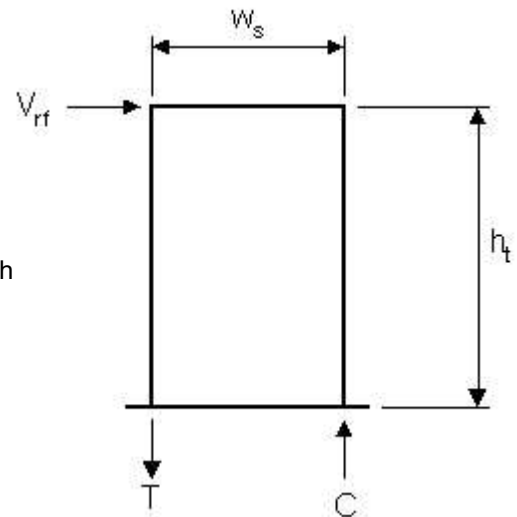
Wind load

$$h_t := 9\text{ft}$$

$$L_s := 2\text{ft} + 3\text{ft}$$

Wal height

Total shear wall length

**First Segment:**

$$w_s := 2\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 4.5$$

$$\text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"NG"}$$

these segments will be
designed as portal frame

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \text{ Aspect ratio factor}$$

$$(\text{WSP}) = 0.7$$

Overturning Forces

$$V_{\text{rf},w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall
(ASD)

$$V_{\text{rf},w} = 2.19 \cdot \text{kip}$$

$$V_{\text{rf},E} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of
wall (ASD)

$$V_{\text{rf},E} = 1.4 \cdot \text{kip}$$

$$M_{\text{ot},w} := V_{\text{rf},w} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},w} = 19.7 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot},E} := V_{\text{rf},E} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},E} = 12.6 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := (DL_{floor}) \cdot \left(\frac{12ft}{2} \right) \cdot w_s$$

Total gravity load on wall

$$P_{rf} = 0.18 \cdot \text{kip}$$

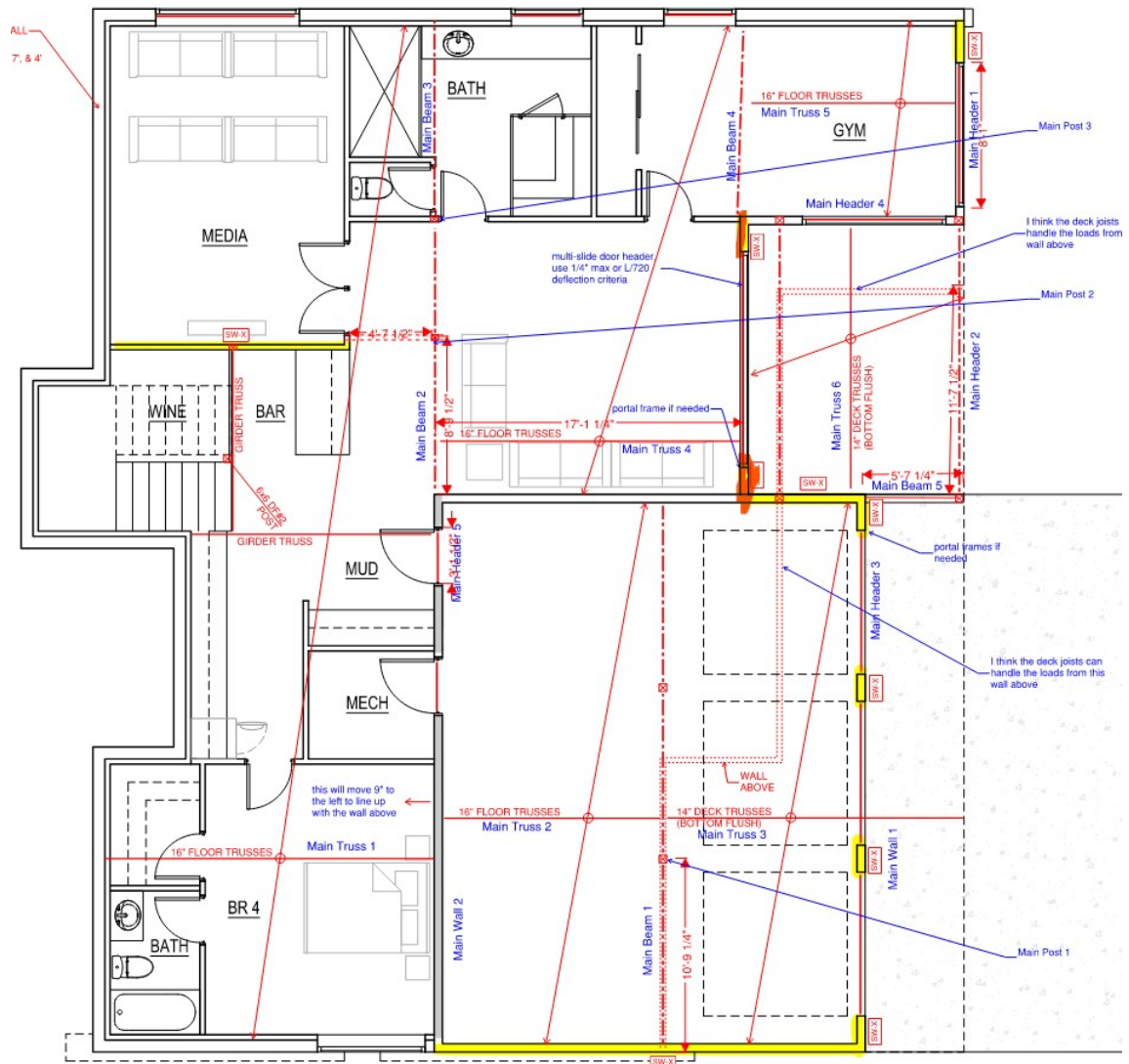
$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.216 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 0.238 \cdot \text{kip} \cdot \text{ft}$$



$$V_{EQ} := V_{story_1} \cdot \frac{850\text{ft}^2}{2780\text{ft}^2} + V_{EQ} = 14.991 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot 14\text{ft} \cdot (h_{floor_3}) + V_{wind} = 21.929 \cdot \text{kip}$$

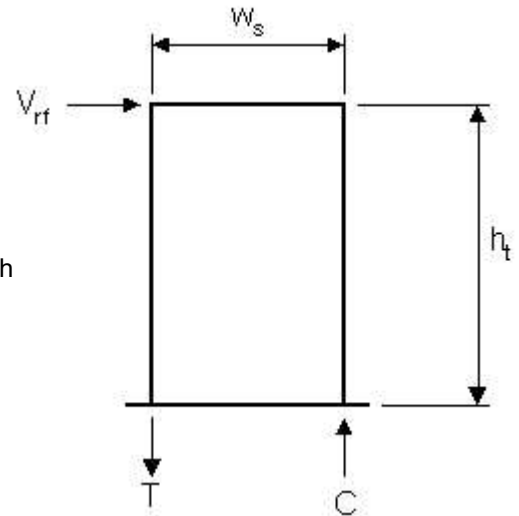
Wind load

$$h_t := 9\text{ft}$$

$$L_s := 2.3\text{ft}$$

Wal height

Total shear wall length

**First Segment:**

$$w_s := 2\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 4.5$$

$$\text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"NG"}$$

smaller segments will
be simpson strong wall

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \text{ Aspect ratio factor}$$

$$(\text{WSP}) = 0.7$$

Overturning Forces

$$V_{\text{rf},w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall
(ASD)

$$V_{\text{rf},w} = 4.39 \cdot \text{kip}$$

$$V_{\text{rf},E} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of
wall (ASD)

$$V_{\text{rf},E} = 3.5 \cdot \text{kip}$$

$$M_{\text{ot},w} := V_{\text{rf},w} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},w} = 39.5 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot},E} := V_{\text{rf},E} \cdot h_t$$

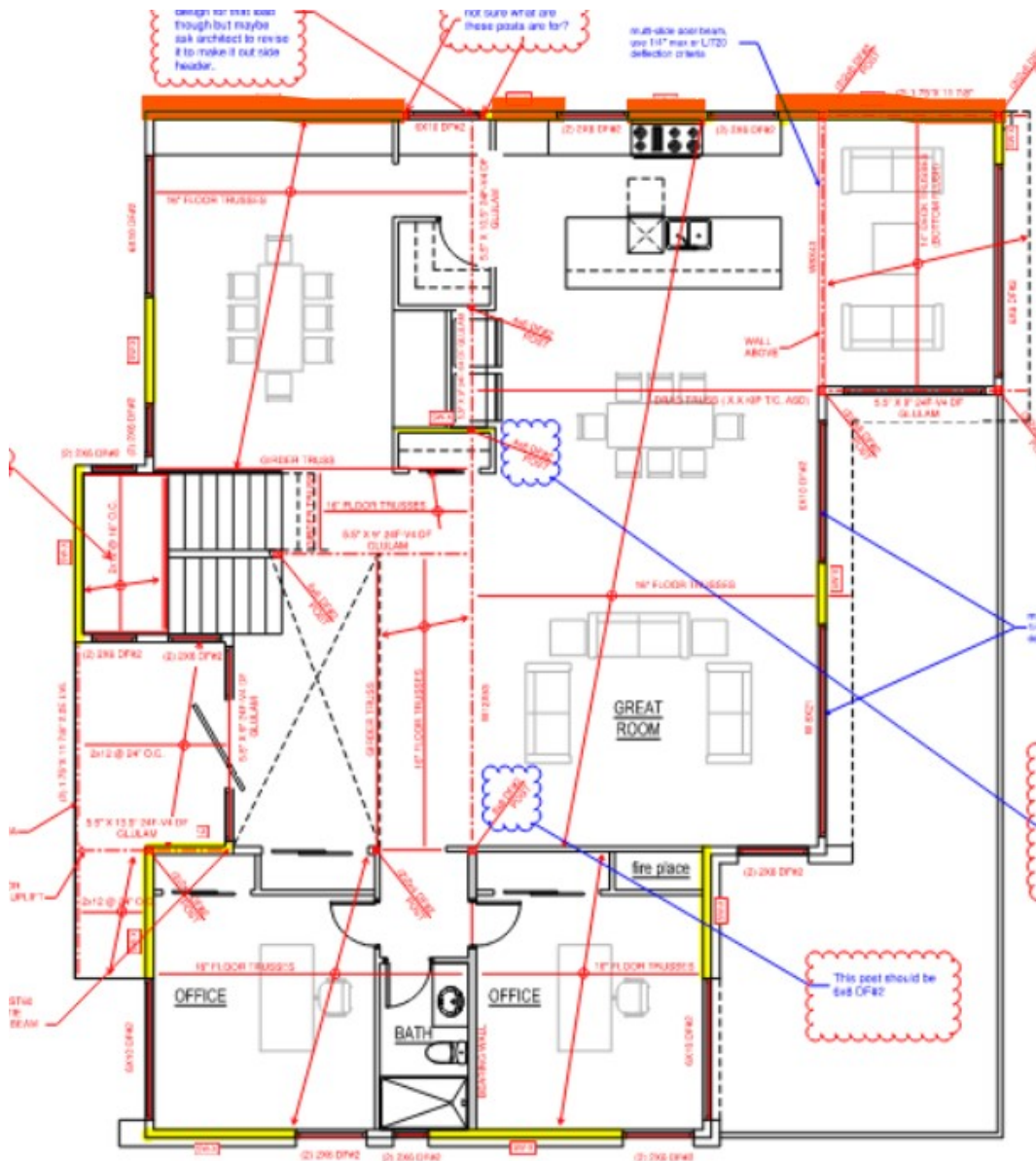
Overturning moment (ASD)

$$M_{\text{ot},E} = 31.5 \cdot \text{kip} \cdot \text{ft}$$

Use simpson-tie strong wall
WSH 24x9

Shear Wall Design for Lateral Load in East-West Direction per NDS-SDPWS2015

Second Floor- Shear wall



$$V_{EQ} := V_{story_2} \cdot \frac{488\text{ft}^2}{2250\text{ft}^2} = 5.96 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

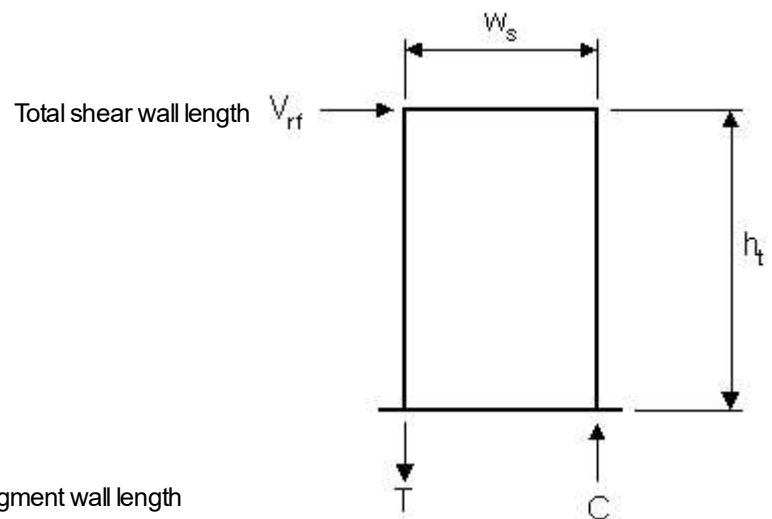
$$V_{wind} := (P_{wind_wall_windward.A} - P_{wind_wall_leeward.A}) \cdot 12\text{ft} \cdot (h_{floor_3} - h_{floor_1}) = 8.406 \cdot \text{kip}$$

Wind load

$$h_t := 10 \cdot \text{ft}$$

Wall height

$$L_s := 9.58\text{ft} + 13\text{ft} + 15.67\text{ft}$$



First Segment:

$$w_s := 9.58\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.044 \quad \text{check}_{ratio} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

check_{ratio} = "OK"

$$(WSP) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

(WSP) = 1.0

Overturning Forces

$$V_{rf,w} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$V_{rf,w} = 1.26 \cdot \text{kip}$

$$V_{rf,E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$V_{rf,E} = 1.04 \cdot \text{kip}$

$$M_{ot.w} := V_{rf.w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.w} = 12.6 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.E} = 10.4 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0 = 0 \cdot \text{lb} \cdot \text{ft}$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 1.15 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 3.304 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 132 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 109 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.6} \cdot n}{\Omega_s} = 335 \cdot \text{plf}$$

$$\text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.394$$

$$\text{check}_{wv} = "OK"$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.6} \cdot n}{\Omega_s} = 240 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.454$$

$$\text{check}_{wE} = "OK"$$

Single Sided 7/16" sheathing w/ 8d @ 6" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 8\text{in}$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v.w} \cdot sp_a = 0.088 \cdot \text{kip}$ Shear load to each nail

$check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.39$

$check_a = "OK"$

Use 16d Nail at 8"o.c. Staggered

Holdown

$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 2.382 \cdot \text{kip}$

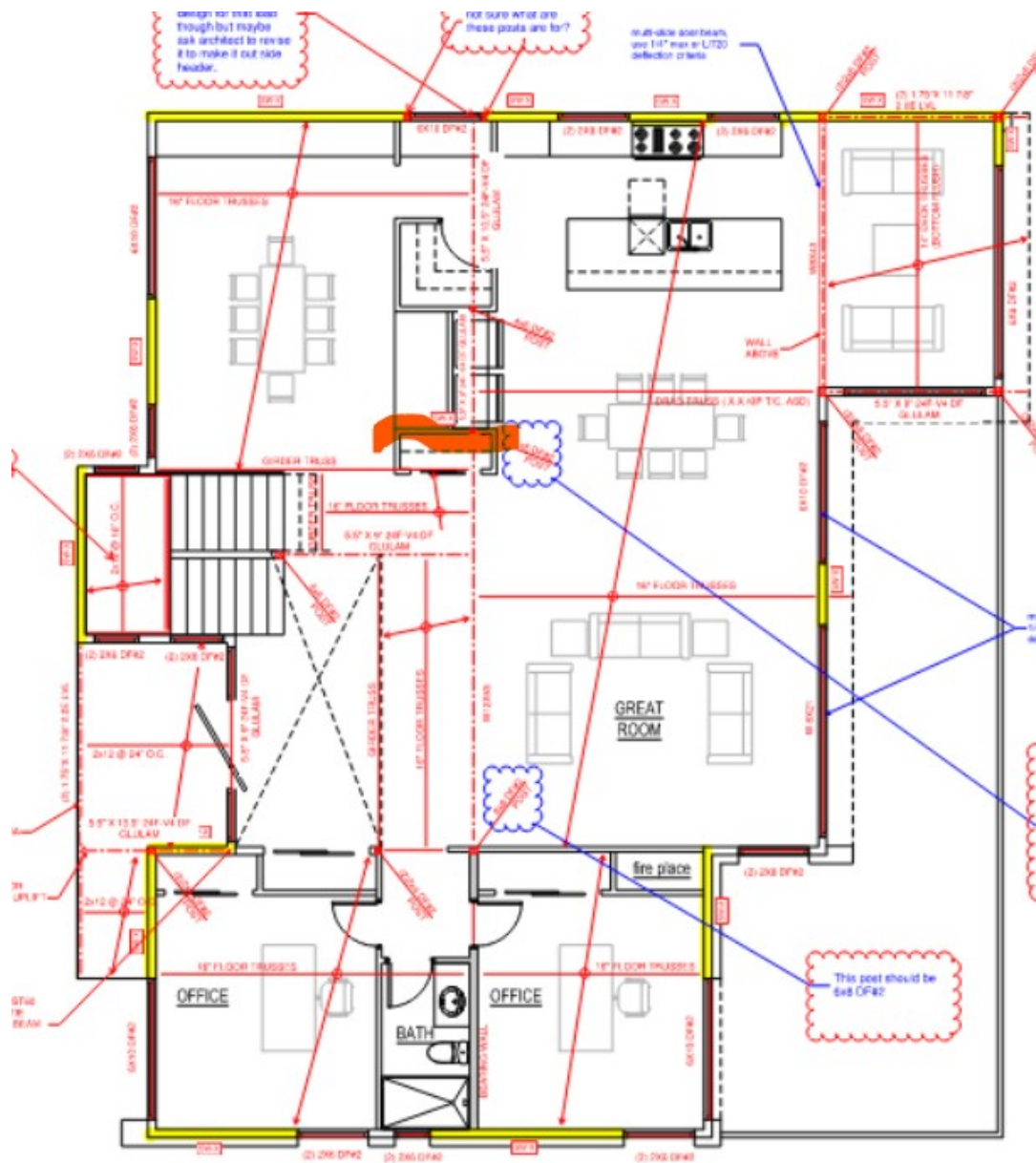
$check_T := \text{if}(T > 150\text{lb}, "HD REQ'D", "NOT REQ'D")$

$check_T = "HD REQ'D"$

$T_{all} := HDU4 = 4.565 \cdot \text{kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.522$

$check_{HD} = "OK"$



$$V_{EQ} := V_{story2} \cdot \frac{840\text{ft}^2}{2250\text{ft}^2} = 10.258 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

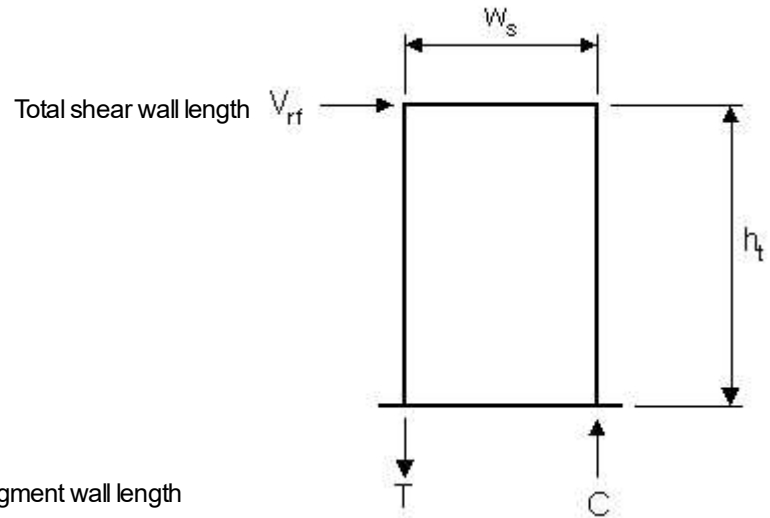
$$V_{wind} := (P_{wind_wall_windward.A} - P_{wind_wall_leeward.A}) \cdot 20\text{ft} \cdot (h_{floor3} - h_{floor1}) = 14.01 \cdot \text{kip}$$

Wind load

$$h_t := 10 \cdot \text{ft}$$

$$L_s := 5 \text{ ft} + 10 \text{ in}$$

Wal height

**First Segment:**

$$w_s := 5 \text{ ft} + 10 \text{ in}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.714$$

$$\text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \text{ Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{\text{rf},w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall
(ASD)

$$V_{\text{rf},w} = 8.41 \cdot \text{kip}$$

$$V_{\text{rf},E} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of
wall (ASD)

$$V_{\text{rf},E} = 7.18 \cdot \text{kip}$$

$$M_{\text{ot},w} := V_{\text{rf},w} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},w} = 84.1 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot},E} := V_{\text{rf},E} \cdot h_t$$

Overturning moment (ASD)

$$M_{\text{ot},E} = 71.8 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{\text{rf}} := 5000 \text{ lbf} = 5 \times 10^3 \cdot \text{lbf}$$

Total gravity load on wall
from forte

$$P_{\text{rf}} = 5 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.7 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 9.975 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 1441 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 1231 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.2} \cdot n}{\Omega_s} = 1640 \cdot \text{plf}$$

$$\text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.879$$

check_{wv} = "OK"

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.2} \cdot n}{\Omega_s} = 1170 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 1.05$$

check_{wE} = "NG"It is less than 5%
above-EOR is OK

double Sided 7/16" sheathing w/ 8d @ 2" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 1.5\text{in}$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v.w} \cdot sp_a = 0.18 \cdot \text{kip}$ Shear load to each nail

$check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.798$

$check_a = "OK"$

Use 16d Nail at 8"o.c. Staggered

Holdown

$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 29.065 \cdot \text{kip}$$

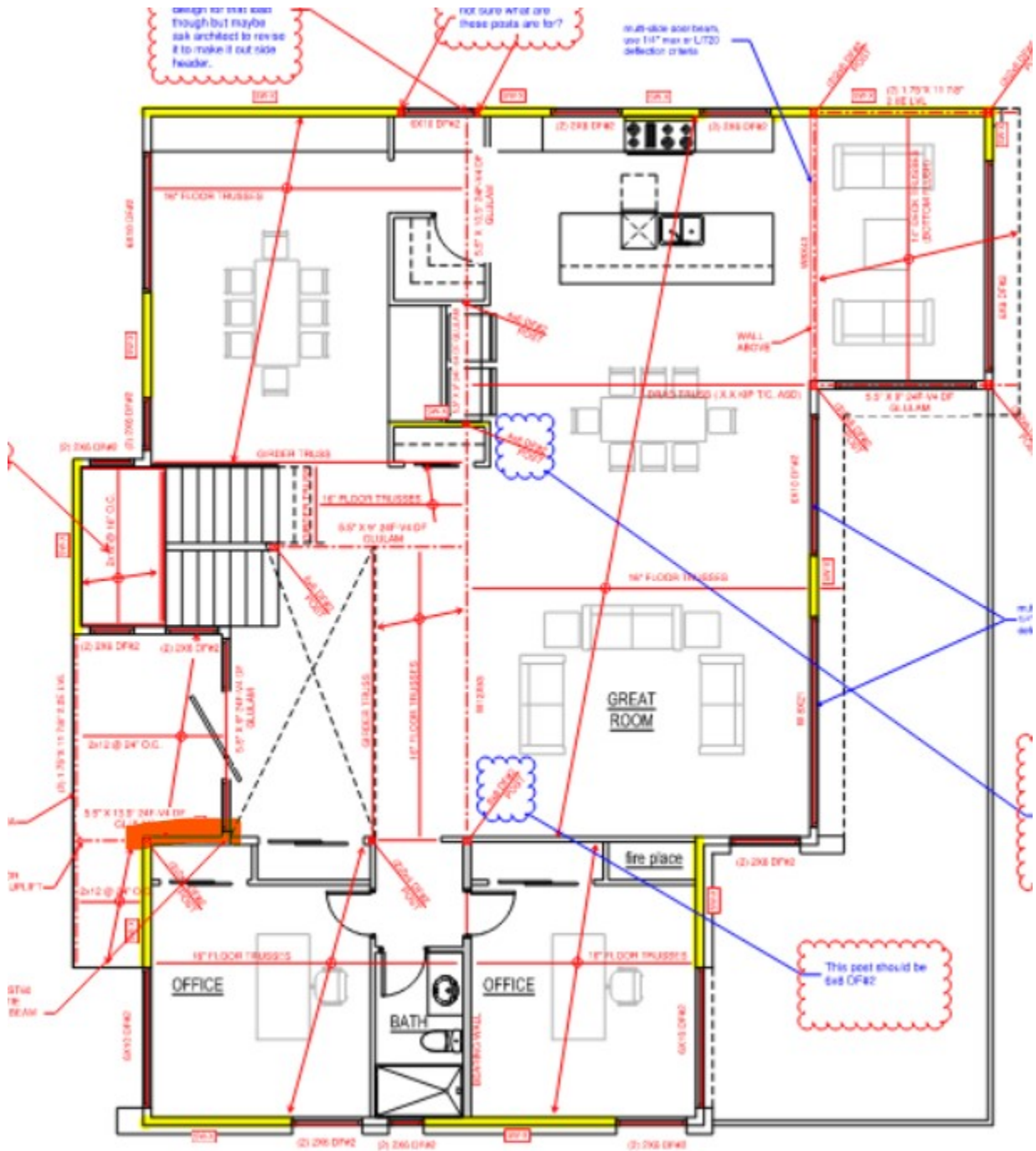
$check_T := \text{if}(T > 150\text{lb}, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$

$T_{all} := 3CMST12_38 = 27.645 \cdot \text{kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 1.05$

$check_{HD} = "NG"$

It is less than 5%
above-EOR is OK



$$V_{EQ} := V_{story2} \cdot \frac{483\text{ft}^2}{2250\text{ft}^2} = 5.898 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (P_{wind_wall_windward} \cdot A - P_{wind_wall_leeward} \cdot A) \cdot 17\text{ft} \cdot (h_{floor3} - h_{floor1}) = 11.909 \cdot \text{kip}$$

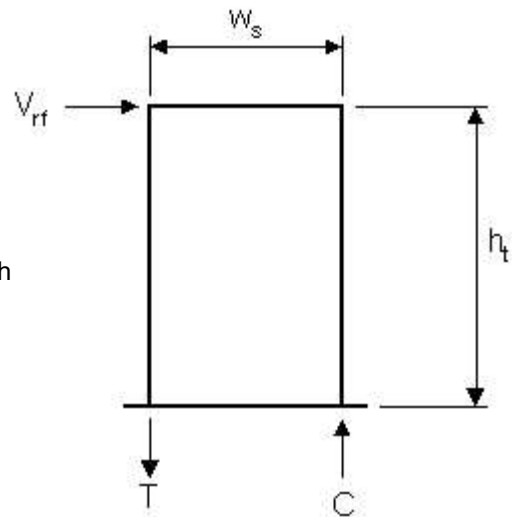
Wind load

$$h_t := 10\text{ft}$$

$$L_s := 5\text{ft}$$

Wall height

Total shear wall length



First Segment:

$$w_s := 5\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 2 \quad \text{check}_{ratio} := \text{if} \left(\frac{h_t}{w_s} > 3.5, "NG", "OK" \right)$$

$$\text{check}_{ratio} = "OK"$$

$$(WSP) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(WSP) = 1.0$$

Overturning Forces

$$V_{rf,w} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall (ASD)

$$V_{rf,w} = 7.15 \cdot \text{kip}$$

$$V_{rf,E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of wall (ASD)

$$V_{rf,E} = 4.13 \cdot \text{kip}$$

$$M_{ot.W} := V_{rf.W} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.W} = 71.5 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.E} = 41.3 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.6 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 0.9 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.W} := \frac{V_{rf.W}}{w_s} = 1429 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 826 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.W} := \frac{(WSP) \cdot v_{w.7-16.8d.2} \cdot n}{\Omega_s} = 1640 \cdot \text{plf}$$

$$\text{check}_{wv} := \text{if} \left(\frac{w_{v.W}}{w_{all.W}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.W}}{w_{all.W}} = 0.871$$

$$\text{check}_{wv} = "OK"$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7-16.8d.2} \cdot n}{\Omega_s} = 1170 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.706$$

$$\text{check}_{wE} = "OK"$$

Double Sided 7/16" sheathing w/ 8d @ 2" **O.C.**, Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$ $t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 1.5\text{in}$ Nail spacing

$$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$$

Allowable load parallel to grain (ref. NDS table 12)

$$V_{sp} := w_{v.w} \cdot sp_a = 0.179 \cdot \text{kip}$$

Shear load to each nail

$$\text{Check}_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK") \quad \text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 0.792$$

 $\text{Check}_a = "OK"$ **Use 16d Nail at 5"o.c. Staggered****Holdown**

$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 20.465 \cdot \text{kip}$$

$$\text{check}_T := \text{if}(T > 150\text{lbf}, "HD \text{ REQ'D}", "NOT \text{ REQ'D}')$$

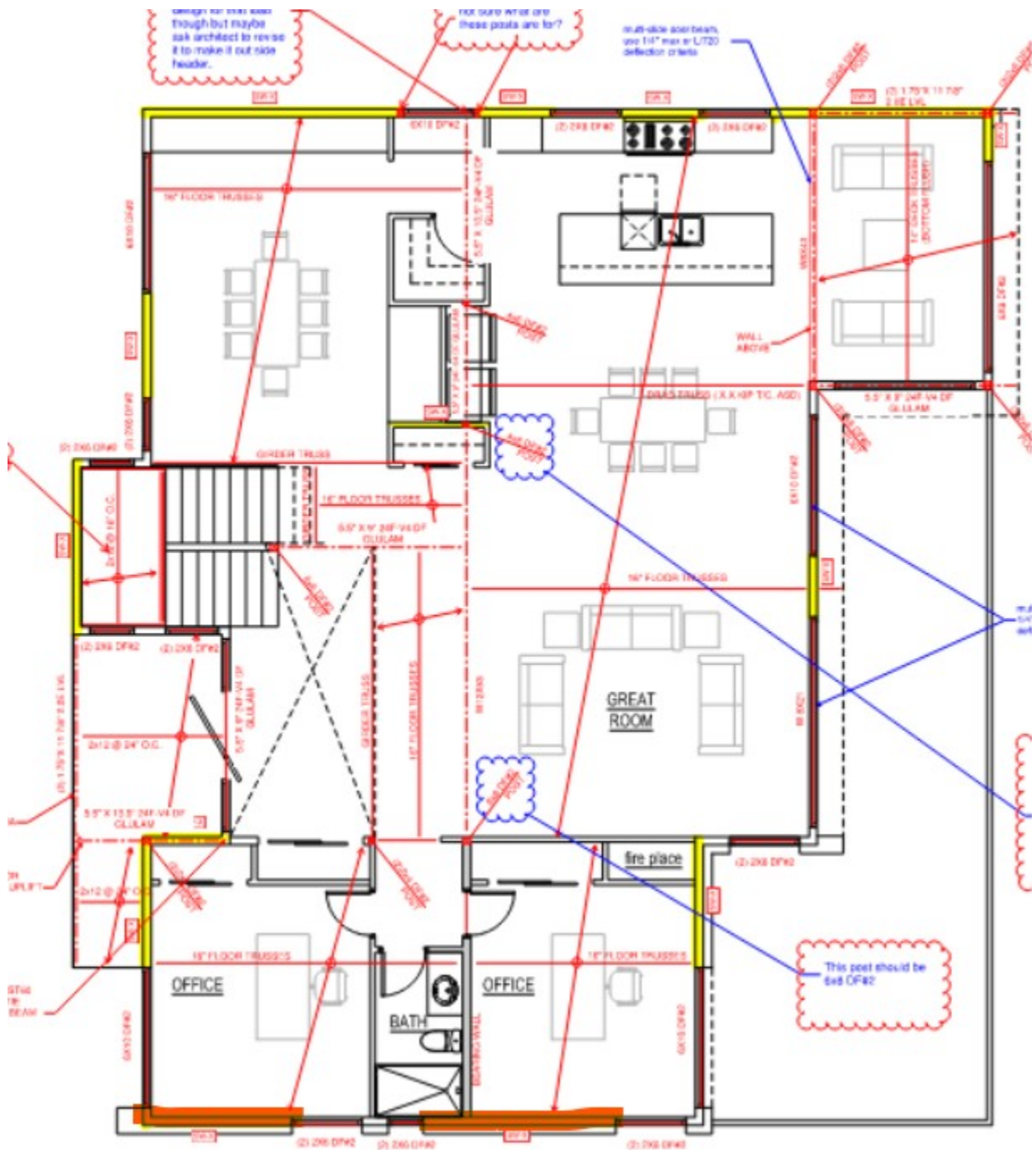
 $\text{check}_T = "HD \text{ REQ'D}"$

$$T_{all} := 3CMST12_{38} = 27.645 \cdot \text{kip}$$

Allowable tension load

$$\text{check}_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right) \quad \text{ratio} := \frac{T}{T_{all}} = 0.74$$

 $\text{check}_{HD} = "OK"$



$$V_{EQ} := V_{story_2} \cdot \frac{281\text{ft}^2}{2250\text{ft}^2} = 3.432\text{-kip}$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot 9\text{ft} \cdot (h_{floor_3} - h_{floor_1}) = 6.305\text{-kip}$$

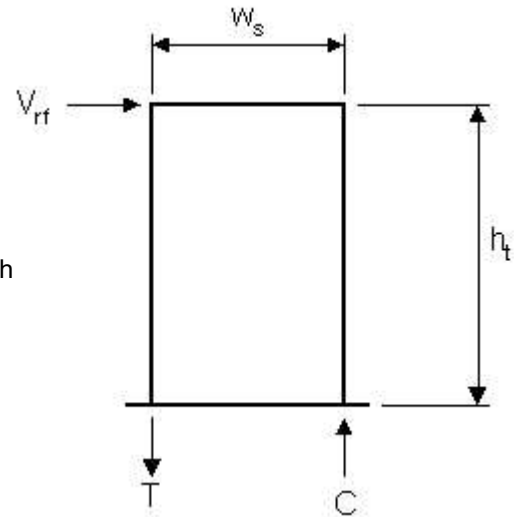
Wind load

$$h_t := 10\text{ft}$$

$$L_s := 6.5\text{ft} + 3.5\text{ft} + 11\text{ft}$$

Wal height

Total shear wall length

**First Segment:**

$$w_s := 3.5\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 2.857 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 0.9$$

Overturning Forces

$$V_{\text{rf},w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{\text{rf},w} = 0.63 \cdot \text{kip}$$

$$V_{\text{rf},E} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{\text{rf},E} = 0.4 \cdot \text{kip}$$

$$M_{\text{ot},w} := V_{\text{rf},w} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{\text{ot},w} = 6.3 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot},E} := V_{\text{rf},E} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{\text{ot},E} = 4 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0 = 0 \cdot \text{lb} \cdot \text{f}$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.42 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 0.441 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 180 \cdot \text{plf}$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 114 \cdot \text{plf}$$

Seismic shear flow

$$w_{all,w} := \frac{(WSP) \cdot v_{w,7_16.8d.6} \cdot n}{\Omega_s} = 299.1 \cdot \text{plf} \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{all,w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,w}}{w_{all,w}} = 0.602$$

check_{wv} = "OK"

$$w_{all,E} := \frac{(WSP) \cdot v_{s,7_16.8d.6} \cdot n}{\Omega_s} = 214.3 \cdot \text{plf} \quad \text{check}_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{all,E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,E}}{w_{all,E}} = 0.534$$

check_{wE} = "OK"

Single Sided 7/16" sheathing w/ 8d @ 2" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 8\text{in}$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v,w} \cdot sp_a = 0.12 \cdot \text{kip}$ Shear load to each nail

$Check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.532$

$Check_a = "OK"$

Use 16d Nail at 8"o.c. Staggered

Holdown

$T := \frac{\max(M_{ot,w}, M_{ot,E} \cdot \Omega_o) - M_{res}}{w_s} = 2.734 \cdot \text{kip}$

$check_T := \text{if}(T > 150\text{lbf}, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$

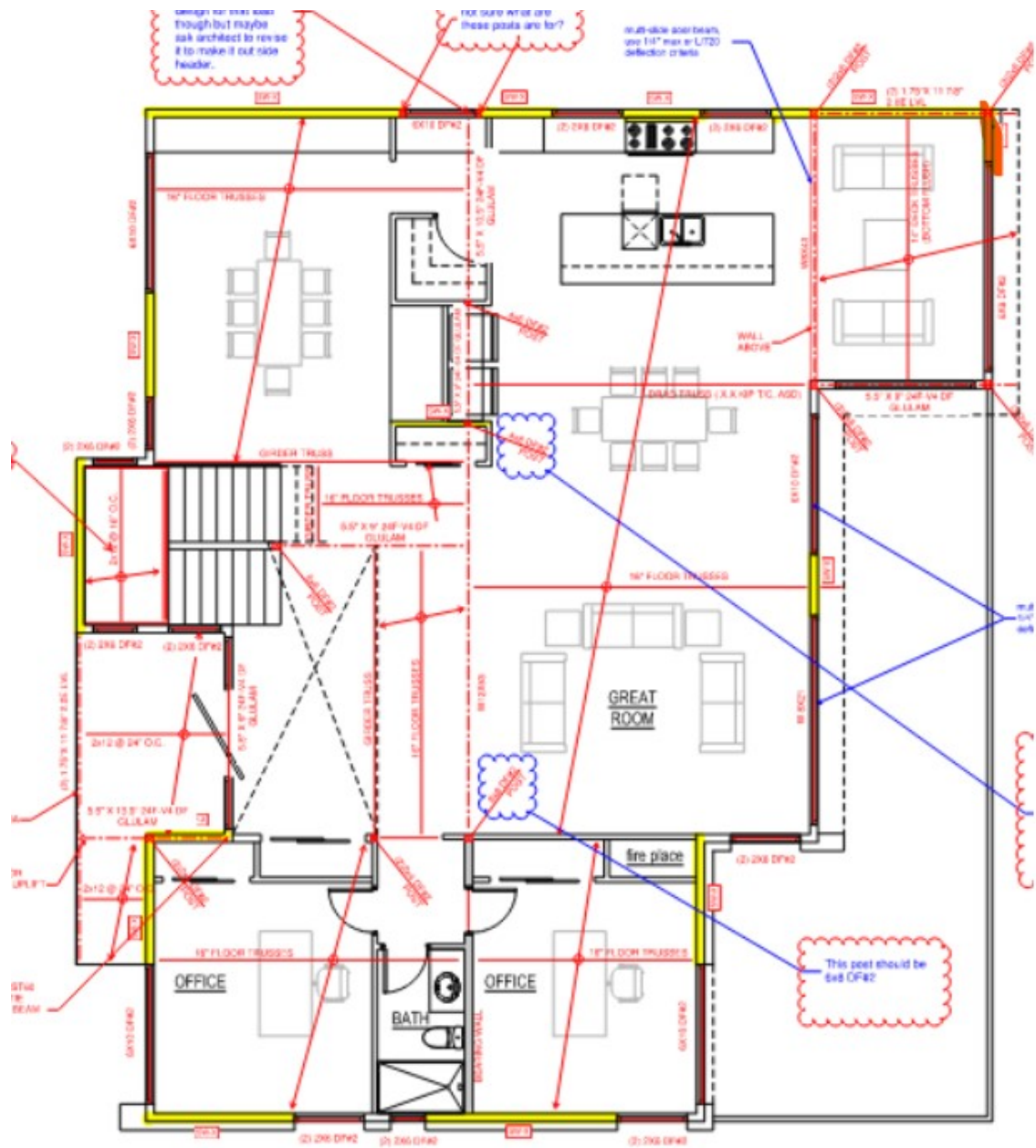
$T_{all} := HDU4 = 4.565 \cdot \text{kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.6$

$check_{HD} = "OK"$

Shear Wall Design for Lateral Load in North-South Direction per NDS-SDPWS2015

Second Floor- Shear wall



$$V_{EQ} := V_{story_2} \cdot \frac{80ft^2}{2250ft^2} = 0.977 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (P_{wind_wall_windward.A} - P_{wind_wall_leeward.A}) \cdot 6ft \cdot (h_{floor_3} - h_{floor_1}) = 4.203 \cdot kip$$

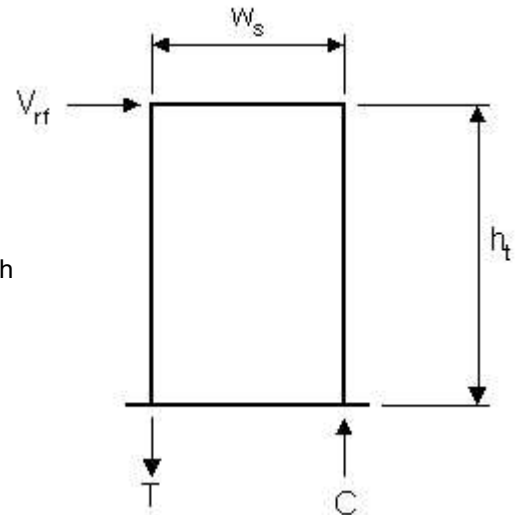
Wind load

$$h_t := 10\text{ft}$$

$$L_s := 3\text{ft}$$

Wal height

Total shear wall length

**First Segment:**

$$w_s := 3\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 3.333 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 0.8$$

Overturning Forces

$$V_{rf.w} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)} \quad V_{rf.w} = 2.52 \cdot \text{kip}$$

$$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)} \quad V_{rf.E} = 0.68 \cdot \text{kip}$$

$$M_{ot.w} := V_{rf.w} \cdot h_t \quad \text{Overturning moment (ASD)} \quad M_{ot.w} = 25.2 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t \quad \text{Overturning moment (ASD)} \quad M_{ot.E} = 6.8 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0 = 0 \cdot \text{lbf}$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s) \quad \text{Wal self weightload}$$

$$P_w = 0.36 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)} \quad M_{res} = 0.324 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2 \quad \text{sides}$$

$$\Omega_s := 2.0 \quad \text{(ASD shear capacity factor ref. section 4.3.3)}$$

$$\Omega_o := 2.5 \quad \text{Overstrength factor}$$

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 841 \cdot \text{plf} \quad \text{Wind shear flow}$$

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 228 \cdot \text{plf} \quad \text{Seismic shear flow}$$

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.4} \cdot n}{\Omega_s} = 816.7 \cdot \text{plf} \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, \text{"NG"}, \text{"OK"} \right) \quad \text{It is less than 5\% above-EOR is OK}$$

$$\frac{w_{v.w}}{w_{all.w}} = 1.029 \quad \text{check}_{wv} = \text{"NG"}$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.4 \cdot n}}{\Omega_s} = 583.3 \cdot \text{plf} \quad \text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.391$$

check_{wE} = "OK"

Double Sided 7/16" sheathing w/ 8d @ 4" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5 \text{ in}$ Sill plate thickness $\text{dia}_a := 16 \text{ d}$ Nail Size $sp_a := 3 \text{ in}$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v.w} \cdot sp_a = 0.21 \cdot \text{kip}$ Shear load to each nail

$\text{Check}_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK") \quad \text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 0.932$

Check_a = "OK"

Use 16d Nail at 3"o.c. Staggered two row

Holdown

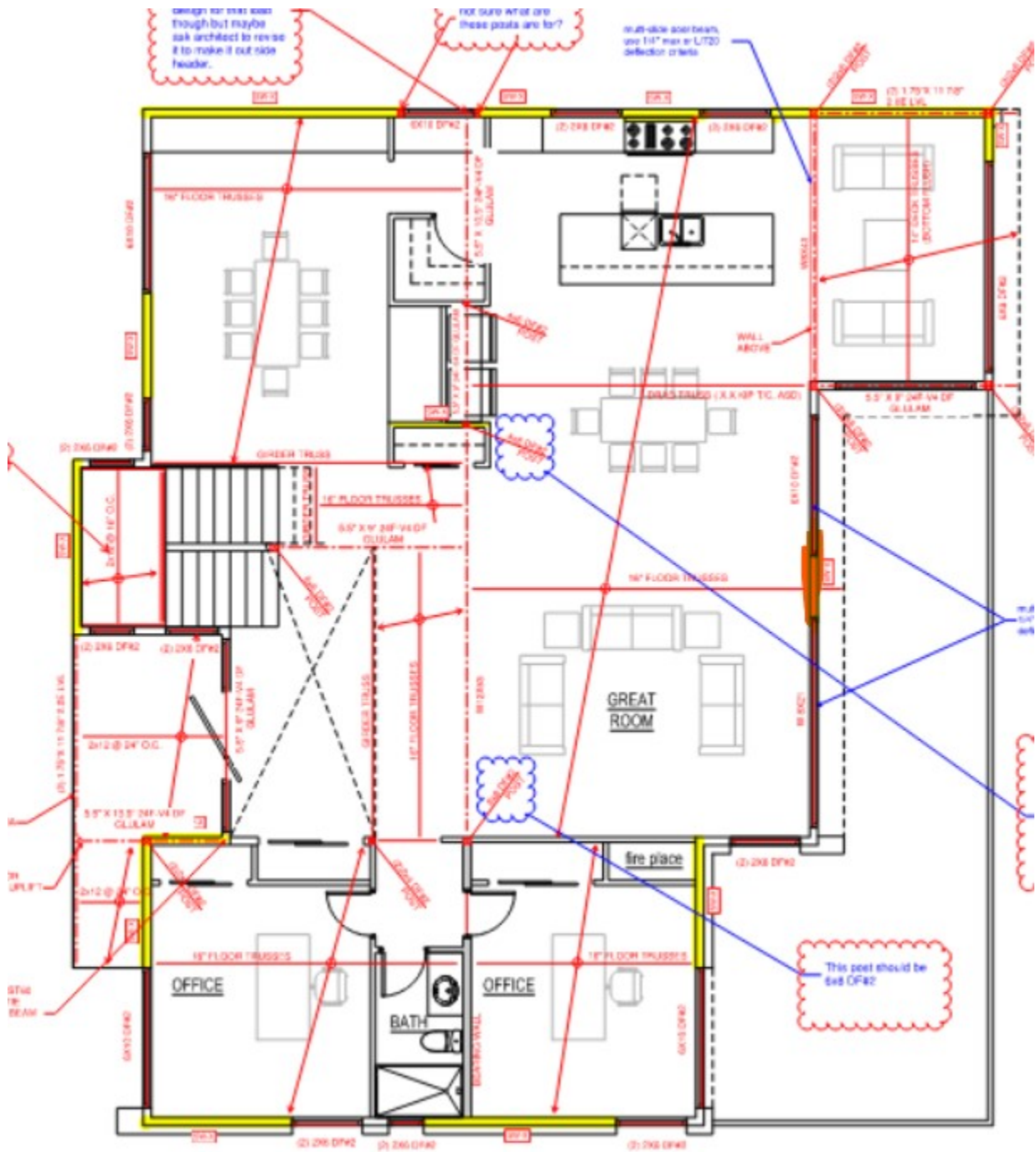
$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 8.298 \cdot \text{kip}$$

$\text{check}_T := \text{if}(T > 150 \text{ lbf}, "HD \text{ REQ'D}", "NOT \text{ REQ'D}") \quad \text{check}_T = "HD \text{ REQ'D}"$

$T_{all} := 2MST48 = 8.4 \cdot \text{kip}$ Allowable tension load

$\text{check}_{HD} := \text{if} \left(\frac{T}{T_{all}} > 1.0, "NG", "OK" \right) \quad \text{ratio} := \frac{T}{T_{all}} = 0.988$

check_{HD} = "OK"



$$V_{EQ} := V_{\text{story}_2} \cdot \frac{215\text{ft}^2}{2250\text{ft}^2} = 2.626\text{-kip}$$

Tributary shear on the wall per plan dimensions

$$V_{\text{wind}} := (P_{\text{wind_wall_windward.A}} - P_{\text{wind_wall_leeward.A}}) \cdot 8.5\text{ft} \cdot (h_{\text{floor}_3} - h_{\text{floor}_1}) = 5.954 \cdot \text{kip}$$

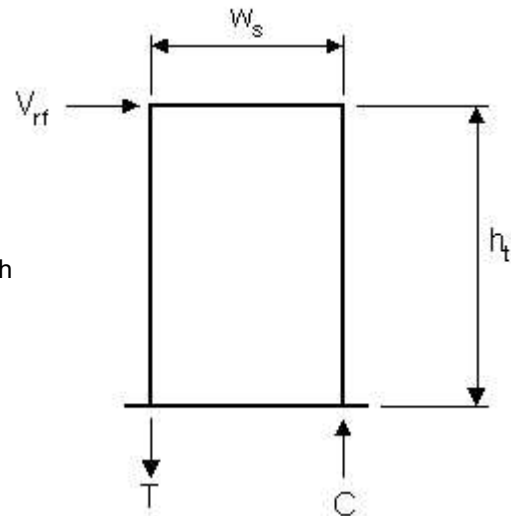
Wind load

$$h_t := 10\text{ft}$$

$$L_s := 3.5\text{ft}$$

Wal height

Total shear wall length

**First Segment:**

$$w_s := 3.5\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 2.857 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

check_{ratio} = "OK"

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

(WSP) = 0.9

Overturning Forces

$$V_{\text{rf.w}} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{\text{rf.w}} = 3.57 \cdot \text{kip}$$

$$V_{\text{rf.E}} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{\text{rf.E}} = 1.84 \cdot \text{kip}$$

$$M_{\text{ot.w}} := V_{\text{rf.w}} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{\text{ot.w}} = 35.7 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot.E}} := V_{\text{rf.E}} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{\text{ot.E}} = 18.4 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := \left(DL_{roof} \cdot \frac{19ft}{2} \cdot w_s + DL_{floor} \cdot \frac{19ft}{2} \cdot w_s \right)$$

Total gravity load on wall

$$P_{rf} = 0.997 \cdot kip$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.42 \cdot kip$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 1.488 \cdot kip \cdot ft$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 1021 \cdot plf$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 525 \cdot plf$$

Seismic shear flow

$$w_{all,w} := \frac{(WSP) \cdot v_{w.7_16.8d.3} \cdot n}{\Omega_s} = 1125 \cdot plf$$

$$check_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{all,w}} > 1.0, "NG", "OK" \right)$$

It is less than 5%
above-EOR is OK

$$\frac{w_{v,w}}{w_{all,w}} = 0.907$$

check_{wv} = "OK"

$$w_{all,E} := \frac{(WSP) \cdot v_{s.7_16.8d.3} \cdot n}{\Omega_s} = 803.6 \cdot plf$$

$$check_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{all,E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.653$$

check_{wE} = "OK"

Double Sided 7/16" sheathing w/ 8d @ 3" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing

$$C_D := 1.6$$

$$t_{sp} := 1.5\text{in} \quad \text{Sill plate thickness}$$

$$\text{dia}_a := 16\text{d} \quad \text{Nail Size}$$

$$sp_a := 2.5\text{in} \quad \text{Nail spacing}$$

$$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$$

Allowable load parallel to grain (ref. NDS table 12)

$$V_{sp} := w_{v.w} \cdot sp_a = 0.213 \cdot \text{kip} \quad \text{Shear load to each nail}$$

$$\text{Check}_a := \text{if}(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"}) \quad \text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 0.943$$

Check_a = "OK"

Use 16d Nail at 2.5"o.c. Staggered
two row

Holdown

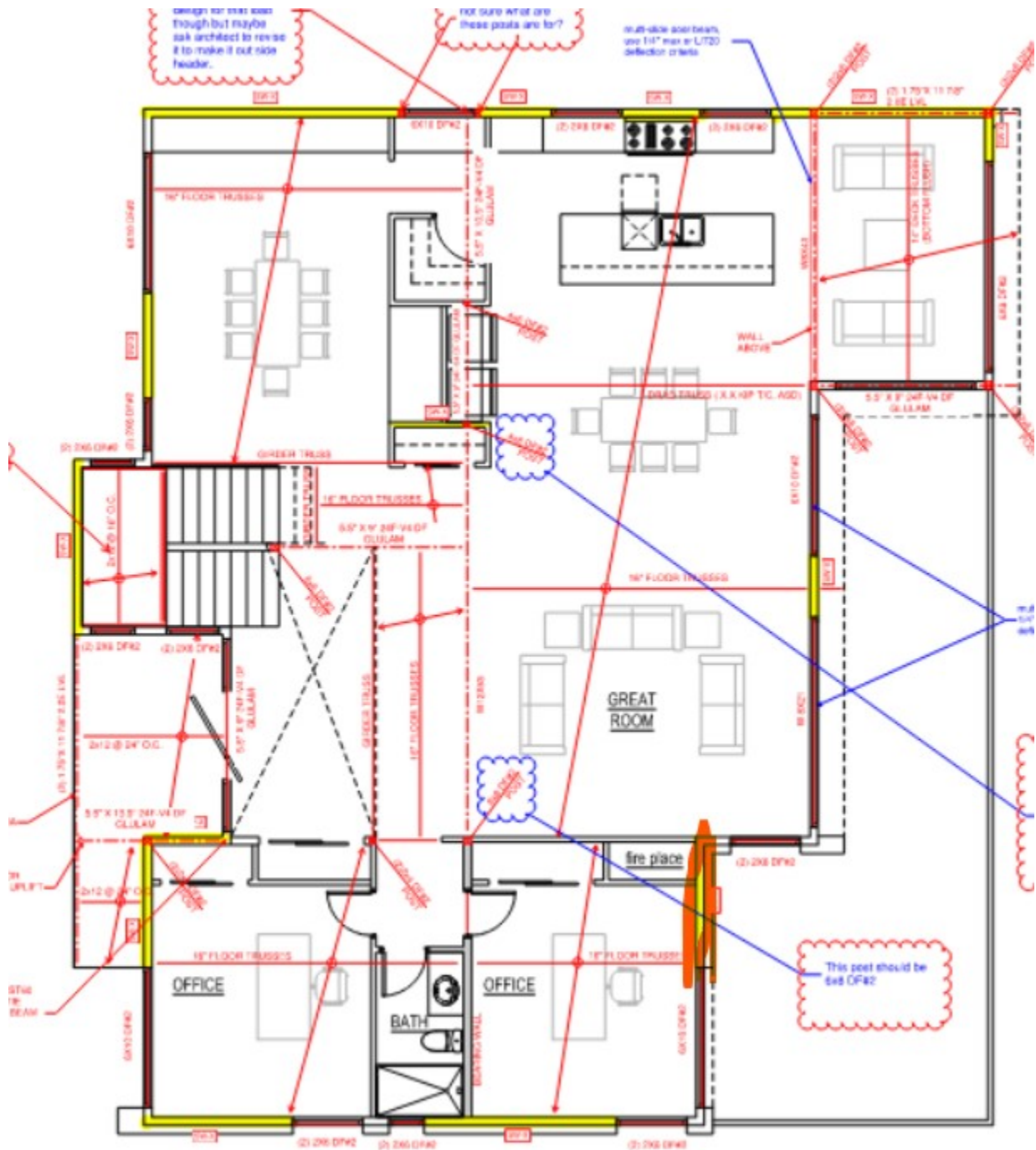
$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 12.703 \cdot \text{kip}$$

$$\text{check}_T := \text{if}(T > 150\text{lbf}, \text{"HD REQ'D"}, \text{"NOT REQ'D"}) \quad \text{check}_T = \text{"HD REQ'D"}$$

$$T_{all} := 4\text{MSTC48B3} = 15.9 \cdot \text{kip} \quad \text{Allowable tension load}$$

$$\text{check}_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, \text{"NG"}, \text{"OK"}\right) \quad \text{ratio} := \frac{T}{T_{all}} = 0.799$$

check_{HD} = "OK"



$$V_{EQ} := V_{story2} \cdot \frac{912\text{ft}^2}{2250\text{ft}^2} = 11.138\text{-kip}$$

Tributary shear on the wall per plan dimensions

$$V_{\text{wind}} := (P_{\text{wind_wall_windward.A}} - P_{\text{wind_wall_leeward.A}}) \cdot (16\text{ft} + 8\text{in}) \cdot (h_{\text{floor}_3} - h_{\text{floor}_1}) = 11.675 \cdot \text{kip}$$

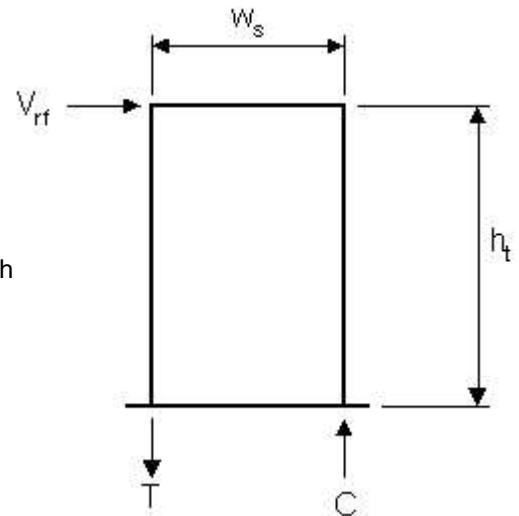
Wind load

$$h_t := 10\text{ft}$$

$$L_s := 7.5\text{ft}$$

Wal height

Total shear wall length

**First Segment:**

$$w_s := 7.5\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.333 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, "NG", "OK" \right)$$

$$\text{check}_{\text{ratio}} = "OK"$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \text{ Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{\text{rf.w}} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{\text{rf.w}} = 7.01 \cdot \text{kip}$$

$$V_{\text{rf.E}} := \left(0.7 \cdot V_{\text{EQ}} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{\text{rf.E}} = 7.8 \cdot \text{kip}$$

$$M_{\text{ot.w}} := V_{\text{rf.w}} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{\text{ot.w}} = 70.1 \cdot \text{kip} \cdot \text{ft}$$

$$M_{\text{ot.E}} := V_{\text{rf.E}} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{\text{ot.E}} = 78 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := \left(DL_{roof} \cdot \frac{13ft}{2} \cdot w_s + DL_{floor} \cdot \frac{13ft}{2} \cdot w_s \right)$$

Total gravity load on wall

$$P_{rf} = 1.463 \cdot kip$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.9 \cdot kip$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 5.316 \cdot kip \cdot ft$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 934 \cdot plf$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 1040 \cdot plf$$

Seismic shear flow

$$w_{all,w} := \frac{(WSP) \cdot v_{w.7_16.8d.2 \cdot n}}{\Omega_s} = 1640 \cdot plf \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{all,w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,w}}{w_{all,w}} = 0.57$$

check_{wv} = "OK"

$$w_{all,E} := \frac{(WSP) \cdot v_{s.7_16.8d.2 \cdot n}}{\Omega_s} = 1170 \cdot plf \quad \text{check}_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{all,E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,E}}{w_{all,E}} = 0.888$$

check_{wE} = "OK"**Double Sided** 7/16" sheathing w/ 8d @ 2" O.C. Panel Edges @ 12" O.C.

Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$ $t_{sp} := 1.5\text{in}$ Sill plate thickness $\text{dia}_a := 16\text{d}$

Nail Size

 $\text{sp}_a := 3\text{in}$

Nail spacing

 $Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$

Allowable load parallel to grain (ref. NDS table 12)

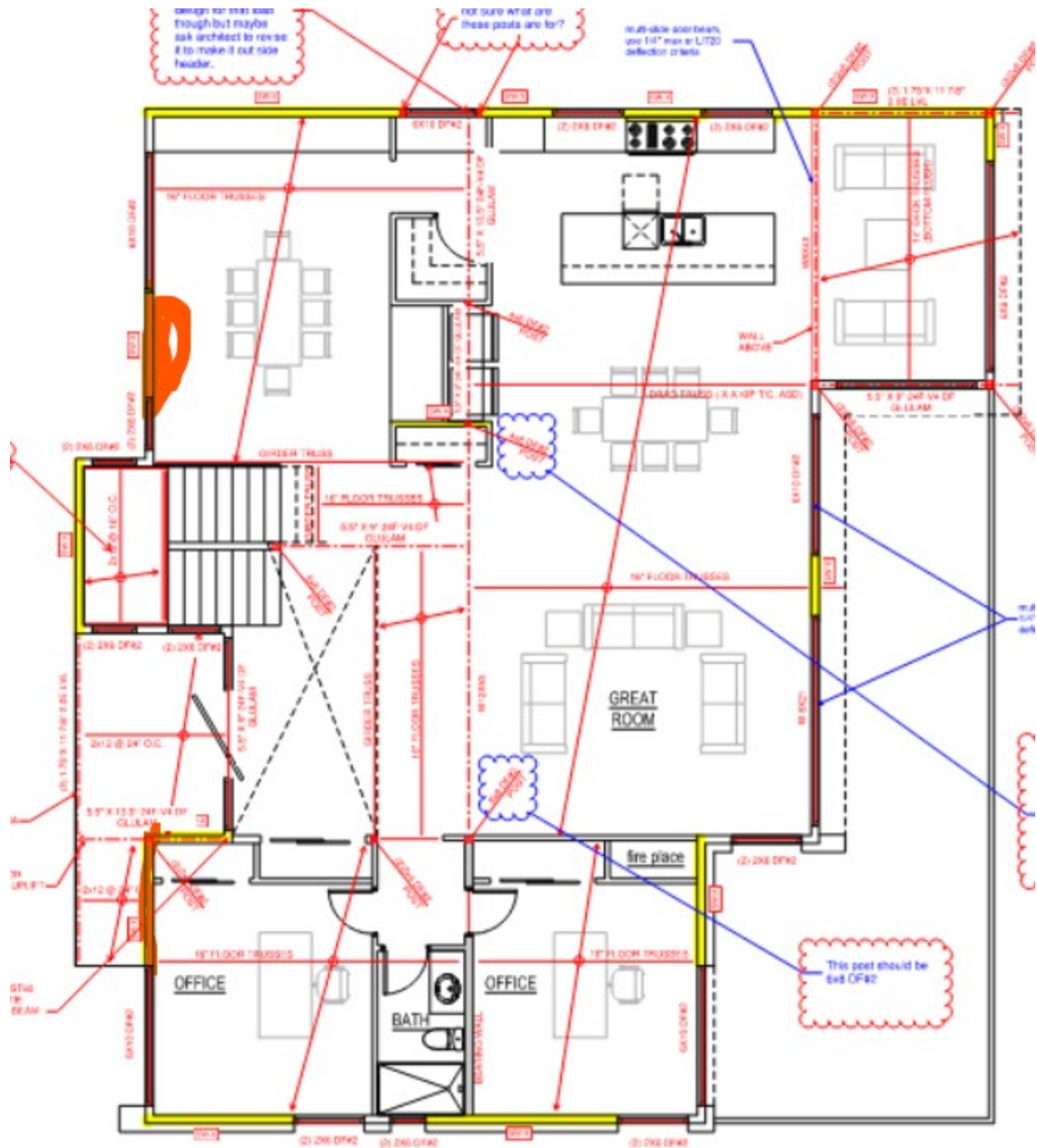
 $V_{sp} := w_{v,w} \cdot \text{sp}_a = 0.234 \cdot \text{kip}$

Shear load to each nail

 $\text{check}_a := \text{if}(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"})$ $\text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 1.035$ $\text{check}_a = \text{"NG"}$ Use 16d Nail at 2.5"o.c. Staggered
two rowIt is less than 5%
above-EOR is OK**Holdown** $T := \frac{\max(M_{ot,w}, M_{ot,E} \cdot \Omega_o) - M_{res}}{w_s} = 25.279 \cdot \text{kip}$ $\text{check}_T := \text{if}(T > 150\text{lbf}, \text{"HD REQ'D"}, \text{"NOT REQ'D"})$ $\text{check}_T = \text{"HD REQ'D"}$ $T_{all} := 4\text{MST60} = 24.94 \cdot \text{kip}$

Allowable tension load

 $\text{check}_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, \text{"NG"}, \text{"OK"}\right)$ $\text{ratio} := \frac{T}{T_{all}} = 1.014$ $\text{check}_{HD} = \text{"NG"}$ It is less than 5%
above-EOR is OK



$$V_{EQ} := V_{story2} \cdot \frac{1230\text{ft}^2}{2250\text{ft}^2} = 15.021 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot (16\text{ft} + 8\text{in}) \cdot (h_{floor3} - h_{floor1}) = 11.675 \cdot \text{kip}$$

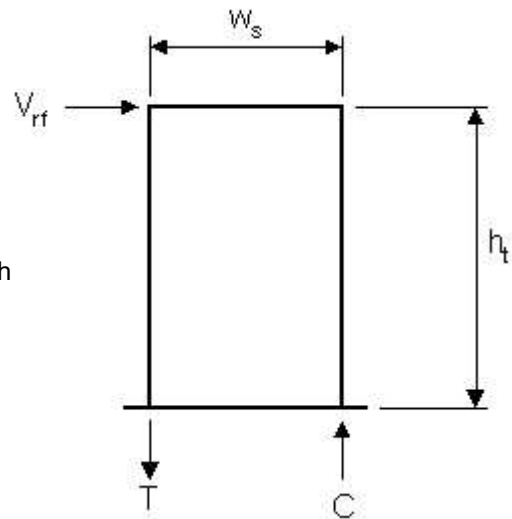
Wind load

$$h_t := 10\text{ft}$$

Wall height

$$L_s := 7.5\text{ft} + 6\text{ft}$$

Total shear wall length



First Segment:

$$w_s := 6\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.667 \quad \text{check}_{ratio} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

check_{ratio} = "OK"

$$(WSP) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

(WSP) = 1.0

Overturning Forces

$$V_{rf.W} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)} \quad V_{rf.W} = 3.11 \cdot \text{kip}$$

$$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)} \quad V_{rf.E} = 4.67 \cdot \text{kip}$$

$$M_{ot.W} := V_{rf.W} \cdot h_t \quad \text{Overturning moment (ASD)} \quad M_{ot.W} = 31.1 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t \quad \text{Overturning moment (ASD)} \quad M_{ot.E} = 46.7 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := DL_{roof} \cdot \frac{18\text{ft}}{2} \cdot w_s + DL_{floor} \cdot \frac{18\text{ft}}{2} \cdot w_s \quad \text{Total gravity load on wall}$$

$$P_{rf} = 1.62 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s) \quad \text{Wal self weightload} \quad P_w = 0.72 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)} \quad M_{res} = 4.212 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2 \quad \text{sides}$$

$$\Omega_s := 2.0 \quad \text{(ASD shear capacity factor ref. section 4.3.3)}$$

$$\Omega_o := 2.5 \quad \text{Overstrength factor}$$

$$w_{v.W} := \frac{V_{rf.W}}{w_s} = 519 \cdot \text{plf} \quad \text{Wind shear flow}$$

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 779 \cdot \text{plf} \quad \text{Seismic shear flow}$$

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.3 \cdot n}}{\Omega_s} = 1260 \cdot plf$$

$$check_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.412 \quad check_{wv} = "OK"$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.3 \cdot n}}{\Omega_s} = 900 \cdot plf$$

$$check_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.865 \quad check_{wE} = "OK"$$

Double Sided 7/16" sheathing w/ 8d @ 3" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5in$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 5in$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226 \cdot kip$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v.w} \cdot sp_a = 0.216 \cdot kip$ Shear load to each nail

$Check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.958$ $Check_a = "OK"$

Use 16d Nail at 5"o.c. Staggered two row

Holdown

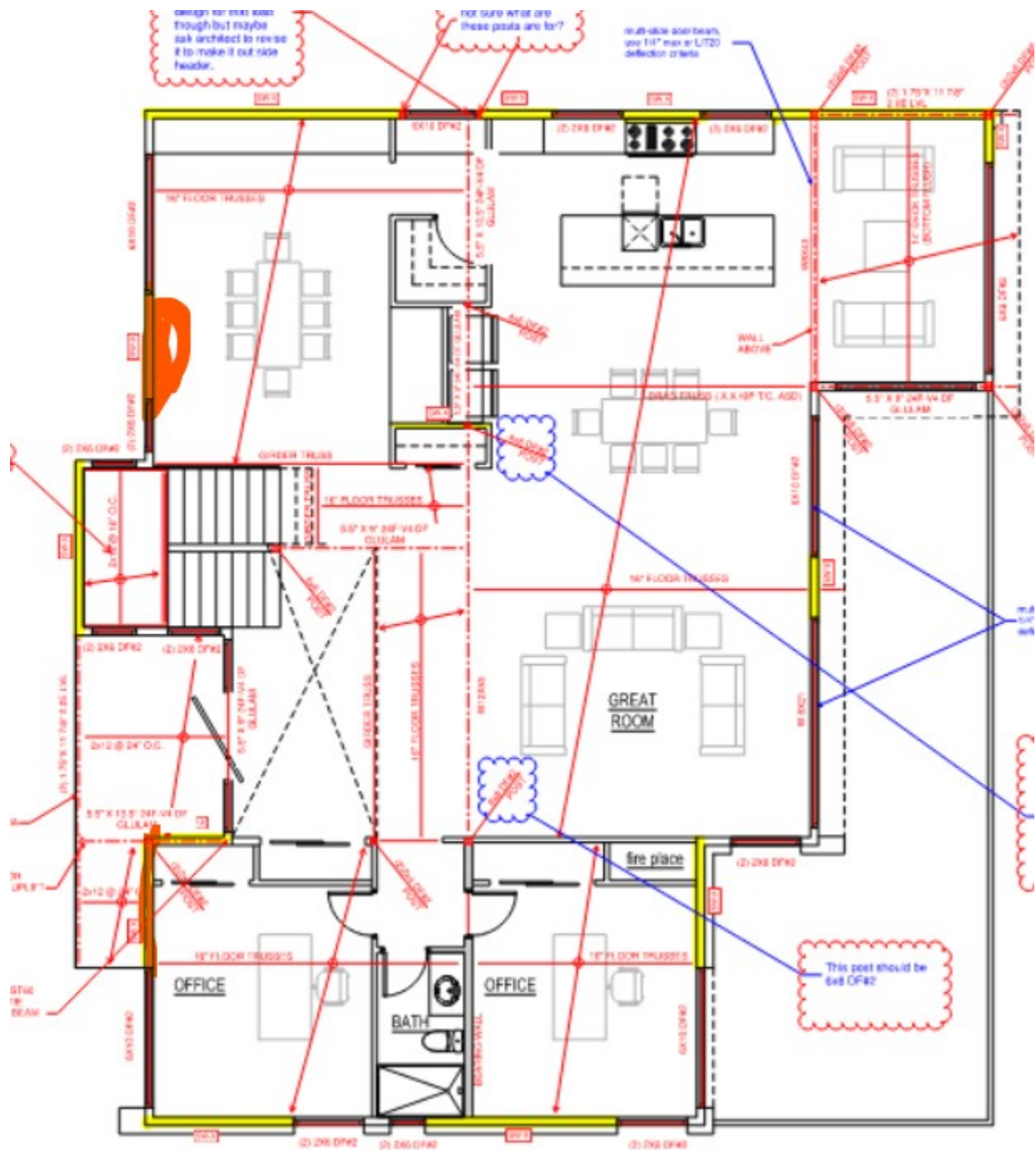
$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 18.77 \cdot kip$$

$check_T := \text{if}(T > 150lbf, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$

$T_{all} := 3MST60 = 18.705 \cdot kip$ Allowable tension load

$check_{HD} := \text{if} \left(\frac{T}{T_{all}} > 1.0, "NG", "OK" \right)$ $ratio := \frac{T}{T_{all}} = 1.003$ $check_{HD} = "NG"$

It is less than 5%
above-EOR is OK



$$V_{EQ} := V_{story_2} \cdot \frac{30\text{ft}^2}{2250\text{ft}^2} = 0.366 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot (3\text{ft}) \cdot (h_{floor_3} - h_{floor_1}) = 2.102 \cdot \text{kip}$$

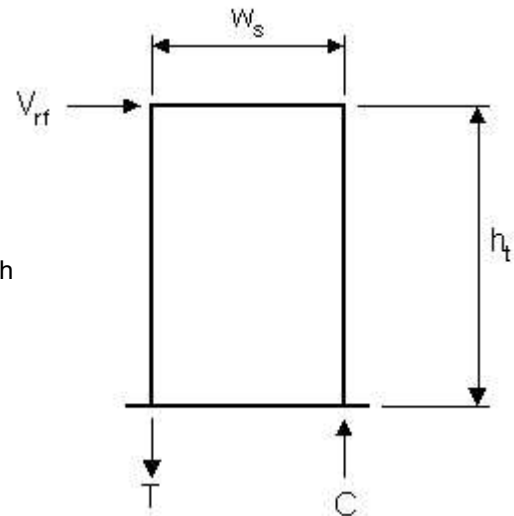
Wind load

$$h_t := 10\text{ft}$$

$$L_s := 9.5\text{ft}$$

Wal height

Total shear wall length



First Segment:

$$w_s := 9.5\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.053 \quad \text{check}_{ratio} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

check_{ratio} = "OK"

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

(WSP) = 1.0

Overturning Forces

$$V_{rf.W} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall (ASD)

$$V_{rf.W} = 1.26 \cdot \text{kip}$$

$$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of wall (ASD)

$$V_{rf.E} = 0.26 \cdot \text{kip}$$

$$M_{ot.w} := V_{rf.w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.w} = 12.6 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.E} = 2.6 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 1.14 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 3.249 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 133 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 27 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.6} \cdot n}{\Omega_s} = 335 \cdot \text{plf} \quad \text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.396$$

$$\text{check}_{wv} = "OK"$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.6} \cdot n}{\Omega_s} = 240 \cdot \text{plf} \quad \text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.112$$

$$\text{check}_{wE} = "OK"$$

Single Sided 7/16" sheathing w/ 8d @ 6" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 8\text{in}$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226\text{-kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v.w} \cdot sp_a = 0.088\text{-kip}$ Shear load to each nail

$check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.392$

$check_a = "OK"$

Use 16d Nail at 5"o.c. Staggered two row

Holdown

$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 0.985\text{-kip}$

$check_T := \text{if}(T > 150\text{lb}, "HD\text{ REQ'D}", "NOT\text{ REQ'D}")$ $check_T = "HD\text{ REQ'D}"$

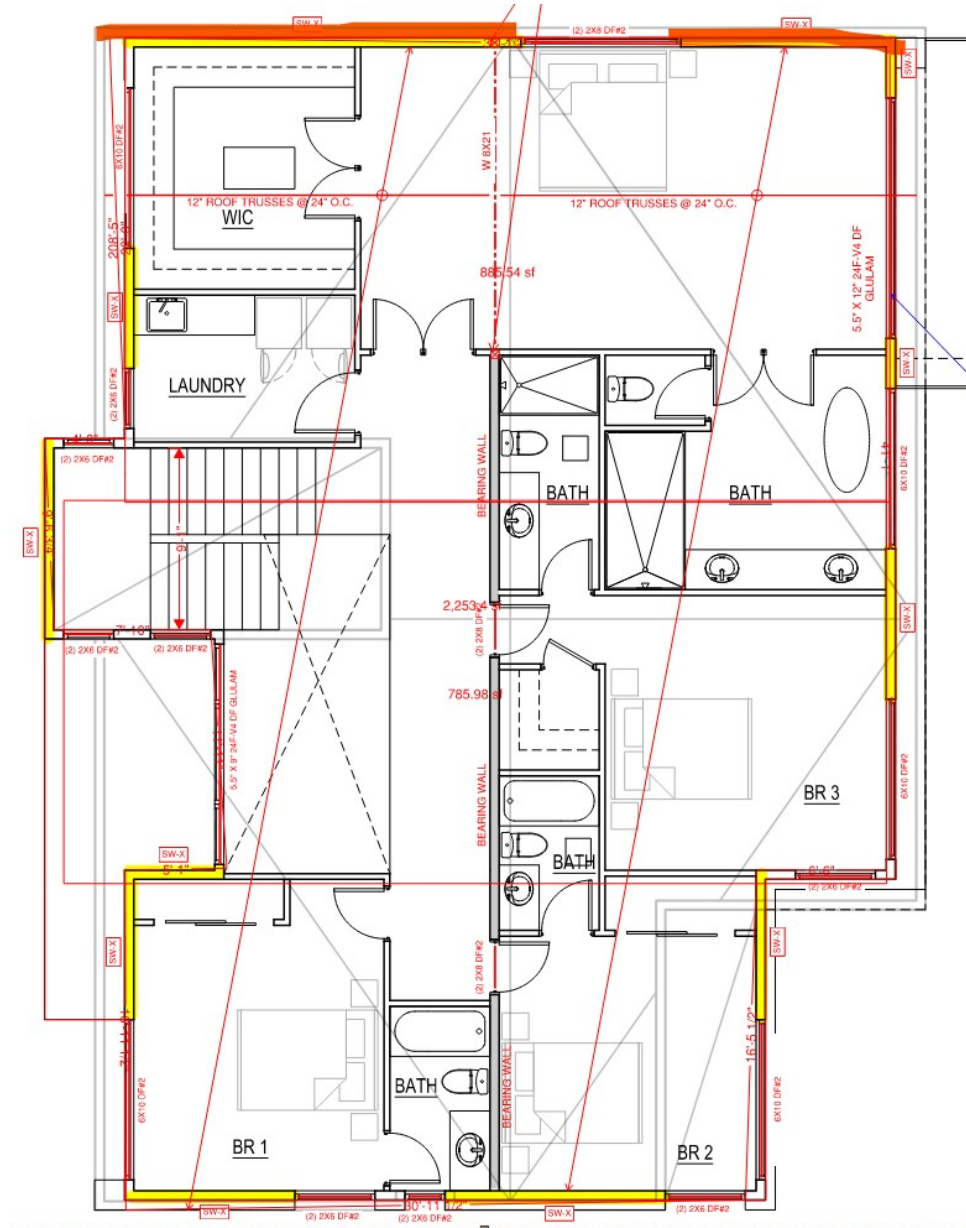
$T_{all} := MST37 = 2.705\text{-kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.364$

$check_{HD} = "OK"$

Shear Wall Design for Lateral Load in East-West Direction per NDS-SDPWS2015

Third Floor- Shear wall



$$V_{EQ} := V_{story_3} \cdot \frac{907\text{ft}^2}{2250\text{ft}^2} = 6.075 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot 24\text{ft} \cdot (h_{floor_3} - h_{floor_2}) = 8.772 \cdot \text{kip}$$

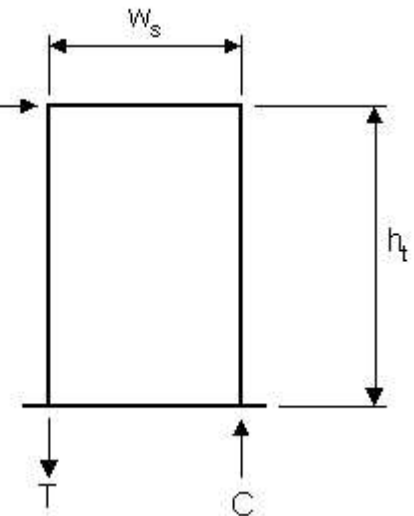
Wind load

$$h_t := 9 \cdot \text{ft}$$

Wal height

$$L_s := 16\text{ft} + 8\text{in} + 19\text{ft} + 9\text{in}$$

Total shear wall length V_{rf}



First Segment:

$$w_s := 16\text{ft} + 8\text{in}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 0.54$$

$$\text{check}_{ratio} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

check_{ratio} = "OK"

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \text{ Aspect ratio factor}$$

(WSP) = 1.0

Overturning Forces

$$V_{rf.W} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall (ASD)

$$V_{rf.W} = 2.41 \cdot \text{kip}$$

$$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of wall (ASD)

$$V_{rf.E} = 1.95 \cdot \text{kip}$$

$$M_{ot.w} := V_{rf.w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.w} = 21.7 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.E} = 17.5 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 1.8 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 9 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 145 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 117 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.6} \cdot n}{\Omega_s} = 335 \cdot \text{plf}$$

$$\text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.431$$

$$\text{check}_{wv} = "OK"$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.6} \cdot n}{\Omega_s} = 240 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\text{check}_{wE} = "OK"$$

Single Sided 7/16" sheathing w/ 8d @ 6" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 8\text{in}$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v.w} \cdot sp_a = 0.096 \cdot \text{kip}$ Shear load to each nail

$check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.427$

$check_a = "OK"$

Use 16d Nail at 8"o.c. Staggered

Holdown

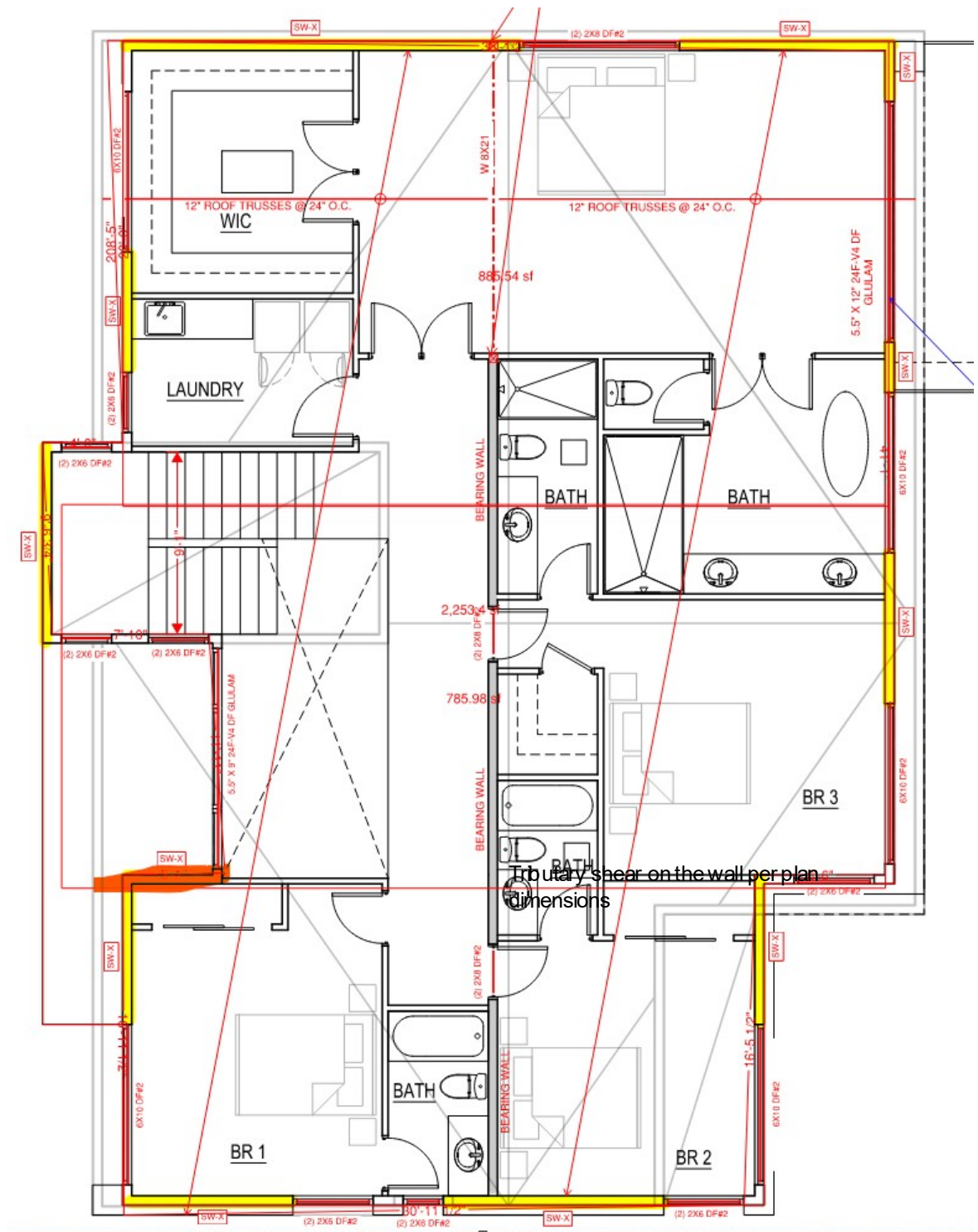
$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 2.087 \cdot \text{kip}$$

$check_T := \text{if}(T > 150\text{lbF}, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$

$T_{all} := MST37 = 2.705 \cdot \text{kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.772$

$check_{HD} = "OK"$



$$V_{EQ} := V_{story_3} \cdot \frac{925\text{ft}^2}{2250\text{ft}^2} = 6.195 \cdot \text{kip}$$

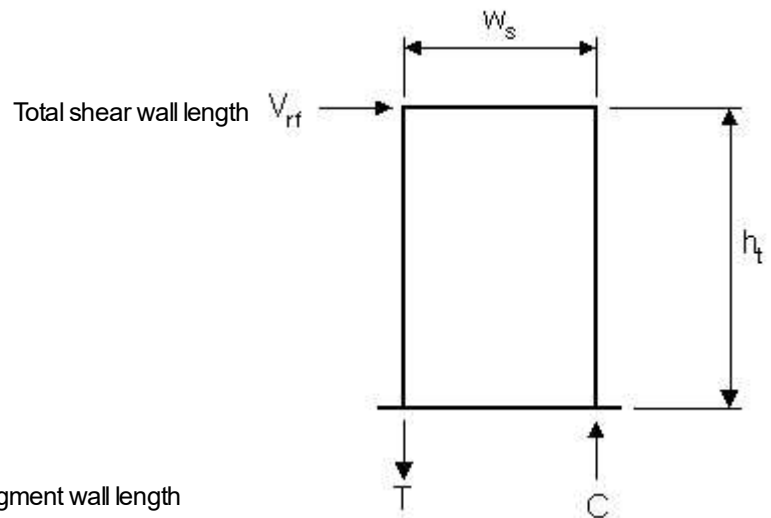
$$V_{wind} := (p_{wind_wall_windward.A} - p_{wind_wall_leeward.A}) \cdot 26.5\text{ft} \cdot (h_{floor_3} - h_{floor_2}) = 9.685 \cdot \text{kip}$$

Wind load

$$h_t := 9 \cdot \text{ft}$$

Wal height

$$L_s := 4.5\text{ft}$$

**First Segment:**

$$w_s := 4.5\text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 2$$

$$\text{check}_{ratio} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

check_{ratio} = "OK"

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \text{ Aspect ratio factor}$$

(WSP) = 1.0

Overturning Forces

$$V_{rf.w} := \left(0.6 \cdot V_{wind} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall
(ASD)

$$V_{rf.w} = 5.81 \cdot \text{kip}$$

$$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of
wall (ASD)

$$V_{rf.E} = 4.34 \cdot \text{kip}$$

$$M_{ot.w} := V_{rf.w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.w} = 52.3 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot.E} := V_{rf.E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot.E} = 39 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0 = 0 \cdot \text{lb} \cdot \text{ft}$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weight load

$$P_w = 0.486 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 0.656 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 1291 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 964 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.2} \cdot n}{\Omega_s} = 820 \cdot \text{plf}$$

$$\text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, \text{"NG"}, \text{"OK"} \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 1.575$$

$$\text{check}_{wv} = \text{"NG"}$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.6} \cdot n}{\Omega_s} = 240 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{wE} = \text{"NG"}$$

Single Sided 7/16" sheathing w/ 8d @ 6" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$$t_{sp} := 1.5\text{in} \quad \text{Sill plate thickness} \quad \text{dia}_a := 16\text{d} \quad \text{Nail Size} \quad sp_a := 8\text{in} \quad \text{Nail spacing}$$

$$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip} \quad \text{Allowable load parallel to grain (ref. NDS table 12)}$$

$$V_{sp} := w_{v,w} \cdot sp_a = 0.861 \cdot \text{kip} \quad \text{Shear load to each nail}$$

$$\text{Check}_a := \text{if}(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"}) \quad \text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 3.816$$

$$\text{Check}_a = \text{"NG"}$$

Use 16d Nail at 8"o.c. Staggered

Holdown

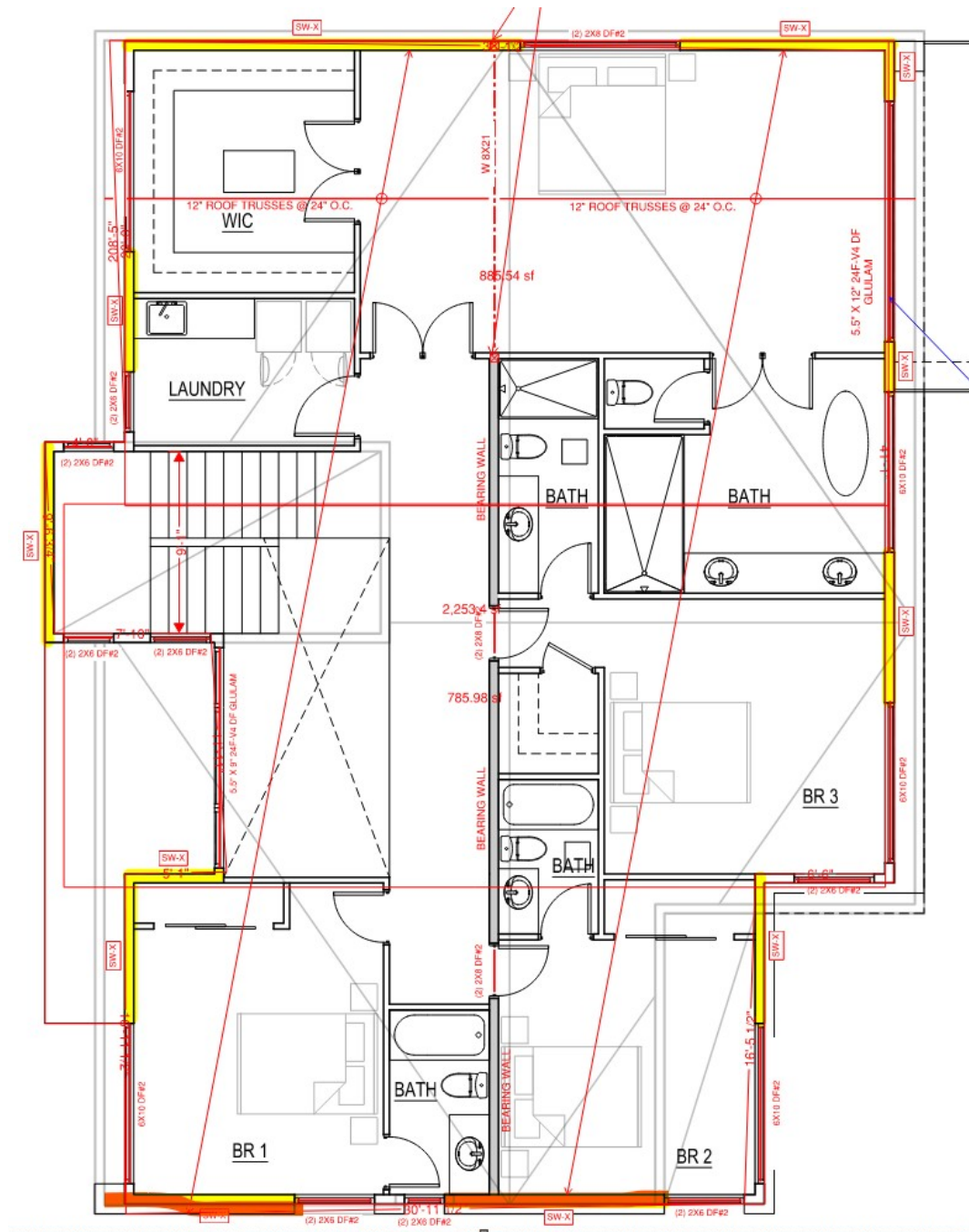
$$T := \frac{\max(M_{ot,w}, M_{ot,E} \cdot \Omega_o) - M_{res}}{w_s} = 21.537 \cdot \text{kip}$$

$$\text{check}_T := \text{if}(T > 150\text{lbf}, \text{"HD REQ'D"}, \text{"NOT REQ'D"}) \quad \text{check}_T = \text{"HD REQ'D"}$$

$$T_{all} := \text{MST60} = 6.235 \cdot \text{kip} \quad \text{Allowable tension load}$$

$$\text{check}_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, \text{"NG"}, \text{"OK"}\right) \quad \text{ratio} := \frac{T}{T_{all}} = 3.454$$

$$\text{check}_{HD} = \text{"NG"}$$



$$V_{EQ} := V_{story_3} \cdot \frac{260\text{ft}^2}{2250\text{ft}^2} = 1.741 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

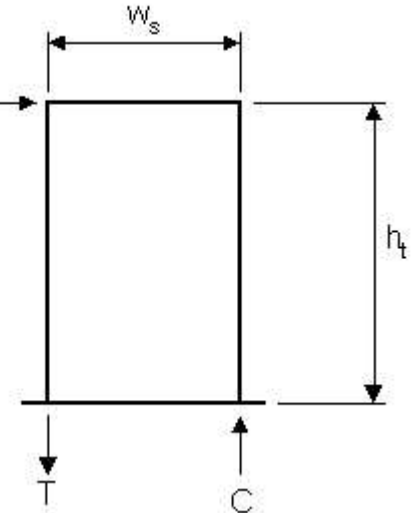
$$V_{wind} := (P_{wind_wall_windward.A} - P_{wind_wall_leeward.A}) \cdot 9\text{ft} \cdot (h_{floor_3} - h_{floor_2}) = 3.289 \cdot \text{kip}$$

Wind load

$$h_t := 9 \cdot \text{ft}$$

Wal height

$$L_s := 6.5 \text{ft} + 3.5 \text{ft} + 11 \text{ft}$$

Total shear wall length V_{rf} **First Segment:**

$$w_s := 3.5 \text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 2.571 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 0.9$$

Overturning Forces

$$V_{rf,w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{rf,w} = 0.33 \cdot \text{kip}$$

$$V_{rf,E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{rf,E} = 0.2 \cdot \text{kip}$$

$$M_{ot,w} := V_{rf,w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,w} = 3 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot,E} := V_{rf,E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,E} = 1.8 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := 0$$

Total gravity load on wall

$$P_{rf} = 0 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.378 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 0.397 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 94 \cdot \text{plf}$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 58 \cdot \text{plf}$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.6} \cdot n}{\Omega_s} = 311.1 \cdot \text{plf}$$

$$\text{check}_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.302$$

check_{wv} = "OK"

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.6} \cdot n}{\Omega_s} = 222.9 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.26$$

check_{wE} = "OK"

Single Sided 7/16" sheathing w/ 8d @ 6" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing

$$C_D := 1.6$$

$$t_{sp} := 1.5 \text{ in}$$

Sill plate thickness

$$\text{dia}_a := 16 \text{ d}$$

Nail Size

$$s_{pa} := 8 \text{ in}$$

Nail spacing

$$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$$

Allowable load parallel to grain (ref. NDS table 12)

$$V_{sp} := w_{v,w} \cdot sp_a = 0.063 \cdot \text{kip}$$

Shear load to each nail

$$\text{Check}_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK") \quad \text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 0.278$$

Check_a = "OK"

Use 16d Nail at 8"o.c. Staggered

Holdown

$$T := \frac{\max(M_{ot,w}, M_{ot,E} \cdot \Omega_o) - M_{res}}{w_s} = 1.193 \cdot \text{kip}$$

$$\text{check}_T := \text{if}(T > 150 \text{ lbf}, "HD \text{ REQ'D}", "NOT \text{ REQ'D}")$$

check_T = "HD REQ'D"

$$T_{all} := MST37 = 2.705 \cdot \text{kip}$$

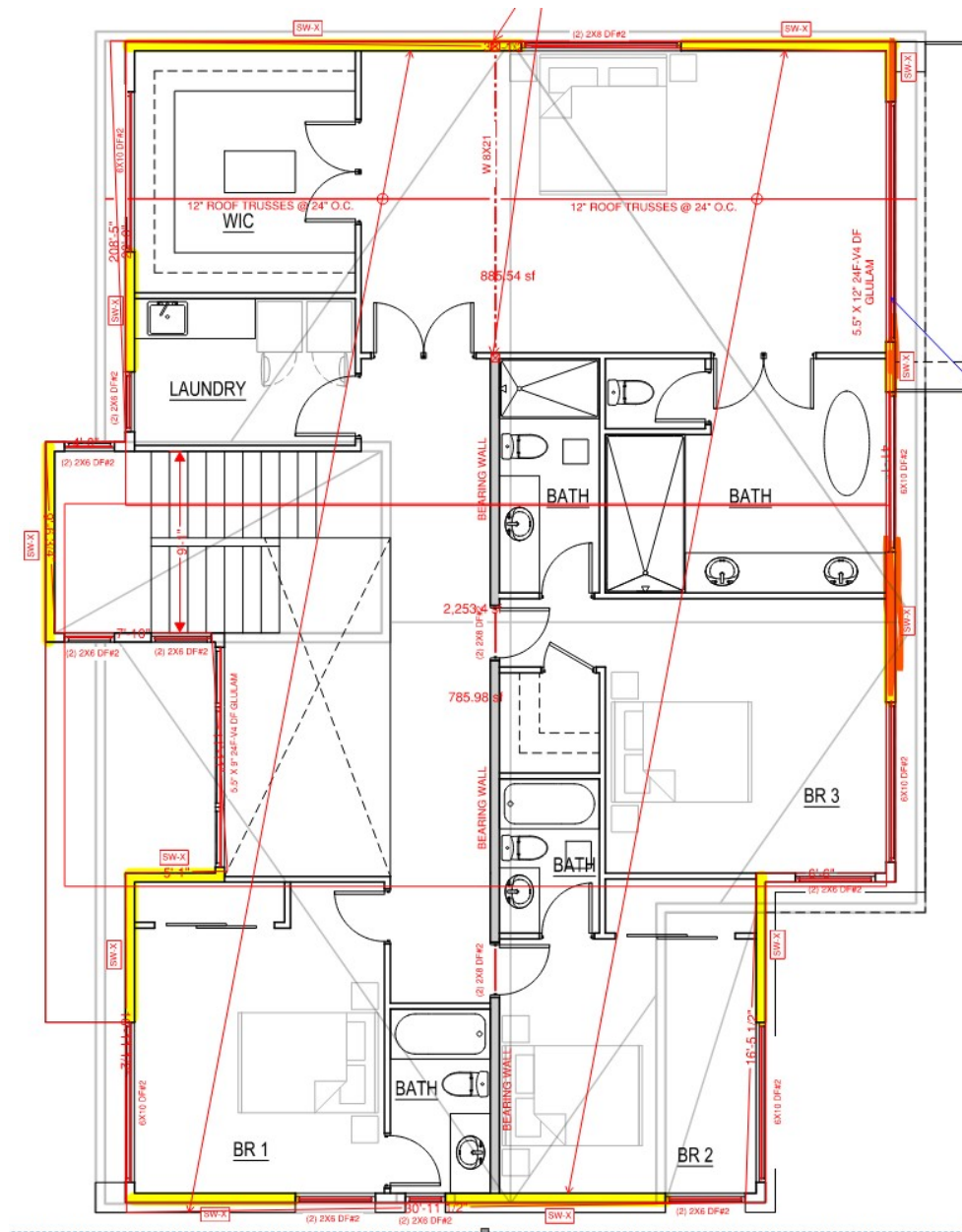
Allowable tension load

$$\text{check}_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right) \quad \text{ratio} := \frac{T}{T_{all}} = 0.441$$

check_{HD} = "OK"

Shear Wall Design for Lateral Load in North-South Direction per NDS-SDPWS2015

Third Floor- Shear wall



$$V_{EQ} := V_{story_3} \cdot \frac{160ft^2}{2250ft^2} = 1.072 \cdot kip$$

Tributary shear on the wall per plan dimensions

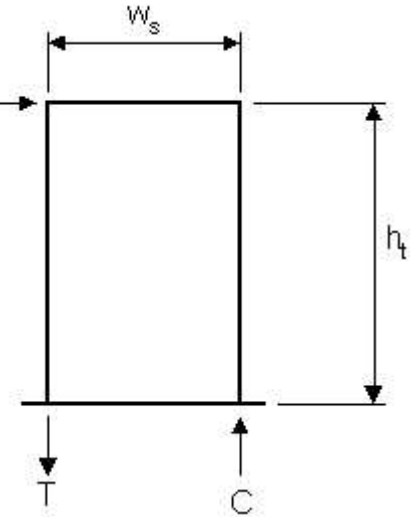
$$V_{wind} := (P_{wind_wall_windward} \cdot A - P_{wind_wall_leeward} \cdot A) \cdot 4ft \cdot (h_{floor_3} - h_{floor_2}) = 1.462 \cdot kip$$

Wind load

$$h_t := 9 \cdot \text{ft}$$

$$L_s := 3 \text{ ft} + 7.5 \text{ ft}$$

Wal height

Total shear wall length V_{rf} **First Segment:**

$$w_s := 3 \text{ ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 3 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 0.9$$

Overturning Forces

$$V_{rf,w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{rf,w} = 0.25 \cdot \text{kip}$$

$$V_{rf,E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{rf,E} = 0.21 \cdot \text{kip}$$

$$M_{ot,w} := V_{rf,w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,w} = 2.3 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot,E} := V_{rf,E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,E} = 1.9 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := DL_{roof} \cdot \frac{20ft}{2} \cdot w_s$$

Total gravity load on wall

$$P_{rf} = 0.45 \cdot kip$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weight load

$$P_w = 0.324 \cdot kip$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 0.697 \cdot kip \cdot ft$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 84 \cdot plf$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 71 \cdot plf$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.6} \cdot n}{\Omega_s} = 293.1 \cdot plf$$

$$check_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.285$$

$$check_{wv} = "OK"$$

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.6} \cdot n}{\Omega_s} = 210 \cdot plf$$

$$check_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

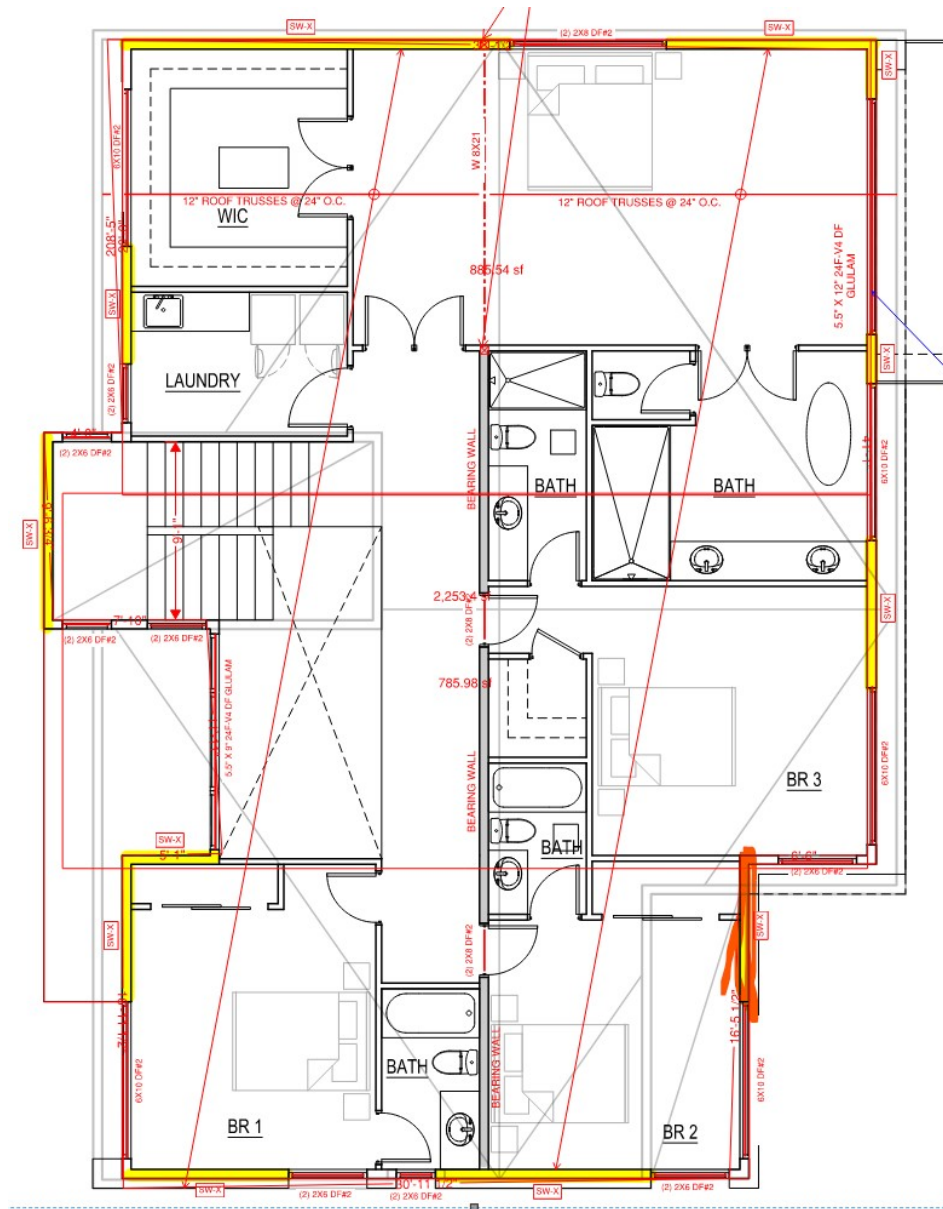
$$check_{wE} = "OK"$$

Single Sided 7/16" sheathing w/ 8d @ 6" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$ $t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 8\text{in}$ Nail spacing $Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12) $V_{sp} := w_{v.w} \cdot sp_a = 0.056 \cdot \text{kip}$ Shear load to each nail $check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.247$ $check_a = "OK"$

Use 16d Nail at 8"o.c. Staggered

Holdown $T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 1.375 \cdot \text{kip}$ $check_T := \text{if}(T > 150\text{lbf}, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$ $T_{all} := MST37 = 2.705 \cdot \text{kip}$ Allowable tension load $check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.508$ $check_{HD} = "OK"$ $T_{all} := DTT2Z = 2.145 \cdot \text{kip}$ Allowable tension load $check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.641$ $check_{HD} = "OK"$



$$V_{EQ} := V_{story_3} \cdot \frac{1100\text{ft}^2}{2250\text{ft}^2} = 7.367 \cdot \text{kip}$$

Tributary shear on the wall per plan dimensions

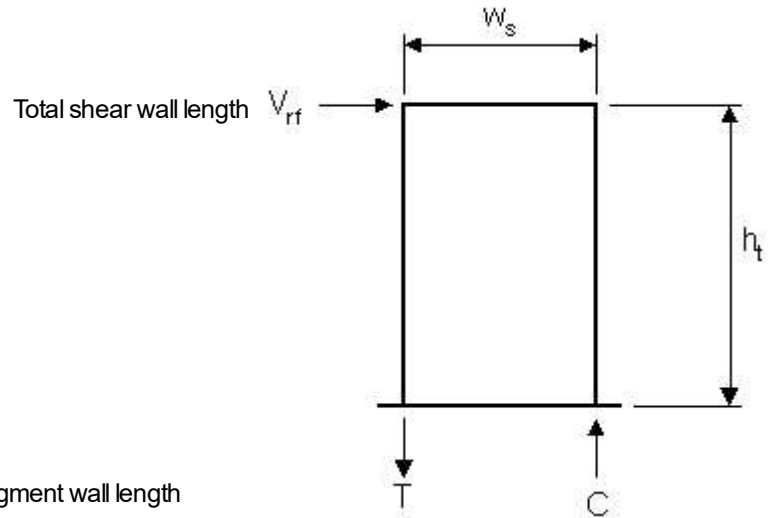
$$V_{wind} := (P_{wind_wall_windward.A} - P_{wind_wall_leeward.A}) \cdot 20\text{ft} \cdot (h_{floor_3} - h_{floor_2}) = 7.31 \cdot \text{kip}$$

Wind load

$$h_t := 9 \cdot \text{ft}$$

$$L_s := 7.5 \text{ft}$$

Wal height

**First Segment:**

$$w_s := 7.5 \text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.2 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{rf,w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall
(ASD)

$$V_{rf,w} = 4.39 \cdot \text{kip}$$

$$V_{rf,E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of
wall (ASD)

$$V_{rf,E} = 5.16 \cdot \text{kip}$$

$$M_{ot,w} := V_{rf,w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,w} = 39.5 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot,E} := V_{rf,E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,E} = 46.4 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := DL_{\text{roof}} \cdot \frac{13 \text{ft}}{2} \cdot w_s$$

Total gravity load on wall

$$P_{rf} = 0.731 \cdot \text{kip}$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.81 \cdot \text{kip}$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 3.468 \cdot \text{kip} \cdot \text{ft}$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 2$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 585 \cdot \text{plf}$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 688 \cdot \text{plf}$$

Seismic shear flow

$$w_{all,w} := \frac{(WSP) \cdot v_{w,7_16.8d.4} \cdot n}{\Omega_s} = 980 \cdot \text{plf}$$

$$\text{check}_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{all,w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,w}}{w_{all,w}} = 0.597$$

check_{wv} = "OK"

$$w_{all,E} := \frac{(WSP) \cdot v_{s,7_16.8d.4} \cdot n}{\Omega_s} = 700 \cdot \text{plf}$$

$$\text{check}_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{all,E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,E}}{w_{all,E}} = 0.982$$

check_{wE} = "OK"

Double Sided 7/16" sheathing w/ 8d @ 4" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing

$$C_D := 1.6$$

$$t_{sp} := 1.5 \text{ in}$$

Sill plate thickness

$$\text{dia}_a := 16 \text{ d}$$

Nail Size

$$s_{pa} := 4.5 \text{ in}$$

Nail spacing

$$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$$

Allowable load parallel to grain (ref. NDS table 12)

$$V_{sp} := w_{v,w} \cdot sp_a = 0.219 \cdot \text{kip} \quad \text{Shear load to each nail}$$

$$\text{Check}_a := \text{if}(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"}) \quad \text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 0.972$$

Check_a = "OK"

Use 16d Nail at 4.5"o.c. Staggered

Holdown

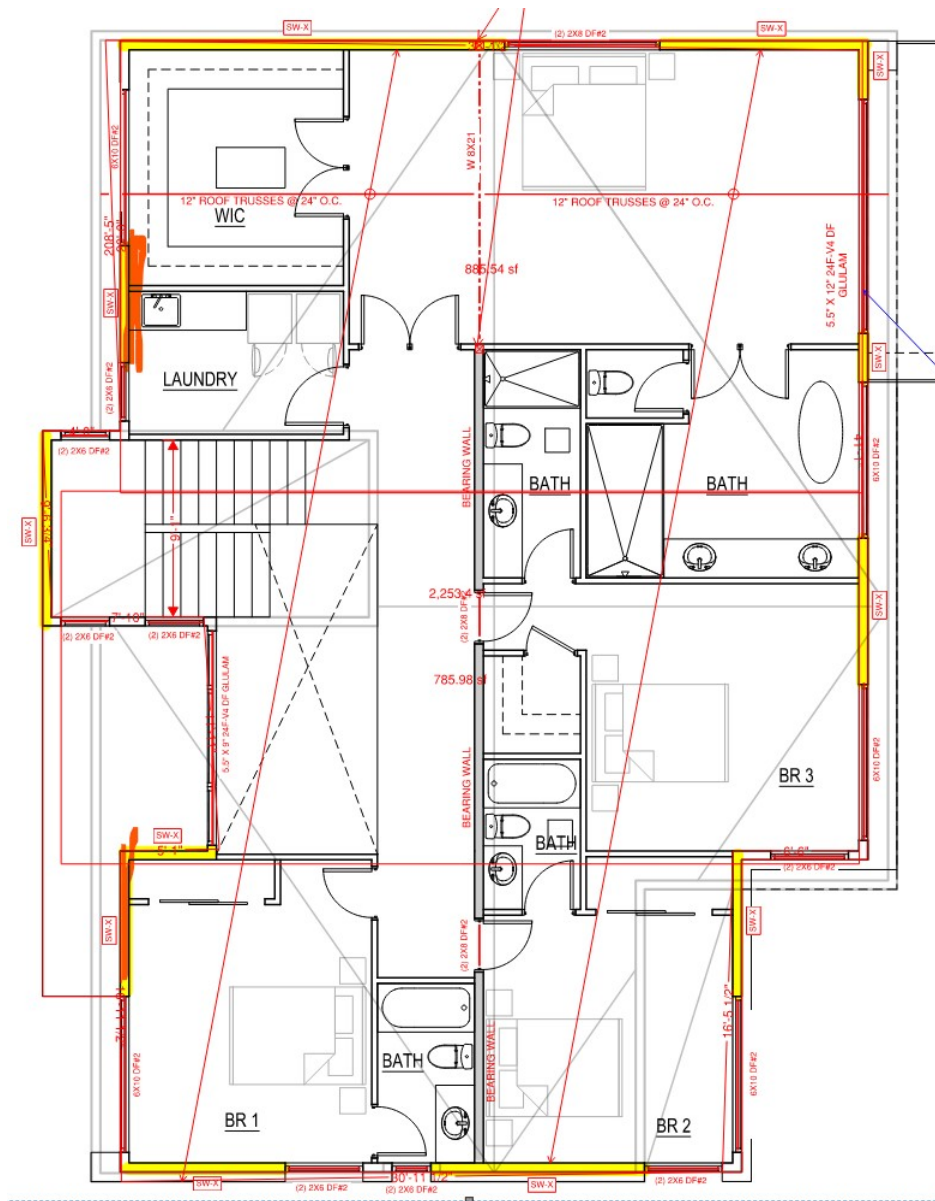
$$T := \frac{\max(M_{ot,w}, M_{ot,E} \cdot \Omega_o) - M_{res}}{w_s} = 15.009 \cdot \text{kip}$$

$$\text{check}_T := \text{if}(T > 150\text{lb}, \text{"HD REQ'D"}, \text{"NOT REQ'D"}) \quad \text{check}_T = \text{"HD REQ'D"}$$

$$T_{all} := 3\text{MST60} = 18.705 \cdot \text{kip} \quad \text{Allowable tension load}$$

$$\text{check}_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, \text{"NG"}, \text{"OK"}\right) \quad \text{ratio} := \frac{T}{T_{all}} = 0.802$$

check_{HD} = "OK"



$$V_{EQ} := V_{story_3} \cdot \frac{900\text{ft}^2}{2250\text{ft}^2} = 6.028\text{-kip}$$

Tributary shear on the wall per plan dimensions

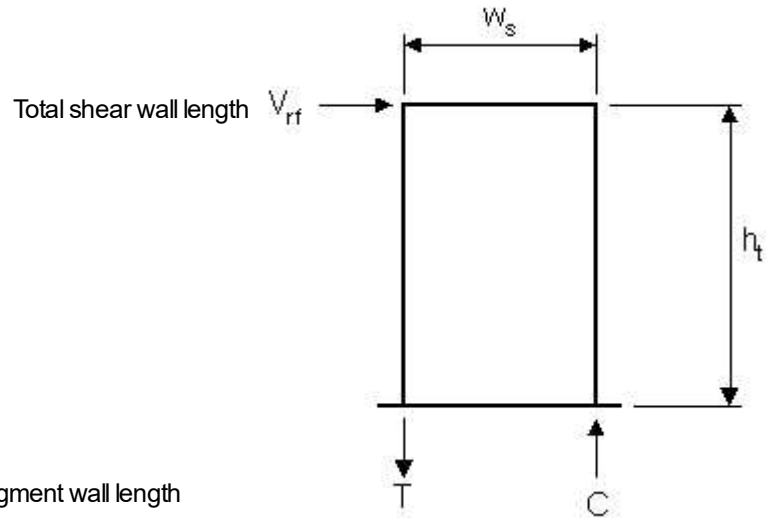
$$V_{wind} := (P_{wind_wall_windward.A} - P_{wind_wall_leeward.A}) \cdot 17\text{ft} \cdot (h_{floor_3} - h_{floor_2}) = 6.213\text{-kip}$$

Wind load

$$h_t := 9 \cdot \text{ft}$$

Wal height

$$L_s := 6 \text{ ft} + 2 \text{ in} + 7.5 \text{ ft}$$

**First Segment:**

$$w_s := 6 \text{ ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.5 \quad \text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \quad \text{Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{rf,w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right) \quad \text{Wind shear load at top of wall (ASD)}$$

$$V_{rf,w} = 1.64 \cdot \text{kip}$$

$$V_{rf,E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right) \quad \text{Seismic shear load at top of wall (ASD)}$$

$$V_{rf,E} = 1.85 \cdot \text{kip}$$

$$M_{ot,w} := V_{rf,w} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{ot,w} = 14.7 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot,E} := V_{rf,E} \cdot h_t \quad \text{Overturning moment (ASD)}$$

$$M_{ot,E} = 16.7 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := DL_{roof} \cdot \frac{17ft + 9in}{2} \cdot w_s$$

Total gravity load on wall

$$P_{rf} = 0.799 \cdot kip$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 0.648 \cdot kip$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 2.604 \cdot kip \cdot ft$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v.w} := \frac{V_{rf.w}}{w_s} = 273 \cdot plf$$

Wind shear flow

$$w_{v.E} := \frac{V_{rf.E}}{w_s} = 309 \cdot plf$$

Seismic shear flow

$$w_{all.w} := \frac{(WSP) \cdot v_{w.7_16.8d.4} \cdot n}{\Omega_s} = 490 \cdot plf$$

$$check_{wv} := \text{if} \left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.w}}{w_{all.w}} = 0.557$$

check_{wv} = "OK"

$$w_{all.E} := \frac{(WSP) \cdot v_{s.7_16.8d.4} \cdot n}{\Omega_s} = 350 \cdot plf$$

$$check_{wE} := \text{if} \left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v.E}}{w_{all.E}} = 0.882$$

check_{wE} = "OK"

Single Sided 7/16" sheathing w/ 8d @ 4" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing

$$C_D := 1.6$$

$$t_{sp} := 1.5\text{in} \quad \text{Sill plate thickness} \quad \text{dia}_a := 16\text{d} \quad \text{Nail Size} \quad sp_a := 8\text{in} \quad \text{Nail spacing}$$

$$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip} \quad \text{Allowable load parallel to grain (ref. NDS table 12)}$$

$$V_{sp} := w_{v.w} \cdot sp_a = 0.182 \cdot \text{kip} \quad \text{Shear load to each nail}$$

$$\text{Check}_a := \text{if}(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"}) \quad \text{ratio}_a := \frac{V_{sp}}{Z_{ll}} = 0.806$$

$$\text{Check}_a = \text{"OK"}$$

Use 16d Nail at 4.5"o.c. Staggered

Holdown

$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 6.512 \cdot \text{kip}$$

$$\text{check}_T := \text{if}(T > 150\text{lbF}, \text{"HD REQ'D"}, \text{"NOT REQ'D"})$$

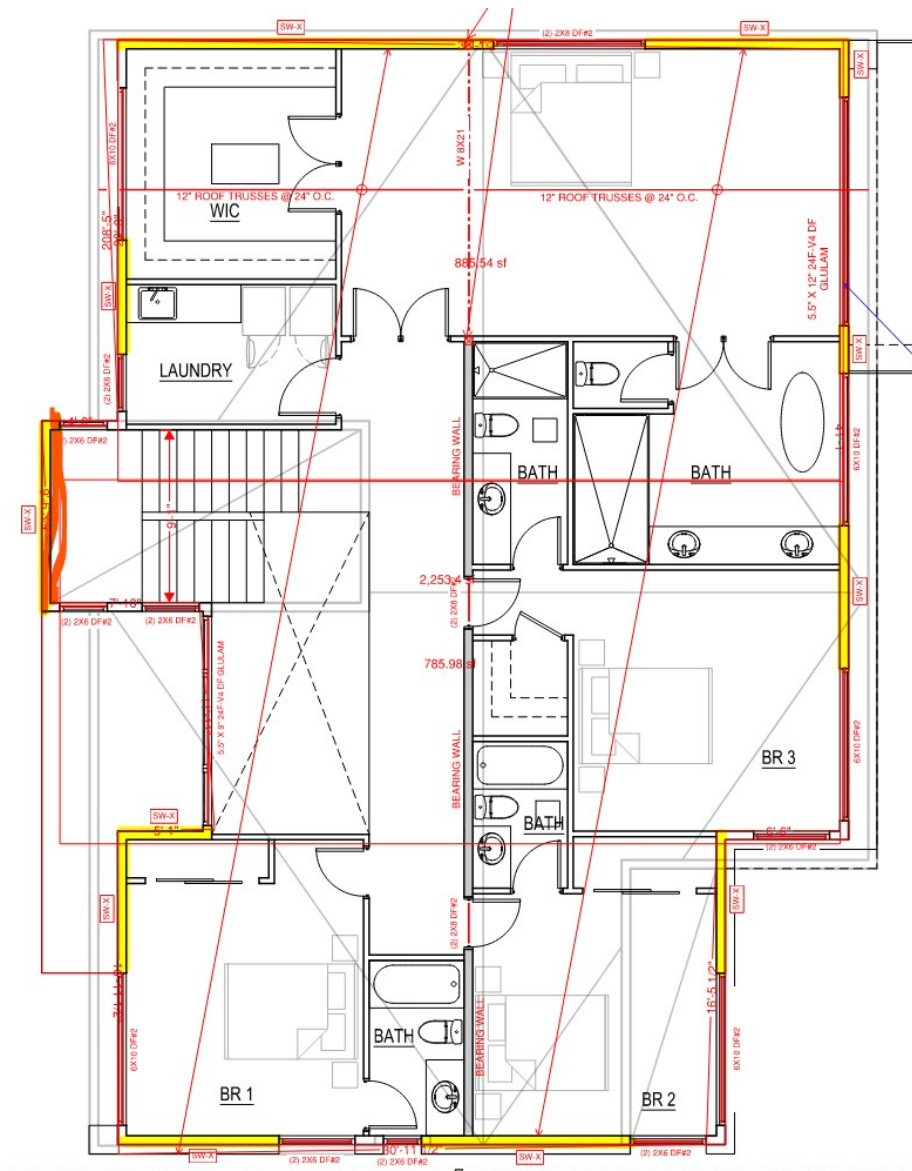
$$\text{check}_T = \text{"HD REQ'D"}$$

$$T_{all} := \text{MST60} = 6.235 \cdot \text{kip} \quad \text{Allowable tension load}$$

$$\text{check}_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, \text{"NG"}, \text{"OK"}\right) \quad \text{ratio} := \frac{T}{T_{all}} = 1.045$$

$$\text{check}_{HD} = \text{"NG"}$$

It is less than 5%
above-EOR is OK



$$V_{EQ} := V_{story_3} \cdot \frac{20ft^2}{2250ft^2} = 0.134 \cdot kip$$

Tributary shear on the wall per plan dimensions

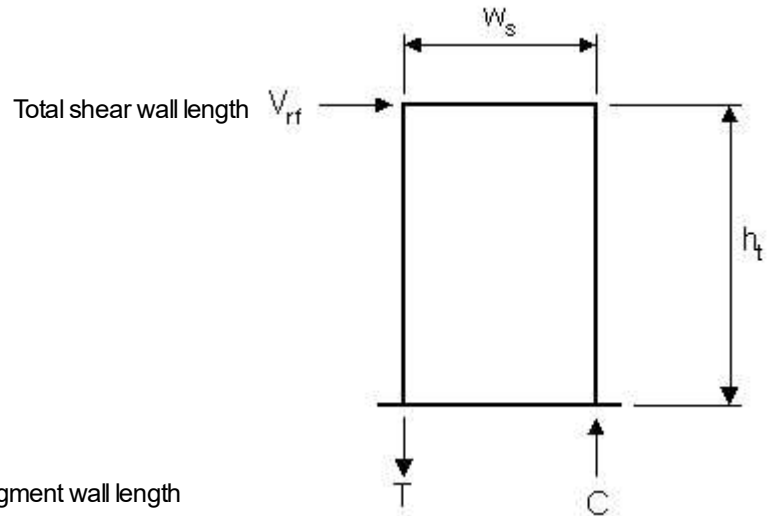
$$V_{wind} := (P_{wind_wall_windward.A} - P_{wind_wall_leeward.A}) \cdot 4.5ft \cdot (h_{floor_3} - h_{floor_2}) = 1.645 \cdot kip$$

Wind load

$$h_t := 9 \cdot \text{ft}$$

$$L_s := 10 \text{ft}$$

Wal height

**First Segment:**

$$w_s := 10 \text{ft}$$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 0.9$$

$$\text{check}_{\text{ratio}} := \text{if} \left(\frac{h_t}{w_s} > 3.5, \text{"NG"}, \text{"OK"} \right)$$

$$\text{check}_{\text{ratio}} = \text{"OK"}$$

$$(\text{WSP}) := \text{if} \left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s} \right) \text{ Aspect ratio factor}$$

$$(\text{WSP}) = 1.0$$

Overturning Forces

$$V_{rf,w} := \left(0.6 \cdot V_{\text{wind}} \cdot \frac{w_s}{L_s} \right)$$

Wind shear load at top of wall
(ASD)

$$V_{rf,w} = 0.99 \cdot \text{kip}$$

$$V_{rf,E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s} \right)$$

Seismic shear load at top of
wall (ASD)

$$V_{rf,E} = 0.09 \cdot \text{kip}$$

$$M_{ot,w} := V_{rf,w} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,w} = 8.9 \cdot \text{kip} \cdot \text{ft}$$

$$M_{ot,E} := V_{rf,E} \cdot h_t$$

Overturning moment (ASD)

$$M_{ot,E} = 0.8 \cdot \text{kip} \cdot \text{ft}$$

Resisting Forces

$$P_{rf} := DL_{roof} \cdot \frac{17ft + 9in}{2} \cdot w_s$$

Total gravity load on wall

$$P_{rf} = 1.331 \cdot kip$$

$$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$$

Wal self weightload

$$P_w = 1.08 \cdot kip$$

$$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6 \quad \text{Resisting moment (ASD)}$$

$$M_{res} = 7.234 \cdot kip \cdot ft$$

Plywood Shear (ref. ANSI/AF&PA SDPWS)

$$n := 1$$

sides

$$\Omega_s := 2.0$$

(ASD shear capacity factor ref. section 4.3.3)

$$\Omega_o := 2.5$$

Overstrength factor

$$w_{v,w} := \frac{V_{rf,w}}{w_s} = 99 \cdot plf$$

Wind shear flow

$$w_{v,E} := \frac{V_{rf,E}}{w_s} = 9 \cdot plf$$

Seismic shear flow

$$w_{all,w} := \frac{(WSP) \cdot v_{w,7-16.8d.6} \cdot n}{\Omega_s} = 335 \cdot plf$$

$$check_{wv} := \text{if} \left(\frac{w_{v,w}}{w_{all,w}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,w}}{w_{all,w}} = 0.295$$

check_{wv} = "OK"

$$w_{all,E} := \frac{(WSP) \cdot v_{s,7-16.8d.6} \cdot n}{\Omega_s} = 240 \cdot plf$$

$$check_{wE} := \text{if} \left(\frac{w_{v,E}}{w_{all,E}} > 1.0, "NG", "OK" \right)$$

$$\frac{w_{v,E}}{w_{all,E}} = 0.039$$

check_{wE} = "OK"

Single Sided 7/16" sheathing w/ 8d @ 6" **O.C.** Panel Edges @ 12" O.C.
Interior Supports (ref. table 4.3A)

Bottom Plate Nailing $C_D := 1.6$

$t_{sp} := 1.5\text{in}$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 8\text{in}$ Nail spacing

$Z_{ll} := v_n \cdot C_D = 0.226 \cdot \text{kip}$ Allowable load parallel to grain (ref. NDS table 12)

$V_{sp} := w_{v.w} \cdot sp_a = 0.066 \cdot \text{kip}$ Shear load to each nail

$Check_a := \text{if}(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.292$

$Check_a = "OK"$

Use 16d Nail at 4.5"o.c. Staggered

Holdown

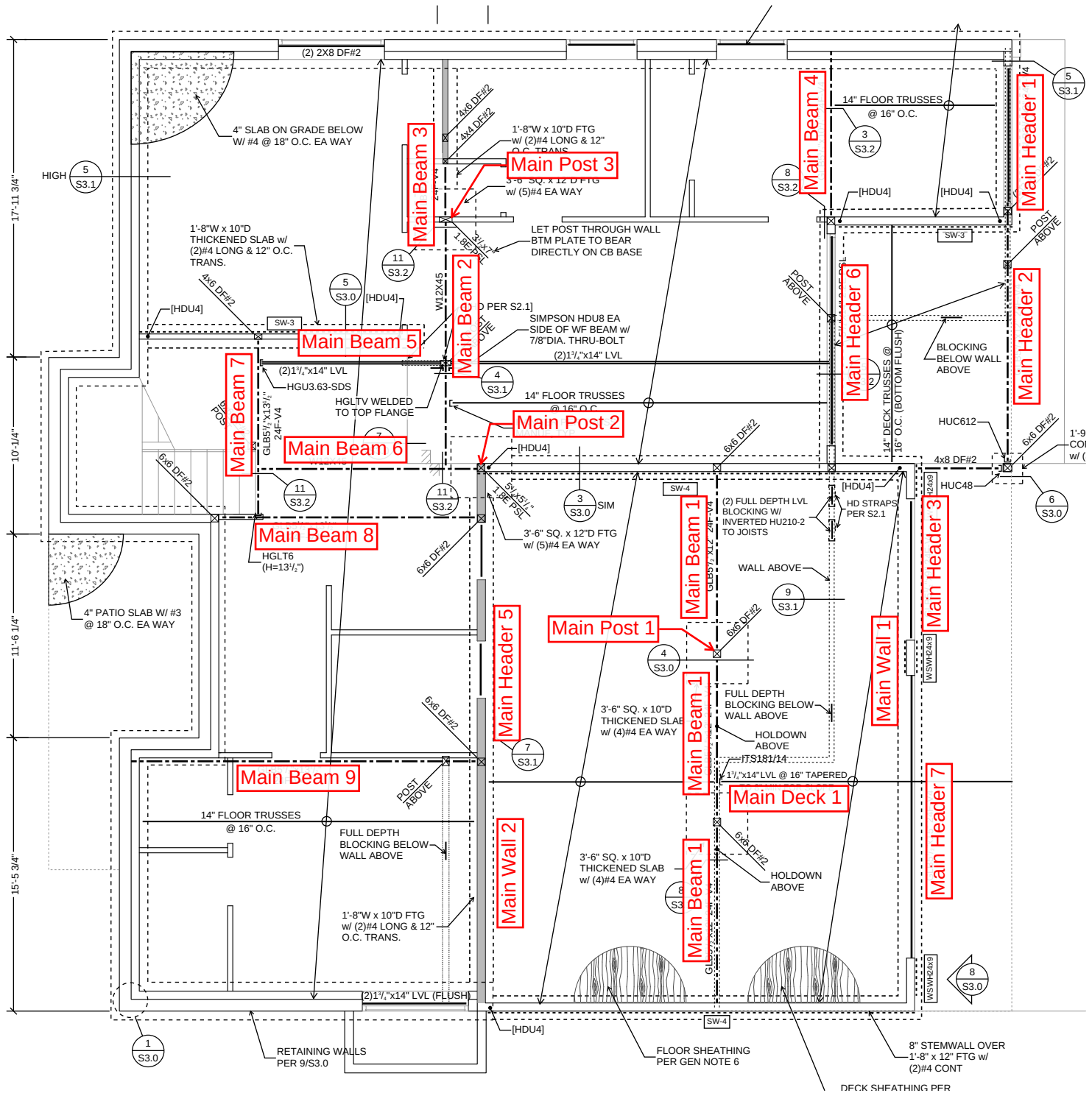
$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 0.165 \cdot \text{kip}$$

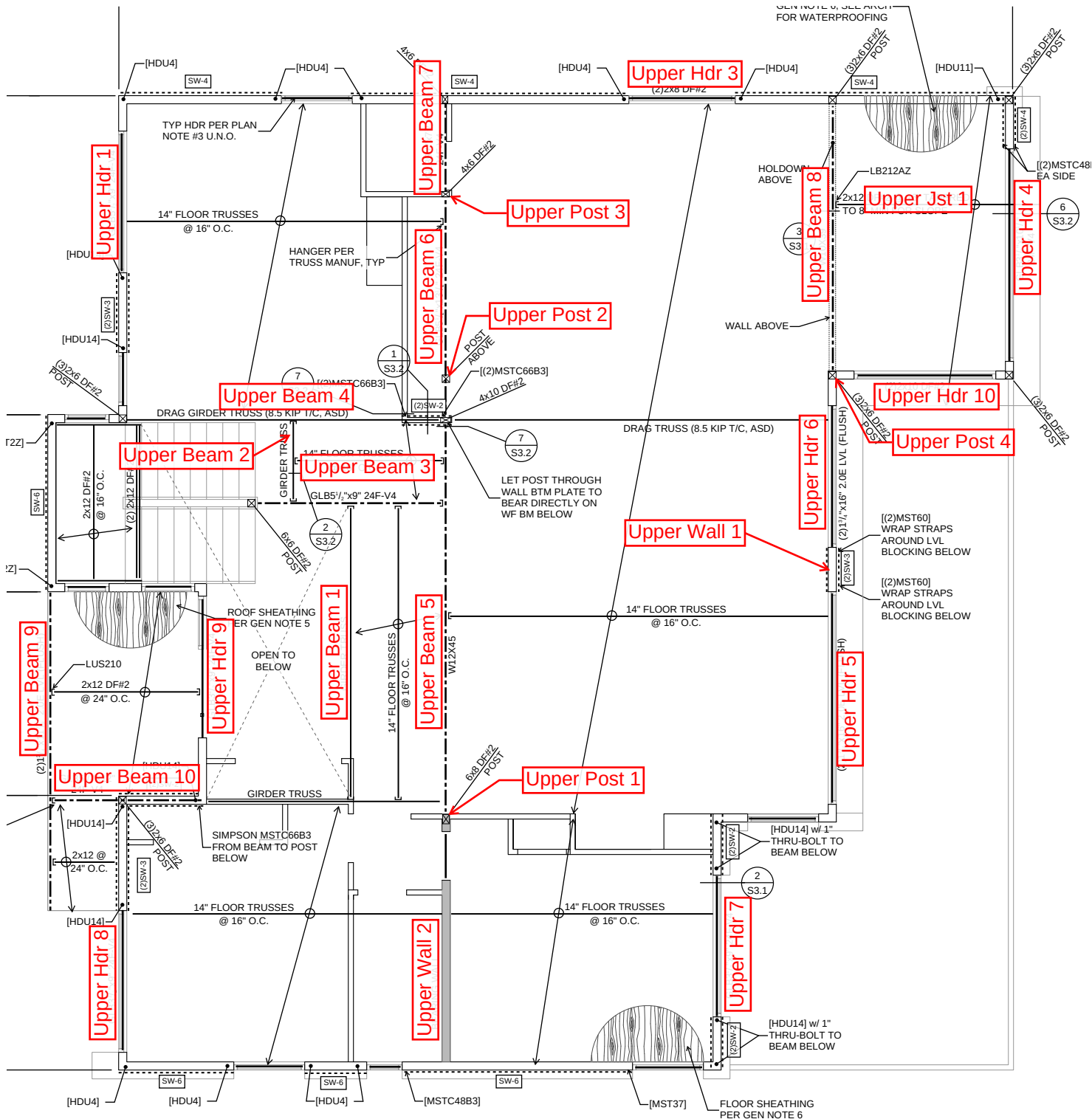
$check_T := \text{if}(T > 150\text{lbf}, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$

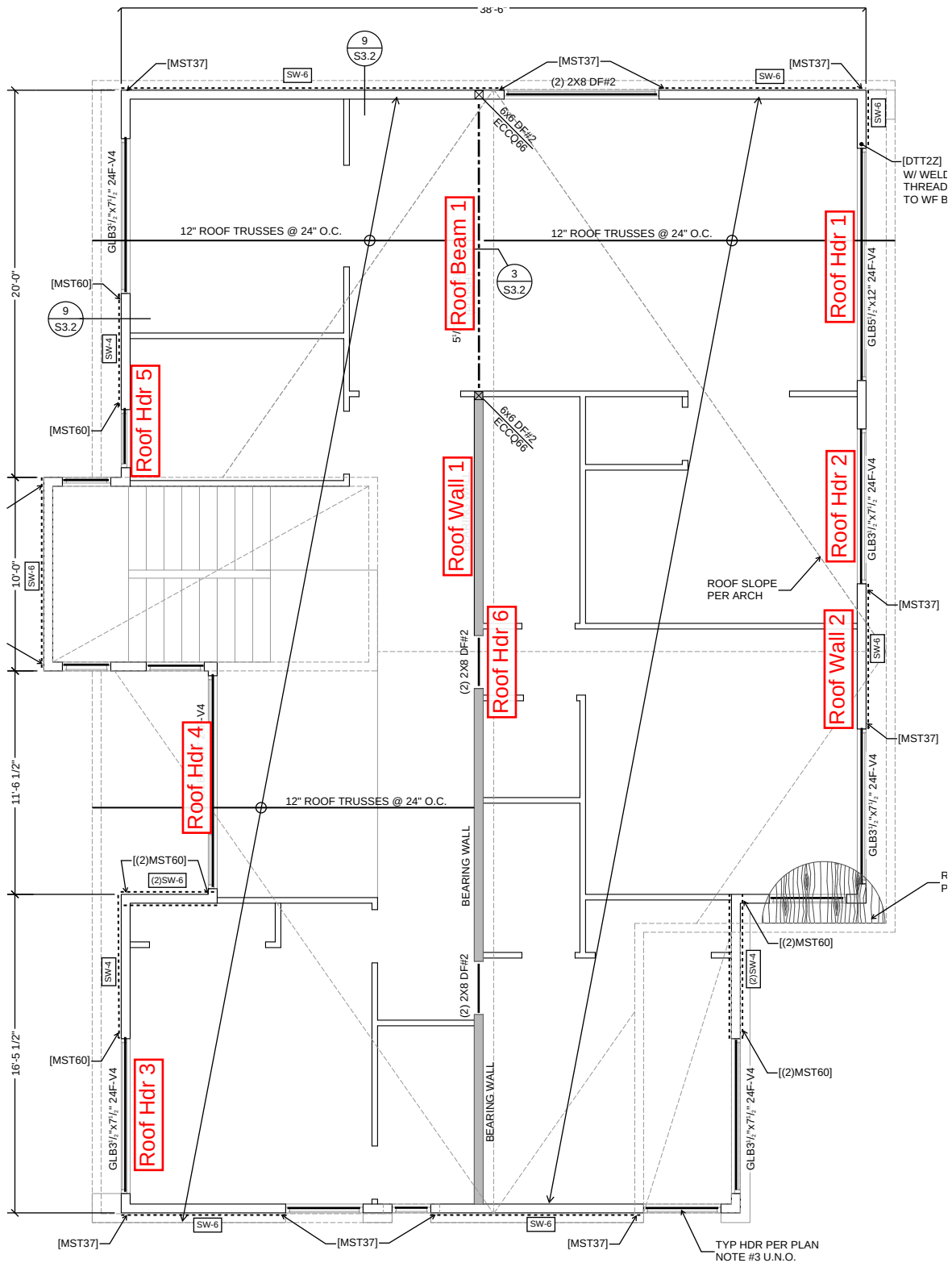
$T_{all} := MST37 = 2.705 \cdot \text{kip}$ Allowable tension load

$check_{HD} := \text{if}\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.061$

$check_{HD} = "OK"$







Roof			
Member Name	Results (Max UTIL %)	Current Solution	Comments
(Loading Only) Roof Truss 1	Passed (74% ΔT)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Roof Truss 2	Passed (46% ΔT)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Roof Truss 3	Failed (27% R)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	Left cantilever exceeds the maximum braced cantilever length of 5'.
Roof Header 1	Passed (84% ΔT)	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Roof Header 2	Passed (62% ΔL)	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam	
Roof Header 3	Passed (53% ΔL)	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam	
Roof Header 4	Passed (75% ΔL)	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Roof Header 5	Passed (29% M)	2 piece(s) 2 x 6 DF No.2	
Roof Header 6	Passed (43% M)	2 piece(s) 2 x 8 DF No.2	
Roof Beam 1	Passed (94% ΔT)	1 piece(s) 5 1/4" x 11 7/8" 2.2E Parallam® PSL	
Roof Post 1	Passed (54% f_{cp})	1 piece(s) 6 x 6 DF No.2	
Roof Wall 1	Passed (77% f_c)	1 piece(s) 2 x 4 DF No.2 @ 16" OC	
Roof Wall 2	Passed (15% f_{cp})	1 piece(s) 2 x 6 DF No.2 @ 16" OC	

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Upper Floor			
Member Name	Results (Max UTIL %)	Current Solution	Comments
(Loading Only) Upper Truss 1	Passed (41% R)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Upper Truss 2	Passed (80% ΔL)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Upper Truss 3	Passed (100% M)	1 piece(s) 14" TJI@ 110 @ 16" OC	
(Loading Only) Upper Truss 4	Passed (80% ΔL)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Upper Truss 5	Passed (53% M)	1 piece(s) 2 x 12 DF No.2 @ 24" OC	
(Loading Only) Upper Truss 6	Passed (25% R)	1 piece(s) 2 x 12 DF No.2 @ 24" OC	
(Loading Only) Upper Truss 7	Passed (39% M)	1 piece(s) 2 x 12 DF No.2 @ 24" OC	
(Loading Only) Upper Truss 8	Passed (57% ΔL)	1 piece(s) 11 7/8" TJI@ 360 @ 16" OC	
(Loading Only) Upper Truss 9	Passed (99% M)	1 piece(s) 2 x 12 DF No.2 @ 16" OC	
(Loading Only) Upper Joist 10	Passed (101% ΔL)	1 piece(s) 2 x 8 DF No.2 @ 16" OC	
Upper Joist 1	Passed (84% M)	1 piece(s) 2 x 8 DF No.2 @ 16" OC	
Upper Beam 1	Passed (31% ΔT)	2 piece(s) 1 1/2" x 14" 1.5E TimberStrand® LSL	
Upper Beam 2	Passed (30% R)	2 piece(s) 1 1/2" x 14" 1.5E TimberStrand® LSL	
Upper Beam 3	Passed (49% M+)	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Upper Beam 4	Passed (67% ΔT)	2 piece(s) 1 1/2" x 14" 1.5E TimberStrand® LSL	
Upper Beam 5	Passed (100% R)	1 piece(s) W12X45 (A992) ASTM Steel	
Upper Beam 6	Passed (98% R)	1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam	
Upper Beam 7	Passed (47% M+)	1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam	
Upper Beam 8	Passed (97% ΔT)	1 piece(s) W10X39 (A992) ASTM Steel	
Upper Beam 9	Failed (93% ΔL)	2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	Left cantilever exceeds the maximum braced cantilever length of 7'.
Upper Beam 10	Passed (96% M-)	1 piece(s) 5 1/2" x 12" 24F-V8 DF Glulam	
Upper Header 1	Passed (39% M+)	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Upper Header 3	Passed (67% M)	2 piece(s) 2 x 8 DF No.2	
Upper Header 4	Passed (63% ΔL)	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Upper Header 5	Passed (99% ΔT)	2 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL	
Upper Header 6	Passed (70% R)	1 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL	
Upper Header 7	Passed (41% M+)	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
Upper Header 8	Passed (60% M+)	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
Upper Header 9	Passed (45% M+)	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
Upper Header 10	Passed (83% M)	2 piece(s) 2 x 10 DF No.2	
Upper Wall 1	Passed (27% B/C)	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Upper Wall 2	Passed (49% f _{ep})	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Upper Post 1	Passed (95% f _{ep})	1 piece(s) 6 x 8 DF No.2	
Upper Post 2	Failed (155% f _{ep})	1 piece(s) 4 x 10 DF No.2	
Upper Post 3	Passed (100% f _{ep})	1 piece(s) 4 x 6 DF No.2	
Upper Post 4	Passed (69% f _{ep})	3 piece(s) 2 x 6 DF No.2	

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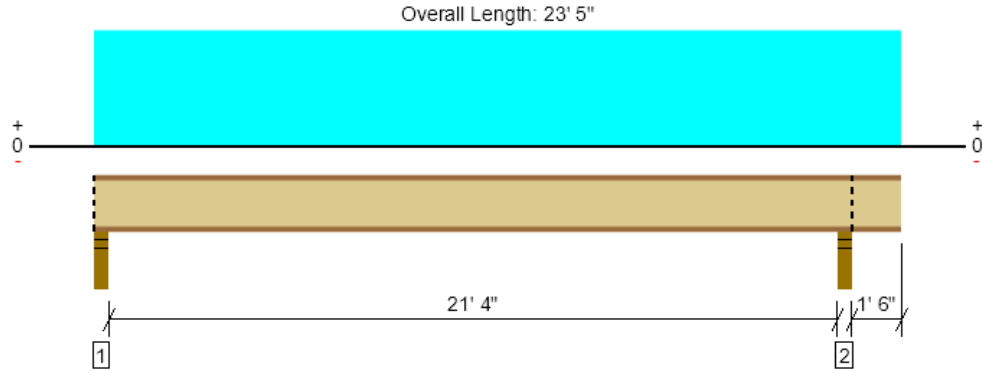
Main			
Member Name	Results (Max UTIL %)	Current Solution	Comments
(Loading Only) Main Truss 1	Passed (78% ΔL)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Main Truss 2	Passed (39% R)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Main Truss 3-2	Passed (36% R)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Main Truss 4	Passed (66% ΔL)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Main Truss 5	Passed (38% R)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Main Truss 6	Passed (78% ΔL)	1 piece(s) 11 7/8" TJI@ 230 @ 16" OC	
(Loading Only) Main Truss 7	Passed (78% ΔL)	1 piece(s) 14" TJI@ 360 @ 16" OC	
Main Deck 1	Passed (72% ΔL)	1 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL @ 16" OC	
Main Beam 1	Passed (77% M+)	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Main Beam 2	Passed (98% M)	1 piece(s) W12X45 (A992) ASTM Steel	
Main Beam 3	Passed (39% R)	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam	
Main Beam 4	Passed (61% ΔL)	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	
Main Beam 5	Passed (46% R)	2 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL	
Main Beam 6	Passed (86% M)	1 piece(s) W12X35 (A992) ASTM Steel	
Main Beam 7	Passed (100% R)	1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam	
Main Beam 8	Passed (74% V)	1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam	
Main Beam 9	Passed (99% V)	1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam	
Main Header 1	Passed (42% M+)	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
Main Header 2	Passed (30% M+)	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Main Header 3	Passed (72% M+)	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Main Header 5	Passed (91% M)	2 piece(s) 2 x 6 DF No.2	
Main Header 6	Passed (100% ΔT)	1 piece(s) 5 1/4" x 14" 2.2E Parallam® PSL	
Main Header 7	Passed (101% M+)	1 piece(s) 5 1/2" x 15" 24F-V4 DF Glulam	
Main Wall 1	Passed (63% f_{cp})	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Main Wall 2	Passed (70% f_{cp})	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Main Post 1	Passed (92% f_c)	1 piece(s) 6 x 6 DF No.2	
Main Post 2	Passed (61% f_c)	1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL	
Main Post 3	Failed (137% f_{cp})	1 piece(s) 3 1/2" x 7" 1.8E Parallam® PSL	

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Roof, (Loading Only) Roof Truss 1
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	584 @ 2 1/2"	1708 (3.50")	Passed (34%)	1.15	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	568 @ 3 1/2"	1903	Passed (30%)	1.15	1.0 D + 1.0 S (Alt Spans)
Moment (Ft-lbs)	3075 @ 10' 11 3/8"	4847	Passed (63%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.499 @ 10' 11 3/4"	0.719	Passed (L/519)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.796 @ 10' 11 11/16"	1.078	Passed (L/325)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 23' 5"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.75"	219	292	365	584	Blocking
2 - Stud wall - SPF	3.50"	3.50"	3.50"	250	333	416	666	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 10" o/c	
Bottom Edge (Lu)	9' 7" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 23' 5"	16"	15.0	20.0	25.0	Default Load

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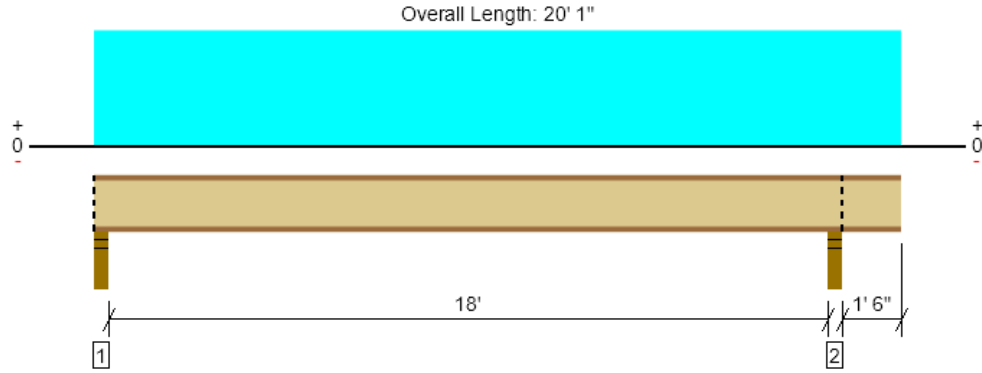
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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Roof, (Loading Only) Roof Truss 2
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	494 @ 2 1/2"	1708 (3.50")	Passed (29%)	1.15	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	479 @ 3 1/2"	1903	Passed (25%)	1.15	1.0 D + 1.0 S (Alt Spans)
Moment (Ft-lbs)	2191 @ 9' 3 1/4"	4847	Passed (45%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.261 @ 9' 3 3/4"	0.608	Passed (L/837)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.417 @ 9' 3 11/16"	0.911	Passed (L/525)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 20' 1"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.75"	185	248	310	494	Blocking
2 - Stud wall - SPF	3.50"	3.50"	3.50"	217	289	361	578	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 9" o/c	
Bottom Edge (Lu)	9' 7" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 20' 1"	16"	15.0	20.0	25.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

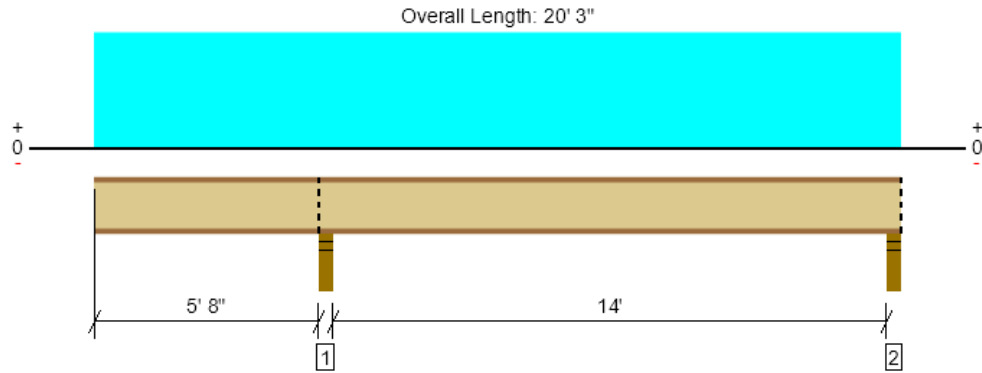
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Roof, (Loading Only) Roof Truss 3
1 piece(s) 11 7/8" TJI® 230 @ 16" OC

Left cantilever exceeds the maximum braced cantilever length of 5'.



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	753 @ 5' 9 3/4"	2772 (3.50")	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	414 @ 5' 11 1/2"	1903	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-901 @ 5' 9 3/4"	3635	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.086 @ 13' 2"	0.474	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.127 @ 13' 3 5/16"	0.711	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Moment capacity over cantilever support 1 has been reduced by 25% to lessen the effects of buckling.
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 20' 3"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	3.50"	282	376	470	753	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.75"	123	179	224	347	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 5" o/c	
Bottom Edge (Lu)	9' 2" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 20' 3"	16"	15.0	20.0	25.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

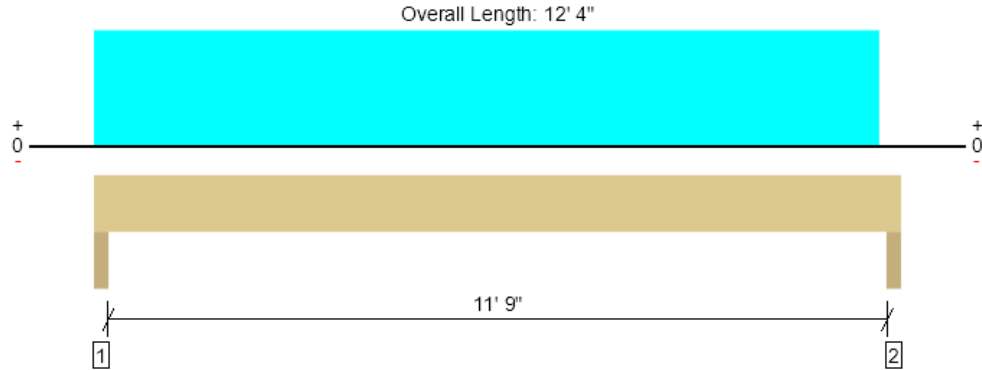
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Roof, Roof Header 1

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3179 @ 2"	12513 (3.50")	Passed (25%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2514 @ 11' 1/2"	13409	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	9276 @ 6' 2"	30360	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.102 @ 6' 2"	0.300	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.169 @ 6' 2"	0.200	Passed (L/854)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/720).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 12' 4"
 System : Wall
 Member Type : Header
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	1255	1540	1924	3179	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1193	1457	1820	3013	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 4" o/c	
Bottom Edge (Lu)	12' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12' 4"	N/A	16.0	--	--	
1 - Uniform (PLF)	0 to 12'	N/A	187.5	249.8	312.0	Linked from: Roof Truss 1, Support 2

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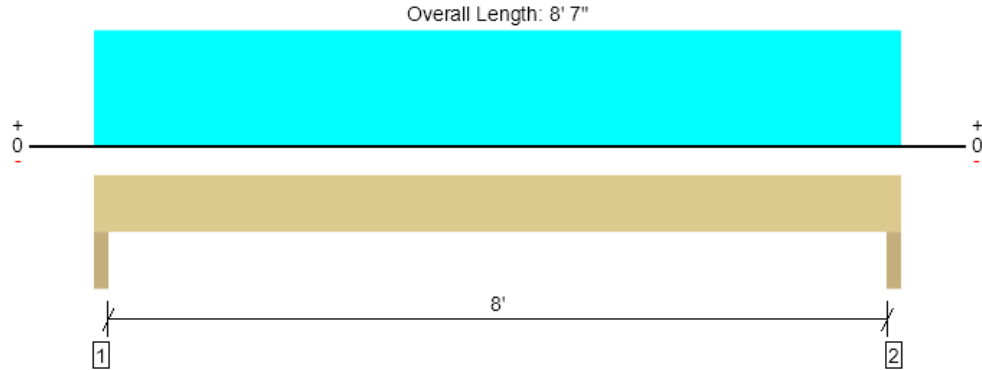


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File Name: 22-112 3804_House
 S114

Roof, Roof Header 2

1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1907 @ 2"	7963 (3.50")	Passed (24%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1500 @ 11"	5333	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3781 @ 4' 3 1/2"	7547	Passed (50%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.129 @ 4' 3 1/2"	0.206	Passed (L/768)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.209 @ 4' 3 1/2"	0.412	Passed (L/473)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 8' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	732	940	1175	1907	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	732	940	1175	1907	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	6.4	--	--	
1 - Uniform (PLF)	0 to 8' 7"	N/A	164.3	219.0	273.8	Linked from: Roof Truss 1, Support 1

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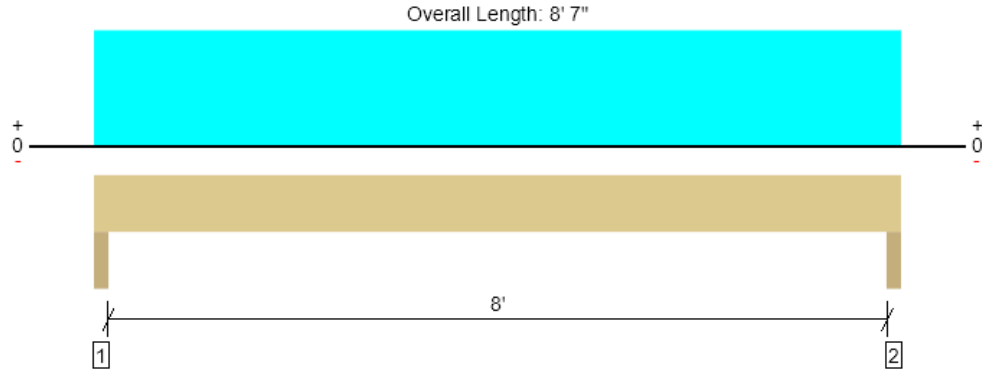


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File Name: 22-112 3804_House
S115

Roof, Roof Header 3

1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1621 @ 2"	7963 (3.50")	Passed (20%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1275 @ 11"	5333	Passed (24%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3213 @ 4' 3 1/2"	7547	Passed (43%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.109 @ 4' 3 1/2"	0.206	Passed (L/905)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.178 @ 4' 3 1/2"	0.412	Passed (L/557)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 8' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	623	798	998	1621	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	623	798	998	1621	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	6.4	--	--	
1 - Uniform (PLF)	0 to 8' 7"	N/A	138.8	186.0	232.5	Linked from: Roof Truss 2, Support 1

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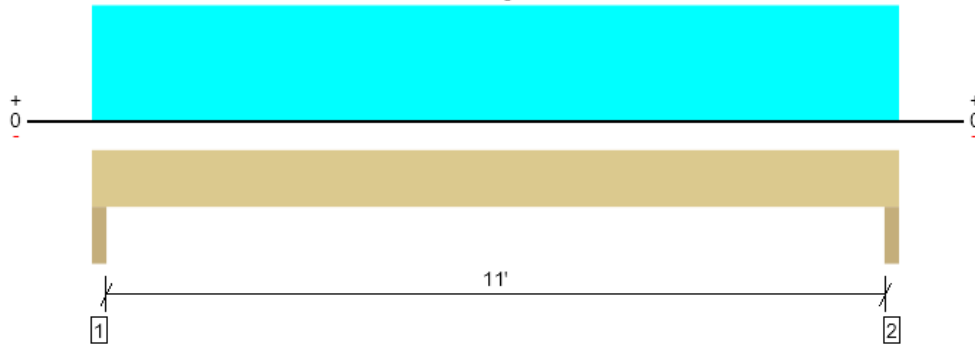
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S116

Roof, Roof Header 4

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam

Overall Length: 11' 7"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3336 @ 2"	12513 (3.50")	Passed (27%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2736 @ 1' 1/2"	10057	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	9113 @ 5' 9 1/2"	17078	Passed (53%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.211 @ 5' 9 1/2"	0.281	Passed (L/639)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.345 @ 5' 9 1/2"	0.563	Passed (L/391)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 11' 7"
 System : Wall
 Member Type : Header
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	1295	1633	2042	3336	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1295	1633	2042	3336	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 7" o/c	
Bottom Edge (Lu)	11' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 11' 7"	N/A	12.0	--	--	
1 - Uniform (PLF)	0 to 11' 7"	N/A	211.5	282.0	352.5	Linked from: Roof Truss 3, Support 1

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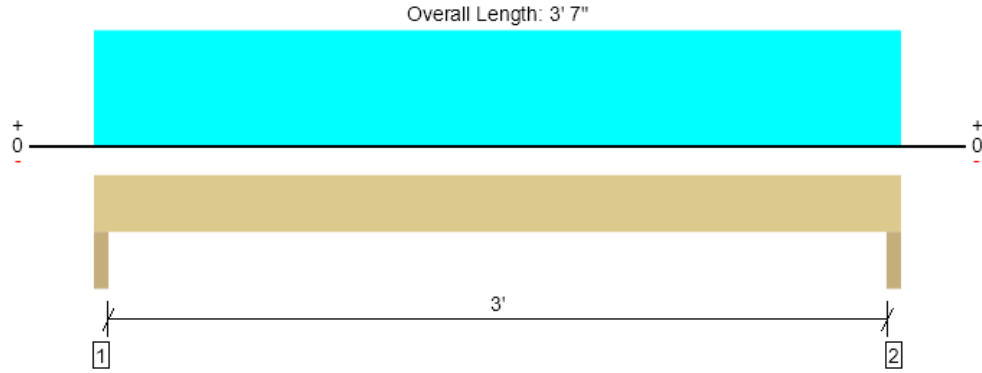
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 S117

Roof, Roof Header 5
2 piece(s) 2 x 6 DF No.2



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	673 @ 2"	6563 (3.50")	Passed (10%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	391 @ 9"	2277	Passed (17%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	496 @ 1' 9 1/2"	1696	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.009 @ 1' 9 1/2"	0.081	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.014 @ 1' 9 1/2"	0.162	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Member Length : 3' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	256	333	417	673	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	256	333	417	673	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 7" o/c	
Bottom Edge (Lu)	3' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 7"	N/A	4.2	--	--	
1 - Uniform (PLF)	0 to 3' 7"	N/A	138.8	186.0	232.5	Linked from: Roof Truss 2, Support 1

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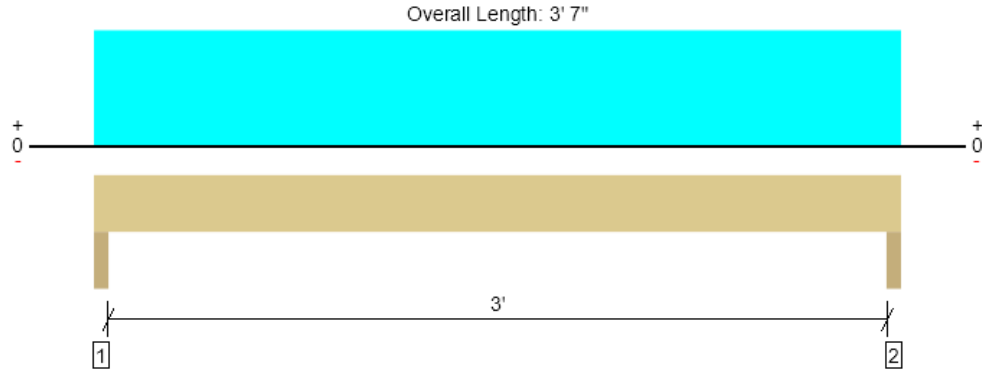
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S118

Roof, Roof Header 6
2 piece(s) 2 x 8 DF No.2



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1571 @ 2"	6563 (3.50")	Passed (24%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	786 @ 10 3/4"	3002	Passed (26%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1158 @ 1' 9 1/2"	2720	Passed (43%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.009 @ 1' 9 1/2"	0.081	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.014 @ 1' 9 1/2"	0.162	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Member Length : 3' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	596	781	976	1571	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	596	781	976	1571	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 7" o/c	
Bottom Edge (Lu)	3' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 7"	N/A	5.5	--	--	
1 - Uniform (PLF)	0 to 3' 7"	N/A	164.3	219.0	273.8	Linked from: Roof Truss 1, Support 1
2 - Uniform (PLF)	0 to 3' 7"	N/A	162.8	216.8	270.8	Linked from: Roof Truss 2, Support 2

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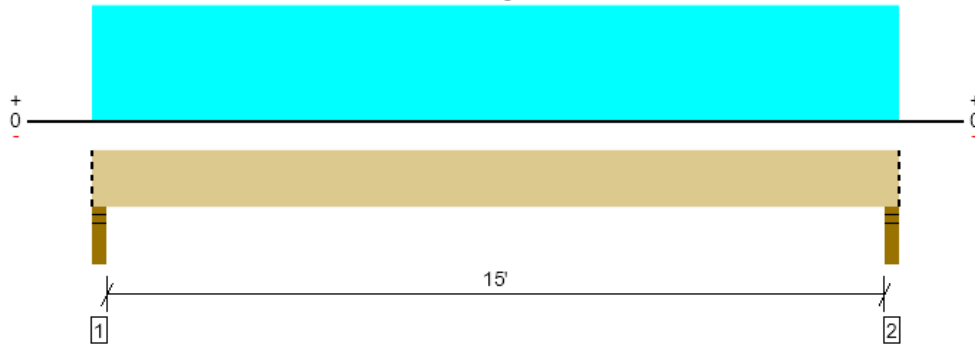


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S119

Roof, Roof Beam 1

1 piece(s) 5 1/4" x 11 7/8" 2.2E Parallam® PSL

Overall Length: 15' 7"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	6942 @ 2"	7809 (3.50")	Passed (89%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	5801 @ 1' 3 3/8"	13861	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	25901 @ 7' 9 1/2"	34332	Passed (75%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.438 @ 7' 9 1/2"	0.508	Passed (L/418)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.716 @ 7' 9 1/2"	0.762	Passed (L/256)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 15' 7"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	3.11"	2700	3395	4243	6942	Blocking
2 - Stud wall - SPF	3.50"	3.50"	3.11"	2700	3395	4243	6942	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	15' 7" o/c	
Bottom Edge (Lu)	15' 7" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 15' 7"	N/A	19.5	--	--	
1 - Uniform (PLF)	0 to 15' 7" (Front)	N/A	164.3	219.0	273.8	Linked from: Roof Truss 1, Support 1
2 - Uniform (PLF)	0 to 15' 7" (Front)	N/A	162.8	216.8	270.8	Linked from: Roof Truss 2, Support 2

- Side loads are assumed to not induce cross-grain tension.

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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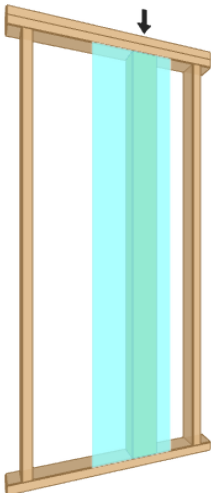
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Roof, Roof Post 1
1 piece(s) 6 x 6 DF No.2

Wall Height: 12'

Member Height: 11' 7 1/2"

Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	6943	14197	Passed (49%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	6943	12856	Passed (54%)	--	1.0 D + 1.0 S
Lateral Reaction (lbs)	84	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	78	5485	Passed (1%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	245 @ mid-span	2773	Passed (9%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.04 @ mid-span	1.16	Passed (L/3321)	--	1.0 D + 0.6 W
Bending/Compression	0.24	1	Passed (24%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- This product has a square cross section. The analysis engine has checked both edge and plank orientations to allow for either installation.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Lateral Connections

Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Loads	Tributary Width	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	-	-	-	
2 - Point (lb)	N/A	2700	3395	4243	Linked from: Roof Beam 1, Support 2

Lateral Load	Location	Tributary Width	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	1'	24.1	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Wind Zone (4), GCpi (+/- 0.18), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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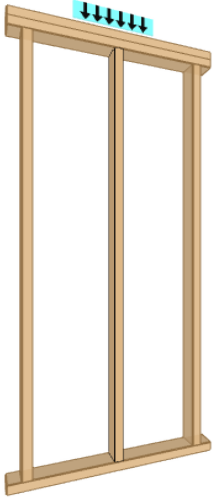
Roof, Roof Wall 1

1 piece(s) 2 x 4 DF No.2 @ 16" OC

Wall Height: 12'

Member Height: 11' 7 1/2"

O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	40	50	Passed (80%)	--	--
Compression (lbs)	1162	1517	Passed (77%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	1162	2789	Passed (42%)	--	1.0 D + 1.0 S
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Vertical Loads	Spacing	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	164.3	219.0	273.8	Linked from: Roof Truss 1, Support 1
2 - Point (PLF)	16.00"	162.8	216.8	270.8	Linked from: Roof Truss 2, Support 2

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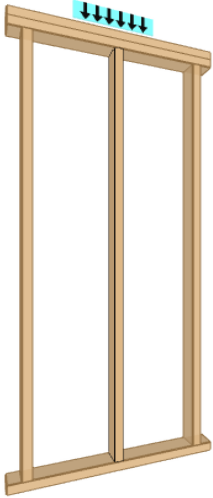
Roof, Roof Wall 2

1 piece(s) 2 x 6 DF No.2 @ 16" OC

Wall Height: 12'

Member Height: 11' 7 1/2"

O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	666	5432	Passed (12%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	666	4383	Passed (15%)	--	1.0 D + 1.0 S
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Vertical Load	Spacing	Dead (0.90)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	187.5	249.8	312.0	Linked from: Roof Truss 1, Support 2

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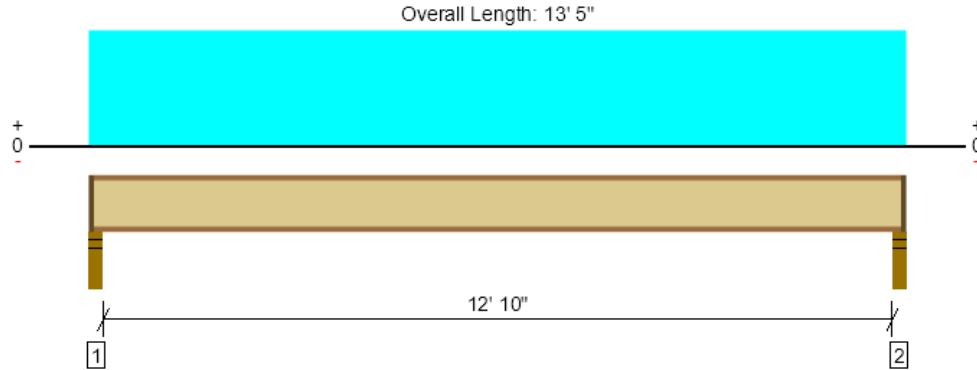
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Upper Floor, (Loading Only) Upper Truss 1
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	484 @ 2 1/2"	1183 (2.25")	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	471 @ 3 1/2"	1655	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1549 @ 6' 8 1/2"	4215	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.102 @ 6' 8 1/2"	0.325	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.140 @ 6' 8 1/2"	0.650	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	56	40	Passed	--	--

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Member Length : 13' 2 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	134	358	492	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	134	358	492	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 11" o/c	
Bottom Edge (Lu)	13' 3" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 5"	16"	15.0	40.0	Default Load

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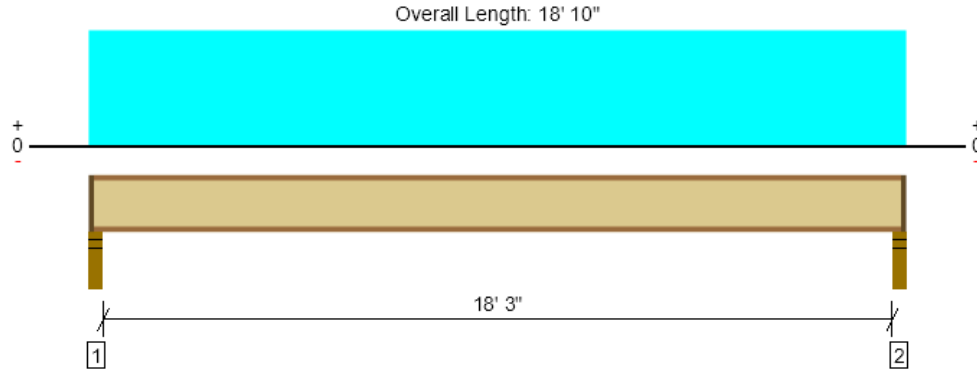
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Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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S124

Upper Floor, (Loading Only) Upper Truss 2
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	683 @ 2 1/2"	1183 (2.25")	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	669 @ 3 1/2"	1655	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3109 @ 9' 5"	4215	Passed (74%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.368 @ 9' 5"	0.460	Passed (L/600)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.507 @ 9' 5"	0.921	Passed (L/436)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	39	35	Passed	--	--

Member Length : 18' 7 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	188	502	691	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	188	502	691	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 9" o/c	
Bottom Edge (Lu)	18' 8" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 18' 10"	16"	15.0	40.0	Default Load

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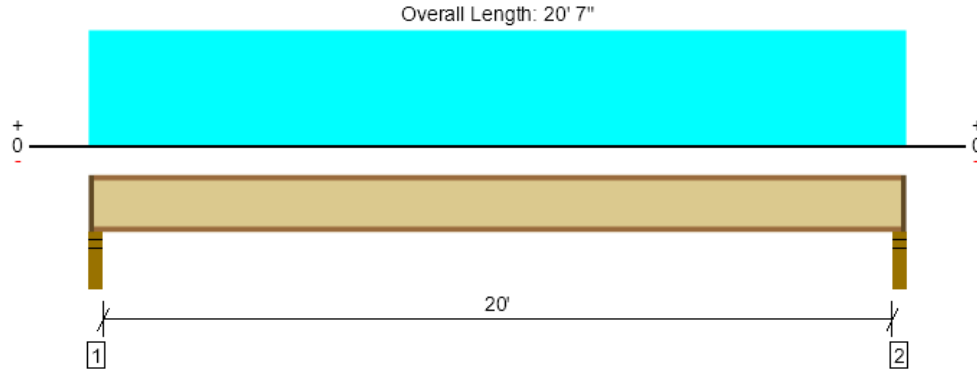
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S125

Upper Floor, (Loading Only) Upper Truss 3
1 piece(s) 14" TJI® 110 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	747 @ 2 1/2"	1041 (2.25")	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	733 @ 3 1/2"	1860	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3728 @ 10' 3 1/2"	3740	Passed (100%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.448 @ 10' 3 1/2"	0.504	Passed (L/540)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.616 @ 10' 3 1/2"	1.008	Passed (L/393)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	35	35	Passed	--	--

Member Length : 20' 4 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	206	549	755	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	206	549	755	1 1/4" Rim Board

Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 1" o/c	
Bottom Edge (Lu)	20' 5" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 7"	16"	15.0	40.0	Default Load

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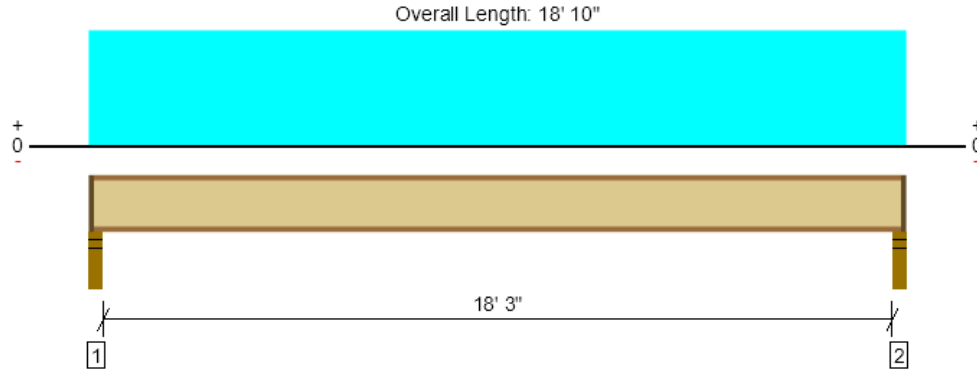
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S126

Upper Floor, (Loading Only) Upper Truss 4
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	683 @ 2 1/2"	1183 (2.25")	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	669 @ 3 1/2"	1655	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3109 @ 9' 5"	4215	Passed (74%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.368 @ 9' 5"	0.460	Passed (L/600)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.507 @ 9' 5"	0.921	Passed (L/436)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	39	35	Passed	--	--

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Member Length : 18' 7 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	188	502	691	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	188	502	691	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 9" o/c	
Bottom Edge (Lu)	18' 8" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 18' 10"	16"	15.0	40.0	Default Load

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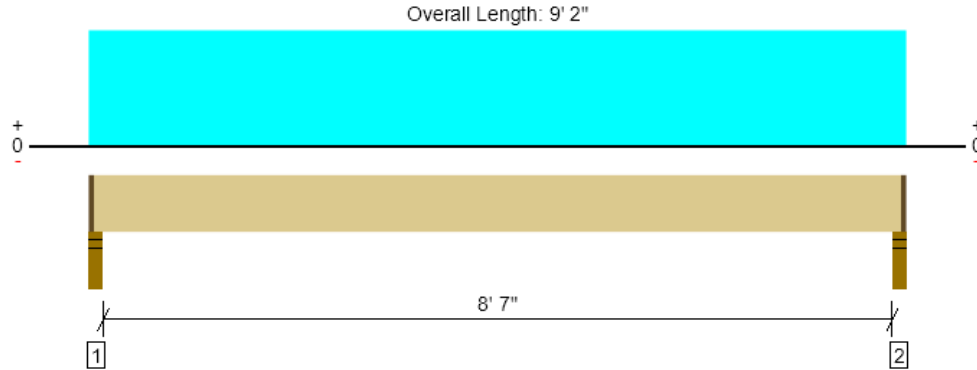
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



7/29/2024 11:53:43 PM UTC
ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2
File Name: 22-112 3804 House
S127

Upper Floor, (Loading Only) Upper Truss 5
1 piece(s) 2 x 12 DF No.2 @ 24" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	672 @ 2 1/2"	1434 (2.25")	Passed (47%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	503 @ 1' 2 3/4"	2025	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1436 @ 4' 7"	2729	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.056 @ 4' 7"	0.219	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.069 @ 4' 7"	0.438	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 8' 11 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	138	550	688	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	138	550	688	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' o/c	
Bottom Edge (Lu)	9' o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 9' 2"	24"	15.0	60.0	Default Load

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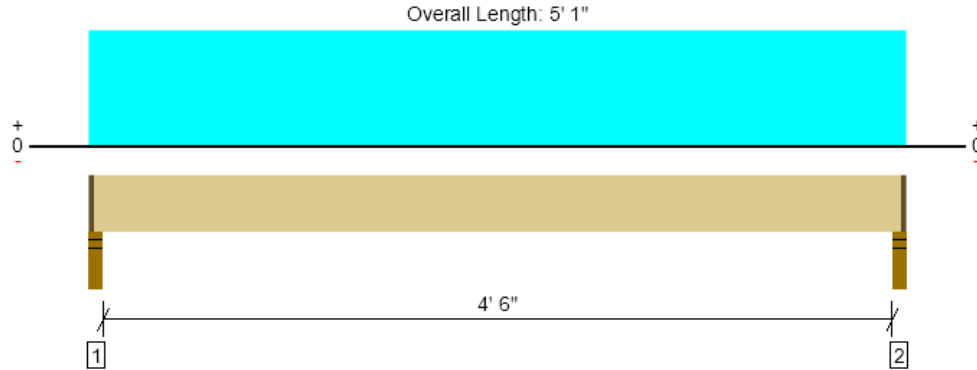
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File Name: 22-112 3804_House
S128

Upper Floor, (Loading Only) Upper Truss 6
1 piece(s) 2 x 12 DF No.2 @ 24" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	366 @ 2' 1/2"	1434 (2.25")	Passed (25%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	197 @ 1' 2 3/4"	2025	Passed (10%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	408 @ 2' 6 1/2"	2729	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.004 @ 2' 6 1/2"	0.117	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.006 @ 2' 6 1/2"	0.233	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 4' 10 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	76	305	381	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	76	305	381	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 11" o/c	
Bottom Edge (Lu)	4' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 5' 1"	24"	15.0	60.0	Default Load

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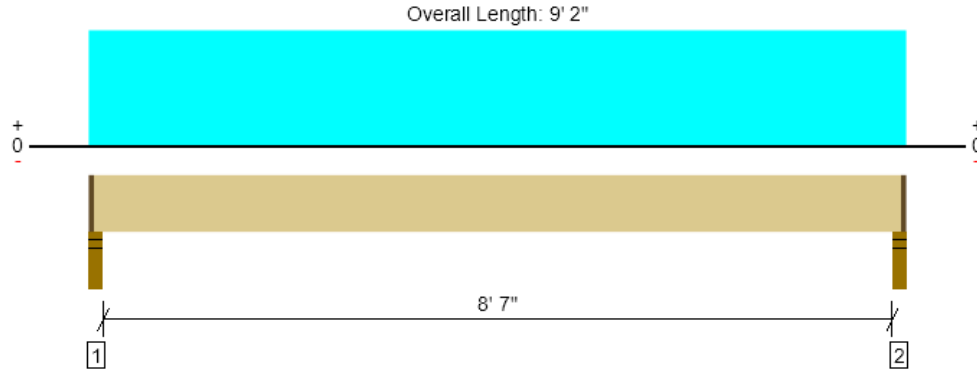
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File Name: 22-112 3804_House
S129

Upper Floor, (Loading Only) Upper Truss 7
1 piece(s) 2 x 12 DF No.2 @ 24" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	493 @ 2 1/2"	1434 (2.25")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	369 @ 1' 2 3/4"	2025	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1053 @ 4' 7"	2729	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.037 @ 4' 7"	0.219	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.051 @ 4' 7"	0.438	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 8' 11 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	138	367	504	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	138	367	504	1 1/4" Rim Board

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' o/c	
Bottom Edge (Lu)	9' o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 9' 2"	24"	15.0	40.0	Default Load

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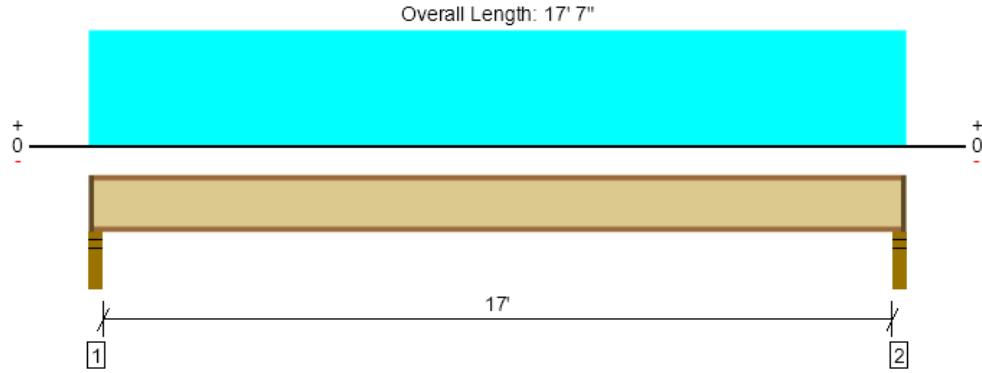
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File Name: 22-112 3804 House
S130

Upper Floor, (Loading Only) Upper Truss 8
1 piece(s) 11 7/8" TJI® 360 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	637 @ 2 1/2"	1202 (2.25")	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	623 @ 3 1/2"	1705	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2701 @ 8' 9 1/2"	6180	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.245 @ 8' 9 1/2"	0.429	Passed (L/841)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.337 @ 8' 9 1/2"	0.858	Passed (L/611)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	46	35	Passed	--	--

Member Length : 17' 4 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	176	469	645	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	176	469	645	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 9" o/c	
Bottom Edge (Lu)	17' 5" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17' 7"	16"	15.0	40.0	Default Load

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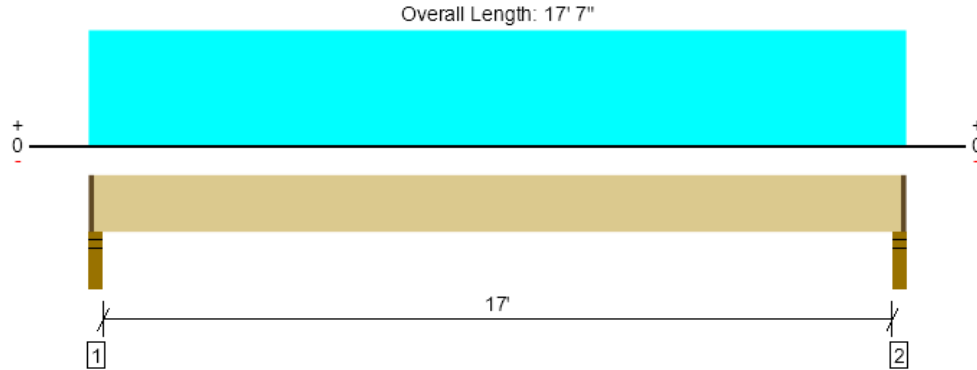
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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File Name: 22-112 3804 House
S131

Upper Floor, (Loading Only) Upper Truss 9
1 piece(s) 2 x 12 DF No.2 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	637 @ 2 1/2"	1434 (2.25")	Passed (44%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	555 @ 1' 2 3/4"	2025	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2701 @ 8' 9 1/2"	2729	Passed (99%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.366 @ 8' 9 1/2"	0.429	Passed (L/563)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.503 @ 8' 9 1/2"	0.858	Passed (L/409)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 17' 4 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	176	469	645	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	176	469	645	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11" o/c	
Bottom Edge (Lu)	17' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17' 7"	16"	15.0	40.0	Default Load

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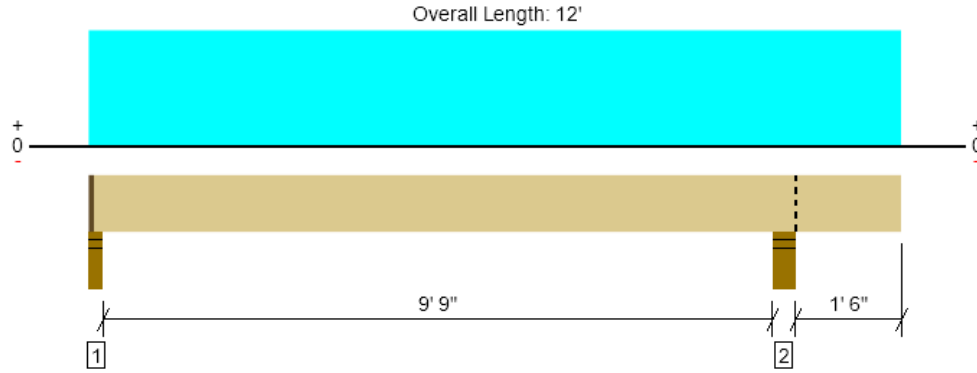
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S132

Upper Floor, (Loading Only) Upper Joist 10
1 piece(s) 2 x 8 DF No.2 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	534 @ 2' 1/2"	1434 (2.25")	Passed (37%)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Shear (lbs)	435 @ 9' 5 1/4"	1305	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1251 @ 5' 2 1/2"	1360	Passed (92%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.255 @ 5' 2 13/16"	0.252	Passed (L/474)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Total Load Defl. (in)	0.311 @ 5' 2 11/16"	0.503	Passed (L/388)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 11' 10 3/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	102	419/-4	172	545	1 1/4" Rim Board
2 - Stud wall - SPF	5.50"	5.50"	1.50"	138	553	230	725	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' o/c	
Bottom Edge (Lu)	11' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 12'	16"	15.0	60.0	25.0	Default Load

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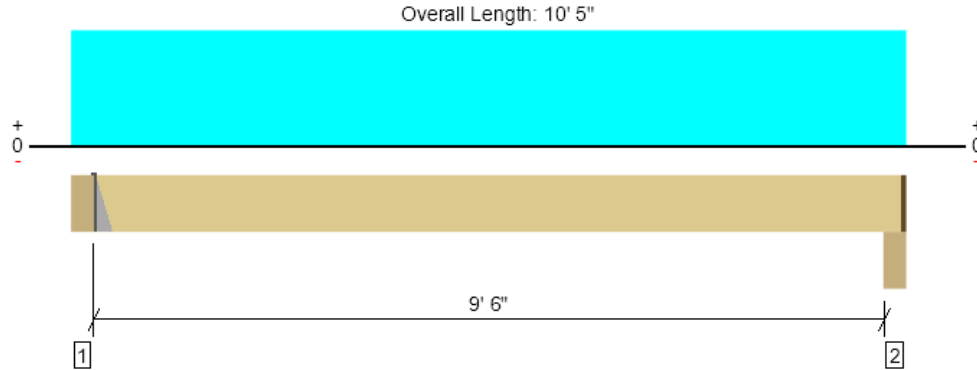
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File Name: 22-112 3804 House

Upper Floor, Upper Joist 1
1 piece(s) 2 x 8 DF No.2 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	479 @ 5' 1/2"	1406 (1.50")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	419 @ 1' 3/4"	1305	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1148 @ 5' 3"	1360	Passed (84%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.199 @ 5' 3"	0.240	Passed (L/577)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.249 @ 5' 3"	0.479	Passed (L/462)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 9' 10 1/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 7 1/4" DF beam	5.50"	Hanger ¹	1.50"	105	420	525	See note ¹
2 - Beam - DF	5.50"	4.25"	1.50"	103	413	517	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 2" o/c	
Bottom Edge (Lu)	9' 10" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	THA29	2.25"	4-10d	6-10d	4-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 10' 5"	16"	15.0	60.0	Floor

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

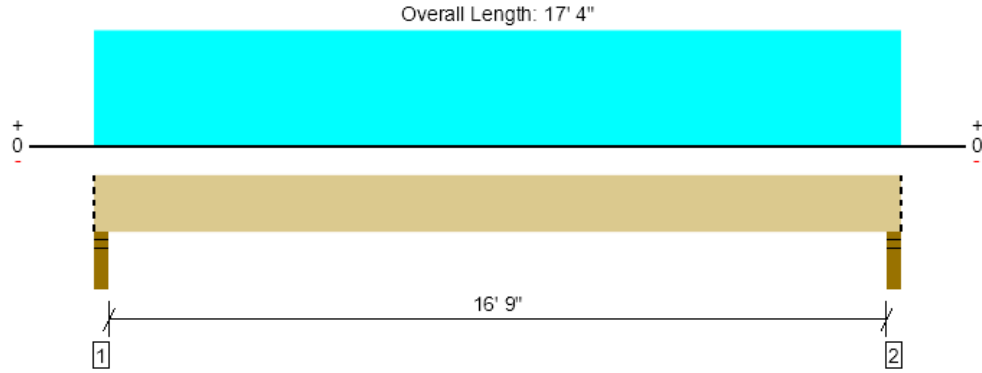
ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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File Name: 22-112 3804 House
S134

Upper Floor, Upper Beam 1
2 piece(s) 1 1/2" x 14" 1.5E TimberStrand® LSL



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1151 @ 2"	4463 (3.50")	Passed (26%)	--	1.0 D (All Spans)
Shear (lbs)	958 @ 1' 5 1/2"	7560	Passed (13%)	0.90	1.0 D (All Spans)
Moment (Ft-lbs)	4799 @ 8' 8"	16305	Passed (29%)	0.90	1.0 D (All Spans)
Live Load Defl. (in)	0.000 @ 0	0.425	Passed (2L/999+)	--	1.0 D (All Spans)
Total Load Defl. (in)	0.260 @ 8' 8"	0.850	Passed (L/784)	--	1.0 D (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 17' 4"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)		Accessories
	Total	Available	Required	Dead	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	1151	1151	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	1151	1151	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 4" o/c	
Bottom Edge (Lu)	17' 4" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Comments
0 - Self Weight (PLF)	0 to 17' 4"	N/A	12.8	
1 - Uniform (PLF)	0 to 17' 4" (Front)	N/A	120.0	Floor

- Side loads are assumed to not induce cross-grain tension.

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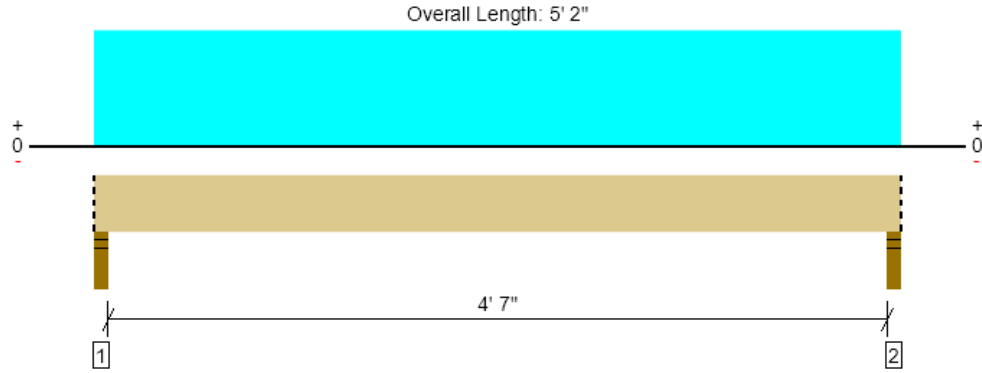
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File Name: 22-112 3804_House
S135

Upper Floor, Upper Beam 2

2 piece(s) 1 1/2" x 14" 1.5E TimberStrand® LSL



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1325 @ 2"	4463 (3.50")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	577 @ 1' 5 1/2"	8400	Passed (7%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1498 @ 2' 7"	18116	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 2' 7"	0.121	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.012 @ 2' 7"	0.242	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 5' 2"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	386	939	1325	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	386	939	1325	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 2" o/c	
Bottom Edge (Lu)	5' 2" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 5' 2"	N/A	12.8	--	
1 - Uniform (PSF)	0 to 5' 2" (Front)	4' 6"	15.0	40.0	Floor
2 - Uniform (PLF)	0 to 5' 2" (Front)	N/A	69.0	183.5	Linked from: Upper Truss 7, Support 1

- Side loads are assumed to not induce cross-grain tension.

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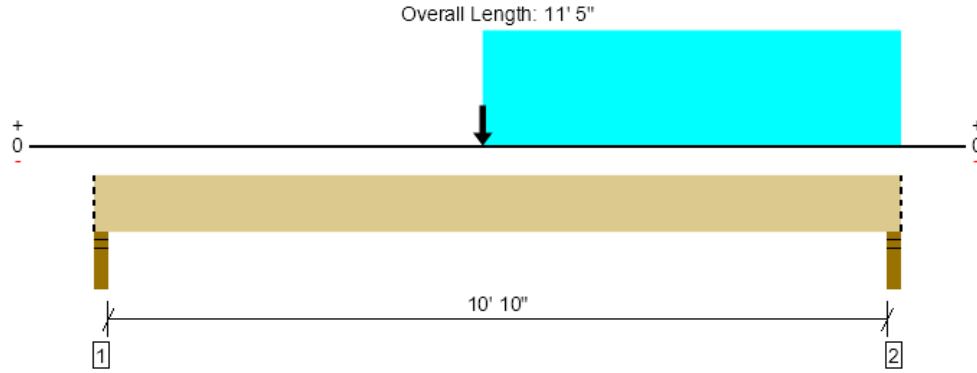


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File Name: 22-112 3804_House

S136

Upper Floor, Upper Beam 3
1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2763 @ 11' 3"	8181 (3.50")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2247 @ 10' 4 1/2"	8745	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	7247 @ 5' 10 1/8"	14850	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.106 @ 6' 1 3/16"	0.277	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.246 @ 5' 11"	0.554	Passed (L/542)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 11' 5"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	863	525	1387	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	1207	1557	2763	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 5" o/c	
Bottom Edge (Lu)	11' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 11' 5"	N/A	12.0	--	
1 - Uniform (PLF)	5' 6" to 11' 5" (Front)	N/A	132.0	351.8	Linked from: Upper Truss 8, Support 2
2 - Point (lb)	5' 6" (Front)	N/A	1151	-	Linked from: Upper Beam 1, Support 2

- Side loads are assumed to not induce cross-grain tension.

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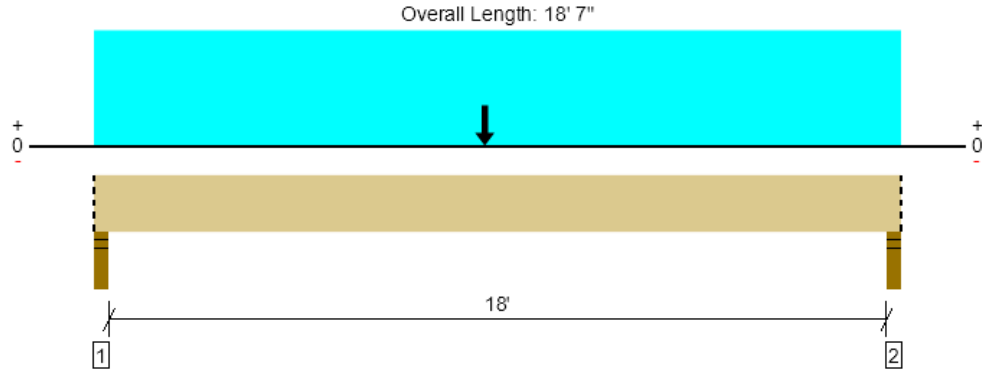
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File Name: 22-112 3804 House
S137

Upper Floor, Upper Beam 4
2 piece(s) 1 1/2" x 14" 1.5E TimberStrand® LSL



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1806 @ 2"	4463 (3.50")	Passed (40%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1630 @ 1' 5 1/2"	8400	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	11065 @ 9'	18116	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.215 @ 9'	0.456	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.614 @ 9'	0.913	Passed (L/356)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 18' 7"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	1322	485	1806	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	1310	454	1764	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 4" o/c	
Bottom Edge (Lu)	18' 7" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 18' 7"	N/A	12.8	--	
1 - Uniform (PLF)	0 to 18' 7" (Front)	N/A	108.0	-	Floor
2 - Point (lb)	9' (Front)	N/A	386	939	Linked from: Upper Beam 2, Support 2

- Side loads are assumed to not induce cross-grain tension.

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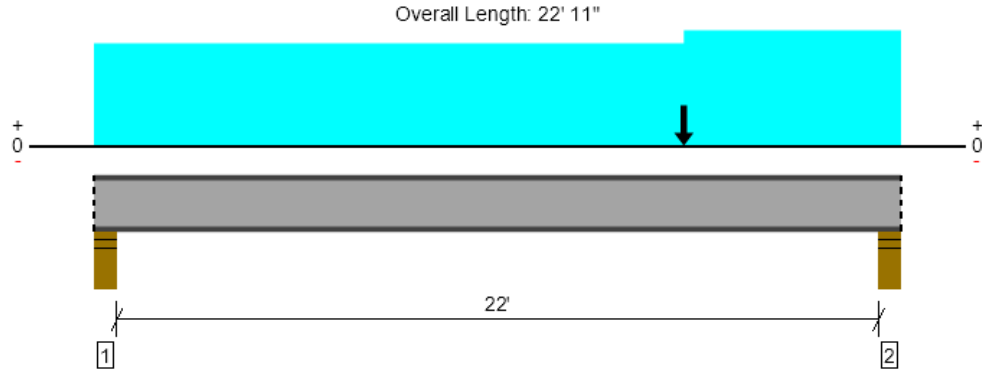
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S138

Upper Floor, Upper Beam 5
1 piece(s) W12X45 (A992) ASTM Steel



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	18769 @ 22' 7"	18817 (5.50")	Passed (100%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	18038 @ 22' 5 1/2"	81070	Passed (22%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	94778 @ 12' 1/4"	101355	Passed (94%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.437 @ 11' 7 1/16"	0.556	Passed (L/612)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.843 @ 11' 7 1/16"	1.112	Passed (L/317)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

Member Length : 22' 11"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	5.50"	8052	5266	4993	6239	16681	Blocking
2 - Stud wall - SPF	5.50"	5.50"	5.50"	8946	6858	4993	6239	18769	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 22' 11"	N/A	45.0	--	--	--	
1 - Uniform (PLF)	0 to 22' 11" (Front)	N/A	144.0	-	-	-	Floor
2 - Uniform (PLF)	0 to 22' 11" (Front)	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 1
3 - Uniform (PLF)	16' 9" to 22' 11" (Front)	N/A	69.0	183.5	-	-	Linked from: Upper Truss 7, Support 2
4 - Point (lb)	16' 9" (Front)	N/A	1207	1557	-	-	Linked from: Upper Beam 3, Support 2
5 - Uniform (PLF)	0 to 22' 11" (Front)	N/A	164.3	-	219.0	273.8	Linked from: Roof Truss 1, Support 1
6 - Uniform (PLF)	0 to 22' 11" (Front)	N/A	162.8	-	216.8	270.8	Linked from: Roof Truss 2, Support 2

- Side loads are assumed to not induce cross-grain tension.

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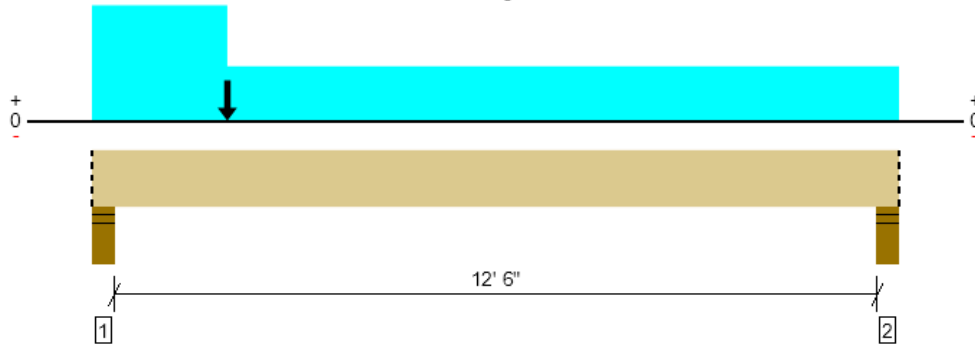


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File Name: 22-112 3804 House

Upper Floor, Upper Beam 6

1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam

Overall Length: 13' 5"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	12581 @ 4"	12856 (5.50")	Passed (98%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	10067 @ 1' 7"	15085	Passed (67%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	25437 @ 6' 3 7/16"	33413	Passed (76%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.231 @ 6' 8 1/2"	0.319	Passed (L/663)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.372 @ 6' 7 1/4"	0.637	Passed (L/411)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 13' 5"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	5.38"	5111	5288	3738	4671	12581	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.36"	2566	5288	569	711	7854	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 5" o/c	
Bottom Edge (Lu)	13' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 13' 5"	N/A	18.0	--	--	--	
1 - Uniform (PLF)	0 to 13' 5" (Front)	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 1
2 - Uniform (PLF)	0 to 13' 5" (Front)	N/A	141.0	376.5	-	-	Linked from: Upper Truss 4, Support 2
3 - Uniform (PLF)	0 to 2' 3" (Top)	N/A	164.3	-	219.0	273.8	Linked from: (Loading Only) Roof Truss 1, Support 1
4 - Uniform (PLF)	0 to 2' 3" (Top)	N/A	138.8	-	186.0	232.5	Linked from: (Loading Only) Roof Truss 2, Support 1
5 - Point (lb)	2' 3" (Top)	N/A	2789	-	3395	4243	Linked from: Roof Post 1, Support 1

- Side loads are assumed to not induce cross-grain tension.

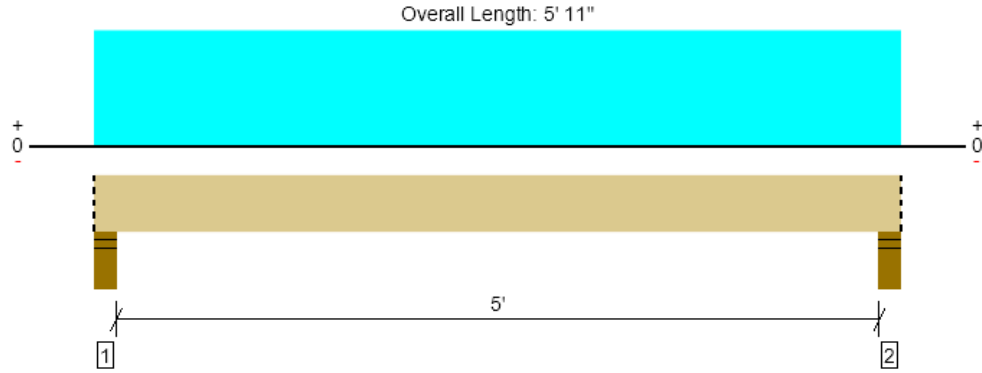
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Upper Floor, Upper Beam 7

1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4672 @ 4"	12856 (5.50")	Passed (36%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2619 @ 1' 1"	7288	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	4812 @ 2' 11 1/2"	10313	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.048 @ 2' 11 1/2"	0.131	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.078 @ 2' 11 1/2"	0.262	Passed (L/812)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 5' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 5' 11"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	2.00"	1800	2332	1198	1498	4672	Blocking
2 - Stud wall - SPF	5.50"	5.50"	2.00"	1800	2332	1198	1498	4672	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 11" o/c	
Bottom Edge (Lu)	5' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 11"	N/A	10.0	--	--	--	
1 - Uniform (PLF)	0 to 5' 11" (Front)	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 1
2 - Uniform (PLF)	0 to 5' 11" (Front)	N/A	141.0	376.5	-	-	Linked from: Upper Truss 4, Support 2
3 - Uniform (PLF)	0 to 5' 11" (Top)	N/A	164.3	-	219.0	273.8	Linked from: (Loading Only) Roof Truss 1, Support 1
4 - Uniform (PLF)	0 to 5' 11" (Top)	N/A	138.8	-	186.0	232.5	Linked from: (Loading Only) Roof Truss 2, Support 1

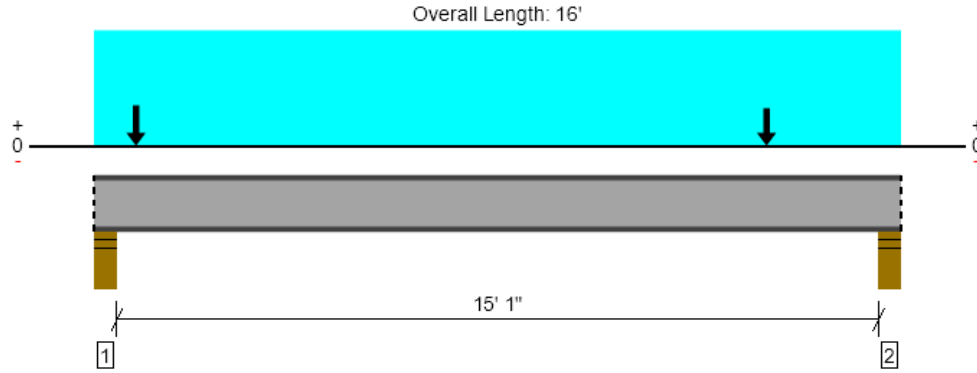
- Side loads are assumed to not induce cross-grain tension.

ForteWEB Software Operator	Job Notes
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File Name: 22-112 3804 House
S141

Upper Floor, Upper Beam 8
1 piece(s) W10X39 (A992) ASTM Steel



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern) [Group]
Member Reaction (lbs)	11441 @ 4"	18677 (5.50")	Passed (61%)	--	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Shear (lbs)	10958 @ 5 1/2"	62496	Passed (18%)	--	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Moment (Ft-lbs)	35218 @ 8' 1 1/2"	95863	Passed (37%)	--	1.0 D + 1.0 L (All Spans) [1]
Live Load Defl. (in)	0.149 @ 8'	0.383	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans) [1]
Total Load Defl. (in)	0.248 @ 8' 7/16"	0.256	Passed (L/742)	--	1.0 D + 1.0 L (All Spans) [1]

- Deflection criteria: LL (L/480) and TL (L/720).
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

Member Length : 16'
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	5.50"	4708	5808	1712	3170	11441	Blocking
2 - Stud wall - SPF	5.50"	5.50"	5.50"	4364	5808	1286	2638	10699	Blocking

Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16'	N/A	39.0	--	--	--	
1 - Uniform (PLF)	0 to 16' (Front)	N/A	144.0	-	-	-	Floor
2 - Uniform (PLF)	0 to 16' (Front)	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 2
3 - Uniform (PLF)	0 to 16' (Back)	N/A	76.5	314.3/-3.0	-	129.0	Linked from: Upper Truss 10, Support 1
4 - Point (lb)	10" (Top)	N/A	1255	-	1540	1924	Linked from: Roof Header 1, Support 1
5 - Point (lb)	13' 4" (Top)	N/A	1193	-	1457	1820	Linked from: Roof Header 1, Support 2

Side loads are assumed to not induce cross-grain tension.

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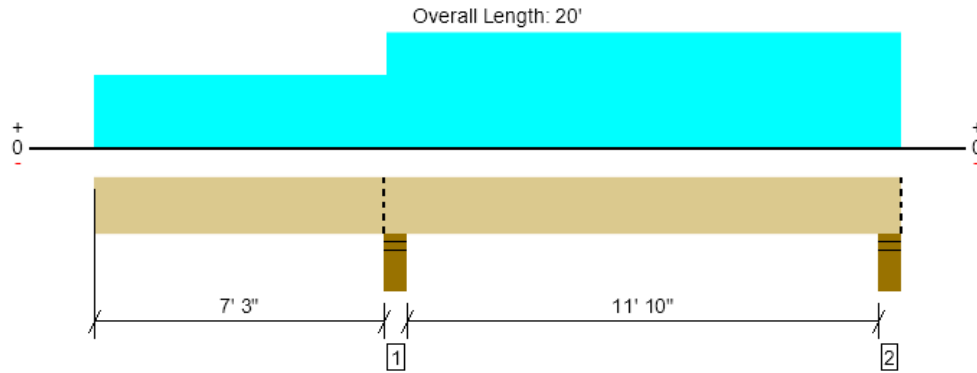


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File Name: 22-112 3804_House
S142

Upper Floor, Upper Beam 9

2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL

Left cantilever exceeds the maximum braced cantilever length of 7'.



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5329 @ 7' 5 3/4"	8181 (5.50")	Passed (65%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2718 @ 8' 8 3/8"	7897	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-7685 @ 7' 5 3/4"	13386	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.347 @ 0	0.374	Passed (2L/518)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.472 @ 0	0.748	Passed (2L/380)	--	1.0 D + 1.0 L (Alt Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Moment capacity over cantilever support 1 has been reduced by 25% to lessen the effects of buckling.

Member Length : 20'
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	3.58"	2134	3195	5329	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.66"	704	1767/-350	2471	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	20' o/c	
Bottom Edge (Lu)	19' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 20'	N/A	12.1	--	
1 - Uniform (PLF)	0 to 20' (Front)	N/A	72.0	-	Floor
2 - Uniform (PLF)	7' 3" to 20' (Front)	N/A	69.0	275.0	Linked from: Upper Truss 5, Support 1
3 - Uniform (PLF)	0 to 7' 3" (Front)	N/A	38.0	152.5	Linked from: Upper Truss 6, Support 1

- Side loads are assumed to not induce cross-grain tension.

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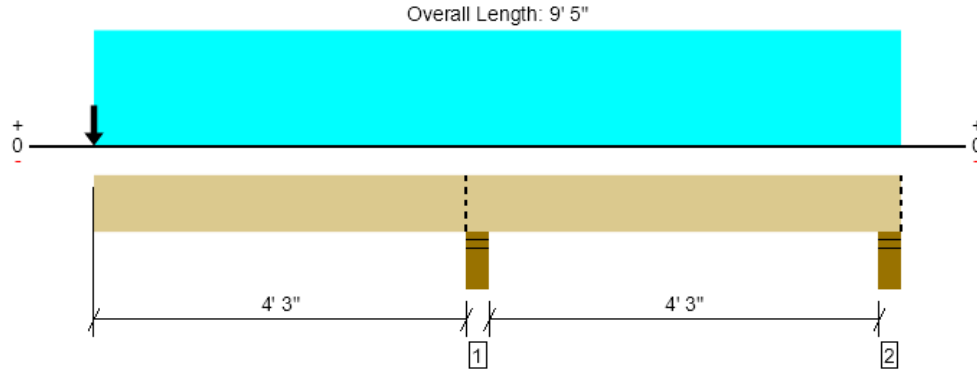
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Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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File Name: 22-112 3804_House
S143

Upper Floor, Upper Beam 10
1 piece(s) 5 1/2" x 12" 24F-V8 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	11947 @ 4' 5 3/4"	12856 (5.50")	Passed (93%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5849 @ 3' 3"	11660	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	0 @ N/A	N/A	Passed (N/A)	--	N/A
Neg Moment (Ft-lbs)	-25475 @ 4' 5 3/4"	26400	Passed (96%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.235 @ 0	0.299	Passed (2L/456)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.412 @ 0	0.448	Passed (2L/260)	--	1.0 D + 1.0 L (All Spans)

Member Length : 9' 5"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 9' 1".
- An excessive uplift of -5111 lbs detected at support located at 9' 1".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	5.11"	5644	6303	11947	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	-2003	-3108	-5111	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 5" o/c	
Bottom Edge (Lu)	9' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 9' 5"	N/A	16.0	--	
1 - Uniform (PLF)	0 to 9' 5" (Front)	N/A	144.0	-	Floor
2 - Point (lb)	0 (Front)	N/A	2134	3195	Linked from: Upper Beam 9, Support 1

- Side loads are assumed to not induce cross-grain tension.

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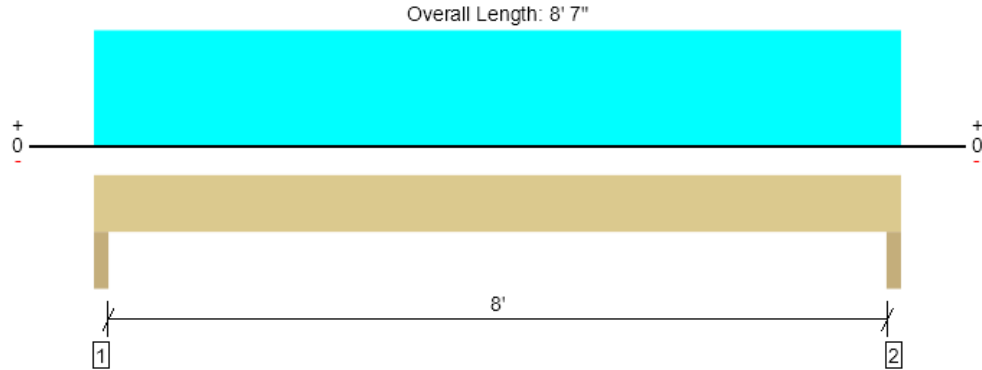
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
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File Name: 22-112 3804 House
S144

Upper Floor, Upper Header 1
1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2891 @ 2"	12513 (3.50")	Passed (23%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2189 @ 1' 1/2"	8745	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	5730 @ 4' 3 1/2"	14850	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.065 @ 4' 3 1/2"	0.206	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.117 @ 4' 3 1/2"	0.412	Passed (L/848)	--	1.0 D + 1.0 L (All Spans)

Member Length : 8' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	1275	1616	2891	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1275	1616	2891	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	12.0	--	
1 - Uniform (PLF)	0 to 8' 7"	N/A	144.0	-	Default Load
2 - Uniform (PLF)	0 to 8' 7"	N/A	141.0	376.5	Linked from: Upper Truss 4, Support 1

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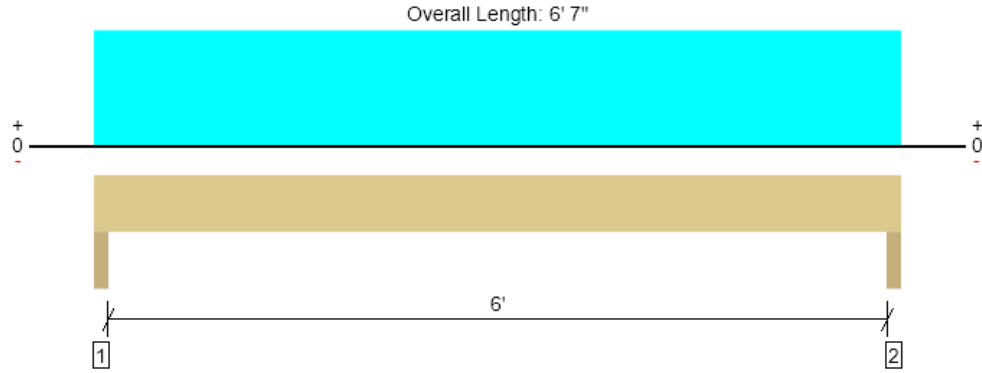
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Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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File Name: 22-112 3804_House

Upper Floor, Upper Header 3
2 piece(s) 2 x 8 DF No.2



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	966 @ 2"	6563 (3.50")	Passed (15%)	--	1.0 D (All Spans)
Shear (lbs)	703 @ 10 3/4"	2349	Passed (30%)	0.90	1.0 D (All Spans)
Moment (Ft-lbs)	1433 @ 3' 3 1/2"	2129	Passed (67%)	0.90	1.0 D (All Spans)
Live Load Defl. (in)	0.000 @ 0	0.156	Passed (2L/999+)	--	1.0 D (All Spans)
Total Load Defl. (in)	0.066 @ 3' 3 1/2"	0.313	Passed (L/999+)	--	1.0 D (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Member Length : 6' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)		Accessories
	Total	Available	Required	Dead	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	966	966	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	966	966	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 7" o/c	
Bottom Edge (Lu)	6' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Comments
0 - Self Weight (PLF)	0 to 6' 7"	N/A	5.5	
1 - Uniform (PLF)	0 to 6' 7"	N/A	288.0	Default Load

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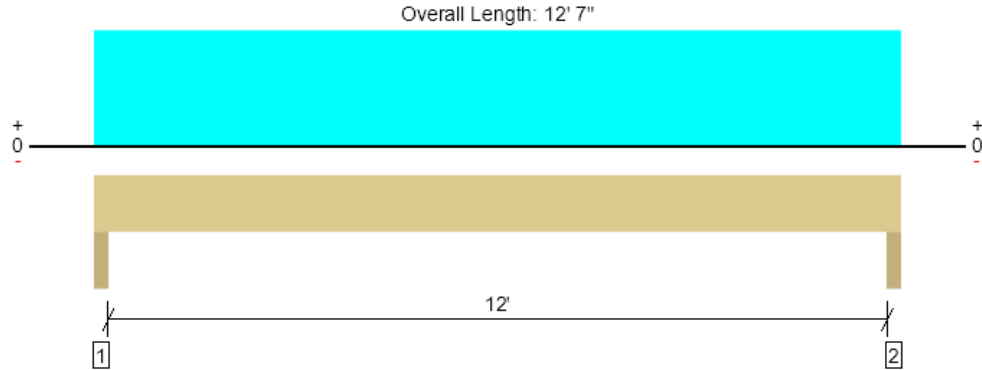
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File Name: 22-112 3804_House
S146

Upper Floor, Upper Header 4
1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2491 @ 2"	7963 (3.50")	Passed (31%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2029 @ 1' 2"	6493	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	7427 @ 6' 3 1/2"	12863	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.258 @ 6' 3 1/2"	0.408	Passed (L/569)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.330 @ 6' 3 1/2"	0.613	Passed (L/445)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 12' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	542	1949	2491	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	542	1949	2491	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 7" o/c	
Bottom Edge (Lu)	12' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 7"	N/A	8.9	--	
1 - Uniform (PLF)	0 to 12' 7"	N/A	77.3	309.8	Linked from: Upper Joist 1, Support 2

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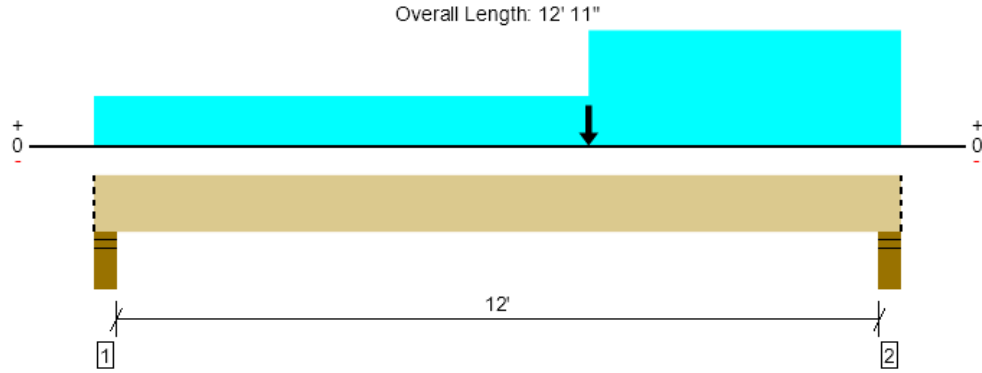
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



7/29/2024 11:53:43 PM UTC
ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2
File Name: 22-112 3804 House
S147

Upper Floor, Upper Header 5
2 piece(s) 1 3/4" x 16" 2.OE Microllam® LVL



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5829 @ 12' 7"	8181 (5.50")	Passed (71%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	4215 @ 11' 1 1/2"	12236	Passed (34%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	15989 @ 7' 11"	35781	Passed (45%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.123 @ 6' 7 3/4"	0.306	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.203 @ 6' 8"	0.204	Passed (L/725)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/720).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 12' 11"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	2.83"	1549	2659	580	725	4208	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.92"	2327	2659	1609	2010	5829	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 2" o/c	
Bottom Edge (Lu)	12' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12' 11"	N/A	16.3	--	--	--	
1 - Uniform (PLF)	0 to 12' 11" (Front)	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 2
2 - Uniform (PLF)	7' 11" to 12' 11" (Top)	N/A	187.5	-	249.8	312.0	Linked from: (Loading Only) Roof Truss 1, Support 2
3 - Point (lb)	7' 11" (Top)	N/A	732	-	940	1175	Linked from: Roof Header 2, Support 2

- Side loads are assumed to not induce cross-grain tension.

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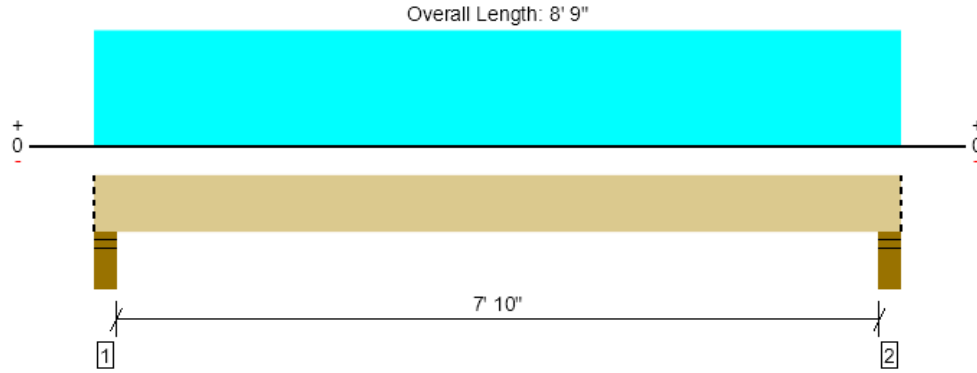
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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File Name: 22-112 3804_House
S148

Upper Floor, Upper Header 6
1 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2863 @ 4"	4091 (5.50")	Passed (70%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1691 @ 1' 9 1/2"	5320	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5345 @ 4' 4 1/2"	15557	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.047 @ 4' 4 1/2"	0.202	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.075 @ 4' 4 1/2"	0.404	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 8' 9"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	3.85"	1062	1801	2863	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.85"	1062	1801	2863	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 9" o/c	
Bottom Edge (Lu)	8' 9" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 9"	N/A	8.2	--	
1 - Uniform (PLF)	0 to 8' 9" (Front)	N/A	154.5	411.8	Linked from: Upper Truss 3, Support 2
2 - Uniform (PSF)	0 to 8' 9" (Front)	8'	10.0	-	Wall

- Side loads are assumed to not induce cross-grain tension.

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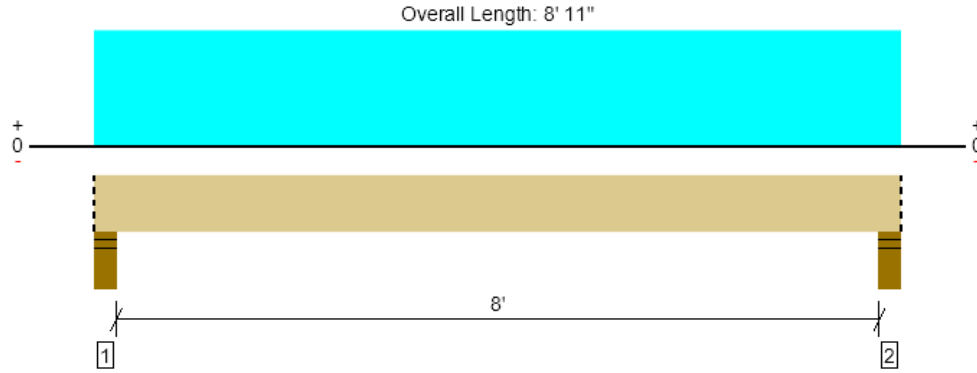
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Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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File Name: 22-112 3804_House
S149

Upper Floor, Upper Header 7
1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2036 @ 4"	8181 (5.50")	Passed (25%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1484 @ 1' 2 1/2"	5565	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	3885 @ 4' 5 1/2"	9450	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.073 @ 4' 5 1/2"	0.206	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.124 @ 4' 5 1/2"	0.412	Passed (L/796)	--	1.0 D + 1.0 L (All Spans)

Member Length : 8' 11"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	1.50"	839	1197	2036	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	839	1197	2036	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 11" o/c	
Bottom Edge (Lu)	8' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 11"	N/A	7.7	--	
1 - Uniform (PLF)	0 to 8' 11" (Front)	N/A	100.5	268.5	Linked from: Upper Truss 1, Support 2
2 - Uniform (PSF)	0 to 8' 11" (Top)	8'	10.0	-	Wall

- Side loads are assumed to not induce cross-grain tension.

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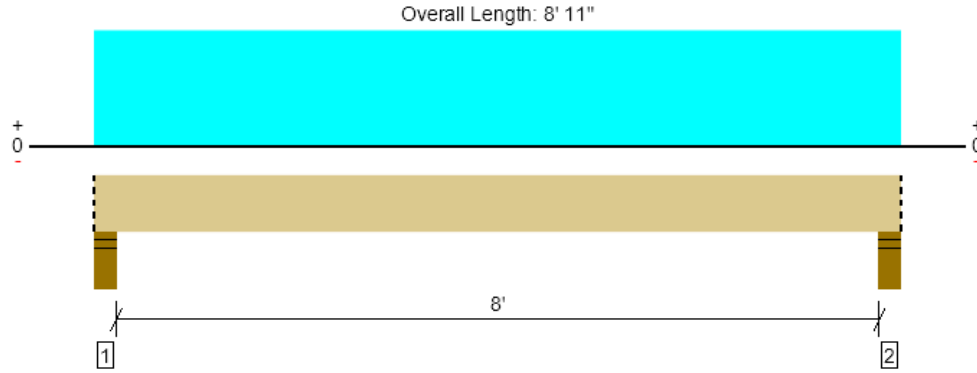
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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File Name: 22-112 3804_House
S150

Upper Floor, Upper Header 8
1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2983 @ 4"	8181 (5.50")	Passed (36%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2175 @ 1' 2 1/2"	5565	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	5693 @ 4' 5 1/2"	9450	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.103 @ 4' 5 1/2"	0.206	Passed (L/966)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.182 @ 4' 5 1/2"	0.412	Passed (L/543)	--	1.0 D + 1.0 L (All Spans)

Member Length : 8' 11"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	2.01"	1305	1679	2983	Blocking
2 - Stud wall - SPF	5.50"	5.50"	2.01"	1305	1679	2983	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 11" o/c	
Bottom Edge (Lu)	8' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 11"	N/A	7.7	--	
1 - Uniform (PLF)	0 to 8' 11" (Front)	N/A	144.0	-	Floor
2 - Uniform (PLF)	0 to 8' 11" (Front)	N/A	141.0	376.5	Linked from: Upper Truss 2, Support 1

- Side loads are assumed to not induce cross-grain tension.

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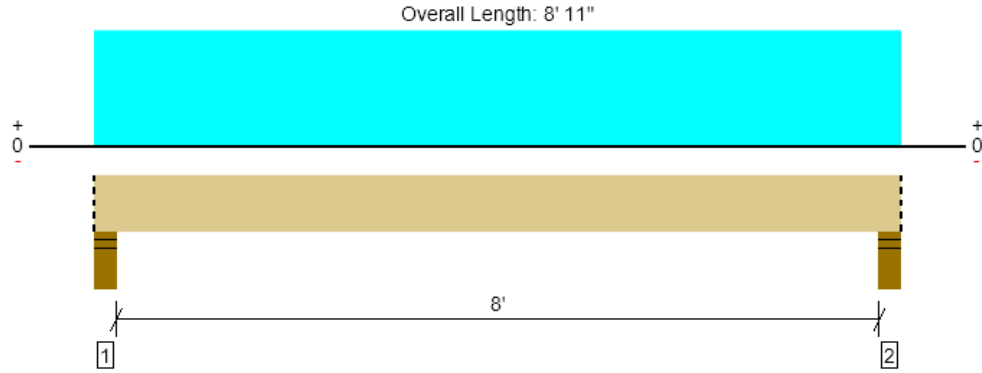
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File Name: 22-112 3804_House
S151

Upper Floor, Upper Header 9
1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2210 @ 4"	8181 (5.50")	Passed (27%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1611 @ 1' 2 1/2"	5565	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	4217 @ 4' 5 1/2"	9450	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.075 @ 4' 5 1/2"	0.206	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.135 @ 4' 5 1/2"	0.412	Passed (L/733)	--	1.0 D + 1.0 L (All Spans)

Member Length : 8' 11"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	1.50"	984	1226	2210	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	984	1226	2210	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 11" o/c	
Bottom Edge (Lu)	8' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 11"	N/A	7.7	--	
1 - Uniform (PLF)	0 to 8' 11" (Front)	N/A	144.0	-	Floor
2 - Uniform (PLF)	0 to 8' 11" (Front)	N/A	69.0	275.0	Linked from: Upper Truss 5, Support 2

- Side loads are assumed to not induce cross-grain tension.

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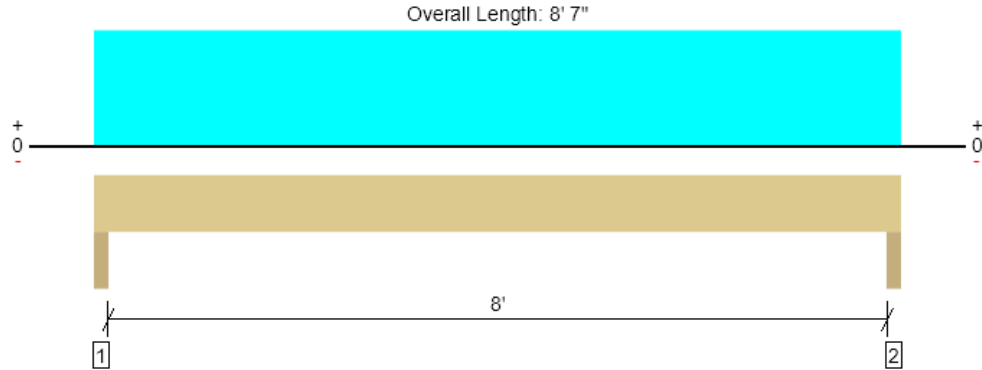
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Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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File Name: 22-112 3804_House
S152

Upper Floor, Upper Header 10
2 piece(s) 2 x 10 DF No.2



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1551 @ 2"	6563 (3.50")	Passed (24%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	1113 @ 1' 3/4"	3330	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2931 @ 4' 3 1/2"	3529	Passed (83%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.094 @ 4' 3 1/2"	0.275	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.119 @ 4' 3 1/2"	0.412	Passed (L/832)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Member Length : 8' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	320	1159	483	1551	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	320	1159	483	1551	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	7.0	--	--	
1 - Uniform (PSF)	0 to 8' 7"	4' 6"	15.0	60.0	25.0	Deck

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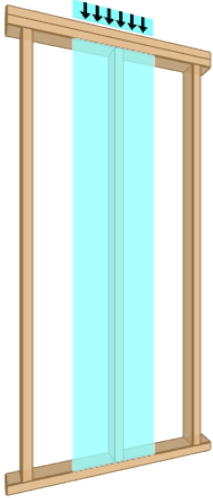
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File Name: 22-112 3804_House
S153

Upper Floor, Upper Wall 1
1 piece(s) 2 x 6 DF No.2 @ 16" OC

Wall Height: 12'

Member Height: 11' 7 1/2"

O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	1101	5432	Passed (20%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	1101	4383	Passed (25%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	112	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	103	1584	Passed (7%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	326 @ mid-span	1342	Passed (24%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.17 @ mid-span	1.16	Passed (L/836)	--	1.0 D + 0.6 W
Bending/Compression	0.27	1	Passed (27%)	1.60	1.0 D + 0.6 W

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Lateral Connections

Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Loads	Spacing	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	144.0	-	-	-	Default Load
2 - Point (PLF)	16.00"	92.3	-	134.3	168.0	Linked from: Roof Truss 3, Support 2
3 - Point (PLF)	16.00"	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 2

Lateral Load	Location	Spacing	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	16.00"	24.1	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Wind Zone (4), GCpi (+/- 0.18), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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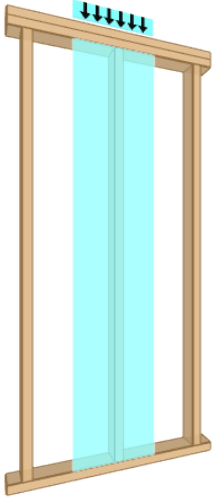


Upper Floor, Upper Wall 2
1 piece(s) 2 x 6 DF No.2 @ 16" OC

Wall Height: 12'

Member Height: 11' 7 1/2"

O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	2140	5432	Passed (39%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	2140	4383	Passed (49%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	112	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	103	1584	Passed (7%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	326 @ mid-span	1342	Passed (24%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.17 @ mid-span	1.16	Passed (L/836)	--	1.0 D + 0.6 W
Bending/Compression	0.42	1	Passed (42%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Lateral Connections

Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Loads	Spacing	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	144.0	-	-	-	Default Load
2 - Point (PLF)	16.00"	100.5	268.5	-	-	Linked from: Upper Truss 1, Support 1
3 - Point (PLF)	16.00"	141.0	376.5	-	-	Linked from: Upper Truss 2, Support 2
4 - Point (PLF)	16.00"	164.3	-	219.0	273.8	Linked from: Roof Truss 1, Support 1
5 - Point (PLF)	16.00"	162.8	-	216.8	270.8	Linked from: Roof Truss 2, Support 2

Lateral Load	Location	Spacing	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	16.00"	24.1	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Wind Zone (4), GCpi (+/- 0.18), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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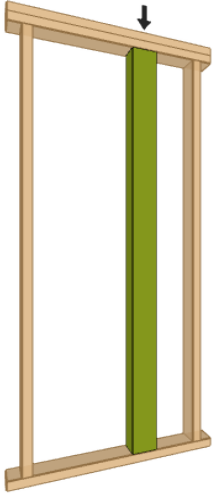


Upper Floor, Upper Post 1
1 piece(s) 6 x 8 DF No.2

Wall Height: 11'

Member Height: 10' 7 1/2"

Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	17	50	Passed (34%)	--	--
Compression (lbs)	16681	27647	Passed (60%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	16681	17531	Passed (95%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- Bearing shall be on a metal plate or strap, or on other equivalently durable, rigid, homogeneous material with sufficient stiffness to distribute applied load.

Supports	Type	Material
Top	Dbl 2X	Douglas Fir-Larch
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Vertical Load	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	8052	5266	4993	6239	Linked from: Upper Beam 5, Support 1

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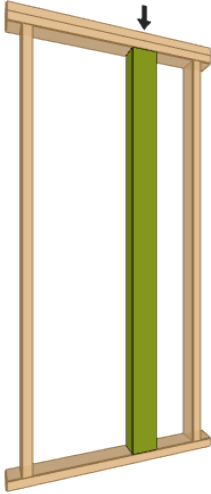


Upper Floor, Upper Post 2
1 piece(s) 4 x 10 DF No.2

Wall Height: 11'

Member Height: 10' 7 1/2"

Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	14	50	Passed (28%)	--	--
Compression (lbs)	31349	41558	Passed (75%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	31349	20234	Failed (155%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- Special detailing and installation procedures are necessary for large wall construction.

Supports	Type	Material
Top	Dbl 2X	Douglas Fir-Larch
Base	2X	Douglas Fir-Larch

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Vertical Loads	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	8946	6858	4993	6239	Linked from: Upper Beam 5, Support 2
2 - Point (lb)	N/A	5111	5288	3738	4671	Linked from: Upper Beam 6, Support 1

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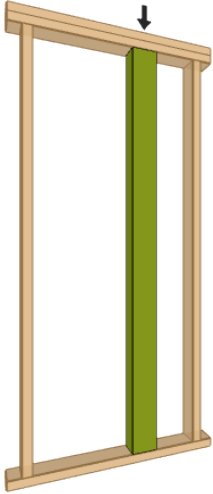


Upper Floor, Upper Post 3
1 piece(s) 4 x 6 DF No.2

Wall Height: 11'

Member Height: 10' 7 1/2"

Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	23	50	Passed (46%)	--	--
Compression (lbs)	11986	14247	Passed (84%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	11986	12031	Passed (100%)	--	1.0 D + 1.0 L
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- Bearing shall be on a metal plate or strap, or on other equivalently durable, rigid, homogeneous material with sufficient stiffness to distribute applied load.

Supports	Type	Material
Top	Dbl 2X	Douglas Fir-Larch
Base	2X	Douglas Fir-Larch

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Vertical Loads	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	2566	5288	569	711	Linked from: Upper Beam 6, Support 2
2 - Point (lb)	N/A	1800	2332	1198	1498	Linked from: Upper Beam 7, Support 1

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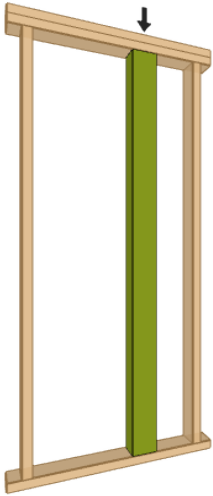


Upper Floor, Upper Post 4
3 piece(s) 2 x 6 DF No.2

Wall Height: 11'

Member Height: 10' 7 1/2"

Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	23	50	Passed (46%)	--	--
Compression (lbs)	10699	18900	Passed (57%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	10699	15469	Passed (69%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- The column stability factor ($K_f = 0.6$) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.

Supports	Type	Material
Top	Dbl 2X	Douglas Fir-Larch
Base	2X	Douglas Fir-Larch

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Vertical Load	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	4364	5808	1286	2638	Linked from: Upper Beam 8, Support 2

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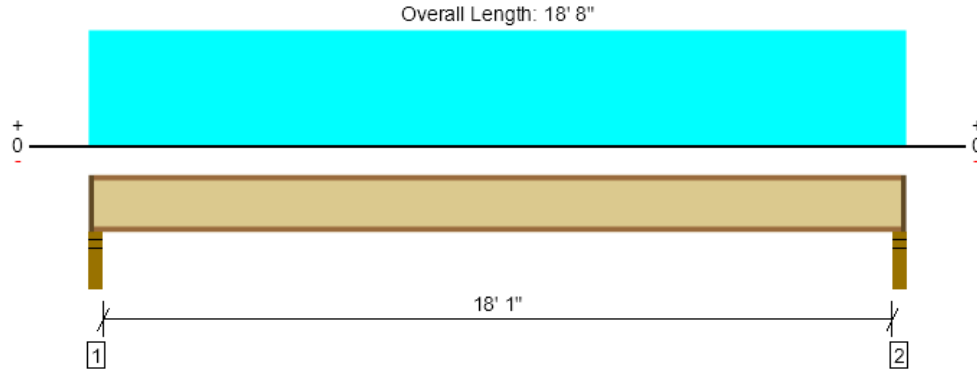
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Main, (Loading Only) Main Truss 1
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	677 @ 2 1/2"	1183 (2.25")	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	663 @ 3 1/2"	1655	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3053 @ 9' 4"	4215	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.356 @ 9' 4"	0.456	Passed (L/615)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.489 @ 9' 4"	0.913	Passed (L/447)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	40	35	Passed	--	--

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Member Length : 18' 5 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	187	498	684	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	187	498	684	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 10" o/c	
Bottom Edge (Lu)	18' 6" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 18' 8"	16"	15.0	40.0	Default Load

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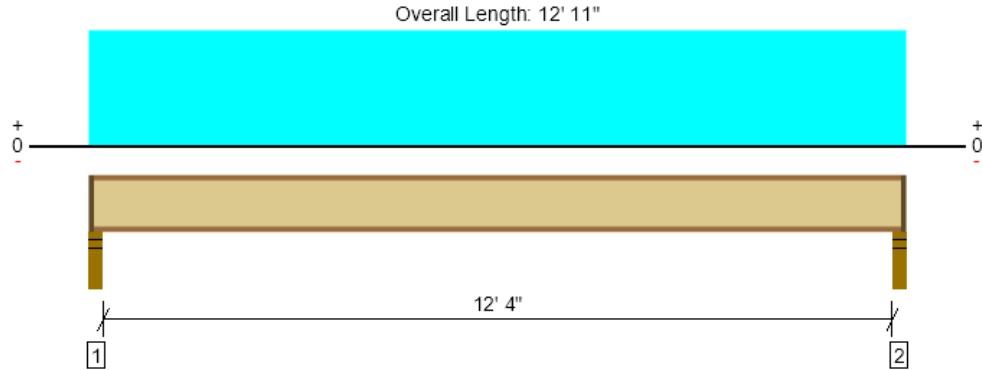
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Main, (Loading Only) Main Truss 2
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	466 @ 2 1/2"	1183 (2.25")	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	452 @ 3 1/2"	1655	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1432 @ 6' 5 1/2"	4215	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.088 @ 6' 5 1/2"	0.313	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.121 @ 6' 5 1/2"	0.625	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	57	35	Passed	--	--

Member Length : 12' 8 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	129	344	474	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	129	344	474	1 1/4" Rim Board

Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 2" o/c	
Bottom Edge (Lu)	12' 9" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 12' 11"	16"	15.0	40.0	Default Load

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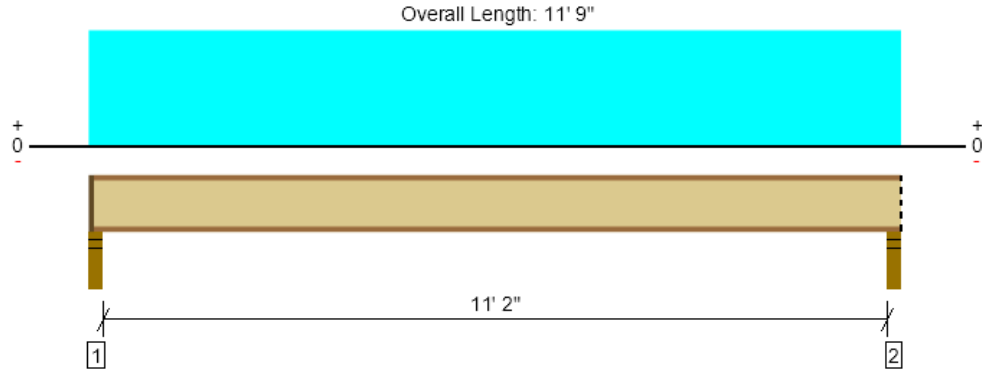
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	



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ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2
File Name: 22-112 3804 House
S161

Main, (Loading Only) Main Truss 3-2
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	423 @ 2 1/2"	1183 (2.25")	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	409 @ 3 1/2"	1655	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1177 @ 5' 10 1/2"	4215	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.062 @ 5' 10 1/2"	0.283	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.086 @ 5' 10 1/2"	0.567	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	60	35	Passed	--	--

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Member Length : 11' 7 3/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	118	313	431	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	3.50"	1.75"	117	313	431	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' o/c	
Bottom Edge (Lu)	11' 8" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 11' 9"	16"	15.0	40.0	Default Load

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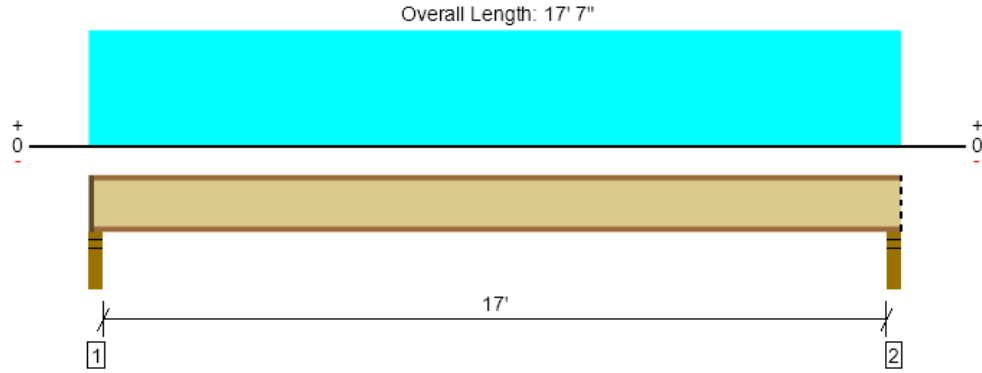
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S162

Main, (Loading Only) Main Truss 4
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	637 @ 2 1/2"	1183 (2.25")	Passed (54%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	623 @ 3 1/2"	1655	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2701 @ 8' 9 1/2"	4215	Passed (64%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.283 @ 8' 9 1/2"	0.429	Passed (L/729)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.389 @ 8' 9 1/2"	0.858	Passed (L/530)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	44	35	Passed	--	--

Member Length : 17' 5 3/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	176	469	645	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	3.50"	1.75"	176	469	645	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 2" o/c	
Bottom Edge (Lu)	17' 6" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17' 7"	16"	15.0	40.0	Default Load

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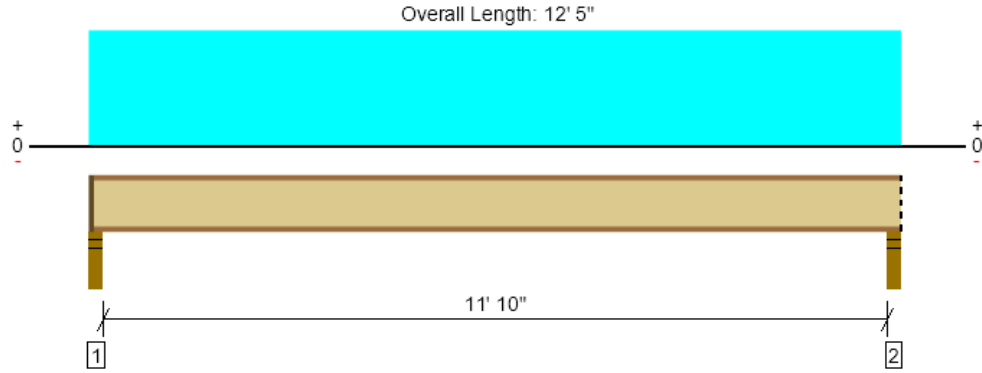
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S163

Main, (Loading Only) Main Truss 5
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	448 @ 2 1/2"	1183 (2.25")	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	434 @ 3 1/2"	1655	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1320 @ 6' 2 1/2"	4215	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.076 @ 6' 2 1/2"	0.300	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.105 @ 6' 2 1/2"	0.600	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	59	35	Passed	--	--

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Member Length : 12' 3 3/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	124	331	455	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	3.50"	1.75"	124	331	455	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 6" o/c	
Bottom Edge (Lu)	12' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 12' 5"	16"	15.0	40.0	Default Load

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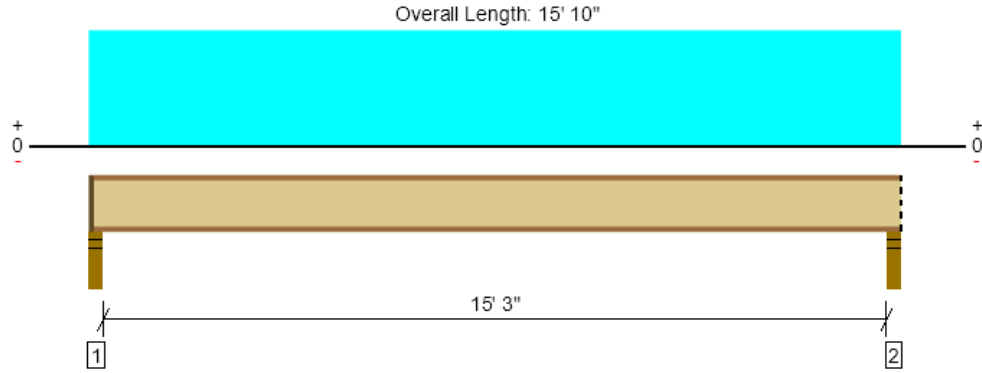
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S164

Main, (Loading Only) Main Truss 6
1 piece(s) 11 7/8" TJI® 230 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	781 @ 2 1/2"	1183 (2.25")	Passed (66%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	762 @ 3 1/2"	1655	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2971 @ 7' 11"	4215	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.302 @ 7' 11"	0.385	Passed (L/613)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.373 @ 7' 11"	0.771	Passed (L/496)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	49	35	Passed	--	--

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Member Length : 15' 8 3/4"
 System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	158	633	264	831	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	3.50"	1.75"	158	633	264	831	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 9" o/c	
Bottom Edge (Lu)	15' 9" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 15' 10"	16"	15.0	60.0	25.0	Default Load

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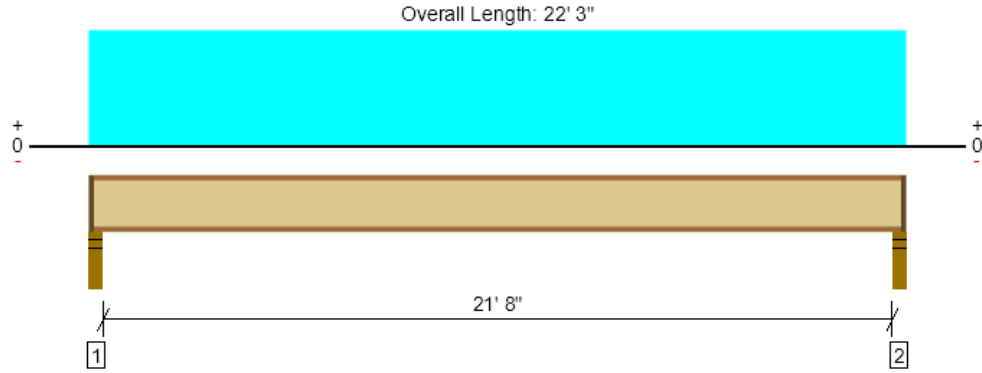
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S165

Main, (Loading Only) Main Truss 7
1 piece(s) 14" TJI® 360 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	808 @ 2 1/2"	1202 (2.25")	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	794 @ 3 1/2"	1955	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4370 @ 11' 1 1/2"	7335	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.428 @ 11' 1 1/2"	0.546	Passed (L/613)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.588 @ 11' 1 1/2"	1.092	Passed (L/446)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	37	35	Passed	--	--

Member Length : 22' 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	222	593	816	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	222	593	816	1 1/4" Rim Board

Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 10" o/c	
Bottom Edge (Lu)	22' 1" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 22' 3"	16"	15.0	40.0	Default Load

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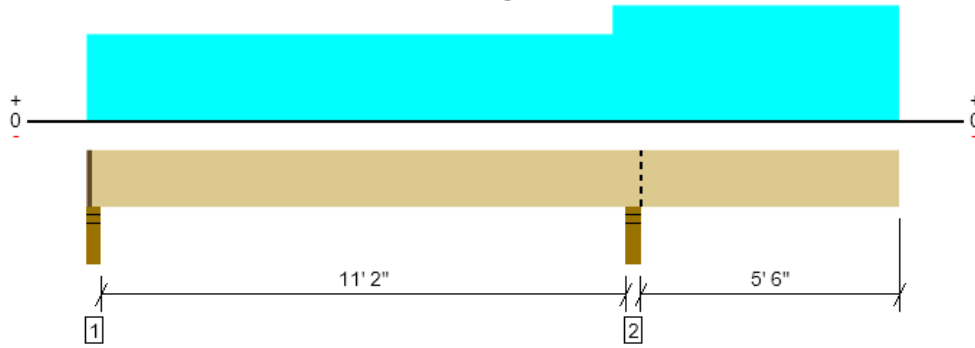


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S166

Main, Main Deck 1

1 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL @ 16" OC

Overall Length: 17' 3"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1274 @ 11' 7 1/4"	2603 (3.50")	Passed (49%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	618 @ 10' 8 1/4"	3076	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1594 @ 11' 7 1/4"	5826	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.272 @ 17' 3"	0.376	Passed (2L/498)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Total Load Defl. (in)	0.290 @ 17' 3"	0.565	Passed (2L/466)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
TJ-Pro™ Rating	58	35	Passed	--	--

Member Length : 17' 1 3/4"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	90	473/-104	-46	563/-22	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	3.50"	1.71"	255	1019	249	1274	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 2" o/c	
Bottom Edge (Lu)	17' 2" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 11' 2"	16"	15.0	60.0	-	Default Load
2 - Uniform (PSF)	11' 2" to 17' 3"	16"	15.0	60.0	25.0	Floor

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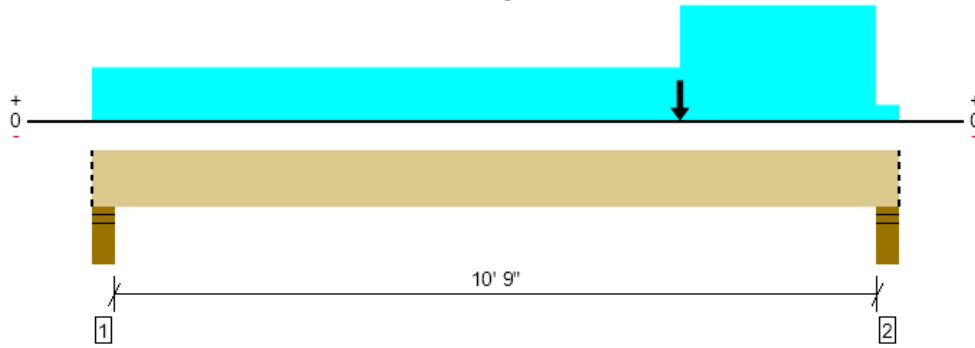


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ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2
File Name: 22-112 3804_House
S167

Main, Main Beam 1

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam

Overall Length: 11' 8"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	9098 @ 11' 4"	12856 (5.50")	Passed (71%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	7099 @ 10' 2 1/2"	11660	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	20319 @ 6' 9 3/16"	26400	Passed (77%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.152 @ 5' 11 13/16"	0.275	Passed (L/870)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.312 @ 6'	0.550	Passed (L/423)	--	1.0 D + 1.0 L (All Spans)

Member Length : 11' 8"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 11'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	2.84"	3364	3281	333	417	6645	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.89"	4670	4262	1314	1643	9098	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 8" o/c	
Bottom Edge (Lu)	11' 8" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 11' 8"	N/A	16.0	--	--	--	
1 - Uniform (PLF)	0 to 11' 8" (Front)	N/A	288.0	-	-	-	Floor
2 - Uniform (PLF)	8' 6" to 11' 4" (Front)	N/A	100.5	268.5	-	-	Linked from: Upper Truss 1, Support 2
3 - Point (lb)	8' 6" (Front)	N/A	839	1197	-	-	Linked from: Upper Header 7, Support 2
4 - Uniform (PLF)	0 to 11' 4" (Front)	N/A	96.8	258.0	-	-	Linked from: Main Truss 2, Support 2
5 - Uniform (PLF)	0 to 11' 4" (Front)	N/A	88.5	234.8	-	-	Linked from: Main Truss 3-2, Support 1
6 - Uniform (PLF)	8' 6" to 11' 4" (Front)	N/A	187.5	-	249.8	312.0	Linked from: Roof Truss 1, Support 2
7 - Point (lb)	8' 6" (Front)	N/A	732	-	940	1175	Linked from: Roof Header 2, Support 2

- Side loads are assumed to not induce cross-grain tension.

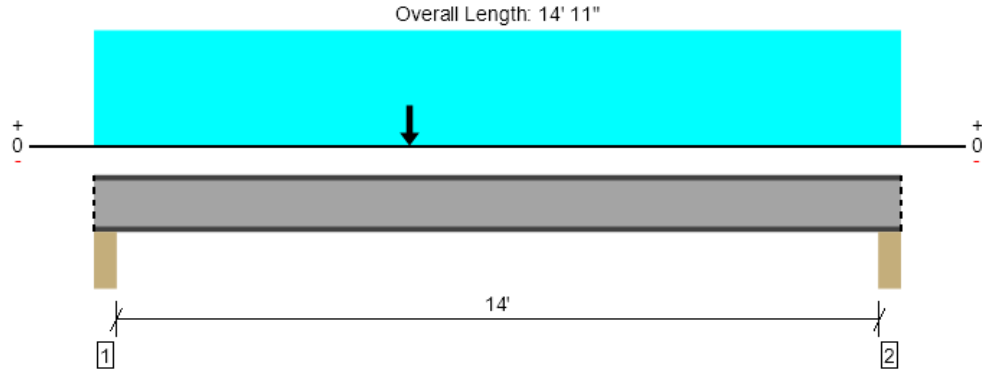
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File Name: 22-112 3804_House
S168

Main, Main Beam 2

1 piece(s) W12X45 (A992) ASTM Steel



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	26503 @ 4"	34313 (5.50")	Passed (77%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	26061 @ 5' 1/2"	81070	Passed (32%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	129397 @ 5' 10"	131988	Passed (98%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.223 @ 7' 1 9/16"	0.356	Passed (L/768)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.391 @ 7' 1 7/16"	0.712	Passed (L/437)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Bearing reinforcement may be required for support located at 4".
- Bearing reinforcement may be required for point load located at 5' 10".
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

Member Length : 14' 11"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Column - DF	5.50"	5.50"	5.50"	11308	13561	5361	6699	26503	Blocking
2 - Column - DF	5.50"	5.50"	5.50"	8083	10791	3370	4211	19334	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 14' 11"	N/A	45.0	--	--	--	
1 - Uniform (PLF)	0 to 14' 11" (Front)	N/A	140.3	373.5	-	-	Linked from: Main Truss 1, Support 2
2 - Uniform (PLF)	0 to 14' 11" (Back)	N/A	166.5	444.8	-	-	Linked from: (Loading Only) Main Truss 7, Support 1
3 - Point (lb)	5' 10" (Top)	N/A	14144	12146	8731	10910	Linked from: Upper Post 2, Support 1

- Side loads are assumed to not induce cross-grain tension.

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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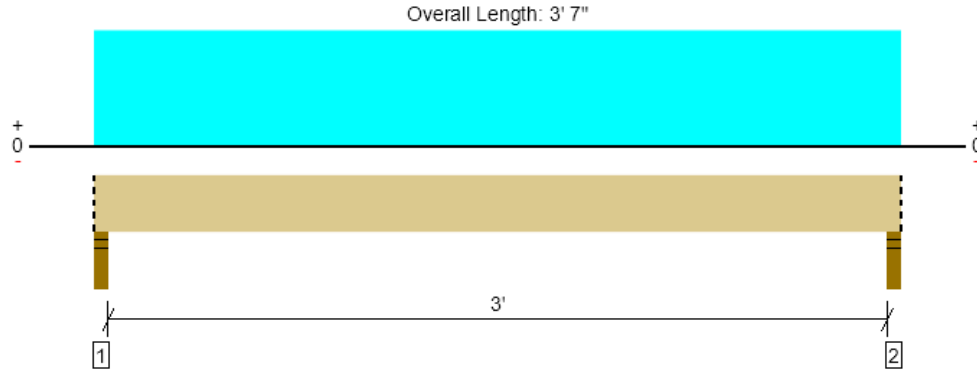


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File Name: 22-112 3804_House
S169

Main, Main Beam 3

1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2027 @ 2"	5206 (3.50")	Passed (39%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	990 @ 11"	4638	Passed (21%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1494 @ 1' 9 1/2"	6563	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.009 @ 1' 9 1/2"	0.081	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.013 @ 1' 9 1/2"	0.162	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 3' 7"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 3' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	561	1466	2027	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	561	1466	2027	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 7" o/c	
Bottom Edge (Lu)	3' 7" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 3' 7"	N/A	6.4	--	
1 - Uniform (PLF)	0 to 3' 7" (Front)	N/A	140.3	373.5	Linked from: Main Truss 1, Support 2
2 - Uniform (PLF)	0 to 3' 7" (Back)	N/A	166.5	444.8	Linked from: (Loading Only) Main Truss 7, Support 1

- Side loads are assumed to not induce cross-grain tension.

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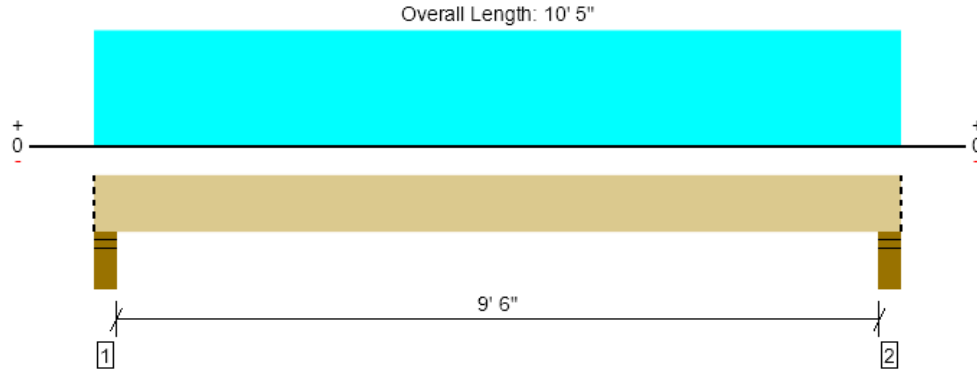
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S170

Main, Main Beam 4

1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5034 @ 4"	12856 (5.50")	Passed (39%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3745 @ 1' 4"	10203	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	11485 @ 5' 2 1/2"	20213	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.148 @ 5' 2 1/2"	0.244	Passed (L/793)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.206 @ 5' 2 1/2"	0.488	Passed (L/569)	--	1.0 D + 1.0 L (All Spans)

Member Length : 10' 5"
System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 9' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	2.15"	1425	3609	5034	Blocking
2 - Stud wall - SPF	5.50"	5.50"	2.15"	1425	3609	5034	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 5" o/c	
Bottom Edge (Lu)	10' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 10' 5"	N/A	14.0	--	
1 - Uniform (PLF)	0 to 10' 5" (Front)	N/A	93.0	248.3	Linked from: Main Truss 5, Support 1
2 - Uniform (PLF)	0 to 10' 5" (Front)	N/A	166.5	444.8	Linked from: (Loading Only) Main Truss 7, Support 2

- Side loads are assumed to not induce cross-grain tension.

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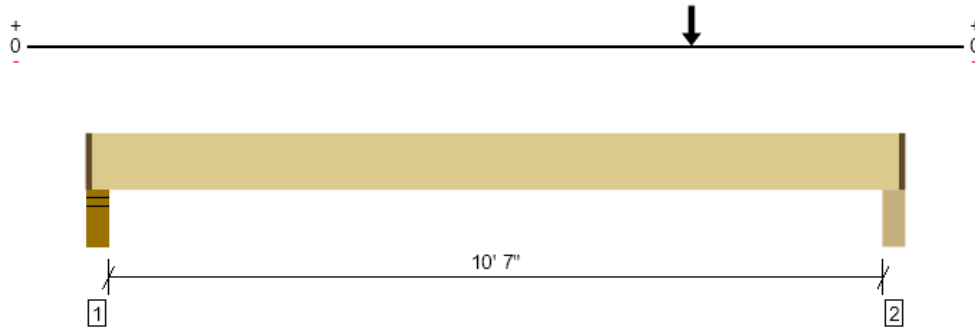


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S171

Main, Main Beam 5

2 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL

Overall Length: 11' 6"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4830 @ 11' 2"	10500 (4.00")	Passed (46%)	--	1.0 D + 0.7 E (All Spans)
Shear (lbs)	4808 @ 9' 10 1/2"	14896	Passed (32%)	1.60	1.0 D + 0.7 E (All Spans)
Moment (Ft-lbs)	12820 @ 8' 6"	38813	Passed (33%)	1.60	1.0 D + 0.7 E (All Spans)
Live Load Defl. (in)	0.000 @ 1 1/2"	0.271	Passed (L/999+)	--	1.0 D (All Spans)
Total Load Defl. (in)	0.003 @ 5' 9 1/16"	0.542	Passed (L/999+)	--	1.0 D (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- An excessive uplift of -1503 lbs detected at support located at 2 1/2".
- An excessive uplift of -4701 lbs detected at support located at 11' 1/2".

Member Length : 11' 3"
 System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Seismic	Factored	
1 - Stud wall - DF	5.50"	4.00"	1.50"	80	2215/-2215	1631/-1503	1 1/2" Rim Board
2 - Column - DF	5.50"	4.00"	1.84"	80	6785/-6785	4830/-4701	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 3" o/c	
Bottom Edge (Lu)	11' 3" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	1 1/2" to 11' 4 1/2"	N/A	14.3	--	
1 - Point (lb)	8' 6" (Top)	N/A	-	9000	HD Forces

- Side loads are assumed to not induce cross-grain tension.

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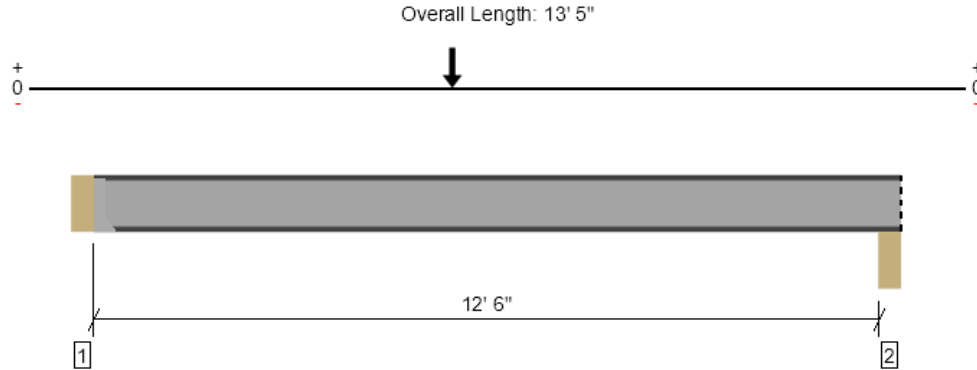


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Main, Main Beam 6

1 piece(s) W12X35 (A992) ASTM Steel



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	15091 @ 5 1/2"	33038 (1.50")	Passed (46%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	15091 @ 5 1/2"	75000	Passed (20%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	83090 @ 6'	96908	Passed (86%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.131 @ 6' 6 7/8"	0.316	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.230 @ 6' 6 7/8"	0.631	Passed (L/658)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Bearing reinforcement may be required for support located at 0".
- Bearing reinforcement may be required for point load located at 5' 6 1/2".
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

Member Length : 12' 11 1/2"
 System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Hanger on 12 1/2" DF beam	5.50"	Hanger ¹	1.50" / - ²	6565	7608	3008	3759	15091	See note ¹
2 - Column - DF	5.50"	5.50"	5.50"	5196	5953	2353	2940	11866	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.
- ² Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	5 1/2" to 13' 5"	N/A	35.0	--	--	--	
1 - Point (lb)	6' (Top)	N/A	11308	13561	5361	6699	Linked from: Main Beam 2, Support 1

- Side loads are assumed to not induce cross-grain tension.

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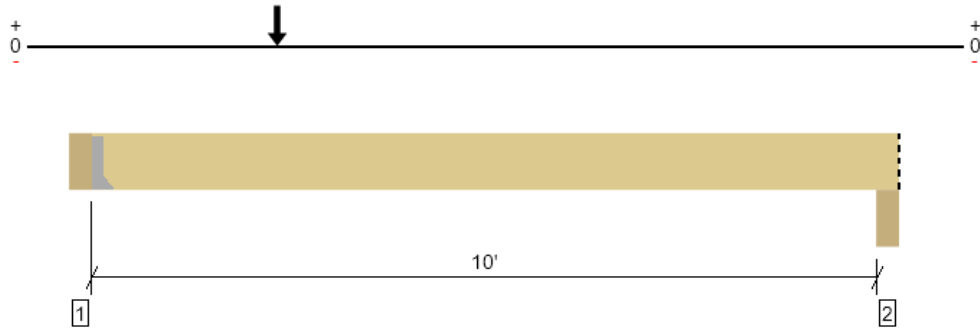


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Main, Main Beam 7

1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam

Overall Length: 10' 11"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	11766 @ 5 1/2"	11766 (3.29")	Passed (100%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	11036 @ 1' 7"	13118	Passed (84%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	25290 @ 2' 9"	33413	Passed (76%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.101 @ 4' 11 5/16"	0.253	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.181 @ 4' 11 3/8"	0.506	Passed (L/671)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

Member Length : 10' 5 1/2"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 10' 1 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Hanger on 13 1/2" DF beam	5.50"	Hanger ¹	3.29"	5170	5886	2327	2908	11766	See note ¹
2 - Column - DF	5.50"	5.50"	1.50"	1583	1722	681	851	3513	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 6" o/c	
Bottom Edge (Lu)	10' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HGUS5.50/12	4.00"	N/A	56-16d	20-16d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	5 1/2" to 10' 11"	N/A	18.0	--	--	--	
1 - Point (lb)	2' 9" (Front)	N/A	6565	7608	3008	3759	Linked from: Main Beam 6, Support 1

- Side loads are assumed to not induce cross-grain tension.

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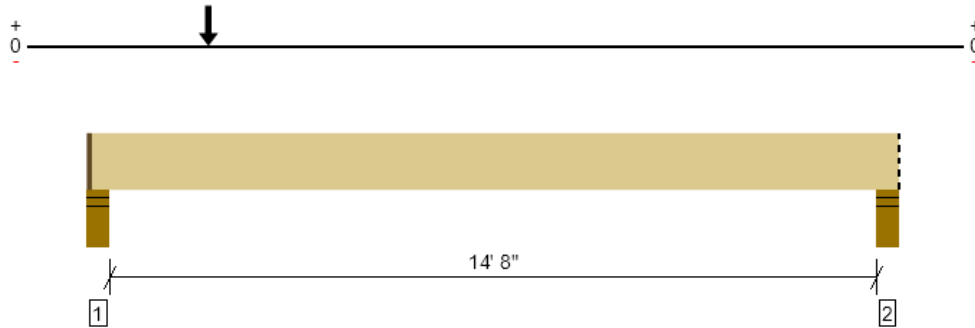


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Main, Main Beam 8

1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam

Overall Length: 15' 7"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	10327 @ 4"	14609 (4.25")	Passed (71%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	9686 @ 1' 7"	13118	Passed (74%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	19380 @ 2' 4"	33413	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.156 @ 6' 9 3/16"	0.373	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.288 @ 6' 9 5/8"	0.746	Passed (L/622)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 14' 11".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 15' 5 3/4"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Stud wall - DF	5.50"	4.25"	3.00"	4616	5097	2015	2518	10327	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.50"	834	789	312	390	1718	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	15' 6" o/c	
Bottom Edge (Lu)	15' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 15' 7"	N/A	18.0	--	--	--	
1 - Point (lb)	2' 4" (Front)	N/A	5170	5886	2327	2908	Linked from: Main Beam 7, Support 1

- Side loads are assumed to not induce cross-grain tension.

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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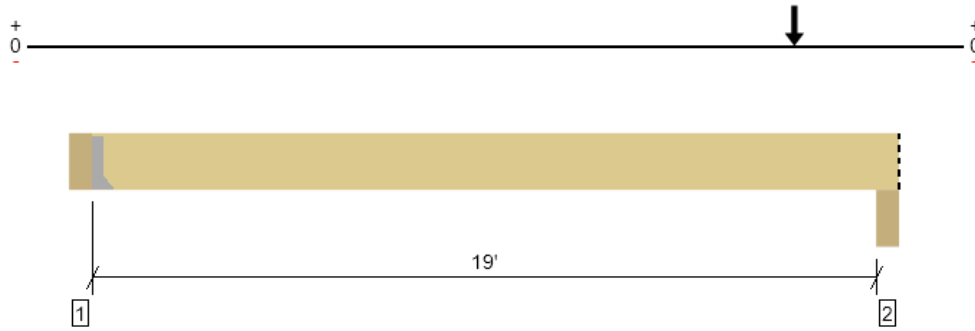
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Main, Main Beam 9

1 piece(s) 5 1/2" x 13 1/2" 24F-V4 DF Glulam

Overall Length: 19' 11"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	14995 @ 19' 7"	19663 (5.50")	Passed (76%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	14966 @ 18' 4"	15085	Passed (99%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	33679 @ 17' 4"	38062	Passed (88%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.380 @ 11' 4 13/16"	0.478	Passed (L/604)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.765 @ 11' 4 3/16"	0.956	Passed (L/300)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

Member Length : 19' 5 1/2"
System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.99 that was calculated using length L = 19' 1 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Roof Live	Snow	Factored	
1 - Hanger on 13 1/2" DF beam	5.50"	Hanger ¹	1.50"	1133	620	587	734	2148	See note ¹
2 - Column - DF	5.50"	5.50"	4.19"	7381	4646	4406	5505	14995	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	19' 6" o/c	
Bottom Edge (Lu)	19' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	U610	2.00"	N/A	14-16d	6-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	5 1/2" to 19' 11"	N/A	18.0	--	--	--	
1 - Point (lb)	17' 4" (Top)	N/A	8163	5266	4993	6239	Linked from: Upper Post 1, Support 1

- Side loads are assumed to not induce cross-grain tension.

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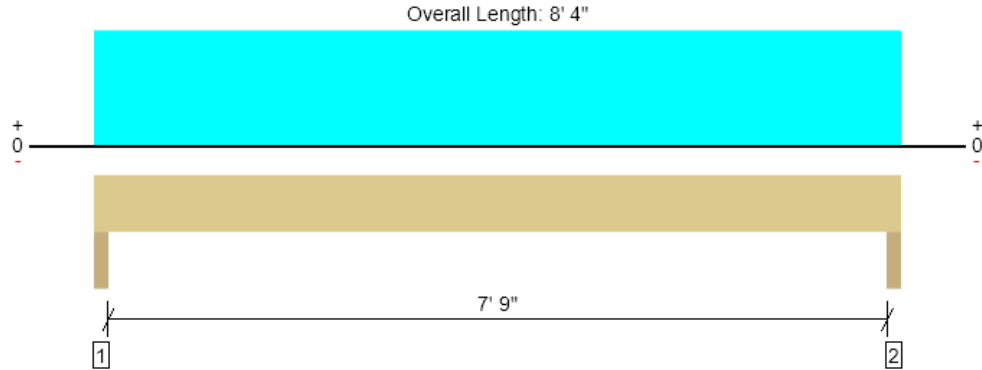


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Main, Main Header 1

1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2054 @ 2"	7963 (3.50")	Passed (26%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1540 @ 1' 1/2"	5565	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	3943 @ 4' 2"	9450	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.060 @ 4' 2"	0.200	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.119 @ 4' 2"	0.400	Passed (L/809)	--	1.0 D + 1.0 L (All Spans)

Member Length : 8' 4"
 System : Wall
 Member Type : Header
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	1019	1034	2054	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1019	1034	2054	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 4" o/c	
Bottom Edge (Lu)	8' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 4"	N/A	7.7	--	
1 - Uniform (PLF)	0 to 8' 4"	N/A	144.0	-	Default Load
2 - Uniform (PLF)	0 to 8' 4"	N/A	93.0	248.3	Linked from: Main Truss 5, Support 2

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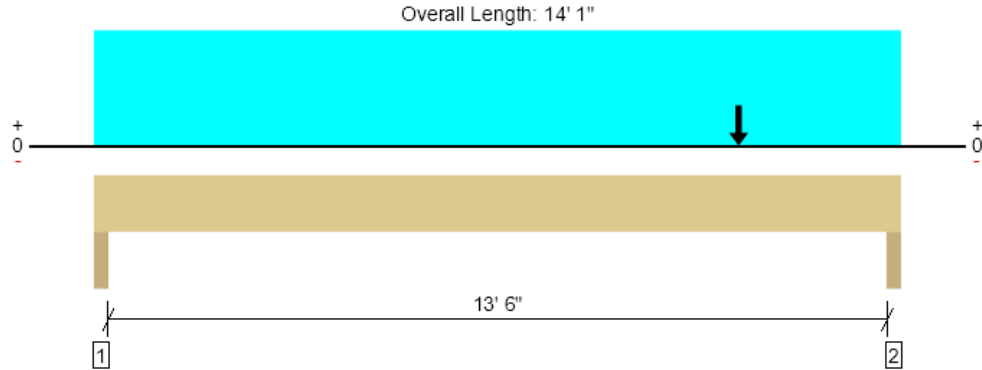
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Main, Main Header 2

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3135 @ 13' 11"	12513 (3.50")	Passed (25%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2928 @ 12' 9 1/2"	11660	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	7833 @ 10' 3/4"	26400	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.072 @ 7' 11 5/16"	0.344	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.182 @ 7' 5 11/16"	0.688	Passed (L/909)	--	1.0 D + 1.0 L (All Spans)

Member Length : 14' 1"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 13' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	1232	378	1610	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1564	1571	3135	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	14' 1" o/c	
Bottom Edge (Lu)	14' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 14' 1"	N/A	16.0	--	
1 - Uniform (PLF)	0 to 14' 1"	N/A	144.0	-	Floor
2 - Point (lb)	11' 3"	N/A	542	1949	Linked from: Upper Header 4, Support 1

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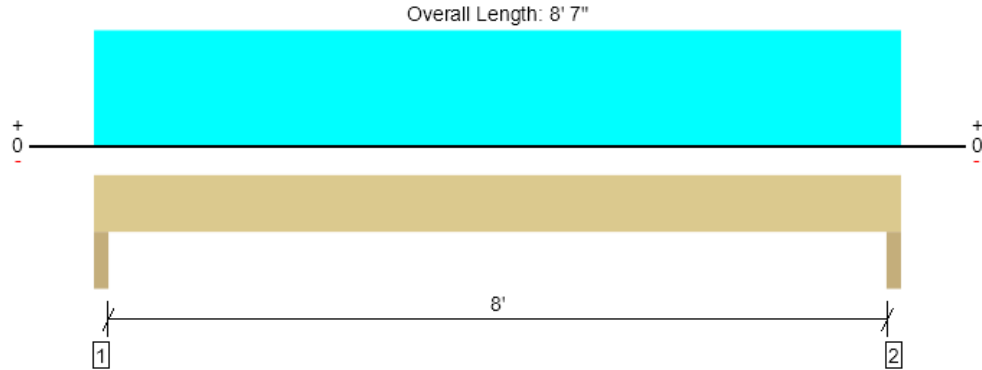
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Main, Main Header 3

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5388 @ 2"	12513 (3.50")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4080 @ 1' 1/2"	8745	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	10682 @ 4' 3 1/2"	14850	Passed (72%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.132 @ 4' 3 1/2"	0.206	Passed (L/747)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.218 @ 4' 3 1/2"	0.412	Passed (L/455)	--	1.0 D + 1.0 L (All Spans)

Member Length : 8' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.51"	2108	3280	801	5388	None
2 - Trimmer - SPF	3.50"	3.50"	1.51"	2108	3280	801	5388	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	12.0	--	--	
1 - Uniform (PLF)	0 to 8' 7"	N/A	288.0	-	-	Floor
2 - Uniform (PLF)	0 to 8' 7"	N/A	191.3	764.3	186.8	Linked from: Main Truss 3, Support 2

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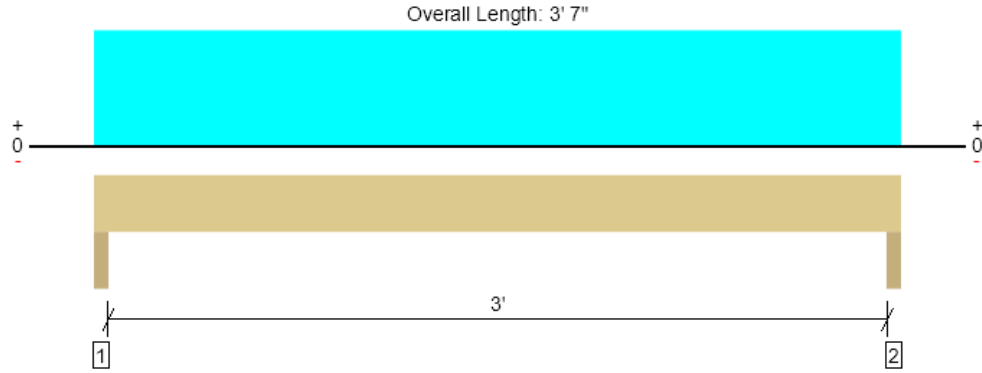
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Main, Main Header 5
2 piece(s) 2 x 6 DF No.2



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1822 @ 2"	6563 (3.50")	Passed (28%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1059 @ 9"	1980	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1342 @ 1' 9 1/2"	1475	Passed (91%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.024 @ 1' 9 1/2"	0.081	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.038 @ 1' 9 1/2"	0.162	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Member Length : 3' 7"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	690	1131	1822	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	690	1131	1822	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 7" o/c	
Bottom Edge (Lu)	3' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 3' 7"	N/A	4.2	--	
1 - Uniform (PLF)	0 to 3' 7"	N/A	144.0	-	Floor
2 - Uniform (PLF)	0 to 3' 7"	N/A	140.3	373.5	Linked from: Main Truss 1, Support 2
3 - Uniform (PLF)	0 to 3' 7"	N/A	96.8	258.0	Linked from: Main Truss 2, Support 1

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ForteWEB Software Operator	Job Notes
Allen Rishel NKH Engineering (206) 641-1733 allen@nkhengineering.com	

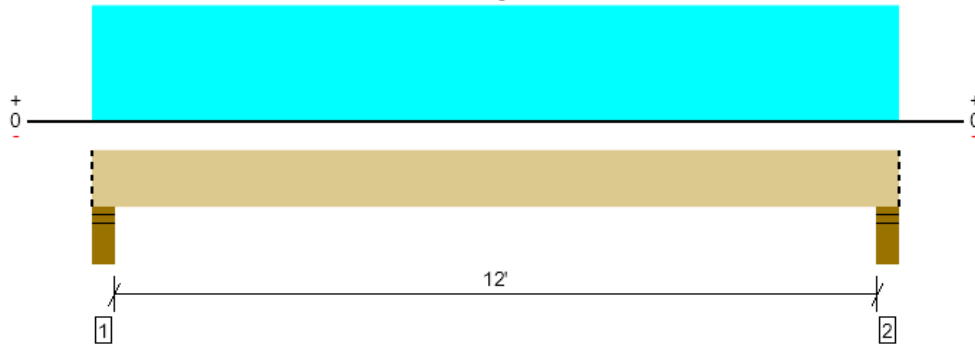


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File Name: 22-112 3804 House
S180

Main, Main Header 6

1 piece(s) 5 1/4" x 14" 2.2E Parallam® PSL

Overall Length: 12' 11"



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7874 @ 4"	12272 (5.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	5893 @ 1' 7 1/2"	14210	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	22870 @ 6' 5 1/2"	40743	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.201 @ 6' 5 1/2"	0.267	Passed (L/730)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.266 @ 6' 5 1/2"	0.267	Passed (L/552)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/550) and TL (L/550).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Member Length : 12' 11"
 System : Floor
 Member Type : Drop Beam
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	5.50"	5.50"	3.53"	1921	5953	7874	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.53"	1921	5953	7874	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 11" o/c	
Bottom Edge (Lu)	12' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 11"	N/A	23.0	--	
1 - Uniform (PSF)	0 to 12' 11" (Back)	9' 6"	15.0	60.0	Deck
2 - Uniform (PLF)	0 to 12' 11" (Front)	N/A	132.0	351.8	Linked from: Main Truss 4, Support 2

- Side loads are assumed to not induce cross-grain tension.

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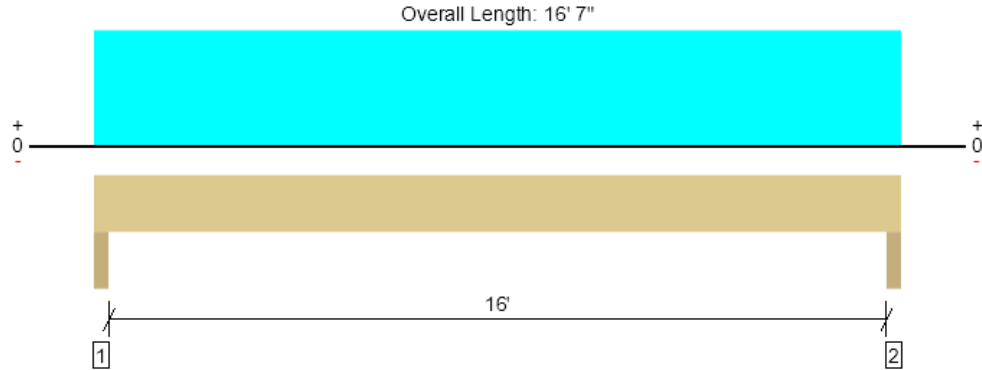


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File Name: 22-112 3804 House
 S181

Main, Main Header 7

1 piece(s) 5 1/2" x 15" 24F-V4 DF Glulam



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	10477 @ 2"	12513 (3.50")	Passed (84%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	8529 @ 1' 6 1/2"	14575	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	41707 @ 8' 3 1/2"	41096	Passed (101%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.431 @ 8' 3 1/2"	0.542	Passed (L/453)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.712 @ 8' 3 1/2"	0.813	Passed (L/274)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 16' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Member Length : 16' 7"
 System : Wall
 Member Type : Header
 Building Use : Residential
 Building Code : IBC 2018
 Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	2.93"	4140	6337	1548	10477	None
2 - Trimmer - SPF	3.50"	3.50"	2.93"	4140	6337	1548	10477	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6" o/c	
Bottom Edge (Lu)	16' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16' 7"	N/A	20.0	--	--	
1 - Uniform (PLF)	0 to 16' 7"	N/A	288.0	-	-	Floor
2 - Uniform (PLF)	0 to 16' 7"	N/A	191.3	764.3	186.8	Linked from: Main Truss 3, Support 2

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 S182

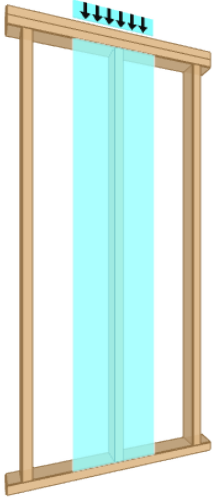
Main, Main Wall 1

1 piece(s) 2 x 6 DF No.2 @ 16" OC

Wall Height: 12'

Member Height: 11' 7 1/2"

O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	2770	5432	Passed (51%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	2770	4383	Passed (63%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	112	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	103	1584	Passed (7%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	326 @ mid-span	1342	Passed (24%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.17 @ mid-span	1.16	Passed (L/836)	--	1.0 D + 0.6 W
Bending/Compression	0.57	1	Passed (57%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Lateral Connections

Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Loads	Spacing	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	288.0	-	-	-	
2 - Point (PLF)	16.00"	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 2
3 - Point (PLF)	16.00"	191.3	764.3	-	186.8	Linked from: Main Truss 3, Support 2
4 - Point (PLF)	16.00"	187.5	-	249.8	312.0	Linked from: Roof Truss 1, Support 2

Lateral Load	Location	Spacing	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	16.00"	24.1	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Wind Zone (4), GCpi (+/- 0.18), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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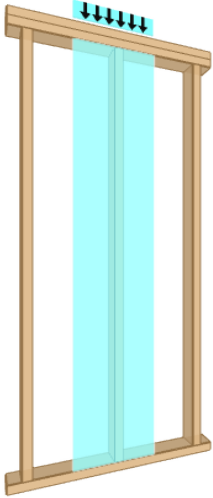
Main, Main Wall 2

1 piece(s) 2 x 6 DF No.2 @ 16" OC

Wall Height: 12'

Member Height: 11' 7 1/2"

O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	3066	5304	Passed (58%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	3082	4383	Passed (70%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	112	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	103	1584	Passed (7%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	326 @ mid-span	1342	Passed (24%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.17 @ mid-span	1.16	Passed (L/836)	--	1.0 D + 0.6 W
Bending/Compression	0.66	1	Passed (66%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Lateral Connections

Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Loads	Spacing	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	288.0	-	-	-	
2 - Point (PLF)	16.00"	92.3	-	134.3	168.0	Linked from: Roof Truss 3, Support 2
3 - Point (PLF)	16.00"	100.5	268.5	-	-	Linked from: Upper Truss 1, Support 1
4 - Point (PLF)	16.00"	141.0	376.5	-	-	Linked from: Upper Truss 2, Support 2
5 - Point (PLF)	16.00"	140.3	373.5	-	-	Linked from: Main Truss 1, Support 2
6 - Point (PLF)	16.00"	96.8	258.0	-	-	Linked from: Main Truss 2, Support 1
7 - Point (PLF)	16.00"	164.3	-	219.0	273.8	Linked from: Roof Truss 1, Support 1

Lateral Load	Location	Spacing	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	16.00"	24.1	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Wind Zone (4), GCpi (+/- 0.18), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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Main, Main Post 1
1 piece(s) 6 x 6 DF No.2

Post Height: 9'



Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	20	50	Passed (39%)	--	--
Compression (lbs)	15577	16909	Passed (92%)	1.00	1.0 D + 1.0 L
Base Bearing (lbs)	15577	898425	Passed (2%)	--	1.0 D + 1.0 L
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Drawing is Conceptual

Vertical Loads	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	3364	3281	333	417	Linked from: Main Beam 1, Support 1
2 - Point (lb)	4670	4262	1314	1643	Linked from: Main Beam 1, Support 2

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Main, Main Post 2

1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL

Post Height: 9'



Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	21	50	Passed (41%)	--	--
Compression (lbs)	26503	43634	Passed (61%)	1.15	1.0 D + 0.75 L + 0.75 S
Base Bearing (lbs)	26503	818606	Passed (3%)	--	1.0 D + 0.75 L + 0.75 S
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Drawing is Conceptual

Vertical Load	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	11308	13561	5361	6699	Linked from: Main Beam 2, Support 1

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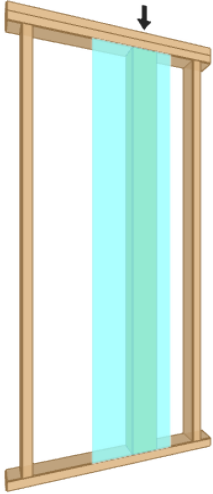
Main, Main Post 3

1 piece(s) 3 1/2" x 7" 1.8E Parallam® PSL

Wall Height: 8'

Member Height: 7' 7 1/2"

Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	11	50	Passed (22%)	--	--
Compression (lbs)	20901	57626	Passed (36%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	20995	15313	Failed (137%)	--	1.0 D + 0.75 L + 0.75 S
Lateral Reaction (lbs)	58	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	49	6011	Passed (1%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	111 @ mid-span	10086	Passed (1%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.08 @ mid-span	0.76	Passed (L/1192)	--	1.0 D + 0.45 W + 0.75 L + 0.75 S
Bending/Compression	0.52	1	Passed (52%)	1.00	1.0 D + 1.0 L

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for this design is 16.67% of applicable member side dimension.
- Applicable calculations are based on NDS.
- Bearing shall be on a metal plate or strap, or on other equivalently durable, rigid, homogeneous material with sufficient stiffness to distribute applied load.

Supports	Type	Material
Top	Dbl 2X	Douglas Fir-Larch
Base	2X	Douglas Fir-Larch

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Lateral Connections

Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Loads	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	561	1466	-	-	Linked from: Main Beam 3, Support 1
2 - Point (lb)	N/A	8083	10791	3370	4211	Linked from: Main Beam 2, Support 2

Lateral Load	Location	Tributary Width	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	1'	25.5	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Wind Zone (4), GCpi (+/- 0.18), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
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FOUNDATION DESIGN FOR PROPERTY LOCATED AT 3804 Mercer Way Mercer Island WA 98040

Basis of Design

This document is showing the detail of design and calculations of foundation for gravity loads according to IRC 2018, IBC 2018, ASCE7-16, and ACI 318-14.

The load distribution is as follow:

Floor Dead Load -----	15 psf
Roof Dead Load-----	15 psf
Floor Live Load-----	40 psf
Roof Live Load-----	20 psf
Roof Snow Load-----	25 psf
Deck Live Load-----	60 psf
Deck Dead Load-----	15 psf

The maximum bearing pressure on soil was considered at least 1500 psf . Concrete strength is assumed to be at least 2500 psi

Material Properties for Design

$f_c := 2500\text{psi}$ Concrete compressive strength

$f_y := 60\text{-ksi}$ Yield strength of rebar

$f_{\text{soil.bearing}} := 1500\text{psf}$ Minimum soil bearing capacity

$\gamma_{\text{concrete}} := 150\text{pcf}$ Concrete unit weight

$\gamma_{\text{steel}} := 490\text{pcf}$ Steel unit weight

$E_s := 29000\text{ksi}$ Young modulus of steel

$E_c := 57000 \cdot \sqrt{\frac{f_c}{\text{psi}}} \cdot \text{psi} = 2.85 \times 10^3 \cdot \text{ksi}$ Young modulus of concrete (ACI-318-14)

Load Assumptions

$LL_{\text{floor}} := 40\text{psf}$ Floor live load

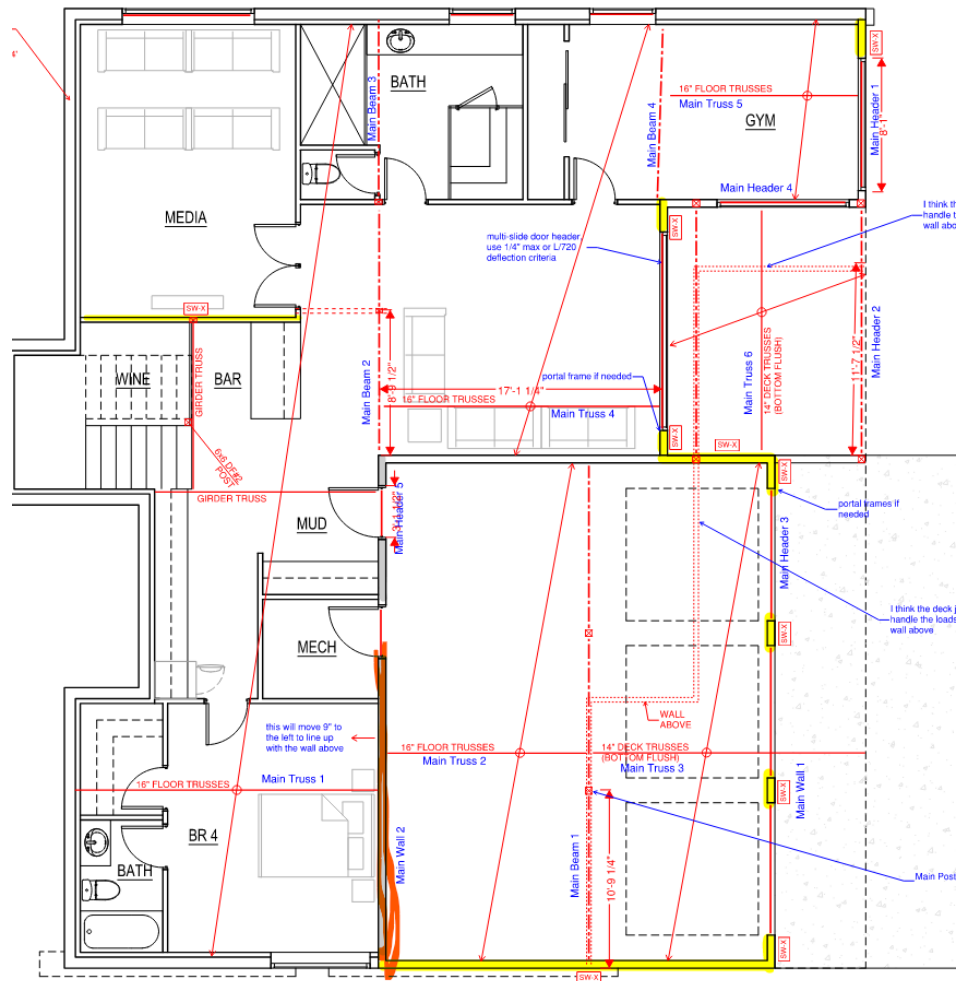
$DL_{\text{floor}} := 15\text{psf}$ Floor dead load

$DL_{\text{roof}} := 15\text{psf}$ Roof dead load

$LL_{\text{roof}} := 20\text{psf}$ Roof live load

$SL_{\text{roof}} := 25\text{psf}$ Roof snow load

Check Bearing Capacity of Foundation



$$F_{\text{wall}} := 3048 \frac{\text{lbf}}{16\text{in}}$$

Axial load on wall per stud-from ForteWeb

$$W_{\text{found}} := 20\text{in}$$

Foundation size

$$d_f := 10\text{in}$$

Thickness of foundation

$$\frac{F_{\text{wall}} + W_{\text{found}} \cdot d_f \cdot \gamma_{\text{concrete}}}{W_{\text{found}}} = 1.497 \times 10^3 \cdot \text{psf}$$

OK less than 1500 psf

Check the one way shear:

$$V_f := 1.6 \cdot \frac{F_{\text{wall}}}{W_{\text{found}}} \cdot \left(\frac{W_{\text{found}}}{2} \right) = 1.829 \times 10^3 \cdot \text{plf}$$

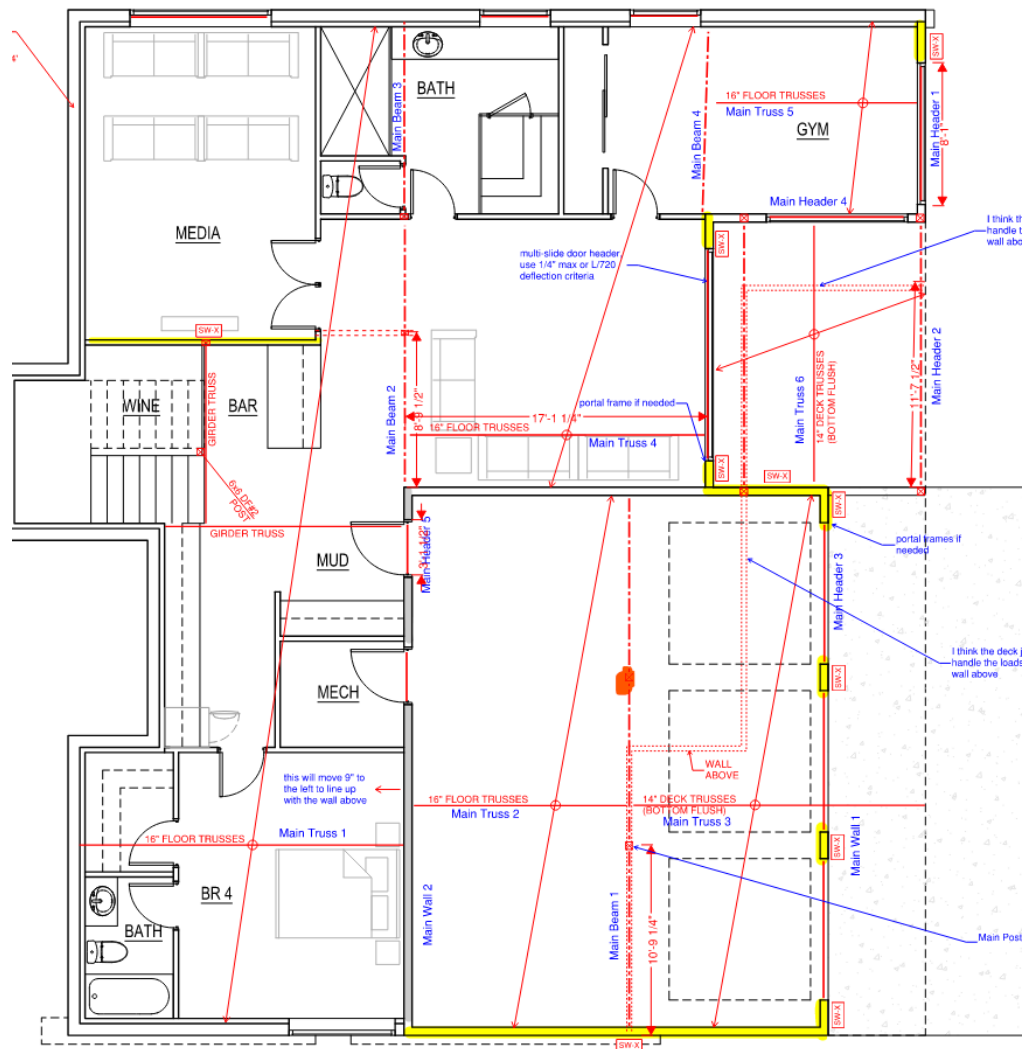
$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{f_c}{\text{psi}}} \cdot (d_f - 3\text{in}) \cdot \text{psi} = 6.3 \times 10^3 \cdot \text{plf}$$

$$\frac{V_f}{\phi V_c} = 0.29$$

Less than 1.0 OK

$$\frac{0.0018 \cdot W_{\text{found}} \cdot d_f}{0.2\text{in}^2} = 1.8$$

Use 2#4 rebar



$$F_f := 158211 \text{ lb}$$

Load from FortWeb

$$W_{\text{found}} := 3.5 \text{ ft}$$

Foundation size

$$D_{\text{found}} := 3.5 \text{ ft}$$

$$d_f := 10 \text{ in}$$

$$\frac{F_f + W_{\text{found}} \cdot D_{\text{found}} \cdot d_f \cdot \gamma_{\text{concrete}}}{W_{\text{found}} \cdot D_{\text{found}}} = 1.417 \times 10^3 \cdot \text{psf}$$

OK less than 1500 psf

Check the Punching Shear:

$$\phi V_c := 0.75 \cdot 4 \cdot \sqrt{\frac{f_c}{\text{psi}}} \cdot \left(5.5 \text{ in} + \frac{d_f - 3 \text{ in}}{2} + 5.5 \text{ in} + \frac{d_f - 3 \text{ in}}{2} \right) \cdot 2 \cdot (d_f - 3 \text{ in}) \cdot \text{psi} = 3.78 \times 10^4 \cdot \text{lbf}$$

$$\frac{F_f \cdot 1.6}{\phi V_c} = 0.67$$

Less than 1.0 ok to use 10" thick foundation (1.6 here is load factor)

Check the one way shear:

$$V_f := 1.5 \cdot \frac{F_f}{W_{\text{found}}} \cdot \left(\frac{D_{\text{found}}}{2} \right) = 1.187 \times 10^4 \cdot \text{lbf}$$

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{f_c}{\text{psi}}} \cdot W_{\text{found}} \cdot (d_f - 3 \text{ in}) \cdot \text{psi} = 2.205 \times 10^4 \cdot \text{lbf}$$

$$\frac{V_f}{\phi V_c} = 0.538$$

Less than 1.0 OK

$$\frac{0.0018 \cdot W_{\text{found}} \cdot d_f}{0.2 \text{ in}^2} = 3.78$$

Use 4#4 rebar

$$M_f := V_f \cdot \frac{D_{\text{found}}}{4} = 1.038 \times 10^4 \cdot \text{lbf} \cdot \text{ft}$$

$$\phi M_n := 4 \cdot 0.2 \text{ in}^2 \cdot f_y \cdot (d_f - 3 \text{ in}) \cdot 0.9 \cdot 0.9 = 2.268 \times 10^4 \cdot \text{lbf} \cdot \text{ft}$$

$$\frac{M_f}{\phi M_n} = 0.458$$

Design of 10 ft Retaining Wall

$t_{\text{wall}} := 8\text{in}$	Thickness of wall
$t_{\text{foun}} := 10\text{in}$	Thickness of foundation
$L_{\text{toe}} := 1\text{ft} + 10\text{in} = 1.833\cdot\text{ft}$	Total foundation length
$h_{\text{key}} := 0\text{ft}$	Height of key
$t_{\text{key}} := 0\text{in}$	Thickness of key
$L_{\text{heel}} := 1\text{ft} + 6\text{in}$	Heel length
$t_{\text{gr_slab}} := 4\text{in}$	Thickness of slab on grade on top of wall foundation
$h_{\text{wall}} := 10\text{ft}$	Height of the wall
$I := \frac{1}{12} \cdot (L_{\text{toe}} + L_{\text{heel}} + t_{\text{wall}})^3 = 5.333 \cdot \frac{\text{ft}^4}{\text{ft}}$	Moment inertia of wall base
$f'_c := 2500\text{psi}$	Concrete compressive strength
$f_y := 60\text{ksi}$	Steel yield strength
$E_s := 29000\text{ksi}$	Steel young modulus
$\gamma_c := 150\text{pcf}$	Concrete unit weight
$p_a := 40\text{pcf}$	Active soil pressure
$p_o := 55\text{pcf}$	At-rest soil pressure
$\Delta p_{\text{eq}} := 8 \left(\frac{h_{\text{wall}}}{\text{ft}} \right) \cdot \text{psf} = 80 \cdot \text{psf}$	Seismic soil pressure
$p_p := 200\text{pcf}$	Passive pressure
$\text{PGA} := 0.607$	

$$\mu := 0.35 \quad \text{Soil friction factor from IBC 2018}$$

$$\phi := \frac{3}{2} \cdot \text{atan}(\mu) = 28.935 \cdot \text{deg} \quad \text{Equivalent friction angle}$$

$$K_a := \frac{1 - \sin(\phi)}{1 + \sin(\phi)} = 0.348 \quad \text{Active pressure coefficient}$$

$$K_o := 1 - \sin(\phi) = 0.516 \quad \text{At-Rest pressure coefficient}$$

$$\gamma_{\text{soil}} := \frac{p_a}{K_a} = 114.984 \cdot \text{pcf} \quad \text{Soil unit weight}$$

Vertical weight on wall

$$P_{d_wall} := (h_{\text{wall}} - t_{\text{foun}}) \cdot t_{\text{wall}} \cdot \gamma_c = 916.667 \cdot \text{plf}$$

$$P_{d_found} := (L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}) \cdot t_{\text{foun}} \cdot \gamma_c = 500 \cdot \text{plf} \quad \text{Concrete weight of foundation}$$

$$P_{d_key} := (h_{\text{key}} - t_{\text{foun}}) \cdot t_{\text{key}} \cdot \gamma_c = 0 \cdot \text{plf} \quad \text{Concrete weight of key}$$

$$P_{d_slab} := t_{\text{gr_slab}} \cdot (44\text{ft}) \cdot \gamma_c + 5\text{psf} \cdot 44\text{ft} + 0.6 \left(3919 \frac{\text{lbf}}{16\text{in}} + 2092 \frac{\text{lbf}}{16\text{in}} + 1507 \frac{\text{lbf}}{16\text{in}} \right) = 5.803 \times 10^3 \cdot \text{p}$$

Concrete weight of slab and
dead load on grade

$$P_{\text{slab.on.found}} := t_{\text{gr_slab}} \cdot \gamma_c \cdot L_{\text{toe}} = 91.667 \cdot \text{plf} \quad \text{Weight of concrete slab on wall foundation}$$

Live load on slab

$$P_{ll} := 0\text{psf} \cdot (L_{\text{toe}}) = 0 \cdot \text{plf}$$

Surcharge pressure on wall due to
slab on grade

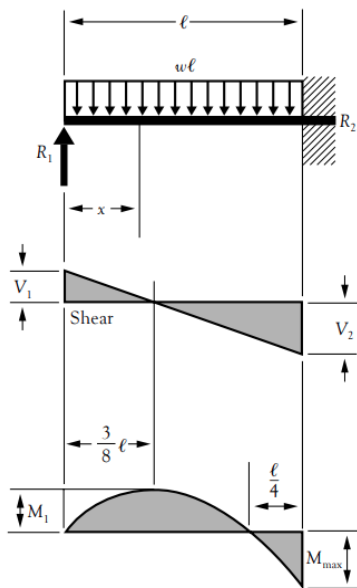
$$P_{d_surch} := 0 \cdot t_{\text{gr_slab}} \cdot \gamma_c \cdot K_a = 0 \cdot \text{psf}$$

Surcharge pressure on wall due to
live load on patio

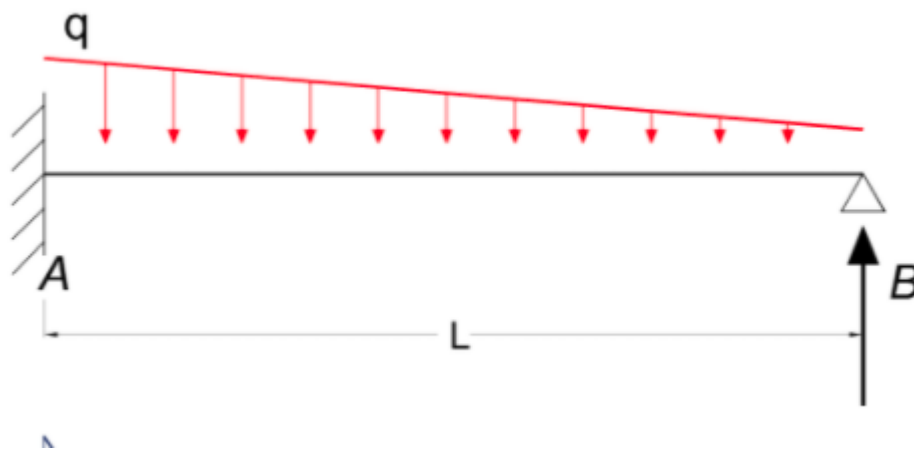
$$P_{ll_surch} := 60\text{psf} \cdot K_a = 20.872 \cdot \text{psf}$$

Check Sliding Capacity for Dead Load

Lateral earth force from active pressure



$$\begin{aligned}
 R_1 = V_1 & \dots\dots\dots = \frac{3w\ell}{8} \\
 R_2 = V_2 & \dots\dots\dots = \frac{5w\ell}{8} \\
 V_x & \dots\dots\dots = R_1 - wx \\
 M_{\max} & \dots\dots\dots = \frac{w\ell^2}{8} \\
 M_1 \left(\text{at } x = \frac{3}{8}\ell \right) & \dots\dots\dots = \frac{9}{128}w\ell^2 \\
 M_x & \dots\dots\dots = R_1x - \frac{wx^2}{2} \\
 \Delta_{\max} \left(\text{at } x = \frac{\ell}{16}(1 + \sqrt{33}) = .4215\ell \right) & \dots\dots\dots = \frac{w\ell^4}{185EI} \\
 \Delta_x & \dots\dots\dots = \frac{wx}{48EI}(\ell^3 - 3\ell x^2 + 2x^3)
 \end{aligned}$$



Bending Moment

$$M_A = -q L^2 / 15 \quad (3a)$$

where

M_A = moment at the fixed end (Nm, lb_f ft)

q = continuous declining load (N/m, lb_f/ft)

$$M_1 = q L^2 / 33.6 \quad (3b)$$

where

M_1 = maximum moment at $x = 0.553 L$ (Nm, lb_f ft)

Deflection

$$\delta_{max} = q L^4 / (419 E I) \quad (3c)$$

where

δ_{max} = max deflection at $x = 0.553 L$ (m, ft)

$$\delta_{1/2} = q L^4 / (427 E I) \quad (3d)$$

where

$\delta_{1/2}$ = deflection at $x = L / 2$ (m, ft)

Support Reactions

$$R_A = 2 q L / 5 \quad (3e)$$

$$R_B = q L / 10 \quad (3f)$$

$$F_d := \frac{2}{5} \cdot p_o \cdot (h_{wall} - t_{gr_slab})^2 + 5 \cdot \frac{P_{d_surch} \cdot (h_{wall} - t_{gr_slab})}{8} = 2.056 \times 10^3 \cdot \text{plf}$$

Resisting force

$$F_{res} := P_{d_wall} + P_{d_found} + P_{d_key} + P_{d_slab} \dots = 8.743 \times 10^3 \cdot \text{plf} \\ + L_{heel} \cdot \gamma_{soil} \cdot (h_{wall} - t_{gr_slab} - t_{foun})$$

$$\frac{F_{res} \cdot \mu}{F_d} = 1.5$$

It is more than or
equal 1.5**Check Sliding Capacity for Seismic
Load**

Lateral earth force from active pressure

$$F_d := \frac{2}{5} \cdot p_a \cdot (h_{wall} - t_{gr_slab})^2 + \frac{5}{8} \cdot P_{d_surch} \cdot (h_{wall} - t_{gr_slab}) \dots = 2.048 \times 10^3 \cdot \text{plf} \\ + \frac{\frac{5}{8} \cdot \Delta p_{eq} \cdot (h_{wall} - t_{gr_slab}) + \left(\frac{P_{d_wall}}{2} + P_{d_found} + P_{d_key} \right) \cdot PGA \cdot \frac{1}{2}}{1.4}$$

Resisting Force

$$F_{res} := P_{d_wall} + P_{d_found} + P_{d_key} + P_{d_slab} \dots = 8.743 \times 10^3 \cdot \text{plf} \\ + L_{heel} \cdot \gamma_{soil} \cdot (h_{wall} - t_{gr_slab} - t_{foun})$$

$$\frac{0.9 F_{res} \cdot \mu + \frac{1}{2} p_p \cdot (h_{key})^2}{F_d} = 1.345$$

It is more than 1.0

Check Overturning Capacity for Dead Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 + \frac{2}{5} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2 \cdot (h_{\text{key}}) \dots = 3.312 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ \frac{P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}}$$

Resisting moment

$$M_{\text{res}} := P_{d_wall} \cdot \left(L_{\text{toe}} + \frac{t_{\text{wall}}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}}{2} \right) \dots = 8.022 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{\text{key}}}{2} + P_{\text{slab.on.found}} \cdot \frac{L_{\text{toe}}}{2} \dots$$

$$+ L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{heel}}}{2} + t_{\text{wall}} + L_{\text{toe}} \right)$$

$$\frac{M_{\text{res}}}{M_d} = 2.422$$

It is more than 1.5

Check Overturning Capacity for Seismic Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 + \frac{2}{5} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2 \cdot (h_{\text{key}}) \dots$$

$$+ \frac{P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots$$

$$+ \frac{\Delta p_{\text{eq}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot \Delta p_{\text{eq}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots$$

$$+ \left[\frac{P_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} - t_{\text{foun}} \right) + P_{d_found} \cdot \frac{t_{\text{foun}}}{2} + P_{d_key} \cdot \frac{h_{\text{key}}}{2} \right] \cdot \text{PGA} \cdot \frac{1}{2}$$

$$+ \frac{\dots}{1.4}$$

$$M_d = 3.535 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

Resisting moment

$$M_{res} := P_{d_wall} \cdot \left(L_{toe} + \frac{t_{wall}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{toe} + t_{wall} + L_{heel}}{2} \right) \dots = 8.022 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{key}}{2} + P_{slab.on.found} \cdot \frac{L_{toe}}{2} \dots$$

$$+ L_{heel} \cdot \gamma_{soil} \cdot (h_{wall} - t_{gr_slab} - t_{foun}) \cdot \left(\frac{L_{heel}}{2} + t_{wall} + L_{toe} \right)$$

$$\frac{0.9 \cdot M_{res}}{M_d} = 2.042$$

It is more than 1.1

Check Overturning Capacity for Dead and Live Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15} \cdot p_o \cdot (h_{wall} - t_{gr_slab})^3 + \frac{2}{5} \cdot p_o \cdot (h_{wall} - t_{gr_slab})^2 \cdot (h_{key}) \dots$$

$$+ \frac{(P_{d_surch} + P_{ll_surch}) \cdot (h_{wall} - t_{gr_slab})^2}{8} \dots$$

$$+ \frac{5}{8} \cdot (P_{d_surch} + P_{ll_surch}) \cdot (h_{wall} - t_{gr_slab}) \cdot h_{key}$$

$$M_d = 3.556 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

Resisting moment

$$M_{res} := P_{d_wall} \cdot \left(L_{toe} + \frac{t_{wall}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{toe} + t_{wall} + L_{heel}}{2} \right) \dots = 8.022 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{key}}{2} + P_{slab.on.found} \cdot \frac{L_{toe}}{2} \dots$$

$$+ L_{heel} \cdot \gamma_{soil} \cdot (h_{wall} - t_{gr_slab} - t_{foun}) \cdot \left(\frac{L_{heel}}{2} + t_{wall} + L_{toe} \right)$$

$$\frac{M_{res} + \frac{1}{4} p_p \cdot (h_{key} + t_{foun} - 4\text{in})^3}{M_d} = 2.258$$

It is more than 1.0

Check Soil Bearing Pressure for DL+LL

$$M_d := \frac{1}{15} \cdot P_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 \dots$$

$$+ \frac{(P_{d_surch} + P_{ll_surch}) \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8}$$

$$M_{\text{res}} := P_{d_wall} \cdot \left(L_{\text{toe}} + \frac{t_{\text{wall}}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}}{2} \right) \dots = 8.022 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{\text{key}}}{2} + P_{\text{slab.on.found}} \cdot \frac{L_{\text{toe}}}{2} \dots$$

$$+ L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{heel}}}{2} + t_{\text{wall}} + L_{\text{toe}} \right)$$

$$L_{\text{base}} := L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}$$

$$P := P_{d_wall} + P_{d_found} + P_{d_key} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$\left| \frac{M_{\text{res}} - M_d}{P} - \frac{(L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}})}{2} \right| = 0.481 \cdot \text{ft} \quad \text{Eccentricity}$$

$$\frac{L_{\text{base}}}{6} = 0.667 \cdot \text{ft}$$

Eccentricity is within 1/3 of base so base is
always in compression

$$\sigma_{\text{toe}} := \frac{P_{d_wall} + P_{d_found} + P_{d_key} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})}{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}} \dots$$

$$+ \frac{M_d \cdot 0.5 \cdot L_{\text{base}}}{I} - \frac{P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) \cdot 0.5 L_{\text{base}}}{I} \dots$$

$$+ \frac{P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} + \frac{P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} \dots$$

$$+ \frac{-L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right) \cdot 0.5 L_{\text{base}}}{I}$$

$$\sigma_{\text{toe}} = 1.449 \times 10^3 \cdot \text{psf} \quad \text{Less than 1500 psf OK}$$

$$\sigma_{\text{heel}} := \frac{P_{d_wall} + P_{d_found} + P_{d_key} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})}{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}} \dots$$

$$+ \frac{-M_d \cdot 0.5 \cdot L_{\text{base}}}{I} - \frac{-P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) \cdot 0.5 L_{\text{base}}}{I} \dots$$

$$+ \frac{-P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} - \frac{P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} \dots$$

$$+ \frac{L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right) \cdot 0.5 L_{\text{base}}}{I}$$

$$\sigma_{\text{heel}} = 21.222 \cdot \text{psf} \quad \text{Less than 1500 psf OK}$$

Check Soil Bearing Pressure for Seismic

$$\begin{aligned}
 M_d := & \frac{1}{15} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 + \frac{2}{5} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2 \cdot (h_{\text{key}}) \dots \\
 & + \frac{p_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot p_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots \\
 & + \frac{\Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot \Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots \\
 & + \left[\frac{p_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} - t_{\text{foun}} \right) + p_{d_found} \cdot \frac{t_{\text{foun}}}{2} + p_{d_key} \cdot \frac{h_{\text{key}}}{2} \right] \cdot PGA \cdot \frac{1}{2} \\
 & + \frac{\dots}{1.4} \\
 M_d = & 4.439 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}
 \end{aligned}$$

Resisting moment

$$\begin{aligned}
 M_{\text{res}} := & p_{d_wall} \cdot \left(L_{\text{toe}} + \frac{t_{\text{wall}}}{2} \right) + p_{d_found} \cdot \left(\frac{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}}{2} \right) \dots = 8.022 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}} \\
 & + p_{d_key} \cdot \frac{t_{\text{key}}}{2} + p_{\text{slab.on.found}} \cdot \frac{L_{\text{toe}}}{2} \dots \\
 & + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{heel}}}{2} + t_{\text{wall}} + L_{\text{toe}} \right)
 \end{aligned}$$

$$P := p_{d_wall} + p_{d_found} + p_{d_key} + p_{d_slab} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$e_{cc} := \left| \frac{0.9 \cdot M_{\text{res}} + \frac{1}{4} p_p \cdot (h_{\text{key}} + t_{\text{foun}} - 1\text{ft})^3 - M_d}{P} - \frac{L_{\text{base}}}{2} \right| = 1.682 \cdot \text{ft} \quad \text{Eccentricity}$$

$$\frac{L_{\text{base}}}{2} = 2 \cdot \text{ft} \quad \text{The resultant is within base}$$

Moment about centroid of foundation

$$M_{\text{center}} := M_d - P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) + P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \dots$$

$$+ P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) - L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right)$$

$$M_{\text{center}} = 2.786 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

Axial load on center of foundation

$$P_{\text{center}} := P_{d_wall} + P_{d_found} + P_{d_key} + P_{\text{slab.on.found}} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$P_{\text{center}} = 3.032 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\sigma_{\text{toe}} = 1.87 \times 10^3 \cdot \text{psf}$$

Maximum bearing pressure on soil due to seismic
is less than 1.3x1500= 1950 psf per IBC OK

Check for Shear and Moment Capacity**Wall Shear and Moment Capacity**

$$A_{s,min.wall} := 0.0018 \cdot t_{wall} \cdot 12in = 0.173 \cdot in^2 \quad \text{Provide at least \#4@12}$$

Shear Capacity ACI-318

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi \cdot (t_{wall} - 3in) = 4.5 \cdot \frac{kip}{ft} \quad \text{Shear Capacity}$$

$$\phi M_{cap_base} := 0.9 \cdot f_y \cdot 0.2 \cdot \frac{in^2}{ft} \cdot \frac{12}{8} \cdot \left(0.9 \cdot \frac{t_{wall}}{2} \right) = 4.86 \cdot \frac{kip \cdot ft}{ft} \quad \text{Moment capacity of wall at the base \#4@8"}$$

$$\phi M_{cap_mid} := 0.9 \cdot f_y \cdot 0.2 \cdot \frac{in^2}{ft} \cdot \frac{12}{8} \cdot \left(0.9 \cdot \frac{t_{wall}}{2} \right) = 4.86 \cdot \frac{kip \cdot ft}{ft} \quad \text{Moment capacity of wall at the middle \#4@12"}$$

$$\phi V_c = 4.5 \cdot \frac{kip}{ft} \quad \text{Shear capacity of wall}$$

**Calculate Demand on Base of Wall
(1.4DL+1.6LL+1.6EH)**

$$M := 1.6 \cdot \frac{1}{15} \cdot P_o \cdot (h_{wall} - t_{gr_slab} - t_{foun})^3 \dots = 4.369 \cdot kip \cdot \frac{ft}{ft} \\ + \frac{(1.2 \cdot P_{d_surch} + 1.6 \cdot P_{ll_surch}) \cdot (h_{wall} - t_{gr_slab} - t_{foun})^2}{8}$$

$$M = 4.369 \cdot kip$$

$$\frac{M}{\phi M_{cap_base}} = 89.903 \cdot \%$$

Moment capacity is more than demand moment on wall-OK

$$V := 1.6 \cdot \frac{2}{5} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}})^2 \dots$$

$$+ \frac{5}{8} \cdot (1.2 \cdot P_{d_surch} + 1.6 \cdot P_{ll_surch}) \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}})$$

$$V = 2.518 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{V}{\phi V_c} = 55.958\%$$

Shear capacity is more than demand moment on wall-OK

Calculate Demand on Base Wall (1.2DL+1.0LL+1.6EH+1.0EQ)

$$M := 1.6 \cdot \frac{1}{15} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})^3 \dots$$

$$+ \frac{1.2 \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})^2}{8} \dots$$

$$+ \frac{\Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})^2}{8} \dots$$

$$+ \left[\frac{1.2 P_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} - t_{\text{foun}} \right) \right] \cdot \frac{\text{PGA}}{2}$$

$$M = 4.417 \cdot \text{kip}$$

$$\frac{M}{\phi M_{\text{cap_base}}} = 90.876\%$$

OK

$$V := 1.6 \cdot \frac{2}{5} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}})^2 + 1.2 \cdot \frac{5}{8} \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}}) \dots$$

$$+ \frac{5}{8} \cdot \Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}}) + \left(\frac{1.2 P_{d_wall}}{2} \right) \cdot \frac{\text{PGA}}{2}$$

$$V = 2.283 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{V}{\phi V_c} = 50.725\%$$

Shear capacity is more than demand moment on wall-OK

$$A_{\text{min.wall}} := 0.0018 \cdot t_{\text{wall}} \cdot 12 \text{ in} = 0.173 \cdot \text{in}^2$$

Ok use #4@8" vertical and horizontal

Toe Foundation Shear and Moment Capacity**Toe Foundation Shear and Moment Capacity**

$$A_{smin.found.L} := \frac{0.0018 \cdot t_{foun} \cdot L_{base}}{0.2in^2} = 4.32$$

Provide 5-#4 rebar
longitudinal

$$A_{smin.found.T} := \frac{0.0018 \cdot t_{foun} \cdot 10in}{0.2in^2} = 0.9$$

Provide- #4@10" rebar transverse

Shear Capacity ACI-318

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi \cdot (t_{foun} - 3in) = 6.3 \cdot \frac{kip}{ft}$$

Shear Capacity

Moment capacity of wall

$$\phi M_{cap} := 0.9 \cdot f_y \cdot \left(0.2 \frac{in^2}{ft} \cdot \frac{12}{10} \right) \cdot \left(0.9 \cdot \frac{t_{foun}}{2} \right) = 4.86 \cdot \frac{kip \cdot ft}{ft}$$

$$\phi V_c = 6.3 \cdot \frac{kip}{ft}$$

Shear capacity of wall

Calculate demand on toe under soil pressure (1.2DL+1.6LL+1.6EH)

Moment about centroid of foundation

$$\begin{aligned}
 M_d &:= 1.6 \frac{1}{15} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 \dots \\
 &\quad + \frac{(1.2 \cdot P_{d_surch} + 1.6 \cdot P_{ll_surch}) \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} \\
 M_{\text{center}} &:= M_d - 1.2 P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) + 1.2 P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \dots \\
 &\quad + 1.2 \cdot P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \dots \\
 &\quad + -1.2 L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right) \\
 M_{\text{center}} &= 3.707 \cdot \text{kip}
 \end{aligned}$$

Axial load on center of foundation

$$\begin{aligned}
 P_{\text{center}} &:= 1.2 P_{d_wall} + 1.2 P_{d_found} + 1.2 P_{d_key} + 1.2 \cdot P_{\text{slab.on.found}} \dots \\
 &\quad + 1.6 L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})
 \end{aligned}$$

$$P_{\text{center}} = 4.248 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{\max(|M_{\text{toe}}|, |M_{\text{heel}}|)}{\phi M_{\text{cap}}} = 71.163\%$$

$$\frac{\max(|V_{\text{toe}}|, |V_{\text{heel}}|)}{\phi V_c} = 33.976\%$$

Calculate demand on toe under soil pressure (1.2DL+1.0LL+1.6EH+1.0EQ)

Moment about centroid of foundation

$$M_d := 1.6 \frac{1}{15} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 \dots$$

$$+ \frac{1.2 \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} \dots$$

$$+ \frac{\Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} \dots$$

$$+ \left[\frac{1.2 P_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} \right) \right] \cdot \text{PGA}$$

$$M_{\text{center}} := M_d - 1.2 P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) + 1.2 P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \dots$$

$$+ 1.2 \cdot P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \dots$$

$$+ -1.0 L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right)$$

$$M_{\text{center}} = 4.856 \cdot \text{kip}$$

Axial load on center of foundation

$$P_{\text{center}} := 1.2 P_{d_wall} + 1.2 P_{d_found} + 1.2 P_{d_key} + 1.2 \cdot P_{\text{slab.on.found}} \dots$$

$$+ 1.6 L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$P_{\text{center}} = 4.248 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{\max(|M_{\text{toe}}|, |M_{\text{heel}}|)}{\phi M_{\text{cap}}} = 87.114\%$$

$$\frac{\max(|V_{\text{toe}}|, |V_{\text{heel}}|)}{\phi V_c} = 42.256\% \quad \text{OK}$$

It is less than 5% Over EOR is OK

Design of 7 ft Retaining Wall

$$t_{\text{wall}} := 8 \text{ in}$$

Thickness of wall

$$t_{\text{foun}} := 10\text{in} \quad \text{Thickness of foundation}$$

$$L_{\text{toe}} := 1\text{ft} + 4\text{in} = 1.333\cdot\text{ft} \quad \text{Total foundation length}$$

$$h_{\text{key}} := 0\text{ft} \quad \text{Height of key}$$

$$t_{\text{key}} := 0\text{in} \quad \text{Thickness of key}$$

$$L_{\text{heel}} := 1\text{ft} \quad \text{Heel length}$$

$$t_{\text{gr_slab}} := 4\text{in} \quad \text{Thickness of slab on grade on top of wall foundation}$$

$$h_{\text{wall}} := 7\text{ft} \quad \text{Height of the wall}$$

$$I := \frac{1}{12} \cdot (L_{\text{toe}} + L_{\text{heel}} + t_{\text{wall}})^3 = 2.25 \cdot \frac{\text{ft}^4}{\text{ft}} \quad \text{Moment inertia of wall base}$$

$$f'_c := 2500\text{psi} \quad \text{Concrete compressive strength}$$

$$f_y := 60\text{ksi} \quad \text{Steel yield strength}$$

$$E_s := 29000\text{ksi} \quad \text{Steel young modulus}$$

$$\gamma_c := 150\text{pcf} \quad \text{Concrete unit weight}$$

$$p_a := 40\text{pcf} \quad \text{Active soil pressure}$$

$$p_o := 55\text{pcf} \quad \text{At-rest soil pressure}$$

$$\Delta p_{\text{eq}} := 8 \left(\frac{h_{\text{wall}}}{\text{ft}} \right) \cdot \text{psf} = 56 \cdot \text{psf} \quad \text{Seismic soil pressure}$$

$$p_p := 200\text{pcf} \quad \text{Passive pressure}$$

$$\text{PGA} := 0.607$$

$$\mu := 0.35 \quad \text{Soil friction factor from IBC 2018}$$

$$\phi := \frac{3}{2} \cdot \text{atan}(\mu) = 28.935 \cdot \text{deg} \quad \text{Equivalent friction angle}$$

$$K_a := \frac{1 - \sin(\phi)}{1 + \sin(\phi)} = 0.348 \quad \text{Active pressure coefficient}$$

$$K_o := 1 - \sin(\phi) = 0.516 \quad \text{At-Rest pressure coefficient}$$

$$\gamma_{\text{soil}} := \frac{p_a}{K_a} = 114.984 \cdot \text{pcf} \quad \text{Soil unit weight}$$

Vertical weight on wall

$$P_{d_wall} := (h_{\text{wall}} - t_{\text{foun}}) \cdot t_{\text{wall}} \cdot \gamma_c = 616.667 \cdot \text{plf}$$

$$P_{d_found} := (L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}) \cdot t_{\text{foun}} \cdot \gamma_c = 375 \cdot \text{plf} \quad \text{Concrete weight of foundation}$$

$$P_{d_key} := (h_{\text{key}} - t_{\text{foun}}) \cdot t_{\text{key}} \cdot \gamma_c = 0 \cdot \text{plf} \quad \text{Concrete weight of key}$$

$$P_{d_slab} := t_{\text{gr_slab}} \cdot (44\text{ft}) \cdot \gamma_c + 5\text{psf} \cdot 44\text{ft} = 2.42 \times 10^3 \cdot \text{plf}$$

Concrete weight of slab and
dead load on grade

$$P_{\text{slab.on.found}} := t_{\text{gr_slab}} \cdot \gamma_c \cdot L_{\text{toe}} = 66.667 \cdot \text{plf}$$

Weight of concrete slab on wall
foundation

Live load on slab

$$P_{ll} := 0\text{psf} \cdot (L_{\text{toe}}) = 0 \cdot \text{plf}$$

Surcharge pressure on wall due to
slab on grade

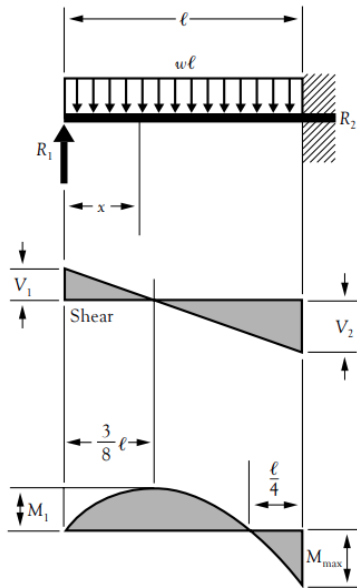
$$P_{d_surch} := 0 \cdot t_{\text{gr_slab}} \cdot \gamma_c \cdot K_a = 0 \cdot \text{psf}$$

Surcharge pressure on wall due to
live load on patio

$$P_{ll_surch} := 60\text{psf} \cdot K_a = 20.872 \cdot \text{psf}$$

Check Sliding Capacity for Dead Load

Lateral earth force from active pressure



$$R_1 = V_1 \dots \dots \dots = \frac{3w\ell}{8}$$

$$R_2 = V_2 \dots \dots \dots = \frac{5w\ell}{8}$$

$$V_x \dots \dots \dots = R_1 - wx$$

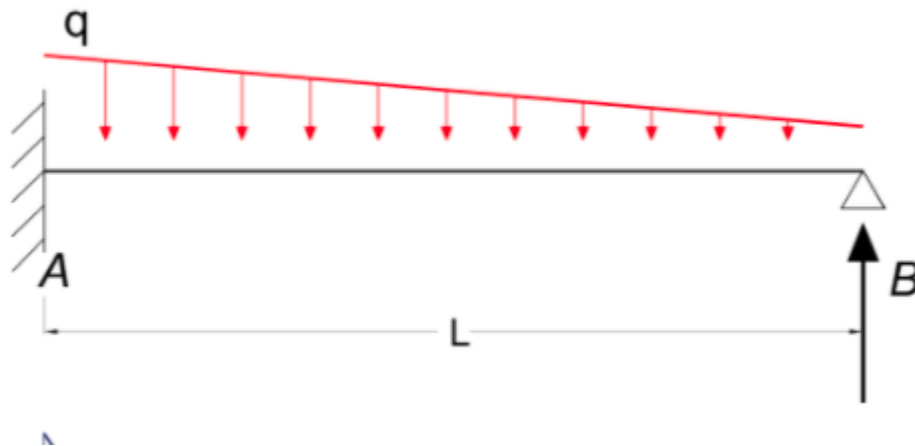
$$M_{\max} \dots \dots \dots = \frac{w\ell^2}{8}$$

$$M_1 \left(\text{at } x = \frac{3}{8} \ell \right) \dots \dots \dots = \frac{9}{128} w\ell^2$$

$$M_x \dots \dots \dots = R_1 x - \frac{wx^2}{2}$$

$$\Delta_{\max} \left(\text{at } x = \frac{\ell}{16} (1 + \sqrt{33}) = .4215 \ell \right) \dots \dots \dots = \frac{w\ell^4}{185EI}$$

$$\Delta_x \dots \dots \dots = \frac{wx}{48EI} (\ell^3 - 3\ell x^2 + 2x^3)$$



Bending Moment

$$M_A = -q L^2 / 15 \quad (3a)$$

where

M_A = moment at the fixed end (Nm, lb_f ft)

q = continuous declining load (N/m, lb_f/ft)

$$M_1 = q L^2 / 33.6 \quad (3b)$$

where

M_1 = maximum moment at $x = 0.553 L$ (Nm, lb_f ft)

Deflection

$$\delta_{max} = q L^4 / (419 E I) \quad (3c)$$

where

δ_{max} = max deflection at $x = 0.553 L$ (m, ft)

$$\delta_{1/2} = q L^4 / (427 E I) \quad (3d)$$

where

$\delta_{1/2}$ = deflection at $x = L / 2$ (m, ft)

Support Reactions

$$R_A = 2 q L / 5 \quad (3e)$$

$$R_B = q L / 10 \quad (3f)$$

$$F_d := \frac{2}{5} \cdot p_o \cdot (h_{wall} - t_{gr_slab})^2 + 5 \cdot \frac{P_{d_surch} \cdot (h_{wall} - t_{gr_slab})}{8} = 977.778 \cdot \text{plf}$$

Resisting force

$$F_{\text{res}} := P_{\text{d_wall}} + P_{\text{d_found}} + P_{\text{d_key}} + P_{\text{d_slab}} \dots = 4.082 \times 10^3 \cdot \text{plf} \\ + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$\frac{F_{\text{res}} \cdot \mu}{F_{\text{d}}} = 1.5$$

It is more than or
equal 1.5**Check Sliding Capacity for Seismic
Load**

Lateral earth force from active pressure

$$F_{\text{d}} := \frac{2}{5} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2 + \frac{5}{8} \cdot P_{\text{d_surch}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \dots = 1.026 \times 10^3 \cdot \text{plf} \\ + \frac{\frac{5}{8} \cdot \Delta p_{\text{eq}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) + \left(\frac{P_{\text{d_wall}}}{2} + P_{\text{d_found}} + P_{\text{d_key}} \right) \cdot \text{PGA} \cdot \frac{1}{2}}{1.4}$$

Resisting Force

$$F_{\text{res}} := P_{\text{d_wall}} + P_{\text{d_found}} + P_{\text{d_key}} + P_{\text{d_slab}} \dots = 4.082 \times 10^3 \cdot \text{plf} \\ + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$\frac{0.9 F_{\text{res}} \cdot \mu + \frac{1}{2} p_p \cdot (h_{\text{key}})^2}{F_{\text{d}}} = 1.253$$

It is more than 1.0

Check Overturning Capacity for Dead Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15} \cdot P_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 + \frac{2}{5} \cdot P_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2 \cdot (h_{\text{key}}) \dots = 1.086 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ \frac{P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}}$$

Resisting moment

$$M_{\text{res}} := P_{d_wall} \cdot \left(L_{\text{toe}} + \frac{t_{\text{wall}}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}}{2} \right) \dots = 3.312 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{\text{key}}}{2} + P_{\text{slab.on.found}} \cdot \frac{L_{\text{toe}}}{2} \dots$$

$$+ L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{heel}}}{2} + t_{\text{wall}} + L_{\text{toe}} \right)$$

$$\frac{M_{\text{res}}}{M_d} = 3.048$$

It is more than 1.5

Check Overturning Capacity for Seismic Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15} \cdot P_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 + \frac{2}{5} \cdot P_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2 \cdot (h_{\text{key}}) \dots$$

$$+ \frac{P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots$$

$$\frac{\Delta p_{\text{eq}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot \Delta p_{\text{eq}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots$$

$$+ \left[\frac{P_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} - t_{\text{foun}} \right) + P_{d_found} \cdot \frac{t_{\text{foun}}}{2} + P_{d_key} \cdot \frac{h_{\text{key}}}{2} \right] \cdot \text{PGA} \cdot \frac{1}{2}$$

$$+ \dots$$

$$M_d = 1.224 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

Resisting moment

$$M_{res} := P_{d_wall} \cdot \left(L_{toe} + \frac{t_{wall}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{toe} + t_{wall} + L_{heel}}{2} \right) \dots = 3.312 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{key}}{2} + P_{slab.on.found} \cdot \frac{L_{toe}}{2} \dots$$

$$+ L_{heel} \cdot \gamma_{soil} \cdot (h_{wall} - t_{gr_slab} - t_{foun}) \cdot \left(\frac{L_{heel}}{2} + t_{wall} + L_{toe} \right)$$

$$\frac{0.9 \cdot M_{res}}{M_d} = 2.434$$

It is more than 1.1

Check Overturning Capacity for Dead and Live Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15} \cdot p_o \cdot (h_{wall} - t_{gr_slab})^3 + \frac{2}{5} \cdot p_o \cdot (h_{wall} - t_{gr_slab})^2 \cdot (h_{key}) \dots$$

$$+ \frac{(P_{d_surch} + P_{ll_surch}) \cdot (h_{wall} - t_{gr_slab})^2}{8} \dots$$

$$+ \frac{5}{8} \cdot (P_{d_surch} + P_{ll_surch}) \cdot (h_{wall} - t_{gr_slab}) \cdot h_{key}$$

$$M_d = 1.202 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

Resisting moment

$$M_{res} := P_{d_wall} \cdot \left(L_{toe} + \frac{t_{wall}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{toe} + t_{wall} + L_{heel}}{2} \right) \dots = 3.312 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{key}}{2} + P_{slab.on.found} \cdot \frac{L_{toe}}{2} \dots$$

$$+ L_{heel} \cdot \gamma_{soil} \cdot (h_{wall} - t_{gr_slab} - t_{foun}) \cdot \left(\frac{L_{heel}}{2} + t_{wall} + L_{toe} \right)$$

$$\frac{M_{res} + \frac{1}{4} p_p \cdot (h_{key} + t_{foun} - 4\text{in})^3}{M_d} = 2.759$$

It is more than 1.0

Check Soil Bearing Pressure for DL+LL

$$M_d := \frac{1}{15} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 \dots$$

$$+ \frac{(P_{d_surch} + P_{ll_surch}) \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8}$$

$$M_{\text{res}} := P_{d_wall} \cdot \left(L_{\text{toe}} + \frac{t_{\text{wall}}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}}{2} \right) \dots = 3.312 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$+ P_{d_key} \cdot \frac{t_{\text{key}}}{2} + P_{\text{slab.on.found}} \cdot \frac{L_{\text{toe}}}{2} \dots$$

$$+ L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{heel}}}{2} + t_{\text{wall}} + L_{\text{toe}} \right)$$

$$L_{\text{base}} := L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}$$

$$P := P_{d_wall} + P_{d_found} + P_{d_key} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$\left| \frac{M_{\text{res}} - M_d}{P} - \frac{(L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}})}{2} \right| = 0.231 \cdot \text{ft} \quad \text{Eccentricity}$$

$$\frac{L_{\text{base}}}{6} = 0.5 \cdot \text{ft}$$

Eccentricity is within 1/3 of base so base is
always in compression

$$\sigma_{\text{toe}} := \frac{P_{d_wall} + P_{d_found} + P_{d_key} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})}{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}} \dots$$

$$+ \frac{M_d \cdot 0.5 \cdot L_{\text{base}}}{I} - \frac{P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) \cdot 0.5 L_{\text{base}}}{I} \dots$$

$$+ \frac{P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} + \frac{P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} \dots$$

$$+ \frac{-L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right) \cdot 0.5 L_{\text{base}}}{I}$$

$$\sigma_{\text{toe}} = 1.014 \times 10^3 \cdot \text{psf} \quad \text{Less than 2500 psf OK}$$

$$\sigma_{\text{heel}} := \frac{P_{d_wall} + P_{d_found} + P_{d_key} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})}{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}} \dots$$

$$+ \frac{-M_d \cdot 0.5 \cdot L_{\text{base}}}{I} - \frac{-P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) \cdot 0.5 L_{\text{base}}}{I} \dots$$

$$+ \frac{-P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} - \frac{P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \cdot (0.5 L_{\text{base}})}{I} \dots$$

$$+ \frac{L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right) \cdot 0.5 L_{\text{base}}}{I}$$

$$\sigma_{\text{heel}} = 94.156 \cdot \text{psf} \quad \text{Less than 2000 psf OK}$$

Check Soil Bearing Pressure for Seismic

$$\begin{aligned}
 M_d := & \frac{1}{15} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 + \frac{2}{5} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2 \cdot (h_{\text{key}}) \dots \\
 & + \frac{P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots \\
 & + \frac{\Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} + \frac{5}{8} \cdot \Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}}) \cdot h_{\text{key}} \dots \\
 & + \left[\frac{P_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} - t_{\text{foun}} \right) + P_{d_found} \cdot \frac{t_{\text{foun}}}{2} + P_{d_key} \cdot \frac{h_{\text{key}}}{2} \right] \cdot PGA \cdot \frac{1}{2} \\
 & + \frac{\dots}{1.4} \\
 M_d = & 1.521 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}
 \end{aligned}$$

Resisting moment

$$\begin{aligned}
 M_{\text{res}} := & P_{d_wall} \cdot \left(L_{\text{toe}} + \frac{t_{\text{wall}}}{2} \right) + P_{d_found} \cdot \left(\frac{L_{\text{toe}} + t_{\text{wall}} + L_{\text{heel}}}{2} \right) \dots = 3.312 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}} \\
 & + P_{d_key} \cdot \frac{t_{\text{key}}}{2} + P_{\text{slab.on.found}} \cdot \frac{L_{\text{toe}}}{2} \dots \\
 & + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{heel}}}{2} + t_{\text{wall}} + L_{\text{toe}} \right)
 \end{aligned}$$

$$P := P_{d_wall} + P_{d_found} + P_{d_key} + P_{d_slab} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$e_{cc} := \left| \frac{0.9 \cdot M_{\text{res}} + \frac{1}{4} p_p \cdot (h_{\text{key}} + t_{\text{foun}} - 1 \text{ ft})^3 - M_d}{P} - \frac{L_{\text{base}}}{2} \right| = 1.143 \cdot \text{ft} \quad \text{Eccentricity}$$

$$\frac{L_{\text{base}}}{2} = 1.5 \cdot \text{ft} \quad \text{The resultant is within base}$$

Moment about centroid of foundation

$$M_{\text{center}} := M_d - P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) + P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \dots$$

$$+ P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) - L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right)$$

$$M_{\text{center}} = 1.008 \cdot \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

Axial load on center of foundation

$$P_{\text{center}} := P_{d_wall} + P_{d_found} + P_{d_key} + P_{\text{slab.on.found}} + L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$P_{\text{center}} = 1.729 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\sigma_{\text{toe}} = 1.257 \times 10^3 \cdot \text{psf}$$

Maximum bearing pressure on soil due to seismic
is less than 1.3x1500=1950 psf per IBC OK

Check for Shear and Moment Capacity

Wall Shear and Moment Capacity

$$A_{s,min.wall} := 0.0018 \cdot t_{wall} \cdot 12in = 0.173 \cdot in^2 \quad \text{Provide at least \#4@12}$$

Shear Capacity ACI-318

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi \cdot (t_{wall} - 3in) = 4.5 \cdot \frac{kip}{ft} \quad \text{Shear Capacity}$$

$$\phi M_{cap_base} := 0.9 \cdot f_y \cdot 0.2 \cdot \frac{in^2}{ft} \cdot \frac{12}{12} \cdot \left(0.9 \cdot \frac{t_{wall}}{2} \right) = 3.24 \cdot \frac{kip \cdot ft}{ft} \quad \text{Moment capacity of wall at the base \#4@12"}$$

$$\phi M_{cap_mid} := 0.9 \cdot f_y \cdot 0.2 \cdot \frac{in^2}{ft} \cdot \frac{12}{12} \cdot \left(0.9 \cdot \frac{t_{wall}}{2} \right) = 3.24 \cdot \frac{kip \cdot ft}{ft} \quad \text{Moment capacity of wall at the middle \#4@12"}$$

$$\phi V_c = 4.5 \cdot \frac{kip}{ft} \quad \text{Shear capacity of wall}$$

**Calculate Demand on Base of Wall
(1.4DL+1.6LL+1.6EH)**

$$M := 1.6 \cdot \frac{1}{15} \cdot p_o \cdot (h_{wall} - t_{gr_slab} - t_{foun})^3 \dots = 1.307 \cdot kip \cdot \frac{ft}{ft} \\ + \frac{(1.2 \cdot P_{d_surch} + 1.6 \cdot P_{ll_surch}) \cdot (h_{wall} - t_{gr_slab} - t_{foun})^2}{8}$$

$$M = 1.307 \cdot kip$$

$$\frac{M}{\phi M_{cap_base}} = 40.326\%$$

Moment capacity is more than demand moment on wall-OK

$$V := 1.6 \frac{2}{5} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}})^2 \dots$$

$$+ \frac{5}{8} \cdot (1.2 \cdot P_{d_surch} + 1.6 \cdot P_{ll_surch}) \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}})$$

$$V = 1.047 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{V}{\phi V_c} = 23.277\%$$

Shear capacity is more than demand moment on wall-OK

Calculate Demand on Base Wall (1.2DL+1.0LL+1.6EH+1.0EQ)

$$M := 1.6 \frac{1}{15} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})^3 \dots$$

$$+ \frac{1.2 \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})^2}{8} \dots$$

$$+ \frac{\Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})^2}{8} \dots$$

$$+ \left[\frac{1.2 P_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} - t_{\text{foun}} \right) \right] \cdot \frac{PGA}{2}$$

$$M = 1.385 \cdot \text{kip}$$

$$\frac{M}{\phi M_{\text{cap_base}}} = 42.733\%$$

OK

$$V := 1.6 \frac{2}{5} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}})^2 + 1.2 \frac{5}{8} \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}}) \dots$$

$$+ \frac{5}{8} \cdot \Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}} - t_{\text{wall}}) + \left(\frac{1.2 P_{d_wall}}{2} \right) \cdot \frac{PGA}{2}$$

$$V = 0.977 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{V}{\phi V_c} = 21.7\%$$

Shear capacity is more than demand moment on wall-OK

$$A_{smin.wall} := 0.0018 \cdot t_{\text{wall}} \cdot 12\text{in} = 0.173 \cdot \text{in}^2$$

Ok use #4@12" vertical and horizontal

Toe Foundation Shear and Moment Capacity**Toe Foundation Shear and Moment Capacity**

$$A_{smin.found.L} := \frac{0.0018 \cdot t_{foun} \cdot L_{base}}{0.2in^2} = 3.24$$

Provide 4-#4 rebar
longitudinal

$$A_{smin.found.T} := \frac{0.0018 \cdot t_{foun} \cdot 10in}{0.2in^2} = 0.9$$

Provide- #4@10" rebar transverse

Shear Capacity ACI-318

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi \cdot (t_{foun} - 3in) = 6.3 \cdot \frac{kip}{ft}$$

Shear Capacity

Moment capacity of wall

$$\phi M_{cap} := 0.9 \cdot f_y \cdot \left(0.2 \frac{in^2}{ft} \cdot \frac{12}{10} \right) \cdot \left(0.9 \cdot \frac{t_{foun}}{2} \right) = 4.86 \cdot \frac{kip \cdot ft}{ft}$$

$$\phi V_c = 6.3 \cdot \frac{kip}{ft}$$

Shear capacity of wall

Calculate demand on toe under soil pressure (1.2DL+1.6LL+1.6EH)

Moment about centroid of foundation

$$M_d := 1.6 \frac{1}{15} \cdot p_o \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 \dots$$

$$+ \frac{(1.2 \cdot P_{d_surch} + 1.6 \cdot P_{ll_surch}) \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8}$$

$$M_{\text{center}} := M_d - 1.2P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) + 1.2P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \dots$$

$$+ 1.2 \cdot P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \dots$$

$$+ -1.2L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right)$$

$$M_{\text{center}} = 1.309 \cdot \text{kip}$$

Axial load on center of foundation

$$P_{\text{center}} := 1.2P_{d_wall} + 1.2P_{d_found} + 1.2P_{d_key} + 1.2 \cdot P_{\text{slab.on.found}} \dots$$

$$+ 1.6L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$P_{\text{center}} = 2.343 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{\max(|M_{\text{toe}}|, |M_{\text{heel}}|)}{\phi M_{\text{cap}}} = 25.573\%$$

$$\frac{\max(|V_{\text{toe}}|, |V_{\text{heel}}|)}{\phi V_c} = 12.004\%$$

Calculate demand on toe under soil pressure (1.2DL+1.0LL+1.6EH+1.0EQ)

Moment about centroid of foundation

$$M_d := 1.6 \frac{1}{15} \cdot p_a \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^3 \dots$$

$$+ \frac{1.2 \cdot P_{d_surch} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} \dots$$

$$+ \frac{\Delta p_{eq} \cdot (h_{\text{wall}} - t_{\text{gr_slab}})^2}{8} \dots$$

$$+ \left[\frac{1.2 P_{d_wall}}{2} \cdot \left(\frac{h_{\text{wall}}}{2} \right) \right] \cdot \text{PGA}$$

$$M_{\text{center}} := M_d - 1.2 P_{d_wall} \cdot \left(\frac{L_{\text{base}}}{2} - t_{\text{wall}} - L_{\text{heel}} \right) + 1.2 P_{d_key} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{t_{\text{key}}}{2} \right) \dots$$

$$+ 1.2 \cdot P_{\text{slab.on.found}} \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{toe}}}{2} \right) \dots$$

$$+ -1.0 L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}}) \cdot \left(\frac{L_{\text{base}}}{2} - \frac{L_{\text{heel}}}{2} \right)$$

$$M_{\text{center}} = 1.881 \cdot \text{kip}$$

Axial load on center of foundation

$$P_{\text{center}} := 1.2 P_{d_wall} + 1.2 P_{d_found} + 1.2 P_{d_key} + 1.2 \cdot P_{\text{slab.on.found}} \dots$$

$$+ 1.6 L_{\text{heel}} \cdot \gamma_{\text{soil}} \cdot (h_{\text{wall}} - t_{\text{gr_slab}} - t_{\text{foun}})$$

$$P_{\text{center}} = 2.343 \cdot \frac{\text{kip}}{\text{ft}}$$

$$\frac{\max(|M_{\text{toe}}|, |M_{\text{heel}}|)}{\phi M_{\text{cap}}} = 32.265\%$$

$$\frac{\max(|V_{\text{toe}}|, |V_{\text{heel}}|)}{\phi V_c} = 15.653\% \quad \text{OK}$$



Project Title: 3804 House
Engineer: NKH
Project ID: 22-112
Project Descr:

General Footing

Project File: Foundations.ec6

LIC# : KW-06013860, Build:20.23.08.30

NKH Engineering

(c) ENERCALC INC 1983-2023

DESCRIPTION: Footing @ Main Post 1

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'_c : Concrete 28 day strength	=	2.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
ϕ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	Yes
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

Increases based on footing plan dimension

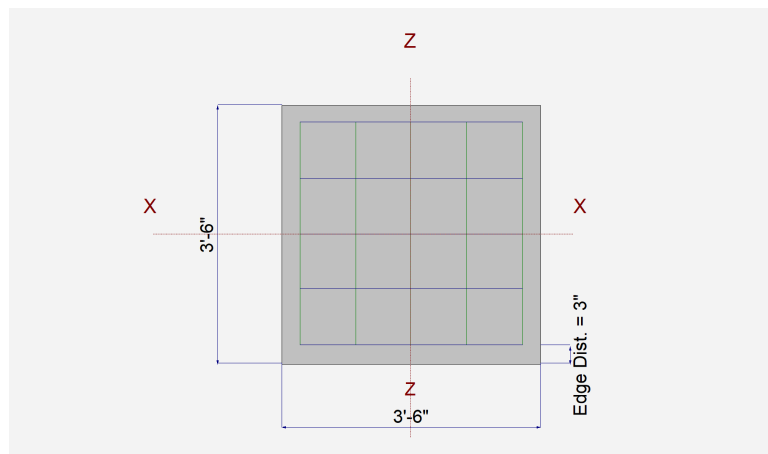
Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

Width parallel to X-X Axis	=	3.50 ft
Length parallel to Z-Z Axis	=	3.50 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete...	=	3.0 in
at Bottom of footing	=	



Reinforcing

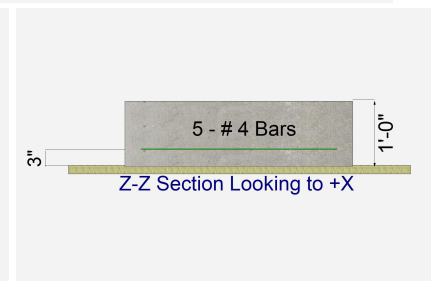
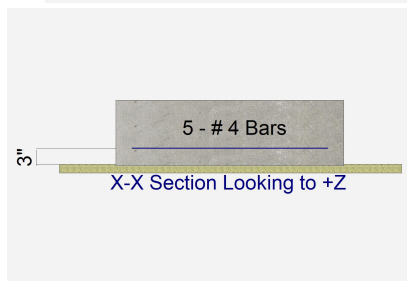
Bars parallel to X-X Axis	=	5.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	

Bars parallel to Z-Z Axis	=	5.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	8.247	1.525	7.543	1.905		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



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DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8717	Soil Bearing	1.434 ksf	1.645 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.2572	Z Flexure (+X)	2.865 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.2572	Z Flexure (-X)	2.865 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.2572	X Flexure (+Z)	2.865 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.2572	X Flexure (-Z)	2.865 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.2344	1-way Shear (+X)	17.582 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2344	1-way Shear (-X)	17.582 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2344	1-way Shear (+Z)	17.582 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2344	1-way Shear (-Z)	17.582 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.4487	2-way Punching	67.310 psi	150.0 psi	+1.20D+1.60L+0.50S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				(in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.645	n/a	0.0			0.8182	0.8182	n/a	n/a	0.497
X-X, +D+L	1.645	n/a	0.0			1.434	1.434	n/a	n/a	0.872
X-X, +D+Lr	1.645	n/a	0.0			0.9427	0.9427	n/a	n/a	0.573
X-X, +D+S	1.645	n/a	0.0			0.9737	0.9737	n/a	n/a	0.592
X-X, +D+0.750Lr+0.750L	1.645	n/a	0.0			1.373	1.373	n/a	n/a	0.835
X-X, +D+0.750L+0.750S	1.645	n/a	0.0			1.397	1.397	n/a	n/a	0.849
X-X, +0.60D	1.645	n/a	0.0			0.4909	0.4909	n/a	n/a	0.298
Z-Z, D Only	1.645	0.0	n/a			n/a	n/a	0.8182	0.8182	0.497
Z-Z, +D+L	1.645	0.0	n/a			n/a	n/a	1.434	1.434	0.872
Z-Z, +D+Lr	1.645	0.0	n/a			n/a	n/a	0.9427	0.9427	0.573
Z-Z, +D+S	1.645	0.0	n/a			n/a	n/a	0.9737	0.9737	0.592
Z-Z, +D+0.750Lr+0.750L	1.645	0.0	n/a			n/a	n/a	1.373	1.373	0.835
Z-Z, +D+0.750L+0.750S	1.645	0.0	n/a			n/a	n/a	1.397	1.397	0.849
Z-Z, +0.60D	1.645	0.0	n/a			n/a	n/a	0.4909	0.4909	0.298

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	1.443	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.40D	1.443	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+1.60L	2.841	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+1.60L	2.841	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60L+0.50S	2.865	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60L+0.50S	2.865	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr+L	2.485	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr+L	2.485	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr	1.542	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr	1.542	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+1.60S	2.561	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK



Project Title: 3804 House
 Engineer: NKH
 Project ID: 22-112
 Project Descr:

General Footing

Project File: Foundations.ec6

LIC#: KW-06013860, Build:20.23.08.30

NKH Engineering

(c) ENERCALC INC 1983-2023

DESCRIPTION: Footing @ Main Post 1

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
X-X, +1.20D+L+1.60S	2.561	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60S	1.618	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60S	1.618	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+L	2.275	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+L	2.275	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.50S	2.299	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.50S	2.299	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +0.90D	0.9278	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +0.90D	0.9278	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.20S	2.228	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.20S	2.228	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.40D	1.443	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.40D	1.443	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+1.60L	2.841	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+1.60L	2.841	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60L+0.50S	2.865	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60L+0.50S	2.865	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr+L	2.485	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr+L	2.485	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr	1.542	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr	1.542	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+1.60S	2.561	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+1.60S	2.561	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60S	1.618	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60S	1.618	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+L	2.275	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+L	2.275	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.50S	2.299	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.50S	2.299	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +0.90D	0.9278	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +0.90D	0.9278	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.20S	2.228	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.20S	2.228	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	8.86 psi	8.86 psi	8.86 psi	8.86 psi	8.86 psi	75.00 psi	0.12	OK
+1.20D+0.50Lr+1.60L	17.44 psi	17.44 psi	17.44 psi	17.44 psi	17.44 psi	75.00 psi	0.23	OK
+1.20D+1.60L+0.50S	17.58 psi	17.58 psi	17.58 psi	17.58 psi	17.58 psi	75.00 psi	0.23	OK
+1.20D+1.60Lr+L	15.25 psi	15.25 psi	15.25 psi	15.25 psi	15.25 psi	75.00 psi	0.20	OK
+1.20D+1.60Lr	9.46 psi	9.46 psi	9.46 psi	9.46 psi	9.46 psi	75.00 psi	0.13	OK
+1.20D+L+1.60S	15.72 psi	15.72 psi	15.72 psi	15.72 psi	15.72 psi	75.00 psi	0.21	OK
+1.20D+1.60S	9.93 psi	9.93 psi	9.93 psi	9.93 psi	9.93 psi	75.00 psi	0.13	OK
+1.20D+0.50Lr+L	13.96 psi	13.96 psi	13.96 psi	13.96 psi	13.96 psi	75.00 psi	0.19	OK
+1.20D+L+0.50S	14.11 psi	14.11 psi	14.11 psi	14.11 psi	14.11 psi	75.00 psi	0.19	OK
+0.90D	5.69 psi	5.69 psi	5.69 psi	5.69 psi	5.69 psi	75.00 psi	0.08	OK
+1.20D+L+0.20S	13.67 psi	13.67 psi	13.67 psi	13.67 psi	13.67 psi	75.00 psi	0.18	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	33.91 psi	150.00psi	0.2261	OK
+1.20D+0.50Lr+1.60L	66.75 psi	150.00psi	0.445	OK
+1.20D+1.60L+0.50S	67.31 psi	150.00psi	0.4487	OK
+1.20D+1.60Lr+L	58.39 psi	150.00psi	0.3892	OK
+1.20D+1.60Lr	36.23 psi	150.00psi	0.2416	OK
+1.20D+L+1.60S	60.17 psi	150.00psi	0.4011	OK
+1.20D+1.60S	38.02 psi	150.00psi	0.2535	OK
+1.20D+0.50Lr+L	53.46 psi	150.00psi	0.3564	OK
+1.20D+L+0.50S	54.02 psi	150.00psi	0.3601	OK
+0.90D	21.80 psi	150.00psi	0.1453	OK
+1.20D+L+0.20S	52.34 psi	150.00psi	0.3489	OK



Project Title: 3804 House
Engineer: NKH
Project ID: 22-112
Project Descr:

General Footing

Project File: Foundations.ec6

LIC# : KW-06013860, Build:20.23.08.30

NKH Engineering

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DESCRIPTION: Footing @ Main Post 2

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'_c : Concrete 28 day strength	=	2.50 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
ϕ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	Yes
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf

Increases based on footing plan dimension

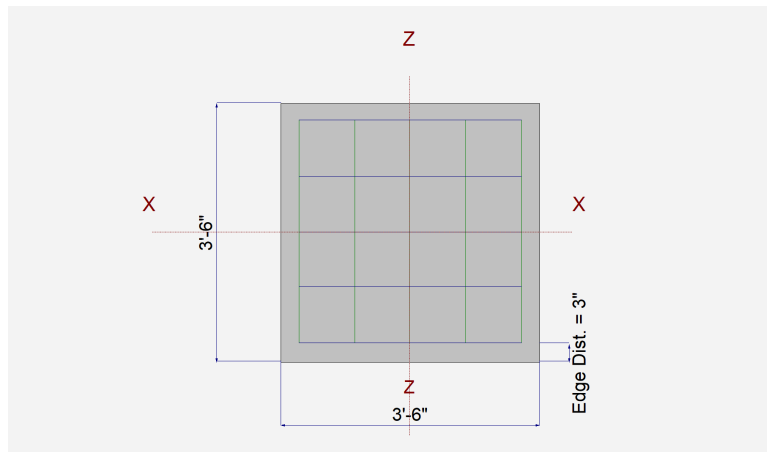
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf
	=	ft

Dimensions

Width parallel to X-X Axis	=	3.50 ft
Length parallel to Z-Z Axis	=	3.50 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



Reinforcing

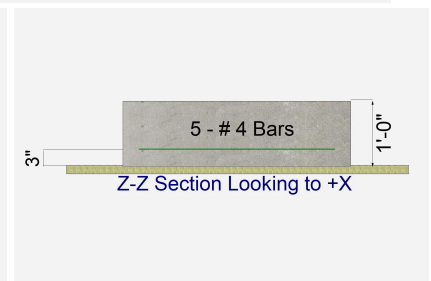
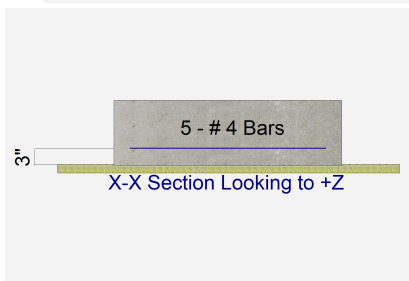
Bars parallel to X-X Axis	=	
Number of Bars	=	5
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	
Number of Bars	=	5
Reinforcing Bar Size	=	# 4

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	7.814	3.161	10.111	3.948		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



Project Title: 3804 House
 Engineer: NKH
 Project ID: 22-112
 Project Descr:

General Footing

Project File: Foundations.ec6

LIC# : KW-06013860, Build:20.23.08.30

NKH Engineering

(c) ENERCALC INC 1983-2023

DESCRIPTION: Footing @ Main Post 2

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9994	Soil Bearing	1.644 ksf	1.645 ksf	+D+0.750L+0.750S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.3089	Z Flexure (+X)	3.441 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.3089	Z Flexure (-X)	3.441 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.3089	X Flexure (+Z)	3.441 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.3089	X Flexure (-Z)	3.441 k-ft/ft	11.139 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.2816	1-way Shear (+X)	21.120 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2816	1-way Shear (-X)	21.120 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2816	1-way Shear (+Z)	21.120 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.2816	1-way Shear (-Z)	21.120 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.5390	2-way Punching	80.852 psi	150.0 psi	+1.20D+1.60L+0.50S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				(in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.645	n/a	0.0			0.7829	0.7829	n/a	n/a	0.476
X-X, +D+L	1.645	n/a	0.0			1.608	1.608	n/a	n/a	0.978
X-X, +D+Lr	1.645	n/a	0.0			1.041	1.041	n/a	n/a	0.633
X-X, +D+S	1.645	n/a	0.0			1.105	1.105	n/a	n/a	0.672
X-X, +D+0.750Lr+0.750L	1.645	n/a	0.0			1.595	1.595	n/a	n/a	0.970
X-X, +D+0.750L+0.750S	1.645	n/a	0.0			1.644	1.644	n/a	n/a	0.999
X-X, +0.60D	1.645	n/a	0.0			0.4697	0.4697	n/a	n/a	0.286
Z-Z, D Only	1.645	0.0	n/a			n/a	n/a	0.7829	0.7829	0.476
Z-Z, +D+L	1.645	0.0	n/a			n/a	n/a	1.608	1.608	0.978
Z-Z, +D+Lr	1.645	0.0	n/a			n/a	n/a	1.041	1.041	0.633
Z-Z, +D+S	1.645	0.0	n/a			n/a	n/a	1.105	1.105	0.672
Z-Z, +D+0.750Lr+0.750L	1.645	0.0	n/a			n/a	n/a	1.595	1.595	0.970
Z-Z, +D+0.750L+0.750S	1.645	0.0	n/a			n/a	n/a	1.644	1.644	0.999
Z-Z, +0.60D	1.645	0.0	n/a			n/a	n/a	0.4697	0.4697	0.286

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

All units k

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	1.367	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.40D	1.367	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+1.60L	3.392	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+1.60L	3.392	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60L+0.50S	3.441	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60L+0.50S	3.441	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr+L	3.068	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr+L	3.068	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr	1.804	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60Lr	1.804	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+1.60S	3.226	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK



Project Title: 3804 House
 Engineer: NKH
 Project ID: 22-112
 Project Descr:

General Footing

Project File: Foundations.ec6

LIC#: KW-06013860, Build:20.23.08.30

NKH Engineering

(c) ENERCALC INC 1983-2023

DESCRIPTION: Footing @ Main Post 2

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
X-X, +1.20D+L+1.60S	3.226	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60S	1.962	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+1.60S	1.962	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+L	2.634	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+0.50Lr+L	2.634	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.50S	2.683	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.50S	2.683	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +0.90D	0.8791	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +0.90D	0.8791	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.20S	2.535	+Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
X-X, +1.20D+L+0.20S	2.535	-Z	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.40D	1.367	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.40D	1.367	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+1.60L	3.392	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+1.60L	3.392	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60L+0.50S	3.441	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60L+0.50S	3.441	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr+L	3.068	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr+L	3.068	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr	1.804	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60Lr	1.804	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+1.60S	3.226	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+1.60S	3.226	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60S	1.962	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+1.60S	1.962	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+L	2.634	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+0.50Lr+L	2.634	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.50S	2.683	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.50S	2.683	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +0.90D	0.8791	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +0.90D	0.8791	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.20S	2.535	-X	Bottom	0.2592	AsMin	0.2857	11.139	OK
Z-Z, +1.20D+L+0.20S	2.535	+X	Bottom	0.2592	AsMin	0.2857	11.139	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	8.39 psi	8.39 psi	8.39 psi	8.39 psi	8.39 psi	75.00 psi	0.11	OK
+1.20D+0.50Lr+1.60L	20.82 psi	20.82 psi	20.82 psi	20.82 psi	20.82 psi	75.00 psi	0.28	OK
+1.20D+1.60L+0.50S	21.12 psi	21.12 psi	21.12 psi	21.12 psi	21.12 psi	75.00 psi	0.28	OK
+1.20D+1.60Lr+L	18.83 psi	18.83 psi	18.83 psi	18.83 psi	18.83 psi	75.00 psi	0.25	OK
+1.20D+1.60Lr	11.07 psi	11.07 psi	11.07 psi	11.07 psi	11.07 psi	75.00 psi	0.15	OK
+1.20D+L+1.60S	19.80 psi	19.80 psi	19.80 psi	19.80 psi	19.80 psi	75.00 psi	0.26	OK
+1.20D+1.60S	12.04 psi	12.04 psi	12.04 psi	12.04 psi	12.04 psi	75.00 psi	0.16	OK
+1.20D+0.50Lr+L	16.16 psi	16.16 psi	16.16 psi	16.16 psi	16.16 psi	75.00 psi	0.22	OK
+1.20D+L+0.50S	16.47 psi	16.47 psi	16.47 psi	16.47 psi	16.47 psi	75.00 psi	0.22	OK
+0.90D	5.40 psi	5.40 psi	5.40 psi	5.40 psi	5.40 psi	75.00 psi	0.07	OK
+1.20D+L+0.20S	15.56 psi	15.56 psi	15.56 psi	15.56 psi	15.56 psi	75.00 psi	0.21	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	32.13 psi	150.00psi	0.2142	OK
+1.20D+0.50Lr+1.60L	79.70 psi	150.00psi	0.5313	OK
+1.20D+1.60L+0.50S	80.85 psi	150.00psi	0.539	OK
+1.20D+1.60Lr+L	72.09 psi	150.00psi	0.4806	OK
+1.20D+1.60Lr	42.39 psi	150.00psi	0.2826	OK
+1.20D+L+1.60S	75.79 psi	150.00psi	0.5053	OK
+1.20D+1.60S	46.09 psi	150.00psi	0.3073	OK
+1.20D+0.50Lr+L	61.88 psi	150.00psi	0.4125	OK
+1.20D+L+0.50S	63.03 psi	150.00psi	0.4202	OK
+0.90D	20.66 psi	150.00psi	0.1377	OK
+1.20D+L+0.20S	59.56 psi	150.00psi	0.397	OK

General Footing

Project File: Foundations.ec6

LIC# : KW-06013860, Build:20.23.08.30

NKH Engineering

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DESCRIPTION: Footing @ Main Post 3

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f _c : Concrete 28 day strength	=	2.50 ksi
f _y : Rebar Yield	=	60.0 ksi
E _c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth when footing base is below	=	ksf
	=	ft

Increases based on footing plan dimension

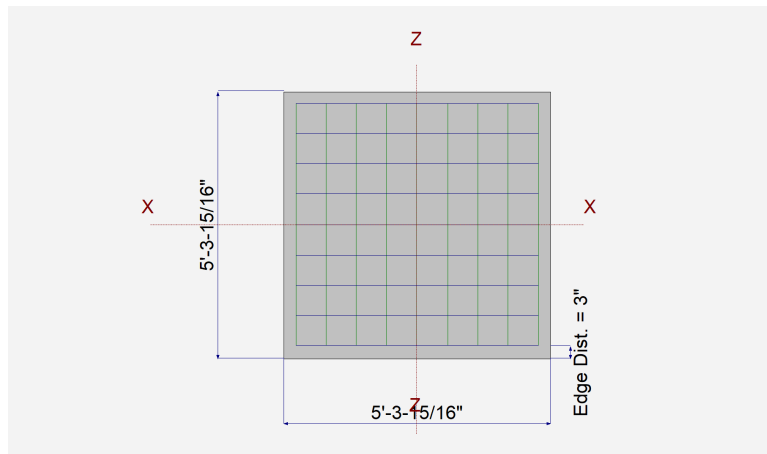
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf
	=	ft

Dimensions

Width parallel to X-X Axis	=	5.330 ft
Length parallel to Z-Z Axis	=	5.330 ft
Footing Thickness	=	14.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



Reinforcing

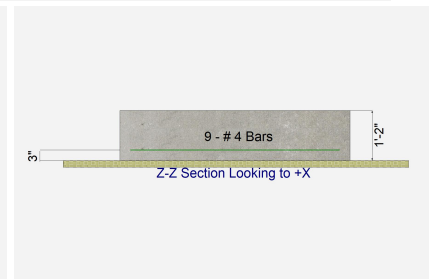
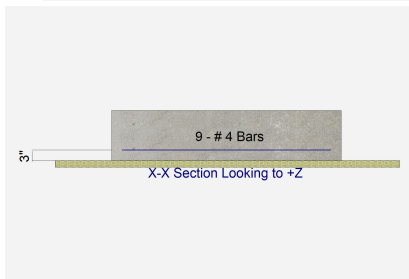
Bars parallel to X-X Axis	=	
Number of Bars	=	9
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	
Number of Bars	=	9
Reinforcing Bar Size	=	# 4

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

	D	L _r	L	S	W	E	H
P : Column Load	=	14.650	5.10	22.730	6.40		k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

General Footing

Project File: Foundations.ec6

LIC# : KW-06013860, Build:20.23.08.30

NKH Engineering

(c) ENERCALC INC 1983-2023

DESCRIPTION: Footing @ Main Post 3

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.990	Soil Bearing	1.485 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.4433	Z Flexure (+X)	7.144 k-ft/ft	16.113 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.4433	Z Flexure (-X)	7.144 k-ft/ft	16.113 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.4433	X Flexure (+Z)	7.144 k-ft/ft	16.113 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.4433	X Flexure (-Z)	7.144 k-ft/ft	16.113 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.3574	1-way Shear (+X)	26.805 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.3574	1-way Shear (-X)	26.805 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.3574	1-way Shear (+Z)	26.805 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.3574	1-way Shear (-Z)	26.805 psi	75.0 psi	+1.20D+1.60L+0.50S
PASS	0.7617	2-way Punching	114.249 psi	150.0 psi	+1.20D+1.60L+0.50S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc		Zecc		Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				(in)		Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0			0.6849	0.6849	n/a	n/a	0.457
X-X, +D+L	1.50	n/a	0.0			1.485	1.485	n/a	n/a	0.990
X-X, +D+Lr	1.50	n/a	0.0			0.8644	0.8644	n/a	n/a	0.576
X-X, +D+S	1.50	n/a	0.0			0.9101	0.9101	n/a	n/a	0.607
X-X, +D+0.750Lr+0.750L	1.50	n/a	0.0			1.420	1.420	n/a	n/a	0.947
X-X, +D+0.750L+0.750S	1.50	n/a	0.0			1.454	1.454	n/a	n/a	0.969
X-X, +0.60D	1.50	n/a	0.0			0.4109	0.4109	n/a	n/a	0.274
Z-Z, D Only	1.50	0.0	n/a			n/a	n/a	0.6849	0.6849	0.457
Z-Z, +D+L	1.50	0.0	n/a			n/a	n/a	1.485	1.485	0.990
Z-Z, +D+Lr	1.50	0.0	n/a			n/a	n/a	0.8644	0.8644	0.576
Z-Z, +D+S	1.50	0.0	n/a			n/a	n/a	0.9101	0.9101	0.607
Z-Z, +D+0.750Lr+0.750L	1.50	0.0	n/a			n/a	n/a	1.420	1.420	0.947
Z-Z, +D+0.750L+0.750S	1.50	0.0	n/a			n/a	n/a	1.454	1.454	0.969
Z-Z, +0.60D	1.50	0.0	n/a			n/a	n/a	0.4109	0.4109	0.274

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	2.564	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.40D	2.564	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+0.50Lr+1.60L	7.062	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+0.50Lr+1.60L	7.062	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60L+0.50S	7.144	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60L+0.50S	7.144	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60Lr+L	6.059	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60Lr+L	6.059	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60Lr	3.218	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60Lr	3.218	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+L+1.60S	6.319	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK

Project Title: 3804 House
 Engineer: NKH
 Project ID: 22-112
 Project Descr:

General Footing

Project File: Foundations.ec6

LIC# : KW-06013860, Build:20.23.08.30

NKH Engineering

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DESCRIPTION: Footing @ Main Post 3

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.20D+L+1.60S	6.319	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60S	3.478	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+1.60S	3.478	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+0.50Lr+L	5.358	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+0.50Lr+L	5.358	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+L+0.50S	5.439	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+L+0.50S	5.439	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +0.90D	1.648	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +0.90D	1.648	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+L+0.20S	5.199	+Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
X-X, +1.20D+L+0.20S	5.199	-Z	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.40D	2.564	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.40D	2.564	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+0.50Lr+1.60L	7.062	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+0.50Lr+1.60L	7.062	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60L+0.50S	7.144	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60L+0.50S	7.144	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60Lr+L	6.059	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60Lr+L	6.059	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60Lr	3.218	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60Lr	3.218	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+L+1.60S	6.319	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+L+1.60S	6.319	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60S	3.478	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+1.60S	3.478	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+0.50Lr+L	5.358	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+0.50Lr+L	5.358	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+L+0.50S	5.439	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+L+0.50S	5.439	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +0.90D	1.648	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +0.90D	1.648	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+L+0.20S	5.199	-X	Bottom	0.3024	AsMin	0.3377	16.113	OK
Z-Z, +1.20D+L+0.20S	5.199	+X	Bottom	0.3024	AsMin	0.3377	16.113	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	9.62 psi	9.62 psi	9.62 psi	9.62 psi	9.62 psi	75.00 psi	0.13	OK
+1.20D+0.50Lr+1.60L	26.50 psi	26.50 psi	26.50 psi	26.50 psi	26.50 psi	75.00 psi	0.35	OK
+1.20D+1.60L+0.50S	26.81 psi	26.81 psi	26.81 psi	26.81 psi	26.81 psi	75.00 psi	0.36	OK
+1.20D+1.60Lr+L	22.74 psi	22.74 psi	22.74 psi	22.74 psi	22.74 psi	75.00 psi	0.30	OK
+1.20D+1.60Lr	12.07 psi	12.07 psi	12.07 psi	12.07 psi	12.07 psi	75.00 psi	0.16	OK
+1.20D+L+1.60S	23.71 psi	23.71 psi	23.71 psi	23.71 psi	23.71 psi	75.00 psi	0.32	OK
+1.20D+1.60S	13.05 psi	13.05 psi	13.05 psi	13.05 psi	13.05 psi	75.00 psi	0.17	OK
+1.20D+0.50Lr+L	20.10 psi	20.10 psi	20.10 psi	20.10 psi	20.10 psi	75.00 psi	0.27	OK
+1.20D+L+0.50S	20.41 psi	20.41 psi	20.41 psi	20.41 psi	20.41 psi	75.00 psi	0.27	OK
+0.90D	6.18 psi	6.18 psi	6.18 psi	6.18 psi	6.18 psi	75.00 psi	0.08	OK
+1.20D+L+0.20S	19.51 psi	19.51 psi	19.51 psi	19.51 psi	19.51 psi	75.00 psi	0.26	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	41.00 psi	150.00psi	0.2734	OK
+1.20D+0.50Lr+1.60L	112.95 psi	150.00psi	0.753	OK
+1.20D+1.60L+0.50S	114.25 psi	150.00psi	0.7617	OK
+1.20D+1.60Lr+L	96.90 psi	150.00psi	0.646	OK
+1.20D+1.60Lr	51.46 psi	150.00psi	0.3431	OK
+1.20D+L+1.60S	101.06 psi	150.00psi	0.6737	OK
+1.20D+1.60S	55.62 psi	150.00psi	0.3708	OK
+1.20D+0.50Lr+L	85.69 psi	150.00psi	0.5712	OK
+1.20D+L+0.50S	86.98 psi	150.00psi	0.5799	OK
+0.90D	26.36 psi	150.00psi	0.1757	OK
+1.20D+L+0.20S	83.15 psi	150.00psi	0.5543	OK