3804 House

Project Number: 22-112

3804 E Mercer Way

Mercer Island, WA 98040

Structural Calculations

9/7/23

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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

$f'_c := 2500psi$	Concrete compressive strength
$f_y := 60 \cdot ksi$	Yield strength of rebar
$f_{soil.bearing} := 1500psf$	Minimum soil bearing capacity
$\gamma_{concrete} := 150pcf$	Concrete unit weight
$\gamma_{steel} := 490pcf$	Steel unit weight
$E_s := 29000ksi$	Young modulus of steel
$E_c := 57000 \cdot \sqrt{\frac{f'_c}{psi}} \cdot psi = 2.85 \times 10^3 \cdot ksi$	Young modulus of concrete (ACI-318-14)

Load Assumptions

$LL_{floor} := 40psf$	Floor live load
$DL_{floor} := 15psf$	Floor dead load
$DL_{roof} := 15psf$	Roof dead load
$LL_{roof} := 20psf$	Roof live load
$SL_{roof} := 25psf$	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

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

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

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

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

$T_a := 0.02 \cdot \left(\frac{h_{building}}{ft}\right)^{0.75} \cdot s = 0.256\,s$ — Fundamental period of structure — ASCE 7-16-12.8.7

$T_L := 6s$ — 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

$\frac{T_a}{1.5 \cdot T_s} = 0.328$ — Ta is less than 1.5Ts. — 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

$C_{S.min} := .044 S_{DS} \cdot I = 0.05$ — Cs is more than minimum-OK

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

Force Distribution Along the Height

$N_{story} := 3$ — Number of story including roof

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

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

$W_1 := 2780\left(ft^2\right) \cdot DL_{floor} + W_{ext} \cdot 248ft10ft = 71.46 \cdot kip$ — Total dead weight of second floor

$W_2 := 2250ft^2 \cdot DL_{floor} + W_{ext} \cdot (230ft)\ 12ft = 66.87 \cdot kip$ — Total dead weight of second floor

$W_3 := 2250ft^2 \cdot DL_{roof} + W_{ext} \cdot 208ft \cdot \frac{12ft}{2} = 48.726 \cdot kip$ — Total dead weight of third floor

$h_{floor_1} := 7ft$ Height of first floor from ground

$h_{floor_2} := h_{floor_1} + 11ft = 18 \cdot ft$ Height of second floor from ground

$h_{floor_3} := h_{floor_2} + 12ft = 30 \cdot ft$ Height of second floor from ground

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

Total base shear due to seismic for all building

$$C_{v_i} := \frac{W_i \cdot h_{floor_i}}{\sum_{i=1}^{N_{story}} \left(W_i \cdot h_{floor_i}\right)}$$

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

$C_{v_i} =$

$$F_i := C_{v_i} \cdot V_{base\_EQ.wall}$$

Seismic force at each floor

$F_i =$

$\cdot kip$

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

Shear at each floor

$V_{story_j} =$

$\cdot kip$

Wind Force Calculation on Building-ASCE7-16

$I := 1$	Risk category II for residential structure	ASCE7-16-Table 1.5.1
$V_{wind} := 110 \frac{mi}{hr}$	Wind speed	ASCE7-16-Fig 26.5.1B
$K_d := 0.85$	Wind directionality factor for buildings	ASCE7-16-Table 26.6-1

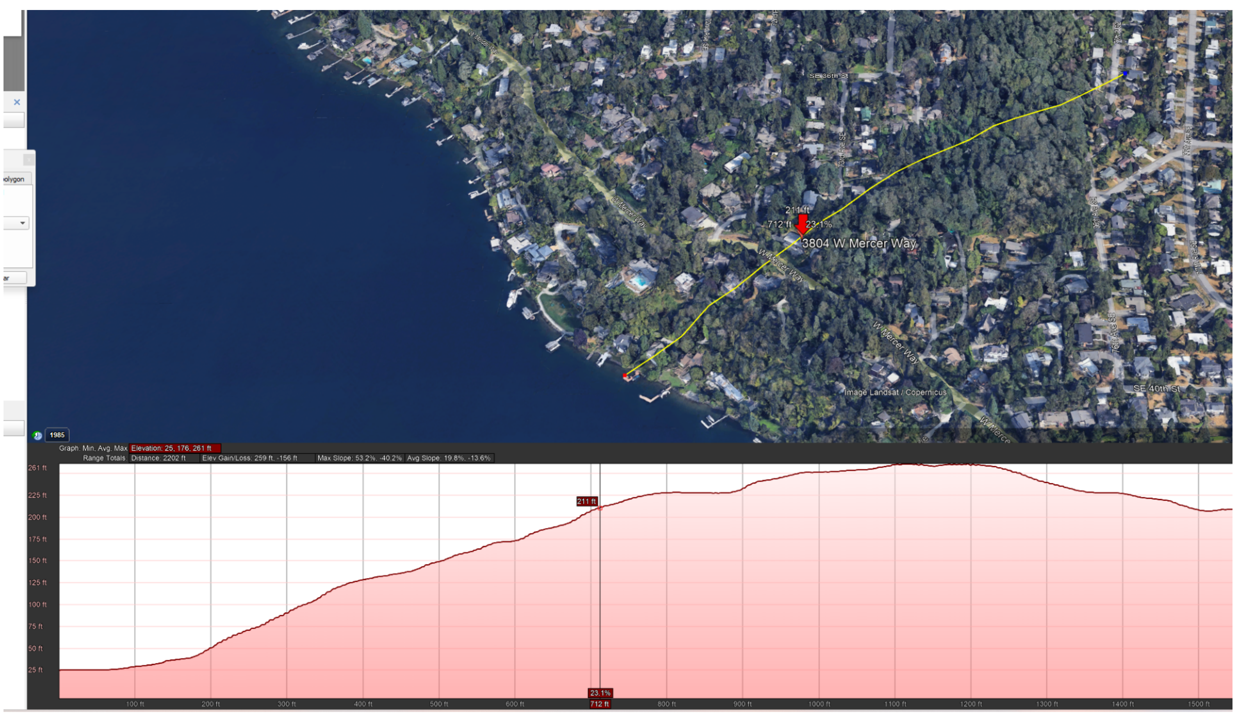
Exposure Category B was considered for this design according to king County

$L_{house} := 58ft$

House foot print dimension

$W_{house} := 50.5ft$

Topographic Factor



$H_{zt} := 260ft - 25ft = 235 \cdot ft$ Height of hill from lowest side

$L_h := 1125ft - 438ft = 687 \cdot ft$ 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

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

$\mu_{upwind} := 1.5$ From table 26.8-1

$\mu_{downwind} := 4$ From table 26.8-1-2D Escapement

$\gamma := 2.5$ 2D Escapement

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

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

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

$$K_{zt.upwind} := \left(1 + K_1 \cdot K_{2\_upwind} \cdot K_3\right)^2 = 1.293$$ ASCE7-16- 26.8.2

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

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

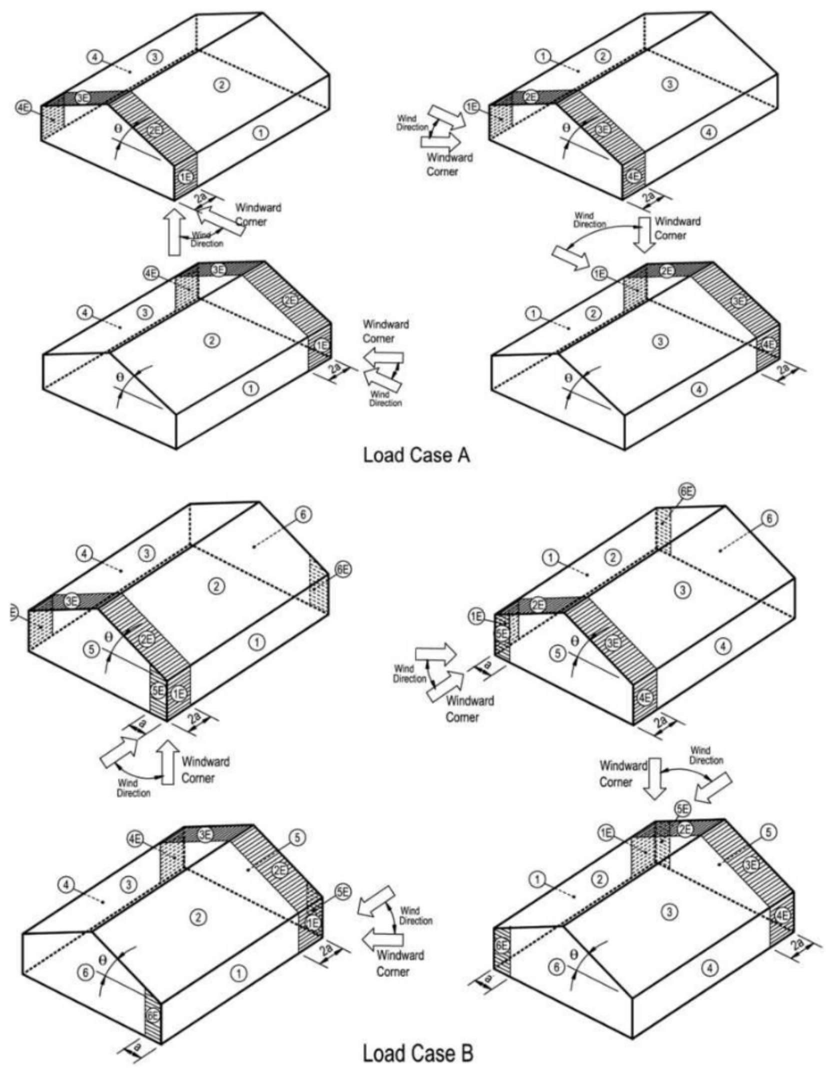
$K_e := 1.0$	Ground elevation factor	ASCE7-16-26.9
$GC_{pi} := -0.18$	Internal Pressure Coefficient for enclosed building	ASCE7-16-Table 26.13-1
$K_z := 0.7$	Velocity pressure exposure coefficient-Assume 25 ft total height for exposure B	ASCE7-16-Table 26.10-1

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

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

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

Diagrams



Notation

a 10% of least horizontal dimension or 0.4 *h*, 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 $\theta \leq 10°$.

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

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

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

$$angle := \begin{pmatrix} 0 \\ 5 \\ 20 \\ 30 \\ 45 \\ 90 \end{pmatrix} deg \quad wall_{p.factor.1} := \begin{pmatrix} 0.4 \\ 0.4 \\ 0.53 \\ 0.56 \\ 0.56 \\ 0.56 \end{pmatrix} \quad wall_{p.factor.2} := \begin{pmatrix} -0.69 \\ -0.69 \\ -0.69 \\ 0.21 \\ 0.21 \\ 0.56 \end{pmatrix} \quad wall_{p.factor.3} := \begin{pmatrix} -0.37 \\ -0.37 \\ -0.48 \\ -0.43 \\ -0.43 \\ -0.37 \end{pmatrix}$$

$$wall_{p.factor.4} := \begin{pmatrix} -0.29 \\ -0.29 \\ -0.43 \\ -0.37 \\ -0.37 \\ -0.37 \end{pmatrix} \quad wall_{p.factor.1E} := \begin{pmatrix} 0.61 \\ 0.61 \\ 0.8 \\ 0.69 \\ 0.69 \\ 0.69 \end{pmatrix} \quad wall_{p.factor.2E} := \begin{pmatrix} -1.07 \\ -1.07 \\ -1.07 \\ 0.27 \\ 0.27 \\ 0.69 \end{pmatrix}$$

$$wall_{p.factor.3E} := \begin{pmatrix} -0.53 \\ -0.53 \\ -0.69 \\ -0.53 \\ -0.53 \\ -0.48 \end{pmatrix} \qquad wall_{p.factor.4E} := \begin{pmatrix} -0.43 \\ -0.43 \\ -0.64 \\ -0.48 \\ -0.48 \\ -0.48 \end{pmatrix}$$

$$wall_{factor.A.1}(\theta) := \text{linterp}\left(angle, wall_{p.factor.1}, \theta\right)$$

$$wall_{factor.A.2}(\theta) := \text{linterp}\left(angle, wall_{p.factor.2}, \theta\right)$$

$$wall_{factor.A.3}(\theta) := \text{linterp}\left(angle, wall_{p.factor.3}, \theta\right)$$

$$wall_{factor.A.4}(\theta) := \text{linterp}\left(angle, wall_{p.factor.4}, \theta\right)$$

$$wall_{factor.A.1E}(\theta) := \text{linterp}\left(angle, wall_{p.factor.1E}, \theta\right)$$

$$wall_{factor.A.2E}(\theta) := \text{linterp}\left(angle, wall_{p.factor.2E}, \theta\right)$$

$$wall_{factor.A.3E}(\theta) := \text{linterp}\left(angle, wall_{p.factor.3E}, \theta\right)$$

$$wall_{factor.A.4E}(\theta) := \text{linterp}\left(angle, wall_{p.factor.4E}, \theta\right)$$

Weighted averaging along length

Wall pressure ASCE7-16-Table 28.3-1

$$GC_{p\_wall\_windward.A} := a \cdot wall_{factor.A.1E}\left(\theta_{roof}\right) + (1 - a) \cdot wall_{factor.A.1}\left(\theta_{roof}\right) = 0.421$$

$$GC_{p\_wall\_leeward.A} := a \cdot wall_{factor.A.4E}\left(\theta_{roof}\right) + (1 - a) \cdot wall_{factor.A.3}\left(\theta_{roof}\right) = -0.376$$

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

$$p_{wind\_wall\_windward.A} := q_z \cdot \left(GC_{p\_wall\_windward.A} + \text{if}\left(GC_{p\_wall\_windward.A} > 0, -GC_{pi}, GC_{pi}\right)\right) = 15.821 \cdot psf$$

$$p_{wind\_wall\_leeward.A} := q_z \cdot \left(GC_{p\_wall\_leeward.A} + \text{if}\left(GC_{p\_wall\_leeward.A} > 0, -GC_{pi}, GC_{pi}\right)\right) = -14.636 \cdot psf$$

$$p_{wind\_roof\_windward.A} := q_z \cdot \left(GC_{p\_roof\_windward.A} + \text{if}\left(GC_{p\_roof\_windward.A} > 0, -GC_{pi}, GC_{pi}\right)\right) = -23.903 \cdot psf$$

$$p_{wind\_roof\_leeward.A} := q_z \cdot \left(GC_{p\_roof\_leeward.A} + \text{if}\left(GC_{p\_roof\_leeward.A} > 0, -GC_{pi}, GC_{pi}\right)\right) = -14.9 \cdot psf$$

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

$p_{wind\_wall\_windward.B} := q_z \cdot \text{if}\left(GC_{p\_wall\_windward.B} > 0, -GC_{pi}, GC_{pi}\right) = 4.738 \cdot psf$

$p_{wind\_wall\_leeward.B} := q_z \cdot \text{if}\left(GC_{p\_wall\_leeward.B} > 0, -GC_{pi}, GC_{pi}\right) = -4.738 \cdot psf$

$p_{wind\_wall\_windward.B\_orthogonal} := q_z \cdot \left(GC_{p\_wall\_windward.B\_orthogonal} \cdots + \text{if}\left(GC_{p\_wall\_windward.B\_orthogonal} > 0, -GC_{pi}, GC_{pi}\right)\right) = -16.663 \cdot p$

$p_{wind\_wall\_leeward.B\_orthogonal} := q_z \cdot \left(GC_{p\_wall\_leeward.B\_orthogonal} \cdots + \text{if}\left(GC_{p\_wall\_leeward.B\_orthogonal} > 0, -GC_{pi}, GC_{pi}\right)\right) = -16.663 \cdot psf$

$p_{wind\_roof\_windward.B} := q_z \cdot \left(GC_{p\_roof\_windward.B} \cdots + \text{if}\left(GC_{p\_roof\_windward.B} > 0, -GC_{pi}, GC_{pi}\right)\right) = -23.903 \cdot psf$

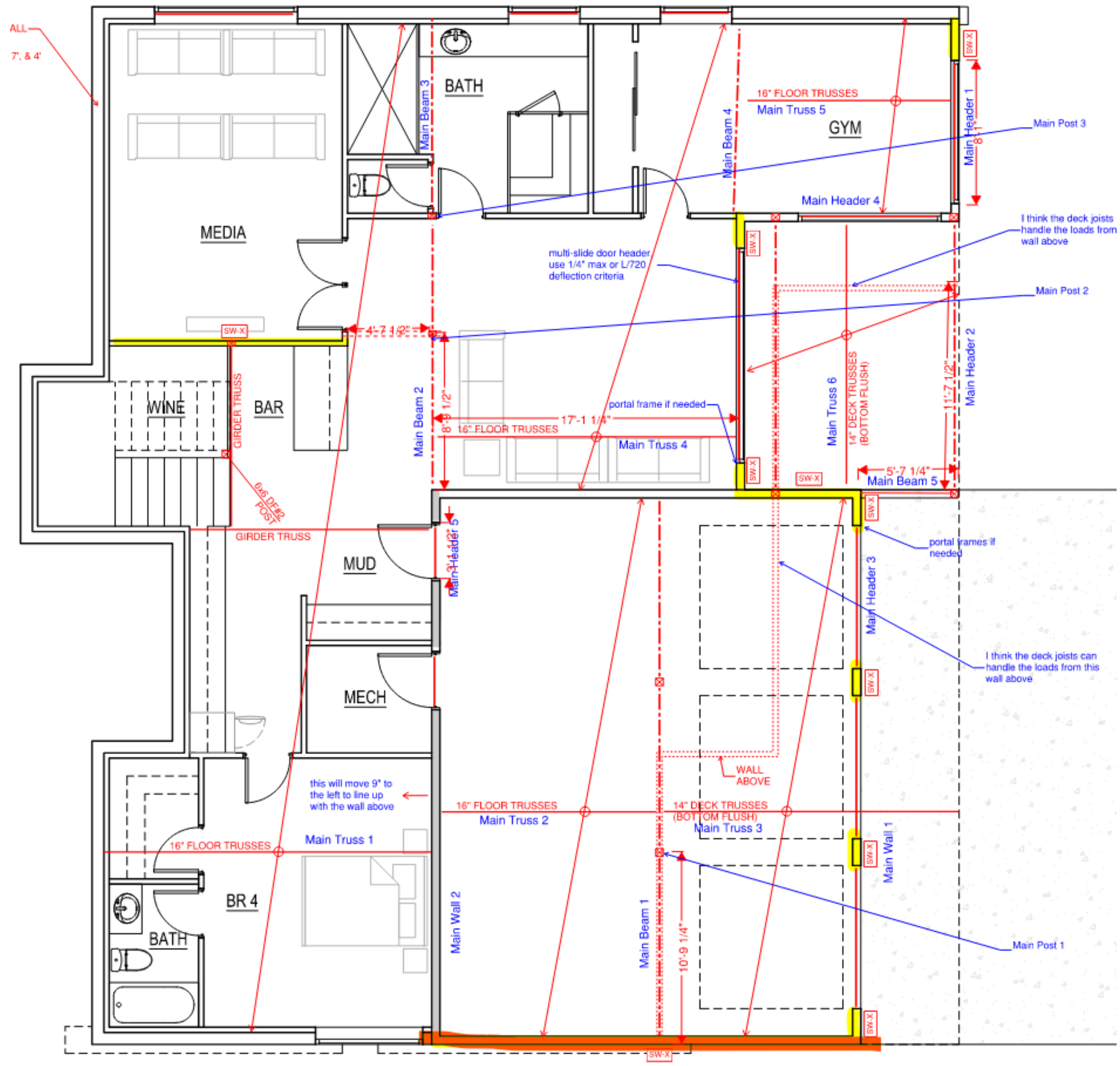
$p_{wind\_roof\_leeward.B} := q_z \cdot \left(GC_{p\_roof\_leeward.B} + \text{if}\left(GC_{p\_roof\_leeward.B} > 0, -GC_{pi}, GC_{pi}\right)\right) = -14.9 \cdot psf$

ASD load combination used for frame design :
- D+S
- D+ 0.6W
- D+0.7E
- D+0.75x0.6W+0.75L+0.75S
- D+0.75 x 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

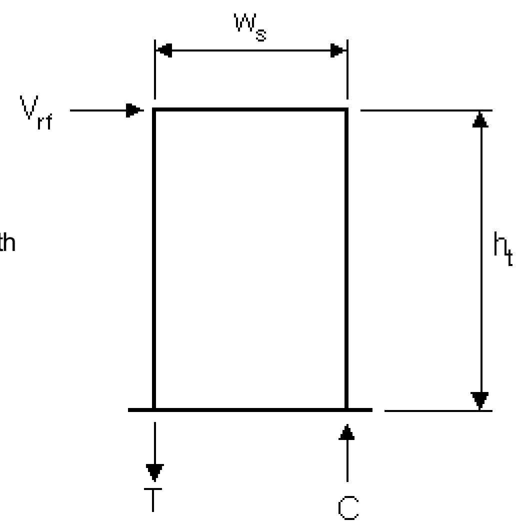


$$V_{EQ} := V_{story_1} \cdot \frac{750ft^2}{2780ft^2} = 8.804 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 17.5ft \cdot h_{floor_3} = 15.99 \cdot kip$$

Wind load



Wall height

$L_s := 24ft$

Total shear wall length

First Segment:

$h_t := 9 \cdot ft$

$w_s := 24ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 0.375$

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

$(WSP) := \text{if}\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ 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) $V_{rf.w} = 9.59 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 6.16 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 86.3 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 55.5 \cdot kip \cdot ft$

Resisting Forces

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

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 2.592 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 18.662 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 400 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 257 \cdot plf$ Seismic shear flow

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.4} \cdot n}{\Omega_s} = 490 \cdot plf$ $check_{wv} := \mathrm{if}\left(\frac{w_{v.w}}{w_{all.w}} > 1.0, \text{"NG"}, \text{"OK"} \right)$

$\frac{w_{v.w}}{w_{all.w}} = 0.816$ $check_{wv} = \text{"OK"}$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.4} \cdot n}{\Omega_s} = 350 \cdot plf$ $check_{wE} := \mathrm{if}\left(\frac{w_{v.E}}{w_{all.E}} > 1.0, \text{"NG"}, \text{"OK"} \right)$

$check_{wE} = \text{"OK"}$

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

Sill Plate Anchorage

$C_D := 1.6$

$t_{sp} := 1.5in$ Sill plate thickness $dia_a := 0.5in$ Anchor Diameter $sp_a := 24in$ Anchor spacing

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

$V_{sp} := \max\left(w_{v.w}, w_{v.E} \cdot \Omega_o\right) \cdot sp_a = 1.284 \cdot kip$ Shear load to each anchor

$Check_a := if\left(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"}\right)$ $ratio_a := \dfrac{V_{sp}}{Z_{ll}} = 0.863$ $Check_a = \text{"OK"}$

Use 5/8" Dia. Anchor at 24o.c. (7" min. embed)

Holdown

$$T := \frac{\max\left(M_{ot.w}, M_{ot.E} \cdot \Omega_o\right) - M_{res}}{w_s} = 5 \cdot kip$$

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

$T_{all} := HDU5 = 5.645 \cdot kip$ Allowable tension load

$check_{HD} := if\left(\dfrac{T}{T_{all}} > 1.0, \text{"NG"}, \text{"OK"}\right)$ $ratio := \dfrac{T}{T_{all}} = 0.886$ $check_{HD} = \text{"OK"}$

Anchor

It is less than 5% above-EOR is OK

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

Bolt diameter

$d_b = 0.625 \cdot in$

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

$F_y := 36ksi$ Nominal strength of bolt-F1554

$\Omega := 1.67$ ASD factor

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

$Check_{anchor} := \left(if\left(\dfrac{T}{T_{a.capacity}} \le 1, \text{"OK"}, \text{"NG"}\right)\right)$ $\dfrac{T}{T_{a.capacity}} = 0.756$ $Check_{anchor} = \text{"OK"}$

Footing Uplift

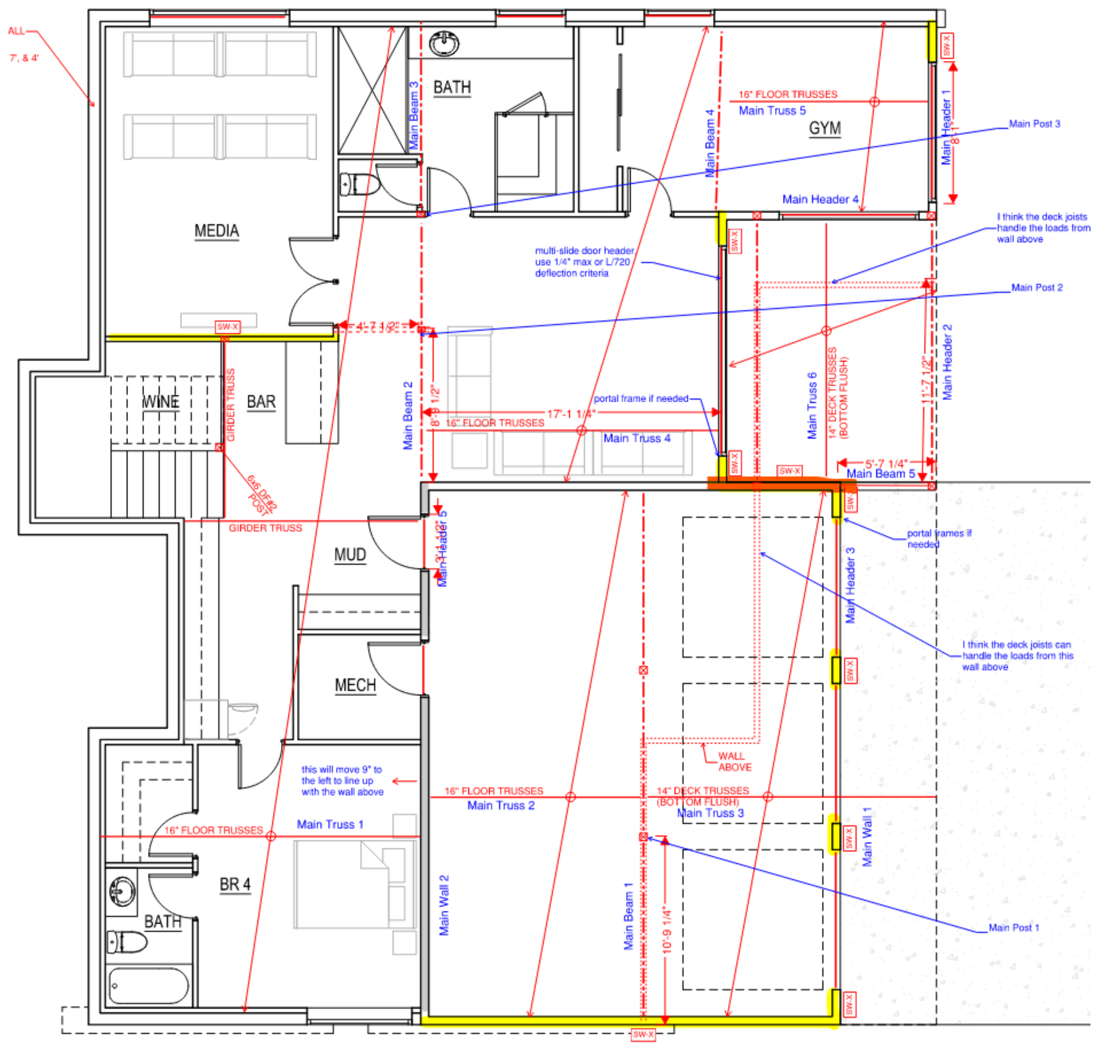
$L_{ftg} := 24ft$	Length of footing	$t_{slab} := 0in$	Slab thickness
$W_{ftg} := 16in$	Width of footing	$trib_{slab} := 0ft$	Slab tributary
$t_{ftg} := 6in$	Thickness of footing	$t_{stem} := 6in$	Stem wall thick
$trib_{flr} := 0$	Floor/deck tributary	$ht_{stem} := 18in$	Stem wall height

$$wt_{resist} := \left[\left(W_{ftg} \cdot t_{ftg} + t_{slab} \cdot trib_{slab} + t_{stem} \cdot ht_{stem}\right) \cdot L_{ftg} \cdot 150pcf + \left(P_{rf} + P_{w}\right) \ldots \atop + \left(\frac{W_{ftg} - t_{stem}}{2}\right) \cdot ht_{stem} \cdot L_{ftg} \cdot 120pcf\right] = 9.492 \cdot kip$$

$$e_{ftg} := \frac{M_{ot.w}}{wt_{resist}} = 9.097 \cdot ft$$

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

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

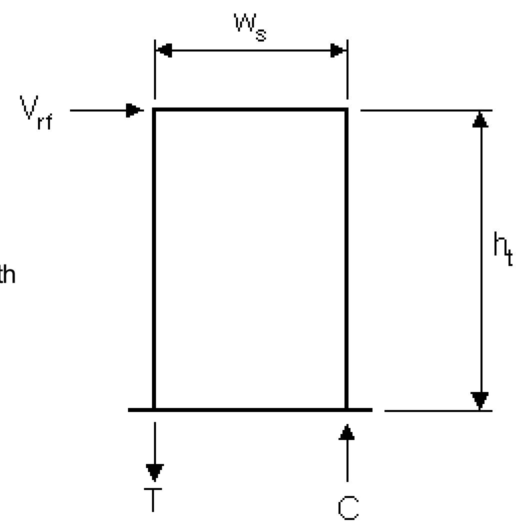


$$V_{EQ} := V_{story_1} \cdot \frac{900ft^2}{2780ft^2} = 10.565 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 19ft \cdot h_{floor_3} = 17.361 \cdot kip$$

Wind load



Wall height

$L_s := 7ft$

Total shear wall length

First Segment:

$h_t := 9 \cdot ft$

$w_s := 7ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 1.286$

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

$check_{ratio} = \text{"OK"}$

$(WSP) := \text{if}\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ 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) $V_{rf.w} = 10.42 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 7.4 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 93.7 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 66.6 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := (DL_{floor}) \cdot \left(\frac{15ft}{2}\right) \cdot w_s + 5626lbf = 6.413 \times 10^3 \cdot lbf$

Total gravity load on wall

$P_{rf} = 6.413 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.756 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2}\right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 15.056 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 1488 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 1056 \cdot plf$ Seismic shear flow

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

$\frac{w_{v.w}}{w_{all.w}} = 0.907$ $check_{wv} = "OK"$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.903$ $check_{wE} = "OK"$

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

Sill Plate Anchorage

$C_D := 1.6$

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

$dia_a := 0.5in$ Anchor Diameter

$sp_a := 7in$ Anchor spacing

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

$V_{sp} := \max(w_{v.w}, w_{v.E} \cdot \Omega_o) \cdot sp_a = 1.541 \cdot kip$ Shear load to each anchor

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$

$ratio_a := \frac{V_{sp}}{Z_{ll}} = 1.035$

$Check_a = "NG"$

Use 5/8" Dia. Anchor at 24"o.c. (7" min. embed)

It is less than 5% above-EOR is OK

Holdown

$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 21.62 \cdot kip$$

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

$T_{all} := 2HDU14 = 21.54 \cdot kip$ Allowable tension load

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

$ratio := \frac{T}{T_{all}} = 1.004$

$check_{HD} = "NG"$

It is less than 5% above-EOR is OK

Anchor

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

Bolt diameter

$d_b = 1 \cdot in$

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

$F_y := 36ksi$ Nominal strength of bolt-F1554

$\Omega := 1.67$ ASD factor

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

$$Check_{anchor} := \left(\text{if}\left(\frac{\frac{T}{2}}{T_{a.capacity}} \le 1, \text{"OK"}, \text{"NG"} \right) \right) \quad \frac{\frac{T}{2}}{T_{a.capacity}} = 0.638$$

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

Footing Uplift

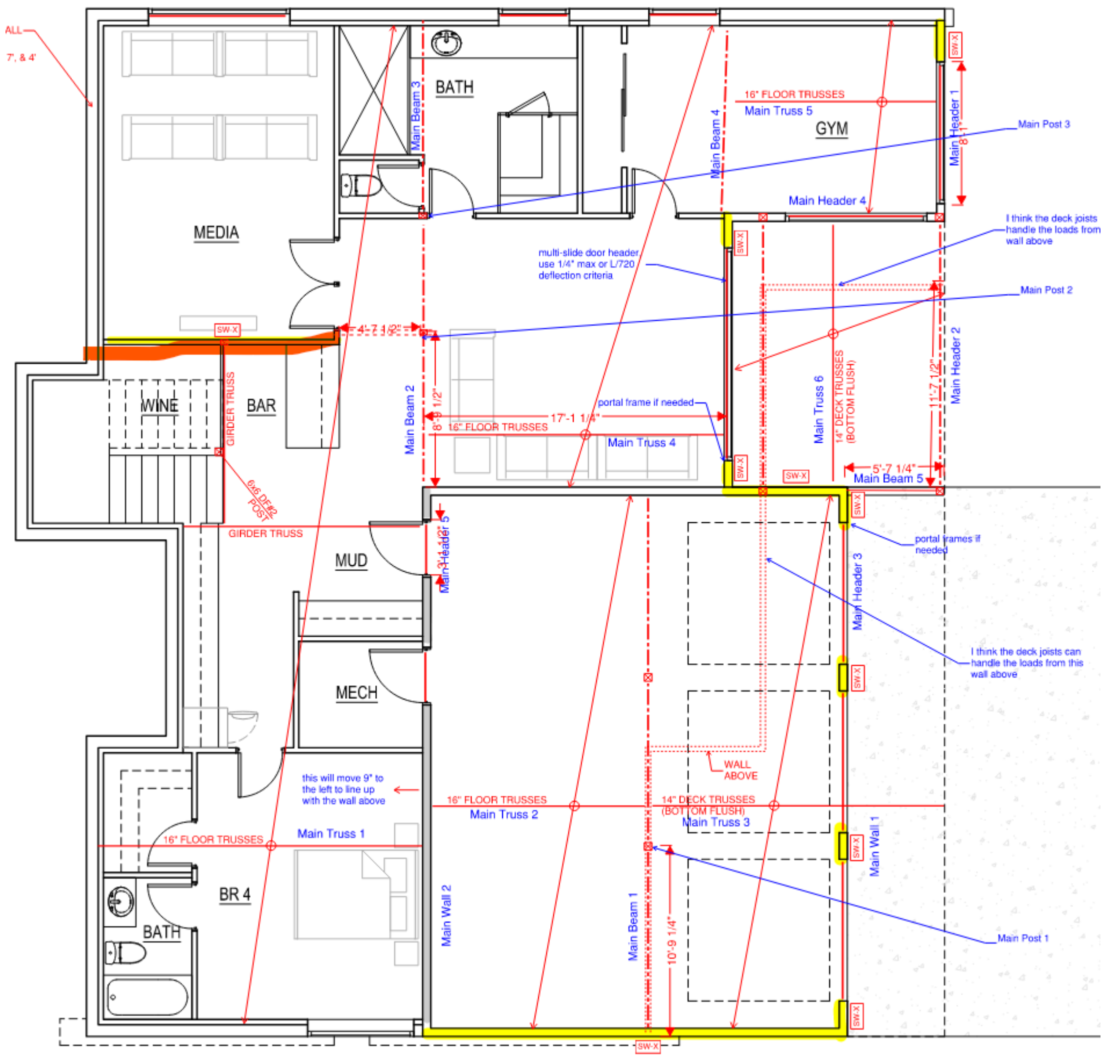
$L_{ftg} := 12ft$	Length of footing	$t_{slab} := 4in$	Slab thickness
$W_{ftg} := 18in$	Width of footing	$trib_{slab} := 18ft$	Slab tributary
$t_{ftg} := 6in$	Thickness of footing	$t_{stem} := 6in$	Stem wall thick
$trib_{flr} := 0$	Floor/deck tributary	$ht_{stem} := 18in$	Stem wall height

$$wt_{resist} := \left[\left(W_{ftg} \cdot t_{ftg} + t_{slab} \cdot trib_{slab} + t_{stem} \cdot ht_{stem}\right) \cdot L_{ftg} \cdot 150pcf + \left(P_{rf} + P_w\right) \ldots + \left(\frac{W_{ftg} - t_{stem}}{2}\right) \cdot ht_{stem} \cdot L_{ftg} \cdot 120pcf \right] = 21.75 \cdot kip$$

$$e_{ftg} := \frac{M_{ot.w}}{wt_{resist}} = 4.31 \cdot ft$$

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

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

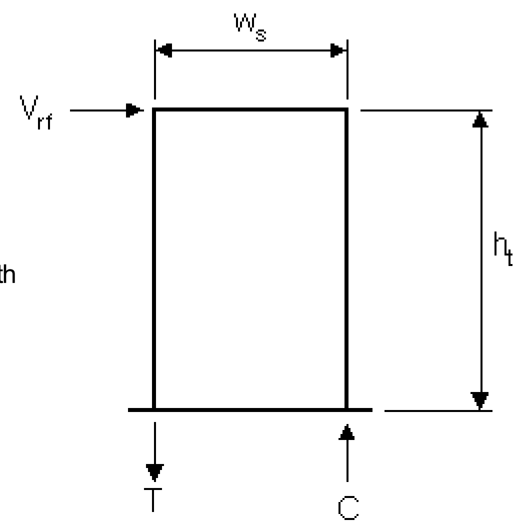


$$V_{EQ} := V_{story_1} \cdot \frac{1000ft^2}{2780ft^2} = 11.739 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 22ft \cdot h_{floor_3} = 20.102 \cdot kip$$

Wind load



Wall height

$L_s := 13.5ft$

Total shear wall length

First Segment:

$h_t := 9 \cdot ft$

$w_s := 13.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 0.667$ $\quad check_{ratio} := if\left(\frac{h_t}{w_s} > 3.5, "NG", "OK"\right)$ $\quad check_{ratio} = "OK"$

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

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) $\quad V_{rf.w} = 12.06 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $\quad V_{rf.E} = 8.22 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $\quad M_{ot.w} = 108.6 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $\quad M_{ot.E} = 74 \cdot kip \cdot ft$

Resisting Forces

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

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 1.458 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 5.905 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 893 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 609 \cdot plf$ Seismic shear flow

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.4} \cdot n}{\Omega_s} = 980 \cdot plf$ $check_{wv} := \text{if}\left(\frac{w_{v.w}}{w_{all.w}} > 1.0, \text{"NG"}, \text{"OK"} \right)$

$\frac{w_{v.w}}{w_{all.w}} = 0.912$ $check_{wv} = \text{"OK"}$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.4} \cdot n}{\Omega_s} = 700 \cdot plf$ $check_{wE} := \text{if}\left(\frac{w_{v.E}}{w_{all.E}} > 1.0, \text{"NG"}, \text{"OK"} \right)$

$\frac{w_{v.E}}{w_{all.E}} = 0.87$ $check_{wE} = \text{"OK"}$

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

Sill Plate Anchorage

$C_D := 1.6$

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

$dia_a := 0.5in$ Anchor Diameter

$sp_a := 12in$ Anchor spacing

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

$V_{sp} := \max(w_{v.w}, w_{v.E} \cdot \Omega_o) \cdot sp_a = 1.522 \cdot kip$ Shear load to each anchor

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$

$ratio_a := \frac{V_{sp}}{Z_{ll}} = 1.023$

$Check_a = "NG"$

Use 5/8" Dia. Anchor at 12"o.c. (7" min. embed)

It is less than 5% above-EOR is OK

Holdown

$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 13.258 \cdot kip$$

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

$check_T = "HD REQ'D"$

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

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

$ratio := \frac{T}{T_{all}} = 0.98$

$check_{HD} = "OK"$

Anchor

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

Bolt diameter

$d_b = 1 \cdot in$

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

$F_y := 36ksi$ Nominal strength of bolt-F1554

$\Omega := 1.67$ ASD factor

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

$$Check_{anchor} := \left(if\left(\frac{\frac{T}{2}}{T_{a.capacity}} \le 1, "OK", "NG"\right)\right)$$

$$\frac{\frac{T}{2}}{T_{a.capacity}} = 0.392$$

$Check_{anchor} = "OK"$

Footing Uplift

$L_{ftg} := 13.5ft$ Length of footing

$W_{ftg} := 18in$ Width of footing

$t_{ftg} := 6in$ Thickness of footing

$trib_{flr} := 0$ Floor/deck tributary

$t_{slab} := 4in$ Slab thickness

$trib_{slab} := 18ft$ Slab tributary

$t_{stem} := 6in$ Stem wall thick

$ht_{stem} := 18in$ Stem wall height

$$wt_{resist} := \left[\left(W_{ftg} \cdot t_{ftg} + t_{slab} \cdot trib_{slab} + t_{stem} \cdot ht_{stem}\right) \cdot L_{ftg} \cdot 150pcf + \left(P_{rf} + P_{w}\right) \ldots + \left(\frac{W_{ftg} - t_{stem}}{2}\right) \cdot ht_{stem} \cdot L_{ftg} \cdot 120pcf\right] = 17.86 \cdot kip$$

$$e_{ftg} := \frac{M_{ot.w}}{wt_{resist}} = 6.078 \cdot ft$$

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

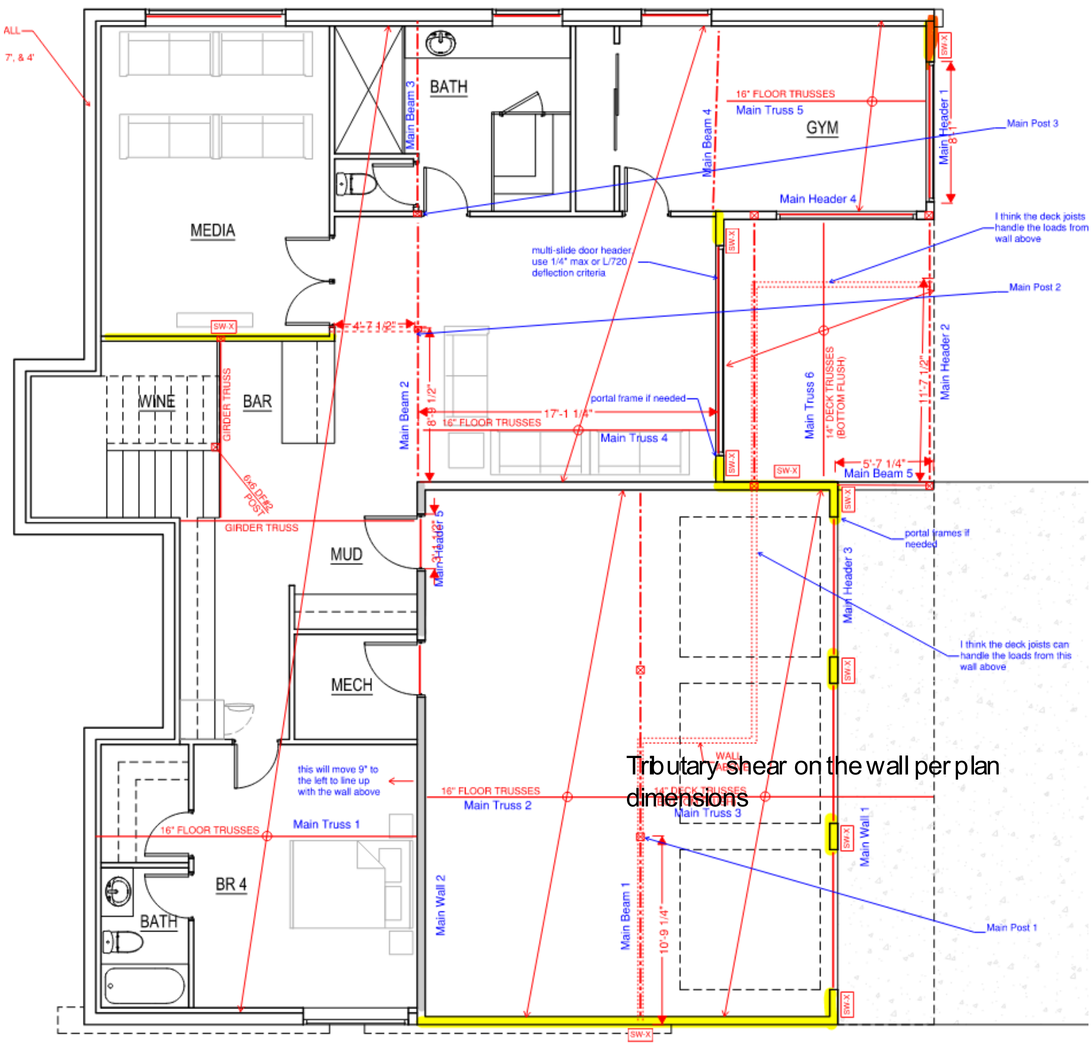
$check_{ftg} = \text{"OK"}$

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 norht-south direction and below would be wood frame wall designed for other half in east side.

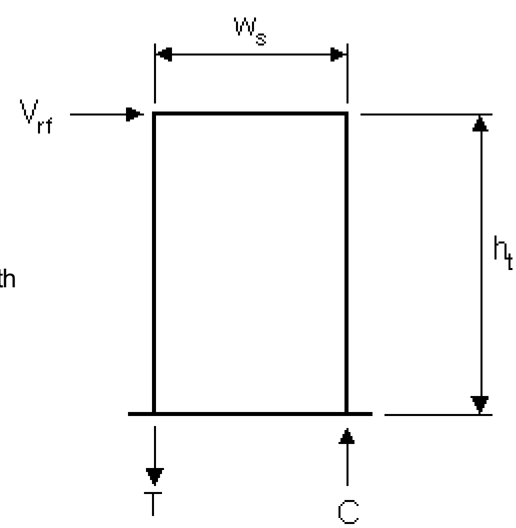


$V_{EQ} := V_{story_1} \cdot \frac{177ft^2}{2780ft^2} = 2.078 \cdot kip$

Tributary shear on the wall per plan dimensions

$V_{wind} := (p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}) \cdot 4ft \cdot (h_{floor_3}) = 3.655 \cdot kip$

Wind load



$h_t := 9 \cdot ft$

Wall height

$L_s := 2ft + 4in$

Total shear wall length

First Segment:

$w_s := (3ft + 8in)$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 2.455$

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

$check_{ratio} = "OK"$

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

$(WSP) = 0.9$

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)

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

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

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

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 31 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 20.6 \cdot kip \cdot ft$

Resisting Forces

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

$P_{rf} = 0.33 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.396 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2}\right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 0.799 \cdot kip \cdot ft$

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

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

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

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

$\frac{w_{v.w}}{w_{all.w}} = 1.017$ $check_{wv} = \text{"NG"}$

It is less than 5% above-EOR is OK

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

$\frac{w_{v.E}}{w_{all.E}} = 0.944$ $check_{wE} = \text{"OK"}$

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

Sill Plate Anchorage

$C_D := 1.6$

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

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

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

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

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

It is less than 5% above-EOR is OK

Holdown

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

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

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

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

It is less than 5% above-EOR is OK

Anchor

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

Bolt diameter

$d_b = 1 \cdot in$

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

$F_y := 36ksi$ Nominal strength of bolt-F1554

$\Omega := 1.67$ ASD factor

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

$$Check_{anchor} := \left(\text{if}\left(\frac{T}{T_{a.capacity}} \le 1, \text{"OK"}, \text{"NG"}\right)\right) \qquad \frac{T}{T_{a.capacity}} = 0.816$$

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

Footing Uplift

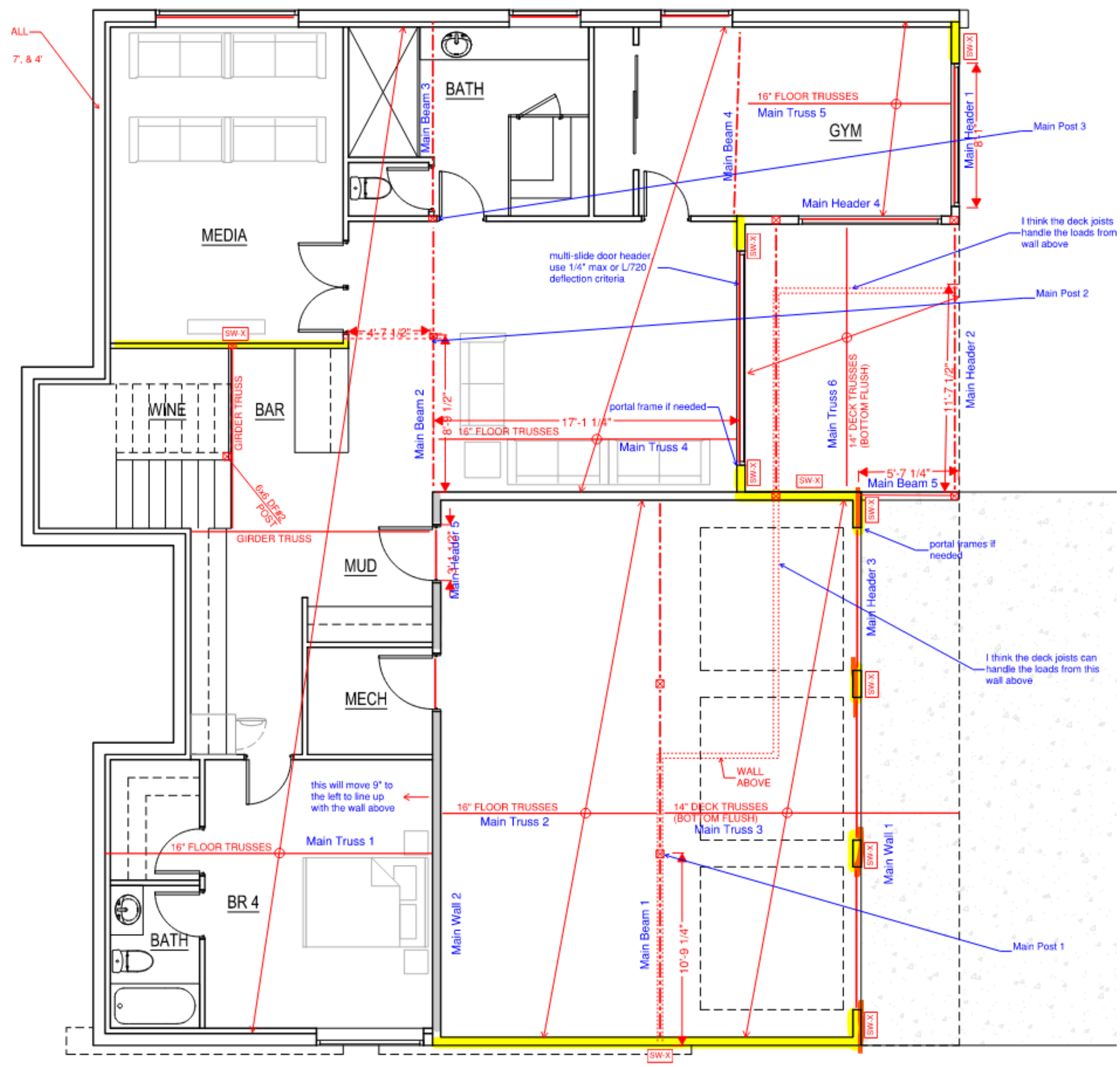
$L_{ftg} := 12ft$	Length of footing	$t_{slab} := 4in$	Slab thickness
$W_{ftg} := 16in$	Width of footing	$trib_{slab} := 27ft$	Slab tributary
$t_{ftg} := 6in$	Thickness of footing	$t_{stem} := 6in$	Stem wall thick
$trib_{flr} := 0$	Floor/deck tributary	$ht_{stem} := 18in$	Stem wall height

$$wt_{resist} := \left[\left(W_{ftg} \cdot t_{ftg} + t_{slab} \cdot trib_{slab} + t_{stem} \cdot ht_{stem}\right) \cdot L_{ftg} \cdot 150pcf + \left(P_{rf} + P_{w}\right) \ldots + \left(\frac{W_{ftg} - t_{stem}}{2}\right) \cdot ht_{stem} \cdot L_{ftg} \cdot 120pcf\right] = 20.376 \cdot kip$$

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

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

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



$$V_{EQ} := V_{story_1} \cdot \frac{250ft^2}{2780ft^2} = 2.935 \cdot kip$$

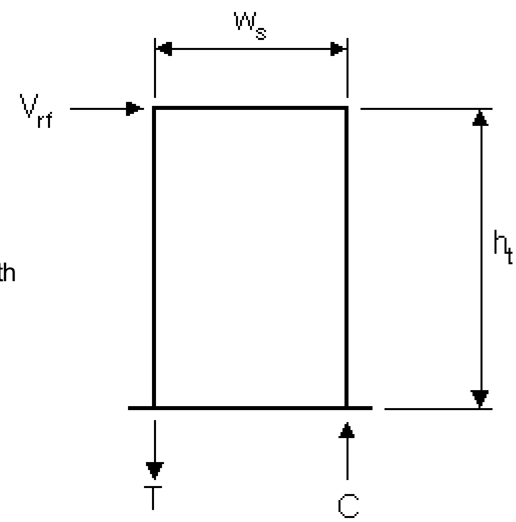
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 6ft \cdot \left(h_{floor_3}\right) = 5.482 \cdot kip$$

Wind load

$h_t := 9ft$ Wall height

$L_s := 1.5ft \cdot 4$ Total shear wall length



First Segment:

$w_s := 1.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 6$

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

$check_{ratio} = "NG"$

these segments will be designed as portal frame

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ Aspect ratio factor $(WSP) = 0.5$

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) $V_{rf.w} = 0.82 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 0.51 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 7.4 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 4.6 \cdot kip \cdot ft$

Resisting Forces

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

Total gravity load on wall

$P_{rf} = 0.135 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wal self weight load $P_w = 0.162 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2}\right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 0.134 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 548 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 342 \cdot plf$ Seismic shear flow

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.3} \cdot n}{\Omega_s} = 630 \cdot plf$ $check_{wv} := if\left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK"\right)$

$\frac{w_{v.w}}{w_{all.w}} = 0.87$ $check_{wv} = "OK"$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.3} \cdot n}{\Omega_s} = 450 \cdot plf$ $check_{wE} := if\left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK"\right)$

$\frac{w_{v.E}}{w_{all.E}} = 0.761$ $check_{wE} = "OK"$

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

Sill Plate Anchorage

$C_D := 1.6$

$t_{sp} := 1.5in$ Sill plate thickness $dia_a := 0.5in$ Anchor Diameter $sp_a := 20in$ Anchor spacing

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

$V_{sp} := \max(w_{v.w}, w_{v.E} \cdot \Omega_o) \cdot sp_a = 1.427 \cdot kip$ Shear load to each anchor

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.959$ $Check_a = "OK"$

Use 5/8" Dia. Anchor at 24"o.c. (7" min. embed)

Check Portal Frame Loads

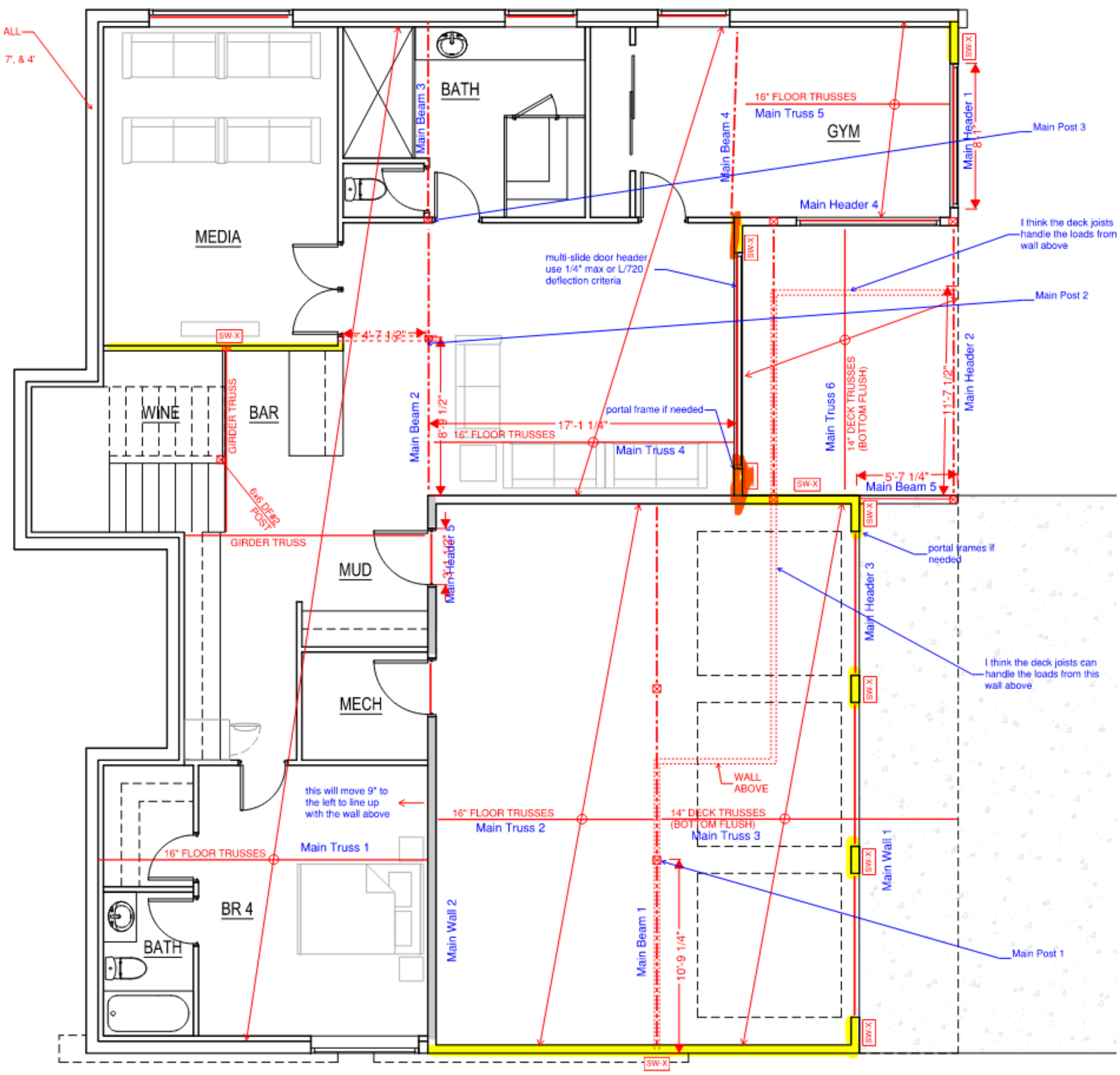
$L_{portal} := 9ft + 8in$

$$M_{base} := \frac{\max\left[\left(\frac{V_{EQ}}{3}\right) \cdot 0.7 \cdot \Omega_o, \frac{V_{wind}}{3} \cdot 0.6\right] \cdot h_t}{4} = 3.852 \cdot kip \cdot ft$$

Bending moment at the base of portal frame (there are 3 portal frame)

$$T_{holdown} := \frac{M_{base}}{w_s} + \frac{-DL_{floor} \cdot L_{portal} \cdot \frac{12ft}{2}}{2} + \frac{\max\left[\left(\frac{V_{EQ}}{3}\right) \cdot 0.7 \cdot \Omega_o, \frac{V_{wind}}{3} \cdot 0.6\right] \cdot h_t - 2 \cdot M_{base}}{L_{portal}} = 2.93 \cdot kip$$

Use HDU 4-SDS 2.5 either side

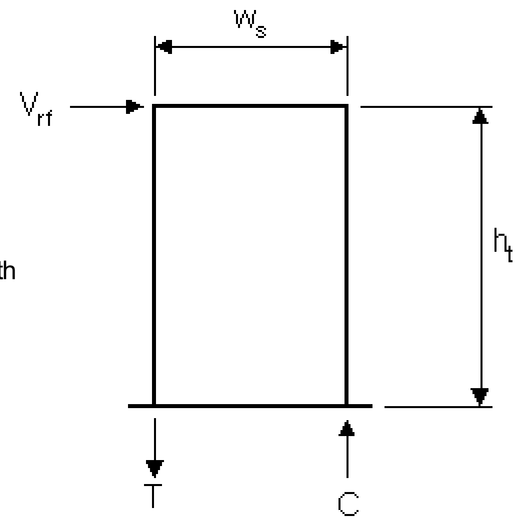


$$V_{EQ} := V_{story_1} \cdot \frac{850ft^2}{2780ft^2} = 9.978 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 14ft \cdot \left(h_{floor_3}\right) = 12.792 \cdot kip$$

Wind load



$h_t := 9ft$ Wall height

$L_s := 2ft \cdot 2$ Total shear wall length

First Segment:

$w_s := 2ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 4.5 \qquad check_{ratio} := if\left(\frac{h_t}{w_s} > 3.5, "NG", "OK"\right) \qquad check_{ratio} = "NG"$$

these segments will be simpson strong wall

$$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$$ Aspect ratio factor $(WSP) = 0.7$

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) $V_{rf.w} = 3.84 \cdot kip$

$$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 3.49 \cdot kip$

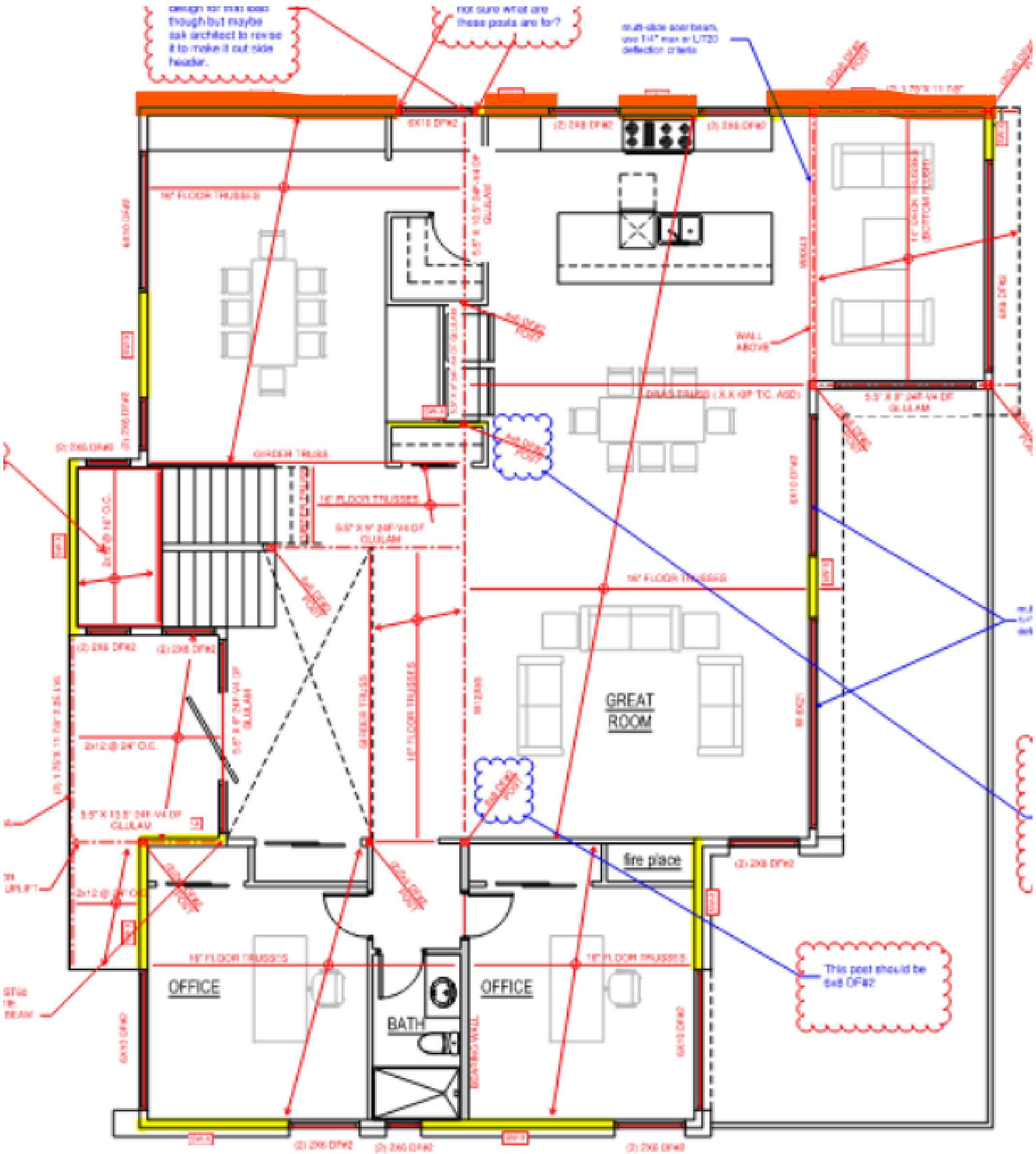
$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 34.5 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 31.4 \cdot kip \cdot ft$

Use simpson-tie strong wall WSH 24x9

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

Second Floor- Shear wall



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

Tributary shear on the wall per plan dimensions

$V_{wind} := (p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}) \cdot 12ft \cdot (h_{floor_3} - h_{floor_1}) = 8.406 \cdot kip$

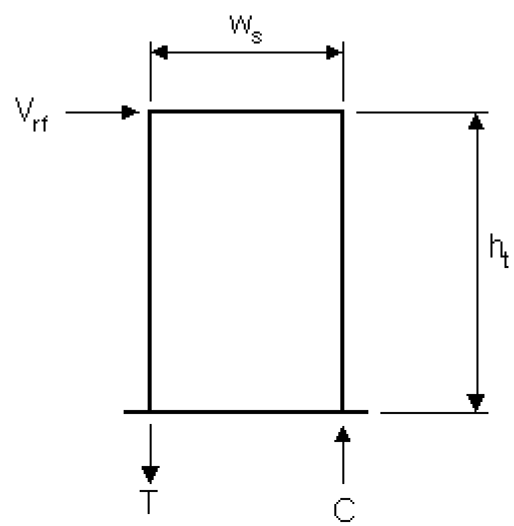
Wind load

$h_t := 10 \cdot ft$

Wall height

$L_s := (4ft + 4in) \cdot 2 + 12ft + 5in + 14ft + 5in$

Total shear wall length



First Segment:

$w_s := 4ft + 4in$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 2.308$

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

$check_{ratio} = "OK"$

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

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)

$V_{rf.w} = 0.62 \cdot kip$

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

Seismic shear load at top of wall (ASD)

$V_{rf.E} = 0.51 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 6.2 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 5.1 \cdot kip \cdot ft$

Resisting Forces

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

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.52 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 0.676 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 142 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 118 \cdot plf$ Seismic shear flow

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.6} \cdot n}{\Omega_s} = 322.1 \cdot plf$

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

$\frac{w_{v.w}}{w_{all.w}} = 0.441$ $check_{wv} = \text{"OK"}$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.6} \cdot n}{\Omega_s} = 230.8 \cdot plf$

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

$check_{wE} = \text{"OK"}$

$\frac{w_{v.E}}{w_{all.E}} = 0.509$

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

Bottom Plate Nailing

$C_D := 1.6$

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

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.095 \cdot kip$ Shear load to each nail

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.42$ $Check_a = "OK"$

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

Holdown

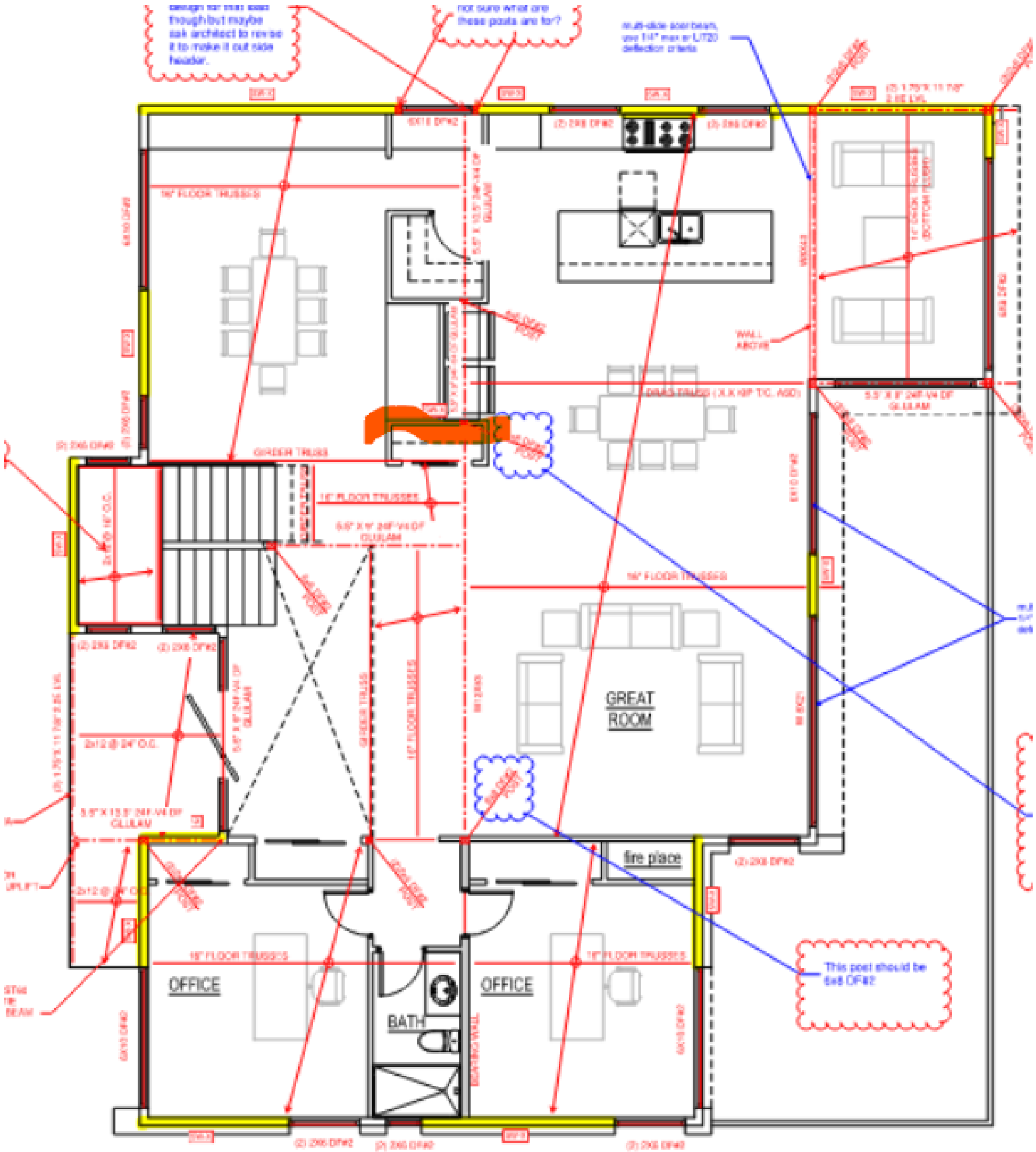
$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 2.782 \cdot kip$$

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

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

$check_{HD} := if\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 1.028$ $check_{HD} = "NG"$

It is less than 5% above-EOR is OK



$$V_{EQ} := V_{story_2} \cdot \frac{840ft^2}{2250ft^2} = 10.258 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 20ft \cdot \left(h_{floor_3} - h_{floor_1}\right) = 14.01 \cdot kip$$

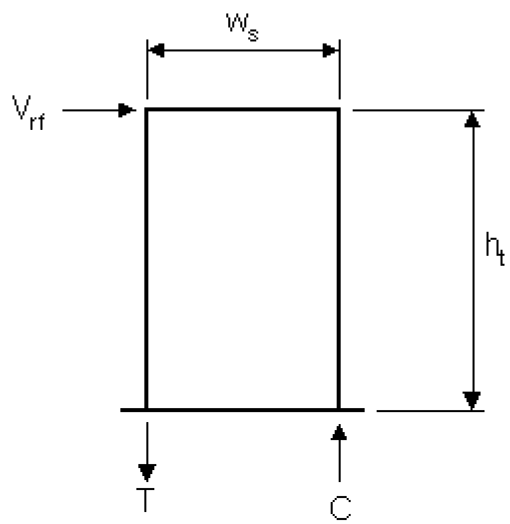
Wind load

$h_t := 10 \cdot ft$

Wal height

$L_s := 5ft + 10in$

Total shear wall length



First Segment:

$w_s := 5ft + 10in$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

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

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

$check_{ratio} = "OK"$

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

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)

$V_{rf.w} = 8.41 \cdot kip$

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

Seismic shear load at top of wall (ASD)

$V_{rf.E} = 7.18 \cdot kip$

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

Overturning moment (ASD)

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

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

Overturning moment (ASD)

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

Resisting Forces

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

Total gravity load on wall from forte

$P_{rf} = 5 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.7 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 9.975 \cdot kip \cdot ft$

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

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

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

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

$\frac{w_{v.w}}{w_{all.w}} = 0.879$ $check_{wv} = \text{"OK"}$

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

$\frac{w_{v.E}}{w_{all.E}} = 1.05$ $check_{wE} = \text{"NG"}$

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

$C_D := 1.6$

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

$dia_a := 16d$ Nail Size

$sp_a := 1.5in$ Nail spacing

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

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

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

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

Holdown

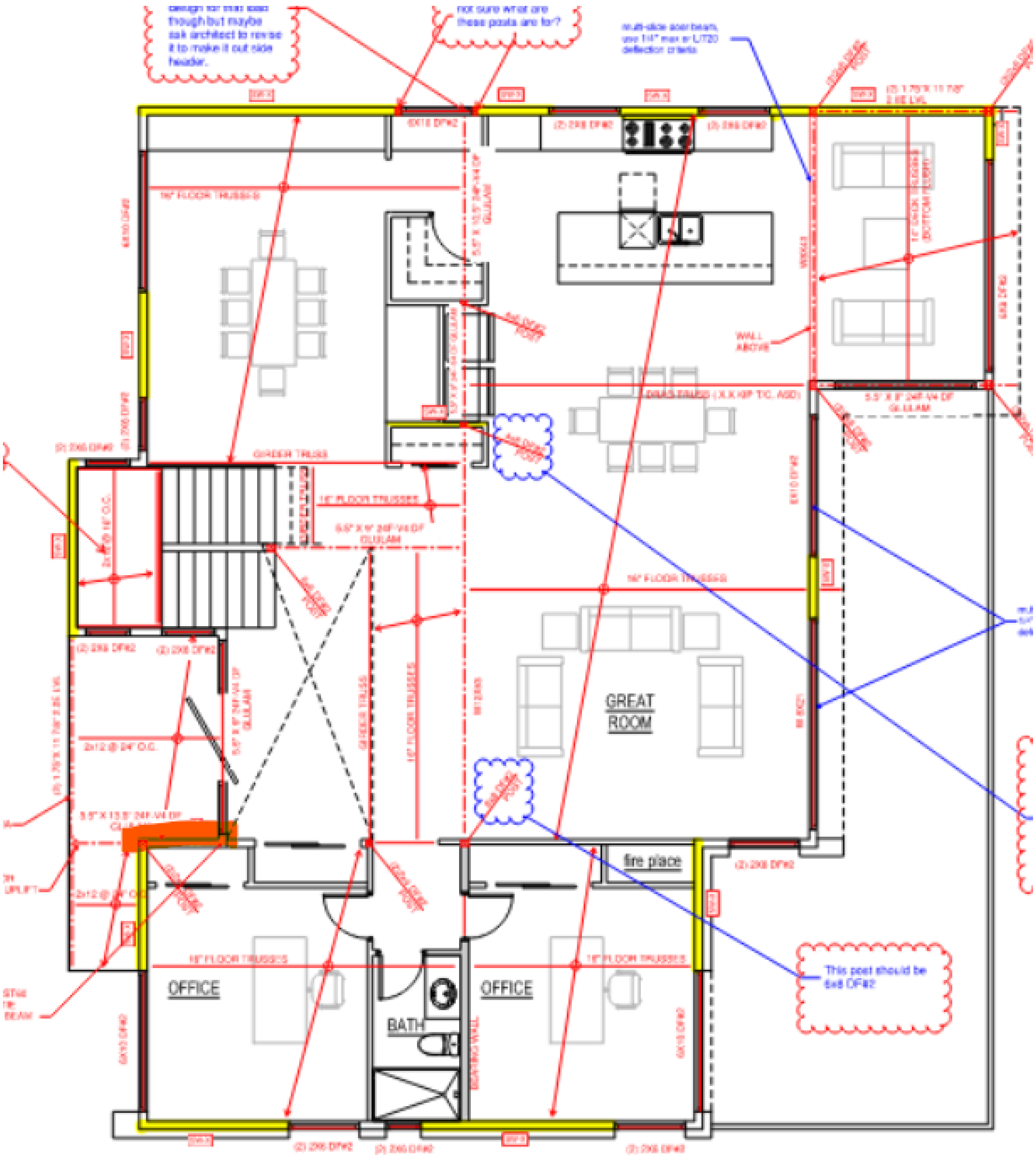
$$T := \frac{max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 29.065 \cdot kip$$

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

$T_{all} := 3CMST12\_38 = 27.645 \cdot kip$ Allowable tension load

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

It is less than 5% above-EOR is OK


GREAT ROOM
OFFICE
OFFICE
BATH
fire place
GIRDER TRUSS
16" FLOOR TRUSSES
This post should be 6x8 DF#2

$$V_{EQ} := V_{story_2} \cdot \frac{483ft^2}{2250ft^2} = 5.898 \cdot kip$$

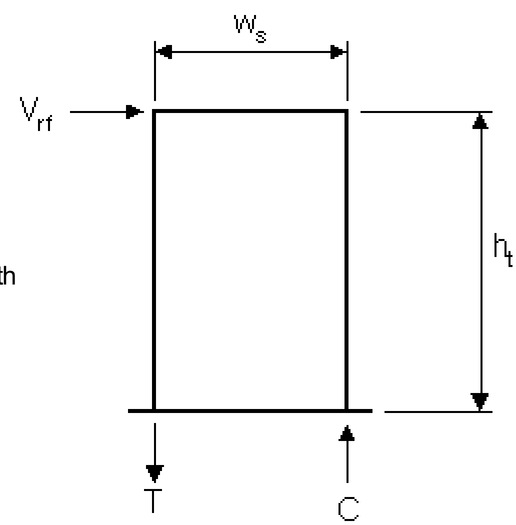
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 17ft \cdot \left(h_{floor_3} - h_{floor_1}\right) = 11.909 \cdot kip$$

Wind load

$h_t := 10ft$ Wall height

$L_s := 5ft$ Total shear wall length



First Segment:

$w_s := 5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 2$

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

$check_{ratio} = "OK"$

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

$V_{rf.w} = 7.15 \cdot kip$

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

$V_{rf.E} = 4.13 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 71.5 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 41.3 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := 0$

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.6 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 0.9 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 1429 \cdot plf$ Wind shear flow

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

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

$\frac{w_{v.w}}{w_{all.w}} = 0.871$ $check_{wv} = "OK"$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.706$ $check_{wE} = "OK"$

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

Bottom Plate Nailing

$C_D := 1.6$

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

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.179 \cdot kip$ Shear load to each nail

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \dfrac{V_{sp}}{Z_{ll}} = 0.792$ $Check_a = "OK"$

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

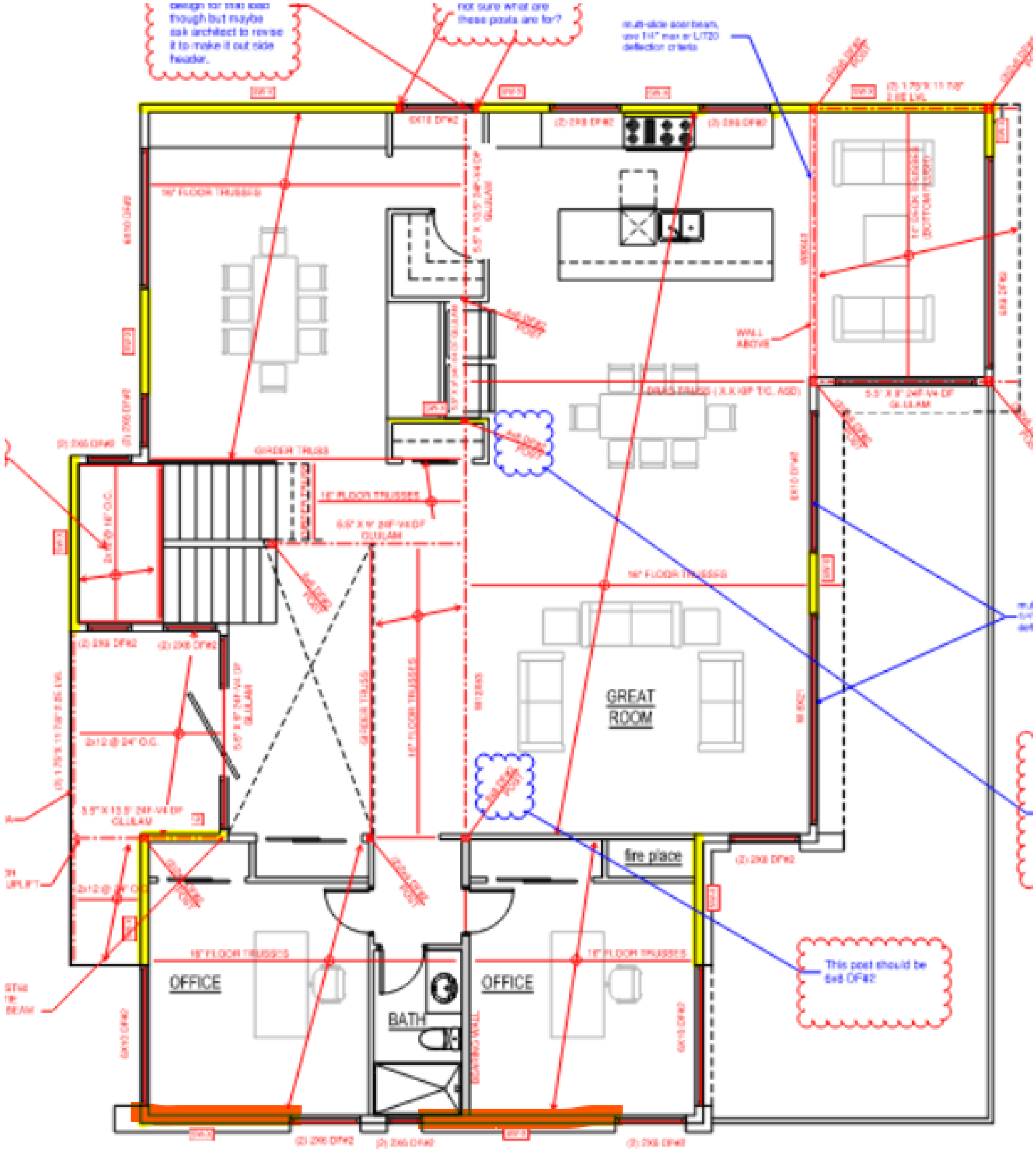
Holdown

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

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

$T_{all} := 3CMST12\_38 = 27.645 \cdot kip$ Allowable tension load

$check_{HD} := if\left(\dfrac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \dfrac{T}{T_{all}} = 0.74$ $check_{HD} = "OK"$



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

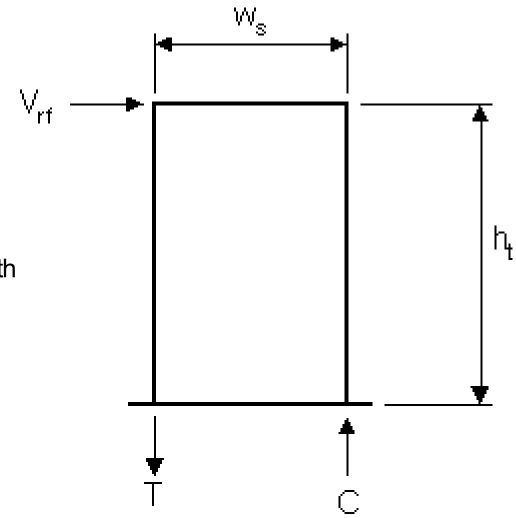
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 9ft \cdot \left(h_{floor_3} - h_{floor_1}\right) = 6.305 \cdot kip$$

Wind load

$h_t := 10ft$ Wal height

$L_s := 8.5ft + 11ft$ Total shear wall length



First Segment:

$w_s := 8.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 1.176$ $check_{ratio} := if\left(\frac{h_t}{w_s} > 3.5, "NG", "OK"\right)$ $check_{ratio} = "OK"$

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ 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) $V_{rf.w} = 1.65 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 1.05 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 16.5 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 10.5 \cdot kip \cdot ft$

Resisting Forces

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

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 1.02 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 2.601 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 194 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 123 \cdot plf$ Seismic shear flow

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

$\frac{w_{v.w}}{w_{all.w}} = 0.579$ $check_{wv} = \text{"OK"}$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.513$ $check_{wE} = \text{"OK"}$

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

Bottom Plate Nailing $C_D := 1.6$

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

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.129 \cdot kip$ Shear load to each nail

$Check_a := if(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"})$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.573$ $Check_a = \text{"OK"}$

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

Holdown

$$T := \frac{max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 2.774 \cdot kip$$

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

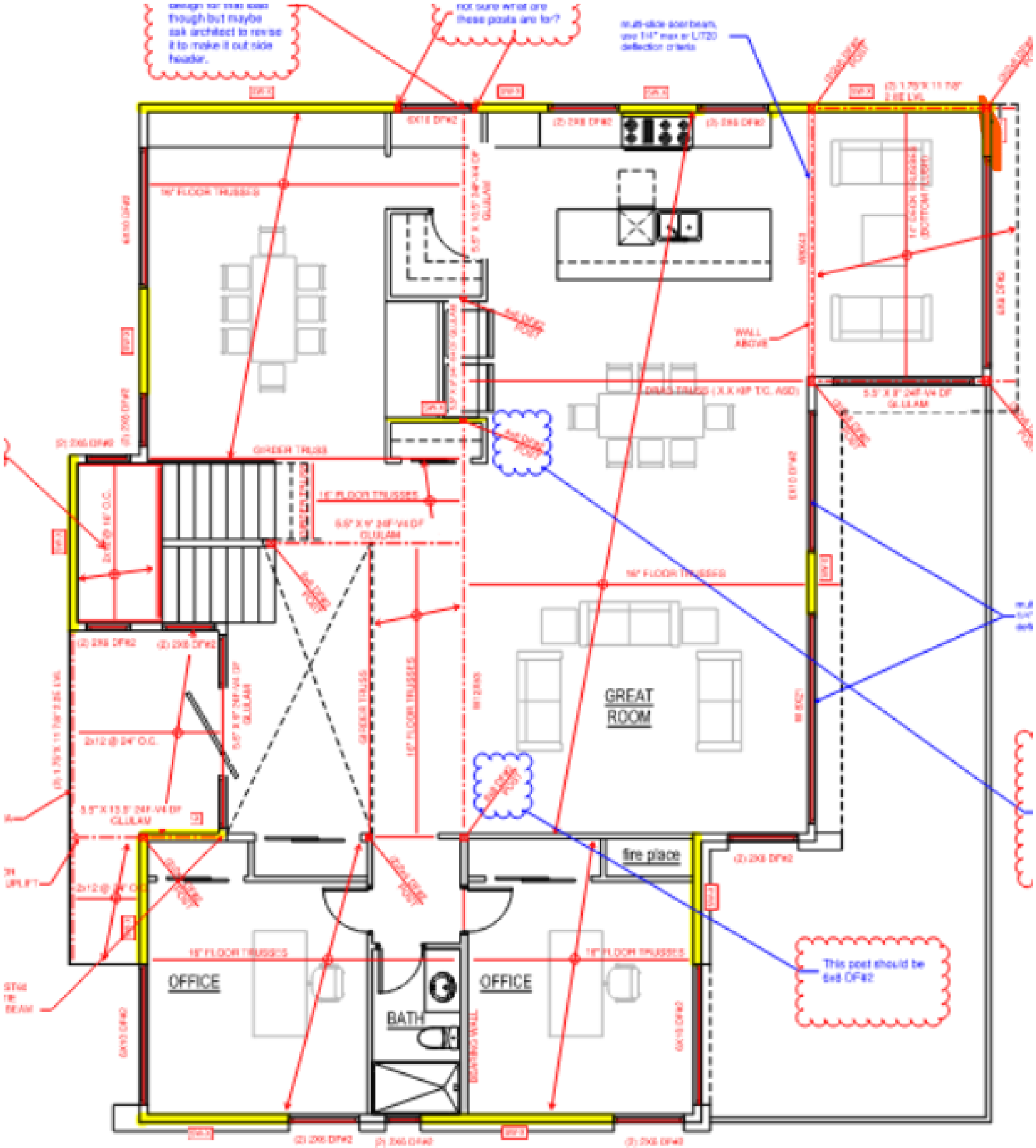
$T_{all} := MST37 = 2.705 \cdot kip$ Allowable tension load

It is less than 5% above-EOR is OK

$check_{HD} := if\left(\frac{T}{T_{all}} > 1.0, \text{"NG"}, \text{"OK"}\right)$ $ratio := \frac{T}{T_{all}} = 1.03$ $check_{HD} = \text{"NG"}$

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

Second Floor- Shear wall

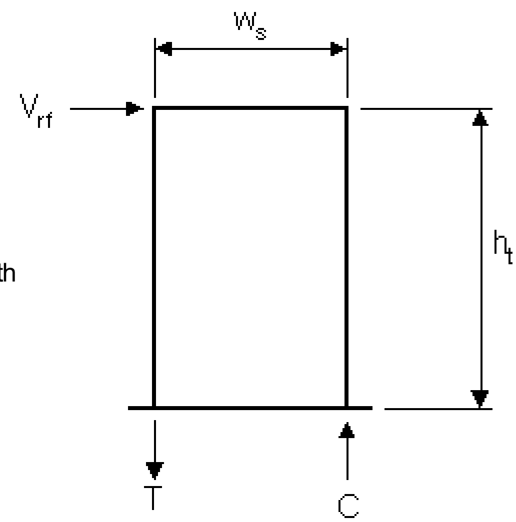


$$V_{EQ} := V_{story_2} \cdot \frac{80ft^2}{2250ft^2} = 0.977 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 6ft \cdot \left(h_{floor_3} - h_{floor_1}\right) = 4.203 \cdot kip$$

Wind load



$h_t := 10ft$ Wall height

$L_s := 3ft$ Total shear wall length

First Segment:

$w_s := 3ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

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

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125\cdot\frac{h_t}{w_s}\right)$ Aspect ratio factor $\quad (WSP) = 0.8$

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) $V_{rf.w} = 2.52 \cdot kip$

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

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

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

Resisting Forces

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

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.36 \cdot kip$

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

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

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

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

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

$\frac{w_{v.w}}{w_{all.w}} = 1.029$ $check_{wv} = "NG"$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.391$ $check_{wE} = "OK"$

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

Bottom Plate Nailing

$C_D := 1.6$

$t_{sp} := 1.5in$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 3in$ Nail spacing

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

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

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.932$ $Check_a = "OK"$

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

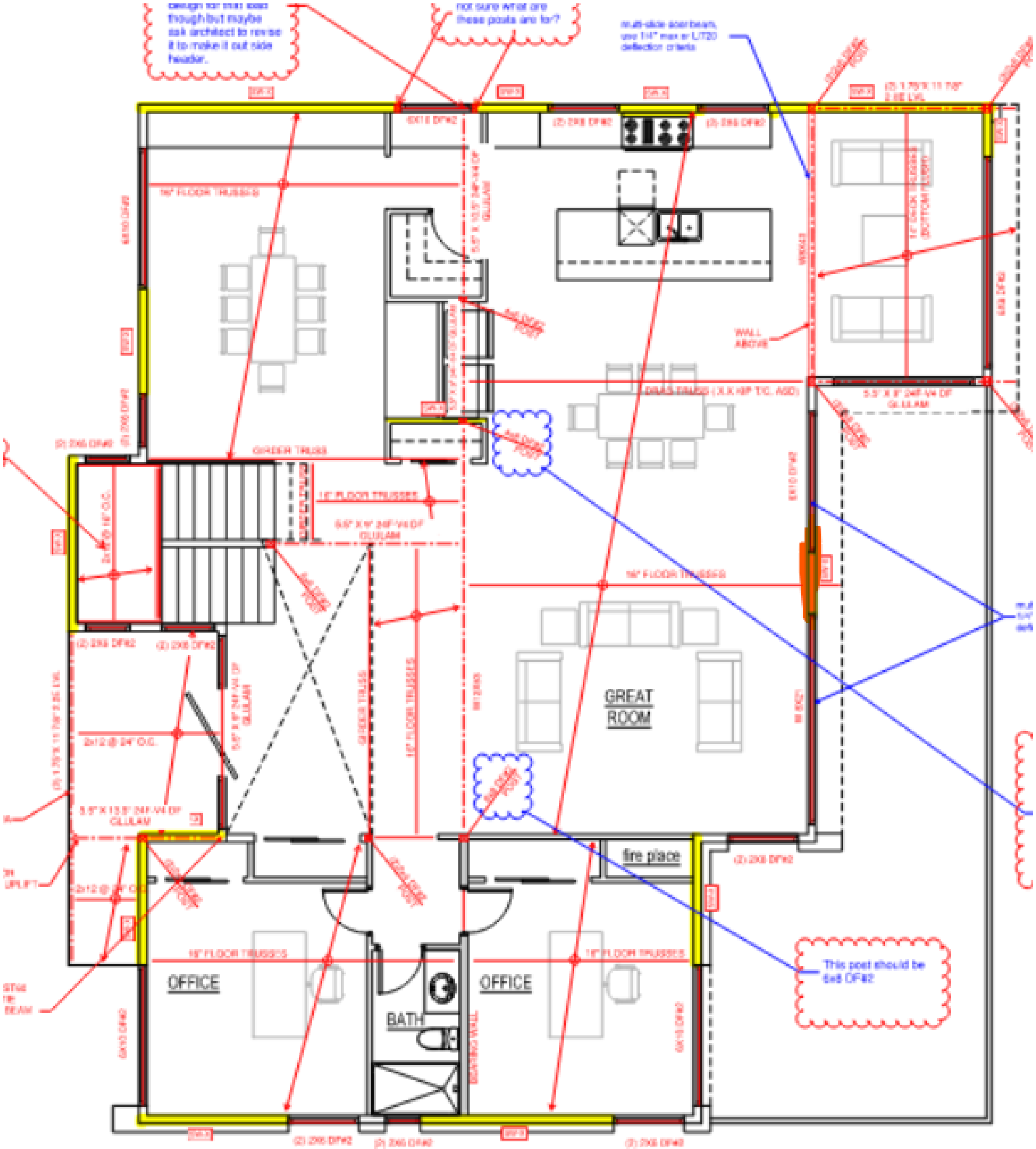
Holdown

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

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

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

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



$$V_{EQ} := V_{story_2} \cdot \frac{215ft^2}{2250ft^2} = 2.626 \cdot kip$$

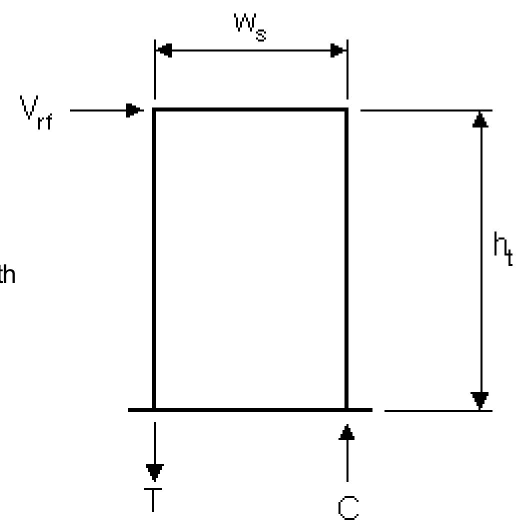
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right)\cdot 8.5ft\cdot\left(h_{floor_3} - h_{floor_1}\right) = 5.954\cdot kip$$

Wind load

$h_t := 10ft$ Wall height

$L_s := 3.5ft$ Total shear wall length



First Segment:

$w_s := 3.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

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

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125\cdot\frac{h_t}{w_s}\right)$ Aspect ratio factor $(WSP) = 0.9$

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

$V_{rf.E} := \left(0.7\cdot V_{EQ}\cdot\frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 1.84\cdot kip$

$M_{ot.w} := V_{rf.w}\cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 35.7\cdot kip\cdot ft$

$M_{ot.E} := V_{rf.E}\cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 18.4\cdot kip\cdot ft$

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

$P_{rf} = 0.997 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.42 \cdot kip$

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

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.3} \cdot n}{\Omega_s} = 1125 \cdot pl$ $check_{wv} := \text{if}\left(\frac{w_{v.w}}{w_{all.w}} > 1.0, \text{"NG"}, \text{"OK"}\right)$ It is less than 5% above-EOR is OK

$\frac{w_{v.w}}{w_{all.w}} = 0.907$ $check_{wv} = \text{"OK"}$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.3} \cdot n}{\Omega_s} = 803.6 \cdot plf$ $check_{wE} := \text{if}\left(\frac{w_{v.E}}{w_{all.E}} > 1.0, \text{"NG"}, \text{"OK"}\right)$

$\frac{w_{v.E}}{w_{all.E}} = 0.653$ $check_{wE} = \text{"OK"}$

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 $sp_a := 2.5in$ Nail spacing

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

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

$Check_a := if(V_{sp} > Z_{ll}, \text{"NG"}, \text{"OK"})$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.943$ $Check_a = \text{"OK"}$

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

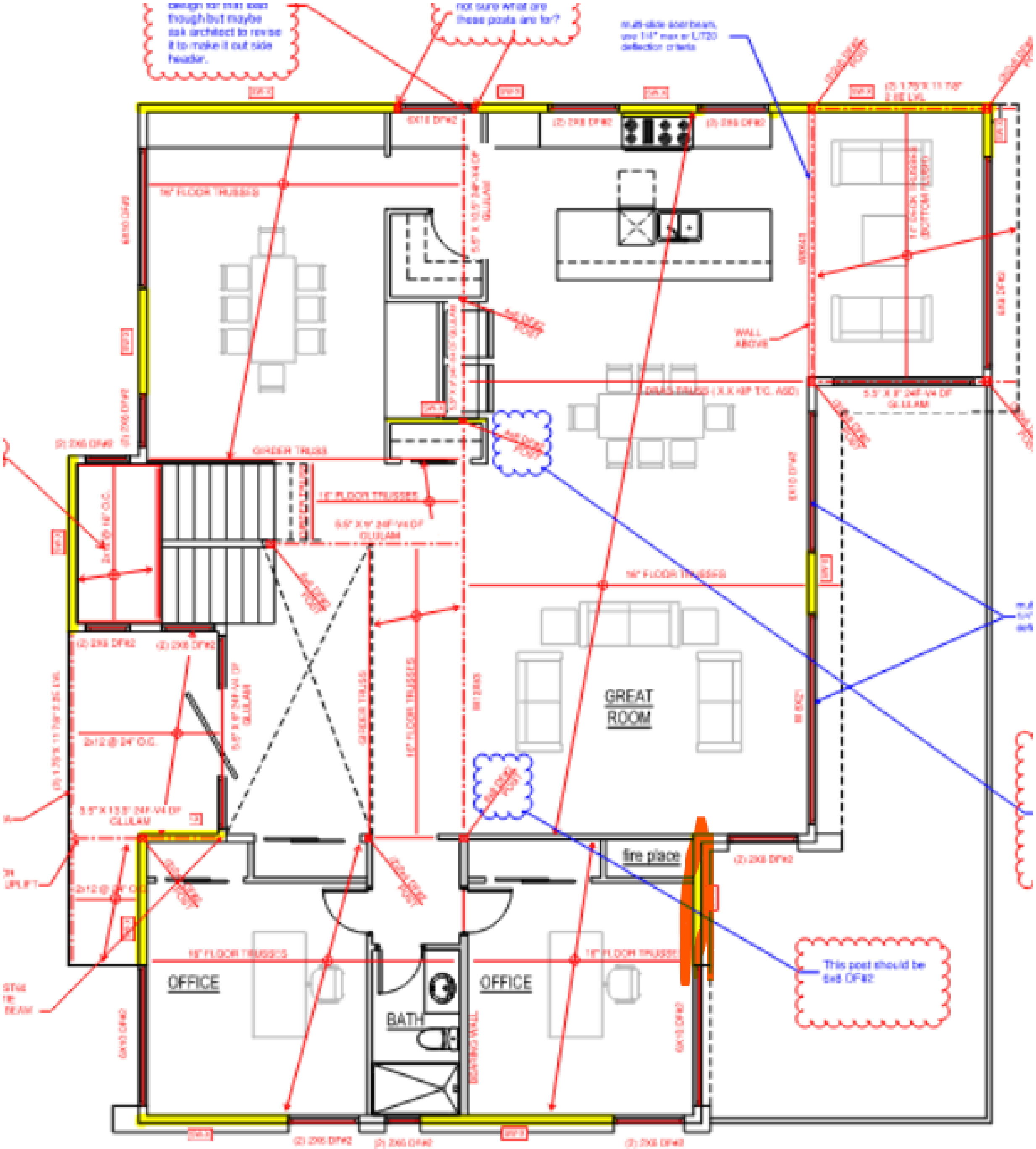
Holdown

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

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

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

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

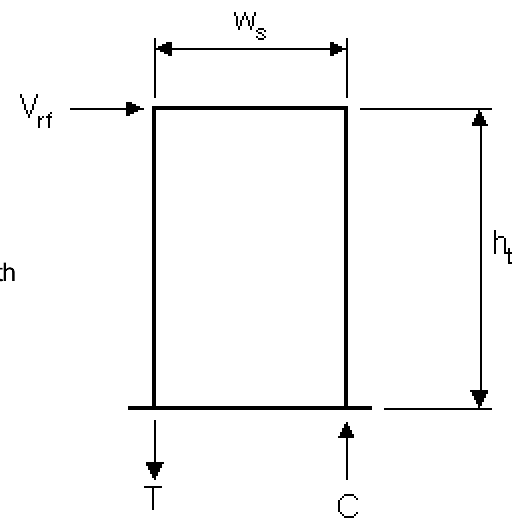


$$V_{EQ} := V_{story_2} \cdot \frac{912\,ft^2}{2250\,ft^2} = 11.138 \cdot kip$$

Tributary shear on the wall per plan dimensions

$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right)\cdot(16ft + 8in)\cdot\left(h_{floor_3} - h_{floor_1}\right) = 11.675\cdot kip$

Wind load



$h_t := 10ft$ Wall height

$L_s := 7.5ft$ Total shear wall length

First Segment:

$w_s := 7.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

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

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125\cdot\frac{h_t}{w_s}\right)$ 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) $V_{rf.w} = 7.01\cdot kip$

$V_{rf.E} := \left(0.7\cdot V_{EQ}\cdot\frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 7.8\cdot kip$

$M_{ot.w} := V_{rf.w}\cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 70.1\cdot kip\cdot ft$

$M_{ot.E} := V_{rf.E}\cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 78\cdot kip\cdot ft$

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

$P_{rf} = 1.463 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.9 \cdot kip$

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

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

$\frac{w_{v.w}}{w_{all.w}} = 0.57$ $check_{wv} = "OK"$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.888$ $check_{wE} = "OK"$

Double Sided 7/16" sheathing w/ 8d @ 2**" O.C.** Panel Edges @ 12" O.C.

Interior Supports (ref. table 4.3A)

Bottom Plate Nailing

$C_D := 1.6$

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

$dia_a := 16d$ Nail Size

$sp_a := 3in$ Nail spacing

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.234 \cdot kip$ Shear load to each nail

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$

$ratio_a := \frac{V_{sp}}{Z_{ll}} = 1.035$

$Check_a = "NG"$

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

It is less than 5% above-EOR is OK

Holdown

$$T := \frac{max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 25.279 \cdot kip$$

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

$check_T = "HD REQ'D"$

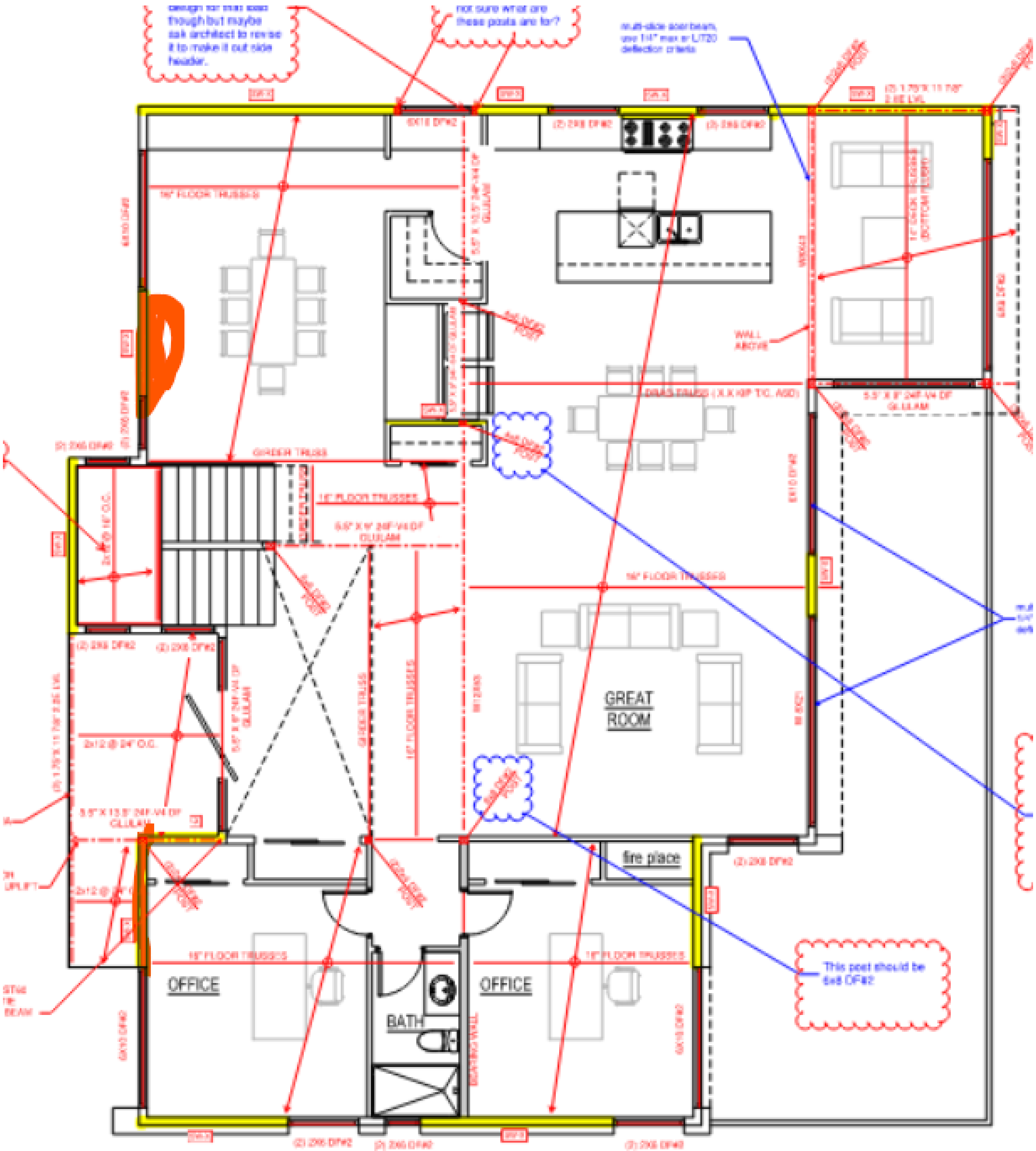
$T_{all} := 4MST60 = 24.94 \cdot kip$ Allowable tension load

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

$ratio := \frac{T}{T_{all}} = 1.014$

$check_{HD} = "NG"$

It is less than 5% above-EOR is OK

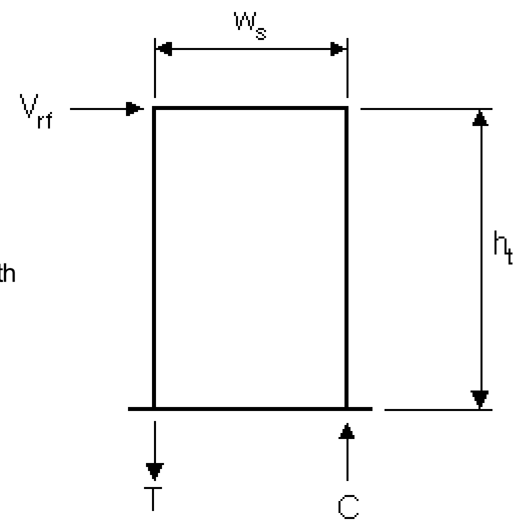

GREAT
ROOM
OFFICE
OFFICE
BATH
fire place
This post should be 6x8 DF#2
16" FLOOR TRUSSES
GIRDER TRUSS
WALL ABOVE

$$V_{EQ} := V_{story_2} \cdot \frac{1230ft^2}{2250ft^2} = 15.021 \cdot kip$$

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot (16ft + 8in) \cdot \left(h_{floor_3} - h_{floor_1}\right) = 11.675 \cdot kip$$

Wind load



$h_t := 10ft$

Wall height

$L_s := 7.5ft + 6ft$

Total shear wall length

First Segment:

$w_s := 6ft$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 1.667$$

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

$$check_{ratio} = \text{"OK"}$$

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

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) $V_{rf.w} = 3.11 \cdot kip$

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

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

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

Resisting Forces

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

$P_{rf} = 1.62 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.72 \cdot kip$

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

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

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

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

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.3} \cdot n}{\Omega_s} = 1260 \cdot pl$ $check_{wv} := if\left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK"\right)$

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

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.3} \cdot n}{\Omega_s} = 900 \cdot plf$ $check_{wE} := if\left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK"\right)$

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

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

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

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

Holdown

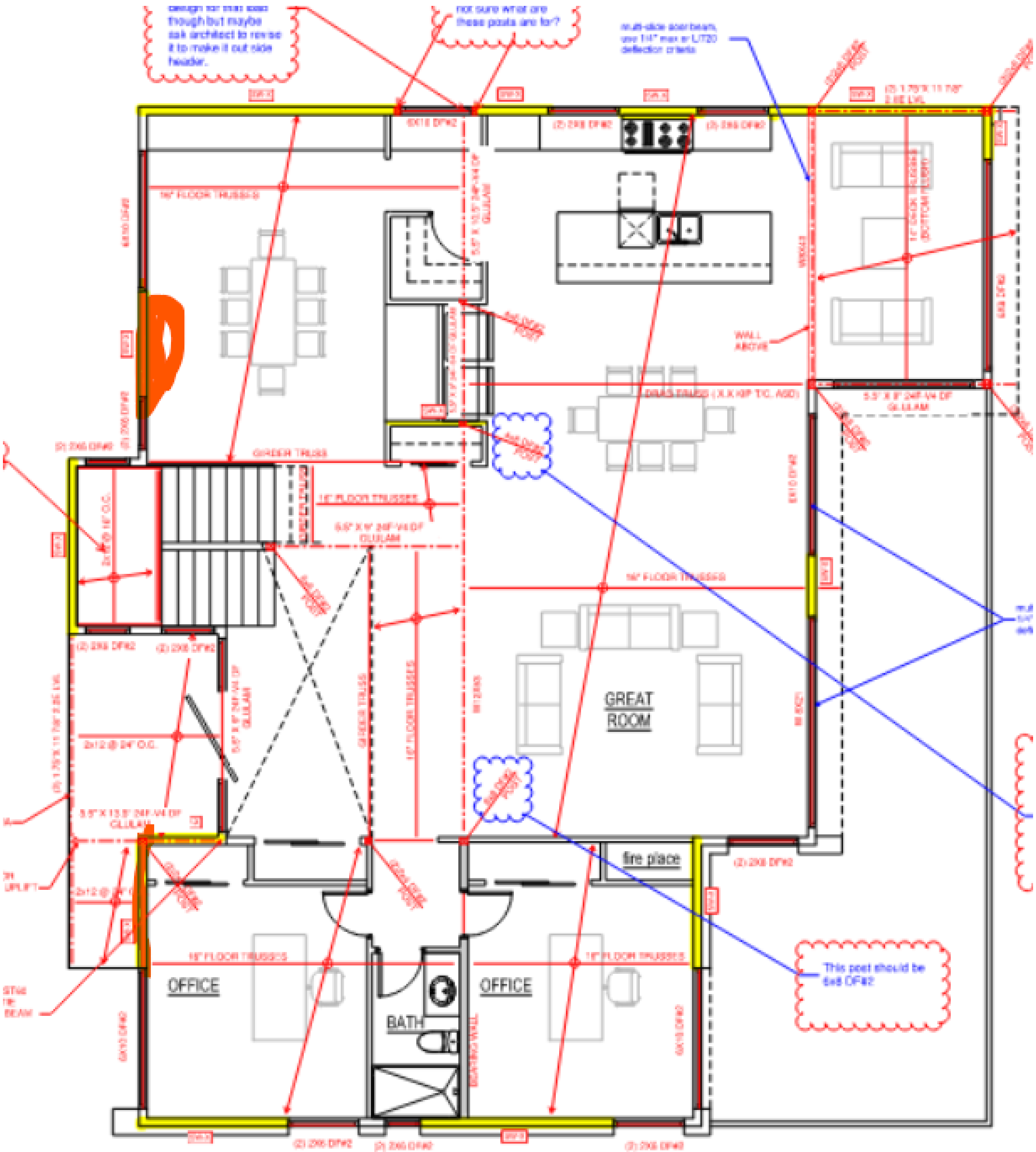
$$T := \frac{\max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 18.77 \cdot kip$$

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

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

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

It is less than 5% above-EOR is OK


GREAT
ROOM
fire place
OFFICE
BATH
OFFICE
This post should be
6x8 DF#2

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

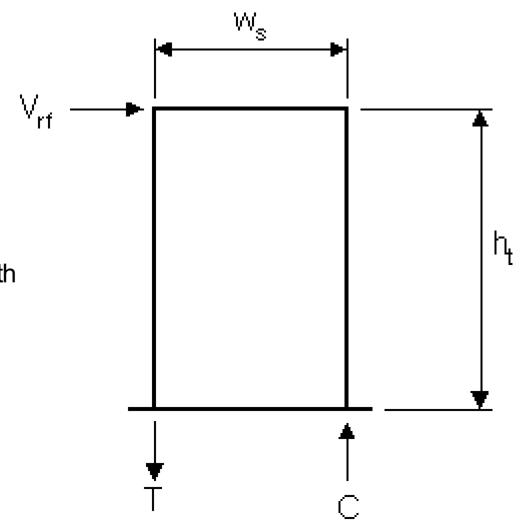
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot (3ft) \cdot \left(h_{floor_3} - h_{floor_1}\right) = 2.102 \cdot kip$$

Wind load

$h_t := 10ft$ Wall height

$L_s := 9.5ft$ Total shear wall length



First Segment:

$w_s := 9.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

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

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

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) $V_{rf.w} = 1.26 \cdot kip$

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

Seismic shear load at top of wall (ASD) $V_{rf.E} = 0.26 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 12.6 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 2.6 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := 0$

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 1.14 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 3.249 \cdot kip \cdot ft$

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

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

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

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

$\frac{w_{v.w}}{w_{all.w}} = 0.396$ $check_{wv} = "OK"$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.112$ $check_{wE} = "OK"$

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

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

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

Holdown

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

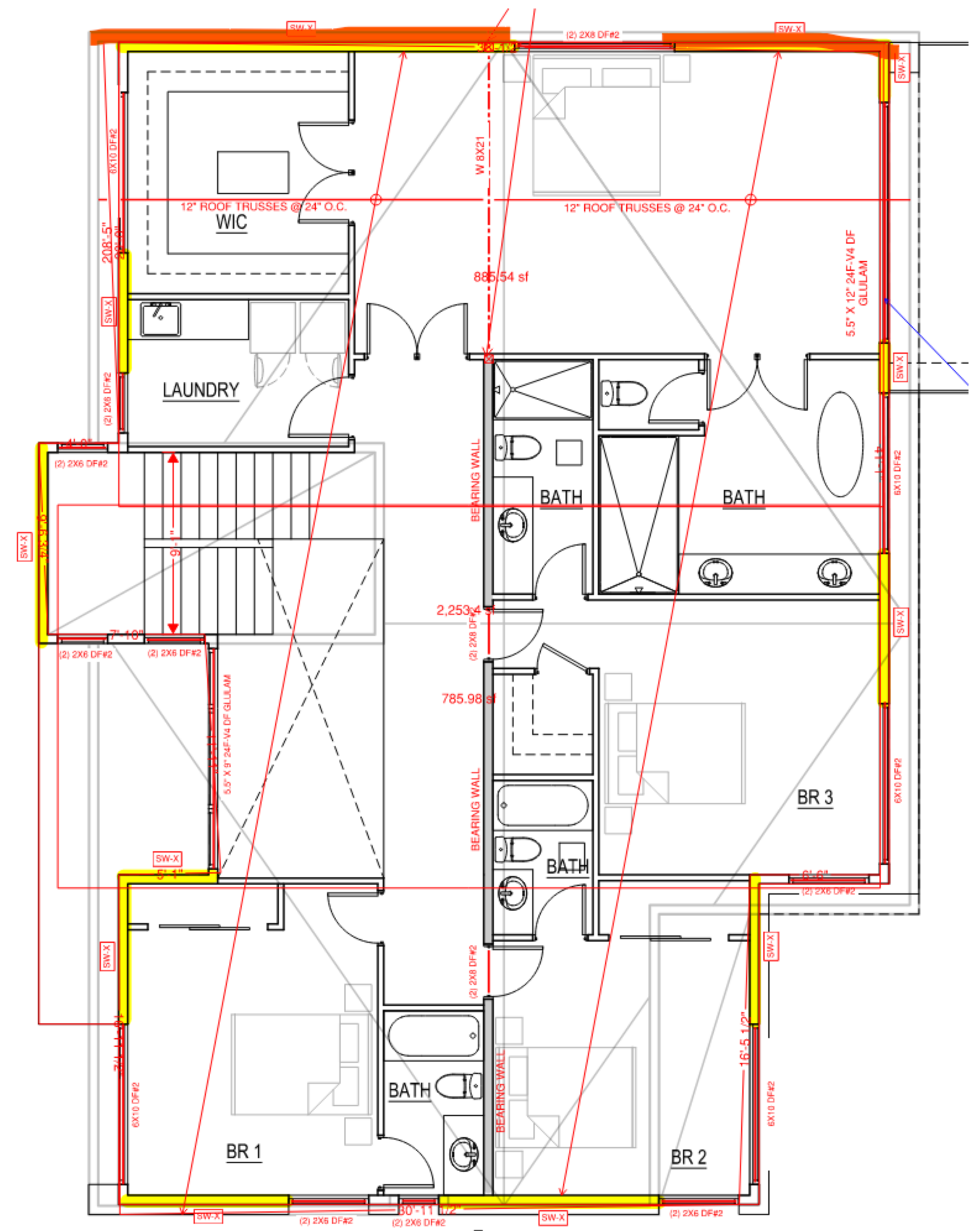
$check_T := \text{if}(T > 150\text{lbf}, \text{"HD REQ'D"}, \text{"NOT REQ'D"})$ $check_T = \text{"HD REQ'D"}$

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

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

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

Third Floor- Shear wall



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

Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 24ft \cdot \left(h_{floor_3} - h_{floor_2}\right) = 8.772 \cdot kip$$

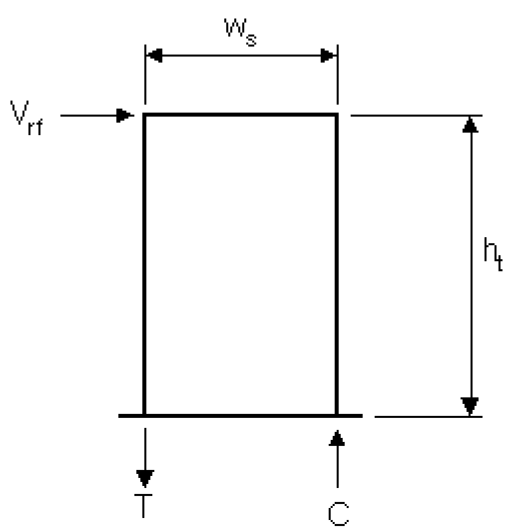
Wind load

$h_t := 9 \cdot ft$

Wall height

$L_s := 16ft + 8in + 19ft + 9in$

Total shear wall length



First Segment:

$w_s := 16ft + 8in$

Segment wall length

Aspect Ratio (Blocked Shear Wall)

$$\frac{h_t}{w_s} = 0.54 \qquad check_{ratio} := if\left(\frac{h_t}{w_s} > 3.5, "NG", "OK"\right) \qquad check_{ratio} = "OK"$$

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

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)

$V_{rf.w} = 2.41 \cdot kip$

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

Seismic shear load at top of wall (ASD)

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

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 21.7 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 17.5 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := 0$

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 1.8 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 9 \cdot kip \cdot ft$

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

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

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

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

$\frac{w_{v.w}}{w_{all.w}} = 0.431$ $check_{wv} = "OK"$

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

$check_{wE} = "OK"$

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

Bottom Plate Nailing

$C_D := 1.6$

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

$dia_a := 16d$ Nail Size

$sp_a := 8in$ Nail spacing

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

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

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

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

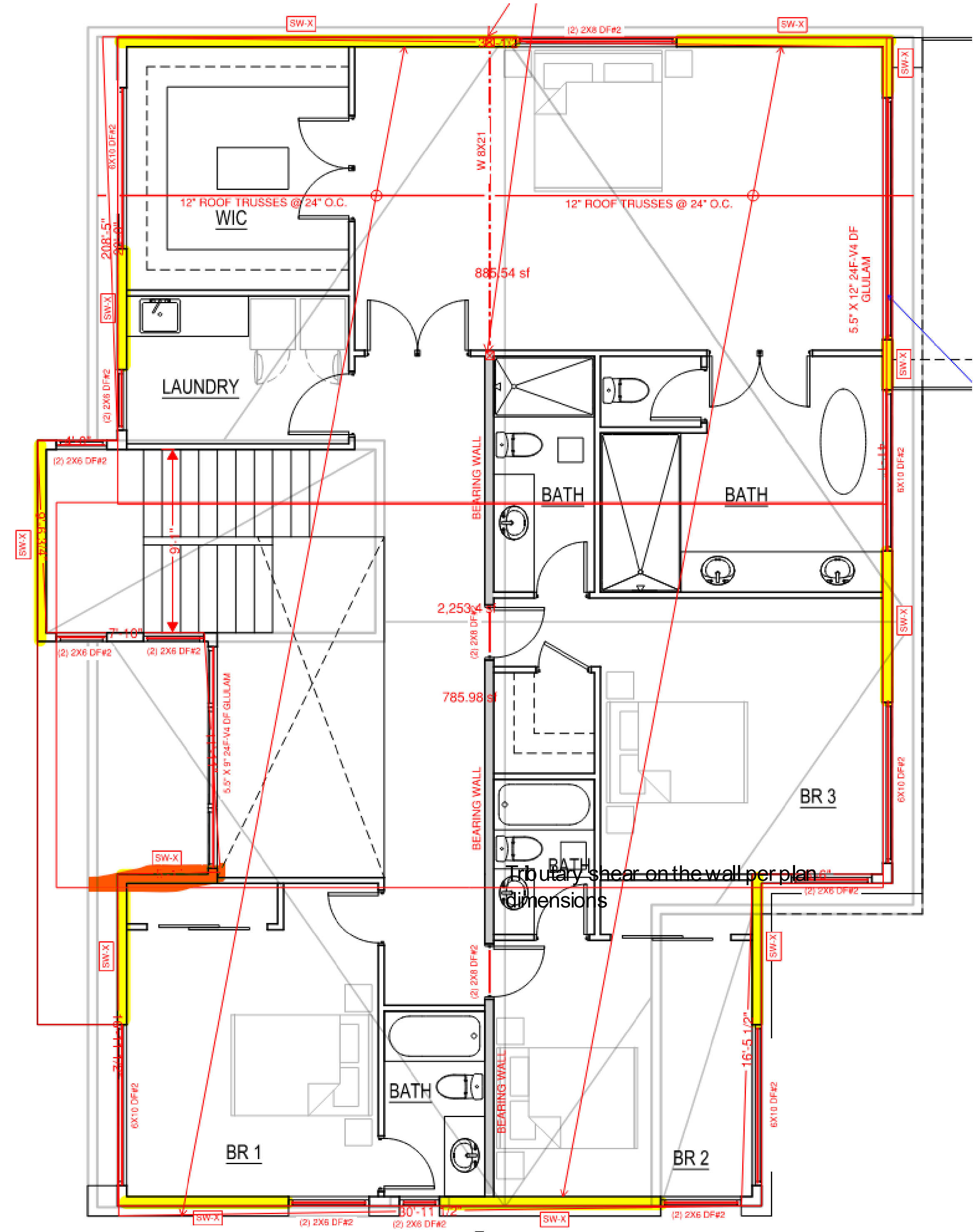
Holdown

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

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

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

$check_{HD} := if\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.772$ $check_{HD} = "OK"$


WIC
LAUNDRY
12" ROOF TRUSSES @ 24" O.C.
W 8X21
885.54 sf
5.5" X 12" 24F-V4 DF GLULAM
BEARING WALL
BATH
BATH
2,253.4 sf
785.98 sf
5.5" X 9" 24F-V4 DF GLULAM
BR 3
Tributary shear on the wall per plan dimensions
BR 1
BATH
BR 2
SW-X
(2) 2X8 DF#2
(2) 2X6 DF#2
6X10 DF#2
16'-5 1/2"
7'-10"
9'-1"

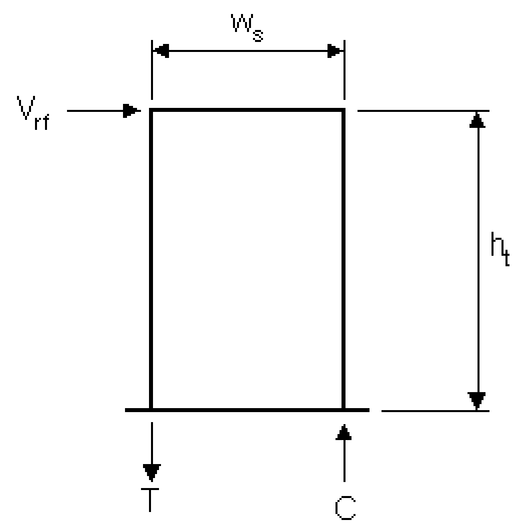
$$V_{EQ} := V_{story_3} \cdot \frac{925ft^2}{2250ft^2} = 6.195 \cdot kip$$

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 26.5ft \cdot \left(h_{floor_3} - h_{floor_2}\right) = 9.685 \cdot kip$$

Wind load

$h_t := 9 \cdot ft$ Wall height

$L_s := 4.5ft$ Total shear wall length



First Segment:

$w_s := 4.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 2$

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

$check_{ratio} = "OK"$

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ 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) $V_{rf.w} = 5.81 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 4.34 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 52.3 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 39 \cdot kip \cdot ft$

Resisting Forces

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

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.486 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2}\right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 0.656 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 1291 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 964 \cdot plf$ Seismic shear flow

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.2} \cdot n}{\Omega_s} = 820 \cdot plf$

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

$\frac{w_{v.w}}{w_{all.w}} = 1.575$ $check_{wv} = "NG"$

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

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

$check_{wE} = \text{"NG"}$

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

Bottom Plate Nailing

$C_D := 1.6$

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

$dia_a := 16d$ Nail Size

$sp_a := 8in$ Nail spacing

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.861 \cdot kip$ Shear load to each nail

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

$ratio_a := \frac{V_{sp}}{Z_{ll}} = 3.816$

$Check_a = \text{"NG"}$

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

Holdown

$$T := \frac{max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 21.537 \cdot kip$$

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

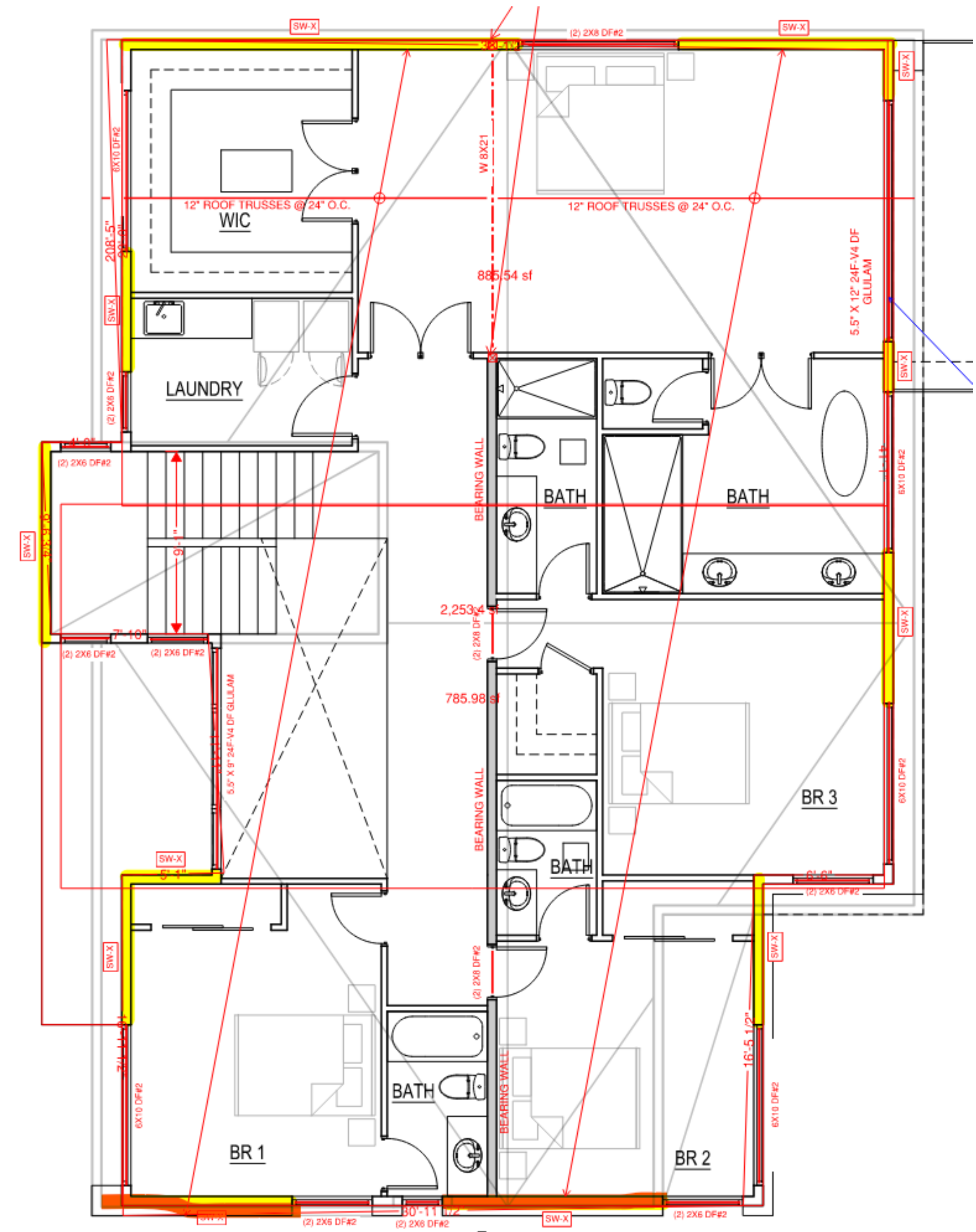
$check_T = \text{"HD REQ'D"}$

$T_{all} := MST60 = 6.235 \cdot kip$ Allowable tension load

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

$ratio := \frac{T}{T_{all}} = 3.454$

$check_{HD} = \text{"NG"}$



$$V_{EQ} := V_{story_3} \cdot \frac{260ft^2}{2250ft^2} = 1.741 \cdot kip$$

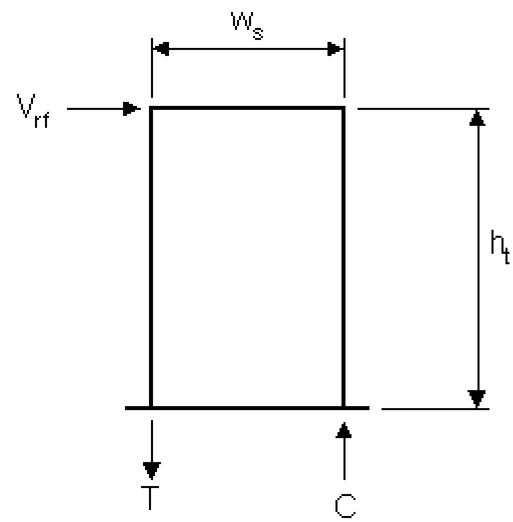
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 9ft \cdot \left(h_{floor_3} - h_{floor_2}\right) = 3.289 \cdot kip$$

Wind load

$h_t := 9 \cdot ft$ Wall height

$L_s := 8.5ft + 11ft$ Total shear wall length



First Segment:

$w_s := 8.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 1.059$ $check_{ratio} := if\left(\frac{h_t}{w_s} > 3.5, "NG", "OK"\right)$ $check_{ratio} = "OK"$

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ 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) $V_{rf.w} = 0.86 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 0.53 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 7.7 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 4.8 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := 0$

Total gravity load on wall

$P_{rf} = 0 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.918 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 2.341 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 101 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 63 \cdot plf$ Seismic shear flow

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

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

$\frac{w_{v.w}}{w_{all.w}} = 0.302$ $check_{wv} = \text{"OK"}$

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

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

$\frac{w_{v.E}}{w_{all.E}} = 0.26$ $check_{wE} = \text{"OK"}$

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

Bottom Plate Nailing

$C_D := 1.6$

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

$dia_a := 16d$ Nail Size

$sp_a := 8in$ Nail spacing

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.067 \cdot kip$ Shear load to each nail

$Check_a := if\left(V_{sp} > Z_{ll}, "NG", "OK"\right)$ $ratio_a := \dfrac{V_{sp}}{Z_{ll}} = 0.299$ $Check_a = "OK"$

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

Holdown

$$T := \frac{max\left(M_{ot.w}, M_{ot.E} \cdot \Omega_o\right) - M_{res}}{w_s} = 1.131 \cdot kip$$

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

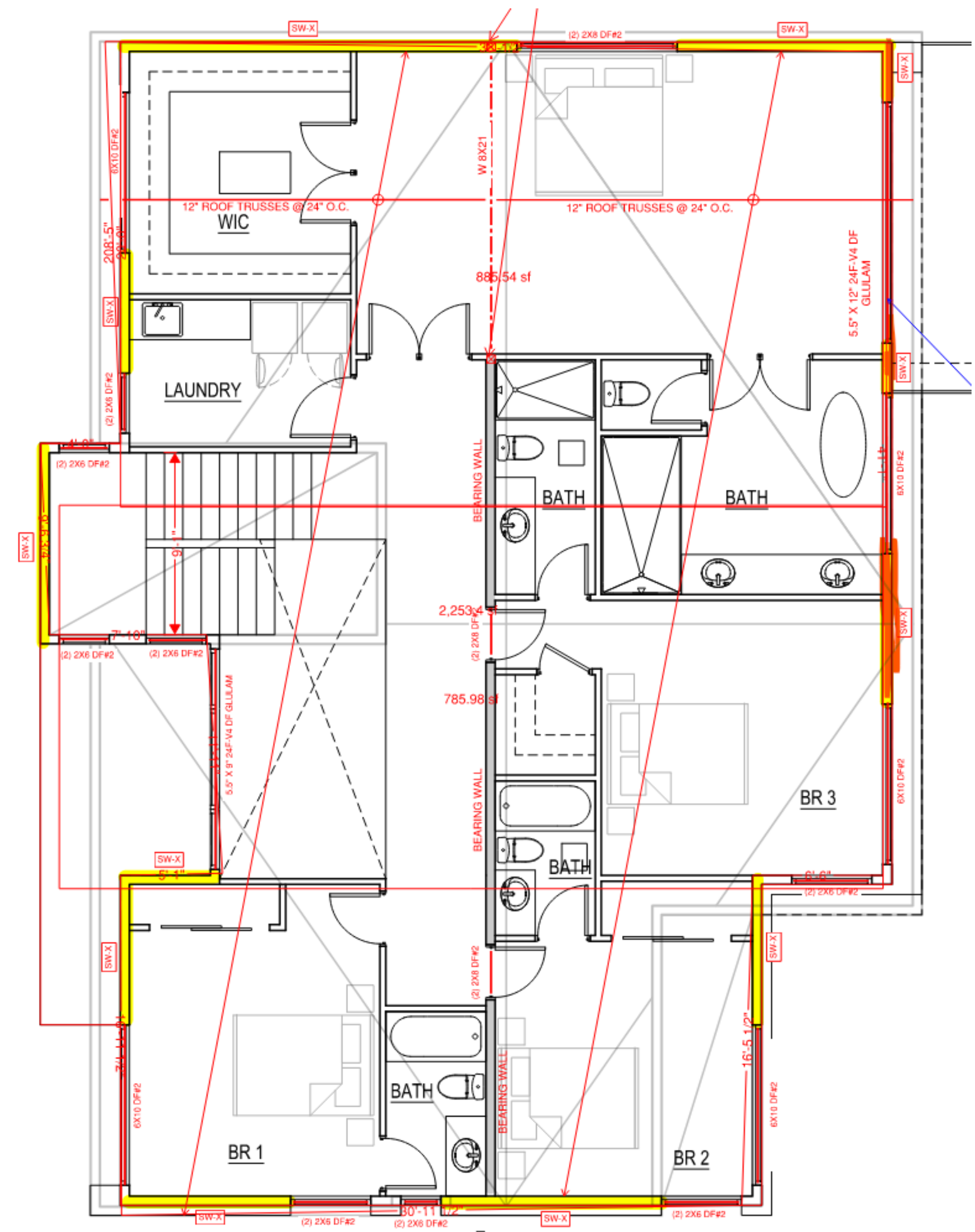
$T_{all} := MST37 = 2.705 \cdot kip$ Allowable tension load

$check_{HD} := if\left(\dfrac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \dfrac{T}{T_{all}} = 0.418$ $check_{HD} = "OK"$

Shear Wall Design for Lateral Load in North-South

Direction per NDS-SDPWS2015

Third Floor- Shear wall



$$V_{EQ} := V_{story_3} \cdot \frac{160ft^2}{2250ft^2} = 1.072 \cdot kip$$

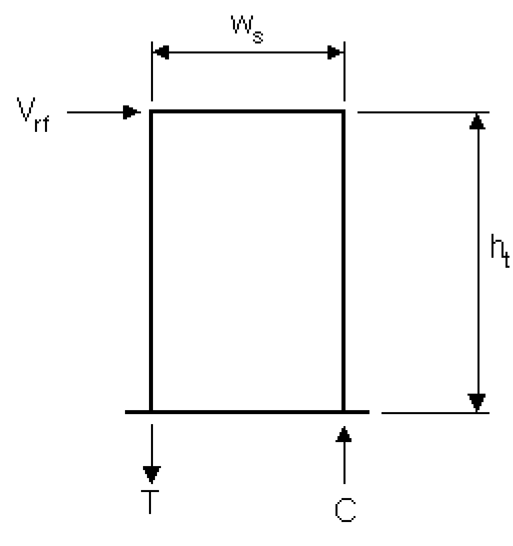
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 4ft \cdot \left(h_{floor_3} - h_{floor_2}\right) = 1.462 \cdot kip$$

Wind load

$h_t := 9 \cdot ft$ Wall height

$L_s := 3ft + 7.5ft$ Total shear wall length



First Segment:

$w_s := 3ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 3$ $\quad check_{ratio} := if\left(\frac{h_t}{w_s} > 3.5, "NG", "OK"\right)$ $\quad check_{ratio} = "OK"$

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ Aspect ratio factor $\quad (WSP) = 0.9$

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) $\quad V_{rf.w} = 0.25 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $\quad V_{rf.E} = 0.21 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 2.3 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 1.9 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := DL_{roof} \cdot \frac{20ft}{2} \cdot w_s$ Total gravity load on wall

$P_{rf} = 0.45 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.324 \cdot kip$

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

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.6} \cdot n}{\Omega_s} = 293.1 \cdot plf$ $check_{wv} := if\left(\frac{w_{v.w}}{w_{all.w}} > 1.0, "NG", "OK" \right)$

$\frac{w_{v.w}}{w_{all.w}} = 0.285$ $check_{wv} = "OK"$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.6} \cdot n}{\Omega_s} = 210 \cdot plf$ $check_{wE} := if\left(\frac{w_{v.E}}{w_{all.E}} > 1.0, "NG", "OK" \right)$

$check_{wE} = "OK"$

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

Bottom Plate Nailing

$C_D := 1.6$

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

$dia_a := 16d$ Nail Size

$sp_a := 8in$ Nail spacing

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.056 \cdot kip$ Shear load to each nail

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.247$ $Check_a = "OK"$

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

Holdown

$$T := \frac{max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 1.375 \cdot kip$$

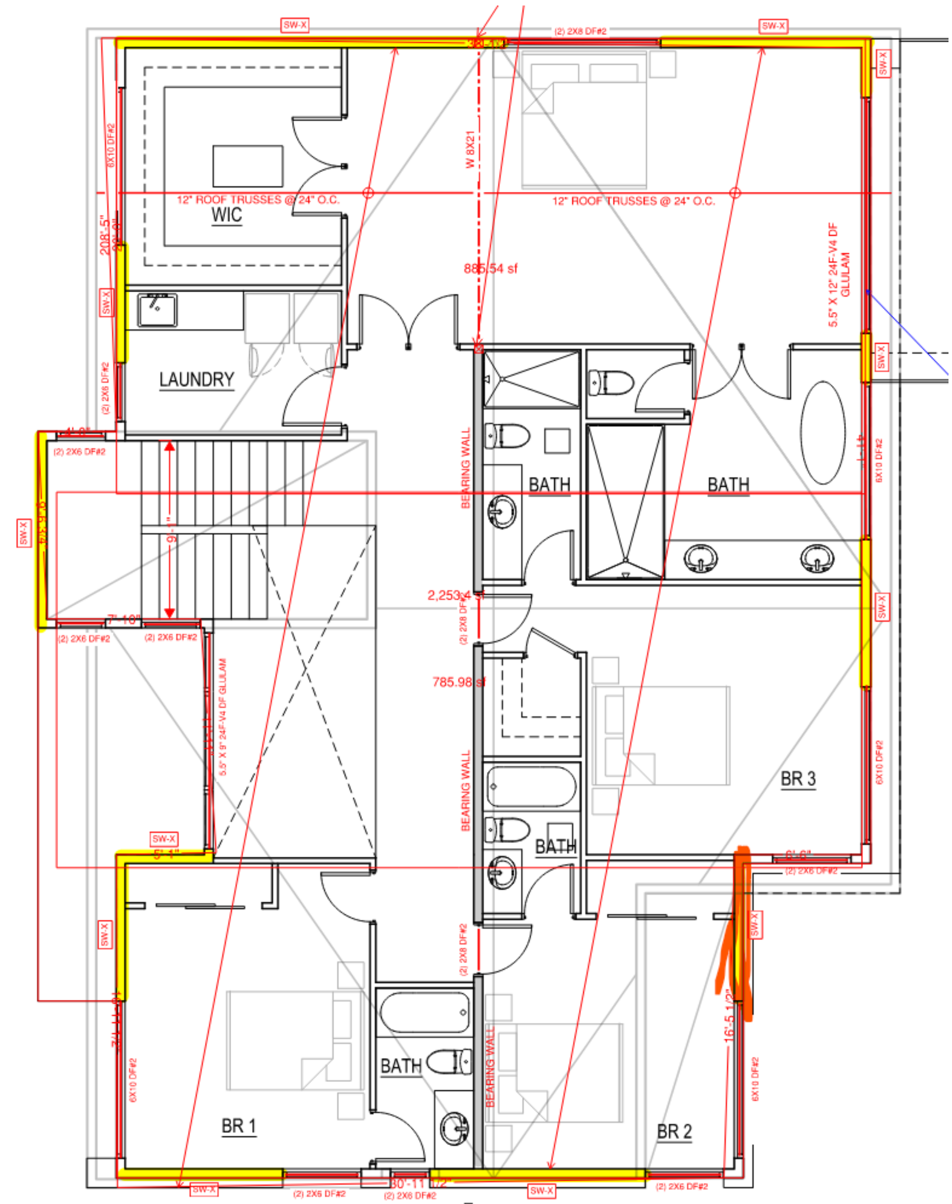
$check_T := if(T > 150lbf, "HD REQ'D", "NOT REQ'D")$ $check_T = "HD REQ'D"$

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

$check_{HD} := if\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.508$ $check_{HD} = "OK"$

$T_{all} := DTT2Z = 2.145 \cdot kip$ Allowable tension load

$check_{HD} := if\left(\frac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \frac{T}{T_{all}} = 0.641$ $check_{HD} = "OK"$



$$V_{EQ} := V_{story_3} \cdot \frac{1100ft^2}{2250ft^2} = 7.367 \cdot kip$$

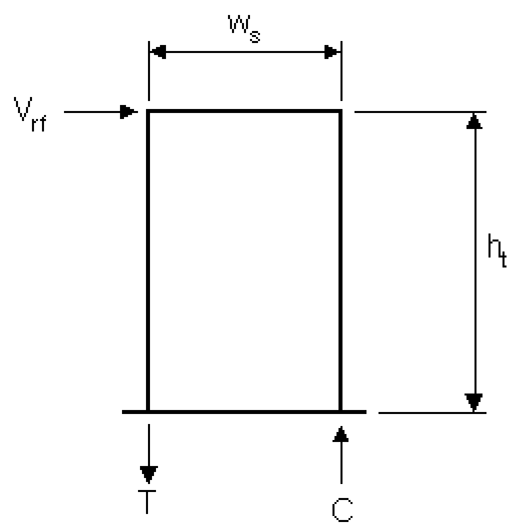
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 20ft \cdot \left(h_{floor_3} - h_{floor_2}\right) = 7.31 \cdot kip$$

Wind load

$h_t := 9 \cdot ft$ Wall height

$L_s := 7.5ft$ Total shear wall length



First Segment:

$w_s := 7.5ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 1.2$ $check_{ratio} := if\left(\frac{h_t}{w_s} > 3.5, "NG", "OK"\right)$ $check_{ratio} = "OK"$

$(WSP) := if\left(\frac{h_t}{w_s} < 2.0, 1.0, 1.25 - 0.125 \cdot \frac{h_t}{w_s}\right)$ 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) $V_{rf.w} = 4.39 \cdot kip$

$V_{rf.E} := \left(0.7 \cdot V_{EQ} \cdot \frac{w_s}{L_s}\right)$ Seismic shear load at top of wall (ASD) $V_{rf.E} = 5.16 \cdot kip$

$M_{ot.w} := V_{rf.w} \cdot h_t$ Overturning moment (ASD) $M_{ot.w} = 39.5 \cdot kip \cdot ft$

$M_{ot.E} := V_{rf.E} \cdot h_t$ Overturning moment (ASD) $M_{ot.E} = 46.4 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := DL_{roof} \cdot \frac{13ft}{2} \cdot w_s$

Total gravity load on wall

$P_{rf} = 0.731 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.81 \cdot kip$

$M_{res} := \left[(P_{rf} + P_w) \cdot \frac{w_s}{2} \right] \cdot 0.6$ Resisting moment (ASD) $M_{res} = 3.468 \cdot kip \cdot ft$

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

$w_{v.w} := \frac{V_{rf.w}}{w_s} = 585 \cdot plf$ Wind shear flow

$w_{v.E} := \frac{V_{rf.E}}{w_s} = 688 \cdot plf$ Seismic shear flow

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.4} \cdot n}{\Omega_s} = 980 \cdot plf$

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

$\frac{w_{v.w}}{w_{all.w}} = 0.597$ $check_{wv} = "OK"$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.4} \cdot n}{\Omega_s} = 700 \cdot plf$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.982$ $check_{wE} = "OK"$

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

Bottom Plate Nailing

$C_D := 1.6$

$t_{sp} := 1.5in$ Sill plate thickness $dia_a := 16d$ Nail Size $sp_a := 4.5in$ Nail spacing

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.219 \cdot kip$ Shear load to each nail

$Check_a := if(V_{sp} > Z_{ll}, "NG", "OK")$ $ratio_a := \dfrac{V_{sp}}{Z_{ll}} = 0.972$ $Check_a = "OK"$

Use 16d Nail at 4.5"o.c. Staggered

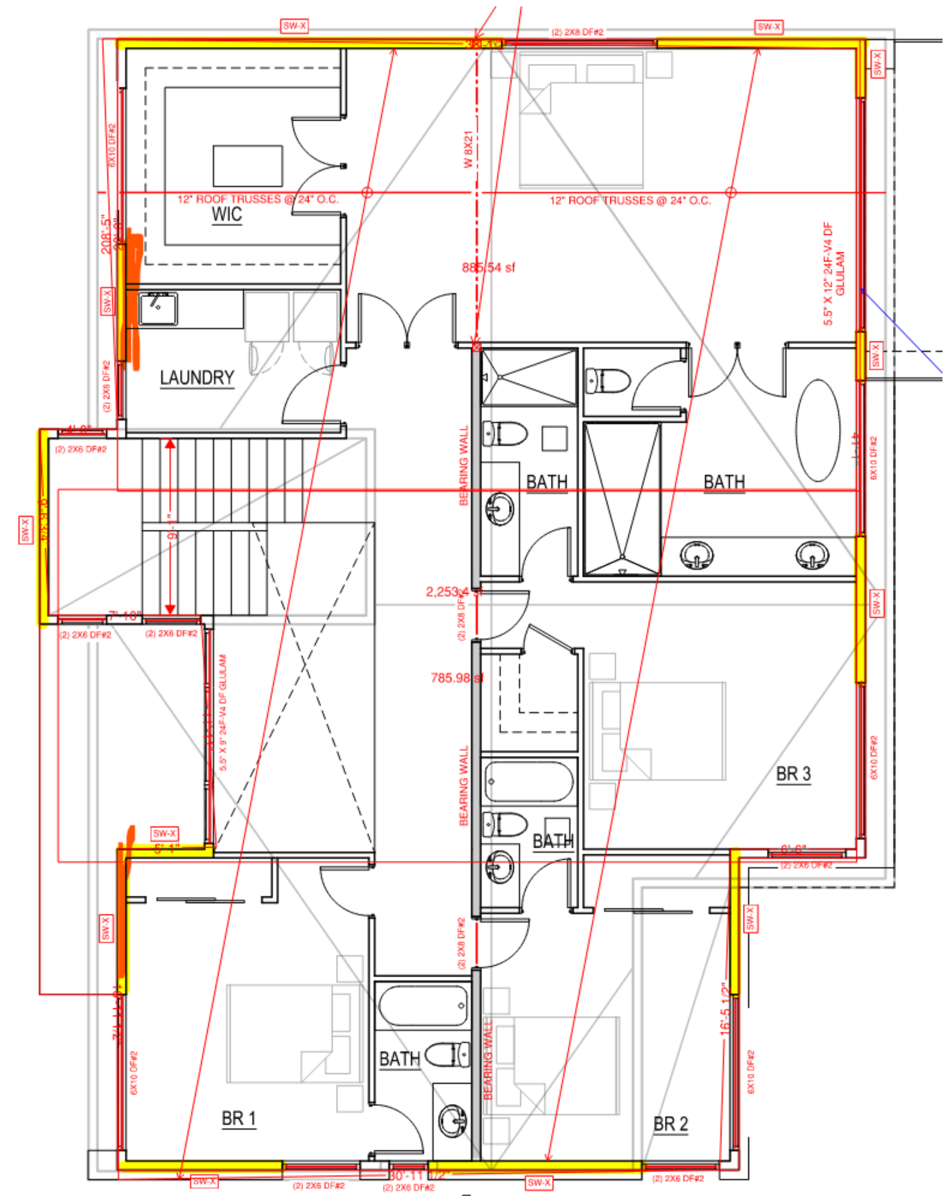
Holdown

$$T := \frac{max(M_{ot.w}, M_{ot.E} \cdot \Omega_o) - M_{res}}{w_s} = 15.009 \cdot kip$$

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

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

$check_{HD} := if\left(\dfrac{T}{T_{all}} > 1.0, "NG", "OK"\right)$ $ratio := \dfrac{T}{T_{all}} = 0.802$ $check_{HD} = "OK"$



$$V_{EQ} := V_{story_3} \cdot \frac{900ft^2}{2250ft^2} = 6.028 \cdot kip$$

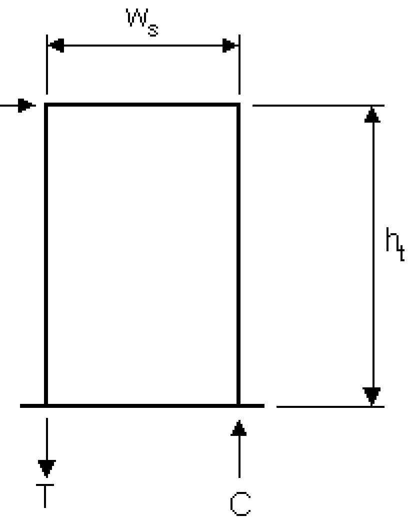
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 17ft \cdot \left(h_{floor_3} - h_{floor_2}\right) = 6.213 \cdot kip$$

Wind load

$h_t := 9 \cdot ft$ Wall height

$L_s := 6ft + 2in + 7.5ft$ Total shear wall length



First Segment:

$w_s := 6ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 1.5$

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

$check_{ratio} = \text{"OK"}$

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

$V_{rf.w} = 1.64 \cdot kip$

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

$V_{rf.E} = 1.85 \cdot kip$

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

$M_{ot.w} = 14.7 \cdot kip \cdot ft$

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

$M_{ot.E} = 16.7 \cdot kip \cdot ft$

Resisting Forces

$P_{rf} := DL_{roof} \cdot \frac{17ft + 9in}{2} \cdot w_s$

Total gravity load on wall

$P_{rf} = 0.799 \cdot kip$

$P_w := W_{ext} \cdot (h_t) \cdot (w_s)$ Wall self weight load $P_w = 0.648 \cdot kip$

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

$w_{all.w} := \frac{(WSP) \cdot v_{w.7\_16.8d.4} \cdot n}{\Omega_s} = 490 \cdot plf$

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

$\frac{w_{v.w}}{w_{all.w}} = 0.557$ $check_{wv} = \text{"OK"}$

$w_{all.E} := \frac{(WSP) \cdot v_{s.7\_16.8d.4} \cdot n}{\Omega_s} = 350 \cdot plf$

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

$\frac{w_{v.E}}{w_{all.E}} = 0.882$ $check_{wE} = \text{"OK"}$

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

Bottom Plate Nailing

$C_D := 1.6$

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

$dia_a := 16d$ Nail Size

$sp_a := 8in$ Nail spacing

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

$V_{sp} := w_{v.w} \cdot sp_a = 0.182 \cdot kip$ Shear load to each nail

$Check_a := if\left(V_{sp} > Z_{ll}, "NG", "OK"\right)$

$ratio_a := \frac{V_{sp}}{Z_{ll}} = 0.806$

$Check_a = "OK"$

Use 16d Nail at 4.5"o.c. Staggered

Holdown

$$T := \frac{max\left(M_{ot.w}, M_{ot.E} \cdot \Omega_o\right) - M_{res}}{w_s} = 6.512 \cdot kip$$

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

$check_T = "HD REQ'D"$

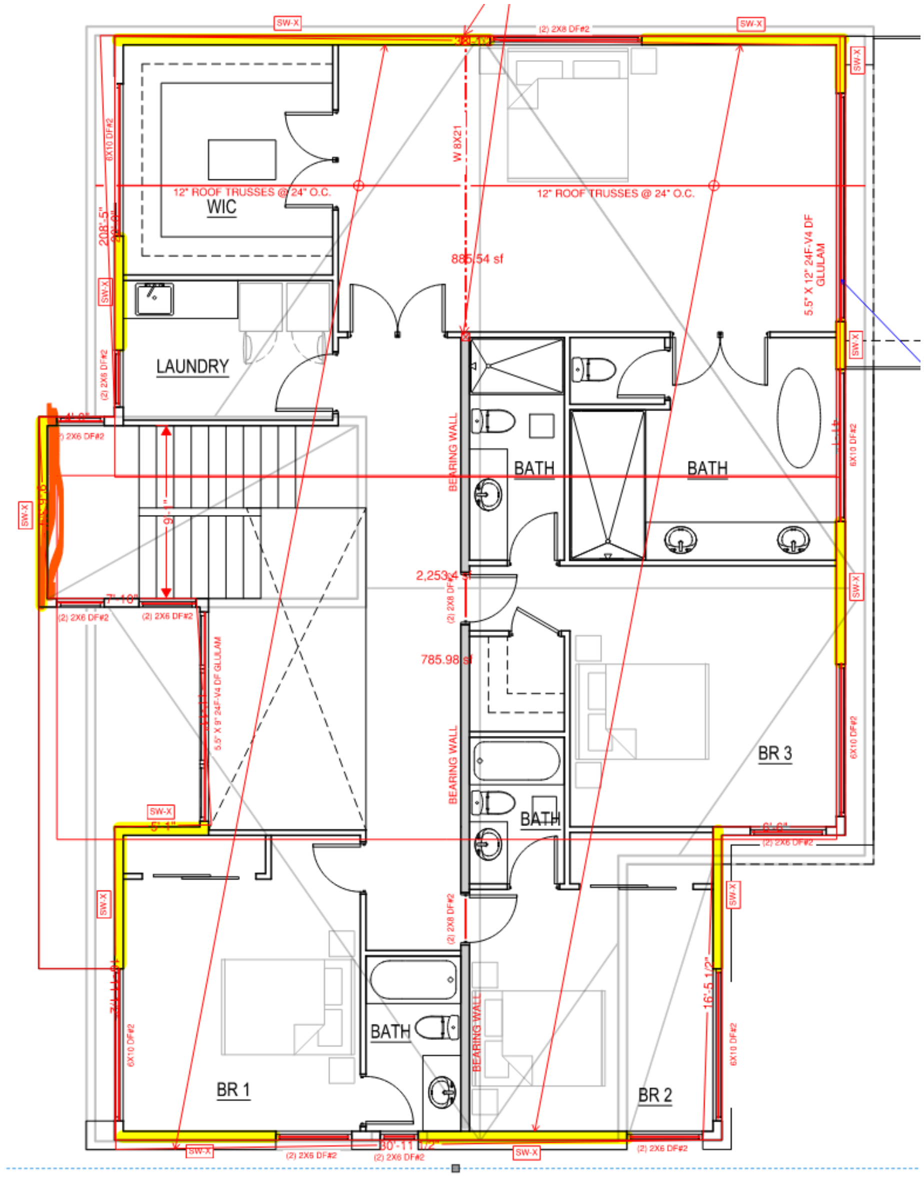
$T_{all} := MST60 = 6.235 \cdot kip$ Allowable tension load

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

$ratio := \frac{T}{T_{all}} = 1.045$

$check_{HD} = "NG"$

It is less than 5% above-EOR is OK



$$V_{EQ} := V_{story_3} \cdot \frac{20 ft^2}{2250 ft^2} = 0.134 \cdot kip$$

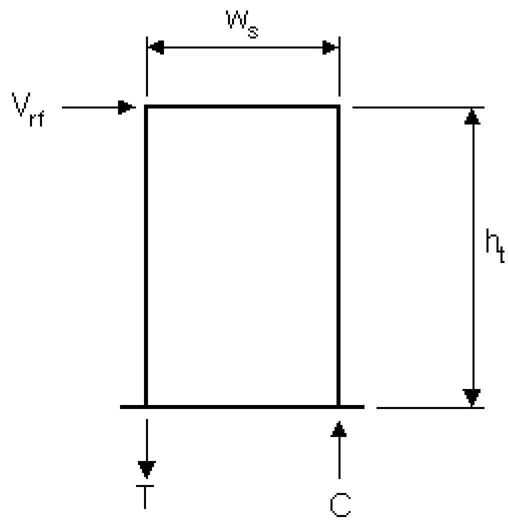
Tributary shear on the wall per plan dimensions

$$V_{wind} := \left(p_{wind\_wall\_windward.A} - p_{wind\_wall\_leeward.A}\right) \cdot 4.5 ft \cdot \left(h_{floor_3} - h_{floor_2}\right) = 1.645 \cdot kip$$

Wind load

$h_t := 9 \cdot ft$ Wall height

$L_s := 10ft$ Total shear wall length



First Segment:

$w_s := 10ft$ Segment wall length

Aspect Ratio (Blocked Shear Wall)

$\frac{h_t}{w_s} = 0.9$

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

$check_{ratio} = "OK"$

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

$V_{rf.w} = 0.99 \cdot kip$

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

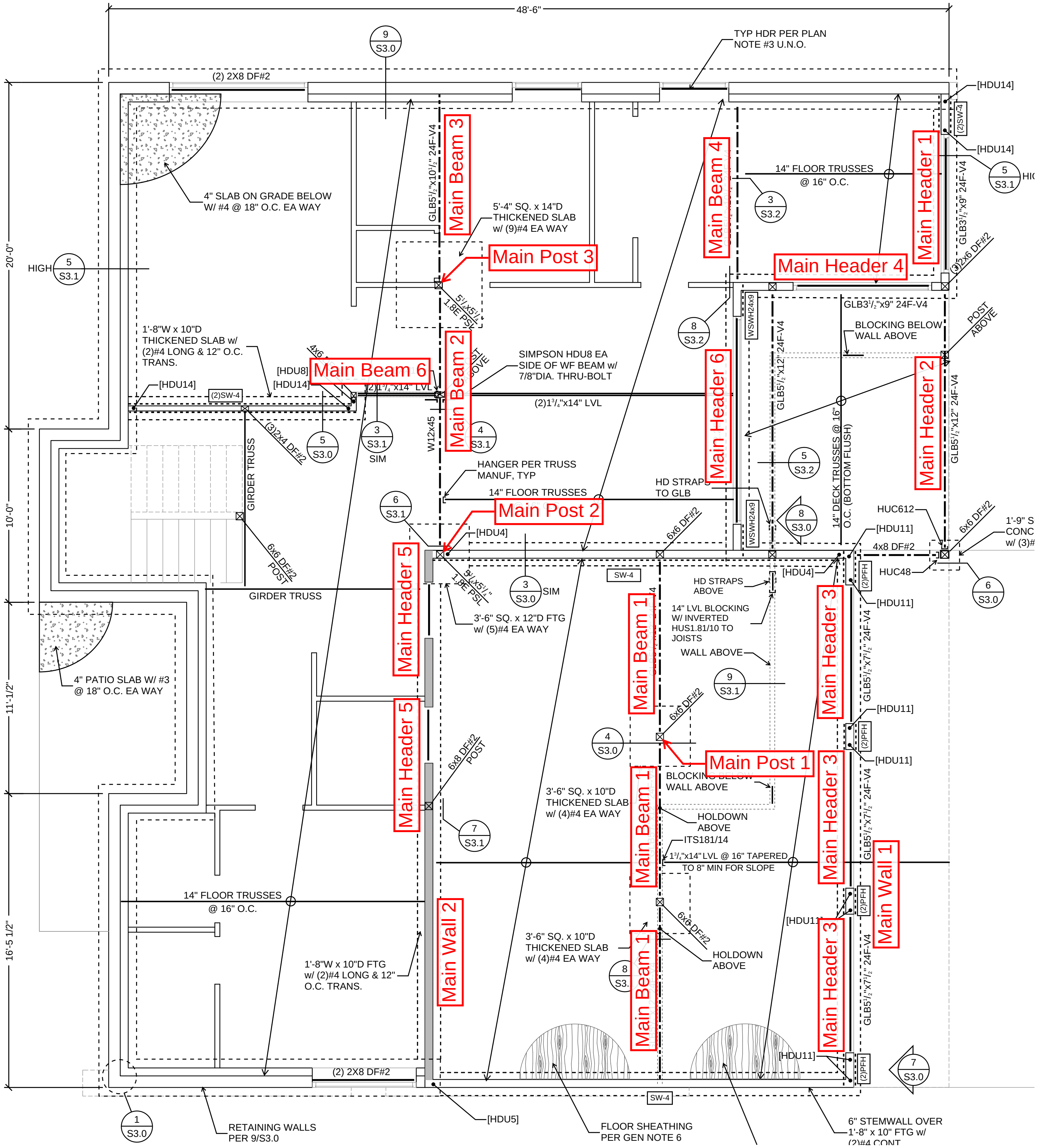
$V_{rf.E} = 0.09 \cdot kip$

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

$M_{ot.w} = 8.9 \cdot kip \cdot ft$

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

$M_{ot.E} = 0.8 \cdot kip \cdot ft$



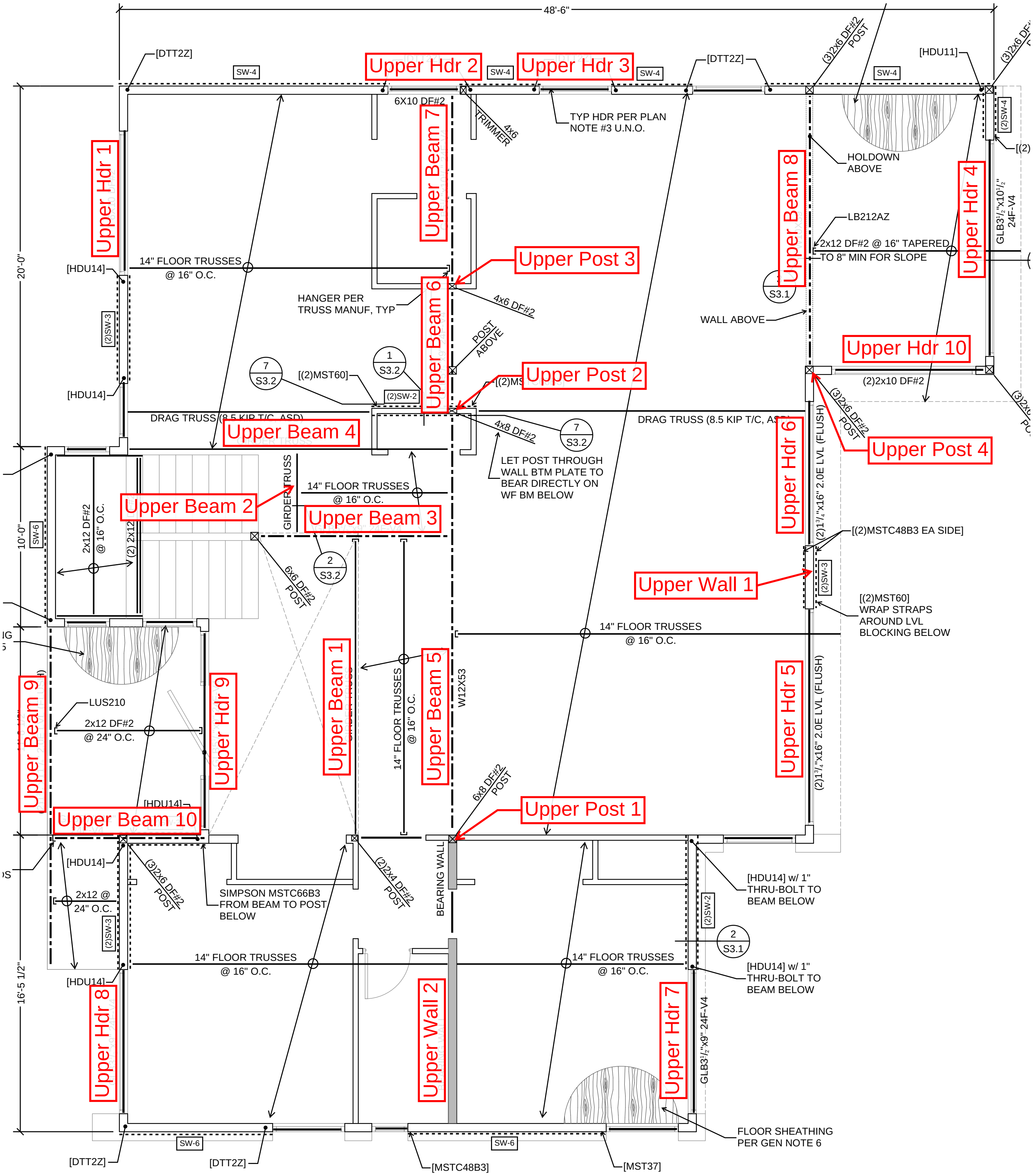
NKH ENGINEERING

PROJECT: 3804 House

DESCRIPTION: Main Floor Framing Keyplan

BY: NKH DATE: 9/7/2023 JOB #: 22-112

S103



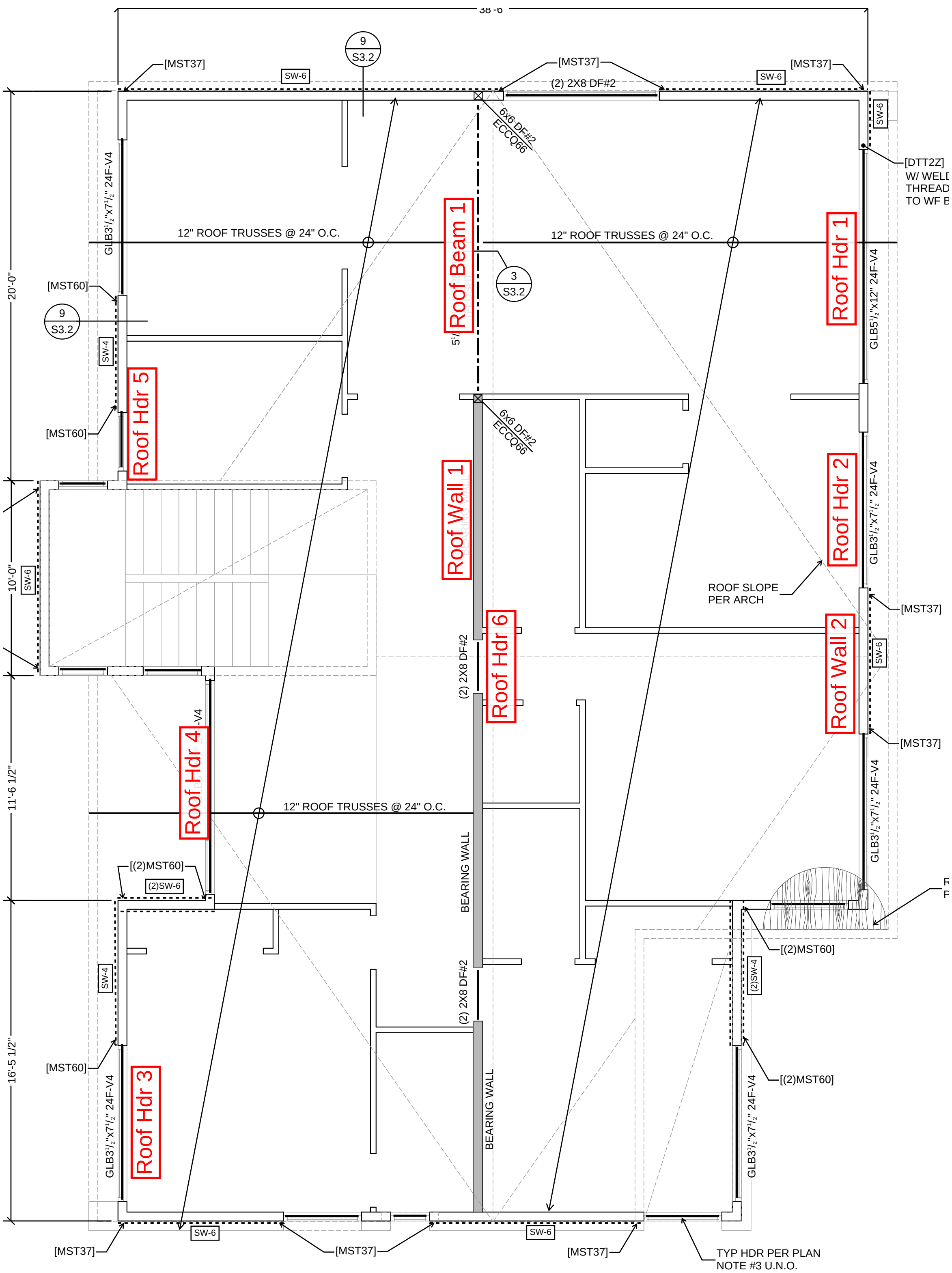
NKH ENGINEERING

PROJECT: 3804 House

DESCRIPTION: Upper Floor Framing Keyplan

BY: NKH DATE: 9/7/2023 JOB #: 22-112

S104



NKH ENGINEERING

PROJECT: 3804 House

DESCRIPTION: Roof Framing Keyplan

BY: NKH DATE: 9/7/2023 JOB #: 22-112

S105

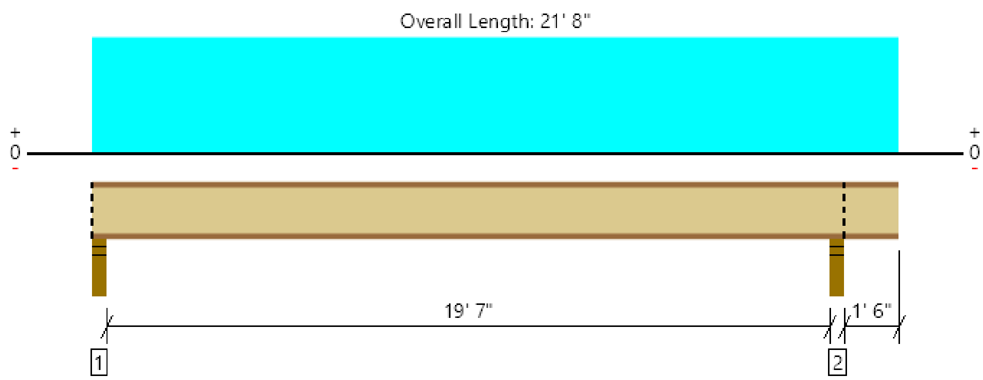
Roof			
Member Name	Results	Current Solution	Comments
Roof Truss 1	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Roof Truss 2	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Roof Truss 3	Failed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	Left cantilever exceeds the maximum braced cantilever length of 5'.
Roof Header 1	Passed	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Roof Header 2	Passed	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam	
Roof Header 3	Passed	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam	
Roof Header 4	Passed	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Roof Header 5	Passed	2 piece(s) 2 x 6 DF No.2	
Roof Header 6	Passed	2 piece(s) 2 x 8 DF No.2	
Roof Beam 1	Passed	1 piece(s) 5 1/4" x 11 7/8" 2.2E Parallam® PSL	
Roof Post 1	Passed	1 piece(s) 6 x 6 DF No.2	
Roof Wall 1	Passed	1 piece(s) 2 x 4 DF No.2 @ 16" OC	
Roof Wall 2	Passed	1 piece(s) 2 x 6 DF No.2 @ 16" OC	

Upper Floor			
Member Name	Results	Current Solution	Comments
Upper Truss 1	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Upper Truss 2	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Upper Truss 3	Passed	1 piece(s) 14" TJI® 110 @ 16" OC	
Upper Truss 4	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Upper Truss 5	Passed	1 piece(s) 2 x 12 DF No.2 @ 24" OC	
Upper Truss 6	Passed	1 piece(s) 2 x 12 DF No.2 @ 24" OC	
Upper Truss 7	Passed	1 piece(s) 2 x 12 DF No.2 @ 24" OC	
Upper Truss 8	Passed	1 piece(s) 11 7/8" TJI® 360 @ 16" OC	
Upper Truss 9	Passed	1 piece(s) 2 x 12 DF No.2 @ 16" OC	
Upper Joist 10	Passed	1 piece(s) 2 x 8 DF No.2 @ 16" OC	
Upper Beam 1	Passed	1 piece(s) 6 x 10 DF No.2	
Upper Beam 2	Passed	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Upper Beam 3	Passed	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Upper Beam 4	Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	
Upper Beam 5	Passed	1 piece(s) W12X53 (A992) ASTM Steel	
Upper Beam 6	Passed	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Upper Beam 7	Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	
Upper Beam 8	Passed	1 piece(s) W10X39 (A992) ASTM Steel	
Upper Beam 9	Failed	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	Failed	1 piece(s) 5 1/2" x 12" 24F-V8 DF Glulam	An excessive uplift of -5111 lbs at support located at 9' 1" failed this product.
Upper Header 1	Passed	1 piece(s) 6 x 10 DF No.2	
Upper Header 2	Passed	1 piece(s) 6 x 10 DF No.2	
Upper Header 3	Passed	2 piece(s) 2 x 6 DF No.2	
Upper Header 4	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Upper Header 5	Passed	2 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL	
Upper Header 6	Passed	1 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL	
Upper Header 7	Passed	1 piece(s) 6 x 10 DF No.2	
Upper Header 8	Passed	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
Upper Header 9	Passed	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Upper Header 10	Passed	2 piece(s) 2 x 10 DF No.2	
Upper Wall 1	Passed	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Upper Wall 2	Passed	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Upper Post 1	Passed	1 piece(s) 6 x 8 DF No.2	
Upper Post 2	Failed	1 piece(s) 4 x 8 DF No.2	
Upper Post 3	Passed	1 piece(s) 4 x 6 DF No.2	
Upper Post 4	Passed	1 piece(s) 6 x 6 DF No.2	

Main			
Member Name	Results	Current Solution	Comments
Main Truss 1	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Main Truss 2	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Main Truss 3-2	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Main Truss 4	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Main Truss 5	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Main Truss 6	Passed	1 piece(s) 11 7/8" TJI® 230 @ 16" OC	
Main Deck 1	Passed	1 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL @ 16" OC	
Main Beam 1	Passed	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Main Beam 2	Passed	1 piece(s) W12X45 (A992) ASTM Steel	
Main Beam 3	Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	
Main Beam 4	Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	
Main Beam 6	Passed	2 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL	
Main Header 1	Passed	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
Main Header 2	Passed	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	
Main Header 3	Failed	1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam	
Main Header 4	Passed	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
Main Header 5	Passed	2 piece(s) 2 x 6 DF No.2	
Main Header 6	Passed	1 piece(s) 5 1/4" x 14" 2.2E Parallam® PSL	
Main Wall 1	Passed	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Main Wall 2	Passed	1 piece(s) 2 x 6 DF No.2 @ 16" OC	
Main Post 1	Passed	1 piece(s) 6 x 6 DF No.2	
Main Post 2	Passed	1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL	
Main Post 3	Passed	1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL	

Roof, Roof Truss 1

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	537 @ 2 1/2"	1708 (3.50")	Passed (31%)	1.15	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	521 @ 3 1/2"	1903	Passed (27%)	1.15	1.0 D + 1.0 S (Alt Spans)
Moment (Ft-lbs)	2592 @ 10' 13/16"	4847	Passed (53%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.360 @ 10' 1 1/4"	0.660	Passed (L/661)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.574 @ 10' 1 3/16"	0.991	Passed (L/414)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- 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.

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"	201	269	336	537	Blocking
2 - Stud wall - SPF	3.50"	3.50"	3.50"	232	310	387	620	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' 4" 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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 21' 8"	16"	15.0	20.0	25.0	Default Load

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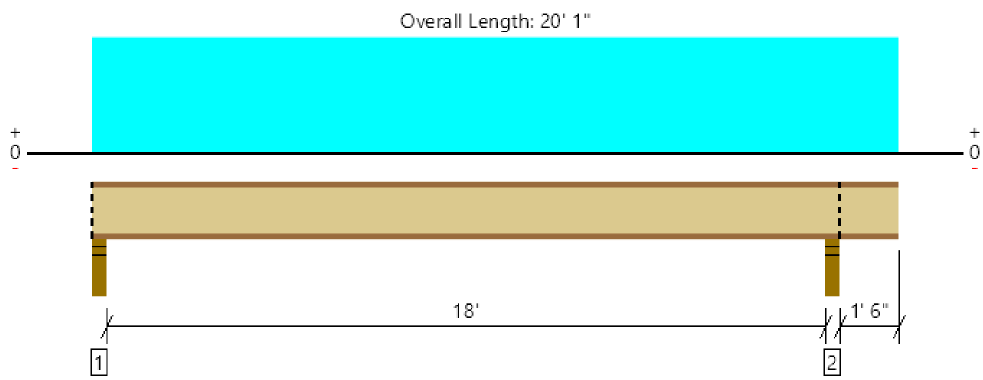
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Roof, Roof Truss 2

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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.

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 (non-snow: 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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FORTEWEB

MEMBER REPORT

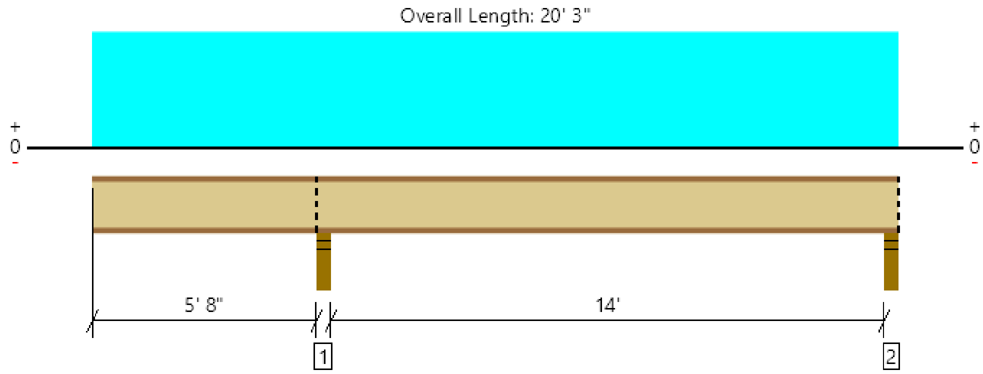
Roof, Roof Truss 3

1 piece(s) 11 7/8" TJI® 230 @ 16" OC

~~FAILED~~

Cantilever will braced,
EOR approves

Left cantilever exceeds the maximum braced cantilever length of 5'.



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- 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.

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 (non-snow: 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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Weyerhaeuser

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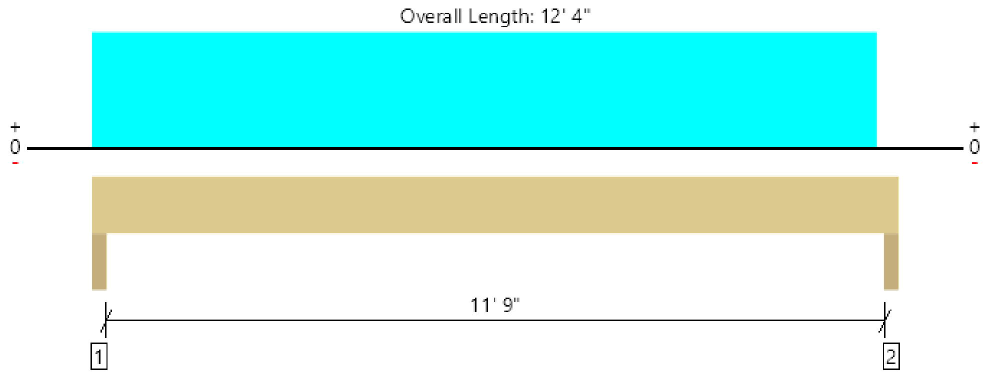
MEMBER REPORT

PASSED

Roof, Roof Header 1

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2961 @ 2"	12513 (3.50")	Passed (24%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2342 @ 11' 1/2"	13409	Passed (17%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	8642 @ 6' 2"	30360	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.095 @ 6' 2"	0.300	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.157 @ 6' 2"	0.200	Passed (L/917)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- 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.

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"	1172	1433	1790	2961	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1114	1357	1693	2808	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 (non-snow: 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	174.0	232.5	290.3	Linked from: Roof Truss 1, Support 2

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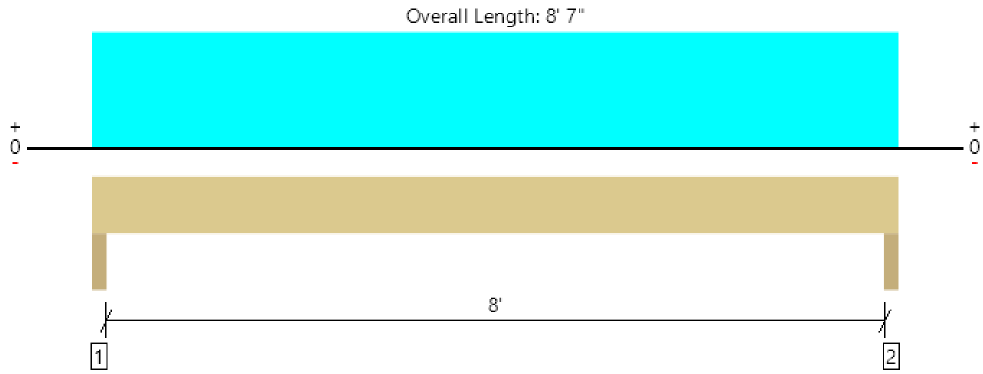
Weyerhaeuser

Roof, Roof Header 2

1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1756 @ 2"	7963 (3.50")	Passed (22%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1381 @ 11"	5333	Passed (26%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3481 @ 4' 3 1/2"	7547	Passed (46%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.119 @ 4' 3 1/2"	0.206	Passed (L/835)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.193 @ 4' 3 1/2"	0.412	Passed (L/514)	--	1.0 D + 1.0 S (All Spans)

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	Roof Live	Snow	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	674	866	1082	1756	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	674	866	1082	1756	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 (non-snow: 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	150.8	201.8	252.0	Linked from: Roof Truss 1, Support 1

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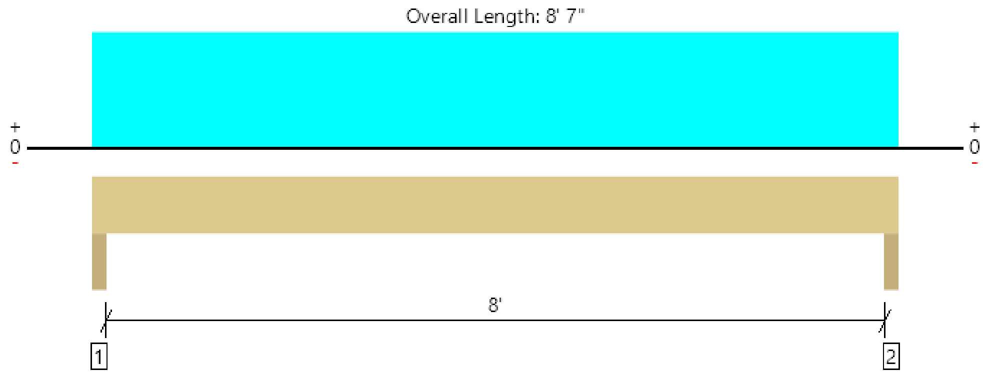
Roof, Roof Header 3

1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

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	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 (non-snow: 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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ForteWEB Software Operator	Job Notes
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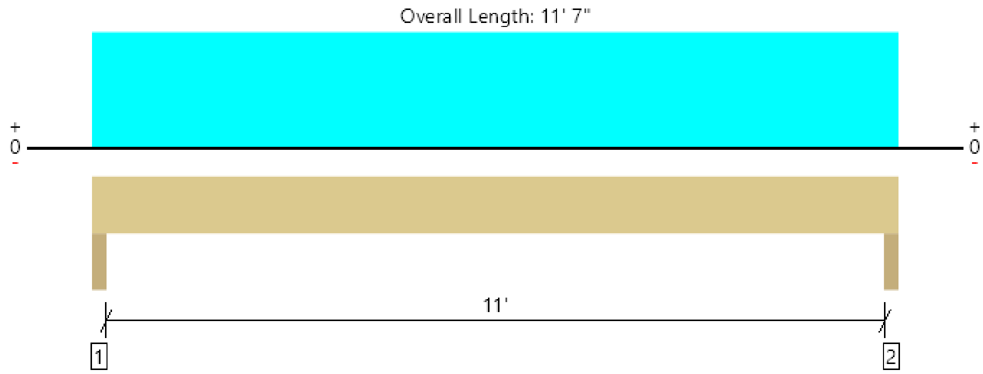
MEMBER REPORT

PASSED

Roof, Roof Header 4

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

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 = 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.

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 (non-snow: 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

Weyerhaeuser Notes

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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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

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MEMBER REPORT

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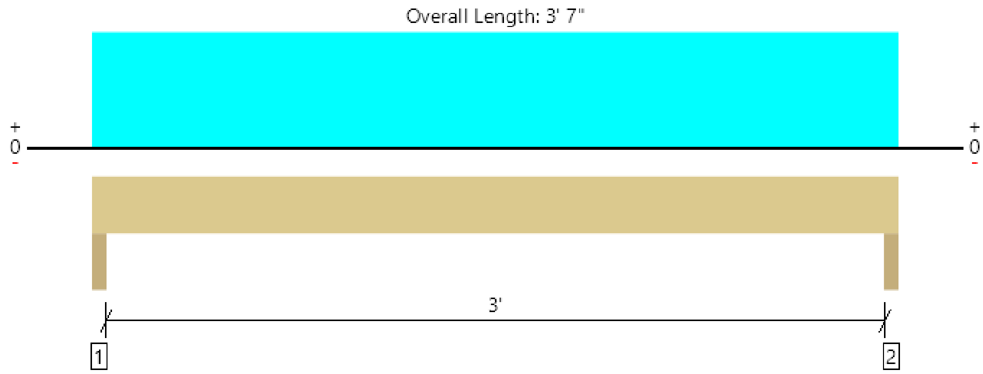
Roof, Roof Header 5
2 piece(s) 2 x 6 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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.

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 (non-snow: 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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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

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MEMBER REPORT

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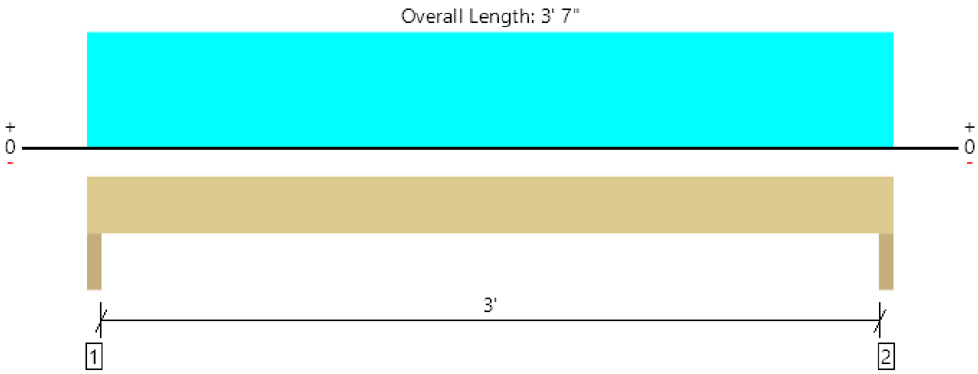
Roof, Roof Header 6
2 piece(s) 2 x 8 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1508 @ 2"	6563 (3.50")	Passed (23%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	754 @ 10 3/4"	3002	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1111 @ 1' 9 1/2"	2720	Passed (41%)	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)

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.
- Applicable calculations are based on NDS.

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"	572	750	937	1508	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	572	750	937	1508	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 (non-snow: 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	150.8	201.8	252.0	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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MEMBER REPORT

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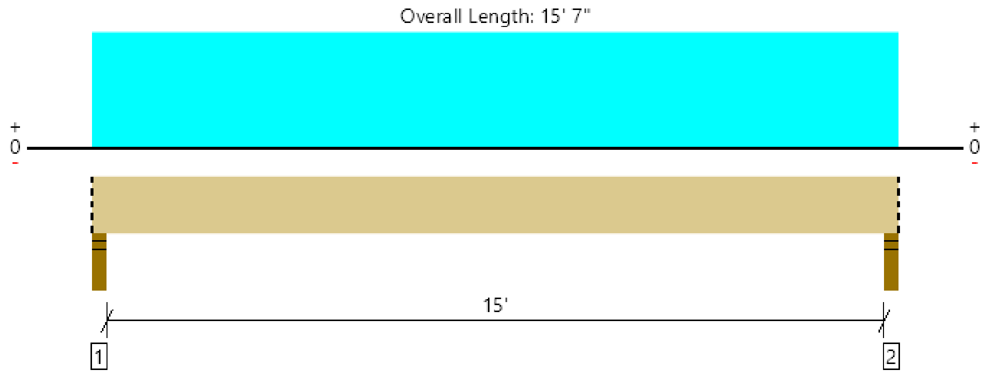
Roof, Roof Beam 1

1 piece(s) 5 1/4" x 11 7/8" 2.2E Parallam® PSL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	6668 @ 2"	7809 (3.50")	Passed (85%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	5571 @ 1' 3 3/8"	13861	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	24876 @ 7' 9 1/2"	34332	Passed (72%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.420 @ 7' 9 1/2"	0.508	Passed (L/435)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.688 @ 7' 9 1/2"	0.762	Passed (L/266)	--	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.

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"	2.99"	2594	3261	4073	6668	Blocking
2 - Stud wall - SPF	3.50"	3.50"	2.99"	2594	3261	4073	6668	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 (non-snow: 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	150.8	201.8	252.0	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

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MEMBER REPORT

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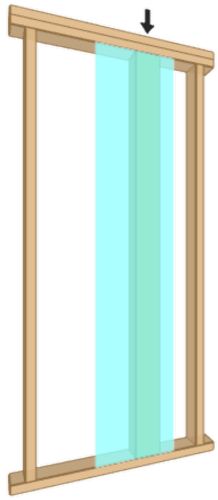
Roof, Roof Post 1

1 piece(s) 6 x 6 DF No.2

Wall Height: 12'   Member Height: 11' 7 1/2"   Tributary Width: 1'



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Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	6667	14197	Passed (47%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	6667	12856	Passed (52%)	--	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	0.23	1	Passed (23%)	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	-	-	-	
2 - Point (lb)	N/A	2594	3261	4073	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), 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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MEMBER REPORT

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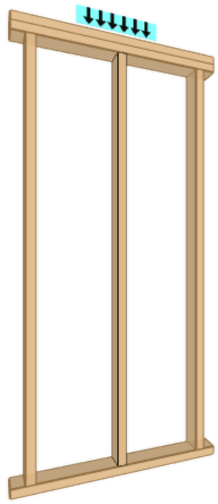
Roof, Roof Wall 1

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"



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Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	40	50	Passed (80%)	--	--
Compression (lbs)	1115	1517	Passed (73%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	1115	2789	Passed (40%)	--	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	150.8	201.8	252.0	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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ForteWEB Software Operator	Job Notes
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Weyerhaeuser

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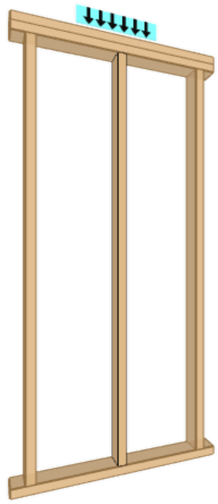
MEMBER REPORT

PASSED

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"



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Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	25	50	Passed (51%)	--	--
Compression (lbs)	619	5432	Passed (11%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	619	4383	Passed (14%)	--	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	174.0	232.5	290.3	Linked from: Roof Truss 1, Support 2

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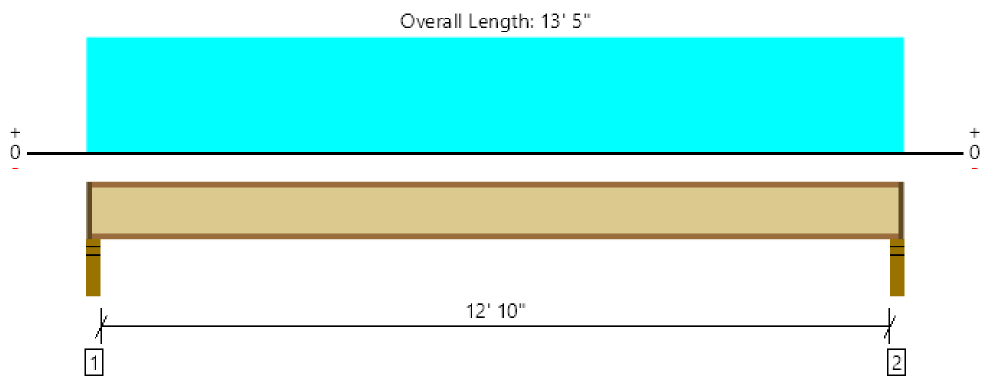
MEMBER REPORT

PASSED

Upper Floor, Upper Truss 1

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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"	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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ForteWEB Software Operator	Job Notes
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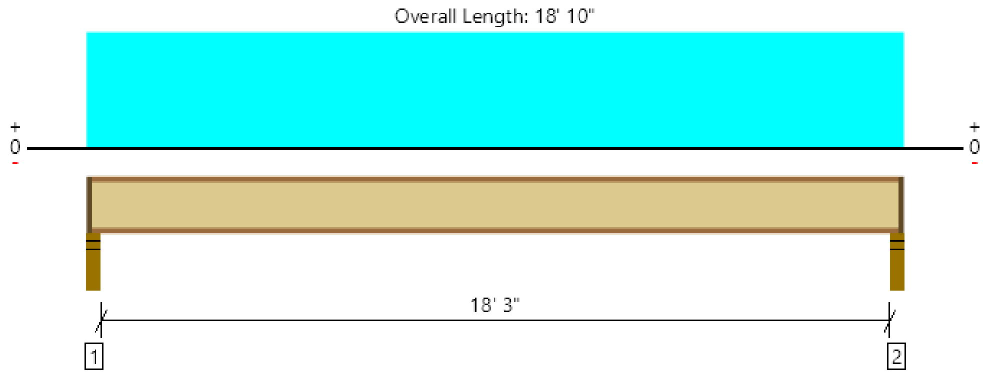
MEMBER REPORT

PASSED

Upper Floor, Upper Truss 2

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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

Weyerhaeuser Notes

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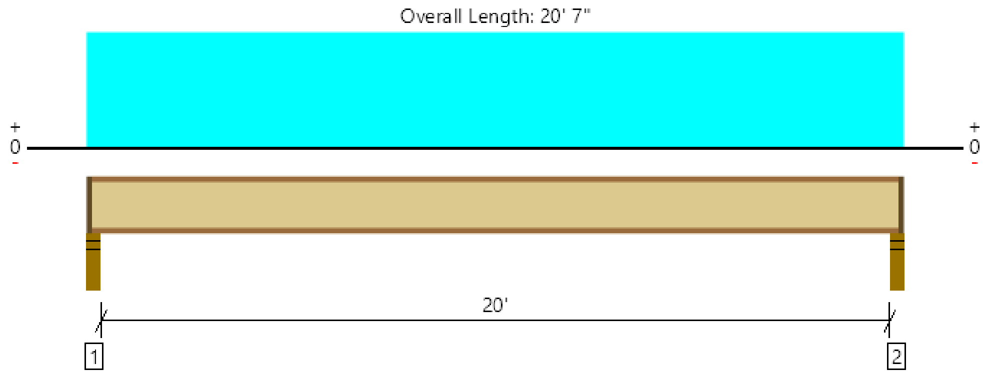
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Upper Floor, Upper Truss 3
1 piece(s) 14" TJI® 110 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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

Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

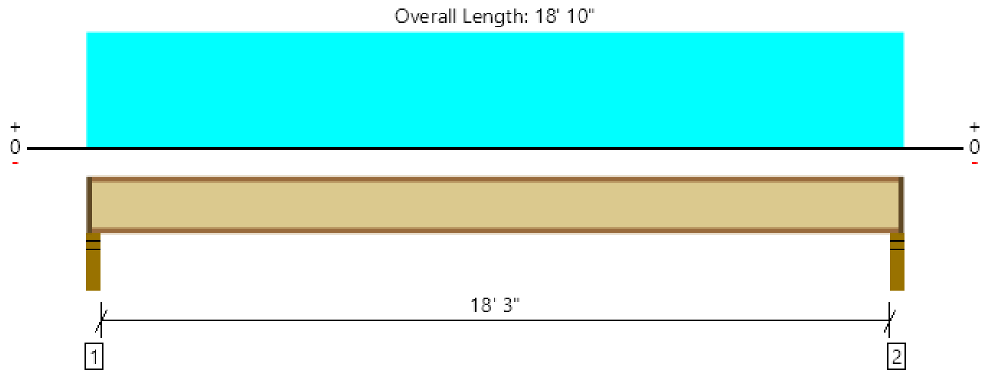
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

MEMBER REPORT

PASSED

Upper Floor, Upper Truss 4

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

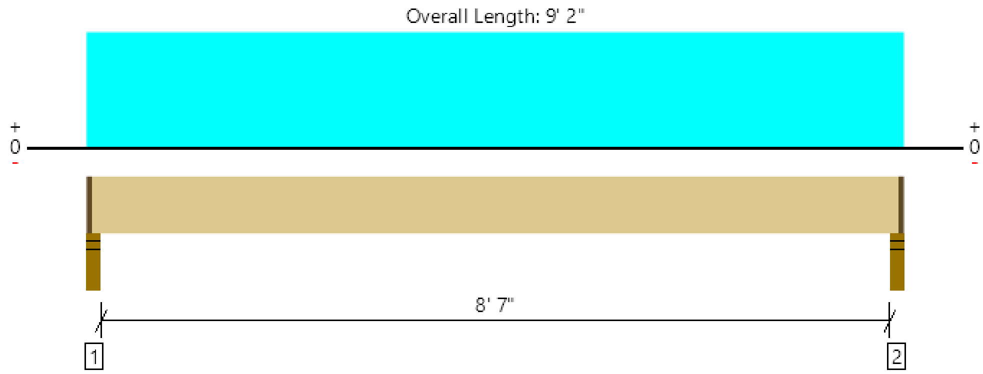
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Truss 5

1 piece(s) 2 x 12 DF No.2 @ 24" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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

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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ForteWEB Software Operator	Job Notes
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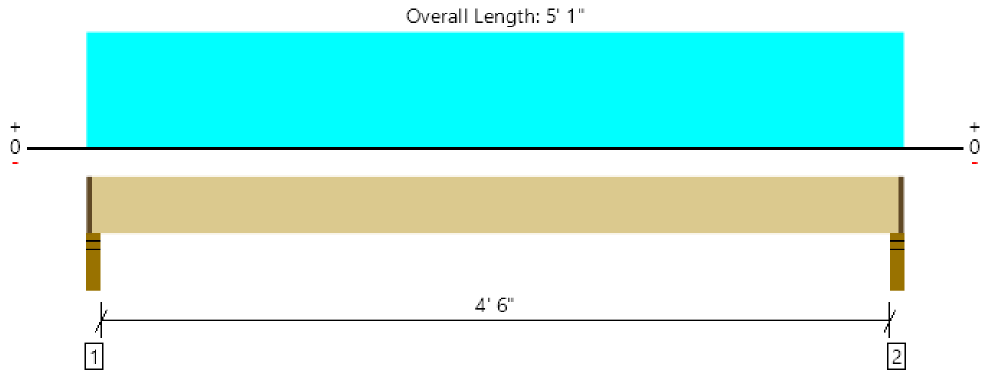
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Truss 6
1 piece(s) 2 x 12 DF No.2 @ 24" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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

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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ForteWEB Software Operator	Job Notes
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9/7/2023 11:22:54 PM UTC
ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1
File Name: 22-112

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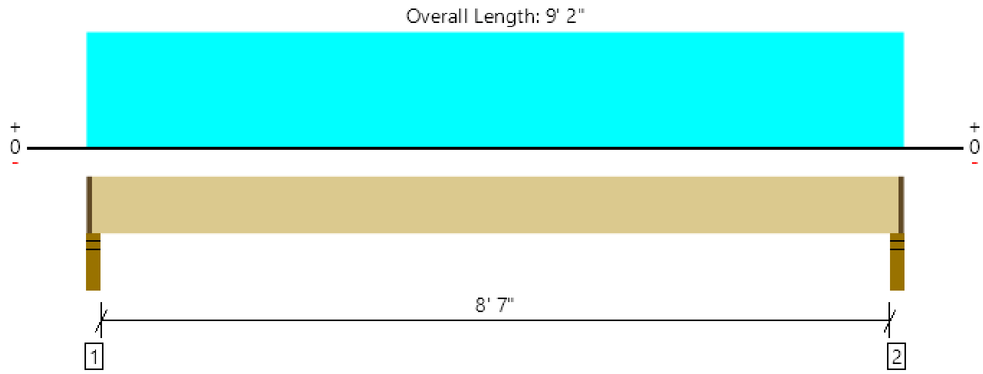
MEMBER REPORT

PASSED

Upper Floor, Upper Truss 7
1 piece(s) 2 x 12 DF No.2 @ 24" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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

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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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

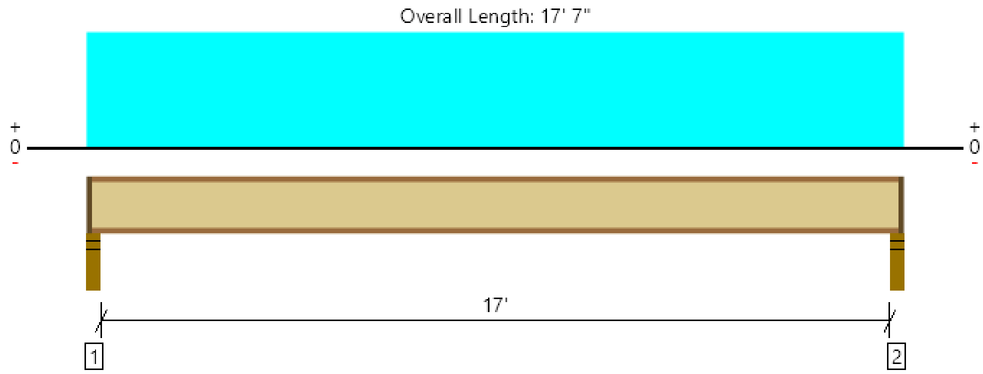
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Truss 8

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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

Weyerhaeuser Notes

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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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

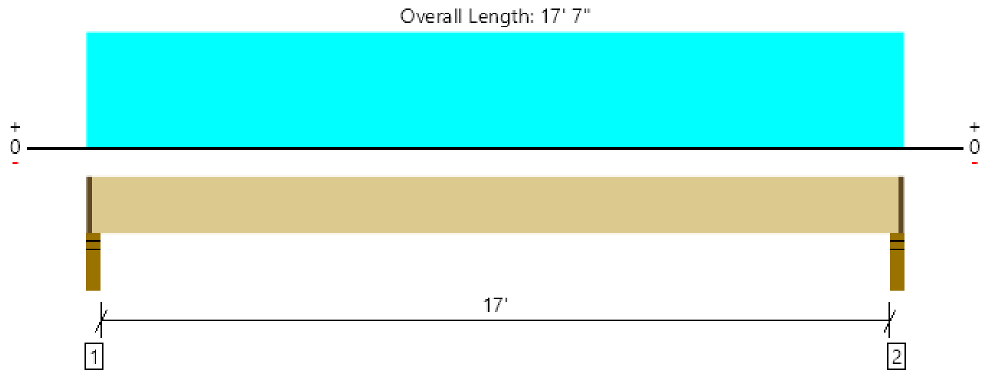
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Truss 9
1 piece(s) 2 x 12 DF No.2 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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

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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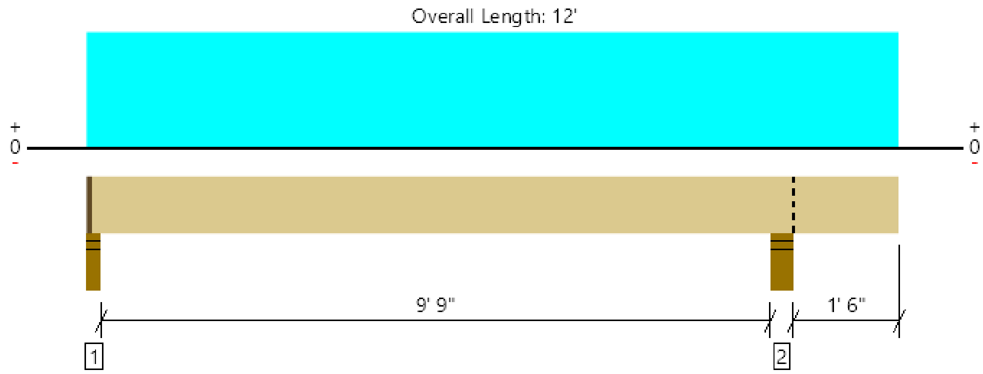
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Upper Floor, Upper Joist 10

1 piece(s) 2 x 8 DF No.2 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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

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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ForteWEB Software Operator	Job Notes
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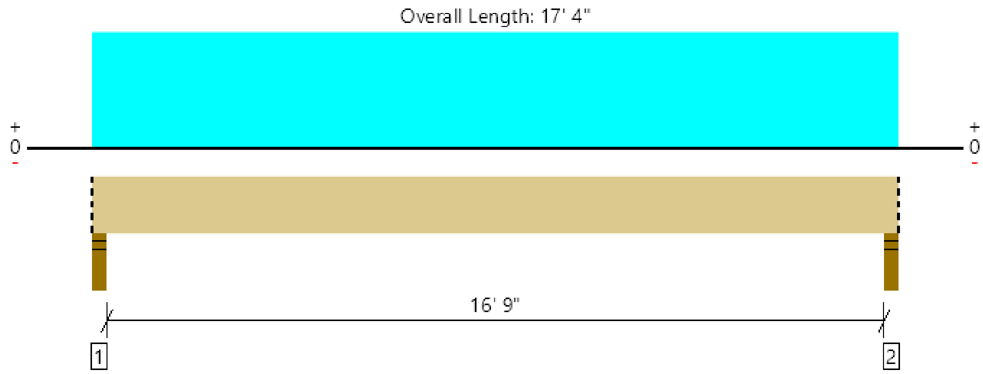
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Beam 1

1 piece(s) 6 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1155 @ 2"	8181 (3.50")	Passed (14%)	--	1.0 D (All Spans)
Shear (lbs)	1010 @ 1' 1"	5330	Passed (19%)	0.90	1.0 D (All Spans)
Moment (Ft-lbs)	4813 @ 8' 8"	5429	Passed (89%)	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)	0.490 @ 8' 8"	0.850	Passed (L/416)	--	1.0 D (All Spans)

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.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)		Accessories
	Total	Available	Required	Dead	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	1155	1155	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	1155	1155	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	13.2	
1 - Uniform (PLF)	0 to 17' 4" (Front)	N/A	120.0	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
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Weyerhaeuser

9/7/2023 11:22:54 PM UTC

ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1

File Name: 22-112

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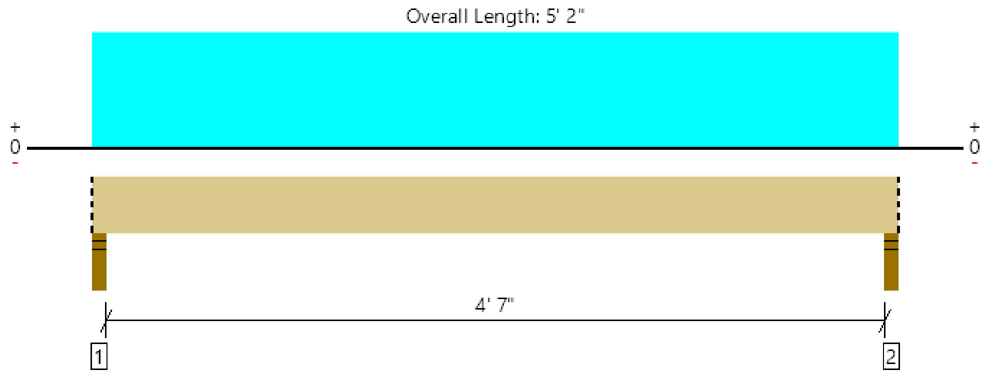
MEMBER REPORT

PASSED

Upper Floor, Upper Beam 2

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1323 @ 2"	8181 (3.50")	Passed (16%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	789 @ 1' 1/2"	8745	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	1495 @ 2' 7"	14850	Passed (10%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.007 @ 2' 7"	0.121	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.010 @ 2' 7"	0.242	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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 = 4' 10".
- 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"	384	939	1323	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	384	939	1323	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	12.0	--	
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

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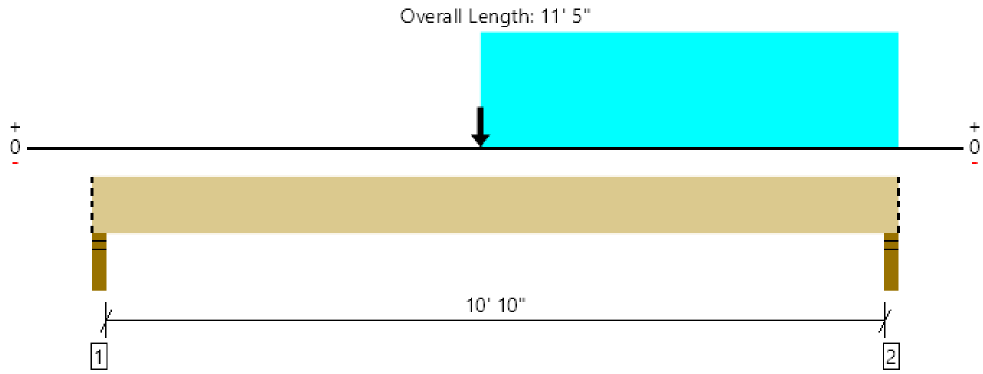
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Beam 3

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2765 @ 11' 3"	8181 (3.50")	Passed (34%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2249 @ 10' 4 1/2"	8745	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	7257 @ 5' 10 1/16"	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/541)	--	1.0 D + 1.0 L (All Spans)

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' 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.

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"	865	525	1389	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	1209	1557	2765	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	1155	-	Linked from: Upper Beam 1, Support 2

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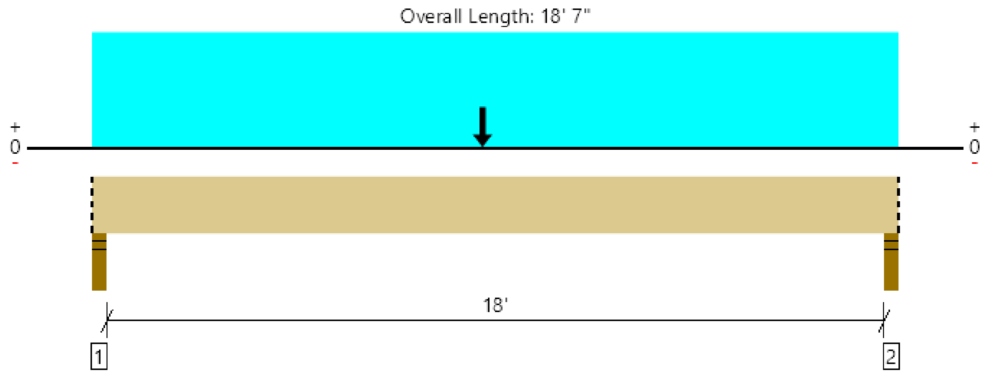
MEMBER REPORT

PASSED

Upper Floor, Upper Beam 4

1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1817 @ 2"	8181 (3.50")	Passed (22%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1674 @ 1' 2"	10203	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	11106 @ 9'	20213	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.215 @ 9' 2 9/16"	0.456	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.622 @ 9' 3"	0.913	Passed (L/352)	--	1.0 D + 1.0 L (All Spans)

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 = 18' 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"	1332	485	1817	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	1320	454	1774	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)	18' 7" 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	14.0	--	
1 - Uniform (PLF)	0 to 18' 7" (Front)	N/A	108.0	-	Floor
2 - Point (lb)	9' (Front)	N/A	384	939	Linked from: Upper Beam 2, Support 2

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ForteWEB Software Operator	Job Notes
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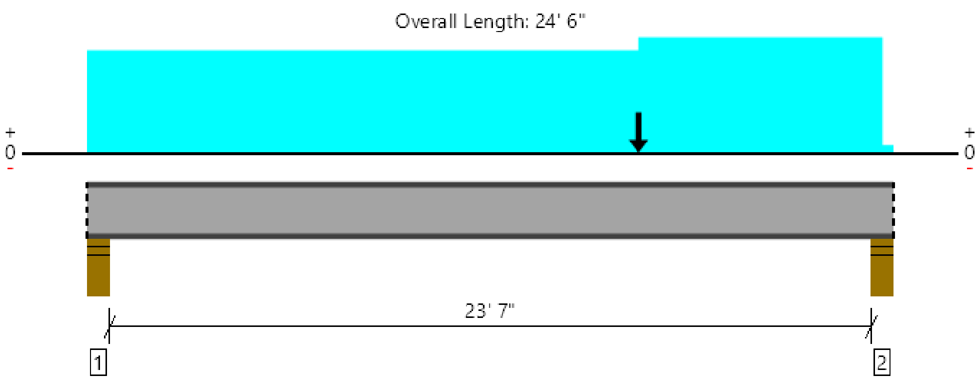
MEMBER REPORT

PASSED

Upper Floor, Upper Beam 5

1 piece(s) W12X53 (A992) ASTM Steel



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	19274 @ 24' 2"	23375 (5.50")	Passed (82%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	19011 @ 24' 1/2"	83490	Passed (23%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	108987 @ 12' 11 9/16"	139286	Passed (78%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.468 @ 12' 4 3/4"	0.596	Passed (L/611)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.908 @ 12' 4 5/8"	1.192	Passed (L/315)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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).
- Bearing reinforcement may be required for support located at 24' 2".
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

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"	8602	5740	5127	6404	17710	Blocking
2 - Stud wall - SPF	5.50"	5.50"	5.50"	9255	7128	4987	6229	19274	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 (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 24' 6"	N/A	53.0	--	--	--	
1 - Uniform (PLF)	0 to 24' 6"	N/A	144.0	-	-	-	Floor
2 - Uniform (PLF)	0 to 24' 2"	N/A	150.8	-	201.8	252.0	Linked from: Roof Truss 1, Support 1
3 - Uniform (PLF)	0 to 24' 2"	N/A	162.8	-	216.8	270.8	Linked from: Roof Truss 2, Support 2
4 - Uniform (PLF)	0 to 24' 2"	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 1
5 - Uniform (PLF)	16' 9" to 24' 2"	N/A	69.0	183.5	-	-	Linked from: Upper Truss 7, Support 2
6 - Point (lb)	16' 9"	N/A	1209	1557	-	-	Linked from: Upper Beam 3, 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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Weyerhaeuser

9/7/2023 11:22:54 PM UTC

ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1

File Name: 22-112

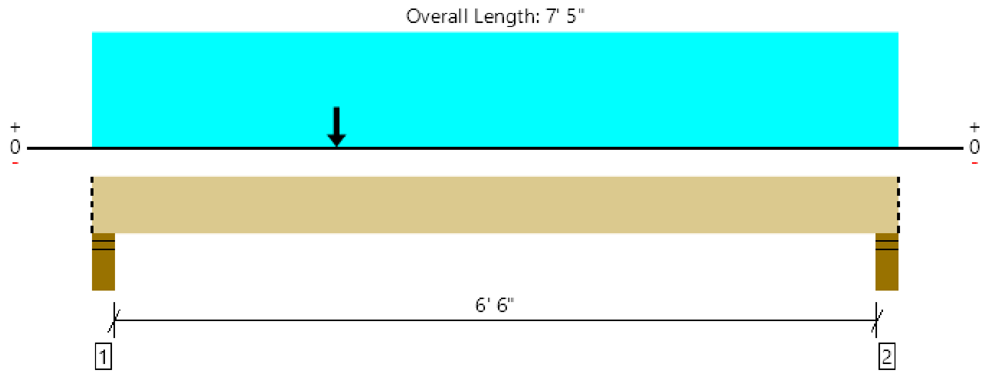
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Beam 6

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7378 @ 4"	12856 (5.50")	Passed (57%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	6292 @ 1' 2 1/2"	10057	Passed (63%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	11915 @ 2' 3"	17078	Passed (70%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.089 @ 3' 6 5/8"	0.169	Passed (L/911)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.149 @ 3' 6 7/16"	0.338	Passed (L/542)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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 = 6' 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	Roof Live	Snow	Factored	
1 - Stud wall - SPF	5.50"	5.50"	3.16"	2998	2923	2335	2916	7378	Blocking
2 - Stud wall - SPF	5.50"	5.50"	2.11"	1877	2923	926	1157	4937	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)	7' 5" o/c	
Bottom Edge (Lu)	7' 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 (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 5"	N/A	12.0	--	--	--	
1 - Point (lb)	2' 3" (Top)	N/A	2594	-	3261	4073	Linked from: Roof Post 1, Support 1
2 - Uniform (PLF)	0 to 7' 5" (Front)	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 1
3 - Uniform (PLF)	0 to 7' 5" (Front)	N/A	141.0	376.5	-	-	Linked from: Upper Truss 4, 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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

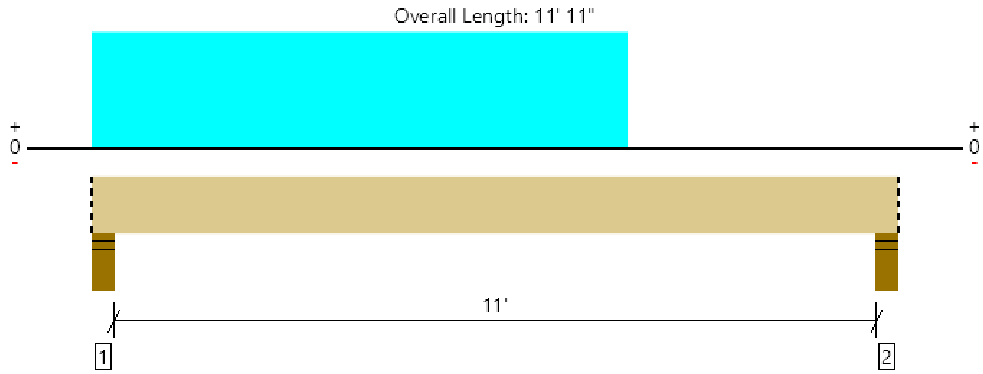
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Beam 7
1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5893 @ 4"	12856 (5.50")	Passed (46%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4430 @ 1' 4"	10203	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	13916 @ 5' 4 7/16"	20213	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.227 @ 5' 9 3/16"	0.281	Passed (L/594)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.318 @ 5' 9 1/4"	0.563	Passed (L/425)	--	1.0 D + 1.0 L (All Spans)

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' 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"	2.52"	1668	4226	5893	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	839	2015	2854	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' 11" o/c	
Bottom Edge (Lu)	11' 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 11' 11"	N/A	14.0	--	
1 - Uniform (PLF)	0 to 7' 11" (Front)	N/A	154.5	411.8	Linked from: Upper Truss 3, Support 1
2 - Uniform (PLF)	0 to 7' 11" (Front)	N/A	141.0	376.5	Linked from: Upper Truss 4, Support 2

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ForteWEB Software Operator	Job Notes
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ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1
File Name: 22-112

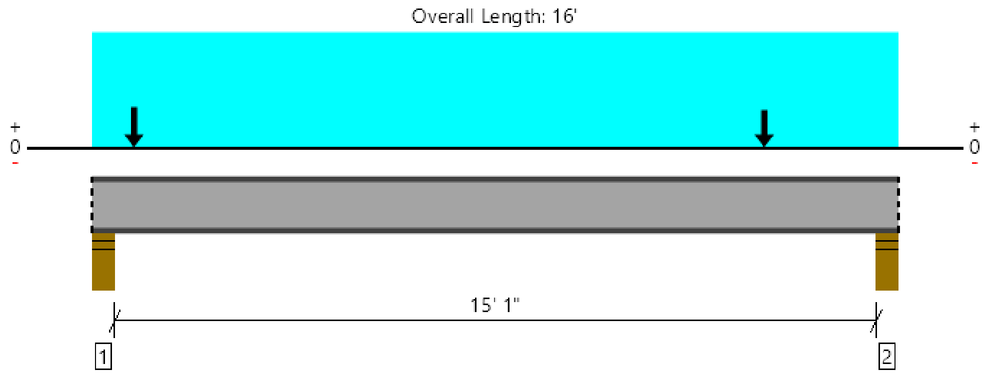
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Beam 8

1 piece(s) W10X39 (A992) ASTM Steel



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern) [Group]
Member Reaction (lbs)	11237 @ 4"	18677 (5.50")	Passed (60%)	--	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Shear (lbs)	10754 @ 5 1/2"	62496	Passed (17%)	--	1.0 D + 0.75 L + 0.75 S (All Spans) [1]
Moment (Ft-lbs)	35104 @ 8' 1 3/8"	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)	0.247 @ 8' 3/8"	0.256	Passed (L/745)	--	1.0 D + 1.0 L (All Spans) [1]

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- 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.

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"	4615	5808	1593	3021	11237	Blocking
2 - Stud wall - SPF	5.50"	5.50"	5.50"	4295	5808	1197	2526	10545	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 (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16'	N/A	39.0	--	--	--	
1 - Uniform (PLF)	0 to 16'	N/A	144.0	-	-	-	Floor
2 - Point (lb)	10"	N/A	1172	-	1433	1790	Linked from: Roof Header 1, Support 1
3 - Point (lb)	13' 4"	N/A	1114	-	1357	1693	Linked from: Roof Header 1, Support 2
4 - Uniform (PLF)	0 to 16'	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 2
5 - Uniform (PLF)	0 to 16'	N/A	76.5	314.3/-3.0	-	129.0	Linked from: Upper Truss 10, Support 1

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ForteWEB Software Operator	Job Notes
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Weyerhaeuser

FORTEWEB

MEMBER REPORT

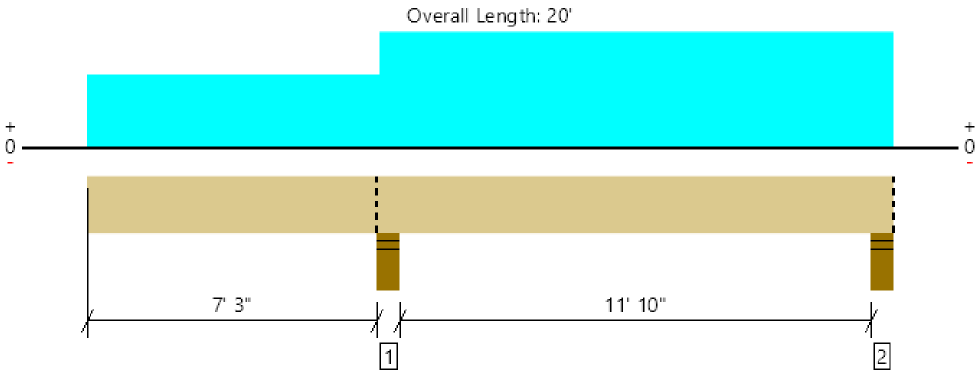
FAILED

Cantilever will braced, EOR approves

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'.



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

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).
- 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.

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

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Weyerhaeuser

9/7/2023 11:22:54 PM UTC

ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1

File Name: 22-112 S140

P

MEMBER REPORT

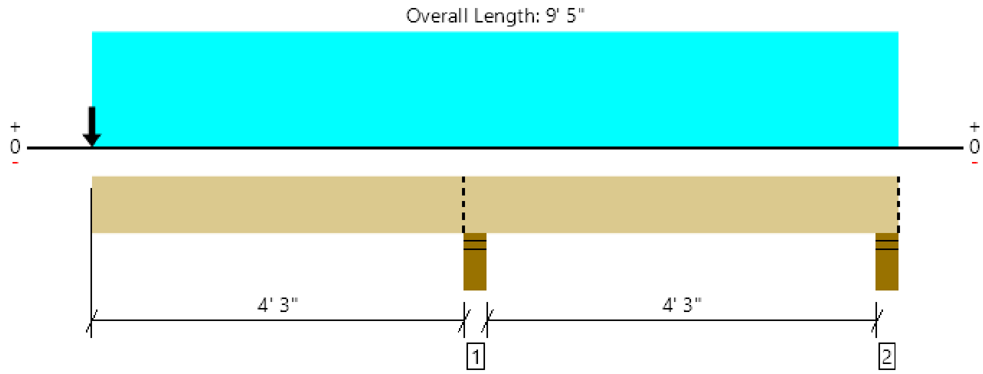
~~FAILED~~

Uplift forces resolved w/ strapping from beam to post below

Upper Floor, Upper Beam 10

1 piece(s) 5 1/2" x 12" 24F-V8 DF Glulam

An excessive uplift of -5111 lbs at support located at 9' 1" failed this product.



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

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".
- 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

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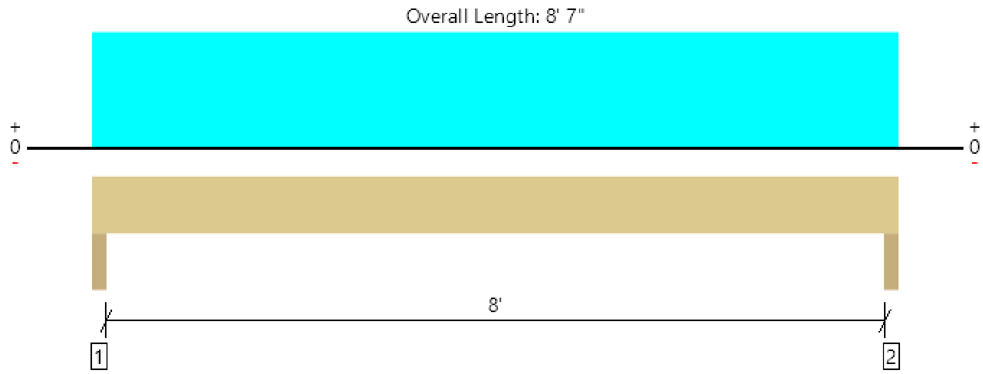
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Header 1
1 piece(s) 6 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2896 @ 2"	12031 (3.50")	Passed (24%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2165 @ 1' 1"	5922	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5741 @ 4' 3 1/2"	6032	Passed (95%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.077 @ 4' 3 1/2"	0.206	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.138 @ 4' 3 1/2"	0.412	Passed (L/719)	--	1.0 D + 1.0 L (All Spans)

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.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- 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"	1280	1616	2896	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1280	1616	2896	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	13.2	--	
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

Weyerhaeuser Notes

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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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Weyerhaeuser

9/7/2023 11:22:54 PM UTC

ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1

File Name: 22-112 S142

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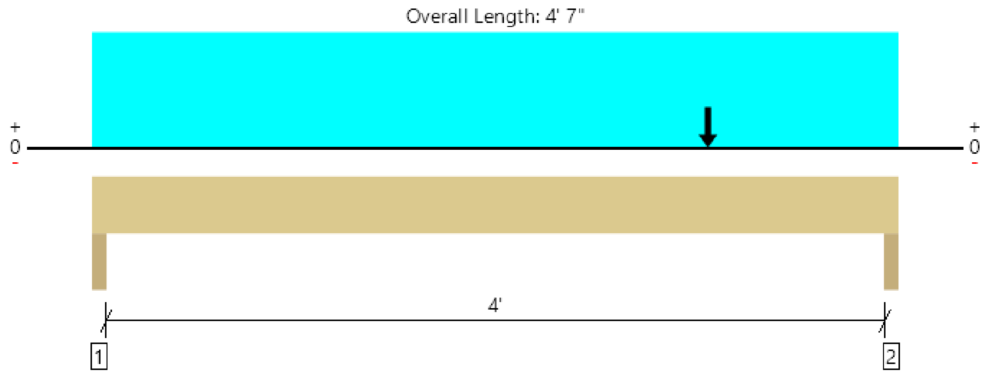
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Header 2

1 piece(s) 6 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	6634 @ 4' 5"	12031 (3.50")	Passed (55%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	6464 @ 3' 6"	6810	Passed (95%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	5991 @ 3' 6"	6937	Passed (86%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.015 @ 2' 6 3/8"	0.106	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.029 @ 2' 6 3/16"	0.213	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- 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 - Trimmer - SPF	3.50"	3.50"	1.50"	1101	435	703	878	2086	None
2 - Trimmer - SPF	3.50"	3.50"	1.93"	3053	1580	2558	3195	6634	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 7" o/c	
Bottom Edge (Lu)	4' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 4' 7"	N/A	13.2	--	--	--	
1 - Uniform (PLF)	0 to 4' 7"	N/A	144.0	-	-	-	Default Load
2 - Point (lb)	3' 6"	N/A	2594	-	3261	4073	Linked from: Roof Post 1, Support 1
3 - Point (lb)	3' 6"	N/A	839	2015	-	-	Linked from: Upper Beam 7, Support 2

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

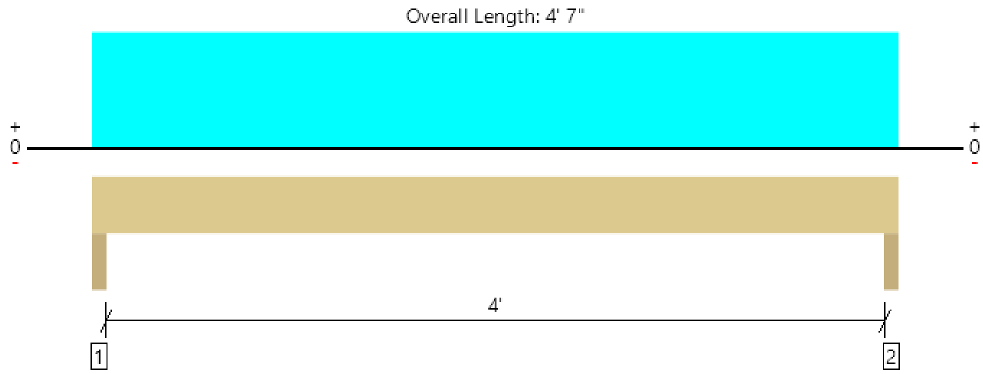
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Weyerhaeuser

MEMBER REPORT

PASSED

Upper Floor, Upper Header 3
2 piece(s) 2 x 6 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	670 @ 2"	6563 (3.50")	Passed (10%)	--	1.0 D (All Spans)
Shear (lbs)	450 @ 9"	1782	Passed (25%)	0.90	1.0 D (All Spans)
Moment (Ft-lbs)	660 @ 2' 3 1/2"	1327	Passed (50%)	0.90	1.0 D (All Spans)
Live Load Defl. (in)	0.000 @ 0	0.106	Passed (2L/999+)	--	1.0 D (All Spans)
Total Load Defl. (in)	0.032 @ 2' 3 1/2"	0.213	Passed (L/999+)	--	1.0 D (All Spans)

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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)		Accessories
	Total	Available	Required	Dead	Factored	
1 - Trimmer - SPF	3.50"	3.50"	1.50"	670	670	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	670	670	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 7" o/c	
Bottom Edge (Lu)	4' 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 4' 7"	N/A	4.2	
1 - Uniform (PLF)	0 to 4' 7"	N/A	288.0	Default Load

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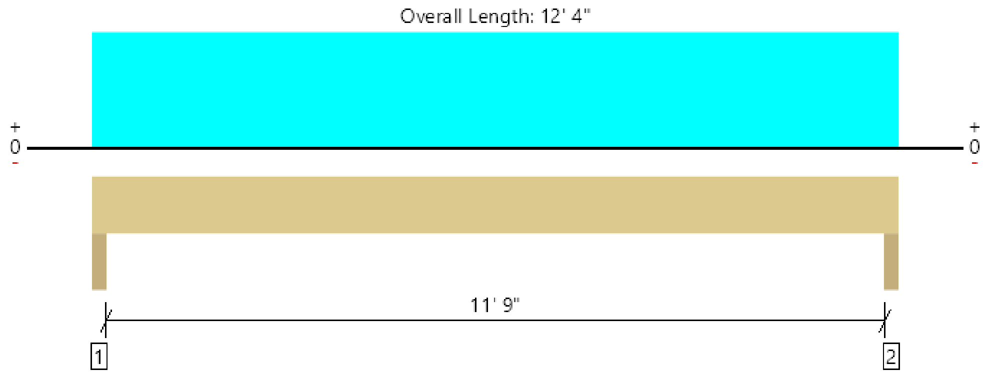
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Upper Floor, Upper Header 4

1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3409 @ 2"	7963 (3.50")	Passed (43%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2636 @ 1' 2"	6493	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	9489 @ 6' 2"	12863	Passed (74%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.338 @ 6' 2"	0.400	Passed (L/426)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.424 @ 6' 2"	0.600	Passed (L/339)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- 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'.
- 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"	1.50"	693	2558	1064	3409	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	693	2558	1064	3409	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)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12' 4"	N/A	8.9	--	--	
1 - Uniform (PLF)	0 to 12' 4"	N/A	103.5	414.8	172.5	Linked from: Upper Truss 10, 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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

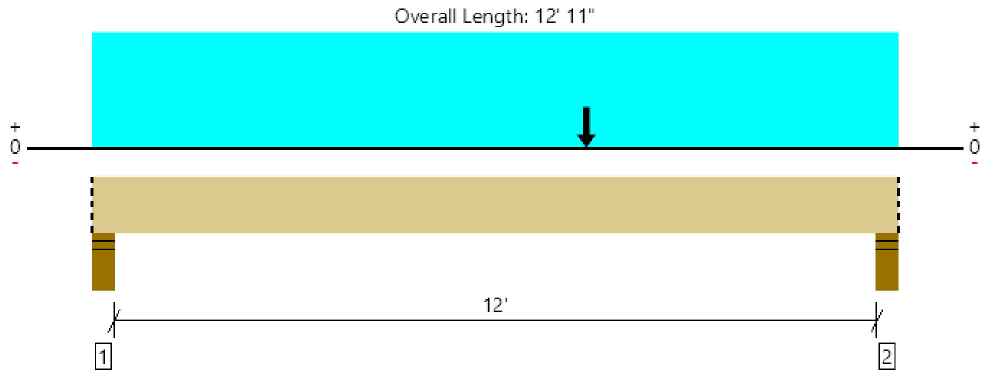
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Header 5

2 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5110 @ 12' 7"	8181 (5.50")	Passed (62%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3808 @ 11' 1 1/2"	10640	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	15247 @ 6' 9 3/4"	31114	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.103 @ 6' 5 1/2"	0.306	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.203 @ 6' 6 1/16"	0.204	Passed (L/726)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/720).
- Allowed moment does not reflect the adjustment for the beam stability factor.

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"	3.33"	2290	2659	330	412	4949	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.44"	2451	2659	536	670	5110	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' 9" 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 (non-snow: 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	144.0	-	-	-	Floor
2 - Point (lb)	7' 11" (Top)	N/A	674	-	866	1082	Linked from: Roof Header 2, Support 2
3 - Uniform (PLF)	0 to 12' 11" (Front)	N/A	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 2

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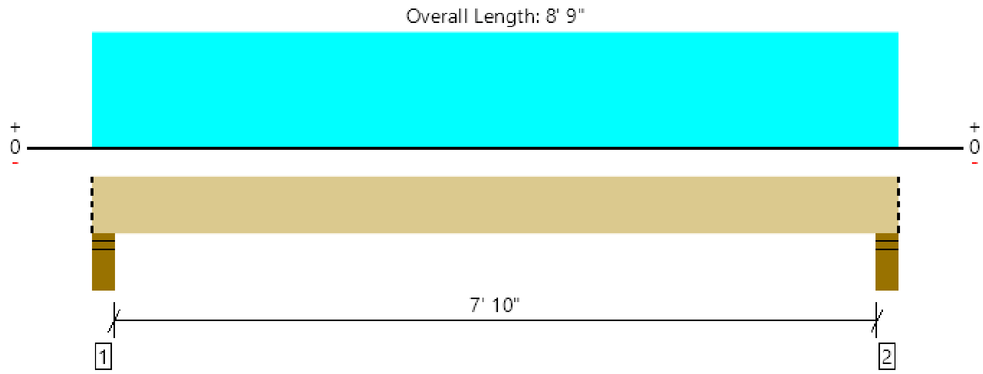
Weyerhaeuser

Upper Floor, Upper Header 6

1 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3038 @ 4"	4091 (5.50")	Passed (74%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1794 @ 1' 9 1/2"	5320	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5672 @ 4' 4 1/2"	15557	Passed (36%)	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)	0.079 @ 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.

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"	4.08"	1237	1801	3038	Blocking
2 - Stud wall - SPF	5.50"	5.50"	4.08"	1237	1801	3038	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	120.0	-	Floor
2 - Uniform (PLF)	0 to 8' 9" (Front)	N/A	154.5	411.8	Linked from: Upper Truss 3, Support 2

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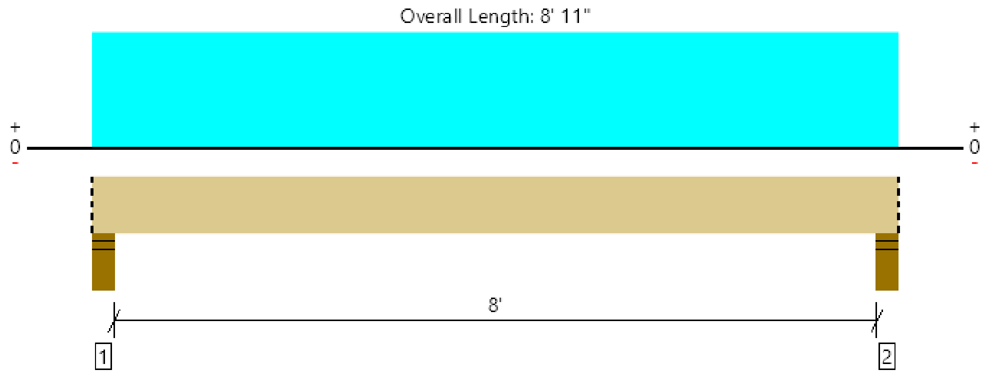
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

MEMBER REPORT

PASSED

Upper Floor, Upper Header 7
1 piece(s) 6 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2346 @ 4"	12856 (5.50")	Passed (18%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1688 @ 1' 3"	5922	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4477 @ 4' 5 1/2"	6032	Passed (74%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.055 @ 4' 5 1/2"	0.206	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.107 @ 4' 5 1/2"	0.412	Passed (L/922)	--	1.0 D + 1.0 L (All Spans)

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.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- 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"	1149	1197	2346	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	1149	1197	2346	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	13.2	--	
1 - Uniform (PLF)	0 to 8' 11" (Front)	N/A	144.0	-	Floor
2 - Uniform (PLF)	0 to 8' 11" (Front)	N/A	100.5	268.5	Linked from: Upper Truss 1, Support 2

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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

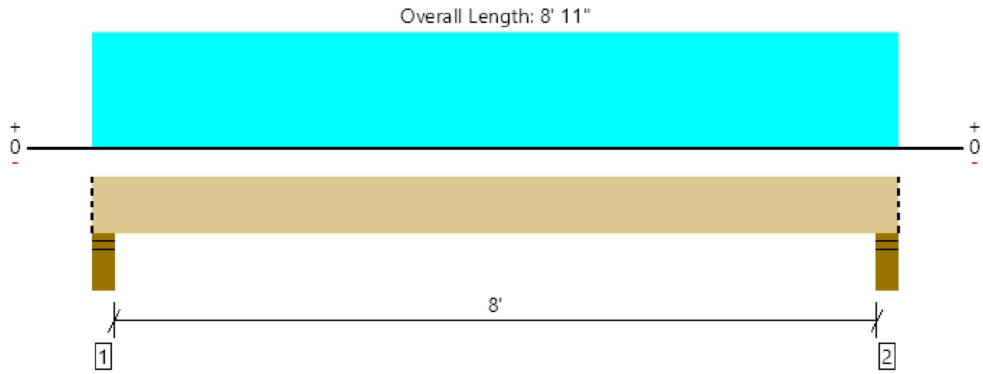
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Header 8

1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

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

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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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Weyerhaeuser

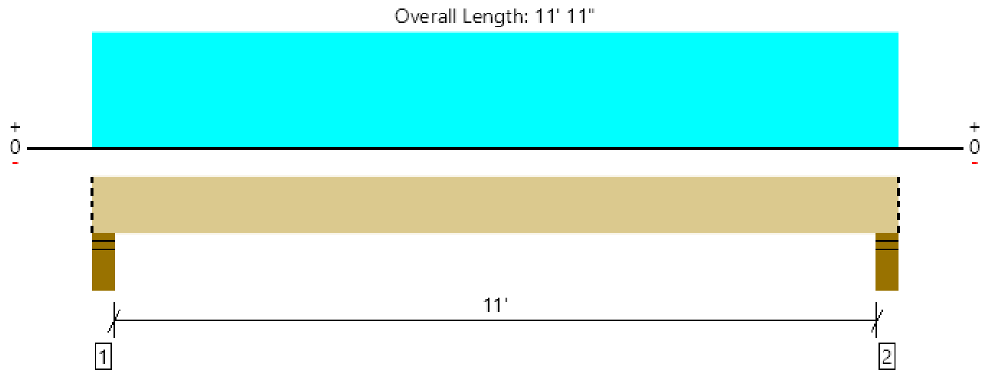
FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Header 9

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2979 @ 4"	12856 (5.50")	Passed (23%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2375 @ 1' 2 1/2"	8745	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	7911 @ 5' 11 1/2"	14850	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.165 @ 5' 11 1/2"	0.281	Passed (L/819)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.300 @ 5' 11 1/2"	0.563	Passed (L/451)	--	1.0 D + 1.0 L (All Spans)

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' 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"	1341	1639	2979	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	1341	1639	2979	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' 11" o/c	
Bottom Edge (Lu)	11' 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 11' 11"	N/A	12.0	--	
1 - Uniform (PLF)	0 to 11' 11" (Front)	N/A	144.0	-	Floor
2 - Uniform (PLF)	0 to 11' 11" (Front)	N/A	69.0	275.0	Linked from: Upper Truss 5, Support 2

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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

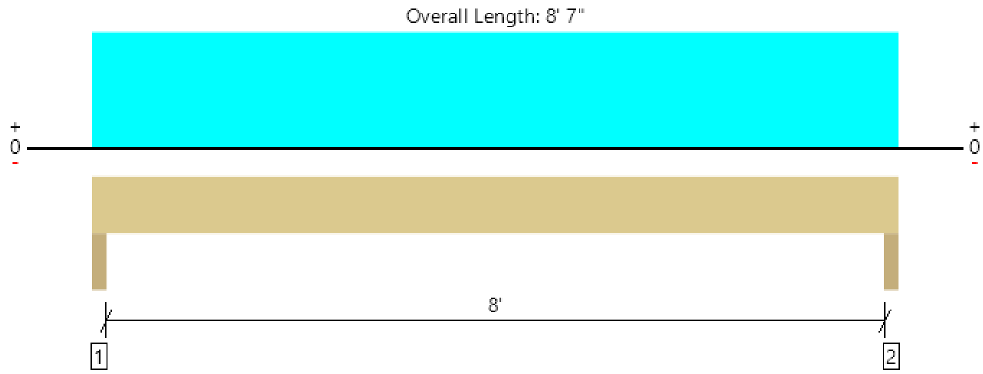
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Upper Floor, Upper Header 10
2 piece(s) 2 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- 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.

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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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Weyerhaeuser

9/7/2023 11:22:54 PM UTC

ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1

File Name: 22-112

FORTEWEB

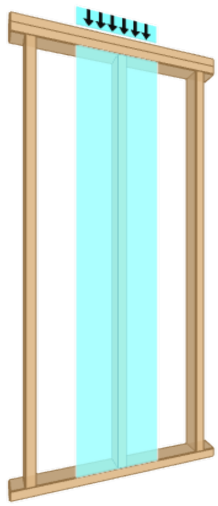
MEMBER REPORT

PASSED

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 (non-snow: 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), 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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

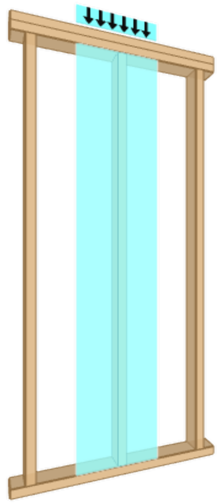
Weyerhaeuser

MEMBER REPORT

PASSED

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)	2100	5432	Passed (39%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	2100	4383	Passed (48%)	--	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	144.0	-	-	-	Default Load
2 - Point (PLF)	16.00"	150.8	-	201.8	252.0	Linked from: Roof Truss 1, Support 1
3 - Point (PLF)	16.00"	162.8	-	216.8	270.8	Linked from: Roof Truss 2, Support 2
4 - Point (PLF)	16.00"	100.5	268.5	-	-	Linked from: Upper Truss 1, Support 1
5 - Point (PLF)	16.00"	141.0	376.5	-	-	Linked from: Upper 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), 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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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

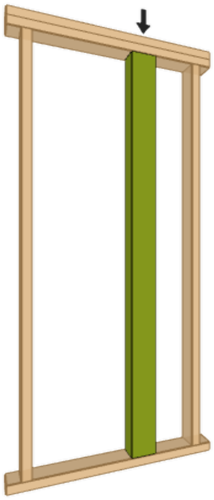
FORTEWEB

MEMBER REPORT

PASSED

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)	17710	27647	Passed (64%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	17710	17531	Passed (101%)	--	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	8602	5740	5127	6404	Linked from: Upper Beam 5, Support 1

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FORTEWEB

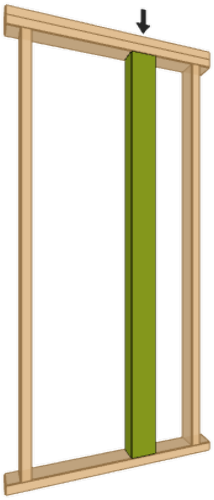
MEMBER REPORT

Upper Floor, Upper Post 2
1 piece(s) 4 x 8 DF No.2

~~FAILED~~

Post will be let through plate to bear directly on WF beam below

Wall Height: 11'   Member Height: 10' 7 1/2"   Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	18	50	Passed (35%)	--	--
Compression (lbs)	26650	27770	Passed (96%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	26650	15859	Failed (168%)	--	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	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	9255	7128	4987	6229	Linked from: Upper Beam 5, Support 2
2 - Point (lb)	N/A	2998	2923	2335	2916	Linked from: Upper Beam 6, Support 1

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ForteWEB Software Operator	Job Notes
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Weyerhaeuser

9/7/2023 11:22:54 PM UTC
ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1
File Name: 22-112

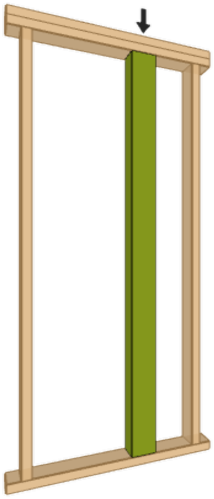
FORTEWEB

MEMBER REPORT

PASSED

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)	10694	14247	Passed (75%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	10694	12031	Passed (89%)	--	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	1877	2923	926	1157	Linked from: Upper Beam 6, Support 2
2 - Point (lb)	N/A	1668	4226	-	-	Linked from: Upper Beam 7, Support 1

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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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

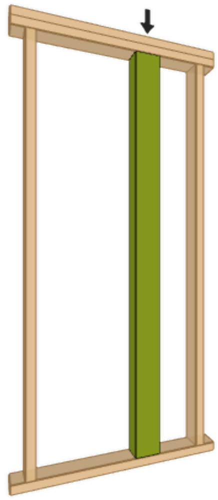
Weyerhaeuser

MEMBER REPORT

PASSED

Upper Floor, Upper Post 4
1 piece(s) 6 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)	10103	14825	Passed (68%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	10546	18906	Passed (56%)	--	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.
- 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	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	N/A	4295	5808	1197	2526	Linked from: Upper Beam 8, 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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

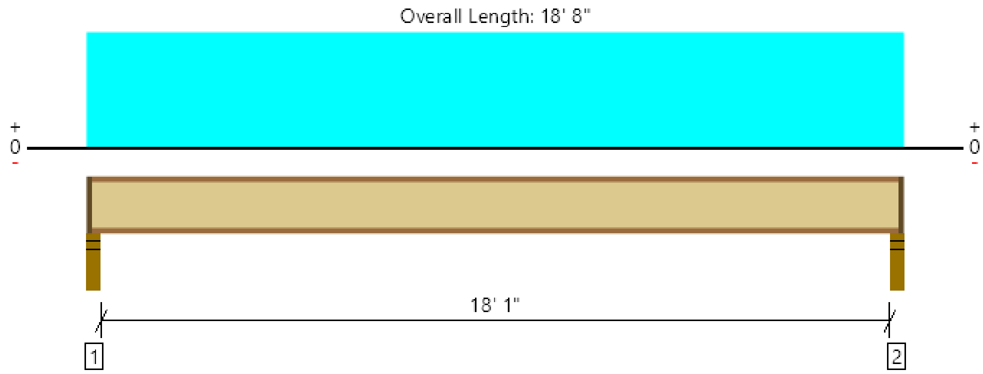
FORTEWEB

MEMBER REPORT

PASSED

Main, Main Truss 1

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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"	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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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

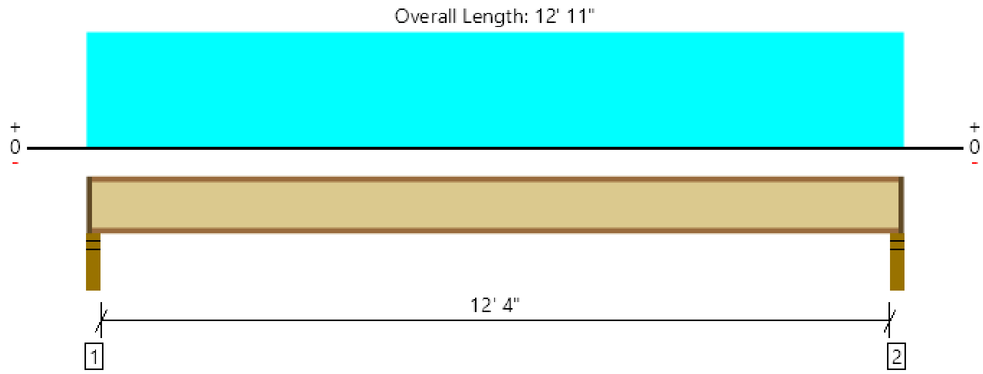
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

MEMBER REPORT

PASSED

Main, Main Truss 2

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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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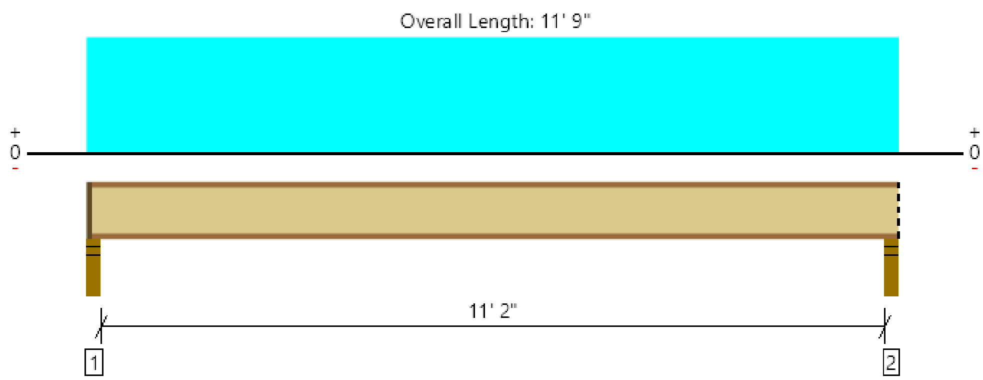
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Main, Main Truss 3-2

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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"	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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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

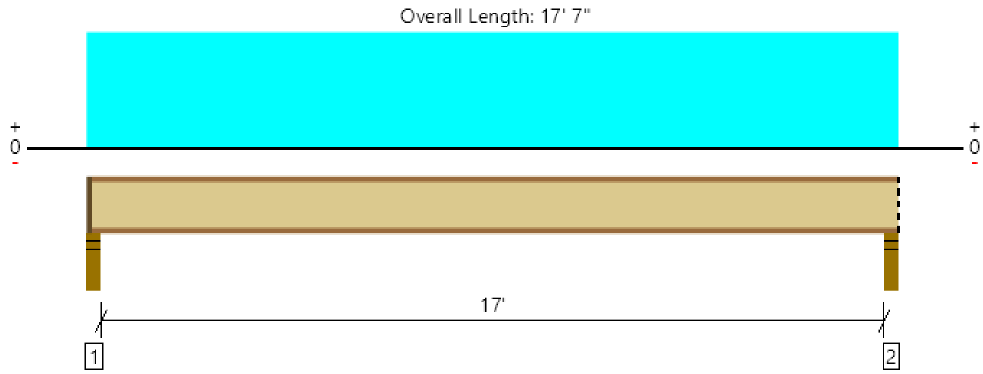
FORTEWEB

MEMBER REPORT

PASSED

Main, Main Truss 4

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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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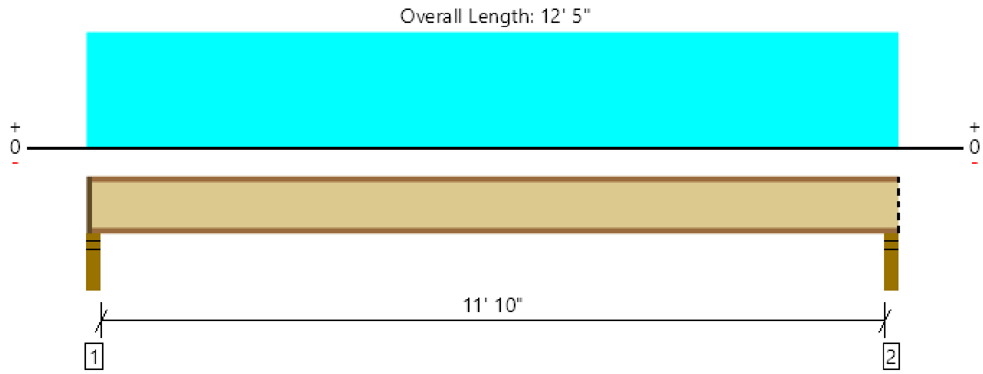
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Main, Main Truss 5

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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"	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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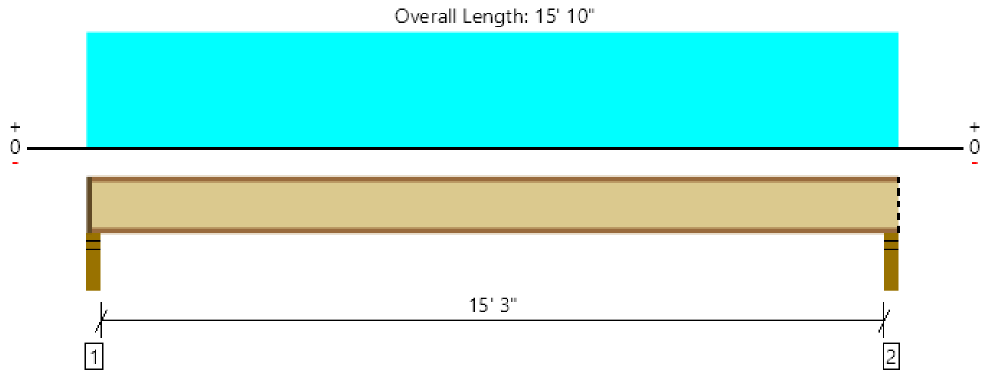
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Main, Main Truss 6

1 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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	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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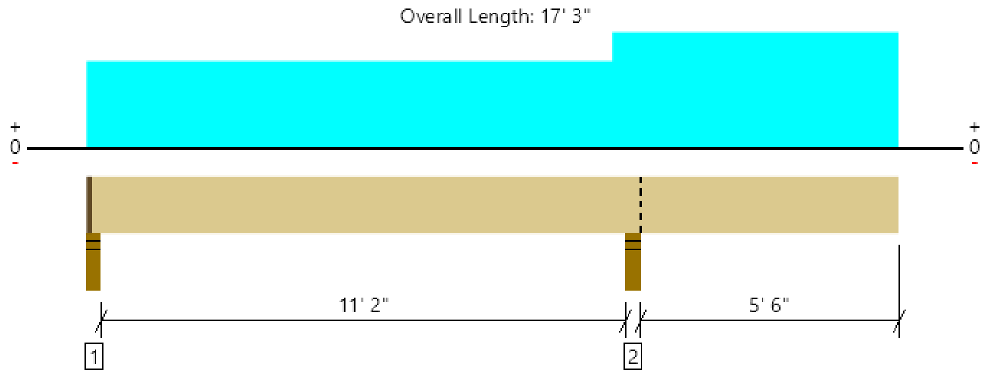
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Main, Main Deck 1

1 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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	--	--

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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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

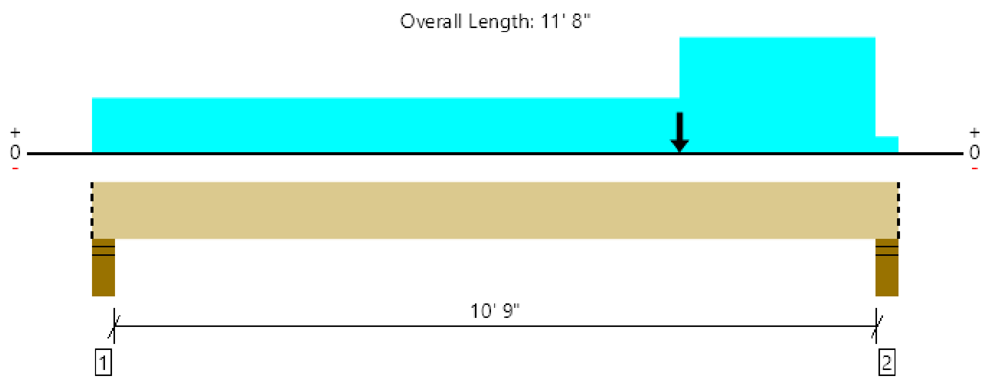
FORTEWEB

MEMBER REPORT

PASSED

Main, Main Beam 1

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	9159 @ 11' 4"	12856 (5.50")	Passed (71%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	7268 @ 10' 2 1/2"	11660	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	20707 @ 6' 9 15/16"	26400	Passed (78%)	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)	0.318 @ 6' 1/16"	0.550	Passed (L/415)	--	1.0 D + 1.0 L (All Spans)

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"	2.87"	3424	3281	308	385	6705	Blocking
2 - Stud wall - SPF	5.50"	5.50"	3.92"	4823	4262	1217	1520	9159	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 (non-snow: 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	174.0	-	232.5	290.3	Linked from: Roof Truss 1, Support 2
3 - Point (lb)	8' 6" (Front)	N/A	674	-	866	1082	Linked from: Roof Header 2, Support 2
4 - Uniform (PLF)	8' 6" to 11' 4" (Front)	N/A	100.5	268.5	-	-	Linked from: Upper Truss 1, Support 2
5 - Point (lb)	8' 6" (Front)	N/A	1149	1197	-	-	Linked from: Upper Header 7, Support 2
6 - Uniform (PLF)	0 to 11' 4" (Front)	N/A	96.8	258.0	-	-	Linked from: Main Truss 2, Support 2
7 - Uniform (PLF)	0 to 11' 4" (Front)	N/A	88.5	234.8	-	-	Linked from: Main Truss 3-2, Support 1

ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

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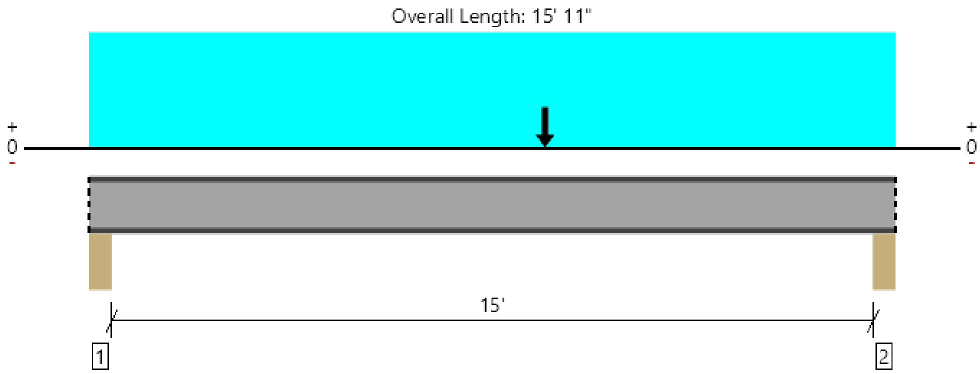
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

MEMBER REPORT

PASSED

Main, Main Beam 2
1 piece(s) W12X45 (A992) ASTM Steel



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	21999 @ 15' 7"	34313 (5.50")	Passed (64%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	21604 @ 15' 5 1/2"	81070	Passed (27%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	124275 @ 9'	128159	Passed (97%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.243 @ 8' 1 15/16"	0.381	Passed (L/753)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.433 @ 8' 2 1/16"	0.762	Passed (L/423)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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).
- Bearing reinforcement may be required for point load located at 9'.
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

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"	7814	10111	3161	3948	18358	Blocking
2 - Column - DF	5.50"	5.50"	5.50"	9488	11484	4161	5197	21999	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 (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 15' 11"	N/A	45.0	--	--	--	
1 - Uniform (PLF)	0 to 15' 11"	N/A	140.3	373.5	-	-	Linked from: Main Truss 1, Support 2
2 - Uniform (PLF)	0 to 15' 11"	N/A	132.0	351.8	-	-	Linked from: Main Truss 4, Support 1
3 - Point (lb)	9'	N/A	12253	10051	7322	9145	Linked from: Upper Post 2, Support 1

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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

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MEMBER REPORT

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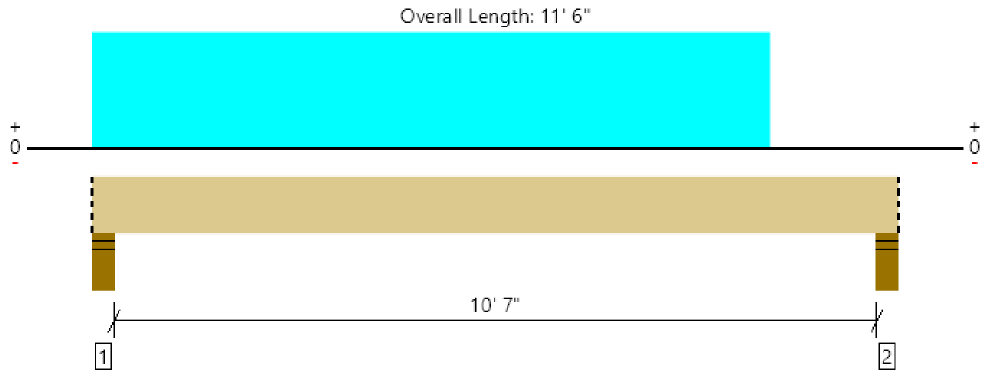
Main, Main Beam 3

1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5713 @ 4"	12856 (5.50")	Passed (44%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4364 @ 1' 4"	10203	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	14284 @ 5' 7 3/4"	20213	Passed (71%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.225 @ 5' 8 5/8"	0.271	Passed (L/579)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.314 @ 5' 8 5/8"	0.542	Passed (L/415)	--	1.0 D + 1.0 L (All Spans)

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 = 10' 10".
- 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"	2.44"	1618	4095	5713	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.75"	1175	2916	4091	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' 6" o/c	
Bottom Edge (Lu)	11' 6" 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' 6"	N/A	14.0	--	
1 - Uniform (PLF)	0 to 9' 8" (Front)	N/A	140.3	373.5	Linked from: Main Truss 1, Support 2
2 - Uniform (PLF)	0 to 9' 8" (Front)	N/A	132.0	351.8	Linked from: Main Truss 4, Support 1

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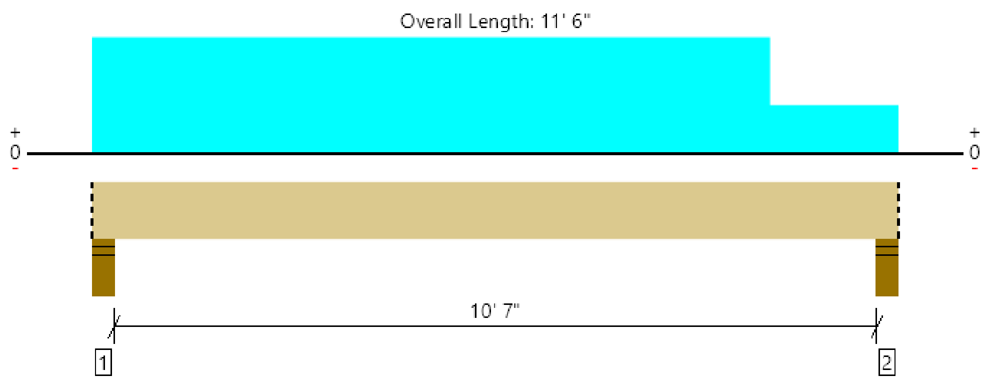
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Main, Main Beam 4

1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4774 @ 4"	12856 (5.50")	Passed (37%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3656 @ 1' 4"	10203	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	12038 @ 5' 8 5/16"	20213	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.190 @ 5' 8 3/4"	0.271	Passed (L/686)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.265 @ 5' 8 13/16"	0.542	Passed (L/490)	--	1.0 D + 1.0 L (All Spans)

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 = 10' 10".
- 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"	2.04"	1361	3413	4774	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.71"	1146	2842	3988	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' 6" o/c	
Bottom Edge (Lu)	11' 6" 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' 6"	N/A	14.0	--	
1 - Uniform (PLF)	0 to 9' 8" (Front)	N/A	132.0	351.8	Linked from: Main Truss 4, Support 2
2 - Uniform (PLF)	0 to 11' 6" (Front)	N/A	93.0	248.3	Linked from: Main Truss 5, Support 1

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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

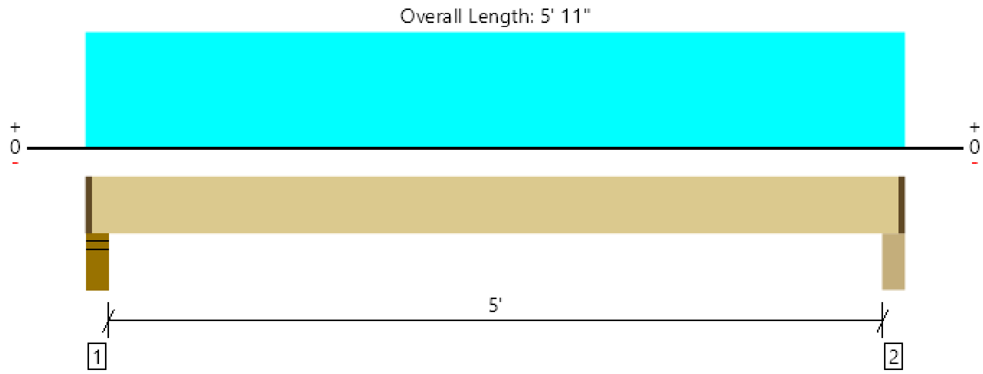
FORTEWEB

MEMBER REPORT

PASSED

Main, Main Beam 6

2 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1740 @ 4"	8750 (4.00")	Passed (20%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	819 @ 1' 7 1/2"	9310	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2116 @ 2' 11 1/2"	24258	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.009 @ 2' 11 1/2"	0.131	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.012 @ 2' 11 1/2"	0.262	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - DF	5.50"	4.00"	1.50"	395	1420	1815	1 1/2" Rim Board
2 - Column - DF	5.50"	4.00"	1.50"	395	1420	1815	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)	5' 8" o/c	
Bottom Edge (Lu)	5' 8" 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)	1 1/2" to 5' 9 1/2"	N/A	14.3	--	
1 - Uniform (PSF)	0 to 5' 11" (Front)	8'	15.0	60.0	Default Load

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ForteWEB Software Operator	Job Notes
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9/7/2023 11:22:54 PM UTC

ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1

File Name: 22-112

S170

P

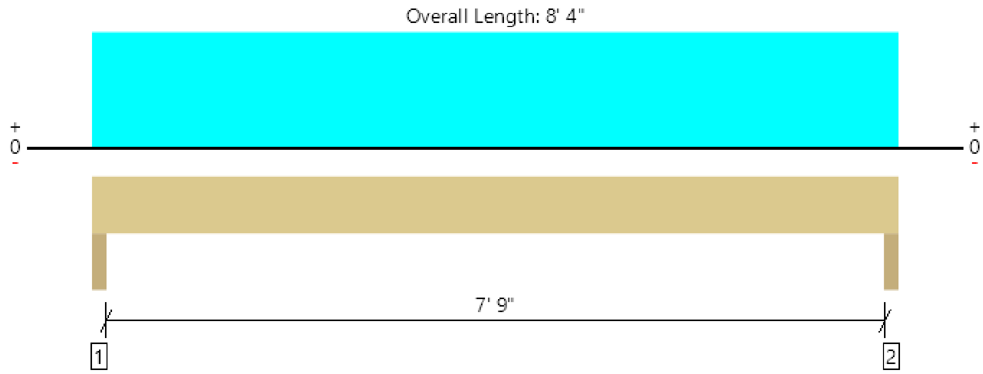
FORTEWEB

MEMBER REPORT

PASSED

Main, Main Header 1

1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

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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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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Weyerhaeuser

9/7/2023 11:22:54 PM UTC

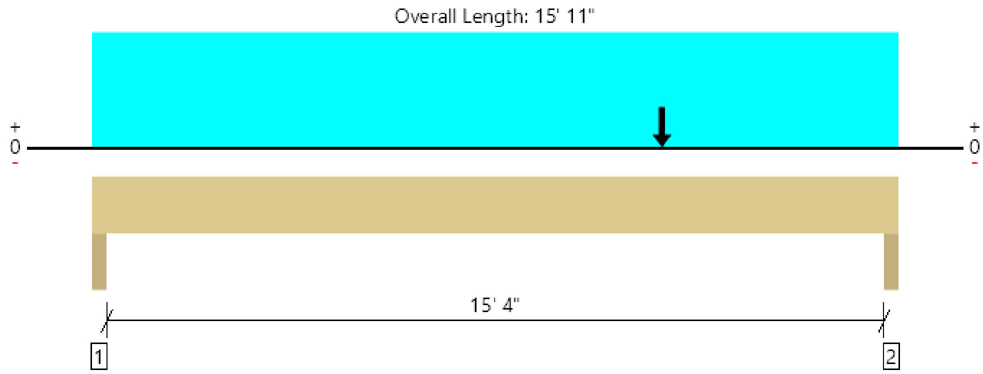
ForteWEB v3.6, Engine: V8.3.1.5, Data: V8.1.4.1

File Name: 22-112 S171

P

Main, Main Header 2

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3699 @ 15' 9"	12513 (3.50")	Passed (30%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	3379 @ 14' 7 1/2"	11660	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	14396 @ 11' 3"	26400	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.203 @ 8' 8 15/16"	0.390	Passed (L/923)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.402 @ 8' 5 9/16"	0.779	Passed (L/465)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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 = 15' 7".
- 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"	1.50"	1474	739	307	2258	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1767	1819	757	3699	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	15' 11" o/c	
Bottom Edge (Lu)	15' 11" 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 15' 11"	N/A	16.0	--	--	
1 - Uniform (PLF)	0 to 15' 11"	N/A	144.0	-	-	Floor
2 - Point (lb)	11' 3"	N/A	693	2558	1064	Linked from: Upper Header 4, Support 1

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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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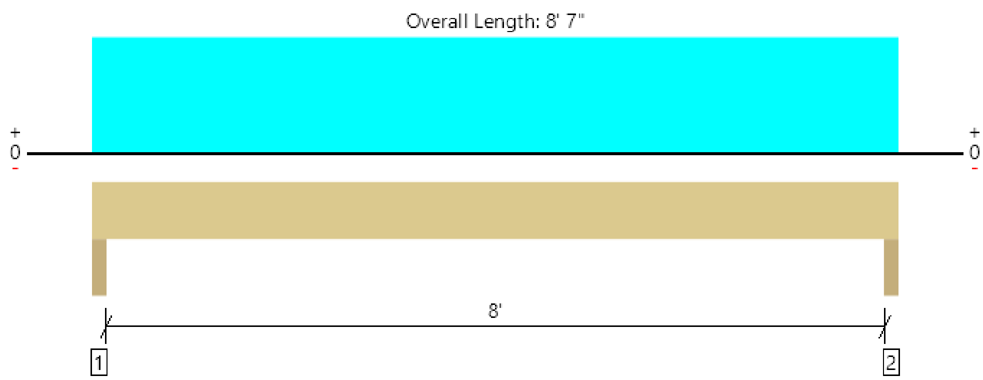
MEMBER REPORT

~~FAILED~~

Less than 5% overstressed, OK by observation

Main, Main Header 3

1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5380 @ 2"	12513 (3.50")	Passed (43%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4231 @ 11"	7288	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	10665 @ 4' 3 1/2"	10313	Failed (103%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.229 @ 4' 3 1/2"	0.206	Failed (L/433)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.375 @ 4' 3 1/2"	0.412	Passed (L/264)	--	1.0 D + 1.0 L (All Spans)

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"	1.50"	2100	3280	801	5380	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	2100	3280	801	5380	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6" 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	10.0	--	--	
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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ForteWEB Software Operator	Job Notes
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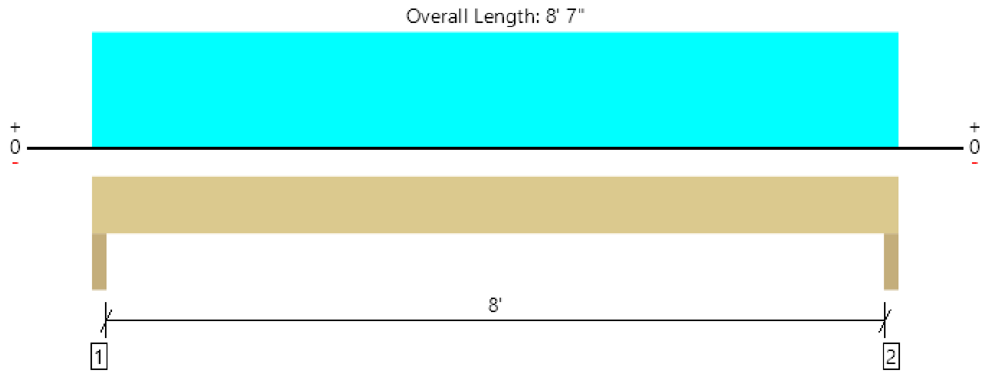
PASSED

Main, Main Header 4

1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3325 @ 2"	7963 (3.50")	Passed (42%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2421 @ 1' 1/2"	5565	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	6338 @ 4' 3 1/2"	9450	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.137 @ 4' 3 1/2"	0.206	Passed (L/720)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.211 @ 4' 3 1/2"	0.412	Passed (L/469)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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"	1.50"	1159	2037	850	3325	None
2 - Trimmer - SPF	3.50"	3.50"	1.50"	1159	2037	850	3325	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	7.7	--	--	
1 - Uniform (PLF)	0 to 8' 7"	N/A	144.0	-	-	Floor
2 - Uniform (PLF)	0 to 8' 7"	N/A	118.5	474.8	198.0	Linked from: Main Truss 6, Support 2

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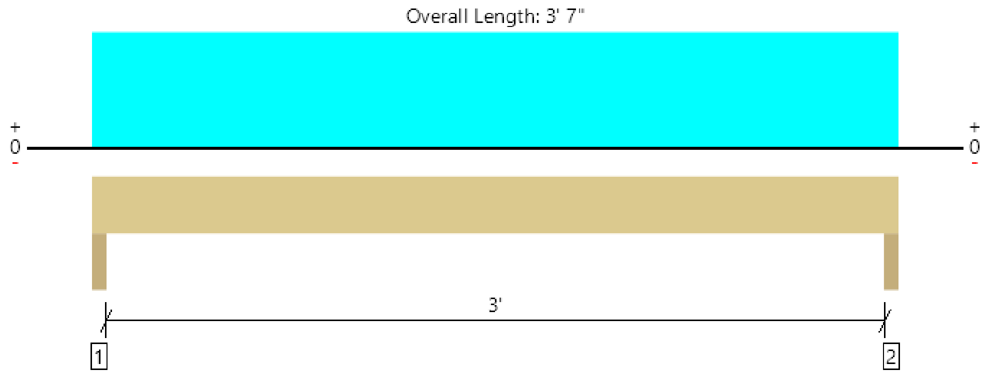
MEMBER REPORT

PASSED

Main, Main Header 5

2 piece(s) 2 x 6 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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)

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.
- 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"	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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Weyerhaeuser

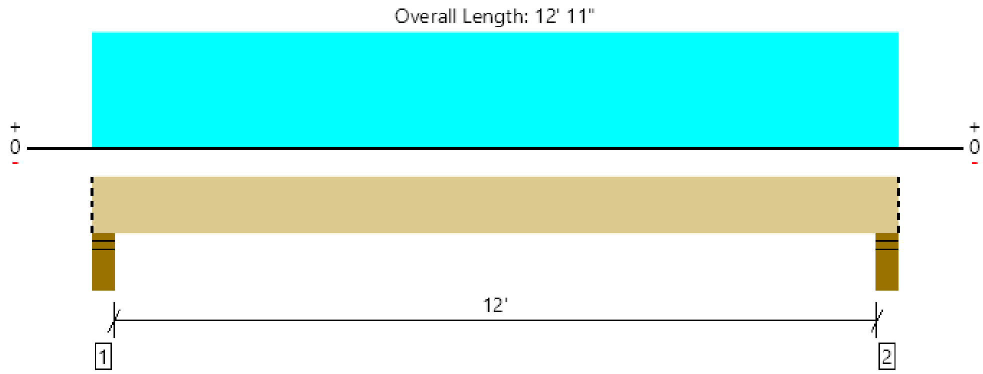
FORTEWEB

MEMBER REPORT

PASSED

Main, Main Header 6

1 piece(s) 5 1/4" x 14" 2.2E Parallam® PSL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

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.

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

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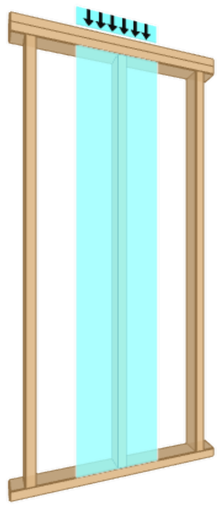
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

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)	2730	5432	Passed (50%)	1.15	1.0 D + 0.75 L + 0.75 S
Plate Bearing (lbs)	2730	4383	Passed (62%)	--	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	0.56	1	Passed (56%)	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	288.0	-	-	-	
2 - Point (PLF)	16.00"	174.0	-	232.5	290.3	Linked from: Roof Truss 1, Support 2
3 - Point (PLF)	16.00"	154.5	411.8	-	-	Linked from: Upper Truss 3, Support 2
4 - Point (PLF)	16.00"	191.3	764.3	-	186.8	Linked from: Main 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), 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
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

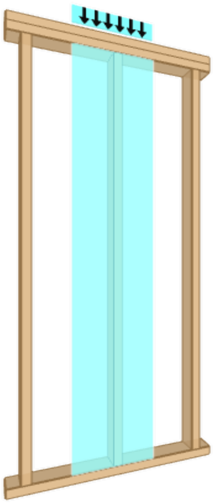
FORTEWEB

MEMBER REPORT

PASSED

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)	3048	5304	Passed (57%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	3048	4383	Passed (70%)	--	1.0 D + 1.0 L
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	0.65	1	Passed (65%)	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 (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (PLF)	16.00"	288.0	-	-	-	
2 - Point (PLF)	16.00"	150.8	-	201.8	252.0	Linked from: Roof Truss 1, Support 1
3 - Point (PLF)	16.00"	92.3	-	134.3	168.0	Linked from: Roof Truss 3, Support 2
4 - Point (PLF)	16.00"	100.5	268.5	-	-	Linked from: Upper Truss 1, Support 1
5 - Point (PLF)	16.00"	141.0	376.5	-	-	Linked from: Upper Truss 2, Support 2
6 - Point (PLF)	16.00"	140.3	373.5	-	-	Linked from: Main Truss 1, Support 2
7 - Point (PLF)	16.00"	96.8	258.0	-	-	Linked from: Main Truss 2, 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), 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

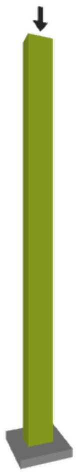
ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Weyerhaeuser

Main, Main Post 1

1 piece(s) 6 x 6 DF No.2

Post Height: 9'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	20	50	Passed (39%)	--	--
Compression (lbs)	15790	16909	Passed (93%)	1.00	1.0 D + 1.0 L
Base Bearing (lbs)	15790	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.

Vertical Loads	Dead (0.90)	Floor Live (1.00)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	3424	3281	308	385	Linked from: Main Beam 1, Support 1
2 - Point (lb)	4823	4262	1217	1520	Linked from: Main Beam 1, Support 2

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ForteWEB Software Operator	Job Notes
Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

FORTEWEB

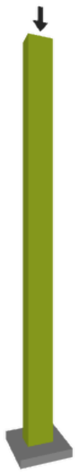
MEMBER REPORT

PASSED

Main, Main Post 2

1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL

Post Height: 9'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	21	50	Passed (41%)	--	--
Compression (lbs)	17925	42272	Passed (42%)	1.00	1.0 D + 1.0 L
Base Bearing (lbs)	18358	818606	Passed (2%)	--	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.

Vertical Load	Dead (0.90)	Floor Live (1.00)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	7814	10111	3161	3948	Linked from: Main Beam 2, Support 1

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Nabil Kausal-Hayes NKH Engineering (206) 601-9728 nabil@nkhengineering.com	

Weyerhaeuser

FORTEWEB

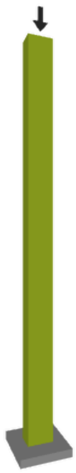
MEMBER REPORT

PASSED

Main, Main Post 3

1 piece(s) 5 1/4" x 5 1/4" 1.8E Parallam® PSL

Post Height: 9'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	21	50	Passed (41%)	--	--
Compression (lbs)	37379	42272	Passed (88%)	1.00	1.0 D + 1.0 L
Base Bearing (lbs)	37379	818606	Passed (5%)	--	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.

Vertical Loads	Dead (0.90)	Floor Live (1.00)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Point (lb)	1877	2923	926	1157	Linked from: Upper Beam 6, Support 2
2 - Point (lb)	1668	4226	-	-	Linked from: Upper Beam 7, Support 1
3 - Point (lb)	1618	4095	-	-	Linked from: Main Beam 3, Support 1
4 - Point (lb)	9488	11484	4161	5197	Linked from: Main Beam 2 Opt 2, Support 2

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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

$f'_c := 2500psi$ Concrete compressive strength

$f_y := 60 \cdot ksi$ Yield strength of rebar

$f_{soil.bearing} := 1500psf$ Minimum soil bearing capacity

$\gamma_{concrete} := 150pcf$ Concrete unit weight

$\gamma_{steel} := 490pcf$ Steel unit weight

$E_s := 29000ksi$ Young modulus of steel

$E_c := 57000 \cdot \sqrt{\frac{f'_c}{psi}} \cdot psi = 2.85 \times 10^3 \cdot ksi$ Young modulus of concrete (ACI-318-14)

Load Assumptions

$LL_{floor} := 40psf$ Floor live load

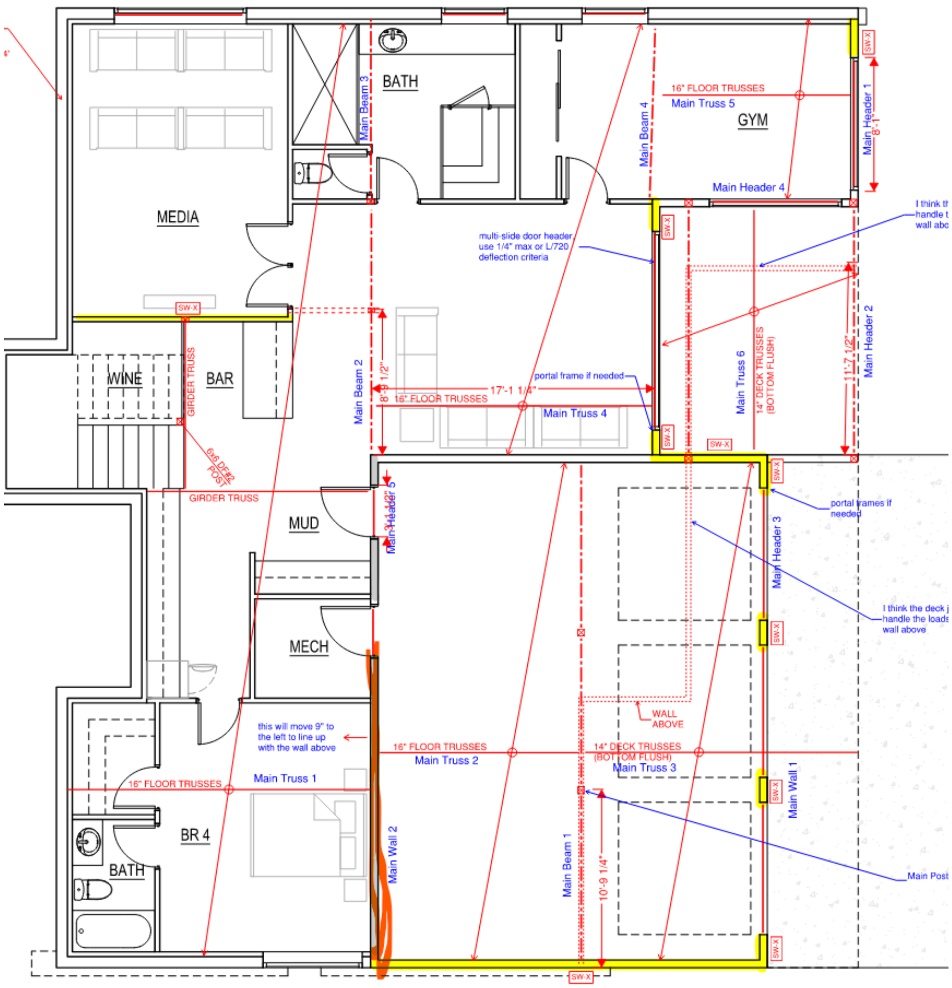
$DL_{floor} := 15psf$ Floor dead load

$DL_{roof} := 15psf$ Roof dead load

$LL_{roof} := 20psf$ Roof live load

$SL_{roof} := 25psf$ Roof snow load

Check Bearing Capacity of Foundation



$F_{wall} := 3048 \frac{lbf}{16in}$ — Axial load on wall per stud-from ForteWeb

$W_{found} := 20in$ — Foundation size

$d_f := 10in$ — Thickness of foundation

$$\frac{F_{wall} + W_{found} \cdot d_f \cdot \gamma_{concrete}}{W_{found}} = 1.497 \times 10^3 \cdot psf$$

OK less than 1500 psf

Check the one way shear:

$$V_f := 1.6 \cdot \frac{F_{wall}}{W_{found}} \cdot \left(\frac{W_{found}}{2}\right) = 1.829 \times 10^3 \cdot plf$$

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{f'_c}{psi}} \cdot \left(d_f - 3in\right) \cdot psi = 6.3 \times 10^3 \cdot plf$$

$$\frac{V_f}{\phi V_c} = 0.29$$

Less than 1.0 OK

$$\frac{0.0018 \cdot W_{found} \cdot d_f}{0.2in^2} = 1.8$$

Use 2#4 rebar

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
fy : Rebar Yield	=	60.0 ksi
Ec : 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

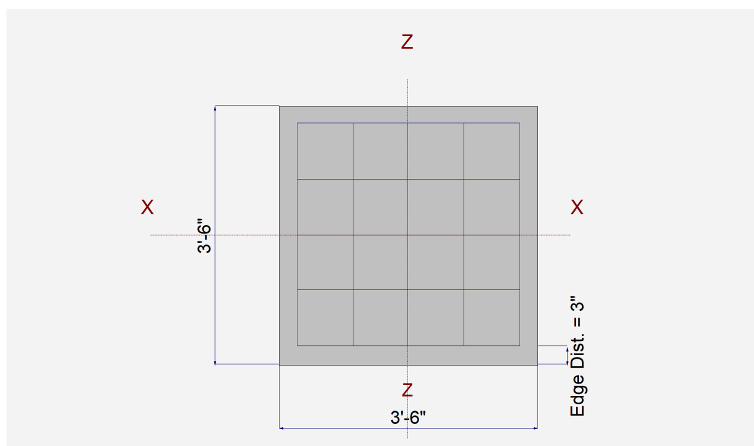
Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

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...

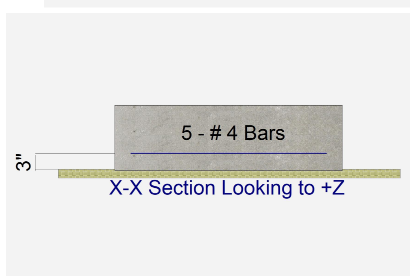
at Bottom of footing	=	3.0 in

Reinforcing

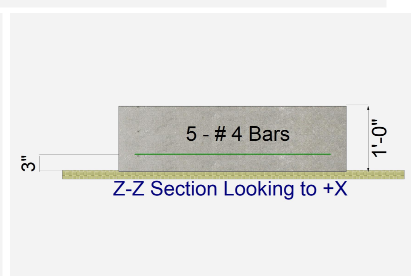
Bars parallel to X-X Axis		
Number of Bars	=	5.0
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis		
Number of Bars	=	5.0
Reinforcing Bar Size	=	# 4

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



X-X Section Looking to +Z



Z-Z Section Looking to +X

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

General Footing

DESCRIPTION: Footing @ Main Post 1

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 (in)	Zecc (in)	Actual Soil Bearing Stress @ Location: Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
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				

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	1.443	+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

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	150.00 psi	0.2261	OK
+1.20D+0.50Lr+1.60L	66.75 psi	150.00 psi	0.445	OK
+1.20D+1.60L+0.50S	67.31 psi	150.00 psi	0.4487	OK
+1.20D+1.60Lr+L	58.39 psi	150.00 psi	0.3892	OK
+1.20D+1.60Lr	36.23 psi	150.00 psi	0.2416	OK
+1.20D+L+1.60S	60.17 psi	150.00 psi	0.4011	OK
+1.20D+1.60S	38.02 psi	150.00 psi	0.2535	OK
+1.20D+0.50Lr+L	53.46 psi	150.00 psi	0.3564	OK
+1.20D+L+0.50S	54.02 psi	150.00 psi	0.3601	OK
+0.90D	21.80 psi	150.00 psi	0.1453	OK
+1.20D+L+0.20S	52.34 psi	150.00 psi	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 (c) ENERCALC INC 1983-2023

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
fy : Rebar Yield	=	60.0	ksi
Ec : 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

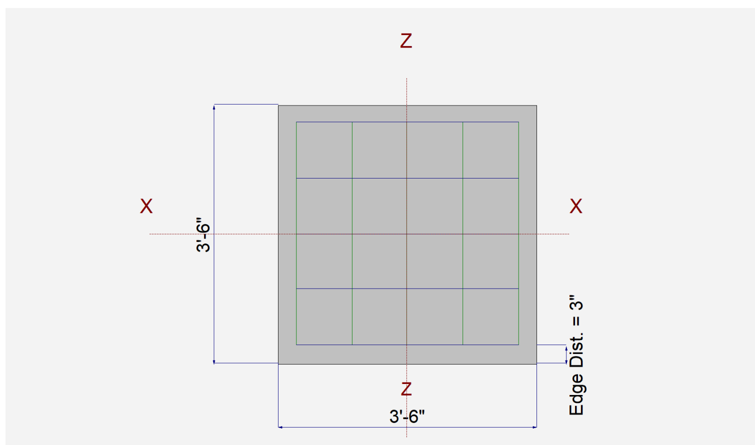
Width parallel to X-X Axis	=	3.50	ft
Length parallel to Z-Z Axis	=	3.50	ft
Footing Thickness	=	12.0	in

Pedestal dimensions...

px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0	in



Reinforcing

Bars parallel to X-X Axis

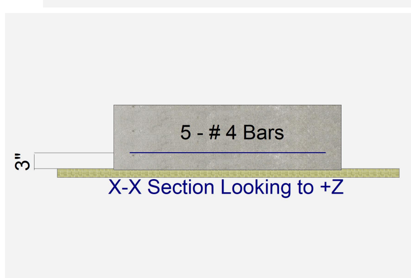
Number of Bars	=		5
Reinforcing Bar Size	=	#	4

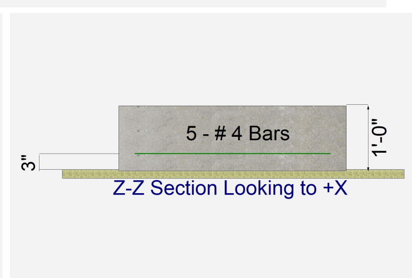
Bars parallel to Z-Z Axis

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

NKH ENGINEERING

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 (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
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				

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	1.367	+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

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	150.00 psi	0.2142	OK
+1.20D+0.50Lr+1.60L	79.70 psi	150.00 psi	0.5313	OK
+1.20D+1.60L+0.50S	80.85 psi	150.00 psi	0.539	OK
+1.20D+1.60Lr+L	72.09 psi	150.00 psi	0.4806	OK
+1.20D+1.60Lr	42.39 psi	150.00 psi	0.2826	OK
+1.20D+L+1.60S	75.79 psi	150.00 psi	0.5053	OK
+1.20D+1.60S	46.09 psi	150.00 psi	0.3073	OK
+1.20D+0.50Lr+L	61.88 psi	150.00 psi	0.4125	OK
+1.20D+L+0.50S	63.03 psi	150.00 psi	0.4202	OK
+0.90D	20.66 psi	150.00 psi	0.1377	OK
+1.20D+L+0.20S	59.56 psi	150.00 psi	0.397	OK

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

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
fy : Rebar Yield	=	60.0 ksi
Ec : 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

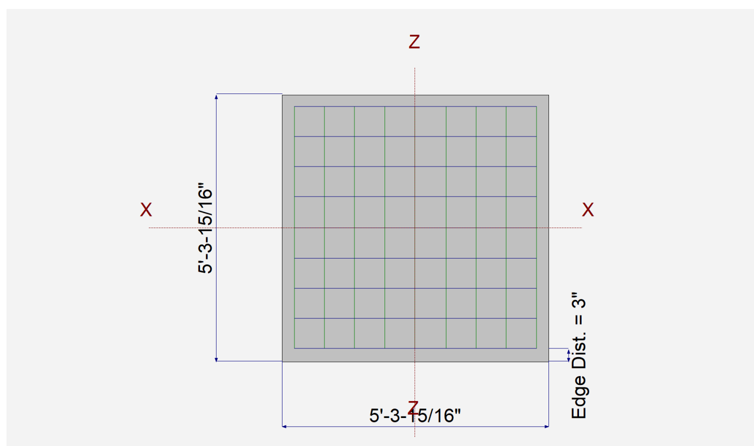
Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

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	=	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...

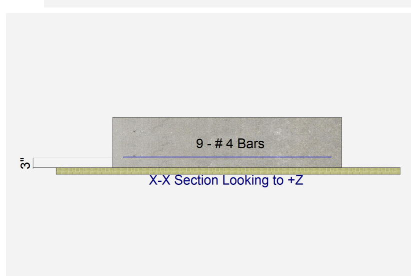
at Bottom of footing	=	3.0 in

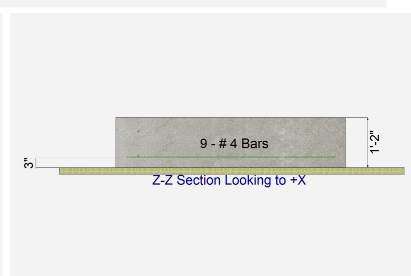
Reinforcing

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	Lr	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 (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
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

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

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	150.00 psi	0.2734	OK
+1.20D+0.50Lr+1.60L	112.95 psi	150.00 psi	0.753	OK
+1.20D+1.60L+0.50S	114.25 psi	150.00 psi	0.7617	OK
+1.20D+1.60Lr+L	96.90 psi	150.00 psi	0.646	OK
+1.20D+1.60Lr	51.46 psi	150.00 psi	0.3431	OK
+1.20D+L+1.60S	101.06 psi	150.00 psi	0.6737	OK
+1.20D+1.60S	55.62 psi	150.00 psi	0.3708	OK
+1.20D+0.50Lr+L	85.69 psi	150.00 psi	0.5712	OK
+1.20D+L+0.50S	86.98 psi	150.00 psi	0.5799	OK
+0.90D	26.36 psi	150.00 psi	0.1757	OK
+1.20D+L+0.20S	83.15 psi	150.00 psi	0.5543	OK

Design of 10 ft Retaining Wall

$t_{wall} := 8in$ Thickness of wall

$t_{foun} := 10in$ Thickness of foundation

$L_{toe} := 1ft + 10in = 1.833 \cdot ft$ Total foundation length

$h_{key} := 0ft$ Height of key

$t_{key} := 0in$ Thickness of key

$L_{heel} := 1ft + 6in$ Heel length

$t_{gr\_slab} := 4in$ Thickness of slab on grade on top of wall foundation

$h_{wall} := 10ft$ Height of the wall

$I := \frac{1}{12} \cdot \left(L_{toe} + L_{heel} + t_{wall}\right)^3 = 5.333 \cdot \frac{ft^4}{ft}$ Moment inertia of wall base

$f'_c := 2500psi$ Concrete compressive strength

$f_y := 60ksi$ Steel yield strength

$E_s := 29000ksi$ Steel young modulus

$\gamma_c := 150pcf$ Concrete unit weight

$p_a := 40pcf$ Active soil pressure

$p_o := 55pcf$ At-rest soil pressure

$\Delta p_{eq} := 8\left(\frac{h_{wall}}{ft}\right) \cdot psf = 80 \cdot psf$ Seismic soil pressure

$p_p := 200pcf$ Passive pressure

$PGA := 0.607$

$\mu := 0.35$ Soil friction factor from IBC 2018

$\phi := \frac{3}{2} \cdot \mathrm{atan}(\mu) = 28.935 \cdot deg$ Equivalent friction angle

$K_a := \frac{1 - \sin(\phi)}{1 + \sin(\phi)} = 0.348$ Active pressure coefficient

$K_o := 1 - \sin(\phi) = 0.516$ At-Rest pressure coefficient

$\gamma_{soil} := \frac{p_a}{K_a} = 114.984 \cdot pcf$ Soil unit weight

Vertical weight on wall

$P_{d\_wall} := (h_{wall} - t_{foun}) \cdot t_{wall} \cdot \gamma_c = 916.667 \cdot plf$

$P_{d\_found} := (L_{toe} + t_{wall} + L_{heel}) \cdot t_{foun} \cdot \gamma_c = 500 \cdot plf$ Concrete weight of foundation

$P_{d\_key} := (h_{key} - t_{foun}) \cdot t_{key} \cdot \gamma_c = 0 \cdot plf$ Concrete weight of key

$P_{d\_slab} := t_{gr\_slab} \cdot (44ft) \cdot \gamma_c + 5psf \cdot 44ft + 0.6\left(3919 \frac{lbf}{16in} + 2092 \frac{lbf}{16in} + 1507 \frac{lbf}{16in}\right) = 5.803 \times 10^3 \cdot p$

Concrete weight of slab and dead load on grade

$P_{slab.on.found} := t_{gr\_slab} \cdot \gamma_c \cdot L_{toe} = 91.667 \cdot plf$ Weight of concrete slab on wall foundation

Live load on slab

$P_{ll} := 0psf \cdot (L_{toe}) = 0 \cdot plf$

Surcharge pressure on wall due to slab on grade

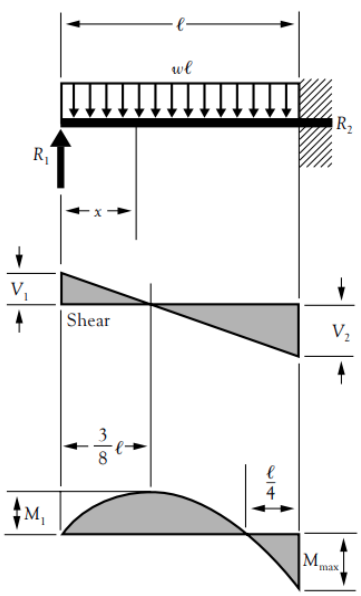
$P_{d\_.surch} := 0 \cdot t_{gr\_slab} \cdot \gamma_c \cdot K_a = 0 \cdot psf$

Surcharge pressure on wall due to live load on patio

$P_{ll\_.surch} := 60psf \cdot K_a = 20.872 \cdot psf$

Check Sliding Capacity for Dead Load

Lateral earth force from active pressure



$$R_1 = V_1 \quad \ldots\ldots\ldots\ldots \quad = \frac{3w\ell}{8}$$

$$R_2 = V_2 \quad \ldots\ldots\ldots\ldots \quad = \frac{5w\ell}{8}$$

$$V_x \quad \ldots\ldots\ldots\ldots \quad = R_1 - wx$$

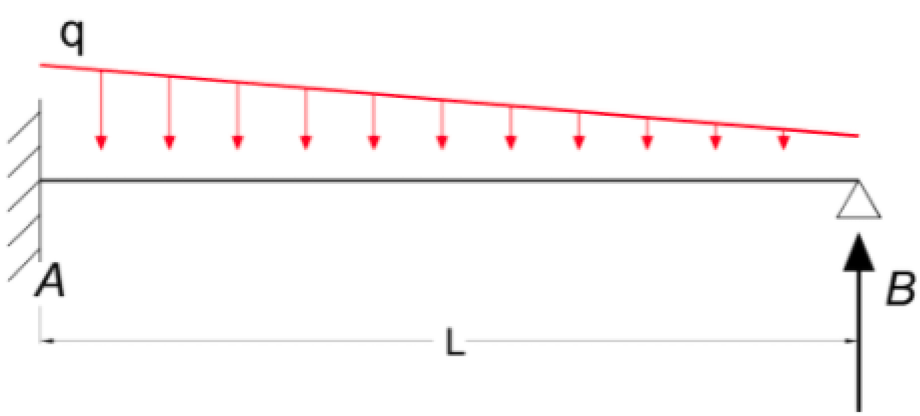
$$M_{max} \quad \ldots\ldots\ldots\ldots \quad = \frac{w\ell^2}{8}$$

$$M_1 \left(\text{at } x = \frac{3}{8}\ell\right) \quad \ldots\ldots\ldots\ldots \quad = \frac{9}{128}w\ell^2$$

$$M_x \quad \ldots\ldots\ldots\ldots \quad = R_1 x - \frac{wx^2}{2}$$

$$\Delta_{max} \left(\text{at } x = \frac{\ell}{16}(1+\sqrt{33}) = .4215\,\ell\right) \quad . \quad = \frac{w\ell^4}{185EI}$$

$$\Delta_x \quad \ldots\ldots\ldots\ldots \quad = \frac{wx}{48EI}(\ell^3 - 3\ell x^2 + 2x^3)$$



Bending Moment

$M_A = - q\ L^2 / 15$ (3a)

where

M_A = *moment at the fixed end (Nm, lb_f ft)*

q = continuous declining load (N/m, lb_f/ft)

$M_1 = q\ L^2 / 33.6$ (3b)

where

M_1 = *maximum moment at x = 0.553 L (Nm, lb_f ft)*

Deflection

$\delta_{max} = q\ L^4 / (419\ E\ I)$ (3c)

where

δ_{max} = *max deflection at x = 0.553 L (m, ft)*

$\delta_{1/2} = q\ L^4 / (427\ E\ I)$ (3d)

where

$\delta_{1/2}$ = *deflection at x = L / 2 (m, ft)*

Support Reactions

$R_A = 2\ q\ L / 5$ (3e)

$R_B = q\ L / 10$ (3f)

$$F_d := \frac{2}{5} \cdot p_o \cdot \left(h_{wall} - t_{gr\_slab}\right)^2 + 5 \cdot \frac{P_{d\_.surch} \cdot \left(h_{wall} - t_{gr\_slab}\right)}{8} = 2.056 \times 10^3 \cdot plf$$

Resisting force

$$F_{res} := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{d\_slab} \cdots + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right) = 8.743 \times 10^3 \cdot plf$$

$$\frac{F_{res} \cdot \mu}{F_d} = 1.5$$

It is more than or equal 1.5

Check Sliding Capacity for Seismic Load

Lateral earth force from active pressure

$$F_d := \frac{2}{5} \cdot p_a \cdot \left(h_{wall} - t_{gr\_slab}\right)^2 + \frac{5}{8} \cdot P_{d\_surch} \cdot \left(h_{wall} - t_{gr\_slab}\right) \cdots + \frac{\frac{5}{8} \cdot \Delta p_{eq} \cdot \left(h_{wall} - t_{gr\_slab}\right) + \left(\frac{P_{d\_wall}}{2} + P_{d\_found} + P_{d\_key}\right) \cdot PGA \cdot \frac{1}{2}}{1.4} = 2.048 \times 10^3 \cdot plf$$

Resisting Force

$$F_{res} := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{d\_slab} \cdots + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right) = 8.743 \times 10^3 \cdot plf$$

$$\frac{0.9F_{res} \cdot \mu + \frac{1}{2} p_p \cdot \left(h_{key}\right)^2}{F_d} = 1.345$$

It is more than 1.0

Check Overturning Capacity for Dead Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \cdots + \frac{P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} = 3.312\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \cdots + P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \cdots + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 8.022\cdot\frac{kip\cdot ft}{ft}$$

$$\frac{M_{res}}{M_d} = 2.422$$

It is more than 1.5

Check Overturning Capacity for Seismic Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \cdots + \frac{P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots \frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots + \frac{+\left[\frac{P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2} - t_{foun}\right) + P_{d\_found}\cdot\frac{t_{foun}}{2} + P_{d\_key}\cdot\frac{h_{key}}{2}\right]\cdot PGA\cdot\frac{1}{2}}{1.4}$$

$$M_d = 3.535\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \ldots + P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \ldots + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 8.022\cdot\frac{kip\cdot ft}{ft}$$

$$\frac{0.9\cdot M_{res}}{M_d} = 2.042$$

It is more than 1.1

Check Overturning Capacity for Dead and Live Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \ldots + \frac{\left(P_{d\_.surch} + P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} \ldots + \frac{5}{8}\cdot\left(P_{d\_.surch} + P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key}$$

$$M_d = 3.556\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \ldots + P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \ldots + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 8.022\cdot\frac{kip\cdot ft}{ft}$$

$$\frac{M_{res} + \frac{1}{4}p_p\cdot\left(h_{key} + t_{foun} - 4in\right)^3}{M_d} = 2.258$$

It is more than 1.0

Check Soil Bearing Pressure for DL+LL

$$M_d := \frac{1}{15} \cdot p_o \cdot \left(h_{wall} - t_{gr\_slab}\right)^3 \ldots + \frac{\left(P_{d\_.surch} + P_{ll\_.surch}\right) \cdot \left(h_{wall} - t_{gr\_slab}\right)^2}{8}$$

$$M_{res} := P_{d\_wall} \cdot \left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found} \cdot \left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \ldots + P_{d\_key} \cdot \frac{t_{key}}{2} + P_{slab.on.found} \cdot \frac{L_{toe}}{2} \ldots + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right) \cdot \left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 8.022 \cdot \frac{kip \cdot ft}{ft}$$

$$L_{base} := L_{toe} + t_{wall} + L_{heel}$$

$$P := P_{d\_wall} + P_{d\_found} + P_{d\_key} + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$\left| \frac{M_{res} - M_d}{P} - \frac{\left(L_{toe} + t_{wall} + L_{heel}\right)}{2} \right| = 0.481 \cdot ft$$

Eccentricity

$$\frac{L_{base}}{6} = 0.667 \cdot ft$$

Eccentricity is within 1/3 of base so base is always in compression

$$\sigma_{toe} := \frac{P_{d\_wall} + P_{d\_found} + P_{d\_key} + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right)}{L_{toe} + t_{wall} + L_{heel}} \ldots$$
$$+ \frac{M_d \cdot 0.5 \cdot L_{base}}{I} - \frac{P_{d\_wall} \cdot \left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right) \cdot 0.5 L_{base}}{I} \ldots$$
$$+ \frac{P_{d\_key} \cdot \left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right) \cdot \left(0.5 L_{base}\right)}{I} + \frac{P_{slab.on.found} \cdot \left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right) \cdot \left(0.5 L_{base}\right)}{I} \ldots$$
$$+ \frac{-L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right) \cdot \left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right) \cdot .5 L_{base}}{I}$$

$\sigma_{toe} = 1.449 \times 10^{3} \cdot psf$ Less than 1500 psf OK

$$\sigma_{heel} := \frac{P_{d\_wall} + P_{d\_found} + P_{d\_key} + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right)}{L_{toe} + t_{wall} + L_{heel}} \ldots$$
$$+ \frac{-M_d \cdot 0.5 \cdot L_{base}}{I} - \frac{-P_{d\_wall} \cdot \left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right) \cdot 0.5 L_{base}}{I} \ldots$$
$$+ \frac{-P_{d\_key} \cdot \left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right) \cdot \left(0.5 L_{base}\right)}{I} - \frac{P_{slab.on.found} \cdot \left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right) \cdot \left(0.5 L_{base}\right)}{I} ..$$
$$+ \frac{L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right) \cdot \left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right) \cdot .5 L_{base}}{I}$$

$\sigma_{heel} = 21.222 \cdot psf$ Less than 1500 psf OK

Check Soil Bearing Pressure for Seismic

$$M_d := \frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \cdots$$
$$+ \frac{P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots$$
$$\frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots$$
$$+ \frac{+\left[\frac{P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2} - t_{foun}\right) + P_{d\_found}\cdot\frac{t_{foun}}{2} + P_{d\_key}\cdot\frac{h_{key}}{2}\right]\cdot PGA\cdot\frac{1}{2}}{1.4}$$

$$M_d = 4.439\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \cdots \quad = 8.022\cdot\frac{kip\cdot ft}{ft}$$
$$+ P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \cdots$$
$$+ L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right)$$

$$P := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{d\_slab} + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$e_{cc} := \left|\frac{0.9\cdot M_{res} + \frac{1}{4}p_p\cdot\left(h_{key} + t_{foun} - 1ft\right)^3 - M_d}{P} - \frac{L_{base}}{2}\right| = 1.682\cdot ft$$

Eccentricity

$$\frac{L_{base}}{2} = 2\cdot ft$$

The resultant is within base

Moment about centroid of foundation

$$M_{center} := M_d - P_{d\_wall}\cdot\left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right) + P_{d\_key}\cdot\left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right) \dots$$
$$+ P_{slab.on.found}\cdot\left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right) - L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right)$$

$$M_{center} = 2.786\cdot\frac{kip\cdot ft}{ft}$$

Axial load on center of foundation

$$P_{center} := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{slab.on.found} + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$P_{center} = 3.032\cdot\frac{kip}{ft}$$

$\sigma_{toe} = 1.87\times10^{3}\cdot psf$

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

$$A_{s.min.wall} := 0.0018 \cdot t_{wall} \cdot 12in = 0.173 \cdot in^2$$

Provide at least #4@12

Shear Capacity ACI-318

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{|f'_c|}{psi}} \cdot psi \cdot \left(t_{wall} - 3in\right) = 4.5 \cdot \frac{kip}{ft}$$

Shear Capacity

$$\phi M_{cap\_base} := 0.9 \cdot f_y \cdot 0.2 \frac{in^2}{ft} \cdot \frac{12}{8} \cdot \left(0.9 \cdot \frac{t_{wall}}{2}\right) = 4.86 \cdot \frac{kip \cdot ft}{ft}$$

Moment capacity of wall at the base #4@8"

$$\phi M_{cap\_mid} := 0.9 \cdot f_y \cdot 0.2 \frac{in^2}{ft} \cdot \frac{12}{8} \cdot \left(0.9 \cdot \frac{t_{wall}}{2}\right) = 4.86 \cdot \frac{kip \cdot ft}{ft}$$

Moment capacity of wall at the middle #4@12"

$$\phi V_c = 4.5 \cdot \frac{kip}{ft}$$

Shear capacity of wall

Calculate Demand on Base of Wall (1.4DL+1.6LL+1.6EH)

$$M := 1.6 \frac{1}{15} \cdot p_o \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^3 \ldots + \frac{\left(1.2 \cdot P_{d\_.surch} + 1.6 \cdot P_{ll\_.surch}\right) \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^2}{8} = 4.369 \cdot kip \cdot \frac{ft}{ft}$$

$$M = 4.369 \cdot kip$$

$$\frac{M}{\phi M_{cap\_base}} = 89.903 \cdot \%$$

Moment capacity is more than demand moment on wall-OK

$$V := 1.6\frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right)^2 \ldots$$
$$+\frac{5}{8}\cdot\left(1.2\cdot P_{d\_.surch} + 1.6\cdot P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right)$$

$$V = 2.518\cdot\frac{kip}{ft}$$

$$\frac{V}{\phi V_c} = 55.958\cdot\%$$

Shear capacity is more than demand moment on wall-OK

Calculate Demand on Base Wall (1.2DL+1.0LL+1.6EH+1.0EQ)

$$M := 1.6\frac{1}{15}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^3 \ldots$$
$$+\frac{1.2\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^2}{8} \ldots$$
$$+\frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^2}{8} \ldots$$
$$+\left[\frac{1.2P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2} - t_{foun}\right)\right]\cdot\frac{PGA}{2}$$

$$M = 4.417\cdot kip$$

$$\frac{M}{\phi M_{cap\_base}} = 90.876\cdot\%$$

OK

$$V := 1.6\frac{2}{5}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right)^2 + 1.2\frac{5}{8}\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right) ..$$
$$+\frac{5}{8}\cdot\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right) + \left(\frac{1.2P_{d\_wall}}{2}\right)\cdot\frac{PGA}{2}$$

$$V = 2.283\cdot\frac{kip}{ft}$$

$$\frac{V}{\phi V_c} = 50.725\cdot\%$$

Shear capacity is more than demand moment on wall-OK

$$A_{smin.wall} := 0.0018\cdot t_{wall}\cdot 12in = 0.173\cdot in^2$$

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

$$M_d := 1.6\frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 \ldots + \frac{\left(1.2\cdot P_{d\_.surch} + 1.6\cdot P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8}$$

$$M_{center} := M_d - 1.2P_{d\_wall}\cdot\left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right) + 1.2P_{d\_key}\cdot\left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right) \ldots + 1.2\cdot P_{slab.on.found}\cdot\left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right) \ldots + -1.2L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right)$$

$$M_{center} = 3.707\cdot kip$$

Axial load on center of foundation

$$P_{center} := 1.2P_{d\_wall} + 1.2P_{d\_found} + 1.2P_{d\_key} + 1.2\cdot P_{slab.on.found} \cdots + 1.6L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$P_{center} = 4.248\cdot\frac{kip}{ft}$$

$$\frac{\max\left(\left|M_{toe}\right|, \left|M_{heel}\right|\right)}{\phi M_{cap}} = 71.163\cdot\%$$

$$\frac{\max\left(\left|V_{toe}\right|, \left|V_{heel}\right|\right)}{\phi V_c} = 33.976\cdot\%$$

Calculate demand on toe under soil pressure (1.2DL+1.0LL+1.6EH+1.0EQ)

Moment about centroid of foundation

$$M_d := 1.6\frac{1}{15}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 \ldots + \frac{1.2\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} \ldots + \frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} \ldots + \left[\frac{1.2P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2}\right)\right]\cdot PGA$$

$$M_{center} := M_d - 1.2P_{d\_wall}\cdot\left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right) + 1.2P_{d\_key}\cdot\left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right) \ldots + 1.2\cdot P_{slab.on.found}\cdot\left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right) \ldots + -1.0L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right)$$

$$M_{center} = 4.856\cdot kip$$

Axial load on center of foundation

$$P_{center} := 1.2P_{d\_wall} + 1.2P_{d\_found} + 1.2P_{d\_key} + 1.2\cdot P_{slab.on.found} \cdots + 1.6L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$P_{center} = 4.248\cdot\frac{kip}{ft}$$

$$\frac{\max\left(\left|M_{toe}\right|,\left|M_{heel}\right|\right)}{\phi M_{cap}} = 87.114\cdot\%$$

$$\frac{\max\left(\left|V_{toe}\right|,\left|V_{heel}\right|\right)}{\phi V_c} = 42.256\cdot\%$$

OK

It is less than 5% Over EOR is OK

Design of 7 ft Retaining Wall

Thickness of wall

$$t_{wall} := 8in$$

$t_{foun} := 10in$ Thickness of foundation

$L_{toe} := 1ft + 4in = 1.333 \cdot ft$ Total foundation length

$h_{key} := 0ft$ Height of key

$t_{key} := 0in$ Thickness of key

$L_{heel} := 1ft$ Heel length

$t_{gr\_slab} := 4in$ Thickness of slab on grade on top of wall foundation

$h_{wall} := 7ft$ Height of the wall

$I := \frac{1}{12} \cdot \left(L_{toe} + L_{heel} + t_{wall}\right)^3 = 2.25 \cdot \frac{ft^4}{ft}$ Moment inertia of wall base

$f'_c := 2500psi$ Concrete compressive strength

$f_y := 60ksi$ Steel yield strength

$E_s := 29000ksi$ Steel young modulus

$\gamma_c := 150pcf$ Concrete unit weight

$p_a := 40pcf$ Active soil pressure

$p_o := 55pcf$ At-rest soil pressure

$\Delta p_{eq} := 8\left(\frac{h_{wall}}{ft}\right) \cdot psf = 56 \cdot psf$ Seismic soil pressure

$p_p := 200pcf$ Passive pressure

$PGA := 0.607$

$\mu := 0.35$ Soil friction factor from IBC 2018

$\phi := \frac{3}{2} \cdot atan(\mu) = 28.935 \cdot deg$ Equivalent friction angle

$K_a := \frac{1 - \sin(\phi)}{1 + \sin(\phi)} = 0.348$ Active pressure coefficient

$K_o := 1 - \sin(\phi) = 0.516$ At-Rest pressure coefficient

$\gamma_{soil} := \frac{p_a}{K_a} = 114.984 \cdot pcf$ Soil unit weight

Vertical weight on wall

$P_{d\_wall} := \left(h_{wall} - t_{foun}\right) \cdot t_{wall} \cdot \gamma_c = 616.667 \cdot plf$

$P_{d\_found} := \left(L_{toe} + t_{wall} + L_{heel}\right) \cdot t_{foun} \cdot \gamma_c = 375 \cdot plf$ Concrete weight of foundation

$P_{d\_key} := \left(h_{key} - t_{foun}\right) \cdot t_{key} \cdot \gamma_c = 0 \cdot plf$ Concrete weight of key

$P_{d\_slab} := t_{gr\_slab} \cdot (44ft) \cdot \gamma_c + 5psf \cdot 44ft = 2.42 \times 10^3 \cdot plf$

Concrete weight of slab and dead load on grade

$P_{slab.on.found} := t_{gr\_slab} \cdot \gamma_c \cdot L_{toe} = 66.667 \cdot plf$ Weight of concrete slab on wall foundation

Live load on slab

$P_{ll} := 0psf \cdot \left(L_{toe}\right) = 0 \cdot plf$

Surcharge pressure on wall due to slab on grade

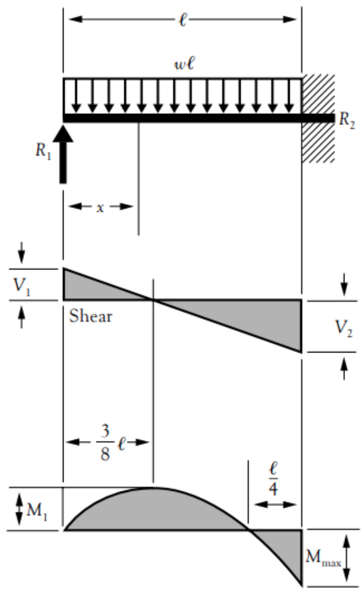
$P_{d\_.surch} := 0 \cdot t_{gr\_slab} \cdot \gamma_c \cdot K_a = 0 \cdot psf$

Surcharge pressure on wall due to live load on patio

$P_{ll\_.surch} := 60psf \cdot K_a = 20.872 \cdot psf$

Check Sliding Capacity for Dead Load

Lateral earth force from active pressure



$$R_1 = V_1 \quad \ldots\ldots\ldots\ldots \quad = \frac{3w\ell}{8}$$

$$R_2 = V_2 \quad \ldots\ldots\ldots\ldots \quad = \frac{5w\ell}{8}$$

$$V_x \quad \ldots\ldots\ldots\ldots \quad = R_1 - wx$$

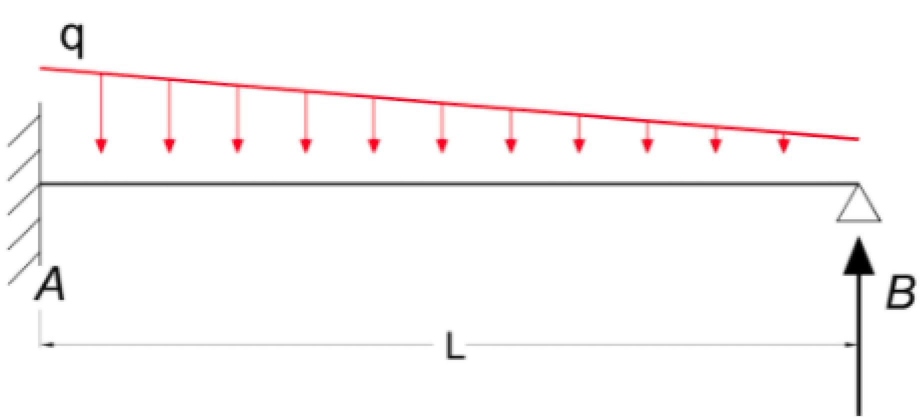
$$M_{max} \quad \ldots\ldots\ldots\ldots \quad = \frac{w\ell^2}{8}$$

$$M_1 \left(\text{at } x = \frac{3}{8}\ell\right) \quad \ldots\ldots\ldots\ldots \quad = \frac{9}{128} w\ell^2$$

$$M_x \quad \ldots\ldots\ldots\ldots \quad = R_1 x - \frac{wx^2}{2}$$

$$\Delta_{max} \left(\text{at } x = \frac{\ell}{16}(1 + \sqrt{33}) = .4215\,\ell\right) \quad . \quad = \frac{w\ell^4}{185EI}$$

$$\Delta_x \quad \ldots\ldots\ldots\ldots \quad = \frac{wx}{48EI}(\ell^3 - 3\ell x^2 + 2x^3)$$



Bending Moment

$M_A = - q L^2 / 15$ (3a)

where

M_A = moment at the fixed end (Nm, lb_f ft)

q = continuous declining load (N/m, lb_f/ft)

$M_1 = q L^2 / 33.6$ (3b)

where

M_1 = maximum moment at x = 0.553 L (Nm, lb_f ft)

Deflection

$\delta_{max} = q L^4 / (419 E I)$ (3c)

where

δ_{max} = max deflection at x = 0.553 L (m, ft)

$\delta_{1/2} = q L^4 / (427 E I)$ (3d)

where

$\delta_{1/2}$ = deflection at x = L / 2 (m, ft)

Support Reactions

$R_A = 2 q L / 5$ (3e)

$R_B = q L / 10$ (3f)

$$F_d := \frac{2}{5} \cdot p_o \cdot \left(h_{wall} - t_{gr\_slab}\right)^2 + 5 \cdot \frac{P_{d\_surch} \cdot \left(h_{wall} - t_{gr\_slab}\right)}{8} = 977.778 \cdot plf$$

Resisting force

$$F_{res} := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{d\_slab} \cdots + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right) = 4.082 \times 10^{3} \cdot plf$$

$$\frac{F_{res} \cdot \mu}{F_d} = 1.5$$

It is more than or equal 1.5

Check Sliding Capacity for Seismic Load

Lateral earth force from active pressure

$$F_d := \frac{2}{5} \cdot p_a \cdot \left(h_{wall} - t_{gr\_slab}\right)^2 + \frac{5}{8} \cdot P_{d\_surch} \cdot \left(h_{wall} - t_{gr\_slab}\right) \cdots + \frac{\frac{5}{8} \cdot \Delta p_{eq} \cdot \left(h_{wall} - t_{gr\_slab}\right) + \left(\frac{P_{d\_wall}}{2} + P_{d\_found} + P_{d\_key}\right) \cdot PGA \cdot \frac{1}{2}}{1.4} = 1.026 \times 10^{3} \cdot plf$$

Resisting Force

$$F_{res} := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{d\_slab} \cdots + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun}\right) = 4.082 \times 10^{3} \cdot plf$$

$$\frac{0.9 F_{res} \cdot \mu + \frac{1}{2} p_p \cdot \left(h_{key}\right)^2}{F_d} = 1.253$$

It is more than 1.0

Check Overturning Capacity for Dead Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \cdots + \frac{P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} = 1.086\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \cdots + P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \cdots + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 3.312\cdot\frac{kip\cdot ft}{ft}$$

$$\frac{M_{res}}{M_d} = 3.048$$

It is more than 1.5

Check Overturning Capacity for Seismic Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \cdots + \frac{P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots + \frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots + \frac{+\left[\frac{P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2} - t_{foun}\right) + P_{d\_found}\cdot\frac{t_{foun}}{2} + P_{d\_key}\cdot\frac{h_{key}}{2}\right]\cdot PGA\cdot\frac{1}{2}}{1.4}$$

$$M_d = 1.224\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \dots + P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \dots + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 3.312\cdot\frac{kip\cdot ft}{ft}$$

$$\frac{0.9\cdot M_{res}}{M_d} = 2.434$$

It is more than 1.1

Check Overturning Capacity for Dead and Live Load

Lateral moment about toe due to soil pressure

$$M_d := \frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \dots + \frac{\left(P_{d\_.surch} + P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} \dots + \frac{5}{8}\cdot\left(P_{d\_.surch} + P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key}$$

$$M_d = 1.202\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \dots + P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \dots + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 3.312\cdot\frac{kip\cdot ft}{ft}$$

$$\frac{M_{res} + \frac{1}{4}p_p\cdot\left(h_{key} + t_{foun} - 4in\right)^3}{M_d} = 2.759$$

It is more than 1.0

Check Soil Bearing Pressure for DL+LL

$$M_d := \frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 \ldots + \frac{\left(P_{d\_.surch} + P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8}$$

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \ldots + P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \ldots + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right) = 3.312\cdot\frac{kip\cdot ft}{ft}$$

$$L_{base} := L_{toe} + t_{wall} + L_{heel}$$

$$P := P_{d\_wall} + P_{d\_found} + P_{d\_key} + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$\left|\frac{M_{res} - M_d}{P} - \frac{\left(L_{toe} + t_{wall} + L_{heel}\right)}{2}\right| = 0.231\cdot ft$$

Eccentricity

$$\frac{L_{base}}{6} = 0.5\cdot ft$$

Eccentricity is within 1/3 of base so base is always in compression

$$\sigma_{toe} := \frac{P_{d\_wall} + P_{d\_found} + P_{d\_key} + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)}{L_{toe} + t_{wall} + L_{heel}} \dots$$
$$+ \frac{M_d\cdot 0.5\cdot L_{base}}{I} - \frac{P_{d\_wall}\cdot\left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right)\cdot 0.5L_{base}}{I} \dots$$
$$+ \frac{P_{d\_key}\cdot\left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right)\cdot\left(0.5L_{base}\right)}{I} + \frac{P_{slab.on.found}\cdot\left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right)\cdot\left(0.5L_{base}\right)}{I} \dots$$
$$+ \frac{-L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right)\cdot .5L_{base}}{I}$$

$\sigma_{toe} = 1.014 \times 10^{3}\cdot psf$

Less than 2500 psf
OK

$$\sigma_{heel} := \frac{P_{d\_wall} + P_{d\_found} + P_{d\_key} + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)}{L_{toe} + t_{wall} + L_{heel}} \dots$$
$$+ \frac{-M_d\cdot 0.5\cdot L_{base}}{I} - \frac{-P_{d\_wall}\cdot\left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right)\cdot 0.5L_{base}}{I} \dots$$
$$+ \frac{-P_{d\_key}\cdot\left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right)\cdot\left(0.5L_{base}\right)}{I} - \frac{P_{slab.on.found}\cdot\left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right)\cdot\left(0.5L_{base}\right)}{I} \dots$$
$$+ \frac{L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right)\cdot .5L_{base}}{I}$$

$\sigma_{heel} = 94.156\cdot psf$

Less than 2000 psf
OK

Check Soil Bearing Pressure for Seismic

$$M_d := \frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 + \frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^2\cdot\left(h_{key}\right) \cdots$$
$$+ \frac{P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots$$
$$+ \frac{\frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} + \frac{5}{8}\cdot\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)\cdot h_{key} \cdots + \left[\frac{P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2} - t_{foun}\right) + P_{d\_found}\cdot\frac{t_{foun}}{2} + P_{d\_key}\cdot\frac{h_{key}}{2}\right]\cdot PGA\cdot\frac{1}{2}}{1.4}$$

$$M_d = 1.521\cdot\frac{kip\cdot ft}{ft}$$

Resisting moment

$$M_{res} := P_{d\_wall}\cdot\left(L_{toe} + \frac{t_{wall}}{2}\right) + P_{d\_found}\cdot\left(\frac{L_{toe} + t_{wall} + L_{heel}}{2}\right) \cdots = 3.312\cdot\frac{kip\cdot ft}{ft}$$
$$+ P_{d\_key}\cdot\frac{t_{key}}{2} + P_{slab.on.found}\cdot\frac{L_{toe}}{2} \cdots$$
$$+ L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{heel}}{2} + t_{wall} + L_{toe}\right)$$

$$P := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{d\_slab} + L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$e_{cc} := \left|\frac{0.9\cdot M_{res} + \frac{1}{4}p_p\cdot\left(h_{key} + t_{foun} - 1ft\right)^3 - M_d}{P} - \frac{L_{base}}{2}\right| = 1.143\cdot ft$$

Eccentricity

$$\frac{L_{base}}{2} = 1.5\cdot ft$$

The resultant is within base

Moment about centroid of foundation

$$M_{center} := M_d - P_{d\_wall} \cdot \left(\frac{L_{base}}{2} - t_{wall} - L_{heel} \right) + P_{d\_key} \cdot \left(\frac{L_{base}}{2} - \frac{t_{key}}{2} \right) \dots$$
$$+ P_{slab.on.found} \cdot \left(\frac{L_{base}}{2} - \frac{L_{toe}}{2} \right) - L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun} \right) \cdot \left(\frac{L_{base}}{2} - \frac{L_{heel}}{2} \right)$$

$$M_{center} = 1.008 \cdot \frac{kip \cdot ft}{ft}$$

Axial load on center of foundation

$$P_{center} := P_{d\_wall} + P_{d\_found} + P_{d\_key} + P_{slab.on.found} + L_{heel} \cdot \gamma_{soil} \cdot \left(h_{wall} - t_{gr\_slab} - t_{foun} \right)$$

$$P_{center} = 1.729 \cdot \frac{kip}{ft}$$

$$\sigma_{toe} = 1.257 \times 10^{3} \cdot psf$$

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

$A_{s.min.wall} := 0.0018 \cdot t_{wall} \cdot 12in = 0.173 \cdot in^2$

Provide at least #4@12

Shear Capacity ACI-318

$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{|f'_c|}{psi}} \cdot psi \cdot (t_{wall} - 3in) = 4.5 \cdot \frac{kip}{ft}$

Shear Capacity

$\phi M_{cap\_base} := 0.9 \cdot f_y \cdot 0.2 \frac{in^2}{ft} \cdot \frac{12}{12} \cdot \left(0.9 \cdot \frac{t_{wall}}{2}\right) = 3.24 \cdot \frac{kip \cdot ft}{ft}$

Moment capacity of wall at the base #4@12"

$\phi M_{cap\_mid} := 0.9 \cdot f_y \cdot 0.2 \frac{in^2}{ft} \cdot \frac{12}{12} \cdot \left(0.9 \cdot \frac{t_{wall}}{2}\right) = 3.24 \cdot \frac{kip \cdot ft}{ft}$

Moment capacity of wall at the middle #4@12"

$\phi V_c = 4.5 \cdot \frac{kip}{ft}$

Shear capacity of wall

Calculate Demand on Base of Wall (1.4DL+1.6LL+1.6EH)

$$M := 1.6 \frac{1}{15} \cdot p_o \cdot (h_{wall} - t_{gr\_slab} - t_{foun})^3 \dots + \frac{(1.2 \cdot P_{d\_.surch} + 1.6 \cdot P_{ll\_.surch}) \cdot (h_{wall} - t_{gr\_slab} - t_{foun})^2}{8} = 1.307 \cdot kip \cdot \frac{ft}{ft}$$

$M = 1.307 \cdot kip$

$\frac{M}{\phi M_{cap\_base}} = 40.326 \cdot \%$

Moment capacity is more than demand moment on wall-OK

$$V := 1.6\frac{2}{5}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right)^2 \ldots$$
$$+ \frac{5}{8}\cdot\left(1.2\cdot P_{d\_surch} + 1.6\cdot P_{ll\_surch}\right)\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right)$$

$$V = 1.047\cdot\frac{kip}{ft}$$

$$\frac{V}{\phi V_c} = 23.277\cdot\%$$

Shear capacity is more than demand moment on wall-OK

Calculate Demand on Base Wall (1.2DL+1.0LL+1.6EH+1.0EQ)

$$M := 1.6\frac{1}{15}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^3 \ldots$$
$$+ \frac{1.2\cdot P_{d\_surch}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^2}{8} \ldots$$
$$+ \frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)^2}{8} \ldots$$
$$+ \left[\frac{1.2P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2} - t_{foun}\right)\right]\cdot\frac{PGA}{2}$$

$$M = 1.385\cdot kip$$

$$\frac{M}{\phi M_{cap\_base}} = 42.733\cdot\%$$

OK

$$V := 1.6\frac{2}{5}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right)^2 + 1.2\frac{5}{8}\cdot P_{d\_surch}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right) \ldots$$
$$+ \frac{5}{8}\cdot\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun} - t_{wall}\right) + \left(\frac{1.2P_{d\_wall}}{2}\right)\cdot\frac{PGA}{2}$$

$$V = 0.977\cdot\frac{kip}{ft}$$

$$\frac{V}{\phi V_c} = 21.7\cdot\%$$

Shear capacity is more than demand moment on wall-OK

$$A_{smin.wall} := 0.0018\cdot t_{wall}\cdot 12in = 0.173\cdot in^2$$

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

$$\phi V_c := 0.75 \cdot 2 \cdot \sqrt{\frac{\left|f'_c\right|}{psi}} \cdot psi \cdot \left(t_{foun} - 3in\right) = 6.3 \cdot \frac{kip}{ft}$$

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

$$M_d := 1.6\frac{1}{15}\cdot p_o\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 \ldots + \frac{\left(1.2\cdot P_{d\_.surch} + 1.6\cdot P_{ll\_.surch}\right)\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8}$$

$$M_{center} := M_d - 1.2P_{d\_wall}\cdot\left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right) + 1.2P_{d\_key}\cdot\left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right) \ldots + 1.2\cdot P_{slab.on.found}\cdot\left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right) \ldots + -1.2L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right)$$

$$M_{center} = 1.309\cdot kip$$

Axial load on center of foundation

$$P_{center} := 1.2P_{d\_wall} + 1.2P_{d\_found} + 1.2P_{d\_key} + 1.2\cdot P_{slab.on.found} \cdots + 1.6L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$P_{center} = 2.343\cdot\frac{kip}{ft}$$

$$\frac{\max\left(\left|M_{toe}\right|, \left|M_{heel}\right|\right)}{\phi M_{cap}} = 25.573\cdot\%$$

$$\frac{\max\left(\left|V_{toe}\right|, \left|V_{heel}\right|\right)}{\phi V_c} = 12.004\cdot\%$$

Calculate demand on toe under soil pressure (1.2DL+1.0LL+1.6EH+1.0EQ)

Moment about centroid of foundation

$$M_d := 1.6\frac{1}{15}\cdot p_a\cdot\left(h_{wall} - t_{gr\_slab}\right)^3 \ldots$$
$$+\frac{1.2\cdot P_{d\_.surch}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} \ldots$$
$$+\frac{\Delta p_{eq}\cdot\left(h_{wall} - t_{gr\_slab}\right)^2}{8} \ldots$$
$$+\left[\frac{1.2P_{d\_wall}}{2}\cdot\left(\frac{h_{wall}}{2}\right)\right]\cdot PGA$$

$$M_{center} := M_d - 1.2P_{d\_wall}\cdot\left(\frac{L_{base}}{2} - t_{wall} - L_{heel}\right) + 1.2P_{d\_key}\cdot\left(\frac{L_{base}}{2} - \frac{t_{key}}{2}\right) \ldots$$
$$+ 1.2\cdot P_{slab.on.found}\cdot\left(\frac{L_{base}}{2} - \frac{L_{toe}}{2}\right) \ldots$$
$$+ -1.0L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)\cdot\left(\frac{L_{base}}{2} - \frac{L_{heel}}{2}\right)$$

$$M_{center} = 1.881\cdot kip$$

Axial load on center of foundation

$$P_{center} := 1.2P_{d\_wall} + 1.2P_{d\_found} + 1.2P_{d\_key} + 1.2\cdot P_{slab.on.found} \cdots$$
$$+ 1.6L_{heel}\cdot\gamma_{soil}\cdot\left(h_{wall} - t_{gr\_slab} - t_{foun}\right)$$

$$P_{center} = 2.343\cdot\frac{kip}{ft}$$

$$\frac{\max\left(\left|M_{toe}\right|, \left|M_{heel}\right|\right)}{\phi M_{cap}} = 32.265\cdot\%$$ $$\frac{\max\left(\left|V_{toe}\right|, \left|V_{heel}\right|\right)}{\phi V_c} = 15.653\cdot\%$$ OK