FRAMEWORK ENGINEERING
104 Vicksburg St
San Francisco, CA 94114

STRUCTURAL REPORT

PROJECT ADDRESS: 22147 Ruoff Rd, Jenner, Ca 95450
MUNICIPALITY: County of Sonoma, Building Division, Santa Rosa, CA 95403
DATE: 13 MAY 2024

STANDARDS USED

2016 ASCE 7 | 2022 CBC | 2018 NDS, SDPWS

PROJECT DESCRIPTION

The project is the new construction of a three-volume inter-connected residential structure. Sloped asymmetric roof framing will be framed with regularly spaced wood framing and exposed glu-lam beam framing. Small steel sections are used at some eaves and overhangs in order to achieve architectural goals.

Wall framing will use wood shearwalls, blocking, shear clips, and holdowns at the main building structure and primary suite -- with one prefabricated Simpson Strongwall necessary at the southern wall edge. The sunroom area uses cantilevered HSS columns as the lateral load resolving system. Please see attached Equivalent Lateral Force Procedure that considers each of the three volumes independently.

Basic floor framing will span over the main crawlspace, but below the bedroom some cantilevered steel beam framing and special detailing were required to accommodate an open-space below this volume.

The foundation will use drilled concrete piers and grade beams with the only slab on grade occuring at the screened in porch + entry. Special notes related to arborist and geotechnical instructions are listed on foundation plan sheet.

APPROACH

The following report is an explanation of structural load paths at the above listed address for the proposed construction project. It describes how the demands of the resulting structure are generated, applied, and analyzed, such that proportionately sized structural members can be selected and detailed with appropriate capacity and stiffness. It also sites applicable and appropriate reference standards but starts first with ASCE 7-16 Minimum Design Loads for Buildings and Other Standards.

If there are any questions about the project or the calculation procedure, please feel free to contact us directly.

Dustin Muhn, PE
Framework Engineering
415 715-9652

License Number: C82063
Issued: 18 DEC 2013
Renews: 31 MAR 2026

REGISTERED PROFESSIONAL ENGINEER
DUSTIN A MUHN
C82063
CIVIL
STATE OF CALIFORNIA
RENEWS 31 MAR 2026

LOAD ASSUMPTIONS

PRIMARY LOAD PATH ASSUMPTIONS

Primary loads, or static loads, will be identified per unit (psf, plf, etc.) and distributed over a structural element by tributary area. Within the ASCE 7-16 Standard, unit loads will be referenced or calculated from Chapters 3-10 and then factored using Chapter 2. Below are the most common unit loads assumed for this project, but specific loads used at each structural element will be described in their respective calculations later in this report.

Roof Load (DL, LL)	15 psf, 20 psf	ASCE 7-16 Chapters 3,4
Floor Load (DL, LL)	15 psf, 40 psf	ASCE 7-16 Chapters 3,4
Deck Load (DL, LL)	15 psf, 60 psf	ASCE 7-16 Chapters 3,4
Snow Load (LL)	not considered	ASCE 7-16 Chapter 7
Rain Load (LL)	not considered	ASCE 7-16 Chapter 8

MOMENTARY LOAD PATH ASSUMPTIONS

Momentary loads, also known as lateral loads or dynamic loads, will be generated by selecting an appropriate analysis and distributing calculated global loads to individual diaphragms and panels. Both seismic loads and wind loads will be considered with the more conservative application of load used to design the structure. The distribution of loads and explanation of analysis selection will follow in this report.

SOIL LOAD ASSUMPTIONS

Per 2015 International Building Code, Table 1806.2 Presumptive Load-Bearing Values, the following default presumptive load bearing values will be used where an accompanying Geotechnical Report does not justify other values.

SOIL PARAMETER	VALUE
SKIN FRICTION [BEDROCK]	750 pcf
END-BEARING	NO CAPACITY
ACTIVE PRESSURE	55 pcf
PASSIVE PRESSURE	350 pcf

SEISMIC ANALYSIS & PARAMETERS

CHOOSE SEISMIC ANALYSIS PROCEDURE

For selection of seismic analysis procedure, this structural report relies on ASCE 7-16 Chapter 11: Seismic Design Criteria for selection of appropriate seismic analysis procedure(s), specifically Section 11.1.3 based on the type of structure or component(s).

USED

Chapter 12: Seismic Design Requirements for Building Structures

Selecting from: "ASCE 7-16 Table 12.6-1 Permitted Analytical Procedures", the Equivalent Lateral Force Procedure will be used (Section 12.8) in lieu of the Simplified Lateral Force Procedure (Section 12.14); the Modal Response Spectrum Analysis (Section 12.9); or the Seismic Response History Procedure (Chapter 16).

NOT USED

Chapter 13: Seismic Design Requirements for Nonstructural Components

Chapter 15: Seismic Design Requirements for Nonbuilding Structures

Chapter 16: Seismic Response History Procedures

Chapter 17: Seismic Design Requirements for Seismically Isolated Structures

Chapter 18: Seismic Design Requirements for Structures with Damping Systems

IDENTIFY SEISMIC PARAMETERS

Primary Lateral Force-Resisting System:	Wood Shearwalls
Diaphragm Rigidity:	Flexible
Latitude	38.5467°N
Longitude	123.2825°W

PARAMETER	VALUE	REFERENCE
Risk / Occupancy Category	II	ASCE 7-16 Table 1.5-1
Seismic Importance Factor, I_e	1	ASCE 7-16 Table 1.5-2
Site Class	D	ASCE 7-16 Chapter 20
Seismic Design Category	E	ASCE 7-16 Table 11.6-1(2)
S_{DS}	1.909 g	USGS Design Maps Summary
S_1	0.933 g	USGS Design Maps Summary
S_{D1}	1.000 g	USGS Design Maps Summary
Design Coefficients & Factors; R, W_0, C_d	6.5, 2.5, 2.5, 4	ASCE 7-16 Table 12.2-1
Redundancy Factor, p	1	ASCE 7-16 Section 12.3.4.2
Allowable Story Drift	0.025	ASCE 7-16 Table 12.12-1

ASCE Hazards Report

Address:
22147 Ruoff Rd
Jenner, California
95450

Standard:	ASCE/SEI 7-22	**Latitude:**	38.545802
Risk Category:	II	**Longitude:**	-123.282415
Soil Class:	Default	**Elevation:**	359.85214403823414 ft (NAVD 88)

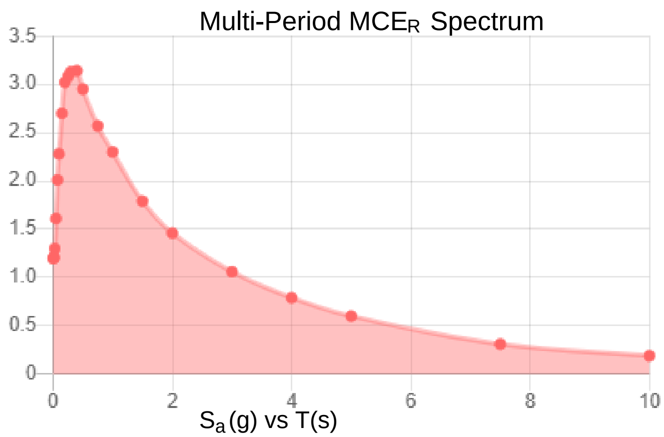
Seismic

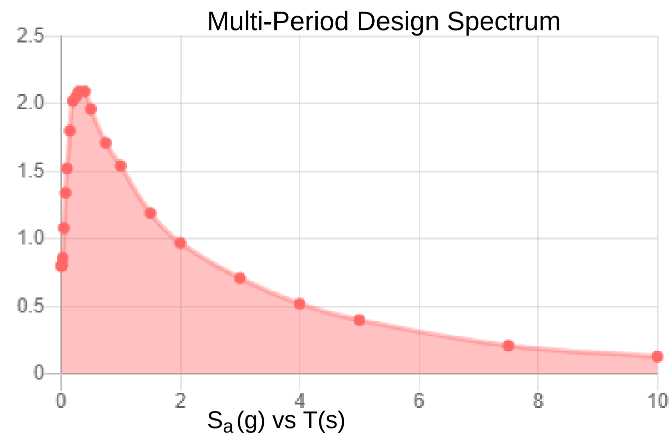
Site Soil Class: Default

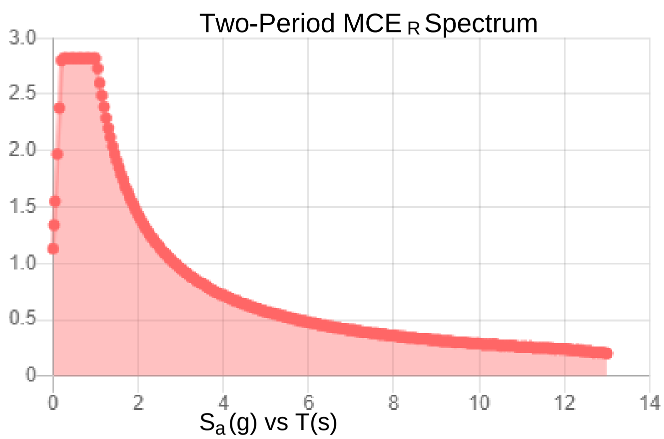
Results:

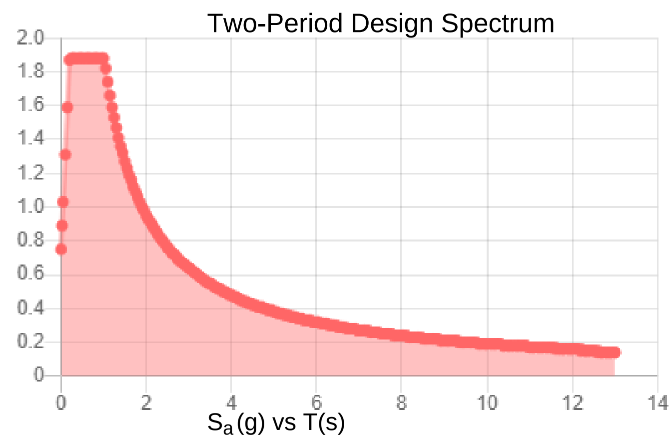
PGA_M :	1	T_L :	12
S_{MS} :	2.82	S_S :	2.65
S_{M1} :	2.86	S_1 :	1.06
S_{DS} :	1.88	V_{S30} :	260
S_{D1} :	1.91		

Seismic Design Category: E









MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Wed Feb 21 2024**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Address	22147 Ruoff Rd
Job #	R23-102
Engineer	Dustin Muhn, PE
Structure Type	Wood Lateral Systems
Analysis:	New Construction Standard: 100%Vb

PRIMARY BEDROOM STRUCTURE

ASCE 7-10 Section 12.8 *Equivalent Lateral Force Procedure*

Determine global seismic demand on structure.

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)}$$

$$V_n = C_s \mathrm{W}$$

$$V_b = 0.7E\ V_n \rho$$

R (Response Modification Factor Table) 12.2-1	6.5
S_{DS} (Design Spectral Response) 11.4.4, 11.4.7	1.91
I_e (Importance Factor Table) 12.2-1	1.0
C_s (Seismic Response Coefficient) 12.8.1.1	0.2937
W (See Table Summary)	11686 lbs
V_n (Nominal Base Shear) 12.8-1	**3430 lbs**
0.7E (ASD Load Case Magnifier) 2.4.1	0.70
p, (Redundancy Factor) 12.3.4.2	1.3
Vb (Factored Base Shear)	**3121 lbs**

ASCE 7-10 Section 12.8.3 *Vertical Distribution of Seismic Forces*

Determine distribution of global seismic demand.

$$T_a = C_t {h_n}^x$$

$$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k}$$

$$F_x = C_{vx} V_b$$

Structural Height (See Table Summary)	11.0 ft
C_t (parameter for Ta) Table 12.8-2	0.02
x (parameter for Ta) Table 12.8-2	0.75
Ta (approximate period) 12.8-7	0.12 s
k (period dependent exponent) 12.8.3	1.00
$\Sigma w_i h_i^k$ (See Table Summary)	128543 ft-lbs

F_x forces calculated for each diaphragm in the Table Summary below using respective C_{vx} values

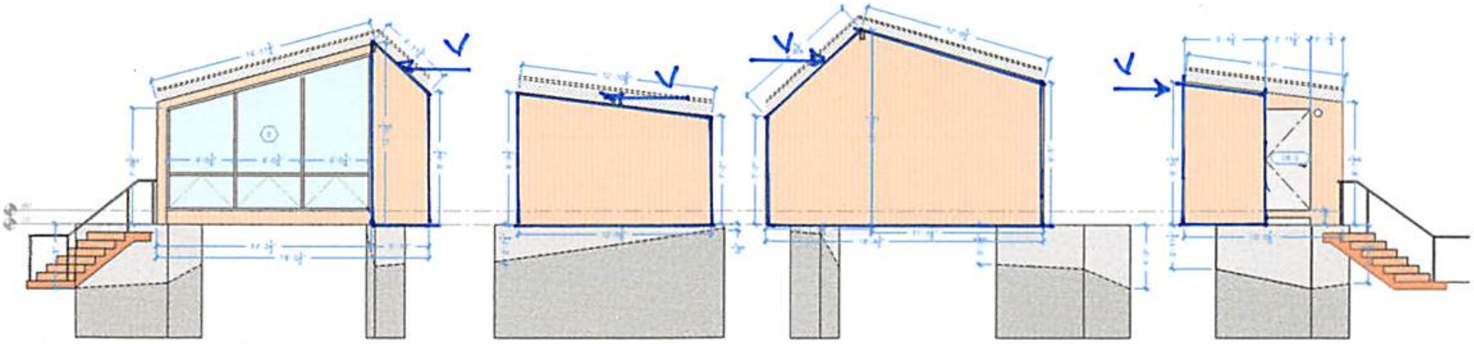
TABLE SUMMARY - VERTICAL DISTRIBUTION OF SEISMIC FORCES

DIAPHRAGMS		Diaphragm Mass		Exterior Wall Mass		Interior Wall Mass		w_x (lbs) [1]	h_x (ft) [2]	$w_x h_x^k$ (ft-lbs) [3]	C_{vx} [4]	F_x (lbs) [5]	Accum. Shear Load (lbs) [6]
		Area	Unit Wt	Area	Unit Wt	Area	Unit Wt						
F1	LEVEL 1	430	18	329	12			11686	11.00	128543	1.000	3120	3120
								W	h_{max}	$\Sigma w_i h_i^k$	Total	Total	
								11686	11.00	128543	1.00	3120	

1. Effective seismic weight at this diaphragm (ASCE 7 Section 12.7.2) - Includes weight of the diaphragm, top half of the walls below, bottom half of the walls above (or full parapet)
2. Average height of diaphragm above grade (ft)
3. Effective seismic weight and height contribution to each diaphragm (ft-lbs)
4. Distribution of base shear to diaphragms (ASCE 7-10 Equation 12.8-12)
5. Story Shear (ASCE 7-10 Equation 12.8-11) rounded to nearest 10 lbs (includes 0.7E and p redundancy factor)
6. Accumulated shear at this diaphragm (value may be larger than Vb calculation due to Fx rounding up)

JOB 22147 RUOFF | DATE | BY

SHEARWALL CALCS: PRIMARY BEDROOM STRUCTURE



B2 BB B1 BA

GRIDLINE	V	w	v	h	HD	SPECIFICATION
B2	1540 lbs	3'-8"	420 plf	10.4'	4368 lbs	TYPE 4, HDU4
BB	1540 lbs	12'-6"	123 plf	8'	984 lbs	TYPE 6, HDU2
B1	1540 lbs	18'-0"	86 plf	10.4'	895 lbs	TYPE 6, HDU2
BA	1540 lbs	5'-0"	308 plf	9'	2772 lbs	TYPE 6, HDU2

$$\sum M_o = 0 \; +\circlearrowright$$

$$(v\cancel{w}) \times h = \cancel{w} \times HD$$

$$HD = vh$$

FRAMEWORK ENGINEERING
13 MAY 2024

Address	22147 Ruoff Rd
Job #	R23-102
Engineer	Dustin Muhn, PE
Structure Type	Wood Lateral Systems
Analysis:	New Construction Standard: 100%Vb

MAIN STRUCTURE

ASCE 7-10 Section 12.8 *Equivalent Lateral Force Procedure*

Determine global seismic demand on structure.

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)}$$

$$V_n = C_s W$$

R (Response Modification Factor Table) 12.2-1	6.5
S_{DS} (Design Spectral Response) 11.4.4, 11.4.7	1.91
I_e (Importance Factor Table) 12.2-1	1.0
C_s (Seismic Response Coefficient) 12.8.1.1	0.2937
W (See Table Summary)	29921 lbs
V_n (Nominal Base Shear) 12.8-1	**8790 lbs**

$$V_b = 0.7E\ V_n \rho$$

0.7E (ASD Load Case Magnifier) 2.4.1	0.70
ρ, (Redundancy Factor) 12.3.4.2	1.3
Vb (Factored Base Shear)	**7999 lbs**

ASCE 7-10 Section 12.8.3 *Vertical Distribution of Seismic Forces*

Determine distribution of global seismic demand.

$$T_a = C_t h_n{}^x$$

$$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k}$$

Structural Height (See Table Summary)	11.0 ft
C_t (parameter for Ta) Table 12.8-2	0.02
x (parameter for Ta) Table 12.8-2	0.75
Ta (approximate period) 12.8-7	0.12 s
k (period dependent exponent) 12.8.3	1.00
$\Sigma w_i h_i^k$ (See Table Summary)	329135 ft-lbs

$$F_x = C_{vx} V_b$$

F_x forces calculated for each diaphragm in the Table Summary below using respective C_{vx} values

TABLE SUMMARY – VERTICAL DISTRIBUTION OF SEISMIC FORCES

DIAPHRAGMS		Diaphragm Mass		Exterior Wall Mass		Interior Wall Mass		1	2	3	4	5	6
		Area	Unit Wt	Area	Unit Wt	Area	Unit Wt	w_x (lbs)	h_x (ft)	$w_x h_x^k$ (ft-lbs)	C_{vx}	F_x (lbs)	Accum. Shear Load (lbs)
F1	LEVEL 1	941	18	866	15			29921	11.00	329135	1.000	8000	8000
								W	h_{max}	$\Sigma w_i h_i^k$	Total	Total	
								29921	11.00	329135	1.00	8000	

1. Effective seismic weight at this diaphragm (ASCE 7 Section 12.7.2) – Includes weight of the diaphragm, top half of the walls below, bottom half of the walls above (or full parapet)
2. Average height of diaphragm above grade (ft)
3. Effective seismic weight and height contribution to each diaphragm (ft-lbs)
4. Distribution of base shear to diaphragms (ASCE 7-10 Equation 12.8-12)
5. Story Shear (ASCE 7-10 Equation 12.8-11) rounded to nearest 10 lbs (includes 0.7E and ρ redundancy factor)
6. Accumulated shear at this diaphragm (value may be larger than Vb calculation due to Fx rounding up)

DIAPHRAGM FLEXIBILITY

Per ASCE 7-10 Section 12.3.1 Diaphragm Flexibility, relative diaphragm stiffnesses shall be considered during horizontal distribution of seismic forces unless it can be idealized as flexible per Section 12.3.1.1 Flexible Diaphragm Condition or calculated per Section 12.3.1.3 Calculated Flexible Diaphragm Condition. This structure meets the following requirements of 12.3.1.1 – and will be idealized with flexible diaphragms:

b) In one and two-family dwellings

c) In structures of light-frame construction where 1) Topping of concrete or similar materials is not placed over wood structural panel diaphragms except for nonstructural topping no greater than 1 ½" thick; & 2) Each line of vertical elements of the seismic force-resisting system complies with the allowable story drift of Table 12.12-1

TABLE SUMMARY - HORIZONTAL DISTRIBUTION OF GOVERNING SEISMIC FORCES

DIAPHRAGMS		TRANSVERSE GRIDLINES					TOTAL	LONGITUDINAL GRIDLINES					TOTAL
		MA	MC	MD	MG			M4	M2,M3				
F1	LEVEL 1	22%	39%	21%	17%		100%	50%	50%				100%
F1	LEVEL 1	1795	3119	1688	1398		8000	4000	4000				8000
						TOTAL	8001					TOTAL	8001

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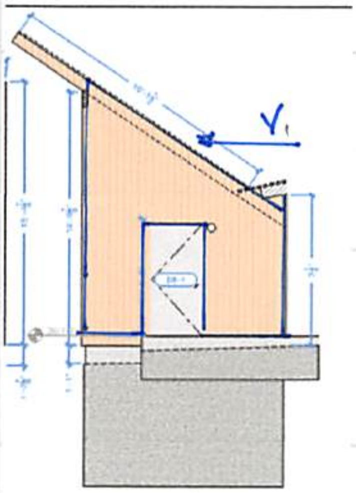
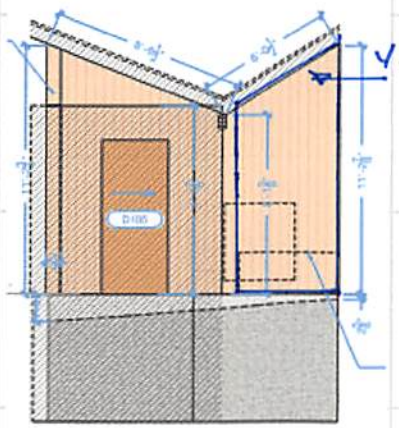
SHEARWALL CALCS: MAIN STRUCTURE LONGITUDINAL





M4

$V = 3935$ lb

$w = 5'\text{-}0" + 42" + 54" = 13'\text{-}0"$

$h_1 = 10'\text{-}9"$

$h_2 = 10'\text{-}0"$

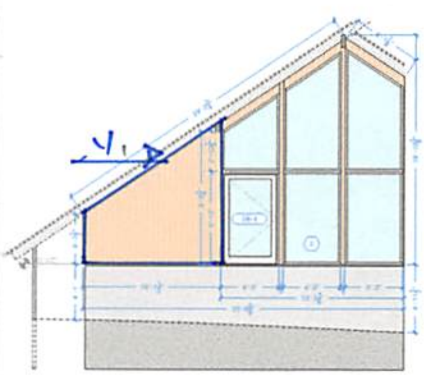
$v = 302$ plf → TYPE 6

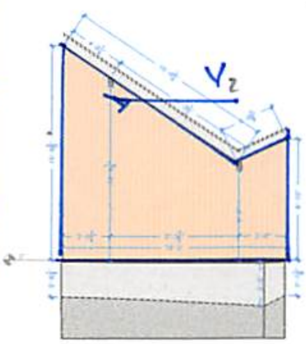
$\Sigma M_o = 0 \; +\circlearrowright$

$v\cancel{w} \times h = \cancel{w} \times HD$

$HD = v \cdot h$

$HD = 3250$ lb → HDU4





M2

M3

$V = 3935$ lbs

$w = 10' + 16' = 26'$

$h_1 = 6.625'$

$h_2 = 12'$

$v = 151$ plf → TYPE 6

$\Sigma M_o = 0 \; +\circlearrowright$

$v\cancel{w}h = \cancel{w}HD$

$HD = vh = 1812$ lb → HDU4

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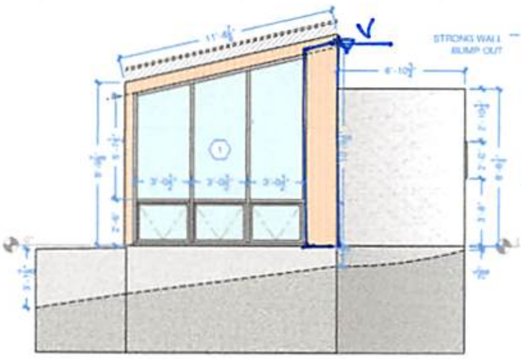
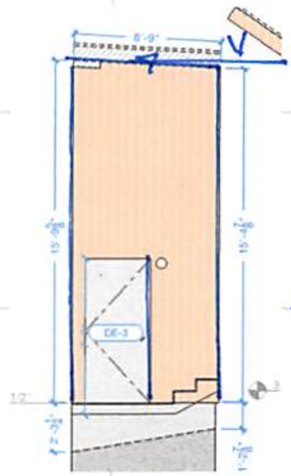
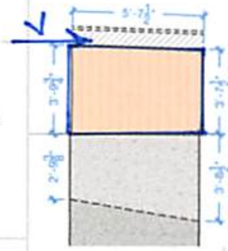


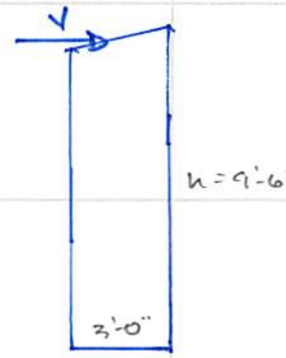
MG



MC



MA



MD

GRIDLINE	V	w	v	h	HD	SPECIFICATION
MG	1375 lbs	→ WSWH18x11 = 1960 lbs, HD = 14,200 lbs				
MC	3068 lbs	2'-10"	1082 plf	15'-6"	4877 lbs	DBL TYPE 3, HDU5
MA	1766 lbs	5'-2"	342 plf	3'-9"	1283 lbs	TYPE 6, HDU2
MD	1661 lbs.	3'-0"	537 plf	9'-6"	5101 lbs	TYPE 2, HDU5

→ INCREASE TO $\frac{9'\text{-}6"}{2(3')} = 1.58$ → 850 plf

Standard and Balloon Framing on Concrete Foundations

Strong-Wall High-Strength Wood Shearwall Model No.	Panel Evaluation Height, He (lb.)[6]	Allow Vertical Load, P (lb.)[4]	2,500 psi Concrete						3,000 psi Concrete					
			Seismic[3]			Wind			Seismic[3]			Wind		
			Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[7]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[7]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[7]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[7]	Anchor Tension at Allowable Shear, T (lb.)[11]
WSWH12x7	78	1,000	1,300	0.32	13,295	1,670	0.43	17,075	1,300	0.32	13,295	1,670	0.43	17,075
		4,000	1,300	0.32	13,295	1,670	0.43	17,075	1,300	0.32	13,295	1,670	0.43	17,075
		7,500	1,300	0.32	13,295	1,670	0.43	17,075	1,300	0.32	13,295	1,670	0.43	17,075
WSWH18x7	78	1,000	3,795	0.32	23,680	4,470	0.39	27,890	3,795	0.32	23,680	4,470	0.39	27,890
		4,000	3,795	0.32	23,680	4,365	0.38	27,245	3,795	0.32	23,680	4,470	0.39	27,890
		7,500	3,795	0.32	23,680	4,050	0.36	25,285	3,795	0.32	23,680	4,470	0.39	27,890
WSWH24x7	78	1,000	7,450	0.30	33,210	7,795	0.34	34,755	7,450	0.30	33,210	7,795	0.34	34,755
		4,000	7,450	0.30	33,210	7,565	0.33	33,715	7,450	0.30	33,210	7,795	0.34	34,755
		7,500	7,115	0.28	31,715	7,115	0.31	31,715	7,450	0.30	33,210	7,795	0.34	34,755
WSWH12x8	93.25	1,000	1,030	0.40	12,580	1,325	0.53	16,195	1,030	0.40	12,580	1,325	0.53	16,195
		4,000	1,030	0.40	12,580	1,325	0.53	16,195	1,030	0.40	12,580	1,325	0.53	16,195
		7,500	1,030	0.40	12,580	1,325	0.53	16,195	1,030	0.40	12,580	1,325	0.53	16,195
WSWH18x8	93.25	1,000	3,060	0.39	22,835	3,880	0.52	28,925	3,060	0.39	22,835	3,955	0.53	29,490
		4,000	3,060	0.39	22,835	3,650	0.49	27,245	3,060	0.39	22,835	3,955	0.53	29,490
		7,500	3,060	0.39	22,835	3,390	0.46	25,285	3,060	0.39	22,835	3,955	0.53	29,490
WSWH24x8	93.25	1,000	6,240	0.37	33,240	6,650	0.43	35,430	6,240	0.37	33,240	6,910	0.45	36,815
		4,000	6,240	0.37	33,240	6,330	0.41	33,715	6,240	0.37	33,240	6,910	0.45	36,815
		7,500	5,950	0.35	31,715	5,950	0.38	31,715	6,240	0.37	33,240	6,910	0.45	36,815
WSWH12x9	105.25	1,000	850	0.45	11,750	1,095	0.60	15,145	850	0.45	11,750	1,095	0.60	15,145
		4,000	850	0.45	11,750	1,095	0.60	15,145	850	0.45	11,750	1,095	0.60	15,145
		7,500	850	0.45	11,750	1,095	0.60	15,145	850	0.45	11,750	1,095	0.60	15,145
WSWH18x9	105.25	1,000	2,575	0.45	21,680	3,325	0.60	27,975	2,575	0.45	21,680	3,325	0.60	27,975
		4,000	2,575	0.45	21,680	3,235	0.58	27,245	2,575	0.45	21,680	3,325	0.60	27,975
		7,500	2,575	0.45	21,680	3,005	0.54	25,285	2,575	0.45	21,680	3,325	0.60	27,975
WSWH24x9	105.25	1,000	5,150	0.43	30,975	5,890	0.52	35,430	5,150	0.43	30,975	6,120	0.54	36,815
		4,000	5,150	0.43	30,975	5,605	0.50	33,715	5,150	0.43	30,975	6,120	0.54	36,815
		7,500	5,150	0.43	30,975	5,275	0.47	31,715	5,150	0.43	30,975	6,120	0.54	36,815
WSWH12x10	117.25	1,000	700	0.50	10,750	900	0.67	13,855	700	0.50	10,750	900	0.67	13,855
		4,000	700	0.50	10,750	900	0.67	13,855	700	0.50	10,750	900	0.67	13,855
		7,500	700	0.50	10,750	900	0.67	13,855	700	0.50	10,750	900	0.67	13,855
WSWH18x10	117.25	1,000	2,140	0.50	20,055	2,755	0.67	25,840	2,140	0.50	20,055	2,755	0.67	25,840
		4,000	2,140	0.50	20,055	2,755	0.67	25,840	2,140	0.50	20,055	2,755	0.67	25,840
		7,500	2,140	0.50	20,055	2,695	0.65	25,285	2,140	0.50	20,055	2,755	0.67	25,840
WSWH24x10	117.25	1,000	4,010	0.48	26,860	5,215	0.67	34,935	4,010	0.48	26,860	5,215	0.67	34,935
		4,000	4,010	0.48	26,860	5,030	0.64	33,715	4,010	0.48	26,860	5,215	0.67	34,935
		7,500	4,010	0.48	26,860	4,735	0.61	31,715	4,010	0.48	26,860	5,215	0.67	34,935
WSWH12x11	129.25	1,000	595	0.56	10,055	765	0.73	12,930	595	0.56	10,055	765	0.73	12,930
		4,000	595	0.56	10,055	765	0.73	12,930	595	0.56	10,055	765	0.73	12,930
		7,500	595	0.56	10,055	765	0.73	12,930	595	0.56	10,055	765	0.73	12,930
WSWH18x11	129.25	1,000	1,960	0.55	20,240	2,520	0.73	26,060	1,960	0.55	20,240	2,520	0.73	26,060
		4,000	1,960	0.55	20,240	2,520	0.73	26,060	1,960	0.55	20,240	2,520	0.73	26,060
		7,500	1,960	0.55	20,240	2,445	0.71	25,285	1,960	0.55	20,240	2,520	0.73	26,060
WSWH24x11	129.25	1,000	4,000	0.54	29,550	4,795	0.68	35,430	4,000	0.54	29,550	4,985	0.70	36,815
		4,000	4,000	0.54	29,550	4,565	0.64	33,715	4,000	0.54	29,550	4,985	0.70	36,815
		7,500	4,000	0.54	29,550	4,295	0.60	31,715	4,000	0.54	29,550	4,985	0.70	36,815

See foonotes on p. 15.

FRAMEWORK ENGINEERING
13 MAY 2024

Address	22147 Ruoff Rd
Job #	R23-102
Engineer	Dustin Muhn, PE
Analysis:	New Construction Standard: 100%Vb

SCREENED PORCH

ASCE 7-10 Section 12.8 *Equivalent Lateral Force Procedure*

Determine global seismic demand on structure.

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)}$$

$$V_n = C_s W$$

R (Response Modification Factor Table) 12.2-1	2.5
S_{DS} (Design Spectral Response) 11.4.4, 11.4.7	1.91
I_e (Importance Factor Table) 12.2-1	1.0
C_s (Seismic Response Coefficient) 12.8.1.1	0.7636
W (See Table Summary)	7500 lbs
V_n (Nominal Base Shear) 12.8-1	**5730 lbs**

$$V_b = 0.7E\ V_n \rho$$

0.7E (ASD Load Case Magnifier) 2.4.1	0.70
p, (Redundancy Factor) 12.3.4.2	1.3
Vb (Factored Base Shear)	**5214 lbs**

ASCE 7-10 Section 12.8.3 *Vertical Distribution of Seismic Forces*

Determine distribution of global seismic demand.

$$T_a = C_t {h_n}^x$$

$$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k}$$

Structural Height (See Table Summary)	11.0 ft
C_t (parameter for Ta) Table 12.8-2	0.02
x (parameter for Ta) Table 12.8-2	0.75
Ta (approximate period) 12.8-7	0.12 s
k (period dependent exponent) 12.8.3	1.00
$\Sigma w_i h_i^k$ (See Table Summary)	82500 ft-lbs

$$F_x = C_{vx} V_b$$

F_x forces calculated for each diaphragm in the Table Summary below using respective C_{vx} values

TABLE SUMMARY - VERTICAL DISTRIBUTION OF SEISMIC FORCES

DIAPHRAGMS		Diaphragm Mass		Exterior Wall Mass		Interior Wall Mass		1	2	3	4	5	6
		Area	Unit Wt	Area	Unit Wt	Area	Unit Wt	w_x (lbs)	h_x (ft)	$w_x h_x^k$ (ft-lbs)	C_{vx}	F_x (lbs)	Accum. Shear Load (lbs)
F1	LEVEL 1	417	18					7500	11.00	82500	1.000	5210	5210

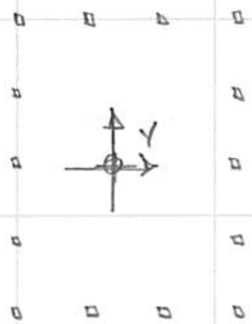
W	h_{max}	$\Sigma w_i h_i^k$	Total	Total
7500	11.00	82500	1.00	5210

1. Effective seismic weight at this diaphragm (ASCE 7 Section 12.7.2) - Includes weight of the diaphragm, top half of the walls below, bottom half of the walls above (or full parapet)
2. Average height of diaphragm above grade (ft)
3. Effective seismic weight and height contribution to each diaphragm (ft-lbs)
4. Distribution of base shear to diaphragms (ASCE 7-10 Equation 12.8-12)
5. Story Shear (ASCE 7-10 Equation 12.8-11) rounded to nearest 10 lbs (includes 0.7E and p redundancy factor)
6. Accumulated shear at this diaphragm (value may be larger than Vb calculation due to Fx rounding up)

JOB 22147 RUOFF RD | DATE | BY

SUNROOM CANTILEVERED COLUMN CONSTRUCTION

$R = 2.5,\ \Omega = 1.25,\ C_d = 2.5$

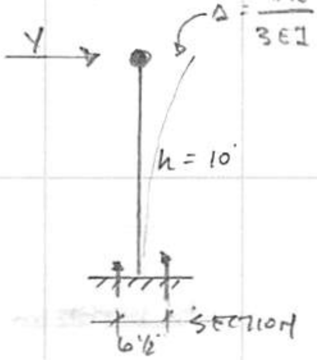


PLAN

$V = 5640$ lb ASD w/ $R = 2.0$

COLUMNS	LOAD PER COLUMN	M
14	402 lb	48,240 lb-in
4	1410 lb	169,200 lb-in

$\Delta = \dfrac{Vh^3}{3EI}$



$\phi M_n = 0.9 F_y S_x$, $F_y = 42$ ksi

$\Delta < 0.025(120") = 3.0"$

COLUMNS	S_x MIN	I_x MIN	SPECIFICATION
14	1.27 in^3	2.66 in^4	HSS 3x3x1/4"
4	4.46 in^3	9.32 in^4	HSS 4x4x5/16"

POST CAP: 402 lb x $\Omega = 1.25$ = 502 lb → USE (2) SDS WOOD SCREWS

POST BASE: M_{max} = 48,240 lb-in = 6.5" x HD

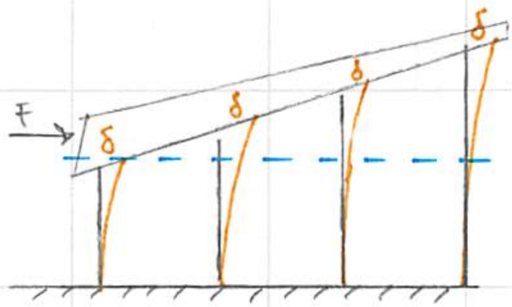
REQUIRED ANCHOR UPLIFT CAPACITY

ANCHOR SPACING

HD = 7421 lb

JOB 22147 BLUFF RD | DATE | BY

SUNROOM LATERAL CALCS



FORCE FOLLOWS STIFFNESS. ALL COLUMNS WILL HAVE EQUAL DRIFT AT HEIGHT OF SHORTEST COLUMN. DETERMINE THAT VALUE TO DEVELOP LOAD DEMANDS FOR EA COLUMN. [ALL COLUMNS SAME SHAPE]

$M_u = F \times HT = 1128\ \text{lb} \times 54" = 60{,}880\ \text{lb·in}$
$= 5\ \text{k·ft}$

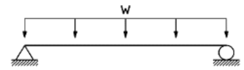
$S_x = M_u / 0.9 \times 46{,}000\ \text{psi} = 1.471\ \text{in}^3 < 2.01\ \text{in}^3$

COLUMN	HT	DEFLECTION[1]	% of V[2]	F[3]	DEFLECTION[4]
1	120"	6.58"	2%	103 lb	0.68
2	114"	5.64"	2.37%	120 lb	0.68
3	108"	4.79"	2.7%	141 lb	0.68
4	102"	4.04"	3.2%	167 lb	0.68
5	96"	3.37"	3.9%	201 lb	0.68
6	54"	0.60"	21.6%	1128 lb	0.68
7	58"	0.74"	17.5%	910 lb	0.68
8	62"	0.91"	14.3%	745 lb	0.68
9	94"	3.16"	4.1%	214 lb	0.68
10	98"	3.58"	3.6%	189 lb	0.68
11	68"	1.20"	10.8%	565 lb	0.68
12	83"	2.18"	6%	311 lb	0.68
13	104"	4.28"	3%	158 lb	0.68
14	88"	2.59"	5%	261 lb	0.68 ✓

1. DEFLECTION $= PL^3/3EI$ USING 1000 lb P, L = HT, $E = 29\times10^6$ psi, $I = 3.04\ \text{in}^4$
2. STIFFNESS RATIO OF V APPLIED AT TOP OF EACH COLUMN
3. BASED ON BASE SHEAR = 5210 lb, FORCE AT TOP OF EACH COLUMN.
4. DEFLECTION AT TOP OF COLUMN USING F, CHECK ALL VALUES EQUAL AND SATISFY DRIFT.

FRAMEWORK ENGINEERING
13 MAY 2024

Address 22147 Ruoff Road
Job # R23-102
Engineer Dustin Muhn, PE



LOADING & DEMAND CALCULATIONS

SPANNING MEMBER ID				GEOMETRY		DISTRIBUTED LOADING (plf)						DEMAND						NOTES:
Member Schedule	Member Name	Floor Location	Building	Span (ft)	Spacing (in)	DL	LL	Lr	RL	SL	w_u	Load Duration	Moisture Condition	LL Defl.	Total Defl.	Moment (lb-ft)	Shear (lbs)	
01	Roof Framing	S100	Master Bedroom	13.25	16	27	27				53	1.00	DRY	.44 in L/360	.44 in L/360	LOAD CASE 2 1170	350	
02	Eave Rim	S100	Master Bedroom	13.50		50	50				100	1.00	DRY	.45 in L/360	.45 in L/360	LOAD CASE 2 2280	680	Uses 2'-6" tributary width
03	Floor Framing	S101	Master Bedroom	11.42	16	27	53				80	1.00	DRY	.38 in L/360	.38 in L/360	LOAD CASE 2 1300	460	
04	Floor Beam	S101	Master Bedroom	14.58		210	220				430	1.00	DRY	.49 in L/360	.49 in L/360	LOAD CASE 2 11430	3140	Uses 5'-6" tributary floor width
01	Roof Framing	S100	Main Cabin	9.50	24	40	40				80	1.00	DRY	.32 in L/360	.48 in L/240	LOAD CASE 2 900	380	
02	GLULAM MB	S100	Main Cabin	11.00		180	180				360	1.00	DRY	.37 in L/360	.37 in L/360	LOAD CASE 2 5450	1980	Uses 9'-0" tributary width
03	GLULAM MC	S100	Main Cabin	15.00		180	180				360	1.00	DRY	.50 in L/360	.50 in L/360	LOAD CASE 2 10130	2700	Uses 9'-0" tributary width
04	GLULAM ME	S100	Main Cabin	14.67		180	180				360	1.00	DRY	.49 in L/360	.49 in L/360	LOAD CASE 2 9680	2640	Uses 9'-0" tributary width
05	GLULAM MF	S100	Main Cabin	11.83		160	160				320	1.00	DRY	.39 in L/360	.39 in L/360	LOAD CASE 2 5600	1890	Uses 8'-0" tributary width

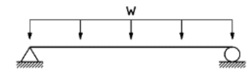
SPANNING MEMBER ID				GEOMETRY		DISTRIBUTED LOADING (plf)						DEMAND						NOTES:
Member Schedule	Member Name	Floor Location	Building	Span (ft)	Spacing (in)	DL	LL	Lr	RL	SL	w_u	Load Duration	Moisture Condition	LL Defl.	Total Defl.	Moment (lb-ft)	Shear (lbs)	
06	HEADER MG	S100	Main Cabin	9.33		80	80				160	1.00	DRY	.31 in L/360	.31 in L/360	LOAD CASE 2 1740	750	Uses 4'-0" tributary width
07	Floor Framing	S101	Main Cabin	11.50	16	67	53				120	1.00	DRY	.38 in L/360	.38 in L/360	LOAD CASE 2 1980	690	DL = 50psf including 3" of topping slab
01	Roof Framing	S100	Screen Porch	12.67	16	27	27				53	1.00	DRY	.42 in L/360	.42 in L/360	LOAD CASE 2 1070	340	
02	All Headers	S100	Screen Porch	4.00		180	180				360	1.00	DRY	.13 in L/360	.13 in L/360	LOAD CASE 2 720	720	Uses 9'-0" tributary width

FRAMEWORK ENGINEERING
13 MAY 2024

Address 22147 Ruoff Road
Job # R23-102
Engineer Dustin Muhn, PE

Table Notes:

1. Adjustment Factors: NDS Table 4.3.1 for Sawn Lumber; NDS Table 5.3.1 for Glulam; NDS Table 8.3.1 for SCL; and NDS Table 7.3.1 for I-Joists.
   Beam Stability Factor, CL (NDS 4.4.1) is assumed to have full depth bridging / blocking at 8' or closer spacing, satisfying all d/b ratios less than 6.
   Flat Use Factor, Cfu (NDS 4.3.7) is conservatively taken as 1.0 for all cases.
2. Capacity calculations use simple mechanics for Sawn Lumber and Glulams; and use ICC-ES Reports for Engineered Lumber.



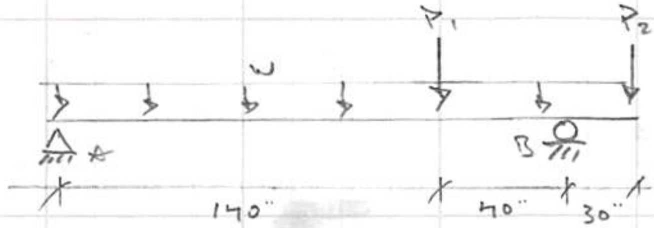
SPECIFICATION & CAPACITY CALCULATIONS

SPANNING MEMBER ID				MEMBER SPECIFICATION (Size and Grade)	NDS Applicability of Adjustment Factors[1]											CAPACITY[2]				DEMAND (increased considering self weight)			
Member Schedule	Member Name	Floor Location	Building		Nominal (psi)	C_D	C_M	C_t	C_L	C_F	C_V	C_{fu}	C_i	C_r	Design (psi)	LL Defl.	Total Defl.	Moment (lb-ft)	Shear (lbs)	LL Defl.	Total Defl.	Moment (lb-ft)	Shear (lbs)
					Fb = 2600	1.00	–	1.00	1.00	–	1.18	–	–	1.04	Fb' = 3182								
01	Roof Framing	S100	Master Bedroom	1-3/4" x 7-1/4" Microllam LVL 2.0E	Fv = 285	1.00	–	1.00	–	–	–	–	–	–	Fv' = 285	.17 in	.36 in	4065	2411	.44 in	.44 in	LOAD CASE 2	
					E = 2000000	–	–	1.00	–	–	–	–	–	–	E' = 2000000	L/930	L/440			L/360	L/360	1230	370
					Fb = 2600	1.00	–	1.00	1.00	–	1.07	–	–	1.00	Fb' = 2784								
02	Eave Rim	S100	Master Bedroom	3.5" x 7.25" Microllam LVL 2.0E	Fv = 285	1.00	–	1.00	–	–	–	–	–	–	Fv' = 285	.17 in	.37 in	7115	4821	.45 in	.45 in	LOAD CASE 2	
					E = 2000000	–	–	1.00	–	–	–	–	–	–	E' = 2000000	L/930	L/440			L/360	L/360	2410	710
					Fb = 900	1.00	1.00	1.00	1.00	1.10	–	1.00	1.00	1.15	Fb' = 1139								
03	Floor Framing	S101	Master Bedroom	2x10 DF #2	Fv = 180	1.00	1.00	1.00	–	–	–	–	1.00	–	Fv' = 180	.13 in	.20 in	2029	1665	.38 in	.38 in	LOAD CASE 2	
					E = 1600000	–	1.00	1.00	–	–	–	–	1.00	–	E' = 1600000	L/1060	L/680			L/360	L/360	1350	470
04	Floor Beam	S101	Master Bedroom								**C9x13.4**									.49 in	.49 in	LOAD CASE 2	
																				L/360	L/360	11430	3140
					Fb = 900	1.00	1.00	1.00	1.00	1.20	–	1.00	1.00	1.15	Fb' = 1242								
01	Roof Framing	S100	Main Cabin	2x8 DF #2	Fv = 180	1.00	1.00	1.00	–	–	–	–	1.00	–	Fv' = 180	.10 in	.20 in	1360	1305	.32 in	.48 in	LOAD CASE 2	
					E = 1600000	–	1.00	1.00	–	–	–	–	1.00	–	E' = 1600000	L/1190	L/580			L/360	L/240	930	390
					Fb = 2400	1.00	1.00	1.00	1.00	–	1.11	–	–	1.00	Fb' = 2663								
02	GLULAM MB	S100	Main Cabin	3-1/2" x 11-7/8" 24F-V4	Fv = 265	1.00	1.00	1.00	–	–	–	–	–	–	Fv' = 265	.07 in	.14 in	18252	7343	.37 in	.37 in	LOAD CASE 2	
					E = 1800000	–	1.00	1.00	–	–	–	–	–	–	E' = 1800000	L/1960	L/950			L/360	L/360	5590	2030
					Fb = 2400	1.00	1.00	1.00	1.00	–	1.08	–	–	1.00	Fb' = 2581								
03	GLULAM MC	S100	Main Cabin	3-1/2" x 11-7/8" 24F-V4	Fv = 265	1.00	1.00	1.00	–	–	–	–	–	–	Fv' = 265	.23 in	.48 in	17695	7343	.50 in	.50 in	LOAD CASE 2	
					E = 1800000	–	1.00	1.00	–	–	–	–	–	–	E' = 1800000	L/770	L/380			L/360	L/360	10390	2770
					Fb = 2400	1.00	1.00	1.00	1.00	–	1.08	–	–	1.00	Fb' = 2587								
04	GLULAM ME	S100	Main Cabin	3-1/2" x 11-7/8" 24F-V4	Fv = 265	1.00	1.00	1.00	–	–	–	–	–	–	Fv' = 265	.21 in	.44 in	17735	7343	.49 in	.49 in	LOAD CASE 2	
					E = 1800000	–	1.00	1.00	–	–	–	–	–	–	E' = 1800000	L/830	L/400			L/360	L/360	9930	2710
					Fb = 2400	1.00	1.00	1.00	1.00	–	1.10	–	–	1.00	Fb' = 2643								
05	GLULAM MF	S100	Main Cabin	3-1/2" x 11-7/8" 24F-V4	Fv = 265	1.00	1.00	1.00	–	–	–	–	–	–	Fv' = 265	.08 in	.17 in	18119	7343	.39 in	.39 in	LOAD CASE 2	
					E = 1800000	–	1.00	1.00	–	–	–	–	–	–	E' = 1800000	L/1770	L/860			L/360	L/360	5760	1950

SPANNING MEMBER ID				MEMBER SPECIFICATION (Size and Grade)	NDS Applicability of Adjustment Factors[1]											CAPACITY[2]				DEMAND (increased considering self weight)			
Member Schedule	Member Name	Floor Location	Building		Nominal (psi)	C_D	C_M	C_t	C_L	C_F	C_V	C_{fu}	C_i	C_r	Design (psi)	LL Defl.	Total Defl.	Moment (lb-ft)	Shear (lbs)	LL Defl.	Total Defl.	Moment (lb-ft)	Shear (lbs)
					Fb = 900	1.00	1.00	1.00	1.00	1.00	–	1.00	1.00	1.00	Fb' = 900								
06	HEADER MG	S100	Main Cabin	6x6	Fv = 180	1.00	1.00	1.00	–	–	–	–	1.00	–	Fv' = 180	.11 in	.23 in	2080	3630	.31 in	.31 in	LOAD CASE 2	
				DF #2	E = 1600000	–	1.00	1.00	–	–	–	–	1.00	–	E' = 1600000	L/1000	L/480			L/360	L/360	1820	780
					Fb = 900	1.00	1.00	1.00	1.00	1.10	–	1.00	1.00	1.15	Fb' = 1139								
07	Floor Framing	S101	Main Cabin	2x10	Fv = 180	1.00	1.00	1.00	–	–	–	–	1.00	–	Fv' = 180	.13 in	.31 in	2029	1665	.38 in	.38 in	LOAD CASE 2	
				DF #2	E = 1600000	–	1.00	1.00	–	–	–	–	1.00	–	E' = 1600000	L/1040	L/450			L/360	L/360	2040	710
					Fb = 900	1.00	1.00	1.00	1.00	1.20	–	1.00	1.00	1.15	Fb' = 1242								
01	Roof Framing	S100	Screen Porch	2x8	Fv = 180	1.00	1.00	1.00	–	–	–	–	1.00	–	Fv' = 180	.20 in	.42 in	1360	1305	.42 in	.42 in	LOAD CASE 2	
				DF #2	E = 1600000	–	1.00	1.00	–	–	–	–	1.00	–	E' = 1600000	L/750	L/360			L/360	L/360	1120	350
					Fb = 900	1.00	1.00	1.00	1.00	1.30	–	1.00	1.00	1.00	Fb' = 1170								
02	All Headers	S100	Screen Porch	4x6	Fv = 180	1.00	1.00	1.00	–	–	–	–	1.00	–	Fv' = 180	.01 in	.03 in	1720	2310	.13 in	.13 in	LOAD CASE 2	
				DF #2	E = 1600000	–	1.00	1.00	–	–	–	–	1.00	–	E' = 1600000	L/3590	L/1780			L/360	L/360	730	730

FLOOR FRAMING

S101 MAIN BEDROOM, GRIDLINES B1,B2



DL LL

$w = 210\ plf + 230\ plf = 440\ plf$

$P_1 = 87\ sqft \times [20+20] = 3565\ lbs.$

$P_2 = 1250\ \Omega = 3125\ lbs.$

$\Sigma M_o = 0\ +\circlearrowright$

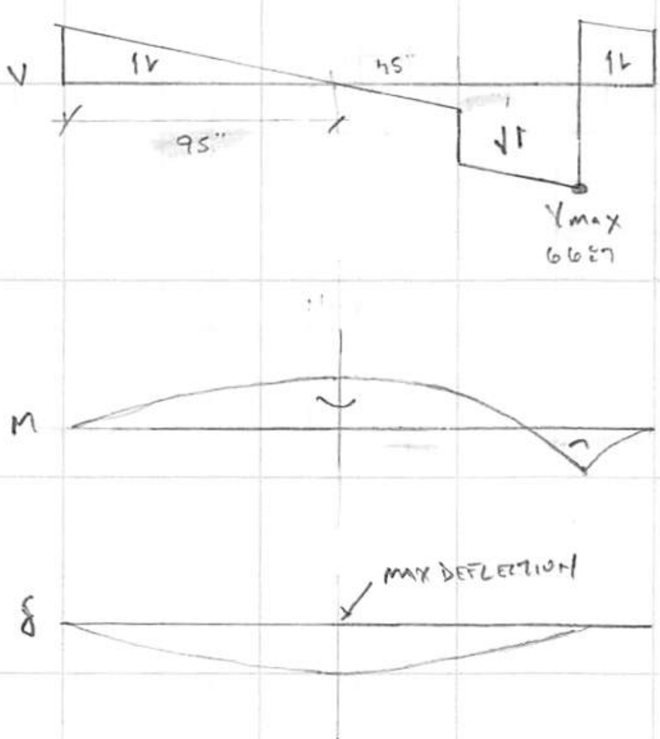
$15' B = 440(17'6") \times \frac{17'6"}{2} + 11'8(P_1) + 17'6"(P_2)$

$B = 10911\ lb$

$\Sigma F_y = 0$

$A + B = 17'6" w + P_1 + P_2$

$A = 3479\ lb$



$V_{max} = 6627\ lb$

$M_{max} = 1/2 \times 3479 \times 7.9' = 13.75\ k\,ft$

$$\delta_{95} = \frac{5wL^4}{384EI} + \frac{Pbx}{6EIl}(l^2 - b^2 - x^2)$$

$w = 36.6\ pli$ | $P = 3565\ lb$
$L = 180"$ | $b = 40"$
$E = 29 \times 10^6$ | $x = 95"$
 | $l = 180"$

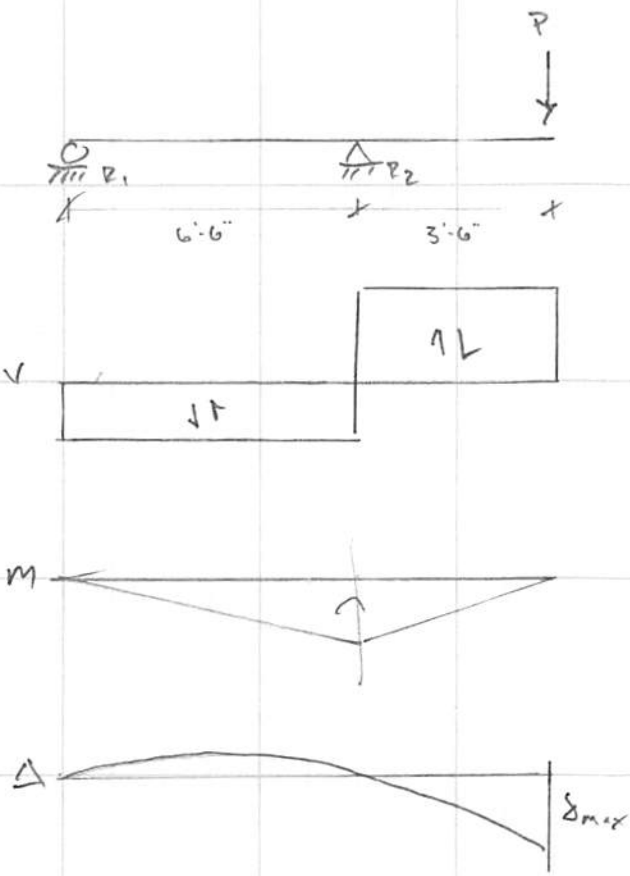
$I_{min} \times \delta = 17.28 + 9.4 = 26.7\ in^4$ STEEL FOR 1" DEFLECTION

$= 347\ in^4$ WOOD.

JOB RUOFF | DATE | BY

CANTILEVERED FLOOR BEAM

S101 MAIN BEDROOM, GRIDLINE BA



P = 4100 lb DL+LL FROM FLOOR BEAM

P = 1120 lb DL+RL FROM ROOF BEAM

P = 770Ω : 1925 lb FROM HOLDOWN

7145 lb

$\sum M_0 = 0 + \circlearrowright$

$10P = 6.5 R_2$

$R_2 = 10990$ lb

$R_1 = -3847$ lb.

$V_{max} = 7145$ lb

$M_{max} = 25$ k-ft

$$\delta_{max} = \frac{Pa^2}{3EI}(l+a)$$

$l = 78"$

$a = 42"$

P = 5220 lb (NO HOLDOWN)

$E = 29 \times 10^6$ psi FOR STEEL

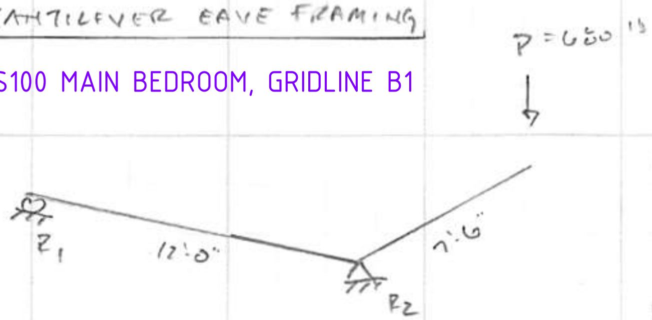
$E = 2.2 \times 10^6$ psi FOR LVL

(1.0 in) I_{min} = 12.7 in^4 FOR STEEL

= 167 in^4 FOR LVL

CANTILEVER EAVE FRAMING

S100 MAIN BEDROOM, GRIDLINE B1

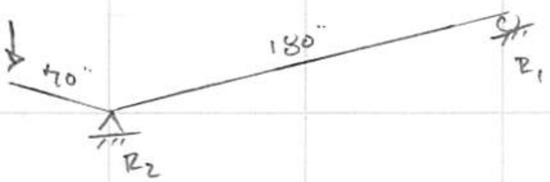


$V_{max} = P = 680$ lb
$R_1 = 440$ lbs
$R_2 = 1120$ lb
$M_{max} = 5100$ lbs-ft
$\delta_{max} = \frac{Pa^2}{3EI}(l+a)$

FOR $\delta = 1/2"$, SOLVE FOR I_{min}

$3EI\delta = Pa^2(l+a)$
$3 \times 29{,}000{,}000 \times I_{min} \times 1/2" = 680$ lb $(90^2)(144+90)$
$I_{min} = 29$ in^4

USE C7x14.7, $I_x = 27.2$ in^4



$V_{max} = P = 680$ lbs
$R_1 = 151$ lbs
$R_2 = 830$ lbs
$M_{max} = 2260$ lb-ft
$\delta = \frac{Pa^2}{3EI}(l+a)$

S100 MAIN BEDROOM, GRIDLINE B2

FOR $\delta = 1/2"$; SOLVE FOR I_{min} $3EI\delta = Pa^2(l+a)$
$3EI_{min}(1/2) = 680(40^2)(180+40)$

$I_{min} = 5.5$ in^4

USE C7x9.8, $I_y = 21.2$ in^4