

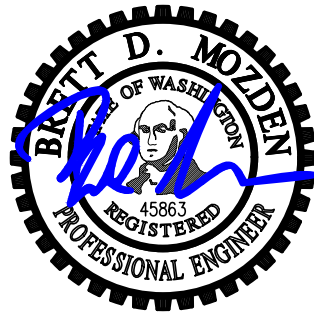


Structural Calculations For:

Miller Blood Residence

2420 63rd Ave SE

Mercer Island, WA 98040



Prepared for: Rain City Architecture

Job #: 11947-2021-02

Date: November 17, 2021



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Criteria Sheet

Codes

Structural IBC 2018
 Loading ASCE 7-16
 Wood: NDS 2018
 Steel: AISC 360-16
 Concrete: ACI 318-14
 Masonry: TMS 402/602-16

Project Location

Street & Number 2420 63rd Ave SE
 City: Mercer Island State: WA
 ZIP: 98040
 Latitude: 47.5885 N
 Longitude: -122.2498 W
 Ground Elevation 114 ft

Occupancy Category

Risk Category: II ASCE 7 Table 1.5-1

Seismic Load Summary:

Analysis Procedure: Equivalent Lateral Force Procedure
 Lateral System: Light-frame (wood) Walls Sheathed with Wood
 Structural Panels Rated for Shear Resistance
 R: 6.50 $C_d = 4$
 Base Shear $V = 8$ kips $\Omega_o = 2.5$
 $S_s = 1.396$ $S_1 = 0.486$
 $S_{DS} = 1.12$ $S_{D1} = 0.59$
 $C_s = 0.172$ $I_E = 1.0$



Story Information

Stories Above Grade (Including Mezzanine Levels) 2

Horizontal and Vertical Irregularities:

Is the building a "Regular Structure"? (No horizontal or vertical irregularities) Yes

Wind Load Summary:

$V = 98$ $K_{ZT} = 1.32$
 Exposure = C

Dead Loads:

Roof		Floor	
Roofing	2.5 psf	Finish Floor	1 psf
1/2" Sheathing	1.8 psf	3/4" Sheathing	2.7 psf
Trusses @ 24" oc	2.5 psf	Joists @ 16" oc	2.2 psf
Misc./Mech.	1.5 psf	Misc./Mech.	2 psf
Ceiling Finish	2.8 psf	Ceiling Finish	2.8
Solar Panels	4		10.7 psf
	15 psf	Use	12 psf
Use	15 psf		

Live Loads:

Snow 25 psf
 Floor 40 psf

Soils:

Soils Report Provided? Yes
 Allowable Bearing _____ psf Active _____ pcf (Restrained/Unrestrained)
 Sliding, μ _____
 Passive _____ pcf Seismic Surcharge _____



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 SHEET 1

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD
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Wind Coefficients

Exposure	C	
V=	98	mph
K _d =	0.85	Table 26.6-1
K _h =	0.90	Table 26.10-1
K _e =	1.00	Table 26.9-1
G=	0.85	26.9.4

Transverse Wind Pressures

L/B = 0.89 h/L = 0.51

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C _p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.36 / 0.1
Leeward Roof	-0.60

Location and Building Dimensions

Calculate K _{zt} ?	Yes	
K _{zt}	1.32	
Roof Type	Hip	
Roof Angle - Transverse Dir	22.5	degrees
Roof Angle - Long Dir	22.5	degrees
Ground to top of roof	23	ft
Bot of roof to top of roof	6	ft
Mean Roof Height, h	20	ft
Short Plan Dimension	39	ft
Long Plan Dimension	44	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	9.5	ft

Velocity Pressure at Mean Roof Height, q _h =	24.8	psf
---	------	-----

Wall Pressures (Unfactored):

Ht	K _z	q _z	ASD		
			P _{ww walls}	P _{lw walls}	P _{walls (psf)}
0-15	0.85	23.37	15.89	10.54	15.9
15-20	0.9	24.74	16.82	10.54	16.4
20-25	0.94	25.84	17.57	10.54	16.9
25-30	0.98	26.94	18.32	10.54	17.3
30-40	1.04	28.59	19.44	10.54	18.0
41-50	1.09	29.96	20.38	10.54	18.5
51-60	1.13	31.06	21.12	10.54	19.0
61-70	1.17	32.16	21.87	10.54	19.4
71-80	1.21	33.26	22.62	10.54	19.9
81-90	1.24	34.09	23.18	10.54	20.2
91-100	1.26	34.64	23.55	10.54	20.5

Roof Pressures (Unfactored)

Windward		Leeward	Horiz Proj (psf)
Max	Min		
2.0	-7.5	-12.6	4.80

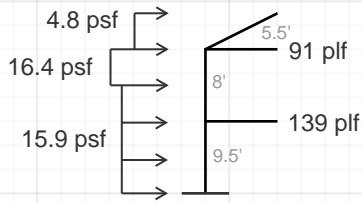


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Lateral Design

Wind Pressure Distribution



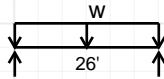
Seismic Story Shear

4.1 k
2.9 k
Total Base Shear = 7.0 k

N-S Direction

Roof

$w_E = 158$ plf
 $w_W = 91$ plf

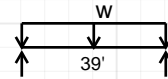


V	2.05 k	2.05 k
L	22.75'	26.5'
v	90 plf	77 plf
OT	---	---
W_	(E) NO CHANGE	(E) NO CHANGE
HD		

E-W Direction

Roof

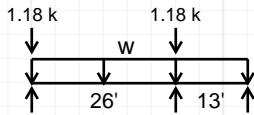
$w_E = 105$ plf
 $w_W = 91$ plf



V	2.05 k	2.05 k
L	21'	18'
v	98 plf	114 plf
OT	---	---
W_	(E) NO CHANGE	(E) NO CHANGE
HD		

Upper Floor

$w_E = 74$ plf
 $w_W = 139$ plf



V	3.0 k	3.9 k	0.90 k
L	15'	14.75'	10'
v	200 plf	264 plf	90 plf
OT	---	2.51 k	---
W_	(E) NO CHANGE	W4	W6
HD		HDU4	---

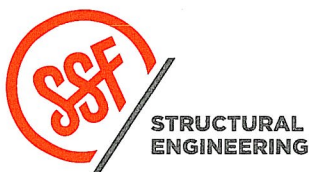
Upper Floor

$w_E = 34$ plf
 $w_W = ---$ plf

(addition is self-supported in this direction:
 $V_E = 0.456 \cdot V = 1.32$ k) (wind sail area does not change so existing shearwalls are sufficient to resist wind forces)



V	0.73 k	0.46 k	0.26 k
L	2.5'	9.5'	8.5'
v	290 plf	48 plf	31 plf
OT	2.8 k	---	---
W_	W4	W6	W6
HD	HDU4	---	---



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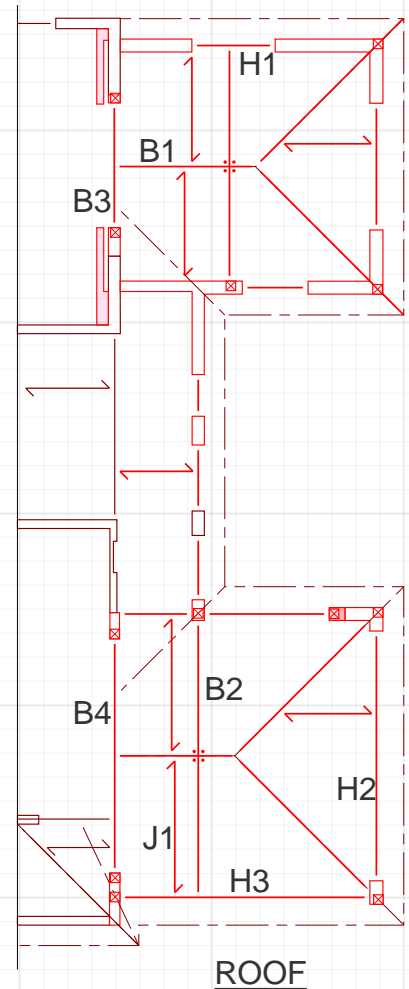
DESIGN

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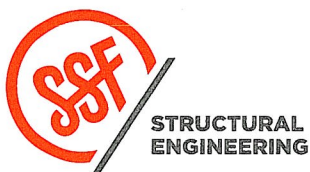
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Gravity Design
Roof Framing

J1	L= 8'	w= 80 plf	Rxn= 0.32 k
	$f_b= 584$ psi	$\Delta= 0.12"$	
	$f_v= 37$ psi	L/806	<u>2x8 @ 24" oc</u>
B1	L= 5'	w= 320 plf	P= 1.0 k
	(+1.5' cant.)		(@ end)
	$f_b= 522$ psi	$\Delta= 0.02"$	
	$f_v= 67$ psi	L/1541	<u>(2)2x10</u>
B2	L= 14'	P= 2.65 k	Rxn= 1.33 k
		(@ mid-span)	
	$f_b= 1609$ psi	$\Delta= 0.47"$	
	$f_v= 43$ psi	L/360	<u>GL 5.125x9</u>
B3	L= 6'	w= 620 plf	P= 0.43 k
			(@ 3')
	$f_b= 826$ psi	$\Delta= 0.07"$	
	$f_v= 74$ psi	L/1009	<u>4x10</u>
B4	L= 11'	w= 620 plf	P= 1.0 k
			(@ 3')
	$f_b= 1753$ psi	$\Delta= 0.35"$	
	$f_v= 113$ psi	L/382	<u>(3)LVL 1.75x9.25</u>
H1	L= 4'	w= 115 plf	P= 1.3 k
			(@ 2')
	$f_b= 688$ psi	$\Delta= 0.03"$	
	$f_v= 62$ psi	L/1658	<u>(2)2x8</u>
H2	L= 12'	w= 140 plf	Rxn= 0.84 k
	$f_b= 629$ psi	$\Delta= 0.20"$	
	$f_v= 29$ psi	L/715	<u>GL 5.125x7.5</u>
H3	L= 12'	w= 160 plf	P= 1.3 k
			(@ 4')
	$f_b= 1525$ psi	$\Delta= 0.45"$	
	$f_v= 68$ psi	L/322	<u>GL 5.125x7.5</u>



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**Gravity Design
Floor Framing**

J1

L= 12'

w= 70 plf

Rxn= 0.42 k

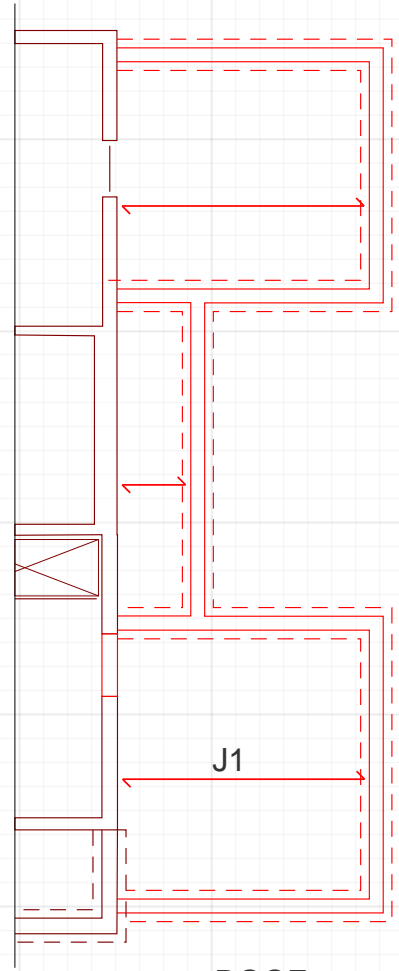
$f_b = 707$ psi

$\Delta = 0.25"$

$f_v = 40$ psi

L/567

2x10 @ 16" oc

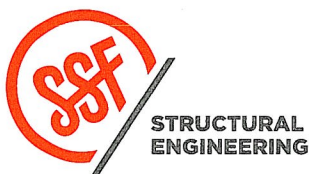


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