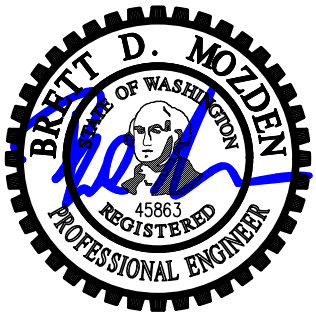
Structural Calculations For:

Lavergne Addition

4139 97th Ave SE

Mercer Island, WA 98040



Prepared for:	Shelly Johnson
Job #:	13590-2025-01
Date:	July 3, 2025

Criteria Sheet

Codes

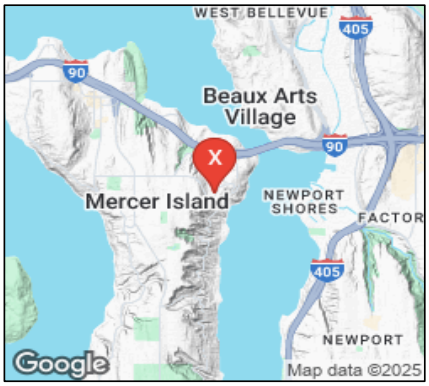
Structural	IBC 2021
Loading	ASCE 7-16
Wood:	NDS 2018 / SDPWS 2021
Steel:	AISC 360-16
Concrete:	ACI 318-19
Masonry:	TMS 402/602-16

Project Location

Street & Number	4139 97th Ave SE		
City:	Mercer Island	State:	WA
ZIP:	98040		
Latitude:	47.5720	N	
Longitude:	-122.2107	W	
Ground Elevation	213	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 =	12 kips	Ω_o=	2.5
S_S=	1.408	S_1=	0.49
S_{DS}=	1.13	S_{D1}=	0.89
C_s=	0.173	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}=	1.30
Exposure =	C		

Dead Loads:

Roof		Floor	
Roofing	1 psf	Finish Floor	2 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	5 psf		11.7 psf
	15 psf	Use	12 psf
Use	15 psf	Add'l Seismic Weight	10 psf
Add'l Seismic Weight	5 psf	Seismic Weight	22 psf
Seismic Weight	20 psf		

Live Loads:

Roof	20	psf
Floor	40	psf

Snow Loading Criteria:

Ground Snow, p_g	25 psf	Flat Roof Snow Load, p_f	25.0 psf	Importance Factor, I_s	1.00
Exposure Factor, C_e	1.00	Sloped Roof Snow Load, p_s	25.0 psf		
Thermal Factor, C_t	1.00	Slope Factor, C_s	1.00		

Soils:

Allowable Bearing	1500 psf	Active	55/35	pcf (Restrained/Unrestrained)
Sliding, μ	0.3	Seismic Surcharge	8H	
Passive	250 pcf			

Soils Report Provided?	No	To be approved by the authority having jurisdiction, per 11.8.2 exception.
Site Specific Ground Motion Hazard Analysis Provided?	No	

SSF STRUCTURAL ENGINEERING

SEATTLE | TACOMA
2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com
SWENSON SAY FAGET

Lavergne Addition	
Criteria	
DATE	7/2/2025
PROJ. #	13590-2025-01
DESIGN	BDM
SHEET	1

Seismic Design

ASCE 7-16 Seismic Analysis | Equivalent Lateral Force Procedure | Apply Section 12.8.1.3 (Where Applicable)? Yes

Seismic Force Resisting System Per Table 12.2-1		
	System	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D	
Risk Category	II	I, II, or III, or IV per Table 1.5-1
Site Class	D (Default)	Assumed default soil properties, per 11.4.3.
Diaphragm Flexibility	Flexible	

Section 12.8.1.3

1. Regular Structure	Yes
2. ≤ 5 Stories above grade	Yes
3. T ≤ 0.5s	Yes
4. ρ = 1.0	No
5. Not Site Class E or F	Yes
6. Risk Category I or II	Yes

If all items above are met, S_{DS} may be taken as 1.0, but not less than 0.7*(Calculated S_{DS})

S_S	1.408 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.49 g	2% in 50 yr, Latitude & Longitude lookup
R	6.50	
C_d	4.0	
Ω_o	2.5	
I_e	1.00	Table 1.5-2
h_n	17.8 ft	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T_a	0.17 sec	
T	0.17 sec	Eq. 12.8-7
T_0	0.16 sec	
T_S	0.79 sec	
T_L	6.00 sec	
F_a	1.20	Table 11.4-1
F_v	1.81	Table 11.4-2
S_{MS}	1.69 g	Eq. 11.4-1
S_{M1}	1.33 g	Eq. 11.4-2
S_{DS}	1.126 g	Eq. 11.4-3
S_{D1}	0.887 g	Eq. 11.4-4
C_s	***0.173 Controls***	Eq. 12.8-2
	0.789	Eq. 12.8-3 need not exceed, T < T_L
	0.010	Eq. 12.8-5 or 12.8-6 minimum
C_s, design	0.173	
Bldg. Weight	67.8 k	
V = C_SW	11.7 k	Eq. 12.8-1, Strength Level Base Shear
V = C_{Sasd}W	8.2 k	Eq. 12.8-1 ASD Base Shear

Building Period Per Alternate Analysis

T (sec)	

Per Geotech Report

F_a	
F_v	

$$T_a = C_t h_n^x \quad \text{Eq. 12.8.7}$$

$$S_{MS} = F_a S_S \quad \text{Eq. 11.4-1}$$
$$S_{M1} = F_v S_1 \quad \text{Eq. 11.4-2}$$
$$S_{DS} = {}^2/_3\, S_{MS} \quad \text{Eq. 11.4-3}$$
$$S_{D1} = {}^2/_3\, S_{M1} \quad \text{Eq. 11.4-4}$$

$$C_S = \frac{S_{DS}}{(R/I_e)} \quad \text{Eq. 12.8-2}$$
$$C_S = \frac{S_{D1}}{T(R/I_e)} \quad \text{Eq. 12.8-3}$$
$$C_S = \frac{S_{D1} T_L}{T^2(R/I_e)} \quad \text{Eq. 12.8-4}$$
$$C_S \geq 0.044 S_{DS} I_e \quad \text{Eq. 12.8-5}$$
$$C_S \geq 0.01 \quad \text{Eq. 12.8-5}$$
$$C_S \geq 0.5 \frac{S_1}{(R/I_e)} \quad \text{Eq. 12.8-6}$$

$$C_{VX} = w_x h_x^k / \textstyle\sum_{i=1}^{n} w_x h_i^k \quad \text{Eq. 12.8-12}$$

$$F_{px} = {}^{\sum_{i=x}^{n} F_i}/_{\sum_{i=x}^{n} w_i}\, w_{px} \quad \text{Eq. 12.10-1}$$
$$F_{px} \geq 0.2 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-2}$$
$$F_{px} \leq 0.4 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-3}$$

Vertical Distribution ASD ρ= 1.3 k= 1.000

Level	h_x (ft)	W_x (k)	h_x^k (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force (ρ not included)				
					C_{vx} (%)	F_x (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	γ=F_{px}/F_x
Roof	17.8	30	17.8	533	0.610	6.5	**6.5**	5.0	4.7	9.5	**5.0**	0.77
2	9.0	38	9.0	340	0.390	4.2	**10.7**	4.6	6.0	11.9	**6.0**	1.43
Σ		67.8		873		**10.7**						

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	C	
V=	98	mph
K_d=	0.85	Table 26.6-1
K_h=	0.93	Table 27.3-1
K_e=	0.99	Table 26.9-1
G=	0.85	26.9.4

Transverse Wind Pressures

L/B = 0.57 h/L = 0.78

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.35 / 0.13
Leeward Roof	-0.60

Location and Building Dimensions

Calculate Kzt?	No	
Kzt	1.30	
Roof Type	Gable	
Roof Slope - Transverse Dir	27	degrees
Roof Slope - Long Dir	0	degrees
Ground to top of roof	27	ft
Bot of roof to top of roof	8	ft
Mean Roof Height, h	23	ft
Short Plan Dimension	29.5	ft
Long Plan Dimension	51.75	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft

Velocity Pressure at Mean Roof Height, q_h =	25.0	psf

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	P_{lwalls}	**P_{walls} (psf)**
0-15	0.85	22.92	15.58	10.64	**15.7**
15-20	0.9	24.26	16.50	10.64	**16.3**
20-25	0.94	25.34	17.23	10.64	**16.7**
25-30	0.98	26.42	17.97	10.64	**17.2**
30-40	1.04	28.04	19.07	10.64	**17.8**
41-50	1.09	29.39	19.98	10.64	**18.4**
51-60	1.13	30.46	20.72	10.64	**18.8**
61-70	1.17	31.54	21.45	10.64	**19.3**
71-80	1.21	32.62	22.18	10.64	**19.7**
81-90	1.24	33.43	22.73	10.64	**20.0**
91-100	1.26	33.97	23.10	10.64	**20.2**

Roof Pressures (Unfactored) ASD

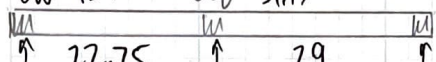
Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
2.8	-7.4	-12.8	**9.36**

SWENSON SAY FAGET
SEATTLE TACOMA
2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

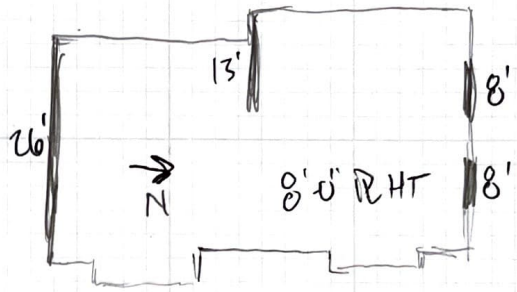
LATERAL ANALYSIS

E/W

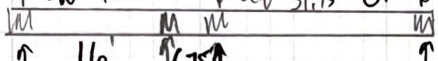
ROOF: SOUTH $V_w = 157^{\#/'}$ $V_{eq} = \frac{6.5}{51.75} = 126^{\#/'}$ NORTH



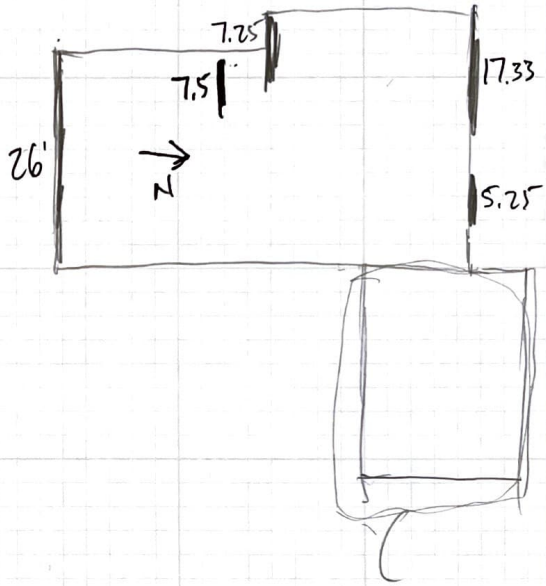
V(k) W/EQ	1.79/1.43	4.06/3.25	2.28/1.83
L(ft)	26	73	16
v(#/')	69	112	143
SW	W6	W4	W6
OT	—	2.8	—
HD	—	(2)CS16	—



UPPER: $V_w = 157^{\#/'}$ $V_{eq} = \frac{4.2}{51.75} = 81^{\#/'}$



V(k) W/EQ	3.05/2.08	1.79/.92	6.85/4.70	4.56/3.00
L(ft)	26	7.5	7.25	22.5
v(#/')	117	239	948	202
SW	W6	W4	2W3	W6
OT	—	1.9	7.5+2.0	1.57
HD	—	HDU2	HDU11	HDU2



NO CHANGE TO GARAGE - SELF SUPPORTING. NEW TRUSSES MATCH EXISTG.

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

SSF STRUCTURAL ENGINEERING

LAKEWOOD
PROJECT

6/30/25
DATE

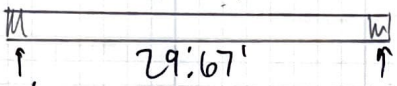
13590-2025-01
PROJ. #

BDM
DESIGN

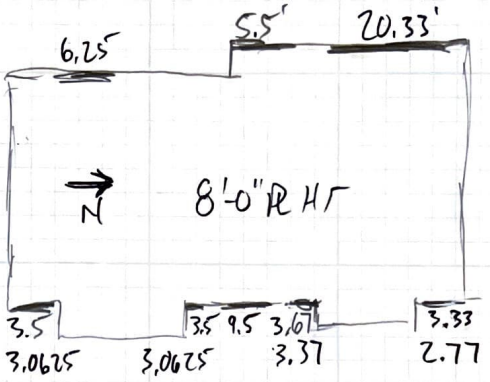
L1
SHEET

N/S

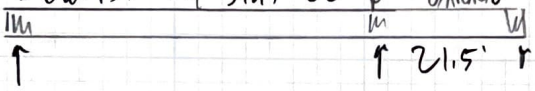
ROOF: WEST $V_W = 157^{\#}$ $V_{eq} = \frac{6.5}{29.67} = 219^{\#}$ EAST



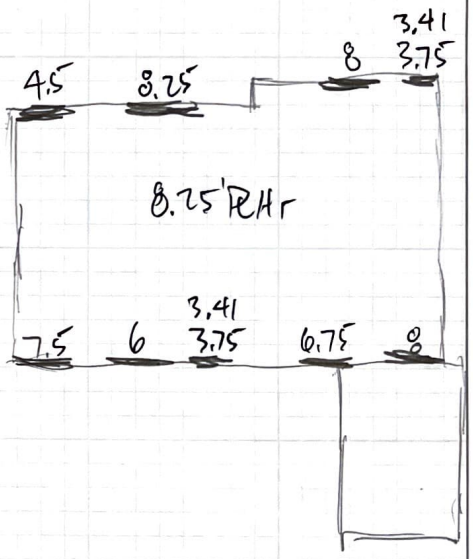
V(k) W/ EQ	2.3/3.25	2.3/3.25
L(ft)	32.08	23.5/21.77
V(#/')	101	149
SW	W6	W6
OT	—	—
HD	—	—



UPPER: $V_W = 157^{\#}$ $V_{eq} = \frac{4.2}{51.17} = 82^{\#}$ EXISTING GARAGE



V(k) W/ EQ	4.6/4.47	6.3/5.35	1.69/.80
L(ft)	24.5/24.2	32/31.66	EXISTING NO CHANGE
V(#/')	190	199	
SW	W6	W6	
OT	1.57	1.64	
HD	HDU2	HDU2	



SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STRUCTURAL ENGINEERING

LAVERGNE
PROJECT

6/30/25
DATE
13590-2025-01
PROJ. #
BDM
DESIGN
L2
SHEET

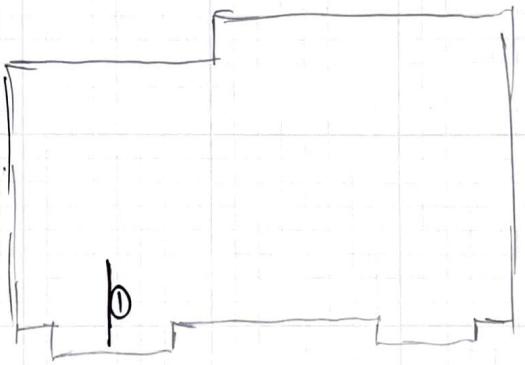
GRAVITY DESIGN

• ROOF

① - RIDGE

$w = 220^{\#}$
$L = 8.75$
$R = .96^{k}$
$m = 2.11^{k-ft}$

$f_b = .59^{ksi}$
$f_v = 43^{psi}$
$A_{req} = .113'' = 8/93$
(2)2x10



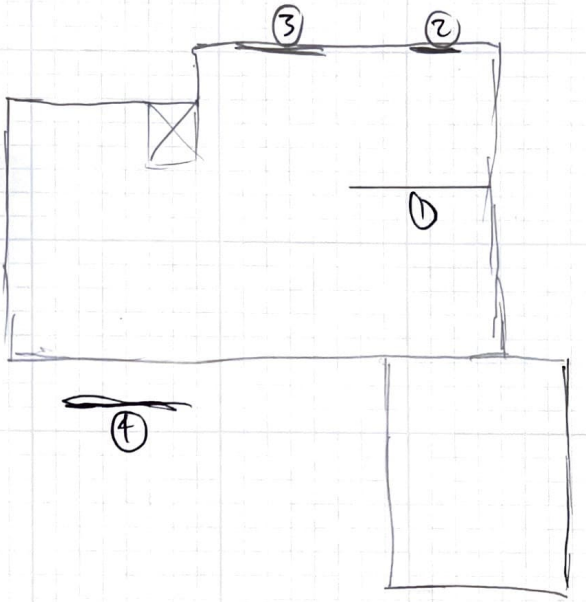
SWENSON SAY FAGET
ssfengineers.com
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470

STRUCTURAL ENGINEERING

LAVERNE
PROJECT

6/30/25
DATE
13590-2025-01
PROJ. #
BDM
DESIGN
G1
SHEET

• UPPER FLOOR FRAMING PLAN



① -Bm

$w = 754^{\#/}$
$L = 14.75'$
$R = 5.56^{k}$
$M = 20.5^{k\cdot ft}$

$f_b = 1.5^{ksi}$
$f_v = 87^{psi}$
$\Delta_T = .91" = \ell/431$
(4) LVL 13/4x11 7/8

② -TYP. Rm

$w = 1041^{\#/}$
$L = 5.5'$
$R = 2.86^{k}$
$m = 3.94^{k\cdot ft}$

$f_b = .57^{ksi}$
$f_v = 66^{psi}$
$\Delta_T = .03" = \ell/2331$
LSL 3 1/2x11 7/8

③ - Rm

$w = 1041^{\#/}$
$L = 10'$
$R = 5.21^{k}$
$M = 13.0^{k\cdot ft}$

$f_b = 1.27^{ksi}$
$f_v = 100^{psi}$
$\Delta_T = .16" = \ell/757$
(3) LVL 13/4x11 7/8

④

$w = 80^{\#/}$
$L = 13'$
$R = .52^{k}$
$M = 1.69^{k\cdot ft}$

$f_b = .66^{ksi}$
$f_v = 28^{psi}$
$\Delta_T = .27" = \ell/573$
4x8

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

SSF STRUCTURAL ENGINEERING

PROJECT: LAVERGNE
DATE: 6/30/25
PROJ. #: 13540-2025-01
DESIGN: BDM
SHEET: G2