STRUCTURAL DESIGN

FOR

4620 MERCER GARAGE

Submitted to:

Date: *7/6/2025*

F.T. Engineering & Construction Management, LLC

T: (509) 822-0489 **E-mail:** F.T.Eng.cm@gmail.com

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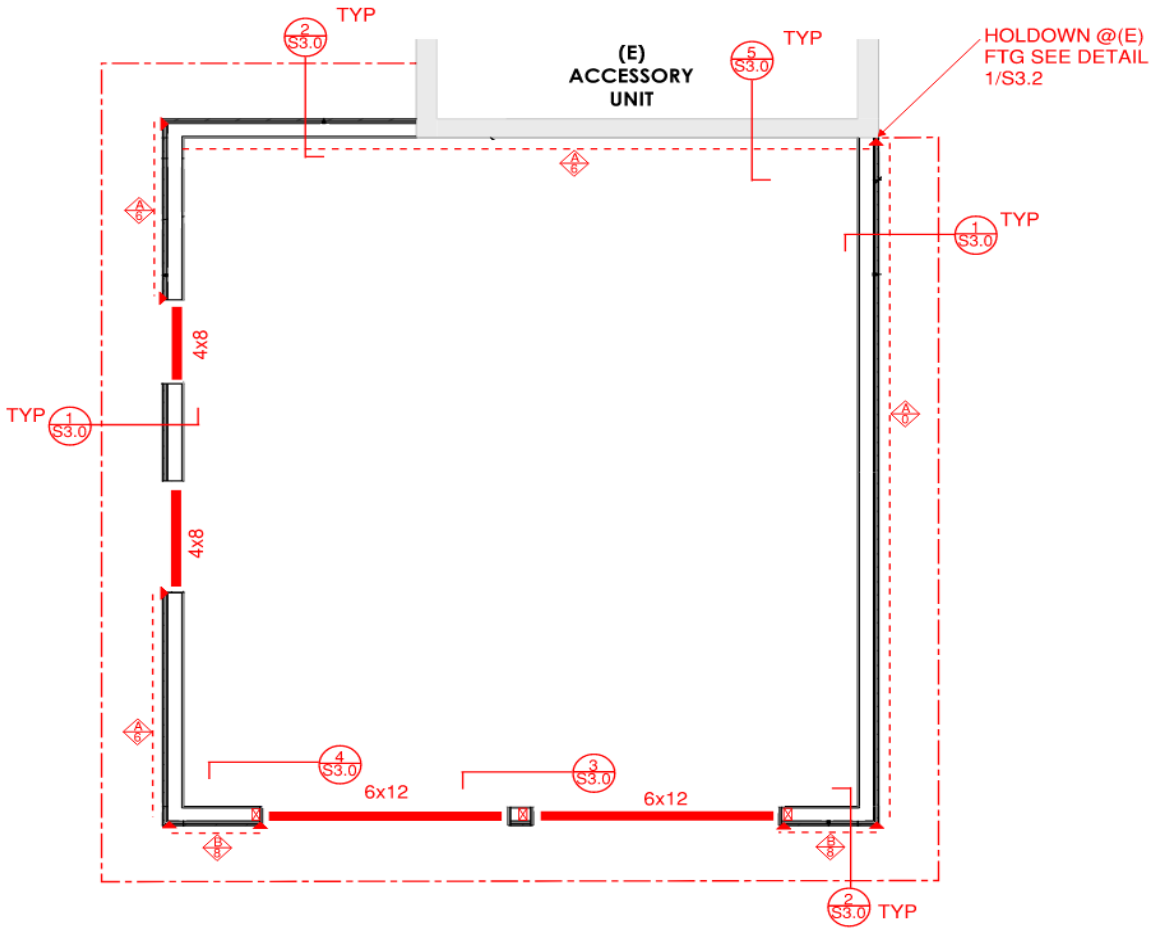
1.0 OBJECTIVE

1 story addition/remodel as shown below.



ROOF FRAMING PLAN

24x36: SCALE 1/4" = 1'-0"

Job Number:	2025029	Engineer:	Frankie Tsui
Job Name:	4620 Mercer Garage	Date:	7/5/2025
Location:	4620 88th Ave SE, Mercer Island, WA 9804	Page:	2

2.0 LOAD

Roof live Load =	20	PSF
Floor live load =	40	psf
Deck live Load =	60	psf
Snow Load, P_f =	$0.7C_eC_tI_sP_g$	
C_e =	1	
C_t =	1	
I_s =	1	
P_g =	25	
P_f =	17.5	
Use =	25	psf
Floor Dead Load =	15	psf
Roof Dead Load =	20	psf
Wind Design :		
Design Wind speed =	110	mph
Exp =	B	
Seismic Design :		
Sds =	1.164	(Shear Wall)
R =	6.5	
Ω =	2.5	

Soil Bearing Capacity :		
Assumed Soil Bearing Capacity =	1500	psf

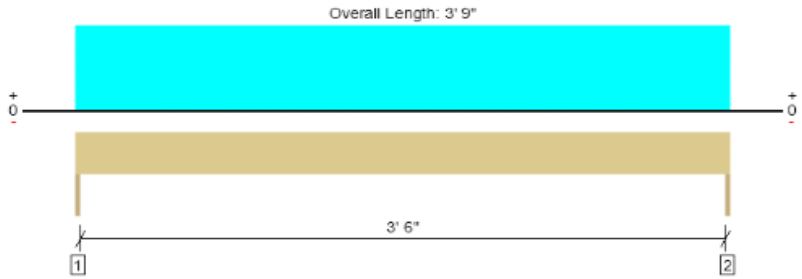
3.0 Garvity Framing Design

FORTEWEB

MEMBER REPORT **PASSED**

Level, Wall: Header

1 piece(s) 4 x 8 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1109 @ 0	2126 (1.50")	Passed (52%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	678 @ 8 3/4"	2918	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1040 @ 1' 10 1/2"	3247	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.010 @ 1' 10 1/2"	0.125	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.018 @ 1' 10 1/2"	0.188	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 3' 9"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2021
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	Snow	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	500	609	1109	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	500	609	1109	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 9" o/c	
Bottom Edge (Lu)	3' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 9"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 3' 9"	13"	20.0	25.0	roof

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
Frankie Tsui F.T. Engineering & Construction Management, LLC (509) 822-0489 f.t.eng.cm@gmail.com	

Weyerhaeuser

7/5/2025 7:42:21 AM UTC
ForteWEB v3.9, Engine: V8.4.3.94, Data: V8.1.7.3
File Name: 2025029 - 4620 Mercer Garage

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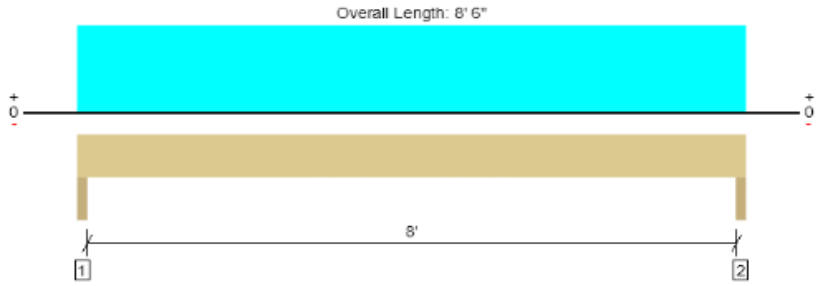
FORTEWEB

MEMBER REPORT

PASSED

Level, Garage Beam

1 piece(s) 6 x 12 HF No.2



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	642 @ 1 1/2"	6683 (3.00")	Passed (10%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	459 @ 1' 2 1/2"	6789	Passed (7%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1285 @ 4' 3"	7842	Passed (16%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.010 @ 4' 3"	0.275	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.021 @ 4' 3"	0.412	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 8' 6"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/360) 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	Snow	Factored	
1 - Trimmer - HF	3.00"	3.00"	1.50"	323	319	642	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	323	319	642	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 6" o/c	
Bottom Edge (Lu)	8' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 6"	N/A	16.0	--	
1 - Uniform (PSF)	0 to 8' 6"	3'	20.0	25.0	roof

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4.0 Lateral Analysis

Dead Load: (only at the timber framing Area)

Roof DL	**20.00**	**PSF**
Floor DL	**15.00**	**PSF**
Main Floor DL	**15.00**	**PSF**
IntWall	**10.00**	**PSF**
Ext Wall	**15.00**	**PSF**

Roof

Diaphragm Area:		1000.00	sq. ft.
Height of Diaphragm:		11.00	ft
	Weight of Diaphragm:	20000.00	lbs

Wall Weights Below:

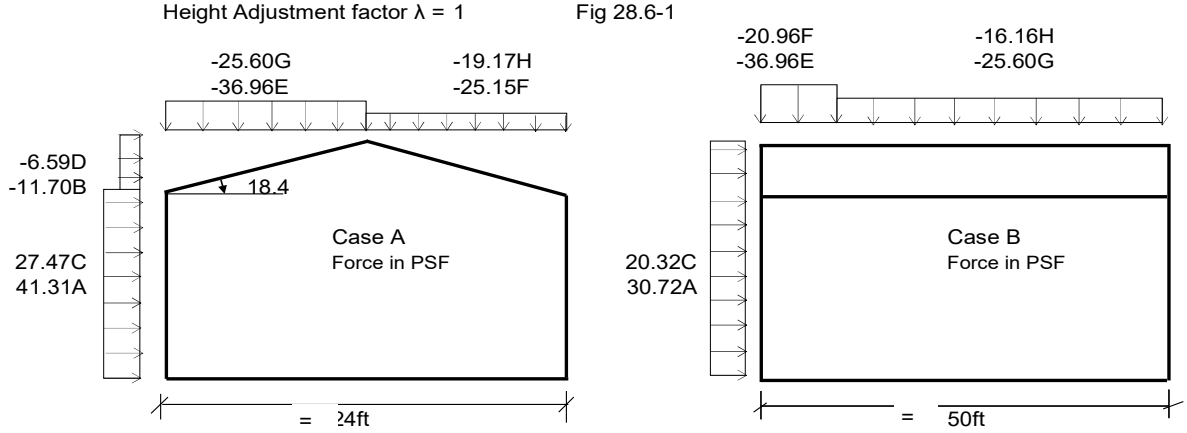
Wall Height:		11.00	ft
Concrete Wall Lengths:		0.00	lf
Int wall Wall Lengths:			lf
Ext Wall Perimeter:		180.00	lf
Concrete Wall Weight:		150.00	psf
Int Wall Weight:		10.00	psf
Ext Wall Wall Weight:		15.00	psf
	Weight of Walls Below:	14850.00	lbs
	Seismic Weight at Roof:	**34850.00**	**lbs**

Base Shear:

V=	CS*w
CS =	SDS / (R/Ie)
SDS =	1.146
R(N-S) =	6.5
R(E-W) =	6.5
V =	6.14 kips
$0.7V_E$ =	4.30 kips

28.4 Envelope Procedure,
MWFRS For Low-Rise Building. Part 2: Enclosed Simple Diaphragm Building (≤ 60 ft)

Roof Height h =	24	feet	
Roof Pitch =	4.00	:12	= 18.43 Degree
Building & Structure Risk Category =	II, standard		IBC T-1604.5
Wind Speed V =	110	MPH	Fig. 26.5-1A, MRI = 700 yrs
Topography factor K_{zt} =	1.60		26.8, Figure 26.8-1
Exposure	B		
Height Adjustment factor λ =	1		Fig 28.6-1



Plus and minus signs signify pressures acting toward and away from projected surfaces, respectively.
For Case B use Θ = 0°
Total horizontal load shall not be less than that determined by assume p_s = 0 in zones B & D

a= 10% of least horizontal dimension or 0.4h, whichever smaller, but bot less than either 4% of least horizontal dimention or 3ft.

10 % of least dimension=	2.4	ft
40 % of the eave height =	9.6	ft
4 % of least dimension or 3 ft=	3.0	ft ⇐

	Section	Wind pressure	Area (sqft)	Wind force (kips)
Roof	B	11.7	60	0.70
	D	6.6	287.5	1.89
	A	41.3	43.5	1.80
	C	27.5	282.5	7.76
			Sum W =	12.15
			0.6W =	7.29

	$0.6V_w$ (Kips)
Roof	7.29

Wind Area -CASE A

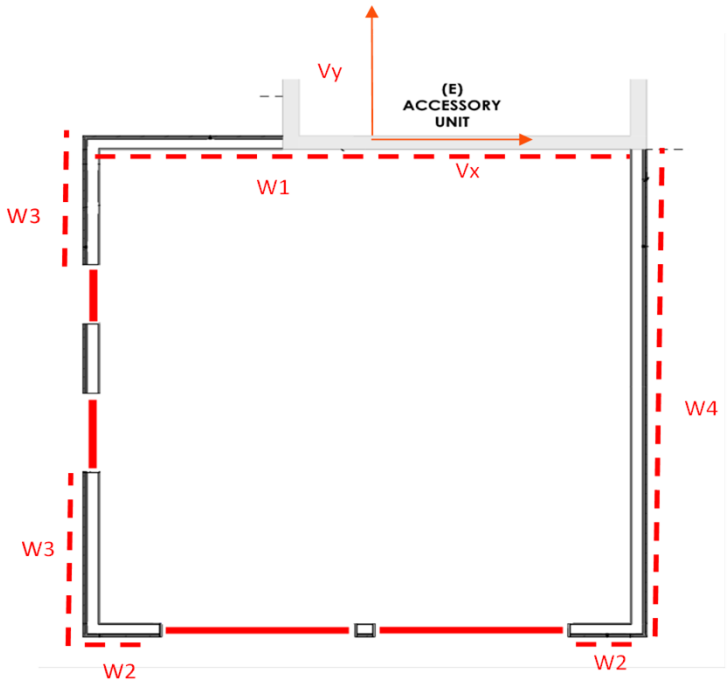
The other projected area is less. So seismiccontrol

	Section	Wind pressure	Area (sqft)	Wind force (kips)
Roof	A	41.3	33	1.36
	C	27.5	104.5	2.87
			Sum W =	4.23
			0.6W =	2.54

	$0.6V_w$ (Kips)
Roof	2.54

Wind Area - CASE B

Roof



Diap. Shear = **73 plf** X direction
90 plf Y direction

Roof:
Vx= **7.29 kips**
Vy= **4.30 kips**

Shear Line	H(ft)	Shear (lbs)	Wall	Wall Shear
W1	11	3646	**23.0 ft**	**159 plf**
W2	11	912	**3.0 ft**	**304 plf**
W3	11	1075	**6.0 ft**	**179 plf**
W4	11	2151	**24.5 ft**	**88 plf**

Wall Pier Loading (Wall Reactions are Treated as Perforated Shearwalls)

Wall	Wall Length	W(DL)	Total Tension(0.6D)	Shear Strength	HD	Shear Wall	Allowable Shear	RATIO
W1	23.00 ft	218 plf	798	159 plf	HDU2	A	230.0 plf	0.69
W2	3.00 ft	165 plf	3194	304 plf	HDU5	B	380.0 plf	0.80
W3	6.00 ft	345 plf	1350	179 plf	HDU2	A	230.0 plf	0.78
W4	24.50 ft	345 plf	-1570	88 plf	NA	A	230.0 plf	0.38