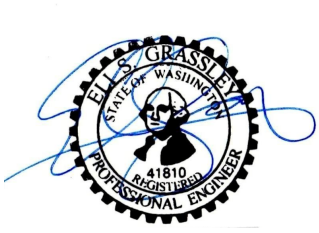
STRUCTURAL CALCULATIONS

FOR

KOVES DADU

Mercer Island, WA

5-24-2024



PREPARED BY:

ESG DESIGN, PLLC
May 24, 2024

PARAMETERS

Hazards by Location

Search Information

Address:	7901 SE 65th St, Mercer Island, WA 98040, USA
Coordinates:	47.5450629, -122.2327897
Elevation:	180 ft
Timestamp:	2024-05-24T22:22:33.855Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

Basic Parameters

Name	Value	Description
S_S	1.468	MCE_R ground motion (period=0.2s)
S_1	0.508	MCE_R ground motion (period=1.0s)
S_{MS}	1.761	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.174	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.902	Coefficient of risk (0.2s)
CR_1	0.898	Coefficient of risk (1.0s)
PGA	0.629	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.754	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	1.468	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.628	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	4.259	Factored deterministic acceleration value (0.2s)
S1RT	0.508	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.566	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.641	Factored deterministic acceleration value (1.0s)
PGAd	1.419	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

Project Parameters

Project

Project name =	Koves DADU			

Location

Address =	7901 SE 65TH ST MERCER ISLAND			
Site Elevation =	180	ft		
Jurisdiction =	City of Mercer Island, Washington			
County =	King County, Washington			

Structure (Addition)

Footprint Parameters

Width (dimension perp to ridge) =	13.00	ft		
Depth (dimension para to ridge) =	43.50	ft		

Height Parameters

Number of stories =	1			
Height, h =	14	ft		
Mean Roof Height, MRH =	12	ft	ASCE 26.2	

Roof Parameters

Roof type =	Gable			
Roof pitch =	5	:12		
Roof slope =	22.62	degrees		
Roof span =	13.00	ft		

Wall Parameters

Wall height, Main Level=	9.0	ft		

Loads

Risk and Importance

Risk Category (wind) =	II		ASCE 7-16 Table 1.5-1	
Snow Importance Factor, I_s =	1.00		ASCE 7-16 Table 1.5-2	
Seismic Importance Factor, I_e =	1.00		ASCE 7-16 Table 1.5-2	

Load Case Factors

ASD wind load case factor =	0.6		ASCE 7-16 2.4.1	
ASD seismic load case factor =	0.7		ASCE 7-16 2.4.1	
ASD dead load resisting case factor =	0.6		ASCE 7-16 2.4.1	

Live loads

Live Load Floor, LL_{floor} =	40	psf		

Dead loads

Roof

Roof, typical covered =	12	psf		
Roof, overhangs =	12	psf		

Walls

Exterior walls =	10	psf	of wall area	
Interior walls =	0.25	pcf	of floor area and wall ht	For determining W only

Project Parameters

Snow Loads

Ground Snow Load, p_g =	25	psf	ASCE 7-16 Table 7.2-5	
Exposure Factor, C_e =	1.0		ASCE 7-16 Table 7.3-1	
Thermal Factor, C_t =	1.0		ASCE 7-16 Table 7.3-2	warm roof
Flat Roof Snow Load p_f =	17.5	psf	ASCE 7-16 Eq 7.3-1	
Slope Factor, C_s =	1.00		ASCE 7-16 Figure 7.4-1	warm roof
Sloped Roof Snow Load, p_s =	17.5	psf	ASCE 7-16 Eq 7.4-1	
Sloped Roof Snow Load min, p_{smin} =	25	psf	Min per AHJ	
Sloped Roof Snow Load design, $p_{sdesign}$ =	**25**	**psf**		**CONTROLS**

Wind Loads: General Requirements

Wind analysis document:	WFCM			
Wind analysis procedure:	WFCM			ASD applied to load tables
Basic Wind Speed, V_{3s} =	100	mph	ASCE 7-16 Figure 26.5-1B	
Exposure Category =	B			
Topographic Factor, K_{zt} =	1.00			
Enclosure Classification =	Enclosed		ASCE 7-16 26.2	
Minimum Design Wind Load, wall area =	16.0	psf	ASCE 7-16 28.3.4	Strength level
Minimum Design Wind Load, roof area =	8.0	psf	ASCE 7-16 28.3.4	Strength level, vert plane

Lateral Diaphragm Loads from Wind — Loads are ASD

Perpendicular to Ridge — *(applied along the width; the side faces)*

Roof	80	plf	calcs attached

Parallel to Ridge — *(applied along the depth; the front and back faces)*

Roof	105	plf	calcs attached

Wind Base Shear — Loads are ASD

Perpendicular to Ridge — *(applied along the width; the side faces)*

Roof	3.5	kips
Wind Base Shear (perp) =	**3.5**	kips

Parallel to Ridge — *(applied along the depth; the front and back faces)*

Roof	1.4	kips
Wind Base Shear (para) =	**1.4**	kips

Seismic Loads

Seismic analysis document:	ASCE 7-16		
Seismic analysis procedure:	12.14.8 Simplified Lateral Force Analysis Procedure		
Force level =	Strength		

Mapped accelerations

S_s =	1.468		Design Map Summary, attached
S_1 =	0.508		Design Map Summary, attached
Site class =	D		ASCE 7-16 20.1

Design accelerations

S_{ds} =	1.174		Design Map Summary, attached
S_{D1} =	0.000		Design Map Summary, attached
Seismic design category =	D		ASCE 7-16 11.6 — $S_{ds} \geq 0.50$

Basic seismic force resisting system = Wood structural panel shear walls

Project Parameters

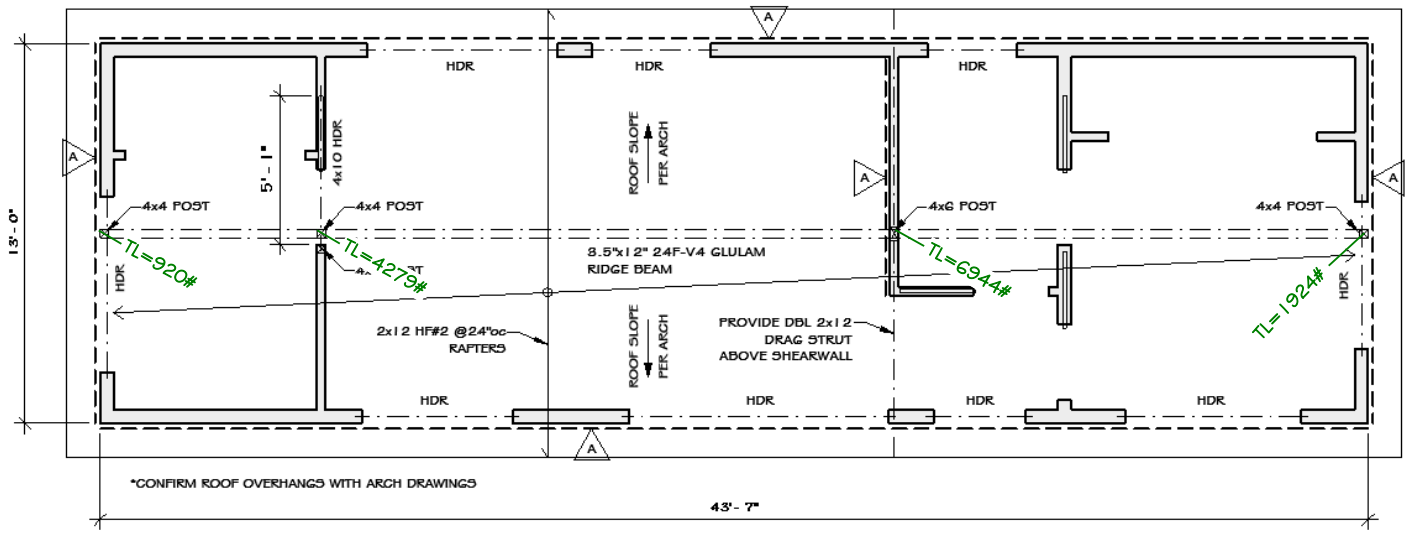
Response modification factor, R =	6.5		ASCE 7-16 Table 12.14-1 A.13	
Story force factor, F =	1.0		ASCE 7-16 12.14.8.1	
Effective Seismic Weight (roof), W =	6.8	kips		
Seismic Design Base Shear Factor, V_f =	0.181	W		Strength level
Seismic Design Base Shear, V =	1.2	kips		Strength level
Seismic Design Base Shear Factor , V_{fASD} =	0.126	W		ASD level
Seismic Design Base Shear ASD Level, V_{ASD} =	**0.9**	**kips**		**ASD level**

Controlling Loads

Controlling base shear (perp) =	**3.5**	**k**	**Wind Controls**
Controlling base shear (para) =	**1.4**	**k**	**Wind Controls**

GRAVITY DESIGN

ROOF FRAMING SCHEME



EXTERIOR WALL FOUNDATION CALCULATIONS:
ASSUMED SOIL BEARING CAPACITY - 1,500 PSF
MAX. LOAD ON EXTERIOR WALL:
DL = 150 PLF, SL = 125 PLF
MIN. EXTERIOR WALL FOUNDATION WIDTH:
(150 + 125) / 1,500 = 0.18'
PROVIDE 12"-WIDE THICKENED SLAB

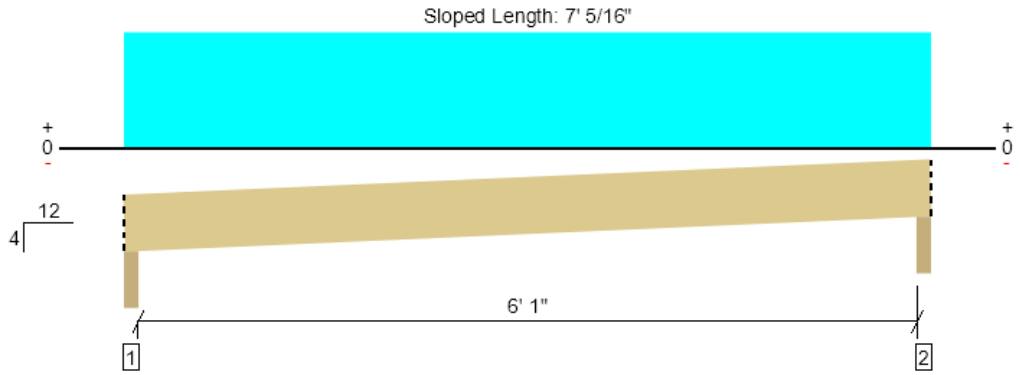
FORTEWEB

MEMBER REPORT

PASSED

Roof, Rafters

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



Drawing is Conceptual. 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)	251 @ 2 1/2"	2126 (3.50")	Passed (12%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	162 @ 1' 2 3/16"	1941	Passed (8%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	368 @ 3' 4"	2964	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.008 @ 3' 4"	0.329	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.012 @ 3' 4"	0.439	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 7' 4 1/16"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD
Member Pitch : 4/12

- Deflection criteria: LL (L/240) and TL (L/180).
- 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	84	167	251	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.50"	84	167	251	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' o/c	
Bottom Edge (Lu)	7' o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 6' 8"	24"	12.0	25.0	Roof

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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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File Name: Koves DADU

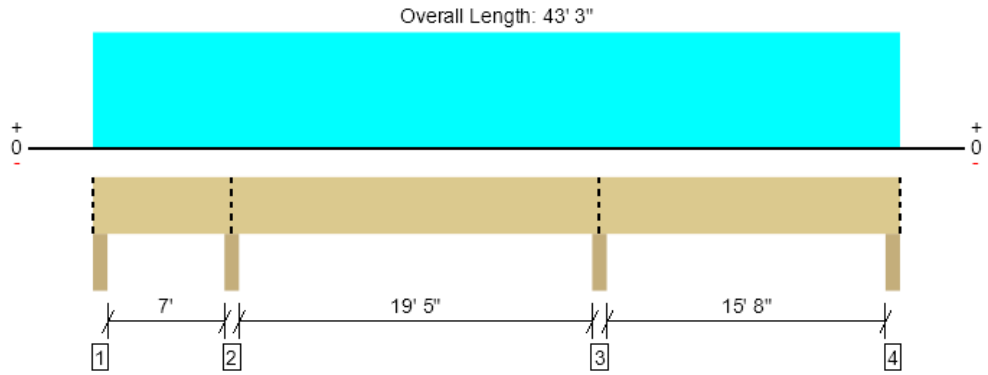
FORTEWEB

MEMBER REPORT

PASSED

Roof, Ridge Beam (Full span)

1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam



Drawing is Conceptual. 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)	5140 @ 27' 1 3/4"	7963 (3.50")	Passed (65%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	2314 @ 26'	8533	Passed (27%)	1.15	1.0 D + 1.0 S (Adj Spans)
Pos Moment (Ft-lbs)	5251 @ 17' 1 1/2"	19320	Passed (27%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-8618 @ 27' 1 3/4"	14893	Passed (58%)	1.15	1.0 D + 1.0 S (Adj Spans)
Live Load Defl. (in)	0.208 @ 17' 3 9/16"	0.985	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.298 @ 17' 2"	1.314	Passed (L/794)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 43' 3"
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- 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' 11 5/16".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 8' 5 7/16".
- -252 lbs uplift at support located at 2". Strapping or other restraint may be required.
- 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	Snow	Factored	
1 - Column - SPF	3.50"	3.50"	1.50"	35	383/-287	418/-252	Blocking
2 - Column - SPF	3.50"	3.50"	1.88"	1448	2821	4269	Blocking
3 - Column - SPF	3.50"	3.50"	2.26"	1804	3336	5140	Blocking
4 - Column - SPF	3.50"	3.50"	1.50"	528	1070	1598	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)	43' 3" o/c	
Bottom Edge (Lu)	40' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 43' 3"	N/A	10.2	--	
1 - Uniform (PSF)	0 to 43' 3" (Front)	6' 6"	12.0	25.0	Roof

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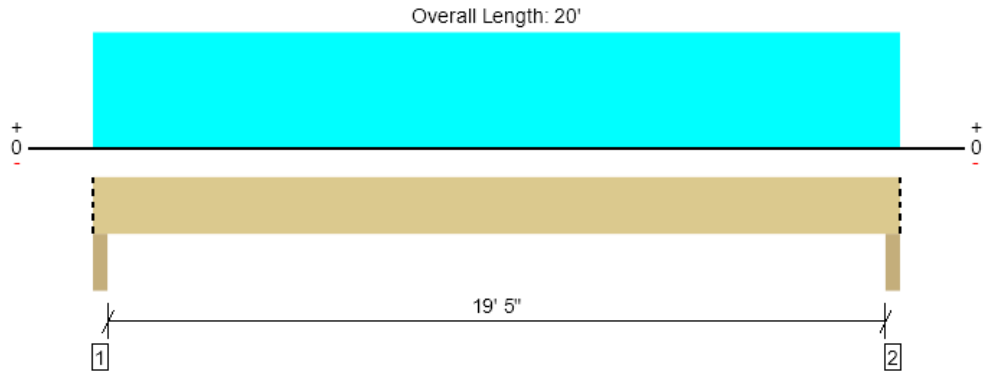
FORTEWEB

MEMBER REPORT

PASSED

Roof, Ridge Beam (single span)
1 piece(s) 3 1/2" x 12" 24F-V4 DF Glulam



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Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2507 @ 2"	7963 (3.50")	Passed (31%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2183 @ 1' 3 1/2"	8533	Passed (26%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	12121 @ 10'	19320	Passed (63%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.603 @ 10'	0.983	Passed (L/391)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.930 @ 10'	1.311	Passed (L/254)	--	1.0 D + 1.0 S (All Spans)

Member Length : 20'
System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- 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 = 19' 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	Snow	Factored	
1 - Column - SPF	3.50"	3.50"	1.50"	882	1625	2507	Blocking
2 - Column - SPF	3.50"	3.50"	1.50"	882	1625	2507	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)	20' o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 20'	N/A	10.2	--	
1 - Uniform (PSF)	0 to 20' (Front)	6' 6"	12.0	25.0	Roof

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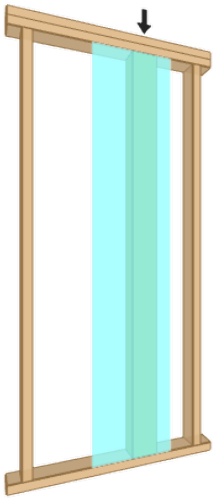
FORTEWEB

MEMBER REPORT

PASSED

Roof, Ridge Beam mid Post
1 piece(s) 4 x 6 HF No.2

Wall Height: 13' Member Height: 12' 7 1/2" Tributary Width: 1'



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	28	50	Passed (55%)	--	--
Compression (lbs)	5140	9073	Passed (57%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	5140	8181	Passed (63%)	--	1.0 D + 1.0 S
Lateral Reaction (lbs)	90	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	84	3080	Passed (3%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	285 @ mid-span	2558	Passed (11%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.16 @ mid-span	1.26	Passed (L/938)	--	1.0 D + 0.45 W + 0.75 L + 0.75 S
Bending/Compression	0.82	1	Passed (82%)	1.15	1.0 D + 1.0 S

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for this design is 16.67% of applicable member side dimension.
- Applicable calculations are based on NDS.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Column
Building Code : IBC 2021
Design Methodology : ASD

Max Unbraced Length	Comments
8'	

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 Load	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Point (lb)	N/A	1804	80	3336	Ridge Beam

Lateral Load	Location	Tributary Width	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	1'	23.9	

- 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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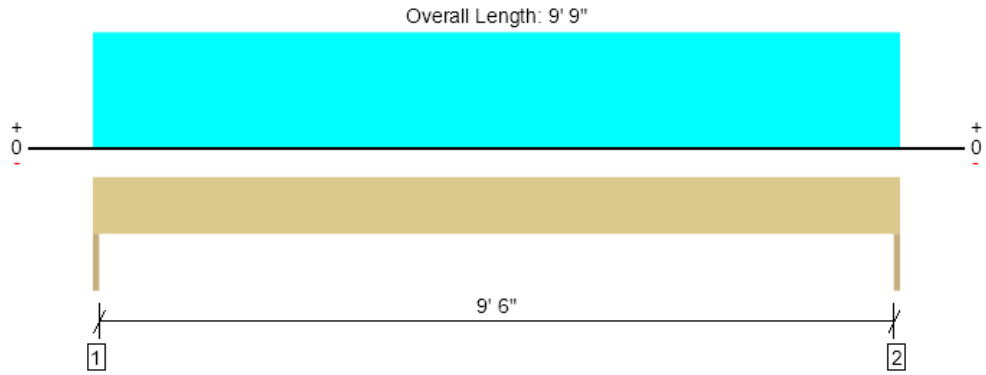
File Name: Koves DADU

FORTEWEB

MEMBER REPORT

PASSED

Roof, (2)2x8 HDR Max Span
2 piece(s) 2 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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	839 @ 0	1823 (1.50")	Passed (46%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	713 @ 8 3/4"	2501	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2044 @ 4' 10 1/2"	2569	Passed (80%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.185 @ 4' 10 1/2"	0.244	Passed (L/633)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.282 @ 4' 10 1/2"	0.313	Passed (L/414)	--	1.0 D + 1.0 S (All Spans)

Member Length : 9' 9"
System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (5/16").
- 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 - SPF	1.50"	1.50"	1.50"	290	548	839	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	290	548	839	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 9" o/c	
Bottom Edge (Lu)	9' 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 9' 9"	N/A	5.5	--	
1 - Uniform (PSF)	0 to 9' 9"	4' 6"	12.0	25.0	Roof

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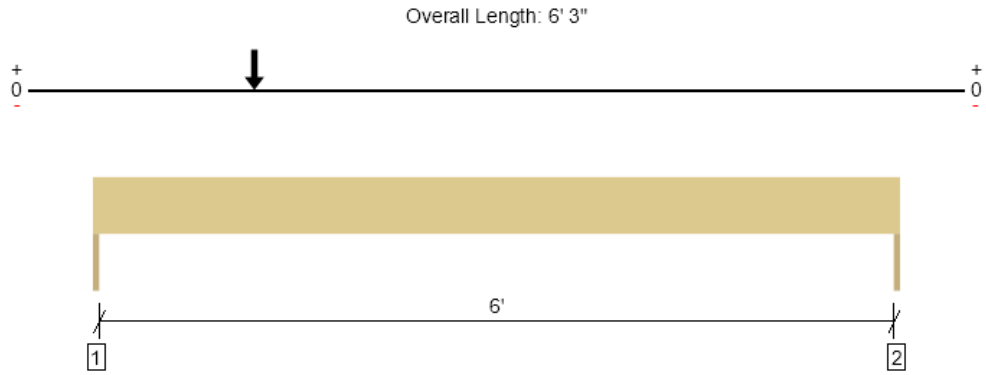
File Name: Koves DADU

FORTEWEB

MEMBER REPORT

PASSED

Roof, 6' HDR Under Ridge Beam post
2 piece(s) 2 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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	777 @ 0	1823 (1.50")	Passed (43%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	773 @ 8 3/4"	2501	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	967 @ 1' 3"	2569	Passed (38%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.025 @ 2' 9"	0.208	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.041 @ 2' 9 3/16"	0.313	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 6' 3"
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 - SPF	1.50"	1.50"	1.50"	284	493	777	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	84	123	207	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	6' 3" 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 6' 3"	N/A	5.5	--	
1 - Point (lb)	1' 3"	N/A	334	616	Ridge beam

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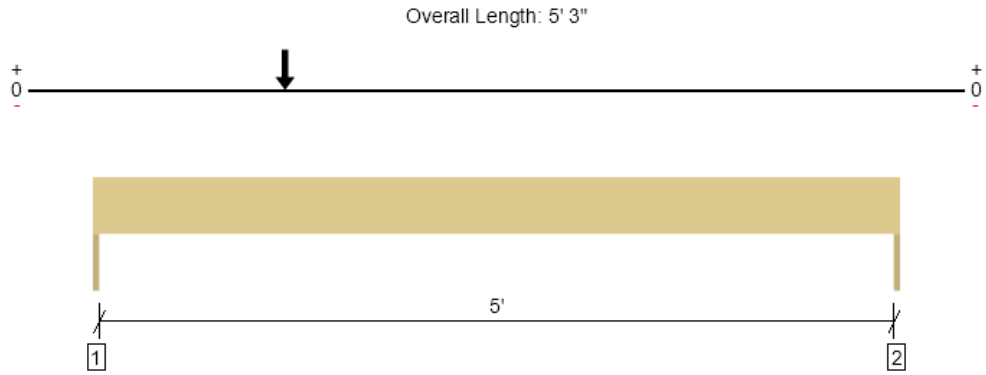
File Name: Koves DADU

FORTEWEB

MEMBER REPORT

PASSED

Roof, 5' HDR Under Ridge Beam post
2 piece(s) 2 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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1232 @ 0	1823 (1.50")	Passed (68%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1228 @ 8 3/4"	2501	Passed (49%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1536 @ 1' 3"	2569	Passed (60%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.030 @ 2' 4 3/16"	0.175	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.046 @ 2' 4 1/4"	0.262	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 5' 3"
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 - SPF	1.50"	1.50"	1.50"	417	815	1232	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	140	255	395	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 3" o/c	
Bottom Edge (Lu)	5' 3" 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 5' 3"	N/A	5.5	--	
1 - Point (lb)	1' 3"	N/A	528	1070	Ridge beam

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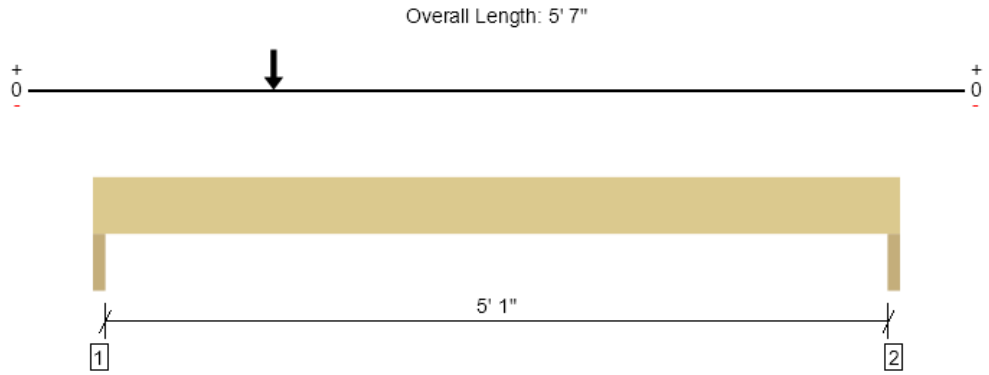
FORTEWEB

MEMBER REPORT

PASSED

Roof, 5'-1" Interior HDR Under Ridge Beam
1 piece(s) 4 x 10 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.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3391 @ 1 1/2"	4253 (3.00")	Passed (80%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3383 @ 1' 1/4"	3723	Passed (91%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3809 @ 1' 3"	4879	Passed (78%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.031 @ 2' 5 13/16"	0.178	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.048 @ 2' 5 13/16"	0.267	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 5' 7"
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 - SPF	3.00"	3.00"	2.39"	1165	2226	3391	None
2 - Trimmer - SPF	3.00"	3.00"	1.50"	328	595	923	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 7" o/c	
Bottom Edge (Lu)	5' 7" 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 5' 7"	N/A	8.2	--	
1 - Point (lb)	1' 3"	N/A	1448	2821	Ridge beam

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LATERAL DESIGN

2.1 General Provisions

2.1.1 Engineered Requirements

The provisions of this Chapter provide minimum loads for the purpose of establishing specific resistance requirements for buildings within the scope of this document. This Chapter includes the results of engineering calculations for specific structural elements, in specific configurations, under specific loads. The tabulated information does not represent a complete engineering analysis as would be performed by a registered professional engineer, but is expected to result in significant time-savings for the design professional.

2.1.2 Continuous Load Path

A continuous load path shall be provided to transfer all lateral and vertical loads from the roof, wall, and floor systems to the foundation.

2.1.3 Engineered Design Limitations

Wood-frame buildings built in accordance with this document shall be limited to the conditions of this section (see Table 2). Structural conditions not complying with this section shall be designed in accordance with accepted engineering practice.

2.1.3.1 Adjustment for Wind Exposure and Mean Roof Height

Tabulated wind requirements in this chapter are based on wind exposure category B and a mean roof height of 33 feet. The building shall neither exceed three stories nor a mean roof height of 33 feet, measured from average grade to average roof elevation (see Figure 1.2). Additional loads from habitable attics shall be considered for purposes of determining gravity and seismic loads. For buildings sited in exposure category B, wind-related tabulated values are permitted to be multiplied by the specific adjustments as provided per Table 2.1.3.1. For buildings sited in exposure category C or D, wind-related tabulated values shall be increased per Table 2.1.3.1 in accordance with specific adjustments as provided in footnotes to applicable tables.

Table 2.1.3.1 Adjustment for Wind Exposure and Mean Roof Height

Mean Roof Height (feet)	Exposure B MWFRS	Exposure B C&C	Exposure C MWFRS and C&C	Exposure D MWFRS and C&C
0-15	0.97	0.79	1.18	1.43
20	0.97	0.86	1.25	1.50
25	0.97	0.92	1.31	1.56
30	0.97	0.97	1.36	1.61
33	1.00	1.00	1.39	1.64

2.1.3.2 Floor Systems

a. Framing Member Spans Single spans of floor framing members shall not exceed 26 feet for lumber joists, I-joists, and floor trusses. Design spans shall consider both strength and serviceability limits. For serviceability, the computed joist deflection under live load shall not exceed L/360 (span divided by 360) or more stringent criteria as specified by the manufacturer.

b. Framing Member Spacings Floor framing member spacings shall not exceed 24 inches on center for lumber joists, I-joists, and floor trusses.

c. Cantilevers Lumber floor joist cantilevers supporting loadbearing walls shall not exceed the depth, d, of the joists (see Figure 2.1a). Lumber floor joist cantilevers supporting non-loadbearing walls shall be limited to L/4 (see Figure 2.1b). I-joist cantilevers shall be in accordance with the manufacturer's code evaluation report. Truss cantilevers shall be in accordance with the truss design/placement plans. Lumber joists, I-joists, and trusses shall be located directly over studs when used in cantilever conditions, unless the top plate is designed to carry the load.

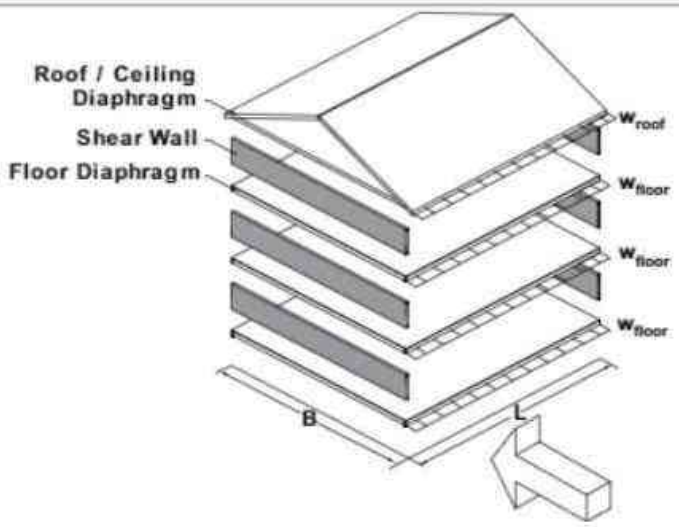
> **EXCEPTION:** Lumber floor joist cantilevers supporting loadbearing walls shall be permitted to exceed these limits when designed for the additional loading requirements, but in no case shall they exceed four times the depth (4d) of the member (see Figure 2.1c).

d. Setbacks Setbacks of loadbearing walls on lumber floor joist systems shall not exceed the depth, d, of the joists (see Figure 2.1d). Setbacks on I-joists shall be in accordance with the manufacturer's code evaluation report. Setbacks on floor trusses shall be in accordance with the truss design/placement plans. Lumber joists, I-joists, and trusses shall be located directly over studs when used in setback conditions supporting loadbearing walls, unless the top plate is designed to carry the load.

> **EXCEPTION:** Lumber floor joist setbacks supporting loadbearing walls shall be permitted

Table 2.5A Lateral Diaphragm Loads from Wind - Perpendicular to Ridge

(For Calculating In-Plane Shear in Roof and Floor Diaphragm)



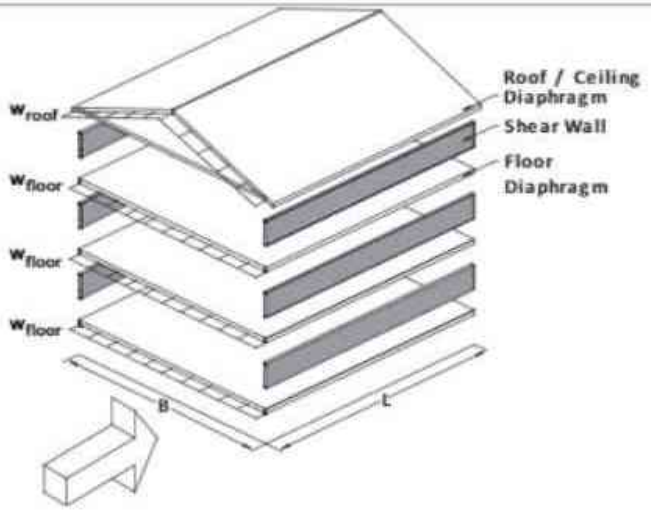
DADU
Perpendicular Ridge

Wind Speed 3-second gust (mph) (See Figure 1.1)		90	95	100	105	110	115	120	130	140	150	160	170	180	195
Roof Pitch	Roof Span (ft)	Unit Lateral Loads for Roof Diaphragm, $w_{roof\perp}$, (plf)[1,3,4,5]													
1.5:12 - 3:12	24	65	65	65	65	65	65	65	76	88	101	115	130	146	172
	36	73	73	73	73	73	73	73	76	88	101	115	130	146	172
	48	80	80	80	80	80	80	80	80	88	101	115	130	146	172
	60	88	88	88	88	88	88	88	88	88	101	115	130	146	172
4:12	24	70	70	70	70	70	70	71	83	97	111	126	142	160	187
	36	80	80	80	80	80	80	80	83	97	111	126	142	160	187
	48	90	90	90	90	90	90	90	90	97	111	126	142	160	187
	60	100	100	100	100	100	100	100	100	100	111	126	142	160	187
5:12	24	75	75	75	75	75	75	75	84	97	112	127	143	161	189
	36	88	88	88	88	88	88	88	88	95	110	125	141	158	185
	48	100	100	100	100	100	100	100	100	100	110	125	141	158	185
	60	113	113	113	113	113	113	113	113	113	113	125	141	158	185
6:12	24	80	80	80	80	83	90	98	115	134	154	175	197	221	260
	13'	95	95	95	95	95	102	112	131	152	174	198	224	251	295
		110	110	110	110	110	116	126	148	172	197	224	253	284	333
	60	125	125	125	125	125	129	141	165	191	220	250	282	316	371
7:12	24	85	85	91	101	110	121	131	154	179	205	234	264	296	347
	36	103	103	112	124	136	149	162	190	220	253	287	325	364	427
	48	120	121	134	148	163	178	194	227	263	302	344	388	435	511
	60	138	141	157	173	189	207	225	265	307	352	401	452	507	595
8:12	24	90	90	98	108	118	129	141	165	191	220	250	282	316	371
	36	110	110	122	134	147	161	175	206	239	274	312	352	395	463
	48	130	133	147	162	178	194	212	248	288	331	376	425	476	559
	60	150	156	172	190	208	228	248	291	338	388	441	498	558	655
9:12	24	95	95	104	115	126	138	150	176	204	234	266	301	337	396
	36	118	118	131	145	159	174	189	222	257	295	336	379	425	499
	48	140	144	160	176	193	211	230	270	313	359	409	461	517	607
	60	163	170	188	207	228	249	271	318	369	423	482	544	609	715
10:12	24	100	100	110	122	134	146	159	187	216	249	283	319	358	420
	36	125	127	141	155	170	186	203	238	276	317	360	407	456	535
	48	150	156	172	190	208	228	248	291	338	388	441	498	558	655
	60	175	184	204	225	247	270	294	345	400	459	522	589	661	775
11:12	24	105	105	117	129	141	155	168	197	229	263	299	338	379	444
	36	133	136	150	166	182	199	216	254	294	338	385	434	487	571
	48	160	167	185	204	224	245	266	313	362	416	473	534	599	703
	60	188	198	220	242	266	291	316	371	431	494	562	635	712	835
12:12	24	110	111	123	136	149	163	177	208	242	277	315	356	399	469
	36	140	144	160	176	193	211	230	270	313	359	409	461	517	607
	48	170	178	198	218	239	261	285	334	387	445	506	571	640	751
	60	200	213	235	260	285	311	339	398	462	530	603	681	763	895
		Unit Lateral Loads for Floor Diaphragm, $w_{floor\perp}$, (plf)[1,2,3,5]													
		110	110	112	123	135	148	161	189	219	251	286	323	362	425

* See Footnotes 1 -5.

Table 2.5B Lateral Diaphragm Loads from Wind - Parallel to Ridge

(For Calculating In-Plane Shear in Roof and Floor Diaphragm)



DADU
Parallel Ridge

Wind Speed 3-second gust (mph) (See Figure 1.1)		90	95	100	105	110	115	120	130	140	150	160	170	180	195
Roof Pitch	Roof Span (ft)	Unit Lateral Loads for Roof Diaphragm, w_{roof}, (plf)[1,3,4,5]													
1.5:12 - 3:12	24	65	65	65	65	65	65	65	76	88	101	115	130	145	170
	36	73	73	73	73	73	73	73	84	97	111	126	143	160	188
	48	80	80	80	80	80	80	80	92	107	123	140	158	177	207
	60	88	88	88	88	88	88	88	101	117	134	153	172	193	227
4:12	24	70	70	70	70	70	70	70	82	95	109	124	140	156	184
	36	80	80	80	80	80	80	80	92	107	123	140	158	177	207
	48	90	90	90	90	90	90	90	104	120	138	157	177	199	233
	60	100	100	100	100	100	100	100	115	134	153	174	197	221	259
5:12	24	75	75	75	75	75	75	75	87	101	116	132	150	168	197
	36	88	88	88	88	88	88	88	101	117	134	153	172	193	227
	48	100	100	100	100	100	100	100	115	134	153	174	197	221	259
	60	113	113	113	113	113	113	113	130	150	173	196	222	248	292
6:12	24	80	80	80	80	80	80	80	93	108	124	141	159	179	210
	36	95	95	95	95	95	95	95	109	127	146	166	187	210	246
	48	110	110	110	110	110	110	110	127	147	169	192	217	243	285
	43.5'	125	125	105plf	125	125	125	125	144	167	192	218	246	276	324
7:12	24	85	85	85	85	85	85	85	99	115	132	150	169	190	223
	36	103	103	103	103	103	103	103	118	137	157	179	202	226	266
	48	120	120	120	120	120	120	120	138	160	184	209	236	265	311
	60	138	138	138	138	138	138	138	158	184	211	240	271	304	356
8:12	24	90	90	90	90	90	90	90	105	122	140	159	179	201	236
	36	110	110	110	110	110	110	110	127	147	169	192	217	243	285
	48	130	130	130	130	130	130	130	150	174	199	227	256	287	337
	60	150	150	150	150	150	150	150	173	200	230	262	295	331	389
9:12	24	95	95	95	95	95	95	95	111	128	147	168	189	212	249
	36	118	118	118	118	118	118	118	135	157	180	205	231	259	305
	48	140	140	140	140	140	140	140	161	187	215	244	276	309	363
	60	163	163	163	163	163	163	163	187	217	249	284	320	359	421
10:12	24	100	100	100	100	100	100	100	117	135	155	177	199	223	262
	36	125	125	125	125	125	125	125	144	167	192	218	246	276	324
	48	150	150	150	150	150	150	150	173	200	230	262	295	331	389
	60	175	175	175	175	175	175	175	202	234	268	305	345	386	454
11:12	24	105	105	105	105	105	105	105	122	142	163	185	209	235	275
	36	133	133	133	133	133	133	133	153	177	203	231	261	293	343
	48	160	160	160	160	160	160	160	184	214	245	279	315	353	415
	60	188	188	188	188	188	188	188	216	250	288	327	369	414	486
12:12	24	110	110	110	110	110	110	110	128	149	171	194	219	246	289
	36	140	140	140	140	140	140	140	161	187	215	244	276	309	363
	48	170	170	170	170	170	170	170	196	227	261	297	335	375	441
	60	200	200	200	200	200	200	200	230	267	307	349	394	442	518
		Unit Lateral Loads for Floor Diaphragm, w_{floor}, (plf)[1,2,3,5]													
		110	110	110	110	110	110	110	128	149	171	194	219	246	289

* See Footnotes 1 -5.

Footnotes to Tables 2.5A and 2.5B

1 The total shear load equals the tabulated unit lateral load multiplied by the building length perpendicular to the wind direction.

2 Tabulated unit lateral loads are based on 10 foot wall heights and a 1 foot floor depth. For other wall heights, H, tabulated values for floor diaphragms shall be permitted to be used when multiplied by (H+1)/11.

3 Tabulated unit lateral loads assume a building located in Exposure B with a mean roof height of 33 feet. For buildings located in other exposures, the tabulated values shall be multiplied by the appropriate adjustment factor in Section 2.1.3.1.

4 Hip roof systems shall be designed using Table 2.5A for both orthogonal directions.

5 Shear capacity requirements for roof diaphragms, shear walls, and floor diaphragms shall be calculated as follows:

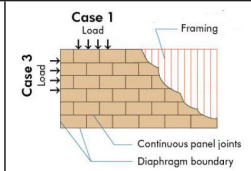
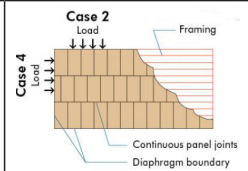
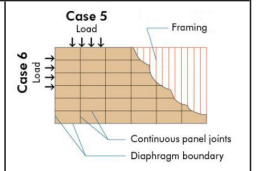
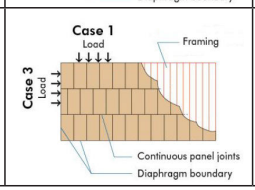
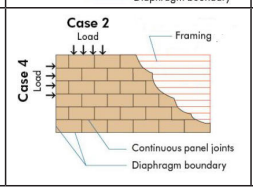
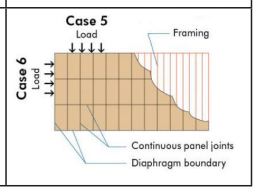
<table>
<tr><th colspan="2">Calculating Total Shear Capacity Requirements V_{roof}, V_{floor} (lbs)</th><th colspan="2">Calculating Diaphragm Unit Shear Capacity Requirements v_{roof}, v_{floor} (plf)</th><th colspan="2">Calculating Total Shear Wall Shear Capacity Requirements V_{wall} (plf)</th></tr>
<tr><th>Wind Perpendicular to Ridge (“w” from Table 2.5A)</th><th>Wind Parallel to Ridge (“w” from Table 2.5B)</th><th>Wind Perpendicular to Ridge</th><th>Wind Parallel to Ridge</th><th>Wind Perpendicular to Ridge</th><th>Wind Parallel to Ridge</th></tr>
<tr><td rowspan="6">$V_{roof\perp} = w_{roof\perp}(L)$
$V_{floor\,(i)\perp} = w_{floor(i)\perp}(L)$</td><td rowspan="6">$V_{roof\parallel} = w_{roof\parallel}(B)$
$V_{floor\,(i)\parallel} = w_{floor(i)\parallel}(B)$</td><td rowspan="6">$v_{roof\perp} = \frac{V_{roof\perp}}{2(B)}$
$v_{floor(i)\perp} = \frac{V_{floor(i)\perp}}{2(B)}$</td><td rowspan="6">$v_{roof\parallel} = \frac{V_{roof\parallel}}{2(L)}$
$v_{floor(i)\parallel} = \frac{V_{floor(i)\parallel}}{2(L)}$</td><td colspan="2">Shear Wall Bracing Roof & Ceiling</td></tr>
<tr><td>$V_{wall\perp} = V_{roof\perp}$</td><td>$V_{wall\parallel} = V_{roof\parallel}$</td></tr>
<tr><td colspan="2">Shear Wall Bracing Roof/Ceiling & 1 Floor</td></tr>
<tr><td>$V_{wall\perp} = V_{roof\perp} + V_{floor(1)\perp}$</td><td>$V_{wall\parallel} = V_{roof\parallel} + V_{floor(1)\parallel}$</td></tr>
<tr><td colspan="2">Shear Wall Bracing Roof/Ceiling & 2 Floors</td></tr>
<tr><td>$V_{wall\perp} = V_{roof\perp} + V_{floor(1)\perp} + V_{floor(2)\perp}$</td><td>$V_{wall\parallel} = V_{roof\parallel} + V_{floor(1)\parallel} + V_{floor(2)\parallel}$</td></tr>
</table>

Table 4.2C Nominal Unit Shear Capacities for Wood-Frame Diaphragms

Unblocked Wood Structural Panel Diaphragms[1,2,3,4,5]

Sheathing Grade	Common Nail Size	Minimum Fastener Penetration in Framing (in.)	Minimum Nominal Panel Thickness (in.)	Minimum Nominal Width of Nailed Face at Supported Edges and Boundaries (in.)	A SEISMIC 6 in. Nail Spacing at diaphragm boundaries and supported panel edges						B WIND 6 in. Nail Spacing at diaphragm boundaries and supported panel edges	
					Case 1			Cases 2,3,4,5,6			Case 1	Cases 2,3,4,5,6
					v_s (plf)	G_a (kips/in.)		v_s (plf)	G_a (kips/in.)		v_w (plf)	v_w (plf)
						OSB	PLY		OSB	PLY		
Structural I	6d	1-1/4	5/16	2	330	9.0	7.0	250	6.0	4.5	460	350
				3	370	7.0	6.0	280	4.5	4.0	520	390
	8d	1-3/8	3/8	2	480	8.5	7.0	360	6.0	4.5	670	505
				3	530	7.5	6.0	400	5.0	4.0	740	560
	10d	1-1/2	15/32	2	570	14	10	430	9.5	7.0	800	600
				3	640	12	9.0	480	8.0	6.0	895	670
Sheathing and Single-Floor	6d	1-1/4	5/16	2	300	9.0	6.5	220	6.0	4.0	420	310
				3	340	7.0	5.5	250	5.0	3.5	475	350
			3/8	2	330	7.5	5.5	250	5.0	4.0	460	350
				3	370	6.0	4.5	280	4.0	3.0	520	390
	8d	1-3/8	3/8	2	430	9.0	6.5	320	6.0	4.5	600	450
				3	480	7.5	5.5	360	5.0	3.5	670	505
			7/16	2	460	8.5	6.0	340	5.5	4.0	645	475
				3	510	7.0	5.5	380	4.5	3.5	715	530
			15/32	2	480	7.5	5.5	360	5.0	4.0	670	505
				3	530	6.5	5.0	400	4.0	3.5	740	560
	10d	1-1/2	15/32	2	510	15	9.0	380	10	6.0	715	530
				3	580	12	8.0	430	8.0	5.5	810	600
			19/32	2	570	13	8.5	430	8.5	5.5	800	600
				3	640	10	7.5	480	7.0	5.0	895	670

1. Nominal unit shear capacities shall be adjusted in accordance with 4.2.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.2.6. For specific requirements, see 4.2.7.1 for wood structural panel diaphragms. See Appendix A for common nail dimensions.
2. For species and grades of framing other than Douglas-Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = [1-(0.5-G)], where G = Specific Gravity of the framing lumber from the *NDS* (Table 12.3.3A). The Specific Gravity Adjustment Factor shall not be greater than 1.
3. Apparent shear stiffness values, G_a, are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for diaphragms constructed with either OSB or 3-ply plywood panels. When 4-ply or 5-ply plywood panels or composite panels are used, G_a values shall be permitted to be multiplied by 1.2.
4. Where moisture content of the framing is greater than 19% at time of fabrication, G_a values shall be multiplied by 0.5.
5. Diaphragm resistance depends on the direction of continuous panel joints with respect to the loading direction and direction of framing members, and is independent of the panel orientation.

	Cases 1&3:Continuous Panel Joints Perpendicular to Framing	**Cases 2&4**: Continuous Panel Joints Parallel to Framing	**Cases 5&6**: Continuous Panel Joints Perpendicular and Parallel to Framing
Long Panel Direction Perpendicular to Supports			
Long Panel Direction Parallel to Supports[a]			

(a) Panel span rating for out-of-plane loads may be lower than the span rating with the long panel direction perpendicular to supports (See Section 3.2.2 and Section 3.2.3)

Roof Diaphragm Calculations:

Roof load perp. to ridge = 80 plf

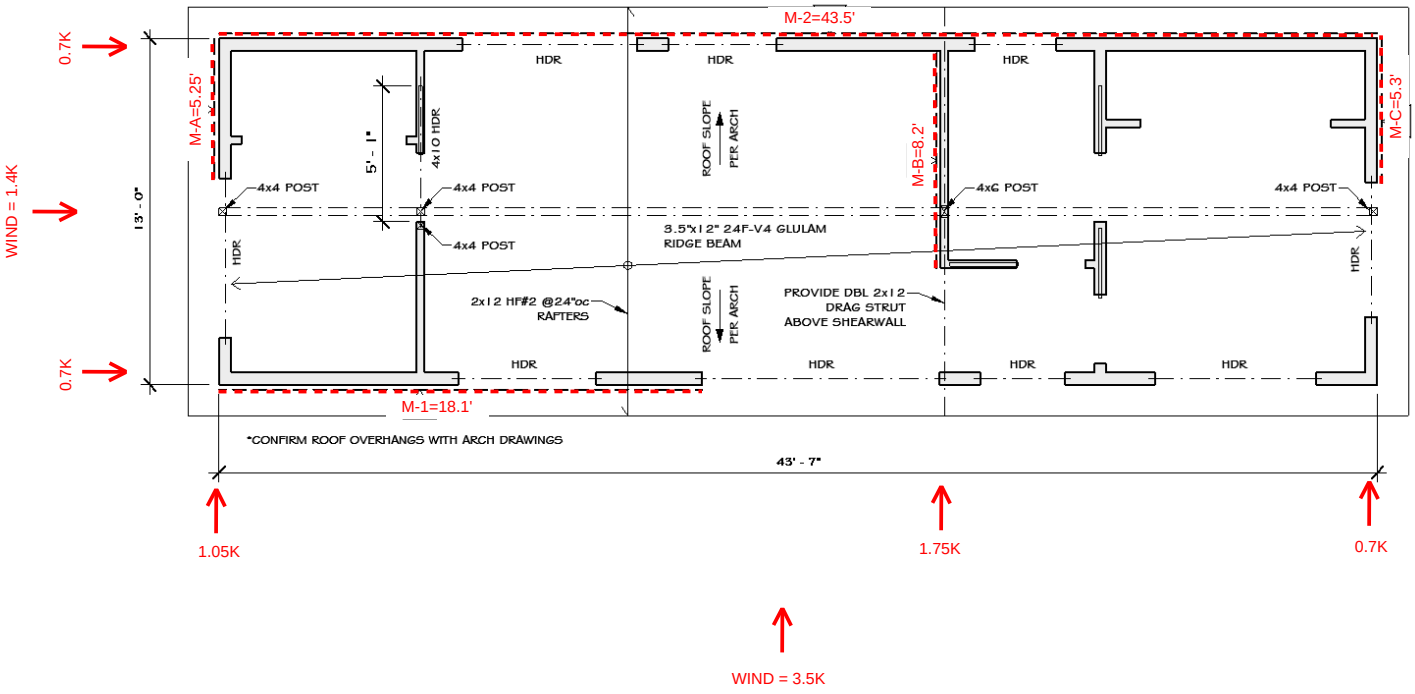
Max. diaphragm shear:
V = (w*L) / (2*B) = 80 * 43.5 / 2 * 13 = 133 plf

Diaphragm nailing capacity:
HF#2 SG=0.43
SGAF = 1 - (0.5-SG) = 1 - (0.5-0.43) = 0.93

Adjusted maximum shear force = 133plf * 0.93 = 123 plf < 237plf = 475plf/2 ... OK

Max chord force in tension and compression:
T n-s = C n-s = $(w*L^2) / (8*B)$ = 80 * 43.5^2 / 8 * 13 = 1455#
(8)16d Dbl Top Chord splice OK by inspection

LATERAL LOAD SCHEME



ESG DESIGN, PLLC	JOB	Coves DADU	
Consulting Engineers	DATE	May 28, 24	ESG
12540 202nd Place SE	SUBJECT	Shear Wall Analysis Summary	
Issaquah Washington 98027			
	SHEET NO.	1	

This sheet performs calculations for Perforated Shearwalls per IBC 2015 - ASD

Shear Wall Data Input ***Results*** ***Callouts***

Shear Line	V (lbs)	L_{WALL} (ft)	$L_{FULL-HT}$ (ft)	H_{WALL} (ft)	H_{OPEN} (ft)	DL (plf)	C_o	v (plf)	R (lbs)	R_total (lbs)	2bs/h* Adjustment (Perforated) (auto)	Flag	ARF* Adjustment (Segmented) (manual)	SW TYPE	HD	Notes
MAIN LEVEL																
North / South (on plan)																
M-A	1050	5.25	5.25	9.50	0.00	90	1.00	200	1758	-	1.00	-	1.00	A	HD1	-
M-B	1750	8.20	8.20	11.00	0.00	90	1.00	213	2126	-	1.00	-	1.00	A	HD2	-
M-C	700	5.30	5.30	9.50	0.00	90	1.00	132	1112	-	1.00	-	1.00	A	HD1	-
East / West (on plan)																
M-1	700	18.10	12.90	9.00	8.00	130	0.63	86	-246	-	1.00	-	1.00	A	-	-
M-2	700	43.50	28.70	9.00	4.50	130	0.83	29	-1174	-	1.00	-	1.00	A	-	-

HOLDOWN SHEDULE

Tag	*Item*	*Capacity*	*Post*	*AB*
HD1	STHD10	2750#	(2)2x	-
HD2	HDU2	2215#	(2)2x	5/8"

SHEAR WALL SCHEDULE

Tag	*Sheathing*	*Nail Size a AB*	Capacity (Wind)
A	7/16" One Side	8d @ 6"o.c.	332#

*2bs/h is applied to the v results in this spreadsheet while the Aspect Ratio Factor (ARF) is accounted for manually by reducing the capacity of the choosen SW