QUANTUM
CONSULTING ENGINEERS

July 11, 2023

STRUCTURAL CALCULATIONS
(Permit Submittal)

ADAMS RESIDENCE
8035 SE 45th Street
Mercer Island, WA 98040

Quantum Job Number: 22229.01

Prepared for:
MCFADDEN DESIGN
1914 Fifth Street
Kirkland, WA 98003

Prepared by:
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DESIGN CRITERIA

Structural Design Criteria

Building Code: 2018 International Building Code
Building Department: City of Mercer Island

Seismic Criteria

S_s:	1.43	I_e:	1.00	
S_1:	0.50	Seismic Soil Site Class:	D	
S_{ds}:	1.15	Seismic Design Category:	D	
S_{d1}:	0.60	C_s:	0.18	
R:	6.50	Light-Framed Wood Walls Sheathed With Wood Structural Panels		

Wind Criteria

Wind Speed:	97 MPH
Risk Category:	II
Wind Exposure:	B
K_{zt}:	1.0

Geotechnical Criteria

Allowable Bearing Pressure	1500 psf
Minimum Footing Width	Continuous: 18" min., Isolated: 24" min.
Frost Depth	18" min.
Active Soil Pressure (Restrained/Unrestrained)	50 pcf / 35 pcf
Seismic Surcharge Pressure (Restrained/Unrestrained)	8H psf / 5H psf
Passive Soil Pressure	350 pcf
Coefficient of Friction	0.35

Materials Criteria

Concrete (28 Day Strength):

Foundation/Slab on Grade	F'c= 2,500 PSI
Basement Walls	F'c= 3,000 PSI

Reinforcing Steel:

Grade 60 (#5 bar and larger)	Fy= 60,000 PSI
Grade 40 (#4 bar)	Fy= 40,000 PSI

Structural Steel:

Wide-Flange Sections: A-992	Fy= 50,000 PSI
Miscellaneous Sections: A-36	Fy= 36,000 PSI
Tube Sections: A-500	Fy= 46,000 PSI
Pipe Sections: A-53	Fy= 35,000 PSI
Welding	Fy= 70,000 PSI

Wood Framing:

2x, 3x & 4x Framing Members	HF#2 or DF#2
6x Framing Members	DF#1
Glulam Beams	24F-V4 (V8 @ Cont. and Cant. Members)
Parallam Beams	2.0 E PSL
LSL Members - Beams & Headers	1.55 E LSL
LSL Members - Studs & Columns	1.3 E LSL
LVL Members - Beams & Headers	1.9 E LVL
Wood Sheathing	APA RATED

Residential Building Loads

Snow Load	Roof		25 psf
Live Load	Residential		40 psf
	Residential exterior decks / balconies		60 psf

Assembly Loads

Roof Loads		Comments
Standard Roofing	4.0 psf	
1/2" Ply. Sheathing	1.5 psf	
Trusses @ 24" o.c.	5.0 psf	
R38 Insulation	1.0 psf	
5/8" GWB	2.8 psf	
Lights, ducts	0.5 psf	
PV Allowance	5.0 psf	
Miscellaneous	0.2 psf	
Total:	**20.0 psf**	SL=25 PSF

Roof Deck Loads		Comments
2" Conc. Pavers	25.0 psf	
Membrane Roofing	2.2 psf	
3/4" Ply. Sheathing	2.3 psf	
Roof Joists @ 16" o.c.	1.8 psf	
R38 Insulation	1.0 psf	
5/8" GWB	2.8 psf	
Lights, ducts	0.5 psf	
Miscellaneous	2.4 psf	
Total:	**38.0 psf**	LL=60 PSF

Roof Deck with Hot Tub		Comments
Hot Tub	100.0 psf	
Membrane Roofing	2.2 psf	
3/4" Ply. Sheathing	2.3 psf	
Roof Joists @ 16" o.c.	3.6 psf	
R38 Insulation	1.0 psf	
5/8" GWB	2.8 psf	
Lights, ducts	0.5 psf	
Miscellaneous	2.6 psf	
Total:	**115.0 psf**	LL=60 PSF

Interior Wall Framing	
5/8" GWB	2.8 psf
2x4 @ 16" o.c.	0.9 psf
5/8" GWB	2.8 psf
Mech./Elec.	0.5 psf
Misc.	1.0 psf
Total:	**8.0 psf**

Exterior Wood Stud Wall	
Siding	2.3 psf
1/2" Plywood	1.5 psf
2x6 studs @ 16 " o.c.	1.7 psf
Insulation	0.5 psf
1/2" GWB	2.2 psf
Mech./Elec.	0.5 psf
Misc.	1.3 psf
Total:	**10.0 psf**

Deflection Criteria

Roof		Walls			Floor	
Live Load:	**L/240**		**L/120**	*flexible finishes	Live Load:	**L/360**
Total Load:	**L/180**		**L/240**	*brittle finish	Total Load:	**L/240**
			L/240	*supporting glass		

ATC Hazards by Location

Search Information

Address:	8035 SE 45th St, Mercer Island, WA 98040, USA
Coordinates:	47.5648511, -122.2294413
Elevation:	195 ft
Timestamp:	2022-12-21T21:44:42.529Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

Basic Parameters

Name	Value	Description
S_S	1.434	MCE_R ground motion (period=0.2s)
S_1	0.498	MCE_R ground motion (period=1.0s)
S_{MS}	1.721	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.147	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	0.897	Coefficient of risk (1.0s)
PGA	0.614	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.737	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	1.434	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.589	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	3.843	Factored deterministic acceleration value (0.2s)
S1RT	0.498	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.555	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.516	Factored deterministic acceleration value (1.0s)
PGAd	1.3	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.

ATC Hazards by Location

Search Information

Address:	8035 SE 45th St, Mercer Island, WA 98040, USA
Coordinates:	47.5648511, -122.2294413
Elevation:	195 ft
Timestamp:	2022-12-21T21:44:10.408Z
Hazard Type:	Wind

ASCE 7-16

MRI 10-Year	67 mph
MRI 25-Year	73 mph
MRI 50-Year	78 mph
MRI 100-Year	83 mph
Risk Category I	92 mph
Risk Category II	97 mph
Risk Category III	104 mph
Risk Category IV	108 mph

ASCE 7-10

MRI 10-Year	72 mph
MRI 25-Year	79 mph
MRI 50-Year	85 mph
MRI 100-Year	91 mph
Risk Category I	100 mph
Risk Category II	110 mph
Risk Category III-IV	115 mph

ASCE 7-05

ASCE 7-05 Wind Speed	85 mph

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. <u>Find out why.</u>

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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ADAMS RESIDENCE
8035 SE 45th Street
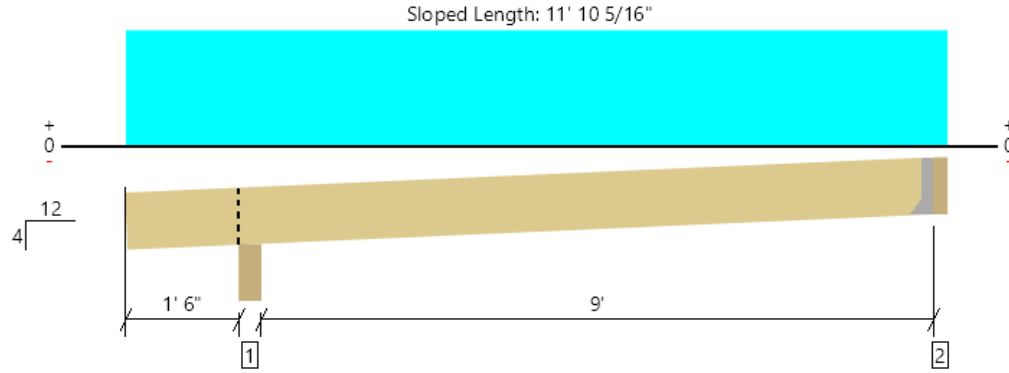Mercer Island, WA 98040

Quantum Job Number: 22229.01

GRAVITY DESIGN

MAIN FLOOR FRAMING KEY PLAN

4" CONC. SLAB-ON-GRADE, SEE NOTE 3

(E) CONC. SLAB-ON-GRADE

4" CONC. SLAB-ON-GRADE, SEE NOTES 3 & 4

HOT TUB PER ARCH. (100 PSF MAX.)

4/S3.1 TYP.

(F2.0) TYP.

P1
P2
P3

B1
B2
B3
J1
J2
J3

W8x24 (FLUSH)
2x10 @ 16" O.C.
2x8 @ 16" O.C.
(2) 2x8 @ 16" O.C.
4x10 (FLUSH)
3⅛x9 GL
6x6
6x6 DF#1

SW-6
SW-4

37'-9"   15'-4¾"   34'-2¼"
32'-3"
8'-1¼"
10'-11"
24'-10½"
8'-6¼"
16'-0"   3'-6½" 2'-5½"   16'-0"   2'-5½" 3'-6½"   14'-0"   4'-0"
29'-4½"   20'-11"   21'-6½"   4'-4"   19'-10¾"

E1 E2 E3 E4
A B C D E F
M1 M2 M3 M4 M5 M6

ROOF FRAMING KEY PLAN

Roof

Member Name	Results	Current Solution	Comments
RJ1 - Kitchen Roof Joist, 9'-0"	Passed	1 piece(s) 2 x 12 HF No.2 @ 24" OC	
RB1 - Kitchen N-S Ridge Beam, 17'-0"	Passed	1 piece(s) 5 1/8" x 12" 24F-V4 DF Glulam	
RB2 - Kitchen Window Header, 20'-3"	Passed	1 piece(s) 5 1/8" x 16 1/2" 24F-V4 DF Glulam	
RB3 - Family Slider Header, 12'-0"	Passed	1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam	
RB4a - Family Window Header, 8'-3"	Passed	1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam	
RB4b - Family Window Header, 5'-6"	Passed	1 piece(s) 4 x 10 HF No.2	
RB5 - Living Slider Header, Two Span	Passed	1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam	
RB6 - Garage Door Header, 9'-0"	Passed	1 piece(s) 4 x 10 HF No.2	
RB7 - Bedroom Window Header, 5'-4"	Passed	2 piece(s) 2 x 10 HF No.2	
RB8 - Entry Door Header, 8'-6"	Passed	1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam	
RB9 - Master Window Header, 7'-0"	Passed	1 piece(s) 4 x 10 HF No.2	
RB10 - Master Slider Header, 12'-0"	Passed	1 piece(s) 4 x 10 HF No.2	
RB11 - Kitchen Valley Beam, 16'-6"	Passed	1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam	
RB12 - Kitchen E-W Ridge Beam, 20'-0"	Passed	1 piece(s) 5 1/8" x 24" 24F-V4 DF Glulam	
RB13 - Kitchen N-S Drop Beam, 16'-3"	Passed	1 piece(s) 5 1/8" x 16 1/2" 24F-V4 DF Glulam	

Main Floor

Member Name	Results	Current Solution	Comments
J1 - Bedroom Joist, 11'-0"	Passed	1 piece(s) 2 x 10 HF No.2 @ 16" OC	
J2 - Roof Deck Joist, 7'-6"	Passed	1 piece(s) 2 x 8 HF No.2 @ 16" OC	
J3 - Roof Deck Joist at Hot Tub, 7'-6"	Passed	2 piece(s) 2 x 8 HF No.2 @ 16" OC	
B1 - Steel Beam at Deck, 18'-10"	Passed	1 piece(s) W8X24 (A992) ASTM Steel	
B2 - Steel Beam at Floor, 18'-10"	Passed	1 piece(s) W8X24 (A992) ASTM Steel	
B3 - Header at Basement Door, 9'-3"	Passed	1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam	
P1 - Kitchen Drop Beam Post	Passed	1 piece(s) 6 x 6 DF No.1	
P2 - Kitchen Window Post	Passed	3 piece(s) 2 x 6 HF No.2	
P3 - Living Slider Post	Passed	3 piece(s) 2 x 6 HF No.2	

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Weyerhaeuser

6/4/2023 6:03:20 PM UTC

ForteWEB v3.5

File Name: 22229.01 Adams Residence

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Roof, RJ1 - Kitchen Roof Joist, 9'-0"
1 piece(s) 2 x 12 HF No.2 @ 24" OC

Sloped Length: 11' 10 5/16"

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

Member Length : 11' 10 3/8"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 4/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	441 @ 10' 11 1/2"	911 (1.50")	Passed (48%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	358 @ 2' 10 3/16"	1941	Passed (18%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	993 @ 6' 5 1/2"	2964	Passed (33%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.045 @ 6' 4 1/2"	0.486	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.072 @ 6' 4 5/8"	0.649	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/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 - HF	5.50"	5.50"	1.50"	247	390	637	Blocking
2 - Hanger on 11 1/4" GLB beam	3.50"	Hanger¹	1.50"	179	290	469	See note ¹

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 7" o/c	
Bottom Edge (Lu)	11' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	LRU28Z	1.94"	N/A	6-10dx1.5	5-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 11' 3"	24"	18.0	30.0	Roof

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Roof, RB1 - Kitchen N-S Ridge Beam, 17'-0"
1 piece(s) 5 1/8" x 12" 24F-V4 DF Glulam
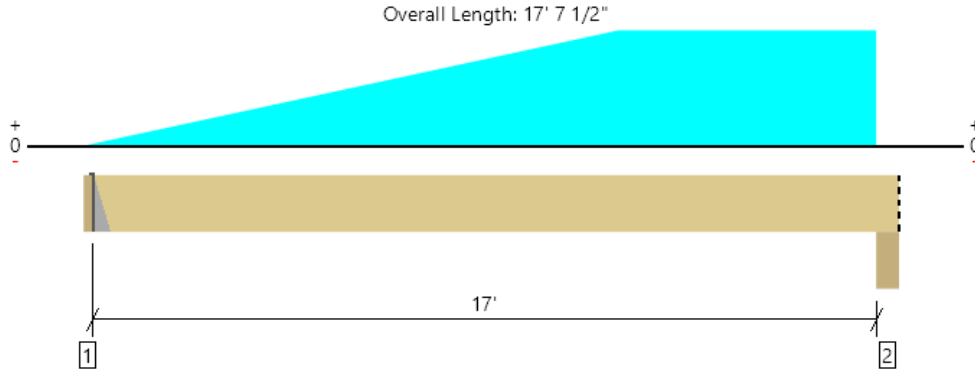
All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2580 @ 2"	4997 (1.50")	Passed (52%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3727 @ 16' 2"	12495	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	16224 @ 9' 9 11/16"	28290	Passed (57%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.375 @ 9'	0.856	Passed (L/547)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.629 @ 8' 11 7/8"	1.142	Passed (L/327)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 1.00 that was calculated using length L = 17' 1 1/2".
- 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 - Hanger on 12" GLB beam	2.00"	Hanger¹	1.50"	1065	1515	2580	See note ¹
2 - Column - DF	5.50"	5.50"	1.50"	1728	2579	4307	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 6" o/c	
Bottom Edge (Lu)	17' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	2" to 17' 7 1/2"	N/A	14.9	--	
1 - Uniform (PSF)	11' 6" to 17' 1 1/2" (Top)	12'	18.6	30.0	Roof
2 - Tapered (PSF)	0 to 11' 6" (Top)	0 to 12'	18.6	30.0	Roof

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Roof, RB2 - Kitchen Window Header, 20'-3"
1 piece(s) 5 1/8" x 16 1/2" 24F-V4 DF Glulam
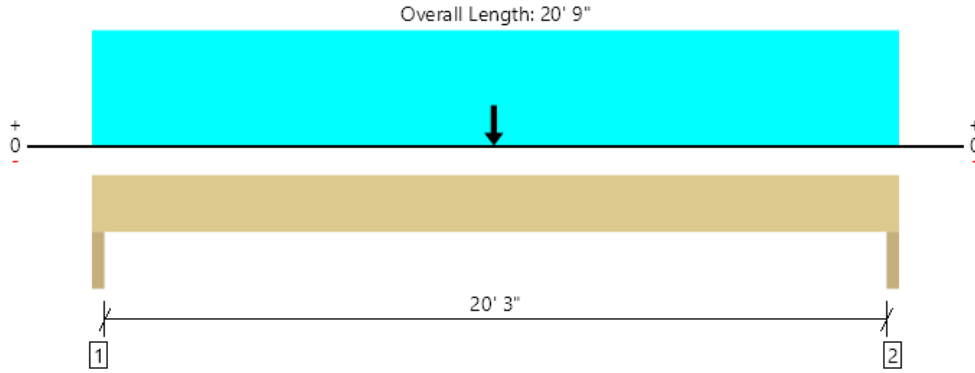
Overall Length: 20' 9"

20' 3"

1   2

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)	3383 @ 1 1/2"	9994 (3.00")	Passed (34%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3192 @ 1' 7 1/2"	17180	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	28254 @ 10' 4"	51934	Passed (54%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.301 @ 10' 4 3/8"	1.025	Passed (L/818)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.522 @ 10' 4 3/8"	1.367	Passed (L/471)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 0.97 that was calculated using length L = 20' 6".
- 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 - Trimmer - HF	3.00"	3.00"	1.50"	1466	1917	3383	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	1459	1907	3365	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	20' 9" o/c	
Bottom Edge (Lu)	20' 9" 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' 9"	N/A	20.5	--	
1 - Uniform (PSF)	0 to 20' 9" (Front)	2'	18.6	30.0	Roof
2 - Point (lb)	10' 4" (Top)	N/A	1728	2579	Linked from: RB1 - Kitchen Ridge Beam, 17'-0", Support 2

Weyerhaeuser Notes

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Roof, RB3 - Family Slider Header, 12'-0"
1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam

Overall Length: 12' 6"

12'

1   2

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)	4502 @ 1 1/2"	6094 (3.00")	Passed (74%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3601 @ 1' 3"	7619	Passed (47%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	13510 @ 6' 3"	17250	Passed (78%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.253 @ 6' 3"	0.613	Passed (L/580)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.451 @ 6' 3"	0.817	Passed (L/326)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 1.00 that was calculated using length L = 12' 3".
- 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 - Trimmer - HF	3.00"	3.00"	2.22"	1970	2531	4502	None
2 - Trimmer - HF	3.00"	3.00"	2.22"	1970	2531	4502	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 6" o/c	
Bottom Edge (Lu)	12' 6" 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 12' 6"	N/A	9.1	--	
1 - Uniform (PSF)	0 to 12' 6" (Top)	13' 6"	22.7	30.0	Roof

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Weyerhaeuser

Roof, RB4a - Family Window Header, 8'-3"
1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam
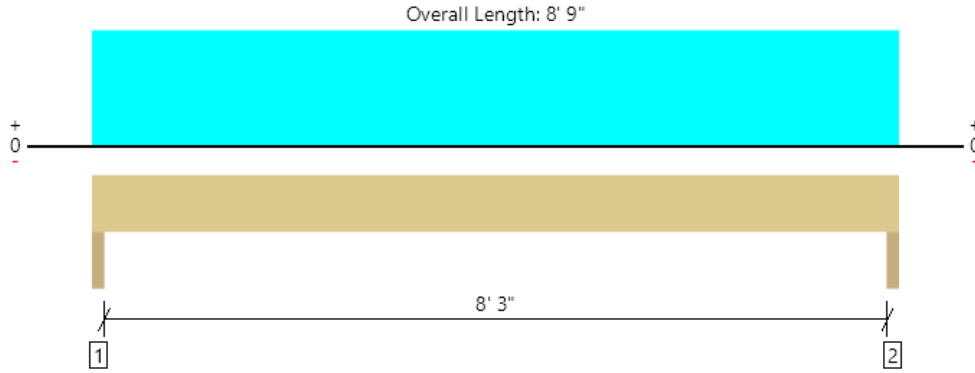
Overall Length: 8' 9"

8' 3"

1   2

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)	3141 @ 1 1/2"	6094 (3.00")	Passed (52%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2423 @ 1'	5714	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	6484 @ 4' 4 1/2"	9703	Passed (67%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.139 @ 4' 4 1/2"	0.425	Passed (L/733)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.247 @ 4' 4 1/2"	0.567	Passed (L/413)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 1.00 that was calculated using length L = 8' 6".
- 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 - Trimmer - HF	3.00"	3.00"	1.55"	1369	1772	3141	None
2 - Trimmer - HF	3.00"	3.00"	1.55"	1369	1772	3141	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 9" o/c	
Bottom Edge (Lu)	8' 9" 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 8' 9"	N/A	6.8	--	
1 - Uniform (PSF)	0 to 8' 9" (Top)	13' 6"	22.7	30.0	Roof

ForteWEB Software Operator	Job Notes
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Roof, RB4b - Family Window Header, 5'-6"
1 piece(s) 4 x 10 HF No.2
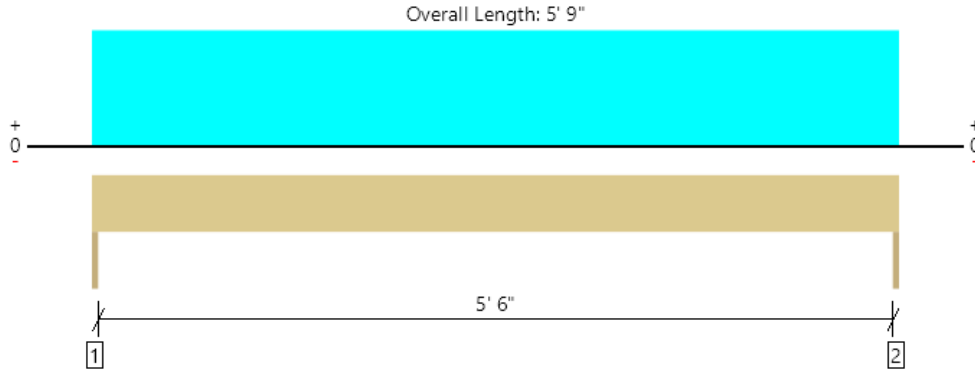
Overall Length: 5' 9"

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)	2068 @ 0	2126 (1.50")	Passed (97%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1424 @ 10 3/4"	3723	Passed (38%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2973 @ 2' 10 1/2"	4879	Passed (61%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.033 @ 2' 10 1/2"	0.287	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.059 @ 2' 10 1/2"	0.383	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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.
• 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"	904	1164	2068	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	904	1164	2068	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 9" o/c	
Bottom Edge (Lu)	5' 9" 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 5' 9"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 5' 9" (Top)	13' 6"	22.7	30.0	Roof

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Maxwell Skotheim
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Weyerhaeuser

Roof, RB5 - Living Slider Header, Two Span
1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam
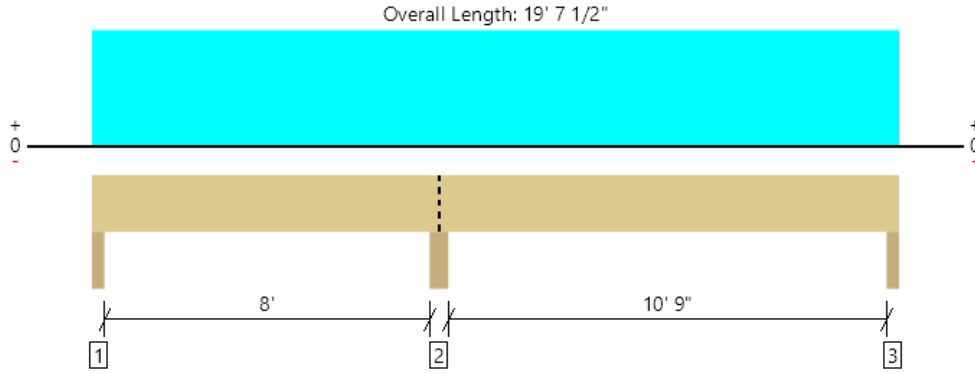
Overall Length: 19' 7 1/2"

| 8' | 10' 9" |
| 1 | 2 | 3 |

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)	8541 @ 8' 5 1/4"	9141 (4.50")	Passed (93%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3795 @ 9' 7 1/2"	7619	Passed (50%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	7029 @ 15'	17250	Passed (41%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-8632 @ 8' 5 1/4"	13297	Passed (65%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.096 @ 14' 5 3/16"	0.553	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.162 @ 14' 5 7/8"	0.738	Passed (L/821)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 1.00 that was calculated using length L = 9'.
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 2 7/8".
- 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 - Trimmer - HF	3.00"	3.00"	1.50"	846	1291	2137	None
2 - Column - HF	4.50"	4.50"	4.20"	3741	4800	8541	Blocking
3 - Trimmer - HF	3.00"	3.00"	1.58"	1377	1833	3210	None

- 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)	19' 8" o/c	
Bottom Edge (Lu)	19' 8" 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 19' 7 1/2"	N/A	9.1	--	
1 - Uniform (PSF)	0 to 19' 7 1/2" (Top)	13'	22.7	30.0	Roof

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
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Weyerhaeuser

Roof, RB6 - Garage Door Header, 9'-0"
1 piece(s) 4 x 10 HF No.2
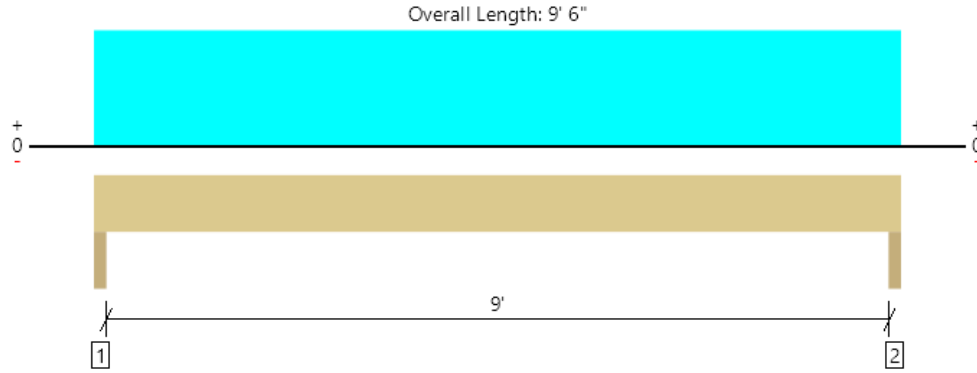
Overall Length: 9' 6"

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)	790 @ 1 1/2"	4253 (3.00")	Passed (19%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	620 @ 1' 1/4"	3723	Passed (17%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1778 @ 4' 9"	4879	Passed (36%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.049 @ 4' 9"	0.463	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.091 @ 4' 9"	0.617	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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.
- 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"	362	428	790	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	362	428	790	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 6" o/c	
Bottom Edge (Lu)	9' 6" 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 9' 6"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 9' 6" (Top)	3'	22.7	30.0	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
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

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Roof, RB7 - Bedroom Window Header, 5'-4"
2 piece(s) 2 x 10 HF No.2
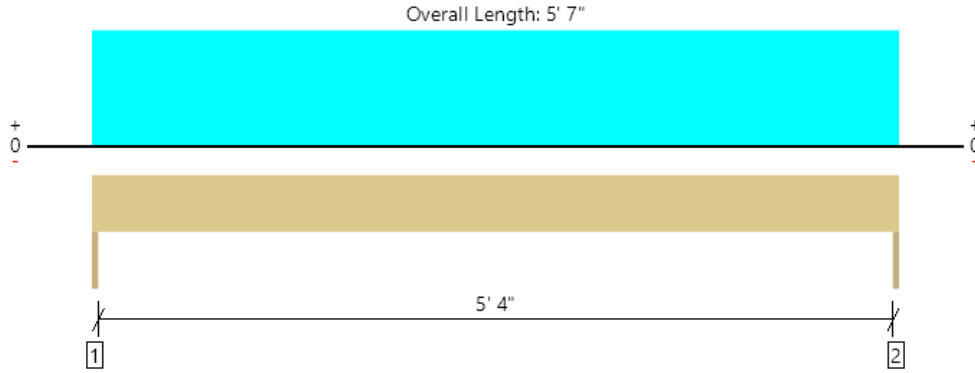
Overall Length: 5' 7"

5' 4"

① ②

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)	1490 @ 0	1823 (1.50")	Passed (82%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1012 @ 10 3/4"	3191	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2080 @ 2' 9 1/2"	3833	Passed (54%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.026 @ 2' 9 1/2"	0.279	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.045 @ 2' 9 1/2"	0.372	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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.
- 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"	653	838	1490	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	653	838	1490	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 (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 7"	N/A	7.0	--	
1 - Uniform (PSF)	0 to 5' 7" (Top)	10'	22.7	30.0	Roof

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
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Weyerhaeuser

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Roof, RB8 - Entry Door Header, 8'-6"
1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam

Overall Length: 9'

8' 6"

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)	2757 @ 1 1/2"	6094 (3.00")	Passed (45%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2144 @ 1'	5714	Passed (38%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	5863 @ 4' 6"	9703	Passed (60%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.133 @ 4' 6"	0.438	Passed (L/789)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.236 @ 4' 6"	0.583	Passed (L/444)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 1.00 that was calculated using length L = 8' 9".
- 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 - Trimmer - HF	3.00"	3.00"	1.50"	1204	1553	2757	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	1204	1553	2757	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' o/c	
Bottom Edge (Lu)	9' 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 9'	N/A	6.8	--	
1 - Uniform (PSF)	0 to 9' (Top)	11' 6"	22.7	30.0	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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Roof, RB9 - Master Window Header, 7'-0"
1 piece(s) 4 x 10 HF No.2

Overall Length: 7' 6"

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)	2846 @ 1 1/2"	4253 (3.00")	Passed (67%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2071 @ 1' 1/4"	3723	Passed (56%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4986 @ 3' 9"	4879	Passed (102%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.089 @ 3' 9"	0.363	Passed (L/982)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.157 @ 3' 9"	0.483	Passed (L/553)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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.
- 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"	2.01"	1243	1603	2846	None
2 - Trimmer - HF	3.00"	3.00"	2.01"	1243	1603	2846	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6" o/c	
Bottom Edge (Lu)	7' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

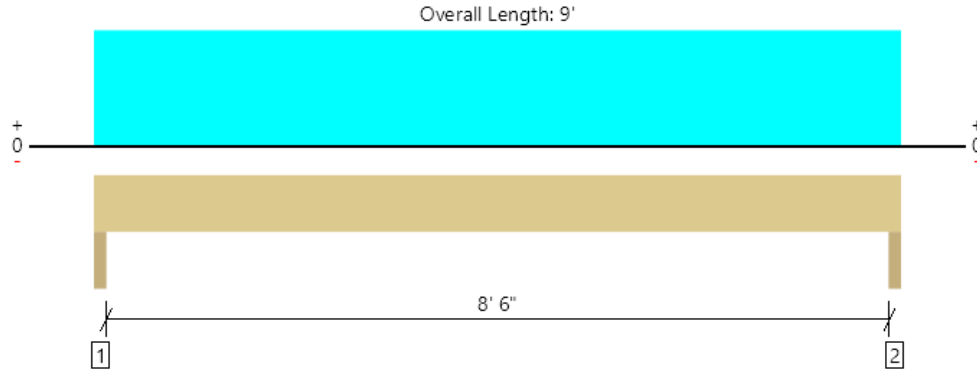| Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 6"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 7' 6" (Top)	14' 3"	22.7	30.0	Roof

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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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Roof, RB10 - Master Slider Header, 12'-0"
1 piece(s) 4 x 10 HF No.2

Overall Length: 12' 6"

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)	1039 @ 1 1/2"	4253 (3.00")	Passed (24%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	869 @ 1' 1/4"	3723	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3118 @ 6' 3"	4879	Passed (64%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.152 @ 6' 3"	0.613	Passed (L/967)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.281 @ 6' 3"	0.817	Passed (L/524)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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.
- 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"	476	563	1039	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	476	563	1039	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 6" o/c	
Bottom Edge (Lu)	12' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

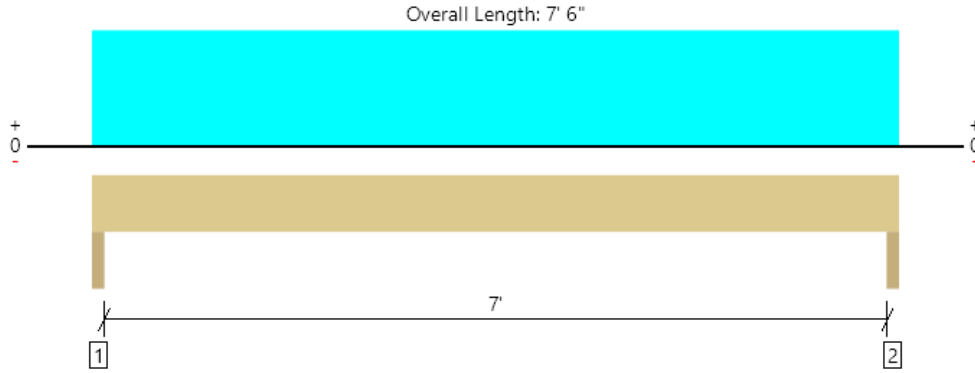| Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12' 6"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 12' 6" (Top)	3'	22.7	30.0	Roof

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
Maxwell Skotheim	
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Weyerhaeuser

Roof, RB11 - Kitchen Valley Beam, 16'-6"
1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam
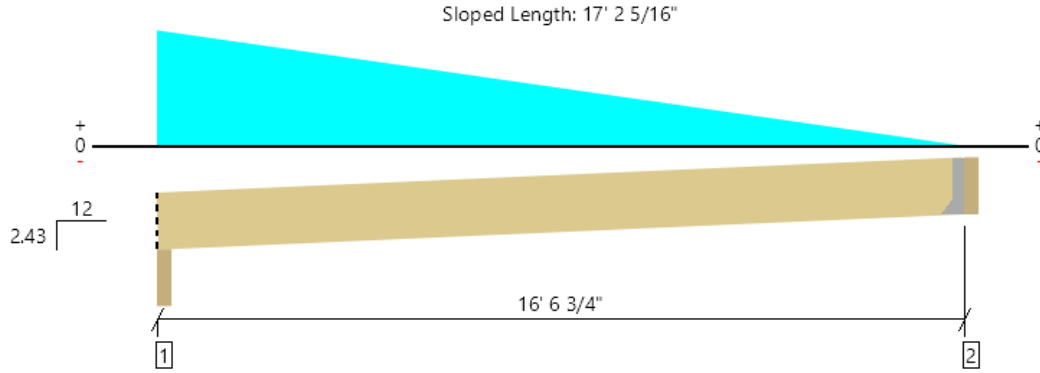
Sloped Length: 17' 2 5/16"

12
2.43

16' 6 3/4"

1
2

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

Member Length : 17' 1 3/16"

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.43/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2326 @ 2"	4648 (3.50")	Passed (50%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1821 @ 1' 3 1/4"	7619	Passed (24%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	7187 @ 7' 1 3/4"	17250	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.257 @ 8' 3/4"	0.558	Passed (L/781)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.437 @ 8' 7/8"	0.836	Passed (L/459)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 16' 8 3/4".
- 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 - Beveled Plate - SPF	3.50"	3.50"	1.75"	942	1384	2326	Blocking
2 - Hanger on 12" SPF beam	3.50"	Hanger¹	1.50"	495	671	1167	See note ¹

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	16' 11" o/c	
Bottom Edge (Lu)	16' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	LSSR210-2Z	1.88"	N/A	22-16dx2.5	18-16dx2.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

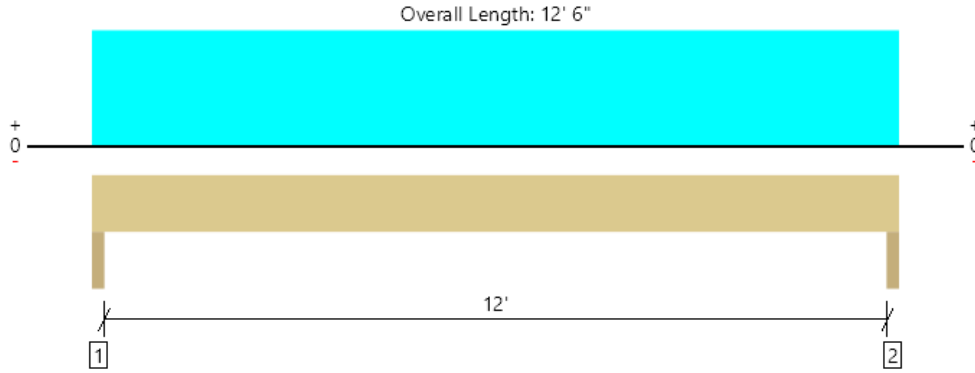| Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16' 6 3/4"	N/A	9.1	--	
1 - Tapered (PLF)	0 to 16' 6 3/4"	N/A	151.9 to 0.0	248.3 to 0.0	Generated from Roof Geometry

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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
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Weyerhaeuser

Roof, RB12 - Kitchen E-W Ridge Beam, 20'-0"
1 piece(s) 5 1/8" x 24" 24F-V4 DF Glulam
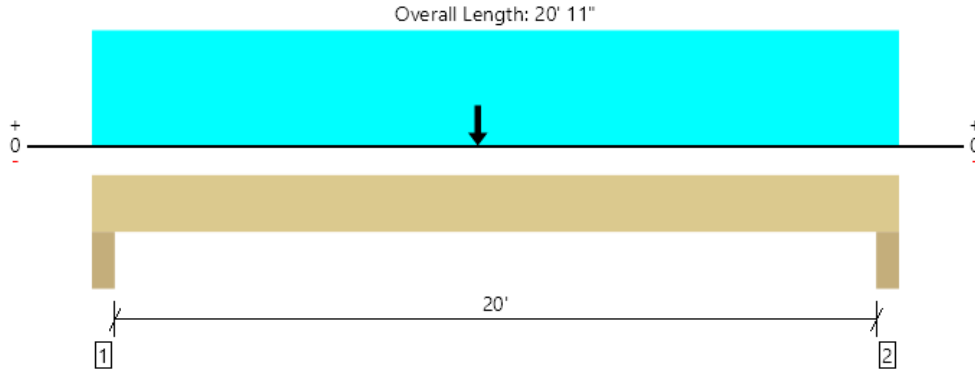
Overall Length: 20' 11"

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)	12852 @ 4"	18322 (5.50")	Passed (70%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	10719 @ 2' 5 1/2"	24990	Passed (43%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	80910 @ 10'	105967	Passed (76%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.304 @ 10' 4 7/8"	1.013	Passed (L/798)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.512 @ 10' 4 7/8"	1.350	Passed (L/475)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 0.94 that was calculated using length L = 20' 3".
- 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 - DF	5.50"	5.50"	3.86"	5201	7651	12852	None
2 - Column - DF	5.50"	5.50"	3.76"	5068	7457	12524	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	20' 11" o/c	
Bottom Edge (Lu)	20' 11" 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' 11"	N/A	29.9	--	
1 - Uniform (PSF)	0 to 20' 11" (Top)	17' 3"	18.6	30.0	Roof
2 - Point (lb)	10' (Front)	N/A	1065	1515	Linked from: RB1 - Kitchen N-S Ridge Beam, 17'-0", Support 1
3 - Point (lb)	10' (Front)	N/A	942	1384	Linked from: RB11 - Kitchen Valley Beam, 16'-6", Support 1
4 - Point (lb)	10' (Front)	N/A	942	1384	Linked from: RB11 - Kitchen Valley Beam, 16'-6", Support 1

Weyerhaeuser Notes

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Weyerhaeuser

Roof, RB13 - Kitchen N-S Drop Beam, 16'-3"
1 piece(s) 5 1/8" x 16 1/2" 24F-V4 DF Glulam
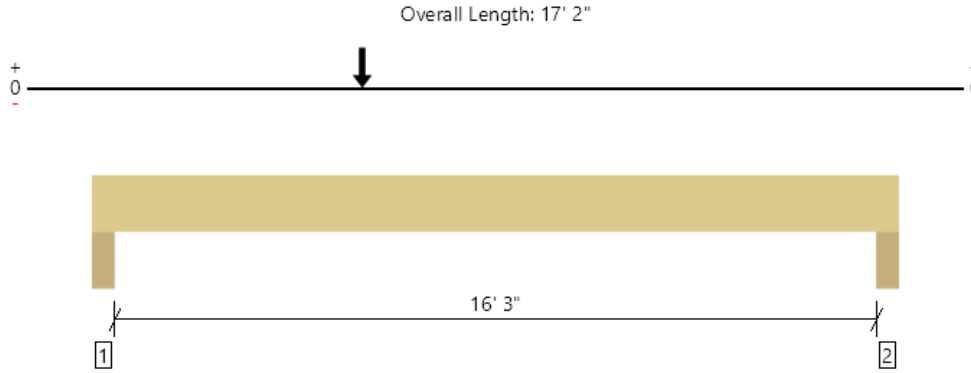
Overall Length: 17' 2"

16' 3"

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)	8809 @ 4"	18322 (5.50")	Passed (48%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	8772 @ 1' 10"	17180	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	47379 @ 5' 9"	53074	Passed (89%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.305 @ 7' 10 3/8"	0.825	Passed (L/649)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.523 @ 7' 10 9/16"	1.100	Passed (L/379)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 factor of 0.99 that was calculated using length L = 16' 6".
- 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 - DF	5.50"	5.50"	2.64"	3670	5139	8809	None
2 - Column - DF	5.50"	5.50"	1.50"	1884	2512	4396	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 2" o/c	
Bottom Edge (Lu)	17' 2" 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 17' 2"	N/A	20.5	--	
1 - Point (lb)	5' 9" (Top)	N/A	5201	7651	Linked from: RB12 - Kitchen E-W Ridge Beam, 24'-0", Support 1

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
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Weyerhaeuser

Main Floor, J1 - Bedroom Joist, 11'-0"
1 piece(s) 2 x 10 HF No.2 @ 16" OC
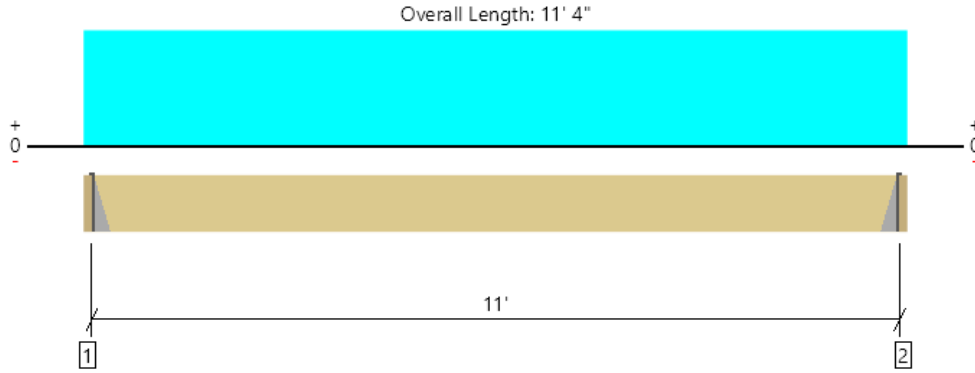
Overall Length: 11' 4"

11'

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)	381 @ 2"	911 (1.50")	Passed (42%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	328 @ 11 1/4"	1388	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1049 @ 5' 8"	1917	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.137 @ 5' 8"	0.275	Passed (L/966)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.178 @ 5' 8"	0.550	Passed (L/743)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- 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.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 9 1/4" HF beam	2.00"	Hanger¹	1.50"	91	302	393	See note ¹
2 - Hanger on 9 1/4" HF beam	2.00"	Hanger¹	1.50"	91	302	393	See note ¹

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger

- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 10" o/c	
Bottom Edge (Lu)	11' o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 11' 4"	16"	12.0	40.0	Floor

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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: 22229.01 Adams Residence
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Weyerhaeuser

Main Floor, J2 - Roof Deck Joist, 7'-6"
1 piece(s) 2 x 8 HF No.2 @ 16" OC
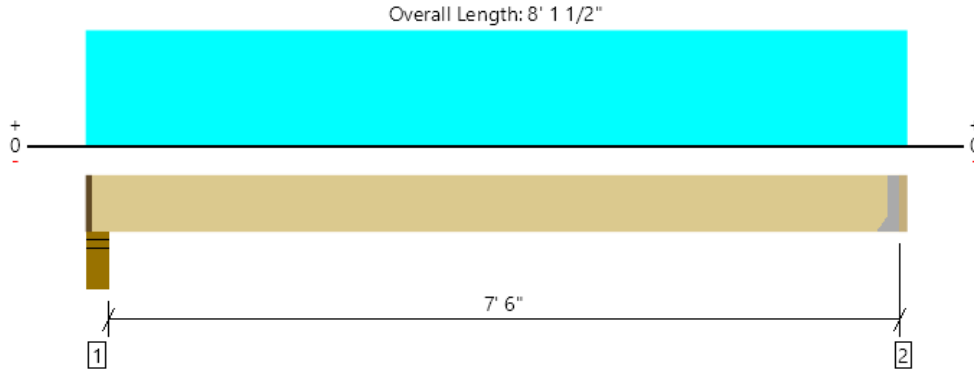
Overall Length: 8' 1 1/2"

7' 6"

1   2

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)	495 @ 7' 11 1/2"	911 (1.50")	Passed (54%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	416 @ 7' 4 1/4"	1088	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	939 @ 4' 2"	1284	Passed (73%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.096 @ 4' 2"	0.190	Passed (L/947)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.157 @ 4' 2"	0.379	Passed (L/580)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

• Deflection criteria: LL (L/480) and TL (L/240).

• 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.

• No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	4.00"	1.50"	211	333	544	1 1/2" Rim Board
2 - Hanger on 7 1/4" GLB beam	2.00"	Hanger¹	1.50"	201	317	517	See note ¹

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

• At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger

• ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 10" o/c	
Bottom Edge (Lu)	7' 10" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	LU26	1.50"	N/A	6-10dx1.5	4-10dx1.5	

• Refer to manufacturer notes and instructions for proper installation and use of all connectors.

| Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8' 1 1/2"	16"	38.0	60.0	Roof Deck

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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
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Weyerhaeuser

Main Floor, J3 - Roof Deck Joist at Hot Tub, 7'-6"
2 piece(s) 2 x 8 HF No.2 @ 16" OC
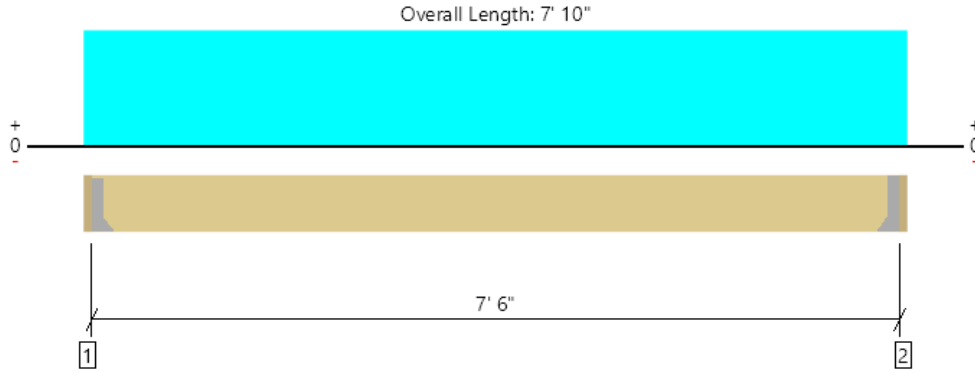
Overall Length: 7' 10"

7' 6"

1   2

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)	875 @ 2"	1823 (1.50")	Passed (48%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	734 @ 9 1/4"	2175	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1641 @ 3' 11"	2569	Passed (64%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.046 @ 3' 11"	0.188	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.134 @ 3' 11"	0.375	Passed (L/671)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- 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.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 7 1/4" HF Ledger	2.00"	Hanger¹	1.50"	601	313	914	See note ¹
2 - Hanger on 7 1/4" GLB beam	2.00"	Hanger¹	1.50"	601	313	914	See note ¹

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 6" o/c	
Bottom Edge (Lu)	7' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HUS28-2	2.00"	N/A	6-10dx1.5	6-10d	
2 - Face Mount Hanger	LUS26-2	2.00"	N/A	4-16d	3-16d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 7' 10"	16"	115.0	60.0	Roof Deck w/ Hot Tub

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Weyerhaeuser

Main Floor, B1 - Steel Beam at Deck, 18'-10"
1 piece(s) W8X24 (A992) ASTM Steel
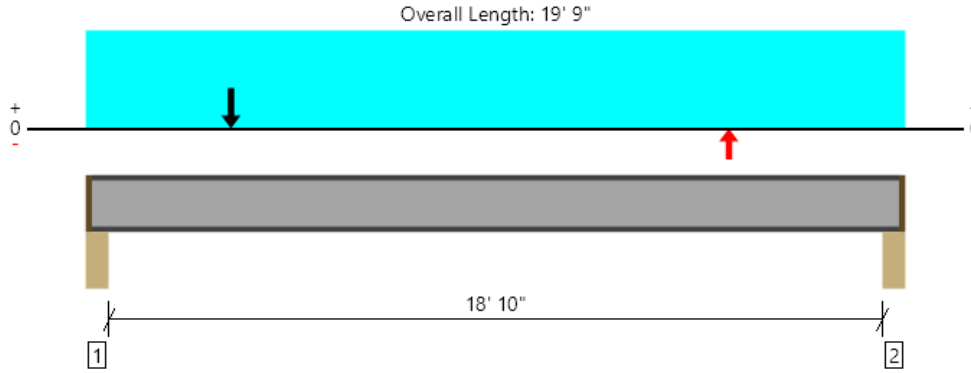
Overall Length: 19' 9"

18' 10"

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)	6419 @ 4"	18850 (4.00")	Passed (34%)	--	1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	6149 @ 5 1/2"	38857	Passed (16%)	--	1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	28929 @ 9' 10 1/2"	36088	Passed (80%)	--	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.379 @ 9' 10 1/2"	0.636	Passed (L/603)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.791 @ 9' 10 1/2"	0.954	Passed (L/290)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Wind	Factored	
1 - Column - HF	5.50"	4.00"	4.00"	3261	3012	494	1176	6419	1 1/2" Rim Board
2 - Column - HF	5.50"	4.00"	4.00"	3261	3012	494	-806	6273	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Wind (1.60)	Comments
0 - Self Weight (PLF)	1 1/2" to 19' 7 1/2"	N/A	24.0	--	--	--	
1 - Uniform (PSF)	0 to 19' 9"	2'	12.0	40.0	-	-	Floor
2 - Uniform (PSF)	0 to 19' 9"	3' 9"	38.0	60.0	-	-	Roof Deck
3 - Point (lb)	3' 6"	N/A	-	-	-	1750	Shear Wall End
4 - Point (lb)	15' 6"	N/A	-	-	-	-1380	Shear Wall End
5 - Uniform (PSF)	0 to 19' 9"	2'	20.0	-	25.0	-	Roof
6 - Uniform (PLF)	0 to 19' 9"	N/A	100.0	-	-	-	Wall Above

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Main Floor, B2 - Steel Beam at Floor, 18'-10"
1 piece(s) W8X24 (A992) ASTM Steel
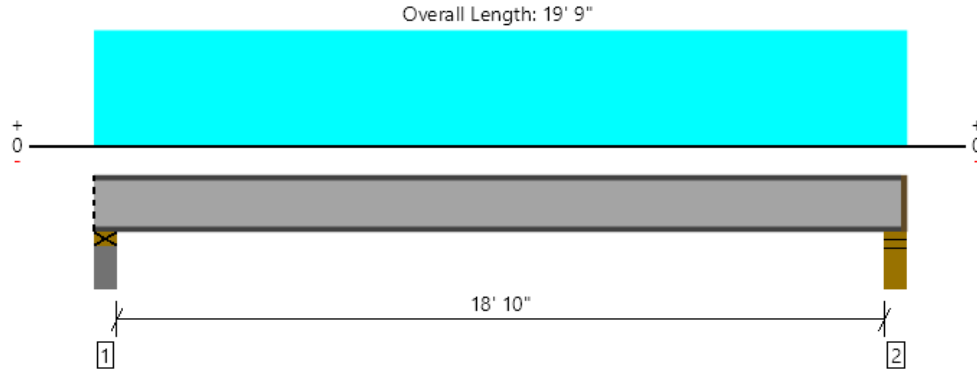
Overall Length: 19' 9"

18' 10"

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)	4085 @ 19' 5"	10530 (4.00")	Passed (39%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3899 @ 5 1/2"	38857	Passed (10%)	--	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	18846 @ 9' 10 1/2"	36088	Passed (52%)	--	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.373 @ 9' 10 1/2"	0.477	Passed (L/614)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.515 @ 9' 10 1/2"	0.954	Passed (L/445)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (C_b) of 1.0 has been assumed.

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Plate on concrete - HF	5.50"	5.50"	5.50"	1126	2963	4088	Blocking
2 - Stud wall - HF	5.50"	4.00"	4.00"	1123	2963	4085	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- 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)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 19' 7 1/2"	N/A	24.0	--	
1 - Uniform (PSF)	0 to 19' 9"	7' 6"	12.0	40.0	Floor

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Weyerhaeuser

Main Floor, B3 - Header at Basement Door, 9'-3"
1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam
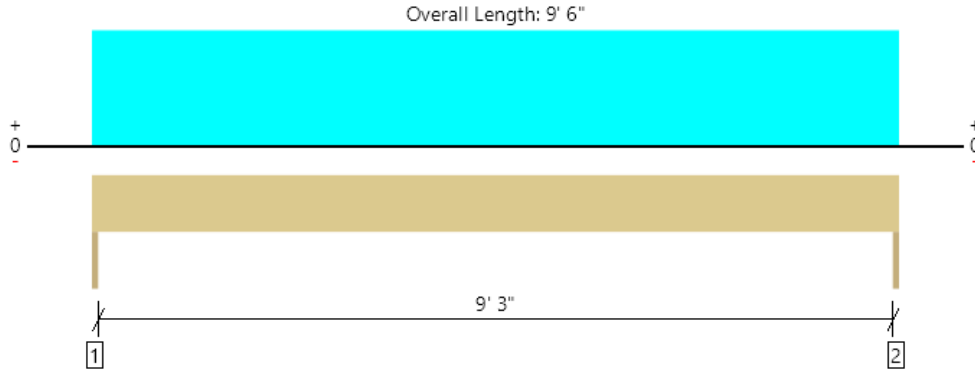
Overall Length: 9' 6"

9' 3"

1   2

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)	1778 @ 0	3047 (1.50")	Passed (58%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1451 @ 10 1/2"	4969	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	4223 @ 4' 9"	8438	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.121 @ 4' 9"	0.317	Passed (L/945)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.201 @ 4' 9"	0.475	Passed (L/568)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 9' 6".
- 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	Floor Live	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	709	1069	1778	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	709	1069	1778	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 6" o/c	
Bottom Edge (Lu)	9' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 9' 6"	N/A	6.8	--	
1 - Uniform (PSF)	0 to 9' 6" (Front)	3' 9"	38.0	60.0	Roof Deck

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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
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Weyerhaeuser

Main Floor, P1 - Kitchen Drop Beam Post
1 piece(s) 6 x 6 DF No.1

Post Height: 9'

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	20	50	Passed (39%)	--	--
Compression (lbs)	8809	24888	Passed (35%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	8809	898425	Passed (1%)	--	1.0 D + 1.0 S
Bending/Compression	0.30	1	Passed (30%)	1.15	1.0 D + 1.0 S

- Input axial load eccentricity for this design is 10% of applicable member side dimension.
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Steel

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Member Type : Free Standing Post
Building Code : IBC 2018
Design Methodology : ASD

Drawing is Conceptual

| Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	3670	5139	Linked from: RB13 - Kitchen N-S Drop Beam, 16'-3", Support 1

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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
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

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6/4/2023 6:03:20 PM UTC

ForteWEB v3.5, Engine: V8.2.5.1, Data: V8.1.3.6

File Name: 22229.01 Adams Residence

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Main Floor, P2 - Kitchen Window Post
3 piece(s) 2 x 6 HF No.2
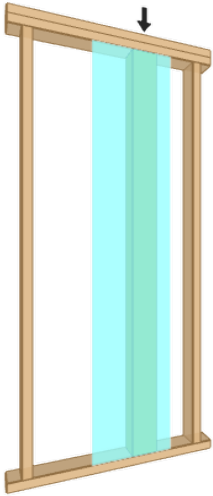
Wall Height: 7' 6"	Member Height: 7' 1 1/2"	Tributary Width: 1'

Drawing is Conceptual

Design Results

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	19	50	Passed (38%)	--	--
Compression (lbs)	3383	12961	Passed (26%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	3383	10024	Passed (34%)	--	1.0 D + 1.0 S
Lateral Reaction (lbs)	55	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	48	3960	Passed (1%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	98 @ mid-span	3317	Passed (3%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.01 @ mid-span	0.71	Passed (L/11087)	--	1.0 D + 0.6 W
Bending/Compression	0.07	1	Passed (7%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- The column stability factor (Kf = 0.6) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.

Supports	Type	Material
Top	Dbl 2X	Hem Fir
Base	2X	Hem Fir

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
7' 1 1/2"	

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)	Snow (1.15)	Comments
1 - Point (lb)	N/A	1466	1917	Linked from: RB2 - Kitchen Window Header, 20'-3", Support 1

Lateral Load	Location	Tributary Width	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	1'	25.7	

- 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.

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes	
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com		

Weyerhaeuser

6/4/2023 6:03:20 PM UTC

ForteWEB v3.5, Engine: V8.2.5.1, Data: V8.1.3.6

File Name: 22229.01 Adams Residence

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Main Floor, P3 - Living Slider Post
3 piece(s) 2 x 6 HF No.2
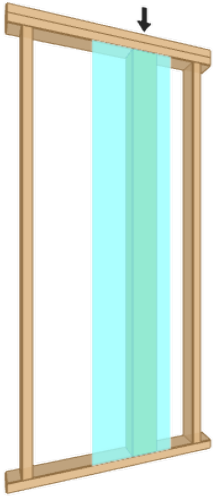
Wall Height: 7' 6" Member Height: 7' 1 1/2" Tributary Width: 1'

Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	19	50	Passed (38%)	--	--
Compression (lbs)	8541	12961	Passed (66%)	1.15	1.0 D + 1.0 S
Plate Bearing (lbs)	8541	10024	Passed (85%)	--	1.0 D + 1.0 S
Lateral Reaction (lbs)	55	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	48	3960	Passed (1%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	98 @ mid-span	3317	Passed (3%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.01 @ mid-span	0.71	Passed (L/11087)	--	1.0 D + 0.6 W
Bending/Compression	0.30	1	Passed (30%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- Bearing shall be on a metal plate or strap, or on other equivalently durable, rigid, homogeneous material with sufficient stiffness to distribute applied load.
- The column stability factor (Kf = 0.6) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.

Supports	Type	Material
Top	Dbl 2X	Hem Fir
Base	2X	Hem Fir

System : Wall
Member Type : Column
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
7' 1 1/2"	

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)	Snow (1.15)	Comments
1 - Point (lb)	N/A	3741	4800	Linked from: RB5 - Living Slider Header, Two Span, Support 2

Lateral Load	Location	Tributary Width	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	1'	25.7	

- 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.

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com	

Wood Beam

Project File: Adams calcs.ec6

LIC# : KW-06016450, Build:20.23.04.05   QUANTUM CONSULTING ENGINEERS   (c) ENERCALC INC 1983-2023

DESCRIPTION: RJ2, Trellis Purlin

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design		Fb +	1000 psi	*E : Modulus of Elasticity*
Load Combination ASCE 7-16		Fb -	1000 psi	Ebend- xx 1700ksi
		Fc - Prll	1500 psi	Eminbend - xx 620ksi
Wood Species : Douglas Fir-Larch		Fc - Perp	625 psi	
Wood Grade : No.1		Fv	180 psi	
		Ft	675 psi	Density 31.21 pcf

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
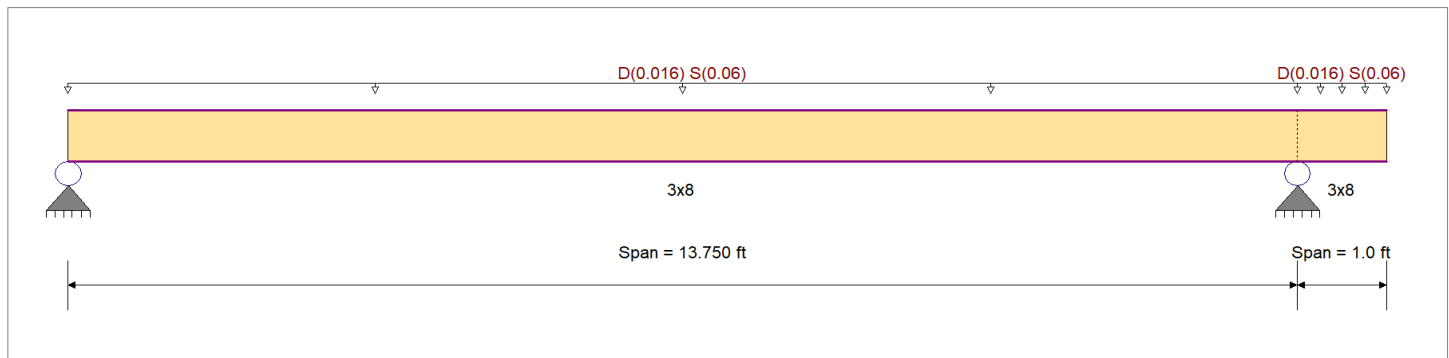
D(0.016) S(0.06)   D(0.016) S(0.06)

3x8   3x8

Span = 13.750 ft   Span = 1.0 ft

Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight NOT internally calculated and added
Load for Span Number 1
  Uniform Load : D = 0.0080, S = 0.030 ksf, Tributary Width = 2.0 ft, (Trellis)
Load for Span Number 2
  Uniform Load : D = 0.0080, S = 0.030 ksf, Tributary Width = 2.0 ft, (Trellis)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.706** : 1	Maximum Shear Stress Ratio	=	**0.194** : 1	
Section used for this span		**3x8**	Section used for this span		**3x8**	
fb: Actual	=	973.73 psi	fv: Actual	=	40.09 psi	
F'b	=	1,380.00 psi	F'v	=	207.00 psi	
Load Combination		+D+S	Load Combination		+D+S	
Location of maximum on span	=	6.837 ft	Location of maximum on span	=	13.212 ft	
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1	

Maximum Deflection
Max Downward Transient Deflection	0.356 in	Ratio =	463 >=240	Span: 1 : S Only
Max Upward Transient Deflection	-0.081 in	Ratio =	294 >=240	Span: 2 : S Only
Max Downward Total Deflection	0.451 in	Ratio =	365 >=180	Span: 1 : +D+S
Max Upward Total Deflection	-0.103 in	Ratio =	232 >=180	Span: 2 : +D+S

Maximum Forces & Stresses for Load Combinations

Load Combination Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 13.750 ft	**1**	0.190	0.052	0.90	1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.37	205.0	1,080.0	0.10	8.4	162.0
Length = 1.0 ft	**2**	0.004	0.052	0.90	1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.01	4.4	1,080.0	0.01	8.4	162.0
+D+S					1.00	1.00	1.00	1.200	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.750 ft	**1**	0.706	0.194	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.78	973.7	1,380.0	0.48	40.1	207.0
Length = 1.0 ft	**2**	0.015	0.194	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.04	20.8	1,380.0	0.03	40.1	207.0
+D+0.750S					1.00	1.00	1.00	1.200	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.750 ft	**1**	0.566	0.155	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.43	781.5	1,380.0	0.39	32.2	207.0

Wood Beam

DESCRIPTION: RJ2, Trellis Purlin

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 1.0 ft	**2**	0.012	0.155	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.03	16.7	1,380.0	0.02	32.2	207.0
+0.60D					1.00	1.00	1.00	1.200	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.750 ft	1	0.064	0.018	1.60	1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.22	123.0	1,920.0	0.06	5.1	288.0
Length = 1.0 ft	**2**	0.001	0.018	1.60	1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.00	2.6	1,920.0	0.00	5.1	288.0

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.4512	6.913		0.0000	0.000
	2	0.0000	6.913	+D+S	-0.1030	1.000

Vertical Reactions

Support notation : Far left is #1   Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	0.520	0.601	
Max Upward from Load Combinations	0.520	0.601	
Max Upward from Load Cases	0.410	0.475	
D Only	0.109	0.127	
+D+S	0.520	0.601	
+D+0.750S	0.417	0.483	
+0.60D	0.066	0.076	
S Only	0.410	0.475	

Wood Beam

DESCRIPTION: RB14, Trellis Beam, 16ft

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design	$F_b +$	1,000.0 psi	*E : Modulus of Elasticity*
Load Combination ASCE 7-16	$F_b -$	1,000.0 psi	Ebend- xx 1,700.0ksi
	Fc - Prll	1,500.0 psi	Eminbend - xx 620.0ksi
Wood Species : Douglas Fir-Larch	Fc - Perp	625.0 psi	
Wood Grade : No.1	F_v	180.0 psi	
	F_t	675.0 psi	Density 31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			

D(0.062) S(0.2325)

6x12

Span = 16.0 ft
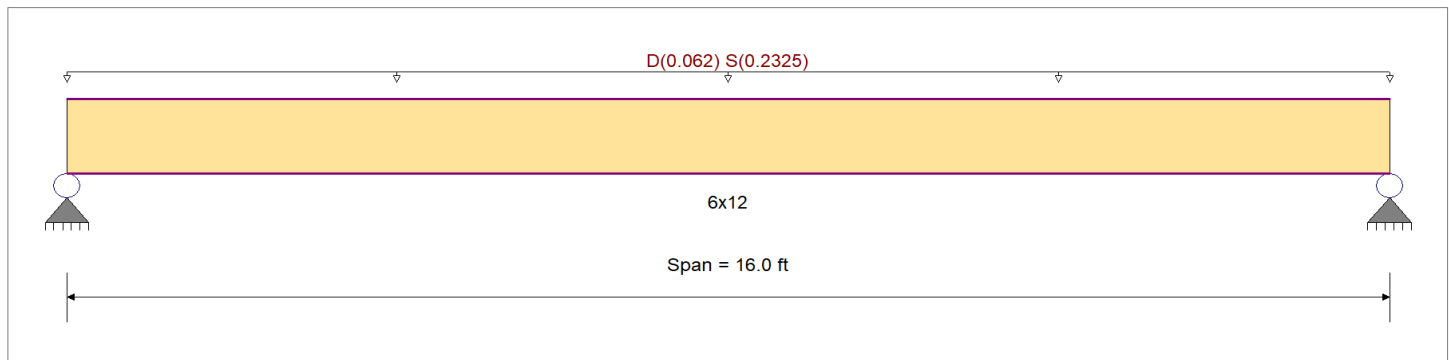
Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0080, S = 0.030 ksf, Tributary Width = 7.750 ft, (Trellis)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.811**: 1	Maximum Shear Stress Ratio	=	**0.238** : 1	
Section used for this span		**6x12**	Section used for this span		**6x12**	
f_b: Actual	=	932.84 psi	f_v: Actual	=	49.35 psi	
F'_b	=	1,150.00 psi	F'_v	=	207.00 psi	
Load Combination		+D+S	Load Combination		+D+S	
Location of maximum on span	=	8.000ft	Location of maximum on span	=	15.066 ft	
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1	

Maximum Deflection
Max Downward Transient Deflection	0.291 in	Ratio =	659	>=240	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<240	n/a
Max Downward Total Deflection	0.369 in	Ratio =	520	>=180	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 16.0 ft	1	0.218	0.064	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.98	196.4	900.0	0.44	10.4	162.0
+D+S					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.0 ft	1	0.811	0.238	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	9.42	932.8	1,150.0	2.08	49.3	207.0
+D+0.750S					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.0 ft	1	0.651	0.191	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.56	748.7	1,150.0	1.67	39.6	207.0
+0.60D					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.0 ft	1	0.074	0.022	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.19	117.8	1,600.0	0.26	6.2	288.0

Wood Beam

Project File: Adams calcs.ec6

DESCRIPTION: RB14, Trellis Beam, 16ft

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.3686	8.058		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1   Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.356	2.356
Max Upward from Load Combinations	2.356	2.356
Max Upward from Load Cases	1.860	1.860
D Only	0.496	0.496
+D+S	2.356	2.356
+D+0.750S	1.891	1.891
+0.60D	0.298	0.298
S Only	1.860	1.860

Cantilevered Retaining Wall

Project File: Adams calcs.ec6

LIC# : KW-06016450, Build:20.22.12.28   QUANTUM CONSULTING ENGINEERS   (c) ENERCALC INC 1983-2022

DESCRIPTION: Stairwell Retaining Wall, 8ft

Code Reference

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in
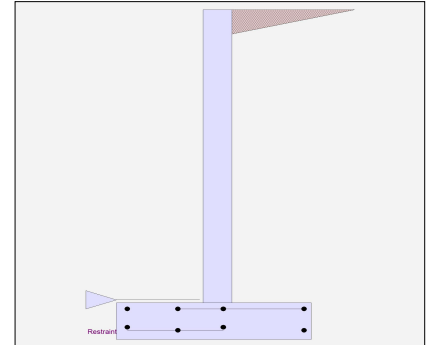
Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Triangular

Load at bottom of Triangular Distribution . . . . = 45.000 psf
(Strength)

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W)
		(Service Level)
Wind on Exposed Stem	=	0.0 psf
(Strength Level)		

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Total Strength-Level Seismic Load.	=	202.500 lbs
Total Service-Level Seismic Load.	=	141.750 lbs

Cantilevered Retaining Wall

Project File: Adams calcs.ec6

DESCRIPTION: Stairwell Retaining Wall, 8ft

Design Summary

Stem Construction

Bottom

Wall Stability Ratios

Overturning	=	1.96 OK	

Slab Resists All Sliding !

Global Stability	=	1.56

Total Bearing Load	=	3,088 lbs
...resultant ecc.	=	9.56 in

Eccentricity outside middle third

Soil Pressure @ Toe	=	1,417 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	1,500 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,983 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	19.1 psi	OK
Footing Shear @ Heel	=	14.2 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	1,559.3 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Stem OK

Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 6		
Rebar Spacing	=	18.00		
Rebar Placed at	=	Edge		

Design Data

fb/FB + fa/Fa	=	**0.738**

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	1,952.0

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	5,205.3
Moment.....Allowable	=	7,044.3

Shear.....Actual

Service Level	psi =	
Strength Level	psi =	28.9
Shear.....Allowable	psi =	82.2
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	5.63

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Adams calcs.ec6

DESCRIPTION: Stairwell Retaining Wall, 8ft

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.218 in2/ft	
(4/3) * As :	0.2907 in2/ft	Min Stem T&S Reinf Area 1.536 in2
200bd/fy : 200(12)(5.625)/60000 :	0.225 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	============	One layer of : Two layers of :
Required Area :	0.225 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.2933 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.9144 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	2.00 ft
Heel Width	=	2.50
Total Footing Width	=	4.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy =	60,000 psi	
Footing Concrete Density =	150.00 pcf	
Min. As %	=	0.0018
Cover @ Top 2.00 @ Btm.=	3.00 in	

Footing Design Results

			Toe	Heel	
Factored Pressure	=		1,983	0 psf	
Mu' : Upward	=		3,360	368 ft-#	
Mu' : Downward	=		360	2,077 ft-#	
Mu: Design	=		3,000 OK	1,709 ft-#	OK
phiMn	=		11,004	12,324 ft-#	
Actual 1-Way Shear	=		19.11	14.15 psi	
Allow 1-Way Shear	=		82.16	82.16 psi	
Toe Reinforcing	= # 6 @ 18.00 in				
Heel Reinforcing	= # 6 @ 18.00 in				
Key Reinforcing	= None Spec'd				
Footing Torsion, Tu	=		0.00 ft-lbs		
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs		

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Key: No key defined

Min footing T&S reinf Area		1.17	in2
Min footing T&S reinf Area per foot		0.26	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: Adams calcs.ec6

LIC# : KW-06016450, Build:20.22.12.28   QUANTUM CONSULTING ENGINEERS   (c) ENERCALC INC 1983-2022

**DESCRIPTION:** Stairwell Retaining Wall, 8ft

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl)	1,613.3	3.58	5,781.1
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.58	5,781.1
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel =			
Surcharge over Heel	=				Surcharge Over Heel =			
Surcharge Over Toe	=				Adjacent Footing Load =			
Adjacent Footing Load	=				Axial Dead Load on Stem =			
Added Lateral Load	=				* Axial Live Load on Stem =			
Load @ Stem Above Soil	=				Soil Over Toe =			
Seismic Earth Load	=	141.8	3.00	425.3	Surcharge Over Toe =			
	=				Stem Weight(s) =	800.0	2.33	1,866.7
					Earth @ Stem Transitions =			
Total	=	1,559.3	**O.T.M.** =	4,677.8	Footing Weight =	675.0	2.25	1,518.8
					Key Weight =			
					Vert. Component =			

Resisting/Overturning Ratio   =   **1.96**
Vertical Loads used for Soil Pressure =   3,088.3   lbs

                               Total =   3,088.3   lbs   **R.M.=**   9,166.5

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios
may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in
the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in
the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus   250.0   pci

Horizontal Defl @ Top of Wall (approximate only)   0.070   in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Adams calcs.ec6

DESCRIPTION: Stairwell Retaining Wall, 8ft

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #6 bar specified in this stem design segment (25.4.2.3a) =	25.63 in
Development length for #6 bar specified in this stem design segment =	19.72 in
Hooked embedment length into footing for #6 bar specified in this stem design segment =	8.82 in
As Provided =	0.2933 in2/ft
As Required =	0.2250 in2/ft

Cantilevered Retaining Wall

Project File: Adams calcs.ec6

LIC# : KW-06016450, Build:20.22.12.28   QUANTUM CONSULTING ENGINEERS   (c) ENERCALC INC 1983-2022

DESCRIPTION: Stairwell Retaining Wall, 8ft

8" w/ #6 @ 18"

Clear Cover : 2"

8'-0"

2"

1'-0"

3"

Restraint

#6@18in

@ Toe

2'-0"

2'-6"

4'-6"

#6@18"

@ Heel

DESCRIPTION: Stairwell Retaining Wall, 8ft

Restraint

4'-4"

1416.54psf

1418#

142#

■ Lateral earth pressure due to the soil BELOW water table

■ Seismic lateral earth pressure
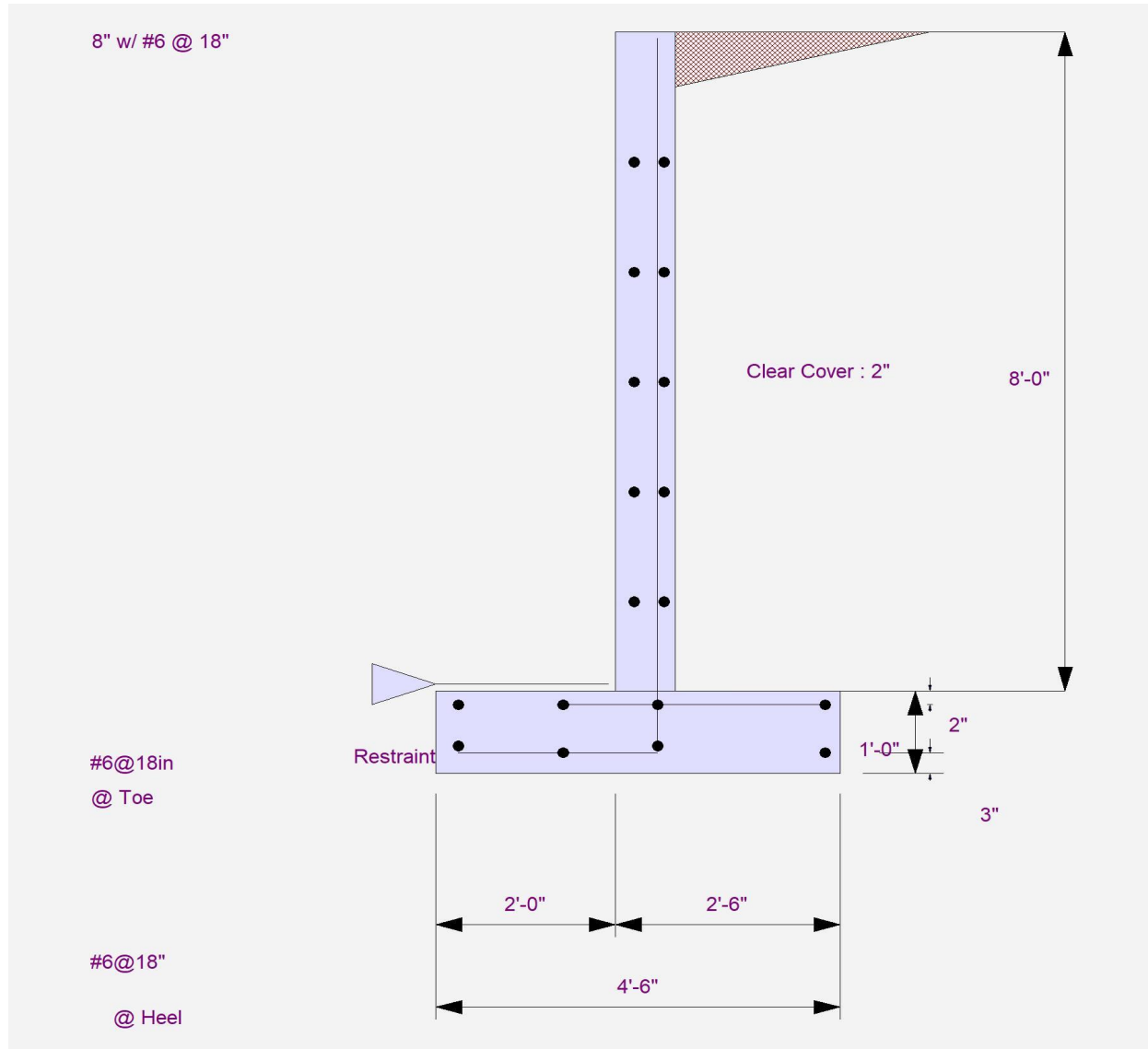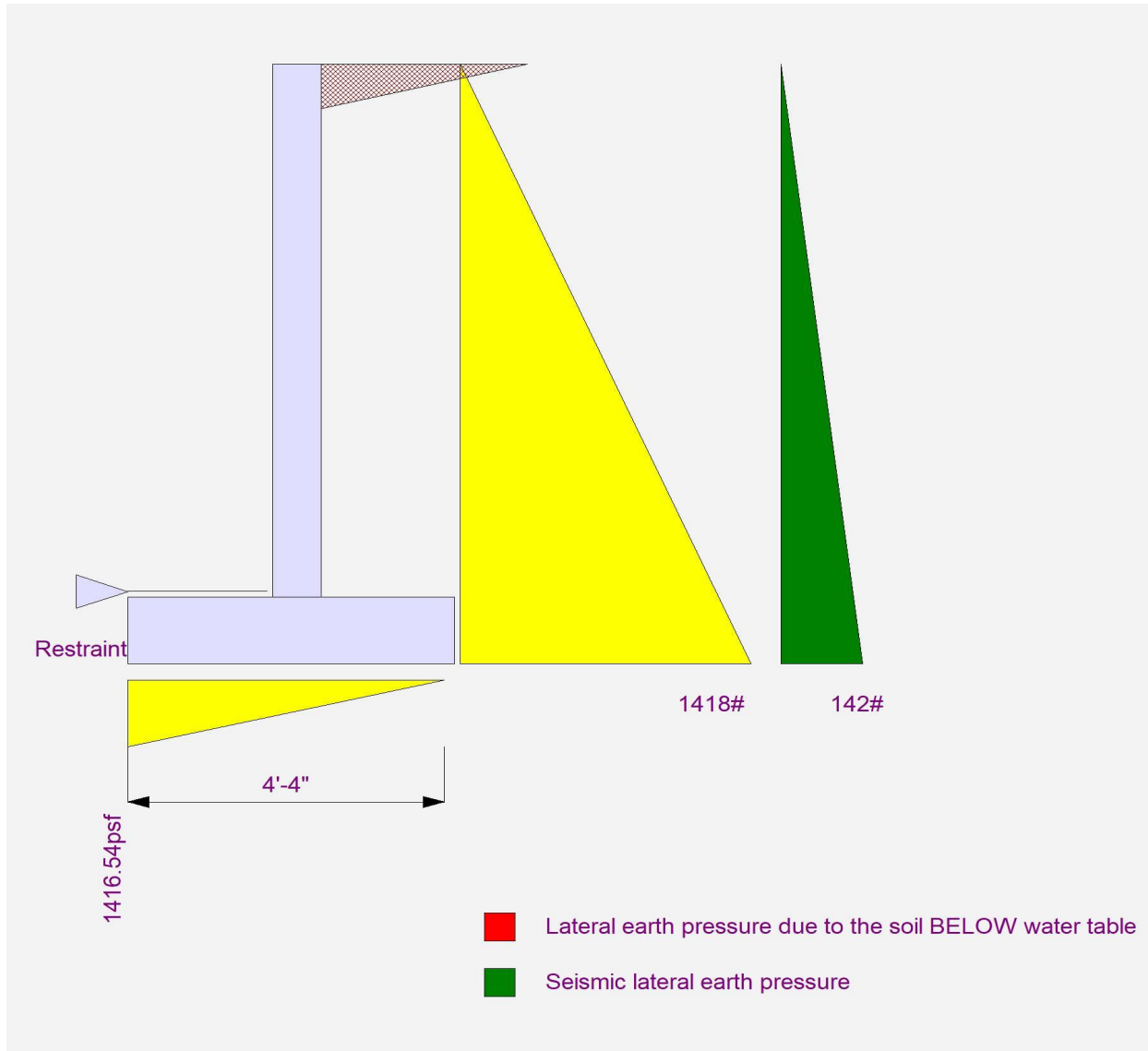
ADAMS RESIDENCE
8035 SE 45th Street
Mercer Island, WA 98040

Quantum Job Number: 22229.01

LATERAL DESIGN

Seismic Base Shear for the Equivalent Lateral Force Procedure

Per IBC 2018 & ASCE 7-16

Structure: **Adams Residence**

Address: **8035 SE 45th Street, Mercer Island, WA 98040**

Latitude: **47.5649**   Longitude: **-122.2294**

Structure Classification

Risk Category : **II**   per ASCE Table 1.5-1

Seismic Force-Resisting System: **Light-Framed Wood Walls Sheathed with Structural Panels**

R: **6 1/2**   per ASCE Table 12.2-1

W_o: **3**   per ASCE Table 12.2-1

C_d: **4**   per ASCE Table 12.2-1

h_n (ft): **15.00**   height above the base to the highest level of the structure

Site Ground Motion

Reg. Structure/5 Stories Max: **Yes**   **Sds (max) = 1.0**   Per ASCE 12.8.1.3

S_1 (g-sec): **0.50** S_S (g-sec): **1.43**

Site Class: **D**   **Assumed Value**   per ASCE 11.4.3

ASCE 11.4.8 Exception 2 Used

F_v **1.80** F_a **1.20**

1.2 Min Value where SC D Assumed

S_{M1} (g-sec): **0.90** S_{MS} (g-sec): **1.72**   per ASCE 11.4.4

S_{D1} (g-sec): **0.60** S_{DS} (g-sec): **1.15**   per ASCE 11.4.5

SDC: **D**   per ASCE 11.6

I_E: **1.00**   per ASCE Table 1.5-2

Fundamental Period per ASCE 12.8.2

Period Method: **Approximate Fundamental Period**

Structure Type: **All Other Structural Systems**

T_L (sec): **6.00**   ASCE Figures 22-14 through 22-17

T_s: 0.52

T_a (sec): 0.15   Ct * hnx per ASCE Eq. 12.8-7

T_{use} (sec): **0.15**   T <= TL

Equivalent Lateral Force Procedure Design Base Shear per ASCE 12.8

C_s:	0.18	$= S_{DS} / (R/I_E)$ per ASCE Eq. 12.8-2
C_{s-max}:	0.60	$= S_{D1} / (T_a \cdot R/I_E)$ for $T <= T_L$ per ASCE Eq. 12.8-3
C_{s-max}:	--	$= S_{D1} \cdot T_L / (T_a^2 \cdot R/I_E)$ for $T > T_L$ per ASCE Eq. 12.8-4
C_{s-min}:	0.05	per ASCE Eq. 12.8-5
C_{s-min}:	--	$= 0.5 S_1 / (R/I_E)$ for $S_1 => 0.6g$ per ASCE Eq. 12.8-6
C_{s-use}:	0.18	

V : 0.176 W   = C_{S-use} * W per ASCE Eq. 12.8-1

Wind Loads Criteria

ASCE 7-16

Wind Load Criteria

Risk Category:	**II**	Table 1.5-1	Roof Type:	**Gable/Mansard**		
Basic Wind Speed:	**97**	Figure 26.5.1	Roof Slope:	**3.0:12**	14.0 DEG	
Exposure Category:	**B**	Section 26.7.3	Mean Roof HT:	**12.0 ft**	UP TO 160FT	
Ground Elevation:	**195 ft**		Parapet:	**No**		
Wall Ht:	**10.0 ft**				UP TO 160FT	

Wind Topographic Factor, K_{zt}:

per Section 26.8
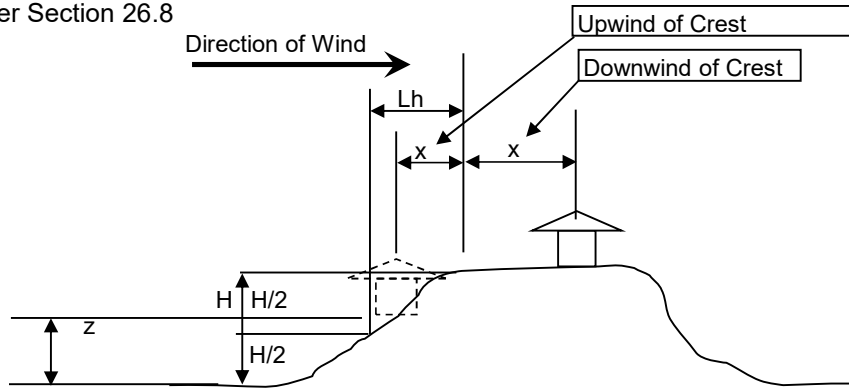
Terrain Type: **2-dimensional escarpments**
Direction: **Upwind of Crest**

L_h: **1400 ft** DIST UPWIND OF CREST TO HALF HT OF HILL OR ESCARP.

H: **380 ft** HT. OF HILL OR ESCARP. RELATIVE TO THE UPWIND TERRAIN

X: **2200 ft** DIST. (UPWIND OR DOWNWIND) FROM THE CREST TO THE BUILDING

Z: **195 ft** HEIGHT ABOVE GROUND SURFACE AT BUILDING SITE

K_{zt}: 1.00 *EQUATION 26.8-1*

K_{zt}: **1.00** *MANUALLY INPUT*

K_e: **0.993** ASCE 26.10.1

K_d: **0.85** ASCE 26.6

Wind Loads - Main Wind Force Resisting System

ASCE 7-16 Chapter 27.3 Part 1 - Enclosed Simple Diaphragm, h<160ft

Wind Load Criteria

Risk Category:	**II**	Table 1.5-1	K_e:	**0.993**	Section 26.10.1
Basic Wind Speed:	**97 mph**	Figure 26.5.1	K_d:	**0.85**	Section 26.6
Exposure Category:	**B**	Section 26.7.3	G:	**0.85**	Section 26.11
K_{zt}:	**1.00**	Section 26.8	Wall Height:	**10.0 ft**	

Wall Pressures:

L/B Ratio:

Short Dimension:	**90.0 ft**
Long Dimension:	**95.0 ft**
Transverse Wind L/B:	0.95
Longitudinal Wind L/B:	1.06

PLAN
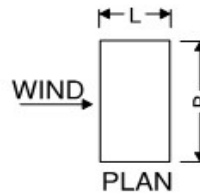
*NOTE: INTERNAL BUILDING PRESSURE CANCEL
EACH OTHER OUT IN ENCLOSED BUILDING

K_h & K_z:	0.512	At Top of Wall
K_z:	0.57	0 ft to 15 ft

ELEVATION
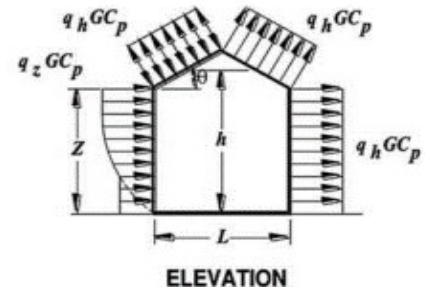
	Transverse Wind Direction	Longitudinal Wind Direction	
Top of Wall:	**16.0 psf** MIN	**16.0 psf** MIN	ASCE EQ 27.3-1
0 ft to 15 ft Wall:	**16.0 psf** MIN	**16.0 psf** MIN	ASCE EQ 27.3-1
	ASCE 27.1.5	ASCE 27.1.5	

*Enveloped Leeward and Windward Pressure
*All Values Ultimate (multiply x0.6 for ASD)

Wind Loads - Main Wind Force Resisting System (Cont.)

ASCE 7-16 Chapter 27.3 Part 1 - Enclosed Simple Diaphragm, h<160ft

Roof Pressure:

Slope:	3.0:12	=	14.0	DEGREES
Mean Roof HT:	12.0 ft			
Building Dimension:	**87.0 ft**	**Parallel to Ridge**		
Building Dimension:	**32.0 ft**	**Normal to Ridge**		
K_h & K_z:	0.570	At Mean Roof Ht		
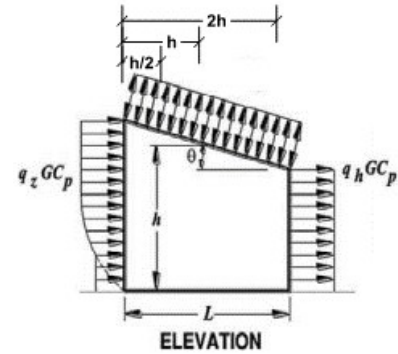
Windward Pressure Parallel to Ridge

	LC 1	LC 2		LC 1	LC 2
0 to h/2	**-11.0 psf**	**0.3 psf**			
h/2 to h	**-11.0 psf**	**0.3 psf**			
h to 2h	**-7.0 psf**	**0.3 psf**			
>2h	**-5.0 psf**	**0.3 psf**			

Windward Pressure Normal to Ridge

1.0 psf   *Horizontal Projected Pressure:* **0.2 psf**

Leeward Pressure Normal to Ridge

-6.8 psf   *Horizontal Projected Pressure:* **-1.7 psf**
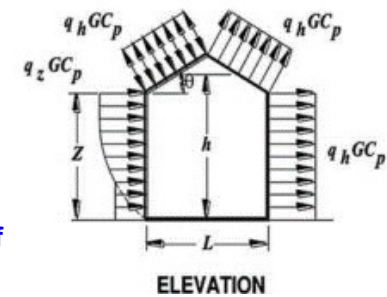
*Negative indicates pressure away from surface
*Total horizontal shear shall not be less than that determined by neglecting roof wind forces
*All Values Ultimate (multiply x0.6 for ASD)

Roof Overhang (PSF)

P_{ovh}: **-14.7 psf**   *Horizontal Projected Pressure:* **-3.6 psf**

Minimum Total Projected Horizontal Pressure (PSF)   **8.0 psf**   ASCE 27.1.5

Wind Loads - Components and Cladding

ASCE 7-16 Chapter 30.3 & 30.5 - Part 1 and Part 3 Enclosed Buildings With h<160 FT

Wind Load Criteria

Risk Category:	**II**	Table 1.5-1		K_d:	**0.85**	Section 26.6
Basic Wind Speed:	**97 mph**	Figure 26.5.1		Roof Type:	**Gable/Mansard**	
Exposure Category:	**B**	Section 26.7.3		Roof Slope:	**3.0:12**	= 14.0 DEG
K_{zt}:	**1.00**	Section 26.8		Mean Roof Height:	**12.0 ft**	
K_e:	**0.99**	Section 26.10.1		Wall Height:	**10.0 ft**	**0.0 ft**

Zone Dimensions

Least Horiz. BLDG Dimension: **90 ft**

a: **4.0 ft**
2a: **8.0 ft**

Wall Pressures

K_z: 0.575 Table 26.10-1 0-15 ft (PART 3)
K_h: 0.570 Table 26.10-1

Effective Wind Area: Zone 4: **10 ft^2**
Zone 5: **10 ft^2**

	At Top of Wall		0 FT TO 15 FT (>60' bldg)	
Load Case	4	5	4	5
1	**16.0**	**16.0**		
2	**-16.0**	**-18.3**		

16 PSF Min. Wind per 30.2.2
*Negative indicates pressure away from surface
*Okay to interpolate between 15ft and top of wall (>60' bldg)
*All Values Ultimate (multiply x0.6 for ASD)

ELEVATION
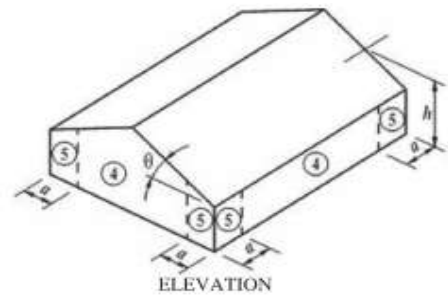
Roof Pressures

K_h: 0.570 Table 26.10-1

Overhang?: **No**

Effective Wind Area:

Zone 1: **10 ft^2**	Zone 2: **10 ft^2**	Zone 3: **10 ft^2**
Zone 1': **10 ft^2**	Zone 2e: **10 ft^2**	Zone 3e: **10 ft^2**
	Zone 2n: **10 ft^2**	Zone 3r: **10 ft^2**
	Zone 2r: **10 ft^2**	Zone 3': **10 ft^2**
	Zone 2': **10 ft^2**	

Zone (PSF)

Load Case	1	1'
1	**8.3**	-
2	**-25.3**	-

Load Case	2	2e	2n	2r	2'
1	-	**8.3**	**8.3**	**8.3**	-
2	-	**-25.3**	**-36.9**	**-36.9**	-

Load Case	3	3e	3r	3'
1	-	**8.3**	**8.3**	-
2	-	**-36.9**	**-43.8**	-

*Negative indicates pressure away from surface
*All Values Ultimate (multiply x0.6 for ASD)

Wind Loads - Components and Cladding (Cont.)

ASCE 7-16 Chapter 30 - Part 4 Enclosed Buildings With h<160 FT (Simplified)
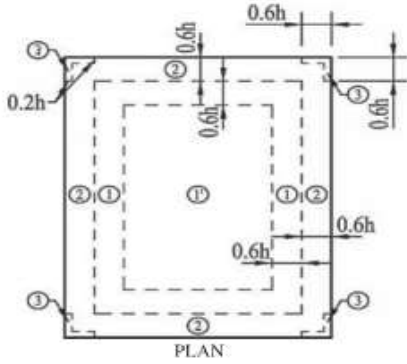
ASCE FIG 30.3-2A
FLAT/GABLE ROOF θ <= 7°
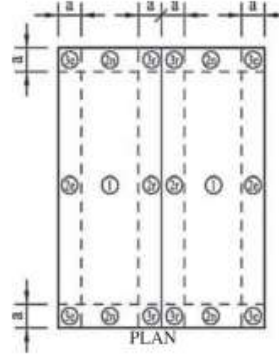
ASCE FIG 30.3-2B to D
GABLE ROOF 7°< θ <= 45°
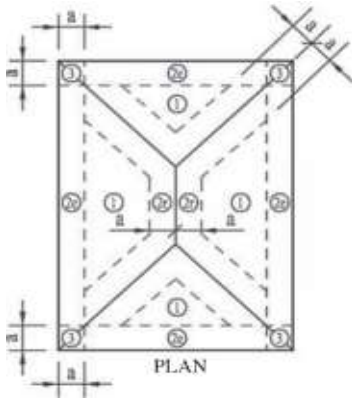
ASCE FIG 30.3-2E to I
HIP ROOF 7°< θ <= 45°
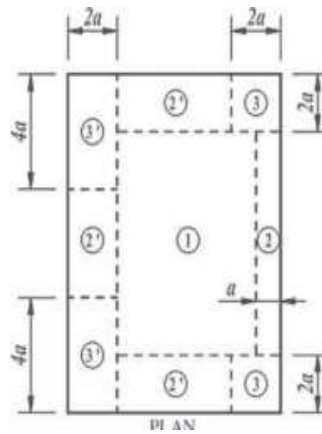
ASCE FIG 30.3-5A
Monoslope ROOF 3°< θ <= 10°
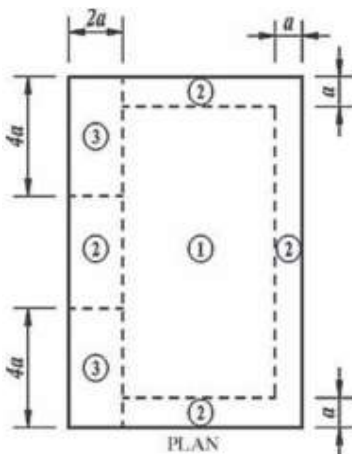
ASCE FIG 30.3-5B
Monoslope ROOF 10°< θ <= 30°
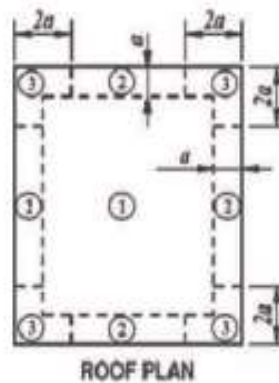
ASCE FIG 30.5-1
ROOF H > 60ft, θ <= 7°

Shear Wall Loads

Structure: **Adams Residence**

Seismic Loads:

Load at Roof:	**32 psf**
Roof Snow Load:	**25 psf**
Seismic Snow Load:	0.0 psf
Load at Floor:	**24 psf**
Load at Deck:	**44 psf**
C_s:	**0.176**

Wind Loads:

Wall Load (E-W):	**16.0 psf**
Wall Load (N-S):	**16.0 psf**
Projected Roof Load:	**8.0 psf**

Main Floor Shear Walls:

SW Grid (N-S)	Seismic Tributary (sf)			EQ (lb)	Wind Tributary (sf)		Wind (lb)
	Roof	Floor	Deck		Wall	Roof	
Grid A	1425			**8026**	115		**1840**
Grid B	1560			**8786**	175		**2800**
Grid D	1620			**9124**	200		**3200**
Grid E	1645			**9265**	110		**1760**
Grid F	230			**1295**	135		**2160**
				0			**0**
(E-W)							
Grid W1	868			**4889**	184		**2944**
				0			**0**
Grid E2	2135			**12024**	486		**7776**
Grid E3	1221			**6877**	218		**3488**
Grid W5	755			**4252**	127		**2032**
Grid W6	450			**2534**	76		**1216**
Grid E4	712			**4010**	162		**2592**

Basement Shear Walls:

SW Grid (N-S)	Seismic Tributary (sf)			EQ (lb)	Wind Tributary (sf)		Wind (lb)
	Roof	Floor	Deck		Wall	Roof	
Grid E	570	175	0	**3949**	110	0	**1760**
Grid F	230	175	80	**2654**	162	0	**2592**
				0			**0**
				0			**0**
				0			**0**
				0			**0**
(E-W)							
				0			**0**
				0			**0**
				0			**0**
				0			**0**
				0			**0**
				0			**0**
				0			**0**

A

32'-5"

B

8'-1¼"

C

10'-11"

D

29'-10½"

SW E.1

2/S3.1

HDU5

HDU5

SW-4

(E) SLAB-ON-GRADE

E   11/S3.1

8'-6¼"

6x6
HDU2

9/S3.1

6x6
HDU2

F2.5

HDU2

12/S3.1

4" CONC.
SLAB-ON-GRADE,
SEE NOTES 3 & 4

SW F.1

SW-6   10/S3.0

HDU2   SW-6

12/S3.1

BASEMENT SHEAR WALL KEY PLAN

MAIN FLOOR SHEAR WALL KEY PLAN

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (E-W)**

Sds =	0.85
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) =	17.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory or Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**W1**	**23.50**	-	-	-	-	-	-	-	-	-
SW Segment	W1.1	23.50	10.00	0.43	HF #2	0.43	Base	10.00	10.0	3.0	15.0
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW GRID	**E2**	**23.67**	-	-	-	-	-	-	-	-	-
	E2.1	8.00	10.00	1.25	HF #2	0.43	Base	10.00	10.0	6.0	15.0
	E2.2	15.67	10.00	0.64	HF #2	0.43	Base	10.00	10.0	2.0	15.0
SW GRID	**E3**	**14.00**	-	-	-	-	-	-	-	-	-
	E3.1	6.00	10.00	1.67	HF #2	0.43	Base	10.00	10.0	6.0	15.0
	E3.2	8.00	10.00	1.25	HF #2	0.43	Base	10.00	10.0	6.0	15.0

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**W1**	4890	2950	-	-	-	-	-	-
SW Segment	W1.1	4890	2950	3408			**SW-6**	2	**HDU2 (3075DF,2215HF)**
SW GRID							-	-	-
SW GRID	**E2**	12030	7780				-	-	-
	E2.1	4066	2629	1520			**SW-4**	2	**HDU5 (5645DF, 4340HF)**
	E2.2	7964	5151	2037			**SW-4**	2	**HDU5 (5645DF, 4340HF)**
SW GRID	**E3**	6880	3490				-	-	-
	E3.1	2949	1496	1140			**SW-4**	2	**HDU5 (5645DF, 4340HF)**
	E3.2	3931	1994	1520			**SW-4**	2	**HDU5 (5645DF, 4340HF)**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (E-W)**

Shear Wall Schedule (LRFD) ϕ_D =   0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
W1.1	208	1.00	224	126	135	224	SW-6	416	OK	Seismic
E2.1	508	1.00	546	329	353	546	SW-4	608	OK	Seismic
E2.2	508	1.00	546	329	353	546	SW-4	608	OK	Seismic
E3.1	491	1.00	528	249	268	528	SW-4	608	OK	Seismic
E3.2	491	1.00	528	249	268	528	SW-4	608	OK	Seismic

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
W1.1	23.50	23.02	2.10%	No	
				No	
E2.1	8.00	7.52	6.44%	No	
E2.2	15.67	15.19	3.19%	No	
E3.1	6.00	5.52	8.78%	No	
E3.2	8.00	7.52	6.44%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN
Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (E-W)**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
W1.1	1457		1457	753		753	1704	1704
E2.1	3558		3558	1972		1972	760	760
E2.2	3558		3558	1972		1972	1019	1019
E3.1	3440		3440	1496		1496	570	570
E3.2	3440		3440	1496		1496	760	760

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
W1.1	269	-637	269	-637	**-637**	HDU2 (3075DF,2215HF)	**-2215**	**OK**
E2.1	-1516	-3192	-1516	-3192	**-3192**	HDU5 (5645DF, 4340HF)	**-4340**	**OK**
E2.2	-1361	-3068	-1361	-3068	**-3068**	HDU5 (5645DF, 4340HF)	**-4340**	**OK**
E3.1	-1154	-3166	-1154	-3166	**-3166**	HDU5 (5645DF, 4340HF)	**-4340**	**OK**
E3.2	-1040	-3074	-1040	-3074	**-3074**	HDU5 (5645DF, 4340HF)	**-4340**	**OK**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (E-W continued)**

Sds = 0.85
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory or Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	W5	11.00	-	-	-	-	-	-	-	-	-
SW Segment	W5.1	11.00	10.00	0.91	HF #2	0.43	Base	10.00	10.0	12.0	15.0
SW GRID	W6	15.75	-	-	-	-	-	-	-	-	-
	W6.1	15.75	10.00	0.63	HF #2	0.43	Base	10.00	10.0	12.0	15.0
SW GRID	E4	13.33	-	-	-	-	-	-	-	-	-
	E4.1	13.33	10.00	0.75	HF #2	0.43	Base	10.00	10.0	2.0	15.0
SW GRID		0.00	-	-	-	-	-	-	-	-	-

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	W5	4260	2040	-	-	-	-	-	-
SW Segment	W5.1	4260	2040	3080			SW-4	2	HDU2 (3075DF,2215HF)
SW GRID	W6	2540	1220				-	-	-
	W6.1	2540	1220	4410			SW-6	2	No HD
SW GRID	E4	4010	2600				-	-	-
	E4.1	4010	2600	1733			SW-6	2	HDU2 (3075DF,2215HF)
SW GRID							-	-	-

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (E-W continued)**

Shear Wall Schedule (LRFD) $\phi_D =$ 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
W5.1	387	1.00	416	185	199	416	SW-4	608	OK	Seismic
W6.1	161	1.00	173	77	83	173	SW-6	416	OK	Seismic
E4.1	301	1.00	323	195	210	323	SW-6	416	OK	Seismic

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
W5.1	11.00	10.52	4.61%	No	
W6.1	15.75	15.38	2.44%	Yes	19.75
E4.1	13.33	12.85	3.77%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN
Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (E-W continued)**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
W5.1	2711		2711	1113		1113	1540	1540
W6.1	900		900	371		371	2205	2205
E4.1	2105		2105	1170		1170	867	867

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
W5.1	-189	-1970	-189	-1970	**-1970**	HDU2 (3075DF,2215HF)	-2215	OK
W6.1	952	160	952	160	**160**	No HD	0	OK
E4.1	-650	-1688	-650	-1688	**-1688**	HDU2 (3075DF,2215HF)	-2215	OK

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (N-S)**

Sds = 0.85
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory or Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**A**	**43.92**	-	-	-	-	-	-	-	-	-
SW Segment	A.1	15.25	10.00	0.66	HF #2	0.43	Base	10.00	10.0	16.0	15.0
	A.2	6.33	10.00	1.58	HF #2	0.43	Base	10.00	10.0	16.0	15.0
	A.3	22.33	10.00	0.45	HF #2	0.43	Base	10.00	10.0	12.0	15.0
SW GRID	**B**	**51.00**	-	-	-	-	-	-	-	-	-
	B.1	37.50	10.00	0.27	HF #2	0.43	Base	10.00	10.0	16.0	15.0
	B.2	6.50	10.00	1.54	HF #2	0.43	Base	10.00	10.0	12.0	15.0
	B.3	7.00	10.00	1.43	HF #2	0.43	Base	10.00	10.0	12.0	15.0
SW GRID	**D**	**37.00**	-	-	-	-	-	-	-	-	-
	D.1	6.00	10.00	1.67	HF #2	0.43	Base	10.00	10.0	13.0	15.0
	D.2	11.50	10.00	0.87	HF #2	0.43	Base	10.00	10.0	13.0	15.0
	D.3	19.50	10.00	0.51	HF #2	0.43	Base	10.00	10.0	14.0	15.0
SW GRID	**E**	**26.00**	-	-	-	-	-	-	-	-	-
	E.2	10.50	10.00	0.95	HF #2	0.43	Base	10.00	10.0	13.0	15.0
	E.3	15.50	10.00	0.65	HF #2	0.43	Interstory	10.00	10.0	14.0	15.0

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**A**	8030	1840	-	-	-	-	-	-
SW Segment	A.1	2788	639	5185			SW-6	2	**HDU2 (3075DF,2215HF)**
	A.2	1158	265	2153			SW-6	2	**HDU2 (3075DF,2215HF)**
	A.3	4084	936	6253			SW-6	2	**No HD**
SW GRID	**B**	8790	2800				-	-	-
	B.1	6463	2059	12750			SW-6	2	**No HD**
	B.2	1120	357	1820			SW-6	2	**HDU2 (3075DF,2215HF)**
	B.3	1206	384	1960			SW-6	2	**HDU2 (3075DF,2215HF)**
SW GRID	**D**	9130	3200				-	-	-
	D.1	1481	519	1770			SW-6	2	**HDU2 (3075DF,2215HF)**
	D.2	2838	995	3393			SW-6	2	**HDU2 (3075DF,2215HF)**
	D.3	4812	1686	6045			SW-6	2	**HDU2 (3075DF,2215HF)**
SW GRID	**E**	9270	1760				-	-	-
	E.2	3744	711	3098			SW-4	2	**HDU2 (3075DF,2215HF)**
	E.3	5526	1049	4805			SW-4	2	**(2) CS16 (3410)**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (N-S)**

Shear Wall Schedule (LRFD) $\phi_D =$ 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

**See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
A.1	183	1.00	197	42	45	197	SW-6	416	OK	Seismic
A.2	183	1.00	197	42	45	197	SW-6	416	OK	Seismic
A.3	183	1.00	197	42	45	197	SW-6	416	OK	Seismic
B.1	172	1.00	185	55	59	185	SW-6	416	OK	Seismic
B.2	172	1.00	185	55	59	185	SW-6	416	OK	Seismic
B.3	172	1.00	185	55	59	185	SW-6	416	OK	Seismic
D.1	247	1.00	265	86	93	265	SW-6	416	OK	Seismic
D.2	247	1.00	265	86	93	265	SW-6	416	OK	Seismic
D.3	247	1.00	265	86	93	265	SW-6	416	OK	Seismic
E.2	357	1.00	383	68	73	383	SW-4	608	OK	Seismic
E.3	357	1.00	383	68	73	383	SW-4	608	OK	Seismic

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
A.1	15.25	14.77	3.28%	No	
A.2	6.33	5.85	8.28%	No	
A.3	22.33	21.96	1.71%	No	
B.1	37.50	37.13	1.01%	No	
B.2	6.50	6.02	8.05%	No	
B.3	7.00	6.52	7.43%	No	
D.1	6.00	5.52	8.78%	No	
D.2	11.50	11.02	4.40%	No	
D.3	19.50	19.02	2.55%	No	
E.2	10.50	10.02	4.84%	No	
E.3	15.50	15.29	1.36%	Yes	11.75

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN
Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (N-S)**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
A.1	1280		1280	251		251	2593	2593
A.2	1280		1280	251		251	1077	1077
A.3	1280		1280	251		251	3127	3127
B.1	1206		1206	329		329	6375	6375
B.2	1206		1206	329		329	910	910
B.3	1206		1206	329		329	980	980
D.1	1727		1727	519		519	885	885
D.2	1727		1727	519		519	1696	1696
D.3	1727		1727	519		519	3023	3023
E.2	2496		2496	406		406	1549	1549
E.3	3292		3292	536		536	2403	2403

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
A.1	1304	-33	1304	-33	-33	HDU2 (3075DF,2215HF)	-2215	OK
A.2	395	-762	395	-762	-762	HDU2 (3075DF,2215HF)	-2215	OK
A.3	1625	224	1625	224	224	No HD	0	OK
B.1	3496	1860	3496	1860	1860	No HD	0	OK
B.2	217	-769	217	-769	-769	HDU2 (3075DF,2215HF)	-2215	OK
B.3	259	-735	259	-735	-735	HDU2 (3075DF,2215HF)	-2215	OK
D.1	12	-1302	12	-1302	-1302	HDU2 (3075DF,2215HF)	-2215	OK
D.2	499	-911	499	-911	-911	HDU2 (3075DF,2215HF)	-2215	OK
D.3	1295	-273	1295	-273	-273	HDU2 (3075DF,2215HF)	-2215	OK
E.2	523	-1751	523	-1751	-1751	HDU2 (3075DF,2215HF)	-2215	OK
E.3	906	-2137	906	-2137	-2137	(2) CS16 (3410)	-3410	OK

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (N-S Continued)**

S_{ds} = 0.85
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory or Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**F**	**8.50**	-	-	-	-	-	-	-	-	-
SW Segment	F.2	4.75	10.00	2.11	HF #2	0.43	Interstory	10.00	10.0	2.0	15.0
	F.3	3.75	10.00	2.67	HF #2	0.43	Interstory	10.00	10.0	2.0	15.0
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**F**	1300	2160	-	-	-	-	-	-
SW Segment	F.2	726	1207	618			SW-6	2	MSTC48B3 (3975DF, 3900HF)
	F.3	574	953	488			SW-6	2	MSTC48B3 (3975DF, 3900HF)
SW GRID							-	-	-
SW GRID							-	-	-
SW GRID							-	-	-

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (N-S Continued)**

Shear Wall Schedule (LRFD) ϕ_D =   0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
F.2	153	0.99	167	254	277	277	SW-6	584	OK	Wind
F.3	153	0.92	179	254	298	298	SW-6	584	OK	Wind

*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
F.2	4.75	4.54	4.59%	Yes	3.75
F.3	3.75	3.54	5.88%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN
Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Roof (N-S Continued)**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
F.2	1356		1356	1931		1931	309	309
F.3	1071		1071	1525		1525	244	244

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
F.2	-1746	-1208	-1746	-1208	**-1746**	**MSTC48B3 (3975DF, 3900HF)**	**-3900**	**OK**
F.3	-1378	-953	-1378	-953	**-1378**	**MSTC48B3 (3975DF, 3900HF)**	**-3900**	**OK**

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Main Floor (N-S)**

Sds =	0.85
Depth of Floor Framing & Plates (Clearspan) at Interstory (in) =	17.25

Shear Wall Line Information

SW Mark		L_{SW} (ft)	Wall Pier h_{wp} (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory or Base?	h_{sw} (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
SW GRID	**E**	**12.25**	-	-	-	-	-	-	-	-	-
SW Segment	E.1	12.25	8.00	0.65	HF #2	0.43	Base	8.00	10.0	2.0	12.0
SW GRID	**F**	**7.25**	-	-	-	-	-	-	-	-	-
	F.1	7.25	8.00	1.10	HF #2	0.43	Base	8.00	10.0	3.0	30.0
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-
SW GRID		**0.00**	-	-	-	-	-	-	-	-	-

Shear Wall Loads and Summary

SW Mark		EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holdown
SW GRID	**E**	3950	1760	-	-	-	-	-	-
SW Segment	E.1	3950	1760	1274			**SW-6**	**2**	**HDU5 (5645DF, 4340HF)**
SW GRID	**F**	2660	2600				-	-	-
	F.1	2660	2600	1233			**SW-6**	**2**	**HDU2 (3075DF,2215HF)**
SW GRID							-	-	-
SW GRID							-	-	-

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Main Floor (N-S)**

Shear Wall Schedule (LRFD) ϕ_D = 0.8

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, G_a (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

See SDPWS Table 4.3A Note 2

Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
E.1	322	1.00	347	144	154	347	SW-6	416	OK	Seismic
F.1	367	1.00	395	359	386	395	SW-6	416	OK	Seismic

NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input M_{OT} Lever Arm (ft)
E.1	12.25	11.77	4.12%	No	
F.1	7.25	6.77	7.16%	No	

LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Adams Residence**
Floor Level: **Main Floor (N-S)**

Shear Wall End Axial Load (ASD)

SW Segment Mark	Seismic Tension (lb)	ASD Seismic Tension Above (lb)	Seismic Tension Total (lb)	Wind Tension (lb)	ASD Wind Tension Above (lb)	Wind Tension Total (lb)	End 1 Dead (lb)	End 2 Dead (lb)
E.1	1806	**2137**	3942	690	**-906**	-216	637	637
F.1	2055		2055	1721		1721	616	616

Determine Required Holdown (ASD)

SW Segment Mark	Wind End 1 Eq. 16-15	EQ End 1 Eq. 16-16	Wind End 2 Eq. 16-15	EQ End 2 Eq. 16-16	Controlling Ten. Load (lb)	Holdown	Holdown Capacity (lb)	Status
E.1	598	-3636	598	-3636	**-3636**	HDU5 (5645DF, 4340HF)	**-4340**	OK
F.1	-1352	-1758	-1352	-1758	**-1758**	HDU2 (3075DF,2215HF)	**-2215**	OK

| **Quantum Consulting Engineers LLC**	Project: Adams Residence	Date:	6/4/23	Job No:	22229.01
1511 Third Avenue, Suite 323		Designer:	MKS	Sheet:	3
Seattle, WA 98101	Client: McFadden Design	Checked By:			

Force Transfer Around Openings Calculator
TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code:	IBC 2018	Date:	6/1/2023
Designer:	MKS		
Client:	McFadden Design		
Project:	Adams Residence		
Wall Line:	SW W6.1		
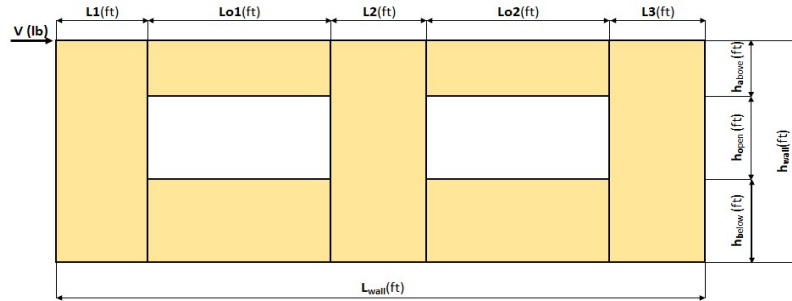
Shear Wall Calculation Variables

		Opening 1		Opening 2	Adj. Factor Method =	1.25-0.125h/bs
V	2540 lbf				Wall Pier Aspect Ratio	Adj. Factor
L1	2.00 ft	h_a1	2.00 ft	h_a2 2.00 ft	P1=h_o/L1= 2.13	0.984
L2	7.00 ft	h_o1	4.25 ft	h_o2 4.25 ft	P2=h_o/L2= 0.61	N/A
L3	7.00 ft	h_b1	3.75 ft	h_b2 3.75 ft	P3=h_o/L3= 0.61	N/A
h_{wall}	10.00 ft	Lo1	2.00 ft	Lo2 2.00 ft		
L_{wall}	20.00 ft					

1. Hold-down forces: H = Vh_{wall}/L_{wall}   1270 lbf

2. Unit shear above + below opening
First opening: va1 = vb1 = H/(h_a1+h_b1) =   221 plf
Second opening: va2 = vb2 = H/(h_a2+h_b2) =   221 plf

3. Total boundary force above + below openings
First opening: O1 = va1 x (Lo1) =   442 lbf
Second opening: O2 = va2 x (Lo2) =   442 lbf

4. Corner forces
F1 = O1(L1)/(L1+L2) =   98 lbf
F2 = O1(L2)/(L1+L2) =   344 lbf
F3 = O2(L2)/(L2+L3) =   221 lbf
F4 = O2(L3)/(L2+L3) =   221 lbf

5. Tributary length of openings
T1 = (L1*Lo1)/(L1+L2) =   0.44 ft
T2 = (L2*Lo1)/(L1+L2) =   1.56 ft
T3 = (L2*Lo2)/(L2+L3) =   1.00 ft
T4 = (L3*Lo2)/(L2+L3) =   1.00 ft

6. Unit shear beside opening
v1 = (V/L)(L1+T1)/L1 =   155 plf
v2 = (V/L)(T2+L2+T3)/L2 =   173 plf
v3 = (V/L)(T4+L3)/L3 =   145 plf
Check v1*L1+v2*L2+v3*L3=V?   2540 lbf **OK**

7. Resistance to corner forces
R1 = v1*L1 =   310 lbf
R2 = v2*L2 =   1214 lbf
R3 = v3*L3 =   1016 lbf

8. Difference corner force + resistance
R1-F1 =   212 lbf
R2-F2-F3 =   649 lbf
R3-F4 =   795 lbf

9. Unit shear in corner zones
vc1 = (R1-F1)/L1 =   106 plf
vc2 = (R2-F2-F3)/L2 =   93 plf
vc3 = (R3-F4)/L3 =   114 plf
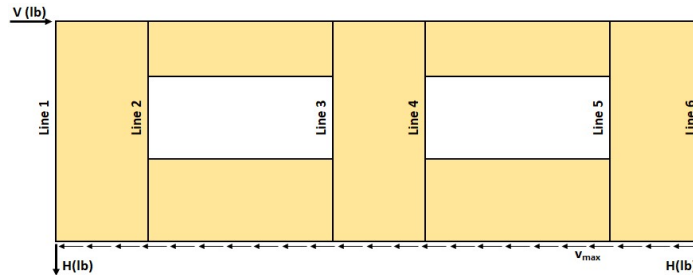
Check Summary of Shear Values for Two Openings

Line 1: vc1(h_a1+h_b1)+v1(h_o1)=H?		610	660	1270 lbf
Line 2: va1(h_a1+h_b1)-vc1(h_a1+h_b1)-v1(h_o1)=0?	1270	610	660	0
Line 3: vc2(h_a1+h_b1)+v2(h_o1)-va1(h_a1+h_b1)=0?	533	737	1270	0
Line 4: va2(h_a2+h_b2)-v2(h_o2)-vc2(h_a2+h_b2)=0?	1270	737	533	0
Line 5: va2(h_a2+h_b2)-vc3(h_a2+h_b2)-v3(h_o2)=0?	1270	653	617	0
Line 6: vc3(h_a2+h_b2)+ v3(h_o2) = H?		653	617	1270 lbf

Design Summary*

Req. Sheathing Capacity	221 plf	4-Term Deflection		3-Term Deflection	
Req. Strap Force	344 lbf	4-Term Story Drift %		3-Term Story Drift %	
Req. HD Force	1270 lbf				
Req. Shear Wall Anchorage Force	127 plf				