BTL
ENGINEERING

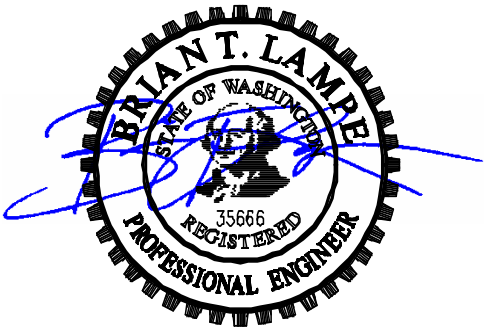
19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

Structural Calculations

For

Munson Residence
Outdoor Living Space
4628 Forest Avenue SE

February 15, 2022



Prepared by

Brian Lampe
Nathan Bonck

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

STRUCTURAL CALCULATIONS SHEET INDEX
Munson Residence
Outdoor Living Space

Item **Page #**

Criteria

- Design Criteria C1.1

Gravity

- Roof Framing
  - ✓ Key Plans R1.1
  - ✓ Beams R2.1
- Main Floor Framing
  - ✓ Key Plans MF1.1
  - ✓ Beams MF2.1

Lateral

- Forces
  - ✓ Criteria L1.1
  - ✓ Seismic Base Shear L1.2
  - ✓ Seismic Weight L1.3
  - ✓ Wind Lateral Loads L1.4
  - ✓ Vertical Distribution of Lateral Forces L1.6
- Shear Walls/Diaphragms
  - ✓ Roof Diaphragm Forces/ Upper Floor Diaphragm Forces L2.1
  - ✓ Shear Wall Forces L2.2
  - ✓ Shear Wall Analysis L2.3
- Shear Wall/Diaphragm Capacities
  - ✓ Allowable Diaphragm Stresses L3.1
  - ✓ Allowable Shear Wall Stresses L3.2
  - ✓ Shear Wall Anchor Bolts L3.3
  - ✓ Shear Wall Schedule L3.4

Miscellaneous

- Stud Wall Design M1.1
- Post Design M1.3
- Footing Design M2.1

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

Criteria

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Project: Munson Residence - Outdoor Living Space
Project Number: 4628 Forest Avenue SE

Code:	IBC 2018			
	Risk Category	II		
Earthquake:	Site Class	D		
		I_e = 1.00		R = 6.5
		S_S = 1.430		Ω_0 = 3.0
		S_1 = 0.549		C_d = 4.0
		ρ = 1.00		
Wind:	Basic Design Wind Speed, *V*		100 MPH	
	Exposure		C	
	Topographic Factor	K_{ZT} = 1.00		
Soil Bearing:	1500-psf Allowable Soil Bearing Pressure			
Concrete:	2500-psi Concrete Strength			
	Higher strength may be used, but special inspection and testing reports not req'd			
Nails:	Sheathing	8d common (2½" x 0.131")		
	Framing	12d box (3¼" x 0.131")		

Roof Framing:

Snow Load	Ground Snow, Pg		25 psf
		Exposure factor, Ce	1.0
		Thermal Factor, Ct	1.2
	Flat Roof Snow, Pf (0.7 Ce Ct I Pg)		21 psf
	Use Snow Load		**25 psf**
	Attic (where accessible)		10 psf
Dead Load	Roofing - Composition Shingles		4.0 psf
	Sheathing - 7/16 OSB		2.2 psf
	Framing - 2x12 @ 24"oc		2.2 psf
	Insulation - Batt.		1.0 psf
	Ceiling - 5/8 GWB		2.8 psf
	Misc.		2.5 psf
		Total	**15 psf**
Deflection	L/360 Live Load, L/240 Total Load		

Floor Framing:

Live Load	Residential		40 psf
	Decks		60 psf
Dead Load	Finish Floor - Carpet/Vinyl		5.0 psf
	Sheathing - 3/4 Plywood/Edge Gold		2.5 psf
	Framing - I-Joists @ 16"oc		2.7 psf
	Ceiling - 5/8 GWB		2.8 psf
	Misc.		2.0 psf
		Total	**15 psf**
Deflection	L/480 Live Load, L/240 Total Load		

Wall Framing:

Dead Load	Exterior 2x Stud Walls	10 psf
	Interior 2x Stud Walls	8 psf

Hazards by Location

Search Information

Address: 4628 Forest Ave SE, Mercer Island, WA 98040, USA

Coordinates: 47.5627828, -122.2294819

Elevation: 127 ft

Timestamp: 2022-02-09T20:52:25.710Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D

Basic Parameters

Name	Value	Description
S_S	1.438	MCE_R ground motion (period=0.2s)
S_1	0.499	MCE_R ground motion (period=1.0s)
S_{MS}	1.438	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.959	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

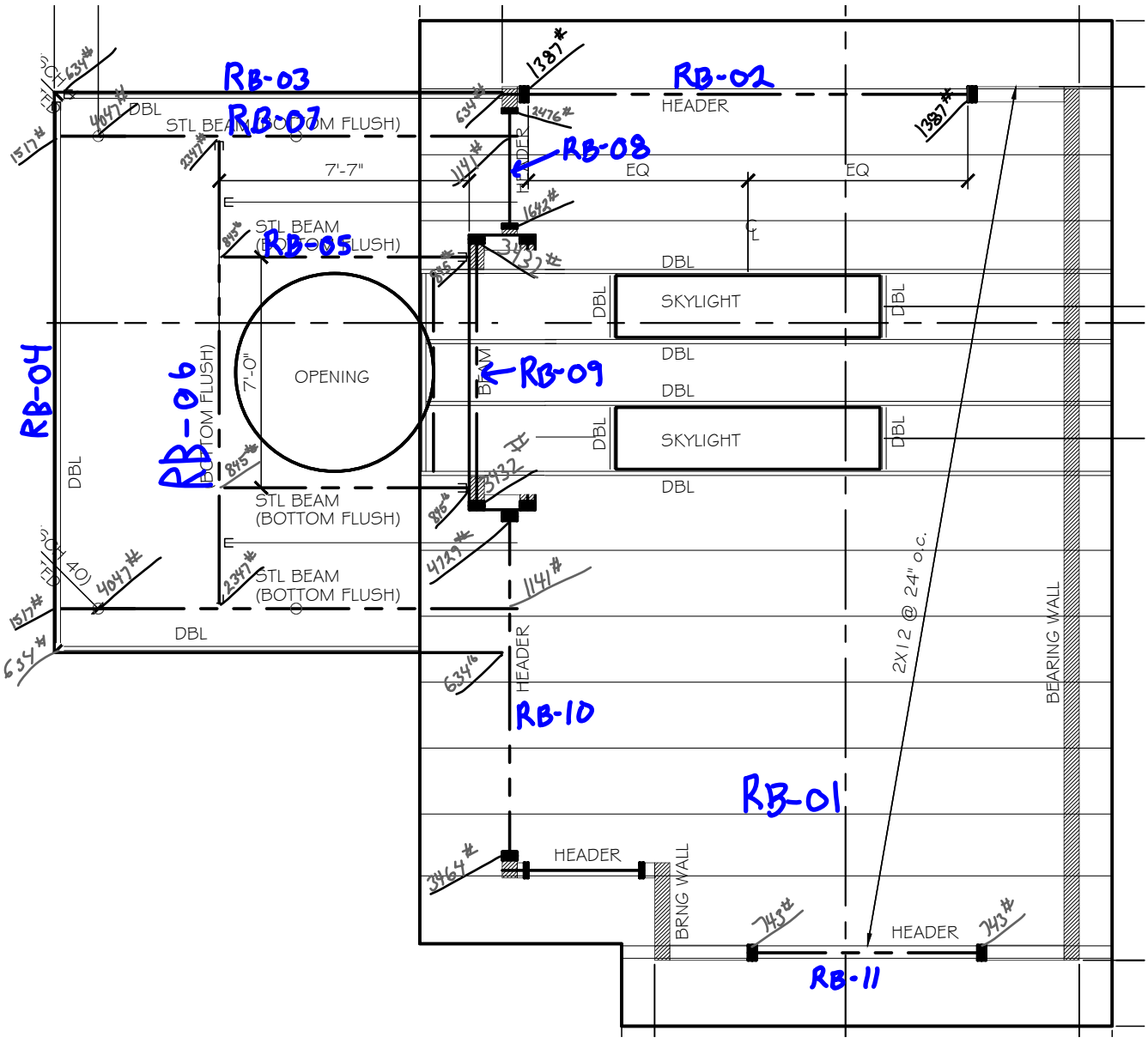
Name	Value	Description
SDC	* null	Seismic design category
F_a	1	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.902	Coefficient of risk (0.2s)
CR_1	0.898	Coefficient of risk (1.0s)
PGA	0.616	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.677	Site modified peak ground acceleration

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

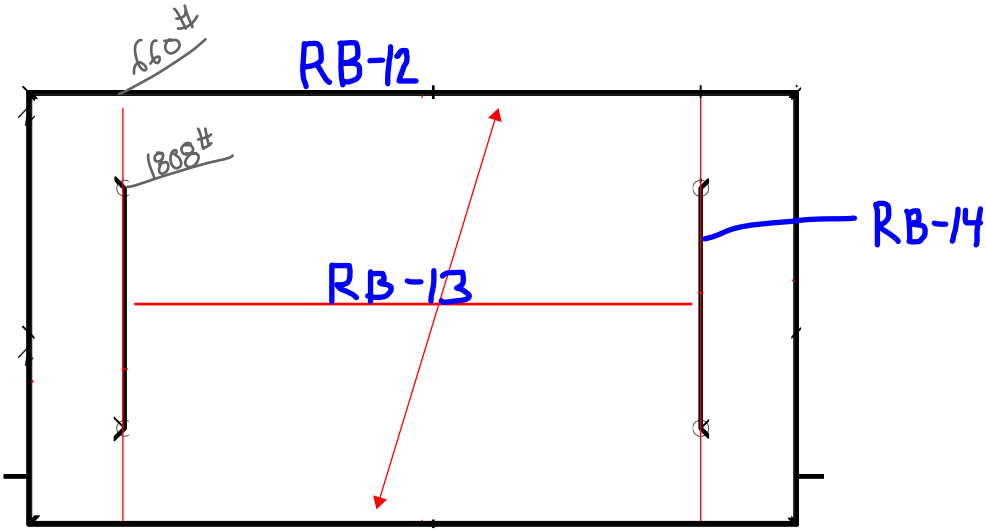
Gravity

Roof Framing



Roof Framing Key Plan

R1.1



Roof Framing Key Plan

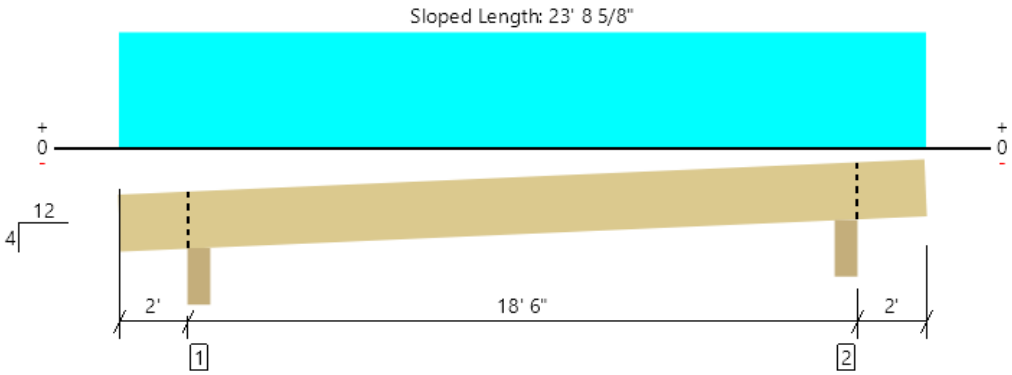
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-01

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



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

Member Length : 24' 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)	922 @ 2' 2 3/4"	3522 (5.50")	Passed (26%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	648 @ 3' 4 3/16"	2329	Passed (28%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	3180 @ 11' 3"	3138	Passed (101%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.448 @ 11' 3"	0.634	Passed (L/509)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.721 @ 11' 3"	0.951	Passed (L/317)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240). Upward deflection on left and right cantilevers exceeds overhang deflection criteria.
- 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	Total	
1 - Beveled Plate - HF	5.50"	5.50"	1.50"	356	566	922	Blocking
2 - Beveled Plate - HF	5.50"	5.50"	1.50"	356	566	922	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6" o/c	
Bottom Edge (Lu)	22' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 22' 6"	24"	15.0	25.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

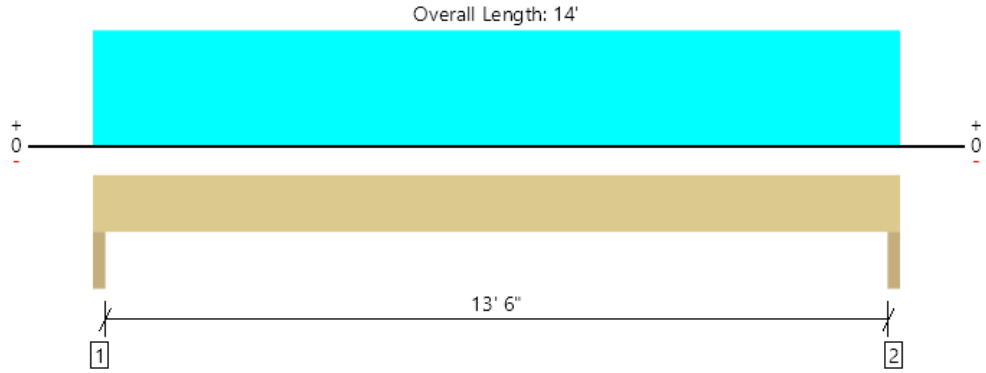
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-02

1 piece(s) 4 x 10 DF No.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)	1387 @ 1 1/2"	6563 (3.00")	Passed (21%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1185 @ 1' 1/4"	4468	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4684 @ 7'	5166	Passed (91%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.163 @ 7'	0.458	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.432 @ 7'	0.688	Passed (L/382)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - DF	3.00"	3.00"	1.50"	862	525	1387	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	862	525	1387	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	14' o/c	
Bottom Edge (Lu)	14' o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 14'	N/A	8.2	--	
1 - Uniform (PSF)	0 to 14'	3'	15.0	25.0	Default Load
2 - Uniform (PSF)	0 to 14'	7'	10.0	-	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

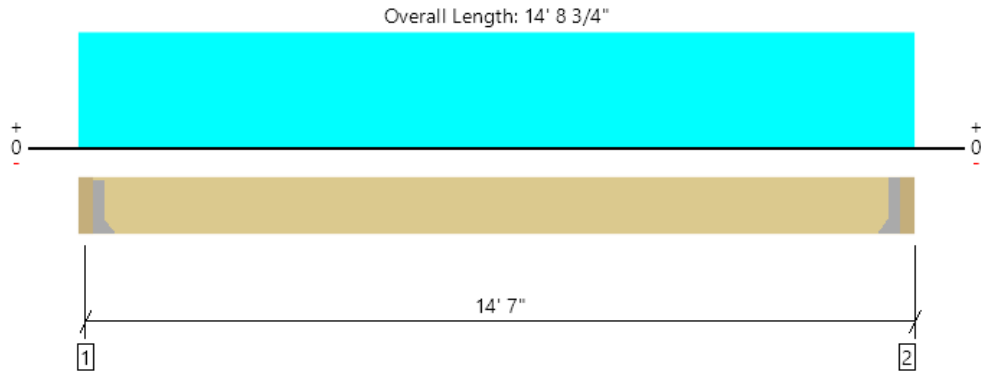
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-03

1 piece(s) 4 x 8 DF No.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)	611 @ 3 1/2"	3281 (1.50")	Passed (19%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	559 @ 10 3/4"	3502	Passed (16%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2162 @ 7' 4 3/8"	3438	Passed (63%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.253 @ 7' 4 3/8"	0.472	Passed (L/670)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.438 @ 7' 4 3/8"	0.707	Passed (L/388)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Hanger on 7 1/4" SPF beam	3.50"	Hanger[1]	1.50"	266	368	634	See note [1]
2 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	266	368	634	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)	14' 2" o/c	
Bottom Edge (Lu)	14' 2" 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	HUC46	2.50"	N/A	8-10dx1.5	4-10d	
2 - Face Mount Hanger	HUC48	2.50"	N/A	10-10dx1.5	4-10d	

- 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)	3 1/2" to 14' 5 1/4"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 14' 8 3/4" (Top)	2'	15.0	25.0	

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

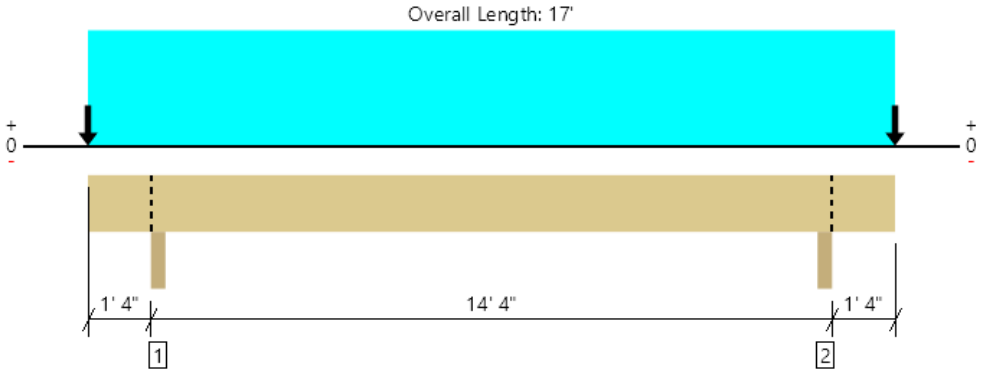
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-04

1 piece(s) 4 x 8 DF No.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)	1518 @ 1' 5 3/4"	4961 (3.50")	Passed (31%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	708 @ 8 3/4"	3502	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1756 @ 8' 6"	3438	Passed (51%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.219 @ 8' 6"	0.468	Passed (L/769)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.321 @ 8' 6"	0.702	Passed (L/525)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Beam - HF	3.50"	3.50"	1.50"	623	894	1517	Blocking
2 - Beam - HF	3.50"	3.50"	1.50"	623	894	1517	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' o/c	
Bottom Edge (Lu)	17' 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'	N/A	6.4	--	
1 - Uniform (PSF)	0 to 17' (Front)	2' 4 1/2"	15.0	25.0	Default Load
2 - Point (lb)	17' (Back)	N/A	266	368	Linked from: RB-03, Support 1
3 - Point (lb)	0 (Back)	N/A	266	368	Linked from: RB-03, Support 1

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

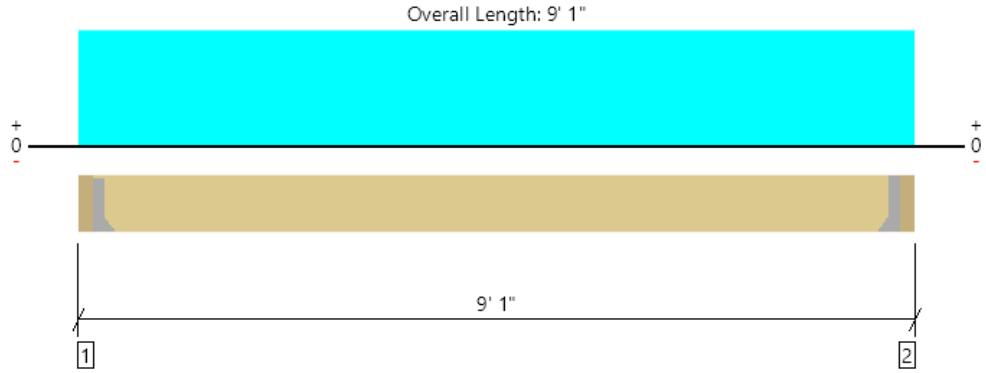
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-05

1 piece(s) 4 x 8 DF No.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)	792 @ 3 1/2"	3281 (1.50")	Passed (24%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	680 @ 10 3/4"	3502	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1684 @ 4' 6 1/2"	3438	Passed (49%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.074 @ 4' 6 1/2"	0.283	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.123 @ 4' 6 1/2"	0.425	Passed (L/828)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	334	511	845	See note [1]
2 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	334	511	845	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)	8' 6" o/c	
Bottom Edge (Lu)	8' 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	LUS46	2.00"	N/A	4-10d	4-10d	
2 - Face Mount Hanger	LUS46	2.00"	N/A	4-10d	4-10d	

- 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)	3 1/2" to 8' 9 1/2"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 9' 1" (Top)	4' 6"	15.0	25.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

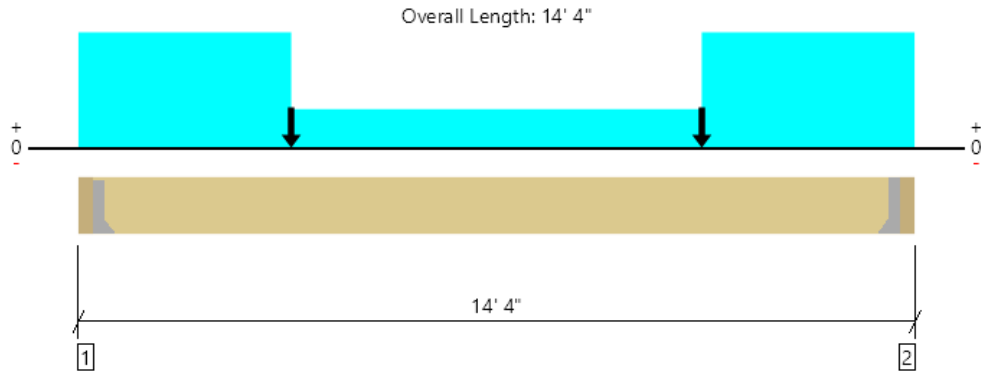
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-06

1 piece(s) 3 1/2" x 9" 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)	2260 @ 3 1/2"	3413 (1.50")	Passed (66%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2029 @ 1' 1/2"	6400	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	6535 @ 7' 2"	10868	Passed (60%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.373 @ 7' 2"	0.458	Passed (L/442)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.623 @ 7' 2"	0.688	Passed (L/265)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- 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 = 13' 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	Total	
1 - Hanger on 9" HF beam	3.50"	Hanger[1]	1.50"	930	1417	2347	See note [1]
2 - Hanger on 9" HF beam	3.50"	Hanger[1]	1.50"	930	1417	2347	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)	13' 9" o/c	
Bottom Edge (Lu)	13' 9" 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	HHUS48	3.00"	N/A	22-10d	8-10d	
2 - Face Mount Hanger	HHUS48	3.00"	N/A	22-10d	8-10d	

- 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)	3 1/2" to 14' 1/2"	N/A	7.7	--	
1 - Uniform (PSF)	0 to 14' 4" (Front)	2' 6"	15.0	25.0	Default Load
2 - Uniform (PSF)	0 to 3' 8" (Back)	5'	15.0	25.0	Default Load
3 - Uniform (PSF)	10' 8" to 14' 4" (Back)	5'	15.0	25.0	Default Load
4 - Point (lb)	3' 8" (Back)	N/A	334	511	Linked from: RB-05, Support 1
5 - Point (lb)	10' 8" (Back)	N/A	334	511	Linked from: RB-05, Support 1

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

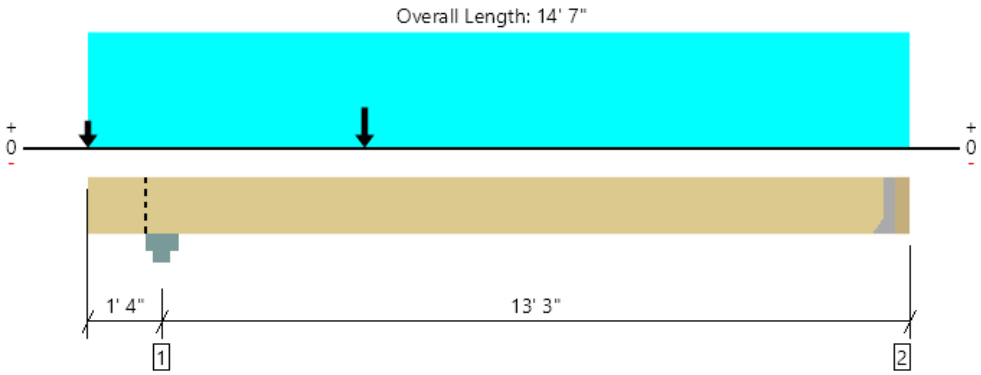
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-07

1 piece(s) 3 1/2" x 9" 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)	1118 @ 14' 3 1/2"	3413 (1.50")	Passed (33%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	2318 @ 2' 5"	6400	Passed (36%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	6601 @ 5'	10868	Passed (61%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-2101 @ 1' 4"	8377	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.275 @ 7' 4 9/16"	0.432	Passed (L/565)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.442 @ 7' 4 15/16"	0.648	Passed (L/352)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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 = 12' 3 7/8".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 2' 2 5/8".
- 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	Total	
1 - Column Cap - steel	8.00"	8.00"	1.78"	1651	2396	4047	Blocking
2 - Hanger on 9" HF beam	3.50"	Hanger[1]	1.50"	449	692	1141	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)	14' 4" o/c	
Bottom Edge (Lu)	14' 4" 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	HU48	2.50"	N/A	14-10dx1.5	6-10d	

- 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 14' 3 1/2"	N/A	7.7	--	
1 - Uniform (PSF)	0 to 14' 7" (Top)	2'	15.0	25.0	
2 - Point (lb)	5' (Front)	N/A	930	1417	Linked from: RB-06, Support 1
3 - Point (lb)	0 (Top)	N/A	623	894	Linked from: RB-04, Support 1

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

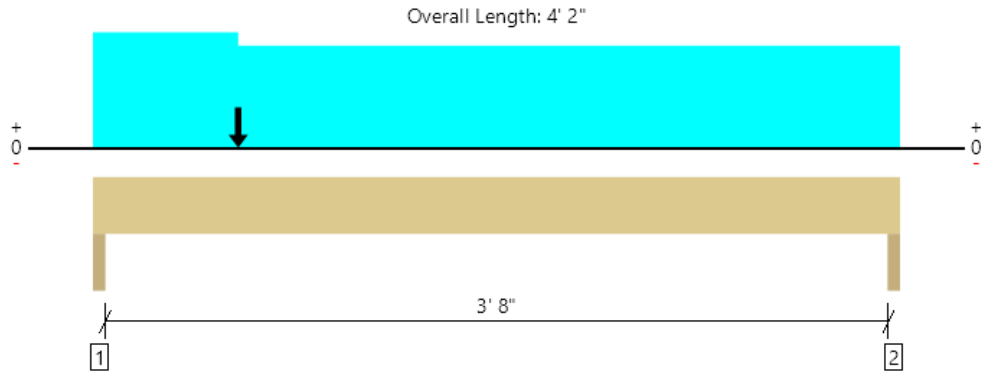
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-08

1 piece(s) 4 x 10 DF No.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)	2477 @ 1 1/2"	6563 (3.00")	Passed (38%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1295 @ 1' 1/4"	4468	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1729 @ 1' 9 13/16"	5166	Passed (33%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.008 @ 2' 3/8"	0.131	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.013 @ 2' 7/16"	0.196	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - DF	3.00"	3.00"	1.50"	1035	1441	2476	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	708	934	1642	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 2" o/c	
Bottom Edge (Lu)	4' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 4' 2"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 4' 2"	11' 3"	15.0	25.0	Default Load
2 - Uniform (PSF)	0 to 4' 2"	6'	10.0	-	Default Load
3 - Uniform (PSF)	0 to 9"	6' 9"	15.0	25.0	Default Load
4 - Uniform (PSF)	9" to 4' 2"	4' 6"	15.0	25.0	Default Load
5 - Point (lb)	9"	N/A	449	692	Linked from: RB-07, Support 2

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

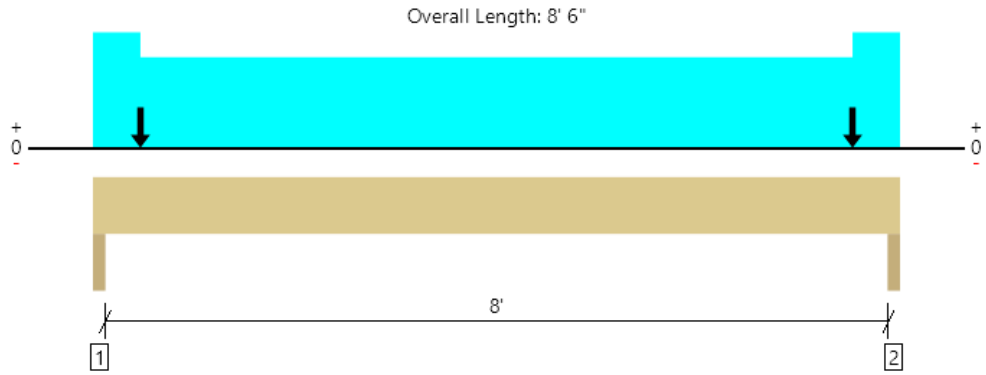
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-09

1 piece(s) 4 x 12 DF No.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)	3432 @ 1 1/2"	6563 (3.00")	Passed (52%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2032 @ 1' 2 1/4"	5434	Passed (37%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5348 @ 4' 3"	7004	Passed (76%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.051 @ 4' 3"	0.275	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.100 @ 4' 3"	0.412	Passed (L/992)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - DF	3.00"	3.00"	1.57"	1596	1836	3432	None
2 - Trimmer - DF	3.00"	3.00"	1.57"	1596	1836	3432	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 6"	N/A	10.0	--	
1 - Uniform (PSF)	0 to 8' 6"	12'	15.0	25.0	ROOF/ LOW ROOF
2 - Uniform (PSF)	0 to 8' 6"	10'	10.0	-	WALL WT
3 - Uniform (PSF)	0 to 6"	4'	15.0	25.0	LOW ROOF
4 - Uniform (PSF)	8' to 8' 6"	4'	15.0	25.0	Default Load
5 - Point (lb)	6"	N/A	334	511	Linked from: RB-05, Support 1
6 - Point (lb)	8'	N/A	334	511	Linked from: RB-05, Support 1

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

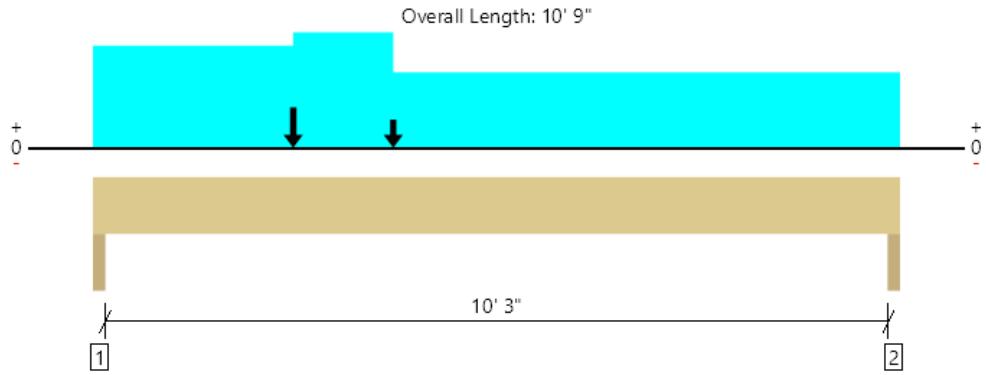
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-10

1 piece(s) 3 1/2" x 10 1/2" 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)	4729 @ 1 1/2"	6825 (3.00")	Passed (69%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3942 @ 1' 1 1/2"	7466	Passed (53%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	11138 @ 4' 7/8"	14792	Passed (75%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.201 @ 5' 2 1/4"	0.350	Passed (L/628)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.356 @ 5' 2 7/16"	0.525	Passed (L/353)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
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 = 10' 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	Total	
1 - Trimmer - DF	3.00"	3.00"	2.08"	2039	2690	4729	None
2 - Trimmer - DF	3.00"	3.00"	1.52"	1546	1918	3464	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 10' 9"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 10' 9"	11' 3"	15.0	25.0	Default Load
2 - Uniform (PSF)	0 to 10' 9"	6'	10.0	-	Default Load
3 - Uniform (PSF)	2' 8" to 4'	6' 9"	15.0	25.0	Default Load
4 - Uniform (PSF)	0 to 2' 8"	4' 6"	15.0	25.0	Default Load
5 - Point (lb)	4'	N/A	266	368	Linked from: RB-03, Support 1
6 - Point (lb)	2' 8"	N/A	449	692	Linked from: RB-07, Support 2

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

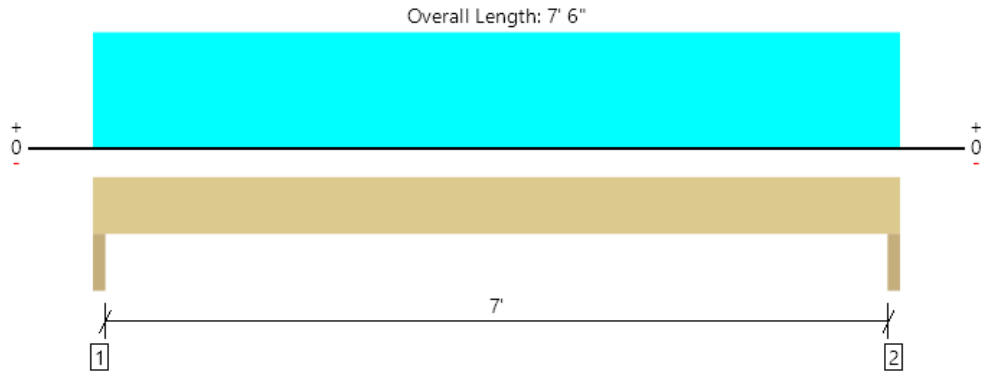
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB-11

1 piece(s) 4 x 10 DF No.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)	743 @ 1 1/2"	6563 (3.00")	Passed (11%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	541 @ 1' 1/4"	4468	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1302 @ 3' 9"	5166	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.013 @ 3' 9"	0.242	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.033 @ 3' 9"	0.363	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - DF	3.00"	3.00"	1.50"	462	281	743	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	462	281	743	None

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.

Vertical Loads	Location	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"	3'	15.0	25.0	Default Load
2 - Uniform (PSF)	0 to 7' 6"	7'	10.0	-	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

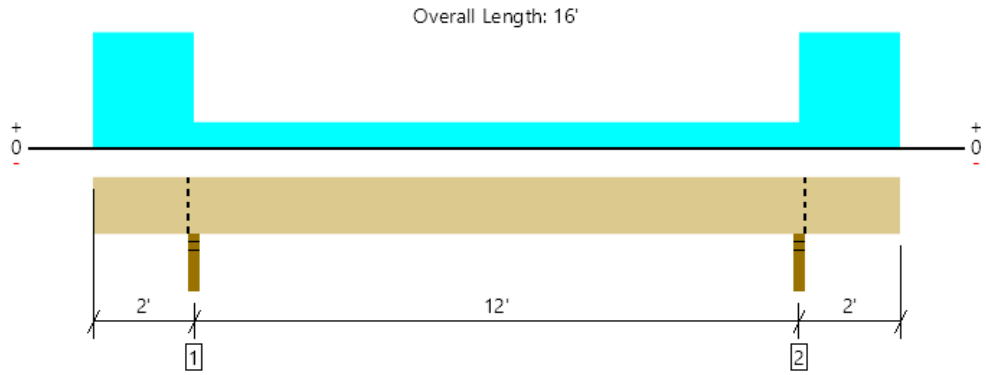
FORTE WEB

MEMBER REPORT

PASSED

Canopy, RB-12

1 piece(s) 4 x 8 DF No.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)	661 @ 2'	6563 (3.00")	Passed (10%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	254 @ 2' 8 3/4"	3502	Passed (7%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	575 @ 8'	3438	Passed (17%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.046 @ 8'	0.400	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.076 @ 8'	0.600	Passed (L/999+)	--	1.0 D + 1.0 S (Alt 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).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - DF	3.00"	3.00"	1.50"	276	384	660	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	276	384	660	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	16' o/c	
Bottom Edge (Lu)	16' 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 16'	N/A	6.4	--	
1 - Uniform (PSF)	0 to 2' (Front)	4' 6"	15.0	25.0	Default Load
2 - Uniform (PSF)	2' to 14' (Front)	1'	15.0	25.0	Default Load
3 - Uniform (PSF)	14' to 16' (Front)	4' 6"	15.0	25.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

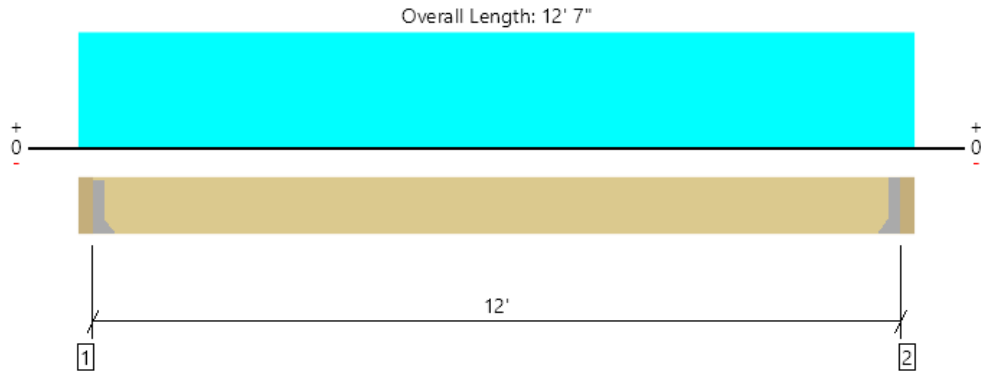
FORTE WEB

MEMBER REPORT

PASSED

Canopy, RB-13

1 piece(s) 2 x 8 HF No.2 @ 24" OC



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)	420 @ 3 1/2"	911 (1.50")	Passed (46%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	378 @ 10 3/4"	1251	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1260 @ 6' 3 1/2"	1477	Passed (85%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.377 @ 6' 3 1/2"	0.400	Passed (L/382)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.527 @ 6' 3 1/2"	0.600	Passed (L/273)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	126	315	441	See note [1]
2 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	126	315	441	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)	4' 11" o/c	
Bottom Edge (Lu)	12' 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	LU26	1.50"	N/A	6-10dx1.5	4-10dx1.5	
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)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 12' 7"	24"	10.0	25.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

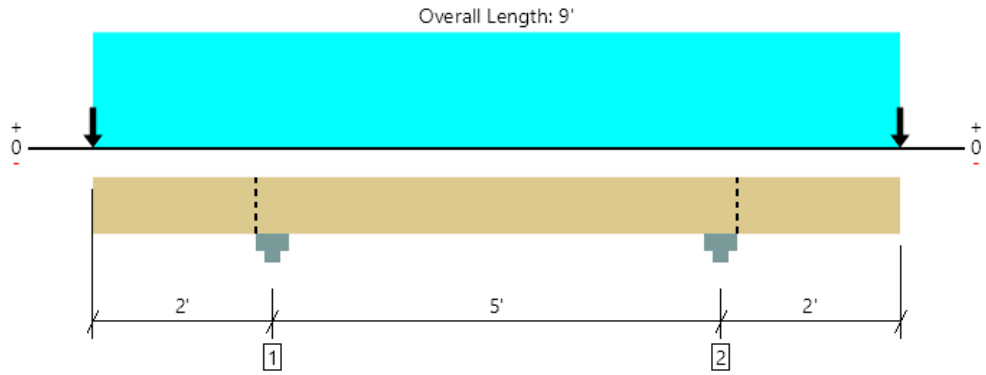
FORTE WEB

MEMBER REPORT

PASSED

Canopy, RB-14

1 piece(s) 6 x 8 HF No.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)	1808 @ 2'	17820 (8.00")	Passed (10%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	901 @ 1' 1/2"	4428	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-1782 @ 2'	2841	Passed (63%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.048 @ 0	0.200	Passed (2L/996)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.078 @ 0	0.200	Passed (2L/618)	--	1.0 D + 1.0 S (Alt 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).
- Overhang deflection criteria: LL (2L/0.2") and TL (2L/0.2").
- 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	Total	
1 - Column Cap - steel	8.00"	8.00"	1.50"	607	1201	1808	Blocking
2 - Column Cap - steel	8.00"	8.00"	1.50"	607	1201	1808	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	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	10.4	--	
1 - Point (lb)	0 (Top)	N/A	276	384	Linked from: RB-12, Support 1
2 - Point (lb)	9' (Top)	N/A	276	384	Linked from: RB-12, Support 2
3 - Uniform (PLF)	0 to 9' (Front)	N/A	63.0	157.5	Linked from: Roof: Joist, Support 1

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

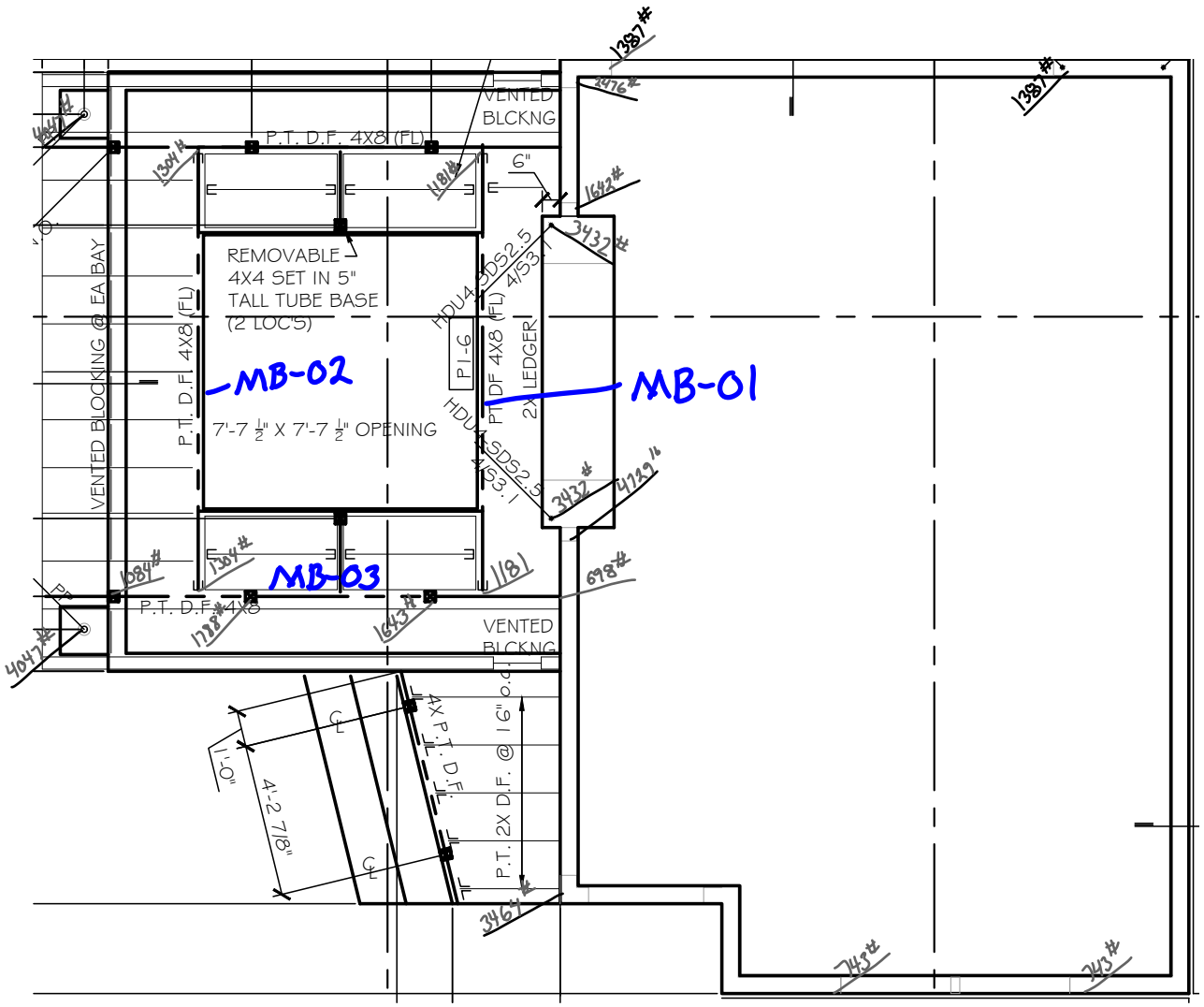
Weyerhaeuser

BTL
ENGINEERING

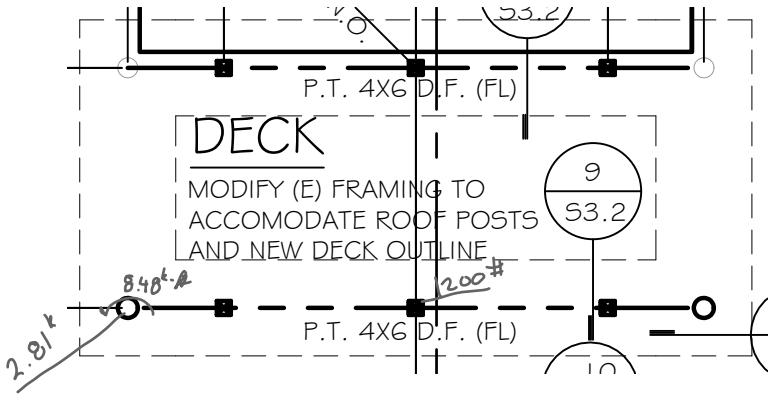
19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

Gravity

Main Floor Framing



Main Floor Framing Key Plan



Main Floor Framing Key Plan

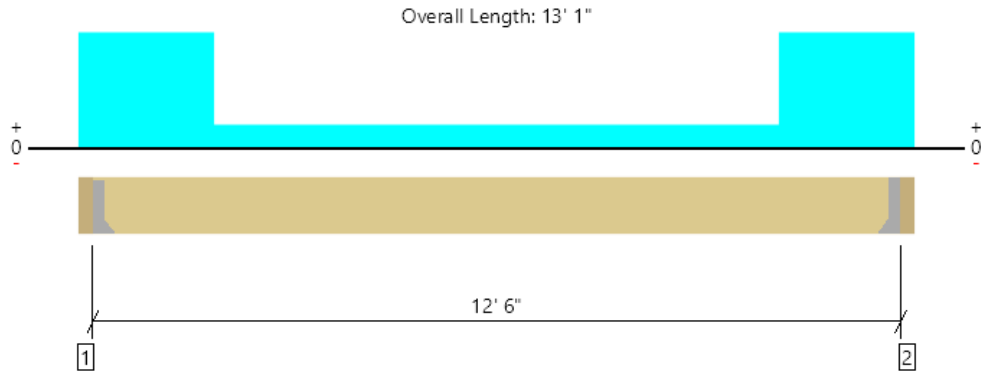
FORTE WEB

MEMBER REPORT

PASSED

Main Level, MB-01

1 piece(s) 4 x 8 DF No.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)	1071 @ 3 1/2"	3281 (1.50")	Passed (33%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	841 @ 10 3/4"	3045	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2118 @ 6' 6 1/2"	2989	Passed (71%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.264 @ 6' 6 1/2"	0.417	Passed (L/568)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.350 @ 6' 6 1/2"	0.625	Passed (L/428)	--	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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	268	913	1181	See note [1]
2 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	268	913	1181	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)	12' 6" o/c	
Bottom Edge (Lu)	12' 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	HU46	2.50"	N/A	12-10d	6-10d	
2 - Face Mount Hanger	HU46	2.50"	N/A	12-10d	6-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 12' 9 1/2"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 2' 2" (Top)	4'	15.0	60.0	Default Load
2 - Uniform (PSF)	0 to 13' 1" (Top)	1'	15.0	60.0	Default Load
3 - Uniform (PSF)	10' 11" to 13' 1" (Top)	4'	15.0	60.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

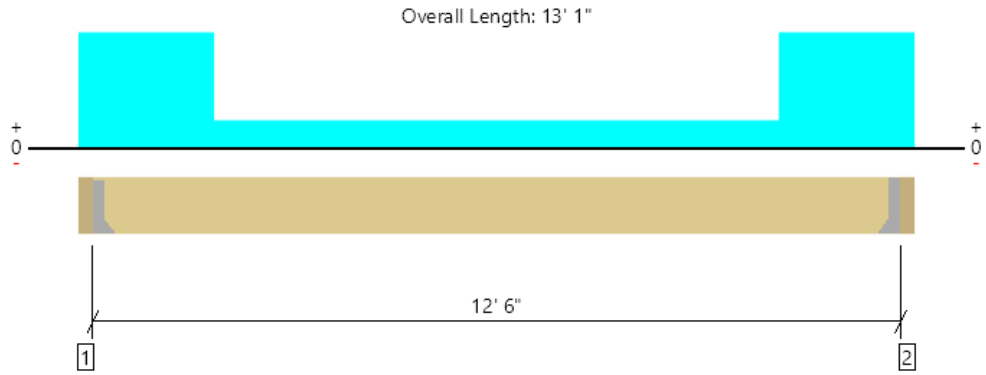
FORTE WEB

MEMBER REPORT

PASSED

Main Level, MB-02

1 piece(s) 4 x 8 DF No.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)	1189 @ 3 1/2"	3281 (1.50")	Passed (36%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	947 @ 10 3/4"	3045	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2484 @ 6' 6 1/2"	2989	Passed (83%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.311 @ 6' 6 1/2"	0.417	Passed (L/483)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.408 @ 6' 6 1/2"	0.625	Passed (L/368)	--	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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	293	1011	1304	See note [1]
2 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	293	1011	1304	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)	12' 6" o/c	
Bottom Edge (Lu)	12' 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	HU46	2.50"	N/A	12-10d	6-10d	
2 - Face Mount Hanger	HHUS46	3.00"	N/A	14-10d	6-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 12' 9 1/2"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 2' 2" (Top)	4'	15.0	60.0	Default Load
2 - Uniform (PSF)	0 to 13' 1" (Top)	1' 3"	15.0	60.0	Default Load
3 - Uniform (PSF)	10' 11" to 13' 1" (Top)	4'	15.0	60.0	Default Load

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

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

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

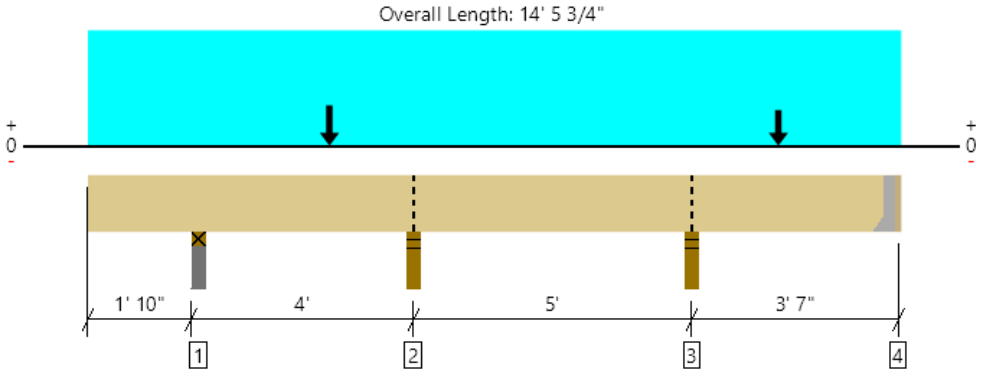
FORTE WEB

MEMBER REPORT

PASSED

Main Level, MB-03

1 piece(s) 4 x 8 DF No.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)	1787 @ 5' 10"	5206 (3.50")	Passed (34%)	--	1.0 D + 1.0 L (Adj Spans)
Shear (lbs)	1159 @ 5' 1"	3045	Passed (38%)	1.00	1.0 D + 1.0 L (Adj Spans)
Moment (Ft-lbs)	1141 @ 4' 4"	2989	Passed (38%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.011 @ 3' 10 11/16"	0.096	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.013 @ 3' 10 3/4"	0.193	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Plate on concrete - HF	3.50"	3.50"	1.50"	239	845	1084	None
2 - Stud wall - SPF	3.50"	3.50"	1.50"	360	1428	1788	Blocking
3 - Stud wall - SPF	3.50"	3.50"	1.50"	342	1301	1643	Blocking
4 - Hanger on 7 1/4" HF beam	1.50"	Hanger[1]	1.50"	147	551/-39	698/-39	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)	14' 4" o/c	
Bottom Edge (Lu)	14' 4" 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
4 - Face Mount Hanger	HU46	2.50"	N/A	8-10dx1.5	4-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 14' 4 1/4"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 14' 5 3/4" (Top)	2'	15.0	60.0	Default Load
2 - Point (lb)	12' 4" (Front)	N/A	268	913	Linked from: MB-01, Support 1
3 - Point (lb)	4' 4" (Front)	N/A	293	1011	Linked from: MB-02, Support 1

ForteWEB Software Operator	Job Notes
Nathan Bonck BTL Engineering (307) 258-1841 nathan.bonck@btleng.net	

Weyerhaeuser

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

Lateral
Forces

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Munson Residence - Outdoor Living Space
4628 Forest Avenue SE

Revision Date: 11/11/2021

Criteria

Code: 2018 IBC

Allowable Stress Design (ASD)

Seismic Design: **ASCE 7-16: 12.8 Equivalent Lateral Force Procedure**

Wind Design: **ASCE 7-16: Ch. 28 Envelope Procedure, Low Rise**

Risk Category: II - Other Structures *Table 1.5-1*

Snow Importance Factor	I_S =	1.00	*Table 1.5-2*
Ice Importance Factor - Thickness	I_i =	1.00	*Table 1.5-2*
Ice Importance Factor - Wind	I_w =	1.00	*Table 1.5-2*
Seismic Importance Factor	I_e =	1.00	*Table 1.5-2*
Spectral Response, Short Period	S_S =	1.438	(Mapped)
Spectral Response, 1-s Period	S_1 =	0.499	(Mapped)

Site Class based on Geotechnical Report

Site Class: D *Table 20.3-1*

Site Coefficient	F_a =	1.01	*Table 11.4-1*
Site Coefficient	F_v =	1.80	*Table 11.4-2*

Structural Systems:

Light framed walls with shear panels

All other structural systems

	T_L =	6	*(Figs. 22-14 thru 22-17)*
Response Modification Coefficient	R =	6.5	*Table 12.2-1*
Overstrength Factor	Ω_0 =	3	*Table 12.2-1*
Deflection Amplification Factor	C_d =	4	*Table 12.2-1*

Basic Wind Speed: 100 mph

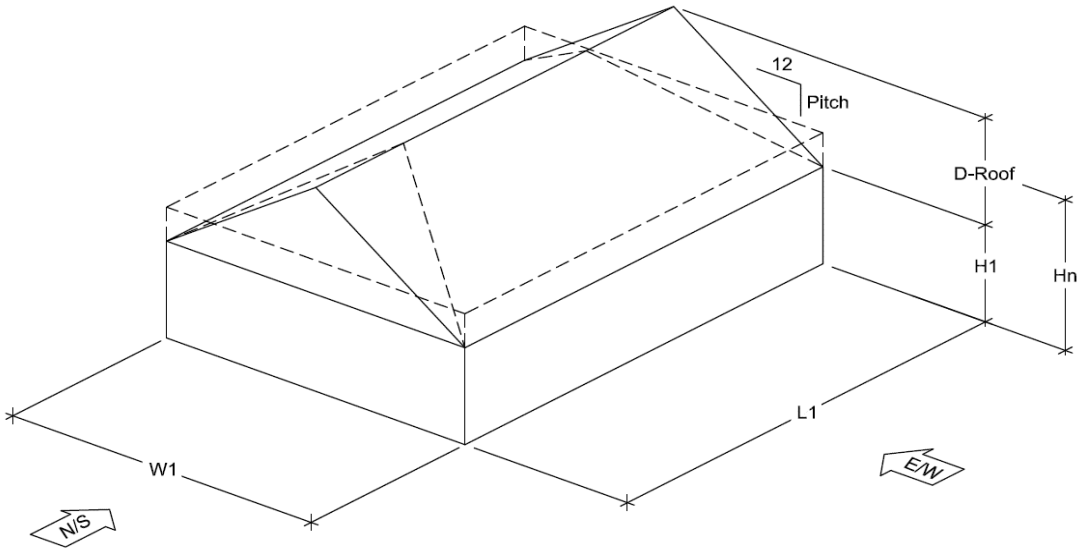
Exposure to Wind: Exposure C *Section 26.7.3*

Topographical Factor K_{ZT} = 1.00

BTL ENGINEERING
19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Munson Residence - Outdoor Living Space
4628 Forest Avenue SE

Revision Date: 11/11/2021



Roof		
Geometry		
Mean Roof Height	Hn =	12.25 ft
Roof Depth	D-Roof =	7.5 ft
Overhang Length		24 in
Pitch		4:12

Floor 1		
Geometry		
Width	W3 =	26.5 ft
Length	L3 =	17.5 ft
Plate Height	H3 =	8.5 ft
Floor Depth	D3 =	0 in

Seismic Weight - Roof				
Roof Area 1	461 SF	15 psf		6,915#
Roof Area 2	164 SF	6 psf		984#
Roof Area 3	223 SF	15 psf		3,345#
Exterior Wall 1	35 LF	11.3 ft	10 psf	3,938#
Exterior Wall 2	26.5 LF	4.25 ft	10 psf	1,126#
Exterior Wall 3	8.5 LF	9.13 ft	10 psf	776#
Exterior Wall 4	18 LF	4.25 ft	34 psf	2,601#
			Total	19,684#

N/S Projected Area - Roof	
Sloped Roof Area	215 SF
Gable/Parapet Area	28 SF
Wall Area	111 SF

E/W Projected Area - Roof	
Sloped Roof Area	
Gable/Parapet Area	42 SF
Wall Area	107 SF

Date: 2/9/2022

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Redundancy, ρ 1.0 *(Section 12.3.4)*

Design Base Shear

$S_{MS} = F_a S_S$ *(Eq. 11.4-1)* $S_{M1} = F_v S_1$ *(Eq. 11.4-2)*

$= 1.46$ $= 0.90$

$S_{DS} = \frac{2}{3} S_{MS}$ *(Eq. 11.4-3)* $S_{D1} = \frac{2}{3} S_{M1}$ *(Eq. 11.4-4)*

$= 0.97$ $= 0.60$

Seismic Design Category:

Short Period -- D

1-Second Period -- D

Structure Period and Weight:

$C_t = 0.020$ *Table 12.8-2*

$x = 0.75$

Building Height (Mean Roof), $h_n = 12$ ft

Approximate Fundamental Period, $T_a = C_t (h_n)^x$ *(Eq. 12.8-7)*

$T = T_a = 0.13$

$T_L = 6$ *(Figs. 22-14 thru 22-17)*

Calculated design base shear:

$V = C_s W$ (Eq. 12.8-1)

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)}$$ (Eq. 12.8-2)

$C_s = 0.15$

The total design base shear need not exceed:

(Eq. 12.8-3) (Eq. 12.8-4)

for $T \leq T_L$ $C_s = \frac{S_{D1}}{T\left(\frac{R}{I_e}\right)}$ for $T > T_L$ $C_s = \frac{S_{D1} T_L}{T^2\left(\frac{R}{I_e}\right)}$

$C_s = 0.70$ $C_s = 32.25$

$C_s = 0.70$ $T \leq TL$

$C_s = 1.06$ *1.5 times Cs in accordance with 11.4.8*

The total design base shear shall not be less than:

$C_s = 0.044 S_{DS} I_e \geq 0.01$ (Eq. 12.8-5)

$C_s = 0.04$

nor where $S_1 \geq 0.6g$*:*

$C_s = 0.5 S_1/(R/I_e)$ (Eq. 12.8-6)

$C_s = 0.00$

$C_s = 0.15$

$V = 0.15 W$

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Munson Residence - Outdoor Living Space
4628 Forest Avenue SE

Revision Date: 11/11/2021

$\rho_S = \lambda K_{ZT} \rho_{S30}$ (28.5-1)

λ = 1.21 (Fig. 28.5.1)

K_{ZT} = 1.00 (Section 26.8)

Exposure = C
Mean Roof Ht hn (ft) = 12 ft
a (roof) = 3.0 ft
Basic Wind Speed = 100 mph
Roof Angle = 19

North/South Loading *28.5.4 Minimum Design Loads*

	Zone	Area	p_{S30} (psf)	$p_{S30\ design}$ (psf)	ρ (psf)	*Force (#)*	*ASD Force (#)*	*Force (#)*	*ASD Force (#)*
Roof	A_{wall}	26	21.6	21.6	26.1	666	400	408	245
	Agable	23	21.6	21.6	26.1	588	353	360	216
	B	45	-6.0	0.0	0.0	0	0	360	216
	Cwall	86	14.3	14.3	17.4	1484	890	1368	821
	Cgable	6	14.3	14.3	17.4	95	57	88	53
	D	170	-3.3	0.0	0.0	0	0	1360	816
	Total Area =	354			Total Load =	2832	1699	3944	2366
					Design:	***3944***	***2366***		

East/West Loading *28.5.4 Minimum Design Loads*

	Zone	Area	p_{S30} (psf)	$p_{S30\ design}$ (psf)	ρ (psf)	*Force (#)*	*ASD Force (#)*	*Force (#)*	*ASD Force (#)*
Roof	Awall	26	21.6	21.6	26.1	666	400	408	245
	Agable	23	21.6	21.6	26.1	588	353	360	216
	B	0	-6.0	0.0	0.0	0	0	0	0
	Cwall	82	14.3	14.3	17.4	1414	848	1304	782
	Cgable	20	14.3	14.3	17.4	338	203	312	187
	D	0	-3.3	0.0	0.0	0	0	0	0
	Total Area =	149			Total Load =	3006	1804	2384	1430
					Design :	***3006***	***1804***		

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Munson Residence - Outdoor Living Space
4628 Forest Avenue SE

Revision Date: 11/11/2021

Vertical Distribution of Lateral Forces

Base Shear:

V = 2.94 kips

Shear Walls:

$F_x = C_{vx} V$ *(Eq. 12.8-11)*

$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k}$ *(Eq. 12.8-12)*

Diaphragms:

$$F_{px} = \left(\sum_{i=x}^{n} F_i \Big/ \sum_{i=x}^{n} w_i\right)(w_{px}) \ldots [Eq.\ 12.10-1]$$

$F_{px} = 0.2 S_{DS} I_e w_{px} \ldots [Eq.\ 12.10-2]$ (min)

$F_{px} = 0.4 S_{DS} I_e w_{px} \ldots [Eq.\ 12.10-3]$ (max)

	Strength Design Seismic Forces (E)							
Floor Level (from base)	Height, h_x (ft)	Story Weight, w_x (Kips)	$w_x h_x$ (ft-Kips)	Lateral Force, F_x (Kips)	Story Shear, ΣF_x (Kips)	Story Moment (ft-Kips)	Portion of Weight at *i*, Σw_i (Kips)	Diaphragm Force, Fpx (Kips)
Roof	12.3	19.68	241	2.94	2.94	36	20	3.82
Totals	W =	19.68 Kips						
		$\Sigma w_x h_x$ =	241	ft-Kips				

	Strength Design Wind Forces (W)			
Floor Level (from base)	Lateral Force N/S, H_x (Kips)	Story Shear N/S, ΣHx (Kips)	Lateral Force E/W, H_x (Kips)	Story Shear E/W, ΣH_x (Kips)
Roof	3.94	3.94	3.01	3.01

	Diaphragm (ASD)		
	Seismic, [0.7E] (kips)	Wind N/S [0.6W] (kips)	Wind E/W [0.6W] (kips)
Roof	2.67	2.37	1.80

	Shear Walls (ASD)		
	Seismic, [0.7E] (kips)	Wind N/S [0.6W] (kips)	Wind E/W [0.6W] (kips)
Floor 1	2.06	2.37	1.80

BTL ENGINEERING
19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
www.btleng.net

OUTDOOR CANOPY

ASCE 7-16

EQ $V = C_S W = 1.67^K$ $F_{px} = 0.2 S_{DS} I_e W_{px} = 0.42$

$W = 2160^{lb}$ $F_{pm} = 0.4 S_{DS} I_e W_{px} = 0.84 \Rightarrow 0.58^K$

$C_S = 0.77$

$R = 1\frac{1}{4}$

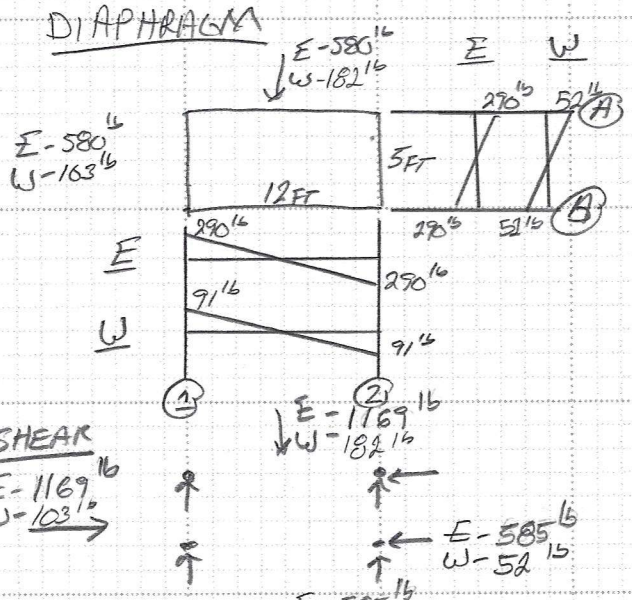
WIND

$P = q_h G C_N = 19 psf$

$(0.6)\ 16FT\ (19psf)(1) = 182^{lb}$

$(0.6)\ 9FT\ (\quad X\ ) = 103^{lb}$

DIAPHRAGM



ASCE §12.12-1

$\delta = 0.020 h_{sx} = 2.4"$

DIAPHRAGM STRESSES

A/B - E - $290^{lb}/12FT = 24plf < 160plf$

W - $52^{lb}/12FT = 4plf < 160plf$

1/2 - E - $290^{lb}/5FT = 58plf < 160plf$

W - $91^{lb}/5FT = 18plf < 160plf$

Project: _____ Designed By: _____ Date: _____

Project Number: _____ Client: _____ Scale: _____ Page: L1.6

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

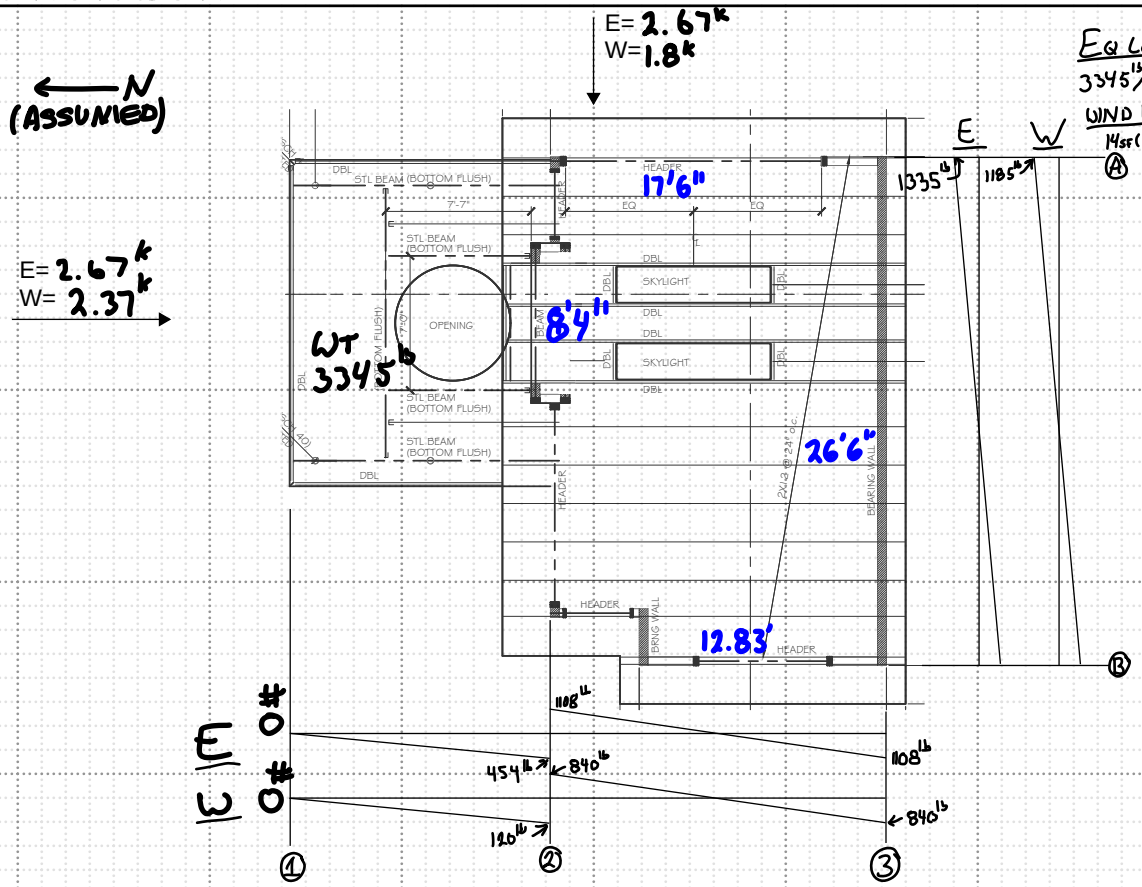
Lateral

Shear Walls/Diaphragms

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

ROOF DIAPHRAGM



Diaphragm Stresses

LINE 2
E - 1108lb / 8'4" = 133plf < 160plf
W - 840lb / 8'4" = 101plf < 160plf

LINE 3
E - 1108lb / 26'6" = 42plf < 160plf
W - 840lb / 26'6" = 32plf < 160plf

LINE A
E - 1330lb / 17'6" = 76plf < 160plf
W - 1185lb / 17'6" = 68plf < 160plf

LINE B
E - 1335lb / 12.83' = 104plf < 160plf
W - 1185lb / 12.83' = 92plf < 160plf

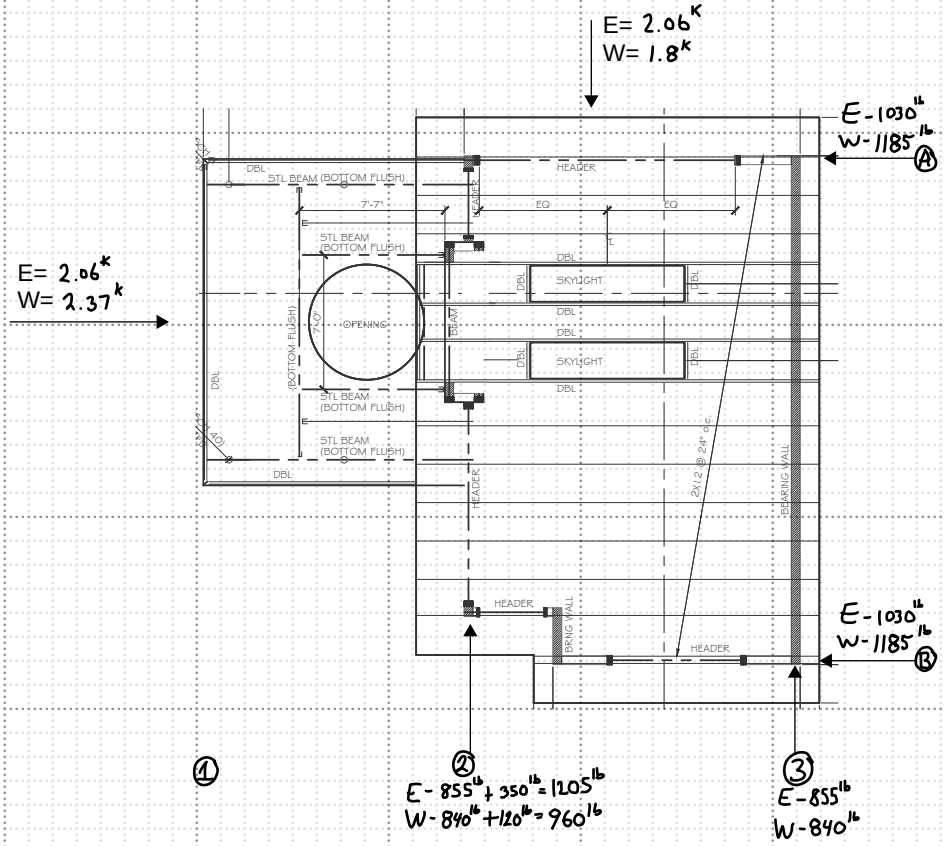
Project: _____ Designed By: _____ Date: _____

Project Number: _____ Client: _____ Scale: _____ Page: L2.1

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

UPPER FLOOR SHEAR WALL



EQ LOAD AWNING
3345lb/19684lb x 2.06k = .350k

WIND LOAD AWNING
14sf(14.3)(0.6) = 120lb

2 E-855lb + 350lb = 1205lb
W-840lb + 120lb = 960lb

3 E-855lb
W-840lb

Project: _____ Designed By: _____ Date: _____

Project Number: _____ Client: _____ Scale: _____ Page: L2.2

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

SHEAR WALL LINE (2)

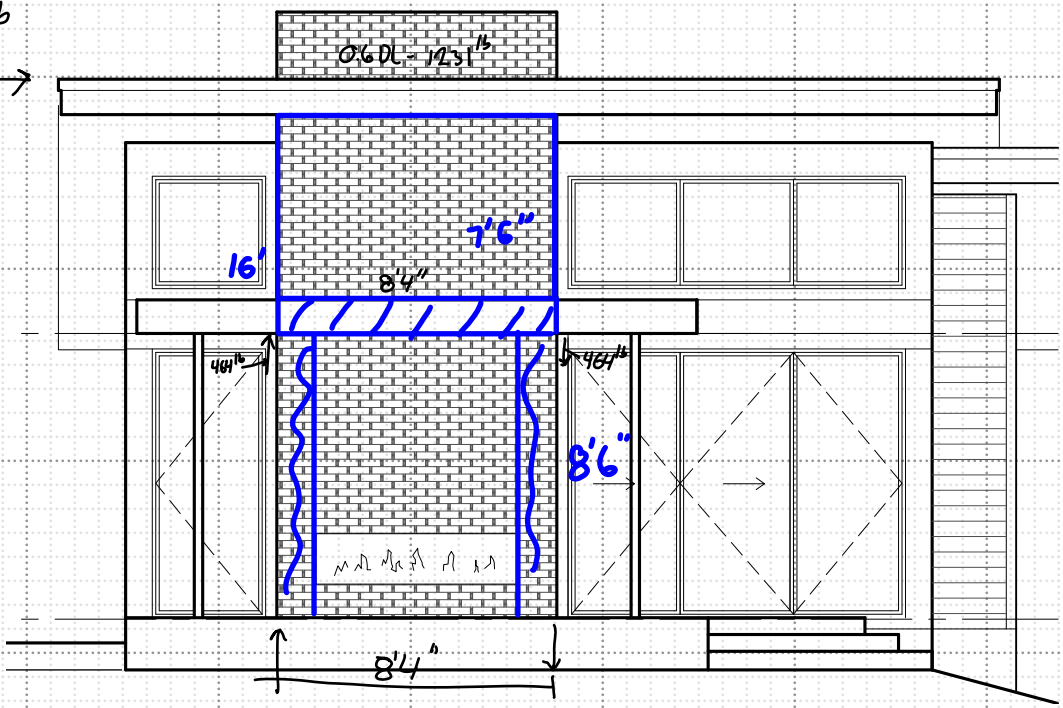
UPPER

$V_E = 1205^{lb}/8'4" = 145 plf$

$V_W = 960^{lb}/8'4" = 121 plf$

P1-6

E - 1205^{lb}
W - 960^{lb}

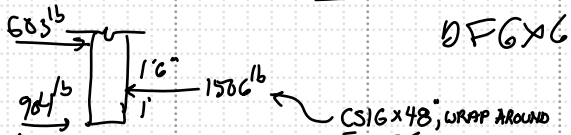


UPLIFT $1205^{lb} \times 16'/8'4" = 2314^{lb}$ HDU2-SD2.5

COLUMN

$1205^{lb} \times 1/2 \times 1'6" = 904^{lb\text{-}ft}$ ← ok

DFGx6



LAP 4 ES OF COLUMN TO SILL PL

PILE

DL - $10psf(16') + 15psf(18.5'/2 + 2 + 8'/2) + 150pcf(8sf) = 1588 plf$

SL - $25psf(18.5'/2 + 2 + 8'/2) = 381 plf$

$\Sigma 16.4^k$, 4"@2", USE (5)

$M_{OT} = 2314^{lb}(8')$ - $19.283^{lb\text{-}ft}$

$M_{RES} = 1588plf(8')^2/2 = 55139^{lb\text{-}ft}$ $\frac{M_{RES}}{M_{OT}} = 2.86 > 1.5$ OK

Project: _____ Designed By: _____ Date: _____

Project Number: _____ Client: _____ Scale: _____ Page: L2.3

BTL
ENGINEERING

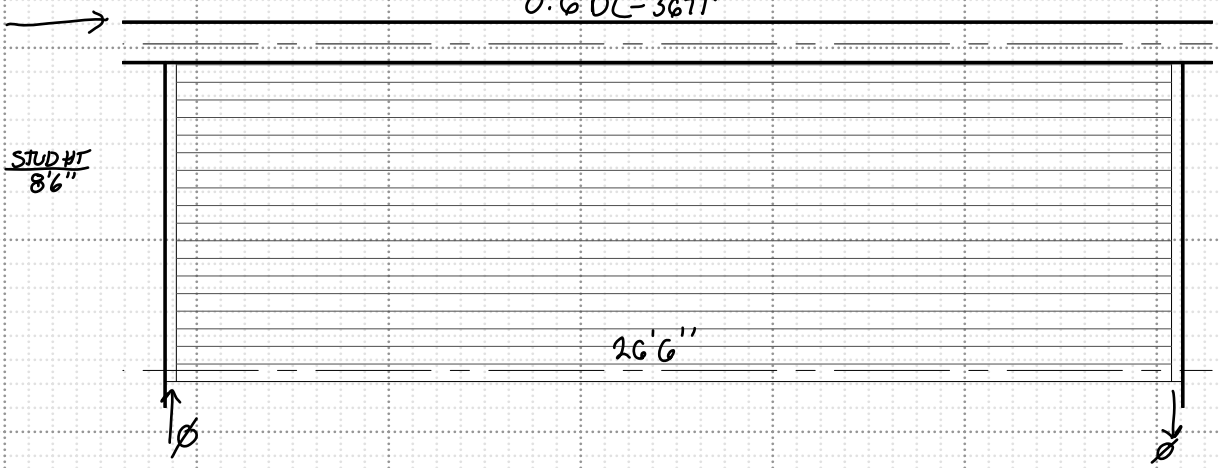
19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

UPPER

SHEAR WALL LINE (3)

E- 855#
W- 840#

$V_E = 855^{lb} / 26'6'' = 32 plf$ P1-6
$V_W = 840^{lb} / 26'6'' = 32 plf$
$0.6\,DL = 3677^{lb}$

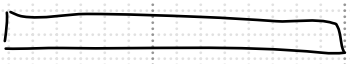


UPLIFT
$32 plf \times 8'6'' = 274^{lb}$
$274^{lb} < 3677^{lb}/2 =$ NO UPLIFT

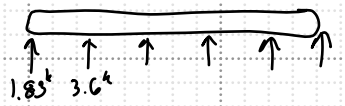
P/LE

DL- $10psf(8.5) + 15psf(17'6\tfrac{1}{2}'' + 1) + 150pcf(1.44) = 447 plf$
SL- $25psf(17'6''/2 + 1)$ $= 244 plf$
$691 plf$

$18312^{lb}/4^{k} =$ 5 PILES, USE 6, SPC 6: 5.3' OC MIN



OVERTURNING OK BY INSPECTION



Project: _____ Designed By: _____ Date: _____

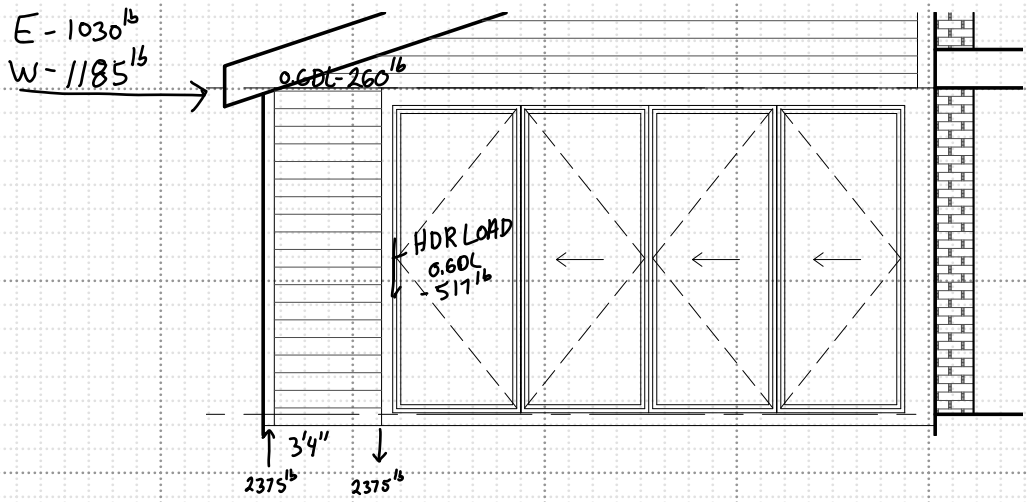
Project Number: _____ Client: _____ Scale: _____ Page: L2.4

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

SHEAR WALL LINE (A)

UPPER



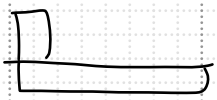
$V_E = 1030^{lb} / 3'4'' = 309$ plf $\quad \left[\frac{h}{b}\right] = 2.55 \Rightarrow 0.93$ ~~PLY~~ PI-3

$V_W = 1185^{lb} / 3'4'' = 356$ plf

UPLIFT

$356\text{plf} \times 8'6'' = 3022^{lb}$

$3022^{lb} - 260^{lb}/2 - 517^{lb} = \underline{2375^{lb}}$ ← HDU4 SDS2.5



PILE DESIGN

DL- $(10psf)(9ft) + (15psf)(3') + 150pcf(1.44ft) = 351plf$

SL- $(25psf)(3) = 75plf$

$(351+75)(11'6'') = 7458^{lb}$, 2" ø 4" CAP ⇒ 3 PILES MIN, USE (4)

8.83' o.c.

$M_{OT} = 3.092^{k}(3'4') = 10.3^{k\text{-}ft}$

$M_{RES} = 38.1 kip(17.5')/2 = 53.75$ $\quad \frac{M_{RES}}{M_{OT}} > 1.5$ OK

Project: _____ Designed By: _____ Date: _____

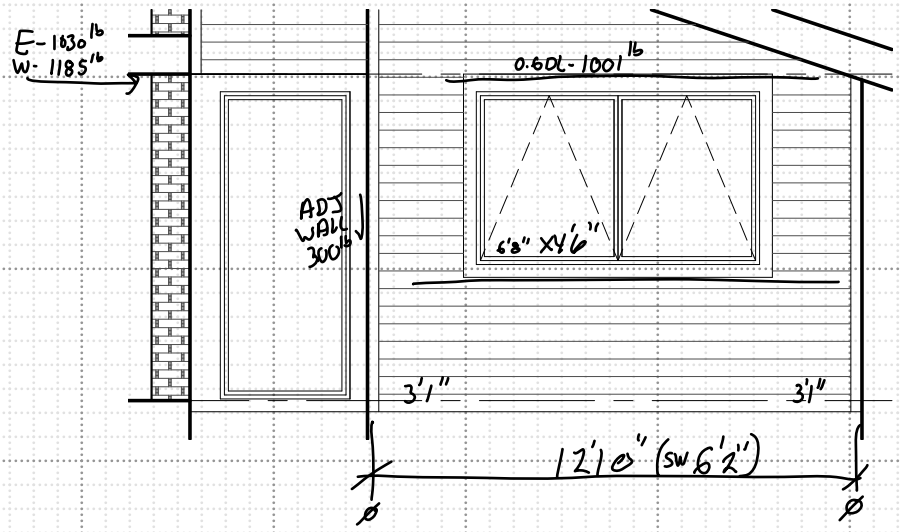
Project Number: _____ Client: _____ Scale: _____ Page: L2.5

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

SHEAR WALL LINE (B)

UPPER



$V_E = 1030^{lb}/62" = 167 plf$ P1-6
$V_W = 1185^{lb}/62" = 192 plf$

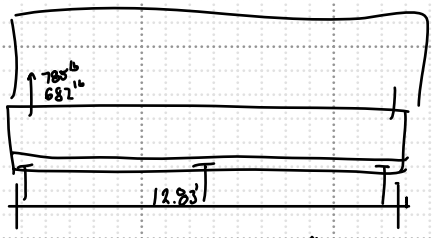
UPLIFT $1185^{lb} \times 8'6"/12'10" = 785^{lb}$ 679^{lb} (EQ)
$785^{lb} - 1001^{lb}/2 - 300^{lb} =$ NO UPLIFT

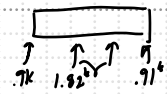
PILE DESIGN

DL- (10psf)(9FT) + (15psf)(3') + 150pcf((14"sq) = 35)plf, $M_{D REQ'D} = (.35)(KLF)(12'10")^2 = 28.16^{k-ft}$
SL- 25psf(3) = 75plf
$M_{LREQ'D} = (.075)(KLF)(12'10")^2 = 6.2^{k-ft}$

V	
DL-	4.5^k
SL-	$.963^k$
WL-	$.785^k$
EL-	$.682^k$

$> 5.467^k \Rightarrow$ 2"ϕ PILE 4k, USE 3 MIN (4) @ SPC 4.27' FT OC





$M_{OT} = (785^{lb})(12.83') = 10072^{lb-ft}$
$(679^{lb})(12.83') = 8712^{lb-ft}$
$M_{RES} = 0.6(.35)plf(12.83^2/2) = 17333^{lb}$
$M_{RES}/M_{OT} = 1.72 > 1.5$ OK

Project: _____ Designed By: _____ Date: _____

Project Number: _____ Client: _____ Scale: _____ Page: L2.6

BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

Lateral

Shear Wall/Diaphragm Capacities

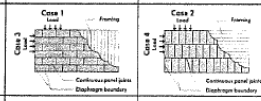
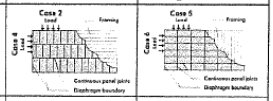
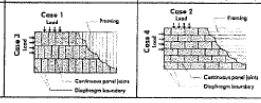
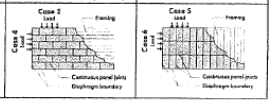
2018 IBC/SDPWS 2015 – Diaphragms (8d Nailing)

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

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

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

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

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

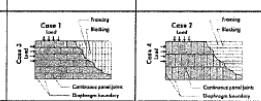
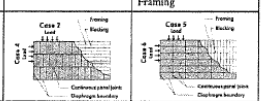
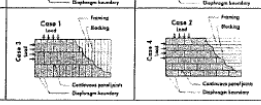
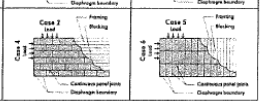
(a) Panel span rating for out-of-plane loads may be lower than the span rating with the long panel direction perpendicular to supports (See Section 3.2.2 and Section 3.2.3)

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

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

Sheathing Grade	Common Nail Size	Minimum Fastener Penetration in Framing Member or Blocking (in.)	Minimum Nominal Panel Thickness (in.)	Minimum Nominal Width of Nailed Face at Adjoining Panel Edges and Boundaries (in.)	A SEISMIC: Nail Spacing (in.) at diaphragm boundaries (all cases), at continuous panel edges parallel to load (Cases 3 & 4), and at all panel edges (Cases 5 & 6): 6 — Nail Spacing (in.) at other panel edges (Cases 1, 2, 3, & 4): 6 — v_s (plf)	G_a (kips/in.) OSB	G_a (kips/in.) PLY	6 — v_s (plf)	G_a (kips/in.) OSB	G_a (kips/in.) PLY	4 — v_s (plf)	G_a (kips/in.) OSB	G_a (kips/in.) PLY	2-1/2 or 2 — v_s (plf)	G_a (kips/in.) OSB	G_a (kips/in.) PLY	B WIND: Nail Spacing (in.) at diaphragm boundaries (all cases), at continuous panel edges parallel to load (Cases 3 & 4), and at all panel edges (Cases 5 & 6): 6	4	2-1/2 or 2 — Nail Spacing (in.) at other panel edges (Cases 1, 2, 3, & 4): 6 — v_w (plf)	6 — v_w (plf)	4 — v_w (plf)	3 — v_w (plf)
Structural I	6d	1-1/4	5/16	2	370	15	12	500	9.5	7.5	750	12	10	840	20	15	520	700	1050	1175
				3	420	12	9.5	560	7.0	6.0	840	9.5	8.5	950	17	13	590	785	1175	1330
	8d	1-3/8	3/8	2	540	14	11	720	9.0	7.5	1060	13	10	1200	21	15	755	1010	1485	1680
				3	600	12	10	800	7.5	6.5	1200	10	9.0	1350	18	13	840	1120	1680	1890
	10d	1-1/2	15/32	2	640	24	17	850	15	12	1280	20	15	1460	31	21	895	1190	1790	2045
				3	720	20	15	960	12	9.5	1440	16	13	1640	26	18	1010	1345	2015	2295
Sheathing and Single-Floor	6d	1-1/4	5/16	2	340	15	10	450	9.0	7.0	670	13	9.5	760	21	13	475	630	940	1065
				3	380	12	9.0	500	7.0	6.0	760	10	8.0	850	17	12	530	700	1065	1205
			3/8	2	370	13	9.5	500	7.0	6.0	750	10	8.0	840	18	12	520	700	1050	1175
				3	420	10	8.0	560	5.5	5.0	840	8.5	7.0	950	14	10	590	785	1175	1330
	8d	1-3/8	3/8	2	480	15	11	640	9.5	7.5	960	13	9.5	1090	21	13	670	895	1345	1525
				3	540	12	9.5	720	7.5	6.0	1080	11	8.5	1220	18	12	755	1010	1510	1710
			7/16	2	510	14	10	680	8.5	7.0	1010	12	9.5	1150	20	13	715	950	1415	1610
				3	570	11	9.0	760	7.0	6.0	1140	10	8.0	1290	17	12	800	1065	1595	1805
			15/32	2	540	13	9.5	720	7.5	6.5	1060	11	8.5	1200	19	13	755	1010	1485	1680
				3	600	10	8.5	800	6.0	5.5	1200	9.0	7.5	1350	15	11	840	1120	1680	1890
	10d	1-1/2	15/32	2	580	25	15	770	15	11	1150	21	14	1310	33	18	810	1080	1610	1835
				3	660	21	14	860	12	9.5	1300	17	12	1470	28	16	910	1205	1820	2060
			19/32	2	640	21	14	850	13	9.5	1280	18	12	1460	28	17	895	1190	1790	2045
				3	720	17	12	960	10	8.0	1440	14	11	1640	24	15	1010	1345	2015	2295

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

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

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

1. Reduction Factor = 2
2. G = 0.42 (SPF or Hem Fir)… Adjustment Factor = [1-(0.5-0.42)] = 0.92 or 0.5 (I-Joists or Douglas Fir)… Adjustment Factor = 1.0

Diaphragm	Sheathing Thickness	Nail Spacing Edge/Intermediate	Blocked	Framing	Seismic Capacity (Case 1/Other)	Wind Capacity (Case 1/Other)
Roof – Unblocked	7/16"	6"/12" oc	N	2x (SPF/HF)	212-plf/156-plf	297-plf/219-plf
Roof – Blocked	7/16"	4"/12" oc	Y	2x (SPF/HF)	313-plf	437-plf
Floor – Unblocked	3/4"	6"/12" oc	N	2x (DF) or 3x (HF)	240-plf/180-plf	335-plf/252-plf
Floor – Blocked	3/4"	4"/12" oc,	Y	2x (DF) or 3x (HF)	360-plf	505-plf

2018 IBC/SDPWS 2015 – Shear Wall Schedule

7/16"OSB; 0.131"ϕ Nails; SPF or HF Studs @ 16"oc

Table 4.3A Nominal Unit Shear Capacities for Wood-Frame Shear Walls[1,3,6,7]

Wood-based Panels[4]

Sheathing Material	Minimum Nominal Panel Thickness (in.)	Minimum Fastener Penetration in Framing Member or Blocking (in.)	Fastener Type & Size	A SEISMIC										B WIND			
				Panel Edge Fastener Spacing (in.)										Panel Edge Fastener Spacing (in.)			
				6			4			3			2				
				v_s (plf)	G_a (kips/in.)		v_s (plf)	G_a (kips/in.)		v_s (plf)	G_a (kips/in.)		v_s (plf)	G_a (kips/in.)		6 v_w (plf)	4 v_w (plf)	3 v_w (plf)	2 v_w (plf)
					OSB	PLY		OSB	PLY		OSB	PLY		OSB	PLY				
Wood Structural Panels - Structural I[4,5]	5/16	1-1/4	Nail (common or galvanized box) 6d	400	13	10	600	18	13	780	23	16	1020	35	22	560	840	1090	1430
	3/8[2]	1-3/8	8d	460	19	14	720	24	17	920	30	20	1220	43	24	645	1010	1290	1710
	7/16[2]			510	16	13	790	21	16	1010	27	19	1340	40	24	715	1105	1415	1875
	15/32			560	14	11	860	18	14	1100	24	17	1460	37	23	785	1205	1540	2045
	15/32	1-1/2	10d	680	22	16	1020	29	20	1330	36	22	1740	51	28	950	1430	1860	2435
Wood Structural Panels – Sheathing[4,5]	5/16	1-1/4	6d	360	13	9.5	540	18	12	700	24	14	900	37	18	505	755	980	1260
	3/8			400	11	8.5	600	15	11	780	20	13	1020	32	17	560	840	1090	1430
	3/8[2]	1-3/8	8d	440	17	12	640	25	15	820	31	17	1060	45	20	615	895	1150	1485
	7/16[2]			480	15	11	700	22	14	900	28	17	1170	42	21	670	980	1260	1640
	15/32			520	13	10	760	19	13	980	25	15	1280	39	20	730	1065	1370	1790
	15/32	1-1/2	10d	620	22	14	920	30	17	1200	37	19	1540	52	23	870	1290	1680	2155
	19/32			680	19	13	1020	26	16	1330	33	18	1740	48	22	950	1430	1860	2435
Plywood Siding	5/16	1-1/4	Nail (galvanized casing) 6d	280		13	420		16	550		17	720		21	390	590	770	1010
	3/8	1-3/8	8d	320		16	480		18	620		20	820		22	450	670	870	1150
Particleboard Sheathing - (M-S "Exterior Glue" and M-2 "Exterior Glue")	3/8		Nail (common or galvanized box) 6d	240		15	360		17	460		19	600		22	335	505	645	840
	3/8		8d	260		18	380		20	480		21	630		23	365	530	670	880
	1/2			280		18	420		20	540		22	700		24	390	590	755	980
	1/2		10d	370		21	550		23	720		24	920		25	520	770	1010	1290
	5/8			400		21	610		23	790		24	1040		26	560	855	1105	1455
Structural Fiberboard Sheathing	1/2		Nail (galvanized roofing) 11 ga. galv. roofing nail (0.120" x 1-1/2" long x 7/16" head)				340		4.0	460		5.0	520		5.5		475	645	730
	25/32		11 ga. galv. roofing nail (0.120" x 1-3/4" long x 3/8" head)				340		4.0	460		5.0	520		5.5		475	645	730

1. Nominal unit shear capacities shall be adjusted in accordance with 4.3.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.3.6. For specific requirements, see 4.3.7.1 for wood structural panel shear walls, 4.3.7.2 for particleboard shear walls, and 4.3.7.3 for fiberboard shear walls. See Appendix A for common and box nail dimensions.
2. Shears are permitted to be increased to values shown for 15/32 inch (nominal) sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.
3. For species and grades of framing other than Douglas-Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = [1-(0.5-G)], where G = Specific Gravity of the framing lumber from the NDS (Table 12.3.3A). The Specific Gravity Adjustment Factor shall not be greater than 1.
4. Apparent shear stiffness values G_a, are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for shear walls constructed with either OSB or 3-ply plywood panels. When 4-ply or 5-ply plywood panels or composite panels are used, G_a values shall be permitted to be multiplied by 1.2.
5. Where moisture content of the framing is greater than 19% at time of fabrication, G_a values shall be multiplied by 0.5.
6. Where panels are applied on both faces of a shear wall and nail spacing is less than 6" on center on either side, panel joints shall be offset to fall on different framing members as shown below. Alternatively, the width of the nailed face of framing members shall be 3" nominal or greater at adjoining panel edges and nails at all panel edges shall be staggered.
7. Galvanized nails shall be hot-dipped or tumbled.

1. Reduction Factor = 2
2. 16"oc studs – use values for 15/32
3. G = 0.42 (SPF or Hem Fir)… Adjustment Factor = [1-(0.5-0.42)] = 0.92

Wall Type	Blocked	Sheathing (1) or (2) Sides	Nail Spacing Edge/Intermediate	Framing	Sill Plate	Seismic Capacity $h/b_s = 2$	Seismic Capacity $h/b_s = 3.5$	Wind Capacity $h/b_s = 2$	Wind Capacity $h/b_s = 3.5$
P1-6	Y	1	6"/12" oc	2x	2x	240-plf	194-plf	335-plf	272-plf
P1-4	Y	1	4"/12" oc	2x	2x	350-plf	284-plf	490-plf	398-plf
P1-3	Y	1	3"/12" oc	2-2x	2x	450-plf	366-plf	630-plf	512-plf
P1-2	Y	1	2"12" oc	2-2x	2x	590-plf	478-plf	820-plf	669-plf
P2-4	Y	2	4"/12" oc, ea.side	2-2x	3x	700-plf	568-plf	980-plf	796-plf
P2-3	Y	2	3"/12" oc, ea. side	2-2x	3x	900-plf	733-plf	1260-plf	1024-plf
P2-2	Y	2	2"/12" oc, ea. side	2-2x	3x	1180-plf	957-plf	1640-plf	1338-plf

2018 IBC/NDS 2015 – Shear Wall Framing Clips

	Model No.	Type of Connection	Fasteners (in.)	Direction of Load	DF/SP Allowable Loads			SPF/HF Allowable Loads		
					Floor (100)	Roof (125)	(160)	Floor (100)	Roof (125)	(160)
	A34	1	(8) 0.131 x 1½	F_1	395	465	465	340	400	400
				F_2[6]	395	430	430	340	370	370
SS		1	(8) #9 x 1½ SD	F_1	640	640	640	550	550	550
				F_2	495	495	495	425	425	425
				Uplift	240	240	240	170	170	170
	A35	2	(9) 0.131 x 1½	A_1	295	350	350	255	300	300
				E	295	360	385	255	310	330
				C_1	185	185	185	160	160	160
SS		3	(12) 0.131 x 1½	A_2	295	325	325	255	280	280
				C_2	295	330	330	255	285	285
				D	225	225	225	195	195	195
		4	(12) 0.131 x 1½	F_1	590	650	650	510	560	560
				F_2[6]	590	670	670	510	575	575
		5	(12) PH612I	F_1	420	420	420	360	360	360
	LTP4	6	(12) 0.131 x 1½	G	580	625	625	500	540	540
				H	580	525	525	500	450	450
	LTP5	7	(12) 0.131 x 1½	G	580	565	565	500	485	485
				H	545	490	490	470	420	420

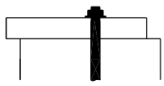
1. Allowable loads are for one angle. When angles are installed on each side of the joist, the minimum joist thickness is 3".
2. Some illustrations show connections that could cause cross-grain tension or bending of the wood during loading if not reinforced sufficiently. In this case, mechanical reinforcement should be considered.
3. LTP4 can be installed over 3/8" wood structural panel sheathing with 0.131" x 1 1/2" nails and achieve 0.72 of the listed load, or over 1/2" sheathing and achieve 0.64 of the listed load. 0.131" x 2 1/2" nails will achieve 100% load.
4. LTP4 satisfies the IRC continuously sheathed portal frame (CS-PF) framing anchor requirements when installed over raised wood floor framing per Figure R602.10.6.4.
5. The LTP5 may be installed over wood structural panel sheathing up to 1/2" thick using 0.131" x 1 1/2" nails with no reduction in load.
6. Connectors are required on both sides to achieve F_2 loads in both directions.
7. Fasteners: Nail dimensions in the table are diameter by length. SD screws are Simpson Strong-Tie® Strong-Drive® screws. PH612I is a pan-head #6 x 1/2" screw available from Simpson Strong-Tie. For additional information, see Fastener Types and Sizes Specified for Simpson Strong-Tie Connectors.

Wall Type	Capacity	A35 Capacity	A35 Spacing	LTP4 Capacity	LTP4 Spacing
P1-6U	144-plf (E)	560#	44" oc	540#	44" oc
P1-6	240-plf (E)	560#	27" oc	540#	27" oc
P1-4	350-plf (E)	560#	18" oc	540#	18" oc
P1-3	450-plf (E)	560#	14" oc	540#	14" oc
P1-2	820-plf (W)	560#	7½" oc	540#	7½" oc
P2-4	700-plf (E)	560#	9" oc	540#	LTP5 18" oc + A35 18" oc
P2-3	900-plf (E)	560#	7" oc	540#	LTP5 14" oc + A35 14" oc
P2-2	1640-plf (W)	560#	2 rows 8" oc	540#	LTP5 8" oc + A35 8" oc

2018 IBC/NDS 2018 – Shear Wall Bolts

Table 12E **BOLTS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3,4]**

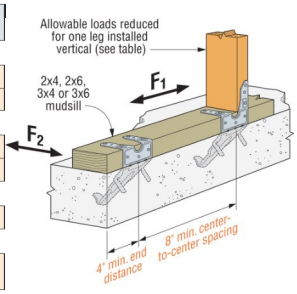
for sawn lumber or SCL to concrete



Embedment Depth in Concrete t_m in.	Thickness Side Member t_s in.	Bolt Diameter D in.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.37 Redwood (open grain) $Z_{\parallel}$ lbs.	G=0.37 Redwood (open grain) $Z_{\perp}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\parallel}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\perp}$ lbs.	G=0.35 Northern Species $Z_{\parallel}$ lbs.	G=0.35 Northern Species $Z_{\perp}$ lbs.
6.0 and greater	1-1/2	1/2	590	340	590	340	550	310	540	290	530	290
		5/8	860	420	850	410	810	350	800	330	780	320
		3/4	1200	460	1190	450	1130	370	1120	360	1100	350
		7/8	1580	500	1540	490	1360	410	1330	390	1280	370
		1	1800	540	1760	530	1560	440	1520	420	1460	410
	1-3/4	1/2	640	360	630	350	580	320	580	310	560	310
		5/8	910	490	900	480	840	400	830	380	810	370
		3/4	1230	540	1220	530	1160	430	1140	420	1120	410
		7/8	1630	580	1610	570	1540	470	1520	460	1490	430
		1	2090	630	2060	610	1820	510	1770	490	1710	470
	2-1/2	1/2	730	410	730	400	700	360	690	340	680	340
		5/8	1070	540	1060	530	980	480	960	470	940	460
		3/4	1400	710	1380	700	1290	620	1270	600	1240	580
		7/8	1790	830	1770	810	1660	680	1640	660	1600	610
		1	2230	900	2210	880	2080	730	2060	700	2030	680
	3-1/2	1/2	730	470	730	470	700	430	690	410	690	400
		5/8	1140	620	1140	610	1090	550	1080	530	1070	520
		3/4	1650	780	1640	770	1540	680	1510	670	1470	660
		7/8	2100	960	2070	950	1910	870	1880	850	1840	820
		1	2550	1190	2520	1180	2340	1020	2310	980	2260	950

1. Tabulated lateral design values, Z, for bolted connections shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "full-body diameter" bolts (see Appendix Table L1) with bolt bending yield strength, F_{yb}, of 45,000 psi.
3. Tabulated lateral design values, Z, are based on dowel bearing strength, F_e, of 7,500 psi for concrete with minimum f_c'=2,500 psi.
4. Six inch anchor embedment assumed.

Model No.	Sill Size	Fasteners (in.) Sides	Fasteners (in.) Top	Allowable Loads: Uncracked, Wind and SDC A&B[5,6]: Uplift	F1	F2	Uncracked, SDC C–F[6]: Uplift	F1	F2	Cracked, Wind and SDC A&B[5,6]: Uplift	F1	F2	Cracked, SDC C–F[6]: Uplift	F1	F2
Standard Installation – Attached to DF/SP Sill Plate															
MASA or MASAP	2x4, x6, x8, x10	(3) 0.148 x 1½	(6) 0.148 x 1½	920	1,475	1,095	745	1,235	1,045	750	1,475	875	660	1,235	765
	3x4, 3x6	(5) 0.148 x 1½	(4) 0.148 x 1½	630	1,165	725	550	1,020	725	475	1,165	725	415	1,020	640
One-Leg-Up Installation – Attached to DF/SP Sill Plate															
MASA or MASAP	2x4, x6, x8, x10	(6) 0.148 x 1½	(3) 0.148 x 1½	755	965	995	660	845	995	570	965	930	500	845	810
	3x4, 3x6	(7) 0.148 x 1½	(2) 0.148 x 1½	—	760	—	—	685	—	—	760	—	—	685	—
Two-Legs-Up Installation – Attached to DF/SP Sill Plate and Rimboard															
MASA or MASAP	2x4, x6, x8, x10	(9) 0.148 x 1½	—	810	1,105	865	740	965	755	620	1,105	630	560	965	550
Double 2x Installation – Attached to DF/SP Sill Plate															
MASA or MASAP	Double 2x4, Double 2x6	(5) 0.148 x 1½	(2) 0.148 x 1½	840	1,030	785	735	900	785	635	1,030	785	555	900	785
Standard Installation – Attached to Hem Fir Sill Plate															
MASA or MASAP	2x4, x6, x8, x10	(3) 0.148 x 1½	(6) 0.148 x 1½	790	1,250	940	640	1,060	900	650	1,250	755	570	1,060	660
	3x4, 3x6	(5) 0.148 x 1½	(4) 0.148 x 1½	535	1,005	625	475	875	625	410	1,005	625	355	875	550
One-Leg-Up Installation – Attached to Hem Fir Sill Plate and HF/SPF Stud															
MASA or MASAP	2x4, x6, x8, x10	(6) 0.148 x 1½	(3) 0.148 x 1½	650	830	855	565	725	855	490	830	795	430	725	695
	3x4, 3x6	(7) 0.148 x 1½	(2) 0.148 x 1½	—	670	—	—	590	—	—	670	—	—	590	—
Two-Legs-Up Installation – Hem Fir Sill Plate and HF/SPF Rimboard															
MASA or MASAP	2x4, x6, x8, x10	(9) 0.148 x 1½	—	700	950	745	635	830	650	545	950	540	480	830	475
Double 2x Installation – Attached to Hem Fir Sill Plate															
MASA or MASAP	Double 2x4, Double 2x6	(5) 0.148 x 1½	(2) 0.148 x 1½	720	890	675	630	775	675	545	890	675	555	775	675



Wall Type	Capacity	Sill Plate	Single 5/8"ϕ Bolt Capacity	5/8"ϕ Anchor Bolt Spacing	MASAP Anchor Capacity	MASAP Anchor Spacing
P1-6U	144-plf (E)	2x	1376#	60" oc	1060#	60" oc
P1-6	240-plf (E)	2x	1376#	60" oc	1060#	52" oc
P1-4	350-plf (E)	2x	1376#	46" oc	1060#	36" oc
P1-3	450-plf (E)	2x	1376#	36" oc	1060#	28" oc
P1-2	820-plf (W)	2x	1376#	20" oc	1250#	18" oc
P2-4	700-plf (E)	3x	1712#	28" oc	875#	15" oc
P2-3	900-plf (E)	3x	1712#	22" oc	875#	11" oc
P2-2	1640-plf (W)	3x	1712#	12" oc	1005#	7" oc

SHEAR WALL SCHEDULE

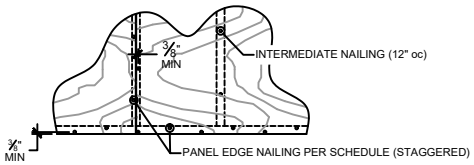
(IN ACCORDANCE w/ ANSI/AF&PA SDPWS-2015 SECTION 4.3)
Updated 1/20/2021

WALL TYPE	SHEATHING	PANEL EDGE NAILING ②	MINIMUM WIDTH OF NAILED FACE OF FRAMING @ ADJOINING PANEL EDGES ③		MUDSILL PLATE	FACE NAILING ④	FRAMING CLIPS ⑤	ANCHORAGE TO CONCRETE ⑥		SEISMIC CAPACITY - h/b = 2 h/b = 3.5	WIND CAPACITY - h/b = 2 h/b = 3.5
			SINGLE MEMBER	BUILT-UP MEMBER				ANCHOR BOLTS	MUDSILL ANCHORS		
P1-6	1 SIDE	6" oc	2x	2x	2x	6" oc	A35 @ 27" oc or LTP4 @ 27" oc	⅝"Ø @ 60" oc	MASAP @ 52" oc	240-plf 194-plf	240-plf 194-plf
P1-4	1 SIDE	4" oc	2x	2x	2x	4" oc	A35 @ 18" oc or LTP4 @ 18" oc	⅝"Ø @ 46" oc	MASAP @ 36" oc	350-plf 284-plf	350-plf 284-plf
P1-3	1 SIDE	3" oc	3x	(2)2x	2x	3" oc	A35 @ 14" oc or LTP4 @ 14" oc	⅝"Ø @ 36" oc	MASAP @ 28" oc	450-plf 366-plf	450-plf 366-plf
P1-2	1 SIDE	2" oc	3x	(2)2x	2x	2" oc	A35 @ 7½" oc or LTP4 @ 7½" oc	⅝"Ø @ 20" oc	MASAP @ 18" oc	590-plf 478-plf	820-plf 669-plf
P2-4	2 SIDES	4"oc	3x	(2)2x	3x	(2) Rows, 4" oc	A35 @ 18" oc and LTP4 @ 18" oc	⅝"Ø @ 28" oc	MASAP @ 15" oc	700-plf 568-plf	700-plf 568-plf
P2-3	2 SIDES	3" oc	3x	(2)2x	3x	(2) Rows, 3" oc	A35 @ 14" oc and LTP4 @ 14" oc	⅝"Ø @ 22" oc	MASAP @ 11" oc	900-plf 733-plf	900-plf 733-plf
P2-2	2 SIDES	2" oc	3x	(2)2x	3x	(2) Rows, 2" oc	A35 @ 8" oc and LTP4 @ 8" oc	⅝"Ø @ 12" oc	MASAP @ 7" oc	1180-plf 957-plf	1640-plf 1338-plf

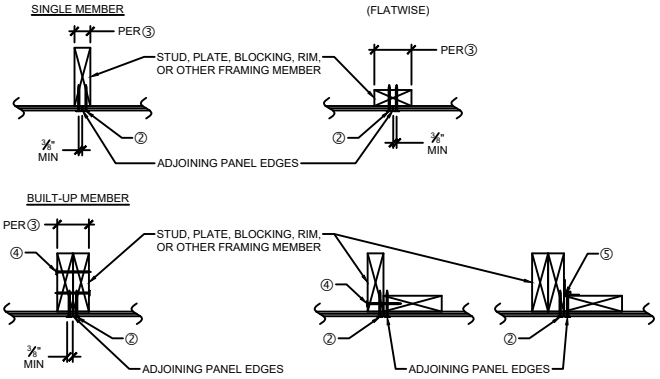
SHEAR WALL SCHEDULE NOTES

(SECTION 4.3.7.1.1)
7/16" OSB or 15/32" PLYWOOD SHEATHING OR SIDING EXCEPT GROUP 5 SPECIES. MINIMUM PANEL SPAN RATING OF (24/0). PANELS SHALL NOT BE LESS THAN 4'x8', EXCEPT AT BOUNDARIES AND CHANGES IN FRAMING. ALL EDGES OF ALL PANELS SHALL BE SUPPORTED BY AND FASTENED TO FRAMING MEMBERS OR BLOCKING.

② (SECTION 4.3.7.1.2. & SECTION 4.3.7.1.3)
PANEL EDGE NAILING APPLIES TO ALL SHEATHING PANEL EDGES. NAIL SHEATHING TO INTERMEDIATE FRAMING MEMBERS WITH SHEATHING NAILS @ 12"oc. MAXIMUM STUD SPACING SHALL BE 16"oc. SHEATHING NAILS SHALL BE 0.131"Ø x 2½". PLYWOOD EDGE NAILING SHALL BE STAGGERED. NAILS SHALL BE LOCATED AT LEAST ⅜" FROM THE PANEL EDGES.

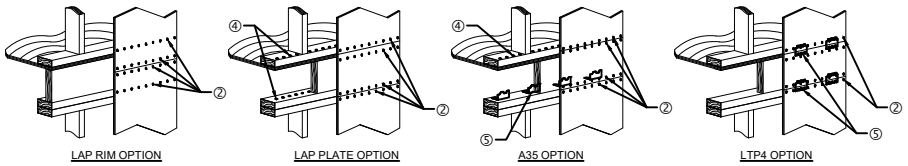


③ (SECTION 4.3.7.1.4)
THE MINIMUM NOMINAL WIDTH OF THE NAILED FACE OF FRAMING AND BLOCKING AT ADJOINING PANEL EDGES SHALL BE AS INDICATED IN THE SCHEDULE.

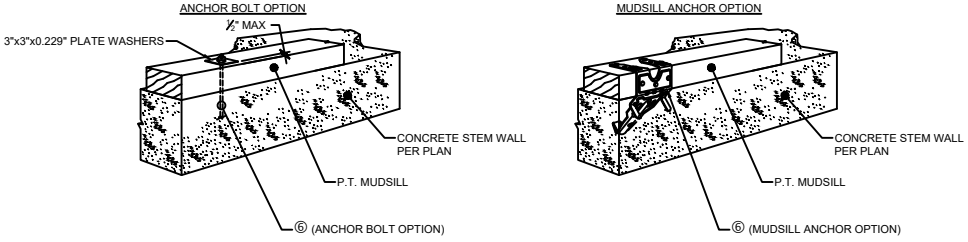


④ FACE NAILING APPLIES TO CONDITIONS WHERE FRAMING NAILS CAN BE STRAIGHT DRIVEN THRU FIRST MEMBER AND PENETRATE MAIN MEMBER MINIMUM OF 1½". FRAMING NAILS SHALL BE 0.131"Ø x 3¼". 0.131"Ø x 3" NAILS MAY BE USED WHEN STITCHING TOGETHER (2)2x MEMBERS WITH NO SPACERS.

⑤ AT ADJOINING PANEL EDGES WHERE SHEATHING CANNOT LAP ON SINGLE MEMBER AND FACE NAILING CANNOT BE ACCOMPLISHED, FRAMING CLIPS SHALL BE USED TO FASTEN BUILT-UP MEMBERS. USE 0.131"Ø x 2½" NAILS AT LTP4 CLIP WHEN INSTALLED OVER ½" SHEATHING.



⑥ (SECTION 4.3.6.4.3)
ANCHOR BOLTS EMBEDMENT SHALL BE 7", U.O.N. ALL ANCHORS SHALL HAVE 3" x 3" x 0.229" PLATE WASHERS. PLATE WASHER SHALL EXTEND TO WITHIN ½" OF THE EDGE OF THE BOTTOM PLATE ON THE SIDE WITH SHEATHING. IF SHEATHING IS ON BOTH SIDES OF THE WALL, STAGGER THE ANCHOR BOLTS, AS REQUIRED, SO THAT HALF OF THE PLATE WASHERS ARE WITHIN ½" OF THE EDGE OF THE BOTTOM PLATE ON EACH SIDE. HOLE IN PLATE WASHERS MAY BE DIAGONALLY SLOTTED.



BTL
ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: (425) 814-8448
Fax: (425) 821-2120

Miscellaneous

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1 \qquad \text{in which: } F_{cE} = 0.822(Emin')/(\ell_e/d)^2$$

Wall: Exterior Walls		Wall Height:	9	ft
		Desired Stud Spacing:	24	in oc
No Fire Rating	▼	Design Axial Dead Load:	683	plf
2x6	▼	Design Axial Live Load:	960	plf
SPF Stud	▼	Design Axial Snow Load:	538	plf
		Design Lateral Pressure (0.6W):	15	psf
		Deflection Criteria: L/	240	

STUD CHECK					
	ℓ_e/d	<	50		OK
D+0.6W (C_D = 1.60)					
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.53	<	1		OK
$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1		OK
D+0.75L+0.75(0.6W)+0.75S (C_D = 1.60)					
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.92	<	1		OK
$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1		OK
D+0.75L+0.75S (C_D = 1.15)					
f_c/F_c' =	0.72	<	1		OK
D+L (C_D = 1.0)					
f_c/F_c' =	0.71	<	1		OK
Deflection (No Increase for Load Duration):					
Defl: L/ 240 = 0.45	0.18	<	0.45		OK
	SPF Stud	2x6	@ 24 oc		OK

PLATE CRUSHING CHECK[1]					
Checks Crushing for Stud Spacing[2]					
No Stress Increase for Load Duration					
Hem Fir Plates:	$f_c/F_{c\perp}'$ =	0.87	<	1	OK
Douglas Fir Plates:	$f_c/F_{c\perp}'$ =	0.56	<	1	OK

[1] Plate must also be checked for bending.

[2] Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate. Also, no stress increase is allowed due to load duration.

Date: 1/27/2021

Page: M1.1

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1$ in which: $F_{cE} = 0.822(Emin')/(\ell_e/d)^2$

Wall: Exterior Walls	Wall Height:		19.25	ft
	Desired Stud Spacing:		16	in oc
No Fire Rating ▼	Design Axial Dead Load:		323	plf
(2)2x6 ▼	Design Axial Live Load:		0	plf
SPF Stud ▼	Design Axial Snow Load:		538	plf
	Design Lateral Pressure (0.6W):		15	psf
	Deflection Criteria:	L/	180	

STUD CHECK		ℓ_e/d	<	50	OK
D+0.6W (C_D = 1.60)					
	$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.70	<	1	OK
	$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1	OK
D+0.75L+0.75(0.6W)+0.75S (C_D = 1.60)					
	$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.71	<	1	OK
	$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1	OK
D+0.75L+0.75S (C_D = 1.15)					
	f_c/F_c' =	0.30	<	1	OK
D+L (C_D = 1.0)					
	f_c/F_c' =	0.14	<	1	OK
Deflection (No Increase for Load Duration):					
Defl: L/ 180 = 1.28		1.24	<	1.28	OK
	SPF Stud (2)2x6 @ 16 oc				OK

PLATE CRUSHING CHECK[1]					
Checks Crushing for Stud Spacing[2]					
No Stress Increase for Load Duration					
Hem Fir Plates:	$f_c/F_{c\perp}'$ =	0.13	<	1	OK
Douglas Fir Plates:	$f_c/F_{c\perp}'$ =	0.08	<	1	OK

[1] Plate must also be checked for bending.

[2] Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate. Also, no stress increase is allowed due to load duration.

Date: 1/27/2021

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1 \qquad \text{in which: } F_{cE} = 0.822(Emin')/(\ell_e/d)^2$$

Wall: Interior Walls	Wall Height:		9	ft
	Desired Stud Spacing:		24	in oc
No Fire Rating	Design Axial Dead Load:		203	plf
2x4	Design Axial Live Load:		540	plf
SPF Stud	Design Axial Snow Load:		0	plf
	Design Lateral Pressure (0.6W):		5	psf
	Deflection Criteria:	L/	180	

STUD CHECK					
	ℓ_e/d	<	50		OK
D+0.6W (C_D = 1.60)					
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.41	<	1		OK
$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1		OK
D+0.75L+0.75(0.6W)+0.75S (C_D = 1.60)					
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.99	<	1		OK
$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1		OK
D+0.75L+0.75S (C_D = 1.15)					
f_c/F_c' =	0.69	<	1		OK
D+L (C_D = 1.0)					
f_c/F_c' =	0.86	<	1		OK
Deflection (No Increase for Load Duration):					
Defl: L/ 180 = 0.60	0.23	<	0.60		OK
SPF Stud 2x4 @ 24 oc					OK

PLATE CRUSHING CHECK[1]					
Checks Crushing for Stud Spacing[2]					
No Stress Increase for Load Duration					
Hem Fir Plates:	$f_c/F_{c\perp}'$ =	0.46	<	1	OK
Douglas Fir Plates:	$f_c/F_{c\perp}'$ =	0.30	<	1	OK

[1] Plate must also be checked for bending.

[2] Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate. Also, no stress increase is allowed due to load duration.

Date: 1/27/2021

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

Stud Wall Design

Based on 2018 NDS Combined axial and bending formula:

$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})] < 1$ in which: $F_{cE} = 0.822(Emin')/(\ell_e/d)^2$

Wall: Interior Walls	Wall Height:		9	ft
	Desired Stud Spacing:		16	in oc
No Fire Rating	Design Axial Dead Load:		338	plf
2x4	Design Axial Live Load:		900	plf
SPF Stud	Design Axial Snow Load:		0	plf
	Design Lateral Pressure (0.6W):		5	psf
	Deflection Criteria:	L/	180	

STUD CHECK					
	ℓ_e/d	<	50		OK
D+0.6W (C_D = 1.60)					
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.31	<	1		OK
$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1		OK
D+0.75L+0.75(0.6W)+0.75S (C_D = 1.60)					
$[f_c/F_c']^2 + f_b/F_b'[1-(f_c/F_{cE})]$ =	0.99	<	1		OK
$f_c/F_{cE2} + (f_b/F_{bE})^2$ =	0.00	<	1		OK
D+0.75L+0.75S (C_D = 1.15)					
f_c/F_c' =	0.76	<	1		OK
D+L (C_D = 1.0)					
f_c/F_c' =	0.95	<	1		OK
Deflection (No Increase for Load Duration):					
Defl: L/ 180 = 0.60	0.15	<	0.60		OK
	SPF Stud	2x4	@ 16 oc		OK

PLATE CRUSHING CHECK[1]					
Checks Crushing for Stud Spacing[2]					
No Stress Increase for Load Duration					
Hem Fir Plates:	$f_c/F_{c\perp}'$ =	0.51	<	1	OK
Douglas Fir Plates:	$f_c/F_{c\perp}'$ =	0.33	<	1	OK

[1] Plate must also be checked for bending.

[2] Check on crushing only applies to stud spacing. Joists above must also be checked for crushing effect on plate.
Also, no stress increase is allowed due to load duration.

Date: 1/27/2021

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

2018 NDS

3.7-SOLID COLUMNS and 15.3-BUILT-UP COLUMNS

Solid Column	F_c =	800 psi	E_{min} =	440	ksi
Visually graded lumber (Dimensional)	C_D =	1.00	E_{min}' =	440	ksi
No Fire Rating	C_M =	1.00	l =	9.0	ft
Hem-Fir Stud	C_t =	1.00	d =	5 1/2	in
	C_F =	1.00	K_e =	1.0	
			l_e =	108.0	in
			l_e/d =	19.6	

$$F_c' = F_c^* \, C_P$$

$$F_c^* = F_c \, C_D \, C_M \, C_t \, C_F$$

F_c^* = 800 psi

C_p = 0.743

F_c' = 594 psi

$$C_p = K_f \left[\frac{1+\left(F_{cE}/F_c^*\right)}{2c} - \sqrt{\left[\frac{1+\left(F_{cE}/F_c^*\right)}{2c}\right]^2 - \frac{F_{cE}/F_c^*}{c}} \right]$$

F_{cE} = 938

$$F_{cE} = \frac{0.822 \, E_{min}'}{\left(l_e/d\right)^2}$$

c = 0.8

K_f = 1.0

	STUD	HF Plate Crushing	DF Plate Crushing
(1) 2x6	4904	3341	5156
(2) 2x6	9807	6683	10313
(3) 2x6	14711	10024	15469
(4) 2x6	19614	13365	20625
(5) 2x6	24518	16706	25781

BTL ENGINEERING

19011 Wood-Sno Road NE, Suite 100
Woodinville, WA 98072-4436
Phone: 425-814-8448
Fax: 425-821-2120

2018 NDS

3.7-SOLID COLUMNS and 15.3-BUILT-UP COLUMNS

Solid Column	F_c =	800 psi	E_{min} =	440	ksi
Visually graded lumber (Dimensional)	C_D =	1.00	E_{min}' =	440	ksi
No Fire Rating	C_M =	1.00	l =	9.0	ft
Hem-Fir Stud	C_t =	1.00	d =	3 1/2	in
	C_F =	1.00	K_e =	1.0	
			l_e =	108.0	in
			l_e/d =	30.9	

$$F_c' = F_c^* \, C_P$$

$$F_c^* = F_c \, C_D \, C_M \, C_t \, C_F$$

F_c^* = 800 psi

C_p = 0.416

F_c' = 333 psi

$$C_p = K_f \left[\frac{1+\left(F_{cE}/F_c^*\right)}{2c} - \sqrt{\left[\frac{1+\left(F_{cE}/F_c^*\right)}{2c}\right]^2 - \frac{F_{cE}/F_c^*}{c}} \right]$$

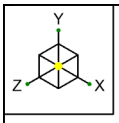
F_{cE} = 380

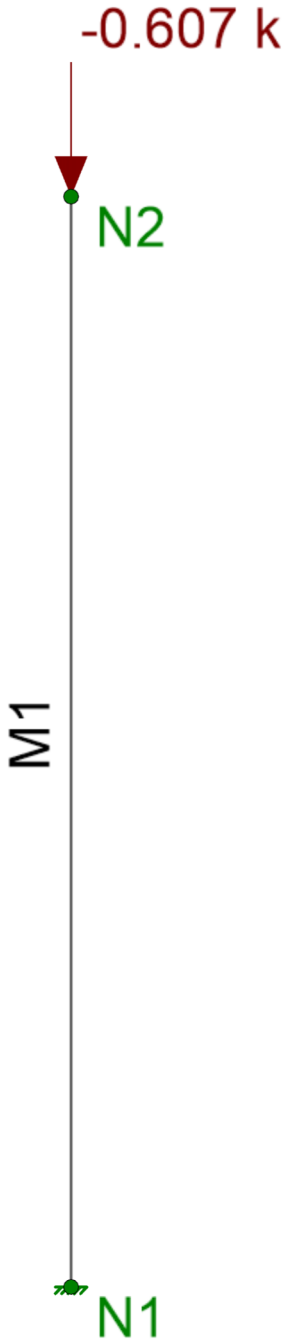
$$F_{cE} = \frac{0.822 \, E_{min}'}{\left(l_e/d\right)^2}$$

c = 0.8

K_f = 1.0

	STUD	HF Plate Crushing	DF Plate Crushing
(1) 2x4	1746	2126	3281
(2) 2x4	3492	4253	6563
(3) 2x4	5237	6379	9844
(4) 2x4	6983	8505	13125
(5) 2x4	8729	10631	16406





Loads: BLC 1, Dead

<Licensed Company>		SK-2
nathan.bonck		Feb 08, 2022
		Munson -post only.r3d

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	12	
2	N2	0	10	12	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot [k-ft/rad]	Y Rot [k-ft/rad]	Z Rot [k-ft/rad]
1	N1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e⁵°F⁻¹]	Density [k/ft³]	Yield [ksi]	Ry	Fu [ksi]	Rt
1	A53 Gr.B	29000	11154	0.3	0.65	0.49	35	1.6	60	1.2

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	Col	PIPE_5.0	Column	HSS Pipe	A53 Gr.B	Typical	4.01	14.3	14.3	28.6

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N1	N2	Col	Column	HSS Pipe	A53 Gr.B	Typical

Design Size and Code Check Parameters

	Label	Max Axial/Bending Chk	Max Shear Chk
1	Typical	1	1

Deflection Design

	Label	LC	Ratio	LC	Ratio	LC	Ratio
1	Typical	1	240	2	360	3	240

Node Loads and Enforced Displacements (BLC 1 : Dead)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-0.607

Node Loads and Enforced Displacements (BLC 3 : Snow)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-1.201

Node Loads and Enforced Displacements (BLC 4 : EQ X)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	X	0.835

Basic Load Cases

	BLC Description	Category	Y Gravity	Nodal
1	Dead	DL	-1	1
2	Live	LL		
3	Snow	SL		1
4	EQ X	ELX		1
5	EQ Z	ELZ		

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	Deflection 1	Yes	Y	DL	1										
2	Deflection 2	Yes	Y	LL	1										
3	Deflection 3	Yes	Y	DL	1	LL	1								
4	IBC 16-1	Yes	Y	DL	1.4										
5	IBC 16-2 (a)	Yes	Y	DL	1.2	LL	1.6	LLS	1.6						
6	IBC 16-2 (b)	Yes	Y	DL	1.2	LL	1.6	LLS	1.6	SL	0.5	SLN	0.5		
7	IBC 16-3 (c)	Yes	Y	DL	1.2	SL	1.6	SLN	1.6	LL	0.5	LLS	1		
8	IBC 16-5 (a)	Yes	Y	DL	1.2	ELX	1	LL	0.5	LLS	1	SL	0.2	SLN	0.7
9	IBC 16-5 (b)	Yes	Y	DL	1.2	ELZ	1	LL	0.5	LLS	1	SL	0.2	SLN	0.7
10	IBC 16-7 (a)	Yes	Y	DL	0.9	ELX	1								
11	IBC 16-7 (b)	Yes	Y	DL	0.9	ELZ	1								

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N1	max	0	11	2.81	7	0	11	0	11	0	11	8.48	8
2		min	-0.84	8	0	2	0	1	0	1	0	1	0	1
3	Totals:	max	0	11	2.81	7	0	11						
4		min	-0.84	8	0	2	0	1						

Envelope Member End Reactions

	Member	Member End		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Moment[k-ft]	LC	z-z Moment[k-ft]	LC
1	M1	I	max	2.81	7	0.85	8	0	11	0	11	0	11	8.48	8
2			min	0	2	0	1	0	1	0	1	0	1	0	1

Envelope Member End Reactions (Continued)

	Member	Member End		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torque[k-ft]	LC	y-y Moment[k-ft]	LC	z-z Moment[k-ft]	LC
3		J	max	2.65	7	0.85	8	0	11	0	11	0	11	0	11
4			min	0	2	0	1	0	1	0	1	0	1	0	1

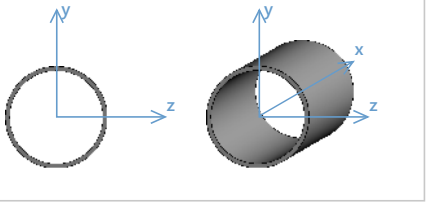
Envelope Member Section Deflections - Strength

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
1	M1	1	max	0	11	0	11	0	11	0	11	NC	11	NC	11
2			min	0	4	0	4	0	4	0	4	NC	4	NC	4
3		2	max	0	11	0	11	0	11	0	11	NC	11	NC	11
4			min	0	7	-0.13	8	0	4	0	4	940.57	8	NC	4
5		3	max	0	11	0	11	0	11	0	11	NC	11	NC	11
6			min	0	7	-0.46	8	0	4	0	4	259.64	8	NC	4
7		4	max	0	11	0	11	0	11	0	11	NC	11	NC	11
8			min	0	7	-0.93	8	0	4	0	4	128.37	8	NC	4
9		5	max	0	11	0	11	0	11	0	11	NC	11	NC	11
10			min	0	7	-1.48	8	0	4	0	4	81.28	8	NC	4

Envelope AISC 15TH (360-16): LRFD Member Steel Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	LC	phi*Pnc [k]	phi*Pnt [k]	phi*Mn y-y [k-ft]	phi*Mn z-z [k-ft]	Cb	Eqn
1	M1	PIPE_5.0	0.48	0	8	0.02	10	8	102.73	126.31	17.93	17.93	1.67	H1-1b

Detail Report: M1 **Unity Check:** 0.48 (LC 8) **Load Combination:** Envelope



Input Data:

Shape:	PIPE_5.0	I Node:	N1
Member Type:	Column	J Node:	N2
Length (ft):	10	I Release:	Fixed
Material Type:	Hot Rolled Steel	J Release:	Fixed
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	97	J Offset (in):	N/A

Material Properties:

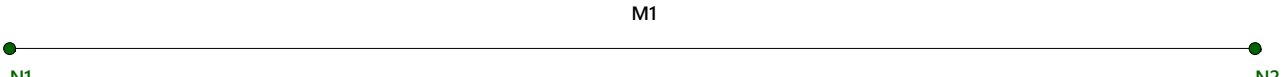
Material:	A53 Gr.B	Therm. Coeff. ($1e^5°F^{-1}$):	0.65	R_y:	1.6
E (ksi):	29000	Density (k/ft^3):	0.49	F_u (ksi):	60
G (ksi):	11154	F_y (ksi):	35	R_t:	1.2
Nu:	0.3				

Shape Properties:

d (in):	5.563	Area (in^2):	4.01	I_{yy} (in^4):	14.3
t (in):	0.241	J (in^4):	28.6	I_{zz} (in^4):	14.3
Z (in^3):	6.83				

Design Properties:

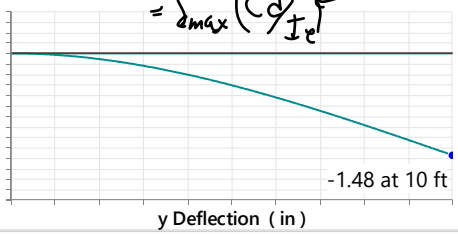
$L_{b\ y-y}$ (ft):	N/A	K_{y-y}:	1	Max Defl Ratio:	L/81
$L_{b\ z-z}$ (ft):	N/A	K_{z-z}:	1	Max Defl Location:	0
$L_{comp\ top}$ (ft):	Lbyy	y sway:	No	Span:	N/A
$L_{comp\ bot}$ (ft):	N/A	z sway:	No		
L_{torque} (ft):	N/A	Function:	Lateral		
		Seismic DR:	None		



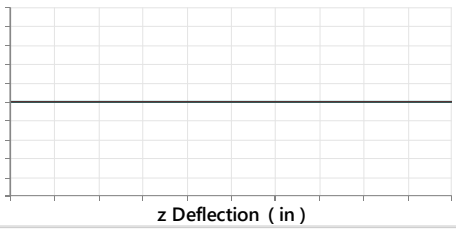
Diagrams:

$1.48'' \times 1.25 = 1.85'' < \delta_{allow}$ ok

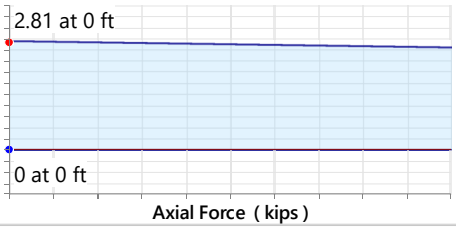
$= \delta_{max}\left(\frac{C_d}{I_e}\right)$



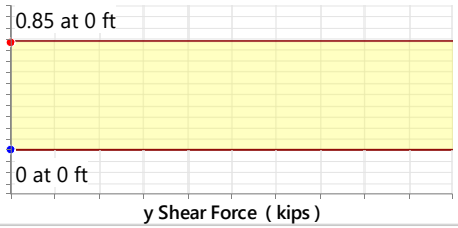
y Deflection (in)



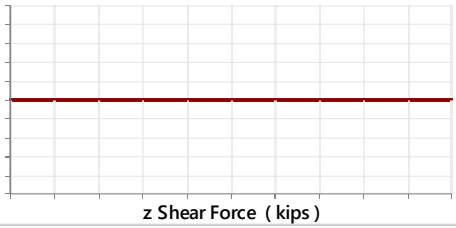
z Deflection (in)



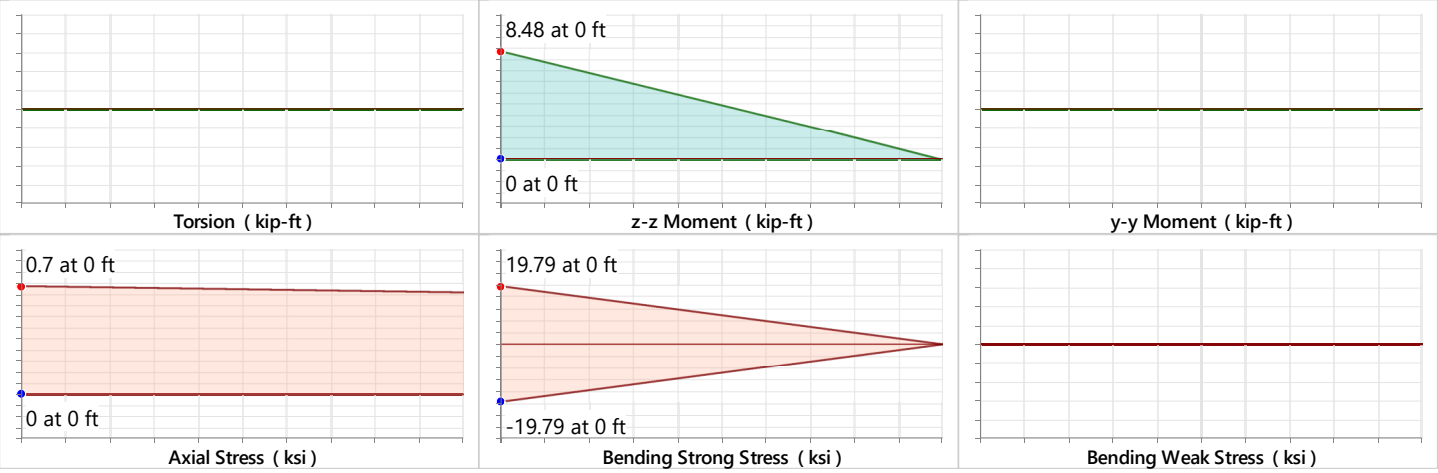
Axial Force (kips)



y Shear Force (kips)



z Shear Force (kips)



AISC 15th (360-16): LRFD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	8	-	-	-	-
Applied Loading - Shear + Torsion	8	-	-	-	-
Axial Tension Analysis	8	0.00 k	126.32 k	-	-
Axial Compression Analysis	8	1.13 k	102.73 k	-	-
Flexural Analysis	8	8.48 k-ft	17.93 k-ft	-	-
Shear Analysis	8	0.85 k	37.89 k	0.02	Pass
Bending & Axial Interaction Check (UC Bending Max)	8	-	-	0.48	Pass
Torsional Analysis	8	0.00 k-ft	16.89 k-ft	0.00	Pass