Harriott Valentine Engineers Inc.

STRUCTURAL CALCULATIONS

Project:
Sullivan Residence
3024 69th Ave SE
Mercer Island, WA 98040

Architect:
SHED Architecture & Design
1404 S Jackson St
Seattle, WA 98144

Structural Engineer:
Harriott Valentine Engineers, Inc.
1932 First Avenue, Suite 720
Seattle, WA 98101
tel. 206-624-4760

5/19/23

SECTION 1: FRAMING

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

CRITERIA

FRAMING

roof (w/ overframing)	dead	solar panel allowance	5.0	live	snow	25.0	psf
		metal roofing	1.2				
		membrane	1.0				
		8" rigid insulation	12.0				
		2x8 @ 24"oc	1.5				
		1-1/8" plywood	3.4				
		5/8" gyp. wallboard	2.8				
		4x10 @ 48"oc	1.9				
		slope factor (2.5:12)	0.6				
		miscellaneous	2.6 8%				
			32.0 psf				
	total	dead + live	57.0 psf				
roof (purlins)	dead	asphalt shingles	2.5	live	snow	25.0	psf
		membrane	1.0				
		1/2" plywood	1.5				
		8" rigid insulation	12.0 (verify)				
		2x decking	4.3				
		4x10 @ 48"oc	1.9				
		slope factor (2.5:12)	0.5				
		miscellaneous	3.3 12%				
			27.0 psf				
	total	dead + live	52.0 psf				
main floor (typ.)	dead	3/4" hardwood	3.0	live	residential	40.0	psf
		1-1/8" plywood	3.4				
		2x12 @ 16"oc	3.3				
		R21 insulation	0.8				
		5/8" gyp. wallboard	2.8				
		miscellaneous	1.7 11%				
			15.0 psf				
	total	dead + live	55.0 psf				
main floor (tiled)	dead	3/8" tile + thinset mortar	6.7	live	residential	40.0	psf
		1-1/8" plywood	3.4				
		2x12 @ 16"oc	3.3				
		R21 insulation	0.8				
		5/8" gyp. wallboard	2.8				
		miscellaneous	2.0 11%				
			19.0 psf				
	total	dead + live	59.0 psf				

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel 206-624-4760 | fax 447-6971

main floor (slab over garage)	dead	4" topping slab	50.0	live	residential	60.0 psf
		1-1/8" plywood	3.4			
		11-7/8" TJI 560 @ 16"oc	3.0			
		R21 insulation	0.8			
		5/8" gyp. wallboard	2.8			
		miscellaneous	2.0 3%			
			62.0 psf			
	total	dead + live	122.0 psf			
deck	dead	2x decking	4.3	live	deck	60.0 psf
		membrane	1.0			
		2x sleepers	1.1			
		3/4" plywood	2.3			
		2x10 @ 16"oc	2.8			
		5/8" gyp. wallboard	2.8			
		miscellaneous	1.7 11%			
			16.0 psf			
	total	dead + live	76.0 psf			
walls (new)		hardie panel (5/16")	2.3			
		battens 2x2 @ 24"oc	0.3			
		2" rigid insulation	3.0			
		1/2" plywood	1.5			
		2x6 @ 16"oc	1.7			
		R21 insulation	0.8			
		5/8" gyp. wallboard	2.8			
		miscellaneous	1.6 11%			
			14.0 psf			

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel 206-624-4760 | fax 447-6971

FORTEWEB®

JOB SUMMARY REPORT

Sullivan (SHED) Framing

Roof			
Member Name	Results	Current Solution	Comments
long cant. rafter	Failed	3 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL @ 12" OC	Left cantilever exceeds the maximum braced cantilever length of 7'.
long cant. purlin	Failed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	Left cantilever exceeds the maximum braced cantilever length of 7'.
kitchen purlin (ss)	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
short cant. rafter	Passed	1 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL @ 24" OC	
short cant. purlin	Failed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	Left cantilever exceeds the maximum braced cantilever length of 7'.
bdrm purlin (ss)	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
short cant. purlin	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
long rafter (ss)	Passed	1 piece(s) 11 7/8" TJI® 360 @ 24" OC	
long ridge	Passed	1 piece(s) 6 3/4" x 24" 24F-V4 DF Glulam	
short ridge at stair	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V8 DF Glulam	
N-S int. short header (bdrm)	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
(ALT) N-S int. short header (bdrm)	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
N-S int. long header (bdrm)	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
(ALT) N-S int. long header (bdrm)	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
N header	Passed	2 piece(s) 2 x 6 HF No.2	
short W stair header	Passed	3 piece(s) 2 x 12 HF No.2	
long W kitchen header	Failed	1 piece(s) 5 1/2" x 19 1/2" 24F-V4 DF Glulam	
long W bdrm header	Passed	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
short W bdrm header	Passed	2 piece(s) 2 x 6 HF No.2	
long E office header	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Attic			
Member Name	Results	Current Solution	Comments
long attic joist	Passed	1 piece(s) 2 x 8 HF No.2 @ 16" OC	
E header	Passed	2 piece(s) 2 x 6 HF No.2	
Second Floor			
Member Name	Results	Current Solution	Comments
kitchen floor joist	Passed	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
entry joist	Passed	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
long bdrm joist	Passed	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
office floor joist	Passed	1 piece(s) 11 7/8" TJI® 560 @ 16" OC	
kitchen crawlspace beam	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
office FB below post	Passed	2 piece(s) 11 7/8" TJI® 560	Web Stiffeners Required
stair header FB	Passed	2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	
N-S int header	Passed	2 piece(s) 2 x 6 HF No.2	
N-S int short FB	Passed	1 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	
N-S int long FB	Passed	1 piece(s) 6 3/4" x 12" 24F-V4 DF Glulam	
N-S int med FB	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
W header	Passed	2 piece(s) 2 x 10 HF No.2	
W header w/ wall abv	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

First Floor			
Member Name	Results	Current Solution	Comments
ext. garage joist (w/ slab)	Passed	1 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL @ 16" OC	
int. long garage joist	Passed	1 piece(s) 11 7/8" TJI® 110 @ 16" OC	
long N-S beam	Passed	1 piece(s) W12X65 (A992) ASTM Steel	
medium middle N-S beam	Failed	1 piece(s) 5 1/2" x 11 7/8" 24F-V4 DF Glulam	
short middle N-S beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	
E N-S beam	Passed	1 piece(s) 3 1/2" x 11 7/8" 24F-V4 DF Glulam	

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

FORTEWEB

MEMBER REPORT

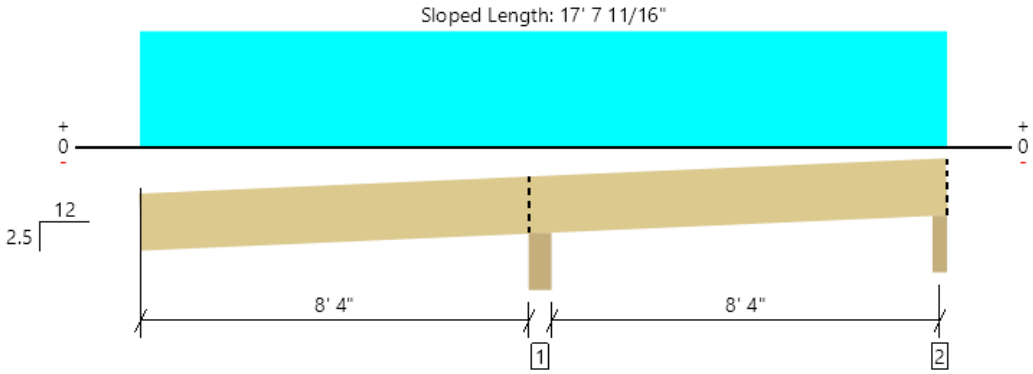
~~FAILED~~

OKAY - CB

Roof, long cant. rafter

3 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL @ 12" OC

Left cantilever exceeds the maximum braced cantilever length of 7'.



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

Member Length : 17' 9 3/16"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	988 @ 8' 6 3/4"	11945 (5.50")	Passed (8%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	447 @ 7' 8 7/8"	8317	Passed (5%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-2115 @ 8' 6 3/4"	9573	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.199 @ 0	0.875	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.440 @ 0	1.166	Passed (2L/478)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- Moment capacity over cantilever support 1 has been reduced by 25% to lessen the effects of buckling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - HF	5.50"	5.50"	1.50"	560	428	988	Blocking
2 - Beveled Plate - HF	3.50"	3.50"	1.50"	5	58/-52	62/-47	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' 8" o/c	
Bottom Edge (Lu)	17' 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 17' 3 1/4"	12"	32.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

FORTEWEB

MEMBER REPORT

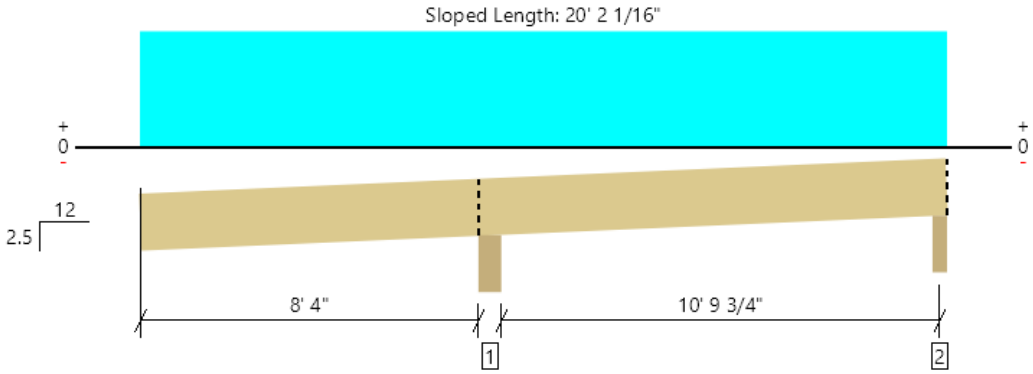
~~FAILED~~

OKAY - CB

Roof, long cant. purlin

1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam

Left cantilever exceeds the maximum braced cantilever length of 7'.



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

Member Length : 20' 4 1/4"

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3909 @ 8' 6 3/4"	12514 (5.50")	Passed (31%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1741 @ 9' 7 3/4"	11733	Passed (15%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	961 @ 16' 7 15/16"	23244	Passed (4%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-8236 @ 8' 6 3/4"	13438	Passed (61%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.299 @ 0	0.875	Passed (2L/700)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.617 @ 0	1.166	Passed (2L/340)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Moment capacity over cantilever support 1 has been reduced by 25% to lessen the effects of buckling.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 11 11/16".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 15' 6 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - HF	5.50"	5.50"	1.72"	2169	1740	3909	Blocking
2 - Beveled Plate - HF	3.50"	3.50"	1.50"	293	401/-49	694	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	20' 2" o/c	
Bottom Edge (Lu)	20' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 19' 9"	N/A	14.0	--	
1 - Uniform (PSF)	0 to 19' 9"	4'	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

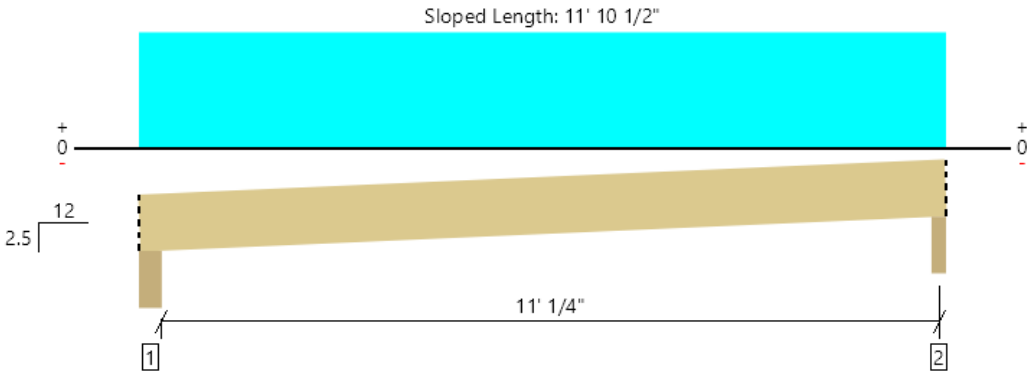
FORTEWEB

MEMBER REPORT

PASSED

Roof, kitchen purlin (ss)

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.

Member Length : 12' 11/16"

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1374 @ 11' 5 1/2"	4961 (3.50")	Passed (28%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1099 @ 1' 3 3/4"	7466	Passed (15%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3711 @ 5' 10 3/4"	14792	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.059 @ 5' 10 3/4"	0.568	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.142 @ 5' 10 3/4"	0.758	Passed (L/961)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 11' 4 3/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - HF	5.50"	5.50"	1.50"	825	590	1414	Blocking
2 - Beveled Plate - HF	3.50"	3.50"	1.50"	801	573	1374	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)	11' 10" o/c	
Bottom Edge (Lu)	11' 10" 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 11' 7 1/2"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 11' 7 1/2"	4'	32.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

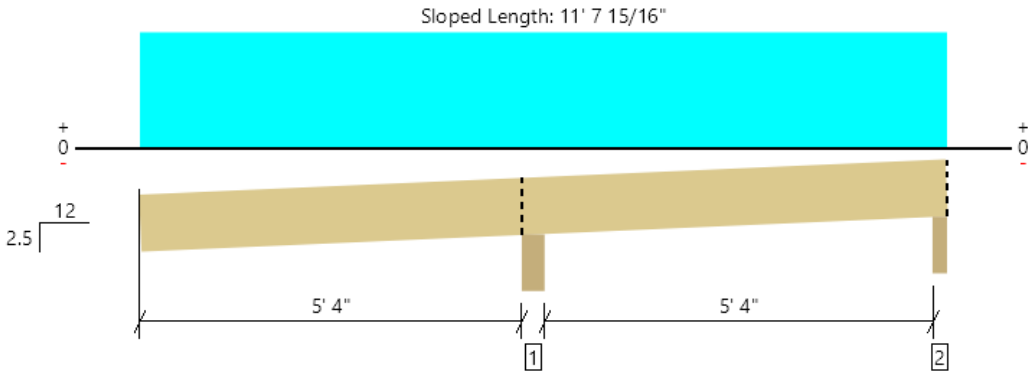
FORTEWEB

MEMBER REPORT

PASSED

Roof, short cant. rafter

1 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL @ 24" OC



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

Member Length : 11' 9 7/16"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1284 @ 5' 6 3/4"	3982 (5.50")	Passed (32%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	547 @ 6' 4 5/8"	2772	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-1785 @ 5' 6 3/4"	4255	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.219 @ 0	0.568	Passed (2L/624)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.482 @ 0	0.758	Passed (2L/282)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Left cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - HF	5.50"	5.50"	1.77"	727	556	1284	Blocking
2 - Beveled Plate - HF	3.50"	3.50"	1.50"	19	83/-61	102/-42	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)	11' 8" o/c	
Bottom Edge (Lu)	11' 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 11' 5"	24"	32.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

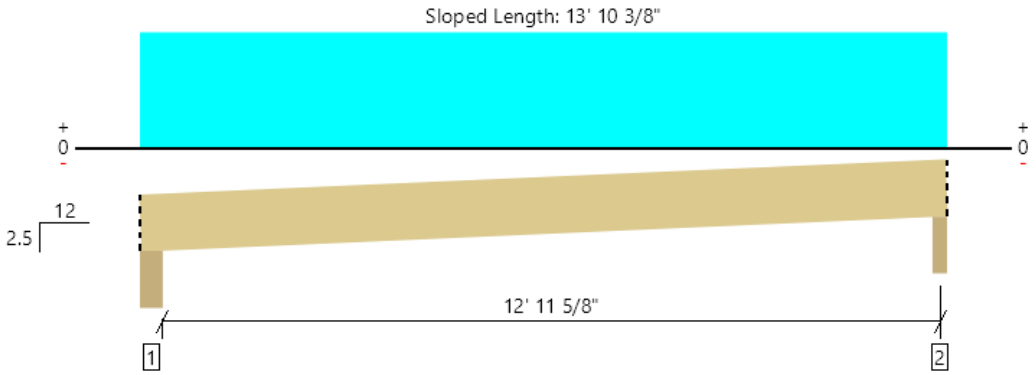
FORTEWEB

MEMBER REPORT

PASSED

Roof, bdrm purlin (ss)

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.

Member Length : 14' 9/16"

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1471 @ 13' 4 7/8"	4961 (3.50")	Passed (30%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1219 @ 1' 3 3/4"	7466	Passed (16%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	4688 @ 6' 10 7/16"	14792	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.113 @ 6' 10 7/16"	0.668	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.248 @ 6' 10 7/16"	0.890	Passed (L/647)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 13' 4 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - HF	5.50"	5.50"	1.50"	821	687	1508	Blocking
2 - Beveled Plate - HF	3.50"	3.50"	1.50"	801	670	1471	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)	13' 10" o/c	
Bottom Edge (Lu)	13' 10" 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 13' 6 7/8"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 13' 6 7/8"	4'	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

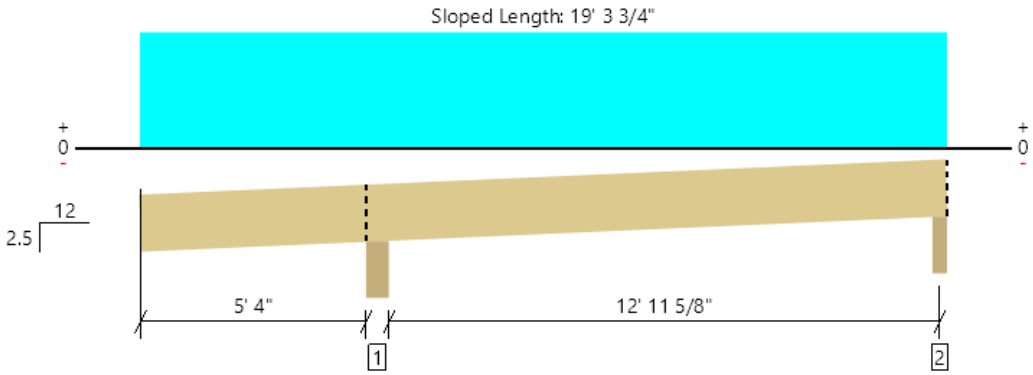
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, short cant. purlin
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.

Member Length : 19' 5 15/16"

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2924 @ 5' 6 3/4"	7964 (5.50")	Passed (37%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1465 @ 6' 7 3/4"	7466	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3542 @ 13' 11/16"	14792	Passed (24%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-3395 @ 5' 6 3/4"	11402	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.092 @ 12' 4 11/16"	0.673	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.172 @ 12' 6 3/4"	0.897	Passed (L/939)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 11' 7 5/16".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 8' 15/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - HF	5.50"	5.50"	2.02"	1592	1333	2924	Blocking
2 - Beveled Plate - HF	3.50"	3.50"	1.50"	667	617	1283	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)	19' 4" o/c	
Bottom Edge (Lu)	19' 4" 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 18' 10 7/8"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 18' 10 7/8"	4'	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

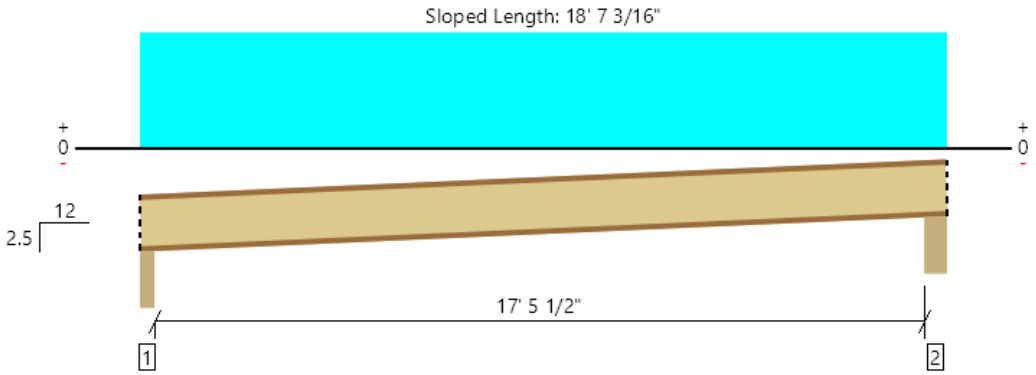
FORTEWEB

MEMBER REPORT

PASSED

Roof, long rafter (ss)

1 piece(s) 11 7/8" TJI® 360 @ 24" OC



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

Member Length : 18' 9 11/16"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 2.5/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1060 @ 17' 10"	1731 (3.50")	Passed (61%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1007 @ 3 1/2"	1961	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4480 @ 9' 1/4"	7107	Passed (63%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.305 @ 9' 1/4"	0.900	Passed (L/708)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.704 @ 9' 1/4"	1.200	Passed (L/307)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - HF	3.50"	3.50"	1.75"	590	451	1041	Blocking
2 - Beveled Plate - HF	5.50"	5.50"	1.75"	601	459	1060	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)	4' 4" o/c	
Bottom Edge (Lu)	18' 7" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.
•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 18' 2 1/2"	24"	32.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

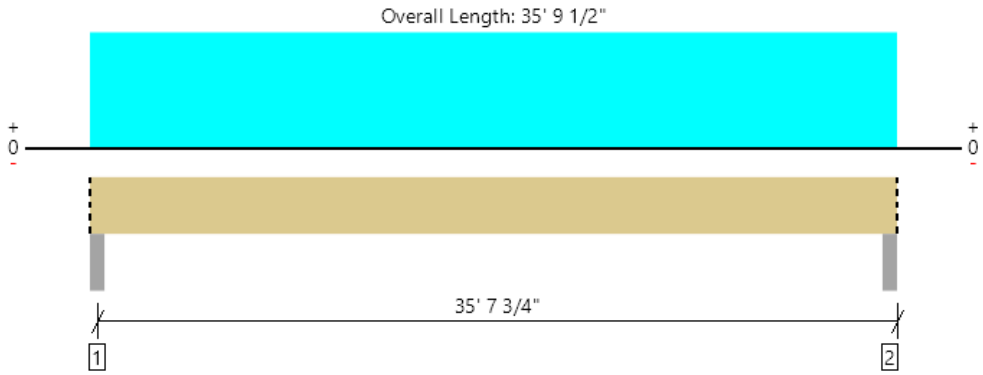
FORTEWEB

MEMBER REPORT

PASSED

Roof, long ridge

1 piece(s) 6 3/4" x 24" 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)	12074 @ 2"	15356 (3.50")	Passed (79%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	10528 @ 2' 3 1/2"	32913	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	106035 @ 17' 10 3/4"	128378	Passed (83%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.708 @ 17' 10 3/4"	1.182	Passed (L/601)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	1.714 @ 17' 10 3/4"	1.773	Passed (L/248)	--	1.0 D + 1.0 S (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).
- A 13.9% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 0.86 that was calculated using length L = 35' 5 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Column - steel	3.50"	3.50"	2.75"	7087	4987	12074	Blocking
2 - Column - steel	3.50"	3.50"	2.75"	7087	4987	12074	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)	4' o/c	
Bottom Edge (Lu)	4' o/c	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 35' 9 1/2"	N/A	39.4	--	
1 - Uniform (PSF)	0 to 35' 9 1/2" (Top)	11' 1 3/4"	32.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

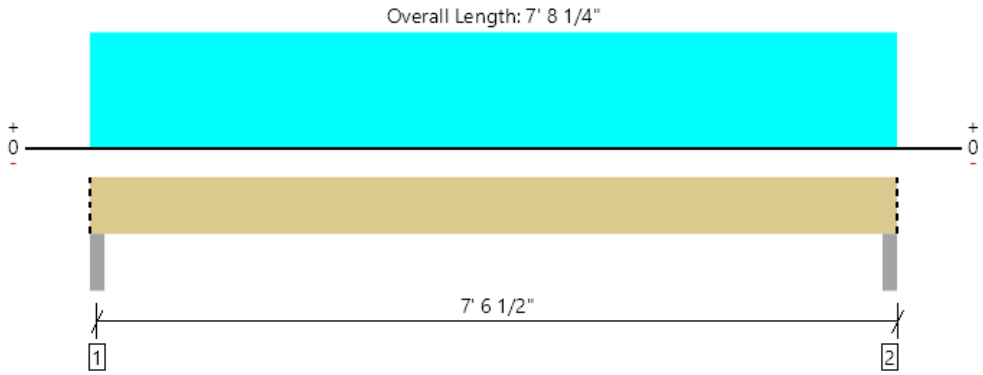
FORTEWEB

MEMBER REPORT

PASSED

Roof, short ridge at stair

1 piece(s) 3 1/2" x 10 1/2" 24F-V8 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)	2262 @ 2"	7963 (3.50")	Passed (28%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1576 @ 1' 2"	7466	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3979 @ 3' 10 1/8"	14792	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.030 @ 3' 10 1/8"	0.245	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.064 @ 3' 10 1/8"	0.368	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 4 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Column - steel	3.50"	3.50"	1.50"	1191	1071	2262	Blocking
2 - Column - steel	3.50"	3.50"	1.50"	1191	1071	2262	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 8" o/c	
Bottom Edge (Lu)	7' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 8 1/4"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 7' 8 1/4" (Top)	11' 1 3/4"	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

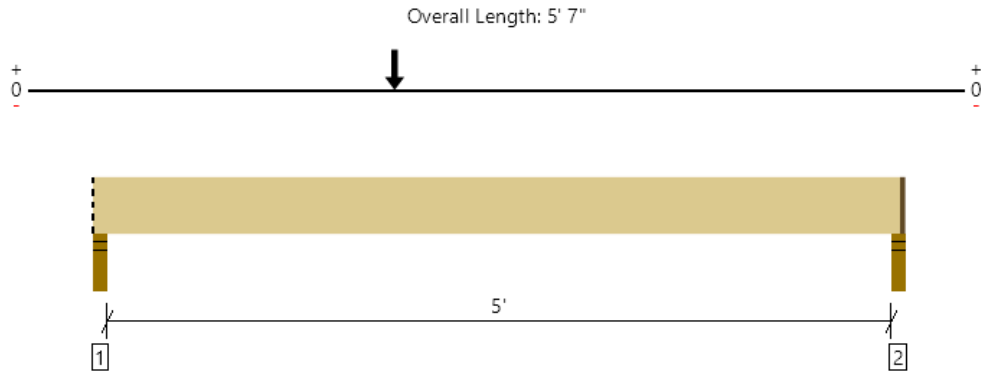
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, N-S int. short header (bdrm)
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)	1922 @ 2"	4961 (3.50")	Passed (39%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1912 @ 1' 2"	7466	Passed (26%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	3645 @ 2' 7/8"	14792	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.011 @ 2' 7 3/4"	0.262	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.023 @ 2' 7 13/16"	0.350	Passed (L/999+)	--	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/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.50"	1058	864	1922	Blocking
2 - Stud wall - HF	3.50"	2.25"	1.50"	613	493	1106	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 6" o/c	
Bottom Edge (Lu)	5' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 5 3/4"	N/A	8.9	--	
1 - Point (lb)	2' 7/8" (Front)	N/A	801	670	Linked from: bdrm purlin (ss), Support 2
2 - Point (lb)	2' 7/8" (Back)	N/A	821	687	Linked from: bdrm purlin (ss), 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

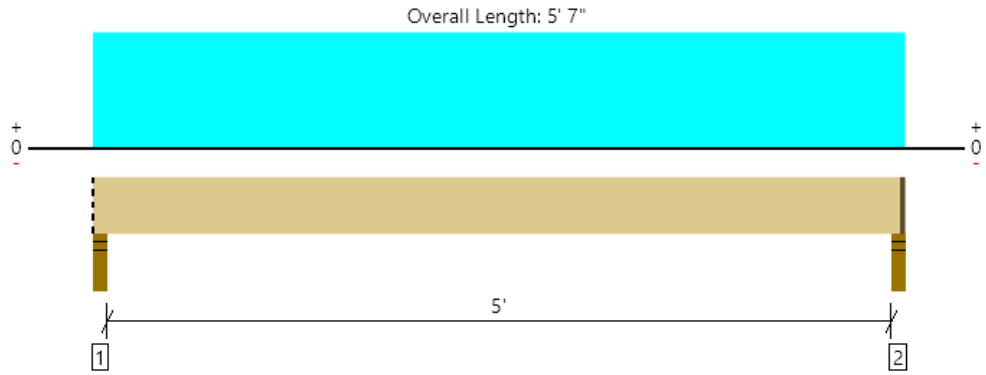
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, (ALT) N-S int. short header (bdrm)
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)	2203 @ 5' 5"	3189 (2.25")	Passed (69%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1332 @ 1' 2"	7466	Passed (18%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	2824 @ 2' 9 1/2"	14792	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.011 @ 2' 9 1/2"	0.262	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.023 @ 2' 9 1/2"	0.350	Passed (L/999+)	--	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/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.61"	1200	1088	2288	Blocking
2 - Stud wall - HF	3.50"	2.25"	1.55"	1199	1088	2287	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 6" o/c	
Bottom Edge (Lu)	5' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 5 3/4"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 5' 7" (Top)	15' 7 1/16"	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

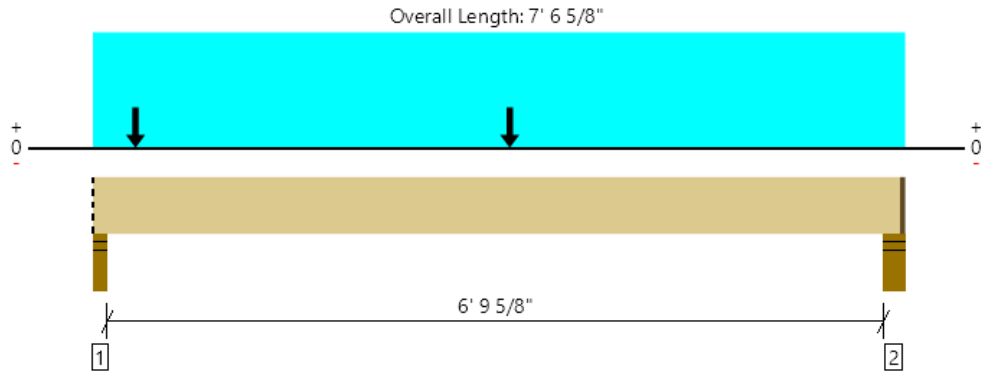
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, N-S int. long header (bdrm)
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)	3866 @ 2"	4961 (3.50")	Passed (78%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2019 @ 1' 2"	7466	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	5676 @ 3' 10 1/2"	14792	Passed (38%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.036 @ 3' 8 1/4"	0.353	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.077 @ 3' 8 1/4"	0.470	Passed (L/999+)	--	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/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 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	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.73"	2077	1789	3866	Blocking
2 - Stud wall - HF	5.50"	4.25"	1.83"	1410	1234	2644	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 5" o/c	
Bottom Edge (Lu)	7' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 5 3/8"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 7' 6 5/8" (Back)	8' 11"	27.0	25.0	roof
2 - Point (lb)	3' 10 1/2" (Front)	N/A	801	670	Linked from: bdrm purlin (ss), Support 2
3 - Point (lb)	4 3/4" (Front)	N/A	801	670	Linked from: bdrm purlin (ss), 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

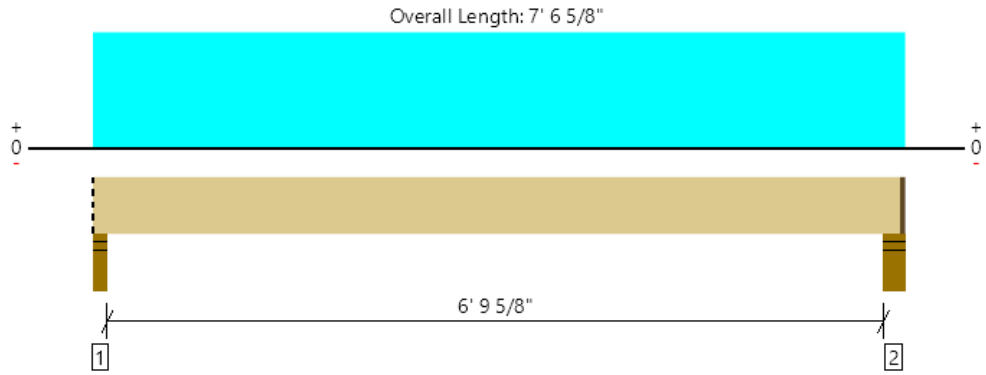
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, (ALT) N-S int. long header (bdrm)
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)	3026 @ 2"	4961 (3.50")	Passed (61%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2070 @ 1' 2"	7466	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	5095 @ 3' 8 5/16"	14792	Passed (34%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.036 @ 3' 8 5/16"	0.353	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.075 @ 3' 8 5/16"	0.470	Passed (L/999+)	--	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/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 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	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.13"	1587	1439	3026	Blocking
2 - Stud wall - HF	5.50"	4.25"	2.17"	1658	1504	3162	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 5" o/c	
Bottom Edge (Lu)	7' 5" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 5 3/8"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 7' 6 5/8" (Top)	15' 7 1/16"	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

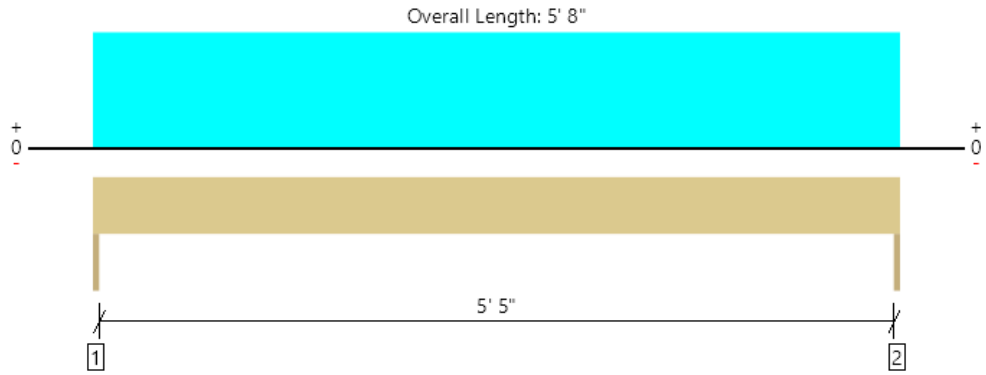
FORTEWEB

MEMBER REPORT

PASSED

Roof, N header

2 piece(s) 2 x 6 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)	307 @ 0	1823 (1.50")	Passed (17%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	243 @ 7"	1898	Passed (13%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	434 @ 2' 10"	1602	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.021 @ 2' 10"	0.189	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.046 @ 2' 10"	0.283	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	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	165	142	307	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	165	142	307	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 8" o/c	
Bottom Edge (Lu)	5' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 8"	N/A	4.2	--	
1 - Uniform (PSF)	0 to 5' 8"	2'	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

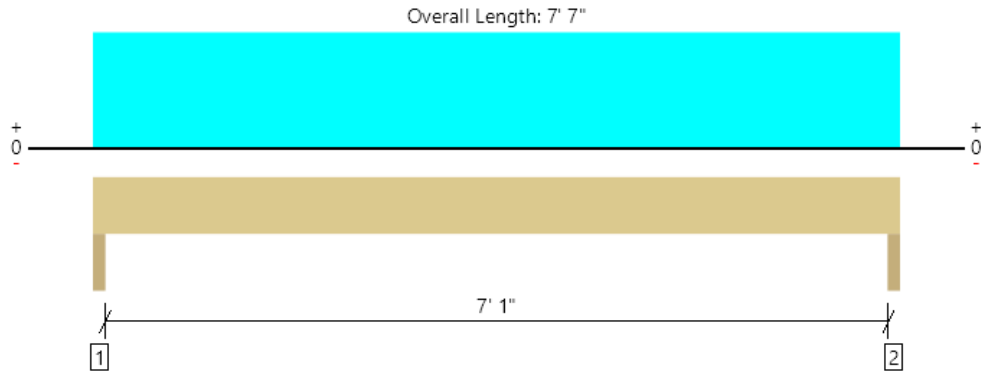
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, short W stair header
3 piece(s) 2 x 12 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)	3795 @ 1 1/2"	5468 (3.00")	Passed (69%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2606 @ 1' 2 1/4"	5822	Passed (45%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	6728 @ 3' 9 1/2"	7732	Passed (87%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.040 @ 3' 9 1/2"	0.244	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.094 @ 3' 9 1/2"	0.367	Passed (L/938)	--	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	Factored	
1 - Trimmer - HF	3.00"	3.00"	2.08"	2172	1623	3795	None
2 - Trimmer - HF	3.00"	3.00"	2.08"	2172	1623	3795	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 7"	N/A	12.8	--	
1 - Uniform (PLF)	0 to 7' 7"	N/A	560.0	428.0	Linked from: long cant. rafter, Support 1

Weyerhaeuser Notes

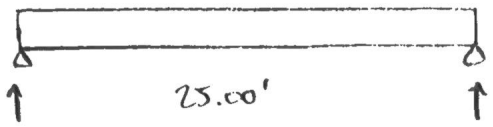
Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

D 560 plf
S 425 plf



D	7.00^{k}	43.8$^{k\text{-}ft}$	7.00^{k}
S	5.35^{k}	33.4$^{k\text{-}ft}$	5.35^{k}

$V = 12.4^{k}$
$M = 77.2^{k\text{-}ft}$

$V_n/\Omega = 55.4^{k}$
$M_n/\Omega = 140^{k\text{-}ft}$
$\delta_L = 0.41\,in = L/732$
$\Delta_L = 0.94\,in = L/319$

USE HSS 14x4x1/2

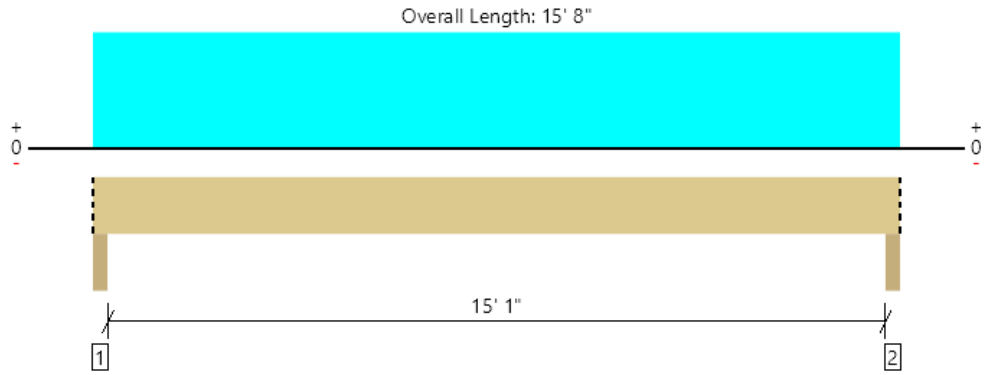
FORTEWEB

MEMBER REPORT

PASSED

Roof, long W bdrm header

1 piece(s) 5 1/2" x 11 7/8" 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)	5149 @ 2"	12513 (3.50")	Passed (41%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	4307 @ 1' 3 3/8"	13269	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	19320 @ 7' 10"	29731	Passed (65%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.250 @ 7' 10"	0.511	Passed (L/735)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.592 @ 7' 10"	0.767	Passed (L/311)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 15' 4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Column - HF	3.50"	3.50"	1.50"	2972	2178	5149	Blocking
2 - Column - HF	3.50"	3.50"	1.50"	2972	2178	5149	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)	15' 8" o/c	
Bottom Edge (Lu)	15' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 15' 8"	N/A	15.9	--	
1 - Uniform (PLF)	0 to 15' 8" (Top)	N/A	363.5	278.0	Linked from: short cant. rafter, 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

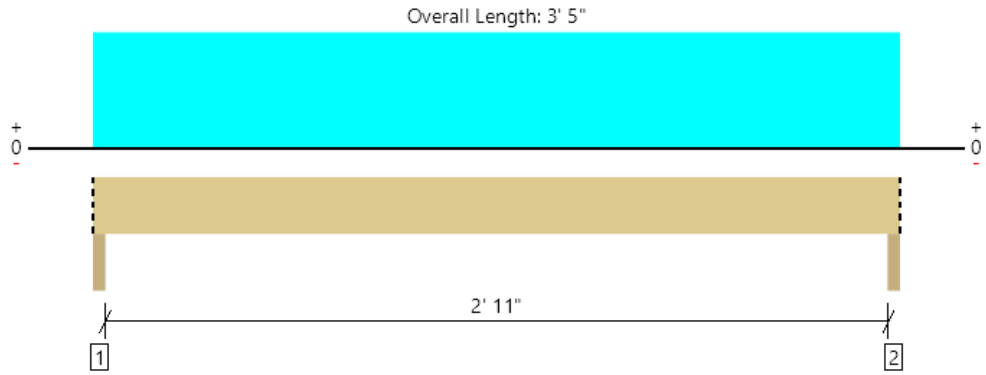
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Roof, short W bdrm header
2 piece(s) 2 x 6 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)	1103 @ 1 1/2"	3645 (3.00")	Passed (30%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	646 @ 8 1/2"	1898	Passed (34%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	809 @ 1' 8 1/2"	1602	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.012 @ 1' 8 1/2"	0.106	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.027 @ 1' 8 1/2"	0.158	Passed (L/999+)	--	1.0 D + 1.0 S (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	Snow	Factored	
1 - Column - HF	3.00"	3.00"	1.50"	628	475	1103	Blocking
2 - Column - HF	3.00"	3.00"	1.50"	628	475	1103	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)	3' 5" o/c	
Bottom Edge (Lu)	3' 5" 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 3' 5"	N/A	4.2	--	
1 - Uniform (PLF)	0 to 3' 5" (Top)	N/A	363.5	278.0	Linked from: short cant. rafter, 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

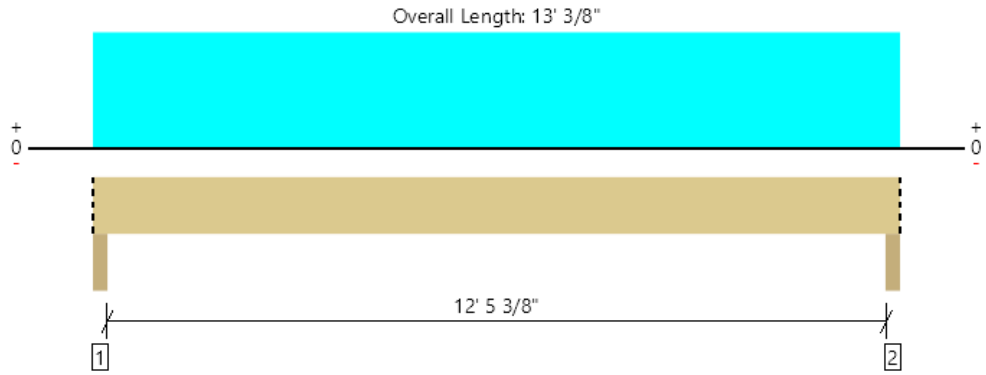
FORTEWEB

MEMBER REPORT

PASSED

Roof, long E office header

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)	2091 @ 2"	7963 (3.50")	Passed (26%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1717 @ 1' 2"	7466	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	6468 @ 6' 6 3/16"	14792	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.144 @ 6' 6 3/16"	0.423	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.309 @ 6' 6 3/16"	0.635	Passed (L/493)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 12' 8 3/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Column - HF	3.50"	3.50"	1.50"	1114	977	2091	Blocking
2 - Column - HF	3.50"	3.50"	1.50"	1114	977	2091	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)	13' o/c	
Bottom Edge (Lu)	13' 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 13' 3/8"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 13' 3/8" (Top)	6'	27.0	25.0	roof

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

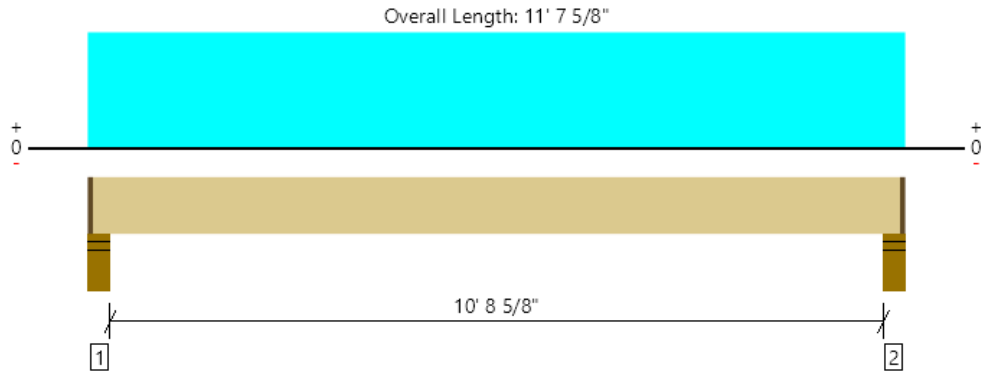
FORTEWEB

MEMBER REPORT

PASSED

Attic, long attic joist

1 piece(s) 2 x 8 HF No.2 @ 16" 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)	259 @ 4 1/2"	2582 (4.25")	Passed (10%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	216 @ 1' 3/4"	1088	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	671 @ 5' 9 13/16"	1284	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.136 @ 5' 9 13/16"	0.363	Passed (L/960)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.231 @ 5' 9 13/16"	0.544	Passed (L/565)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	4.25"	1.50"	109	155	264	1 1/4" Rim Board
2 - Stud wall - HF	5.50"	4.25"	1.50"	109	155	264	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 5" o/c	
Bottom Edge (Lu)	11' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 11' 7 5/8"	16"	14.0	20.0	attic w/ storage

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

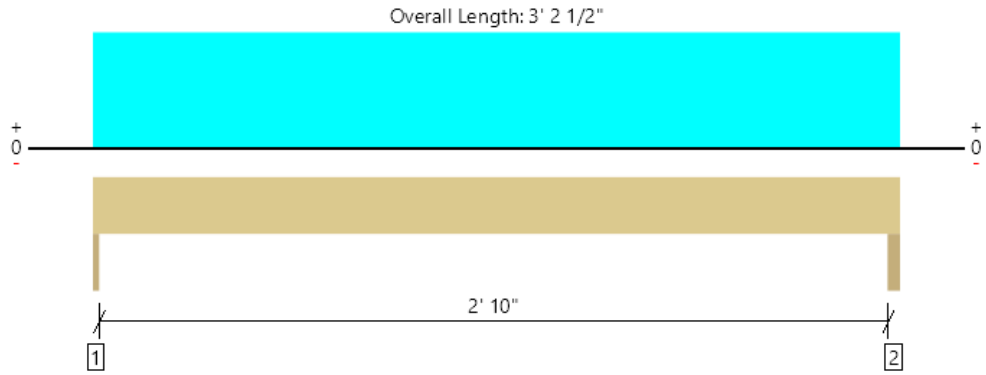
FORTEWEB

MEMBER REPORT

PASSED

Attic, E header

2 piece(s) 2 x 6 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)	1315 @ 0	1823 (1.50")	Passed (72%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	817 @ 7"	1898	Passed (43%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1014 @ 1' 6 1/2"	1602	Passed (63%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.014 @ 1' 6 1/2"	0.103	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.032 @ 1' 6 1/2"	0.154	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	Floor Live	Snow	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	746	179	568	1315	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	807	194	615	1422	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 2 1/2"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 3' 2 1/2"	14' 9"	27.0	-	25.0	roof
2 - Uniform (PLF)	0 to 3' 2 1/2"	N/A	81.8	116.3	-	Linked from: long attic joist, 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

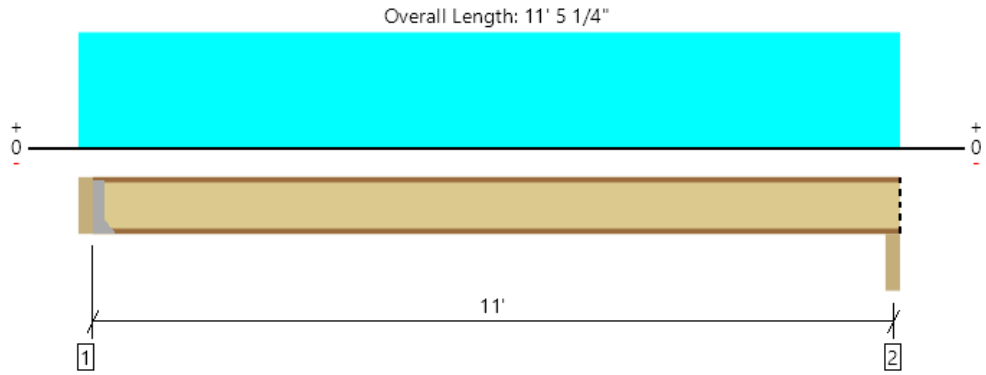
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, kitchen floor joist
1 piece(s) 11 7/8" TJI® 110 @ 16" 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)	394 @ 3 1/2"	910 (1.75")	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	394 @ 3 1/2"	1560	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1077 @ 5' 9 1/8"	3160	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.071 @ 5' 9 1/8"	0.365	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.095 @ 5' 9 1/8"	0.547	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	56	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.75" / - [2]	108	307	415	See note [1]
2 - Beam - GLB	3.50"	3.50"	1.75"	106	303	409	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 6" o/c	
Bottom Edge (Lu)	11' 2" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	Connector not found	N/A	N/A	N/A	N/A	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 11' 5 1/4"	16"	14.0	40.0	kitchen floor

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

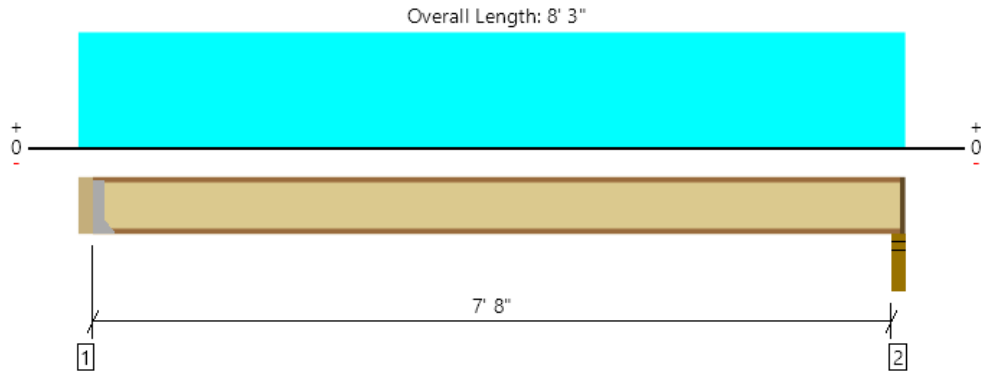
FORTEWEB

MEMBER REPORT

PASSED

Second Floor, entry joist

1 piece(s) 11 7/8" TJI® 110 @ 16" 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)	279 @ 3 1/2"	910 (1.75")	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	279 @ 3 1/2"	1560	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	541 @ 4' 2"	3160	Passed (17%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.021 @ 4' 2"	0.258	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.029 @ 4' 2"	0.387	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	66	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.75" / - [2]	78	222	300	See note [1]
2 - Stud wall - HF	3.50"	2.25"	1.75"	76	218	294	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 4" o/c	
Bottom Edge (Lu)	7' 10" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	IUS1.81/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8' 3"	16"	14.0	40.0	second floor

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

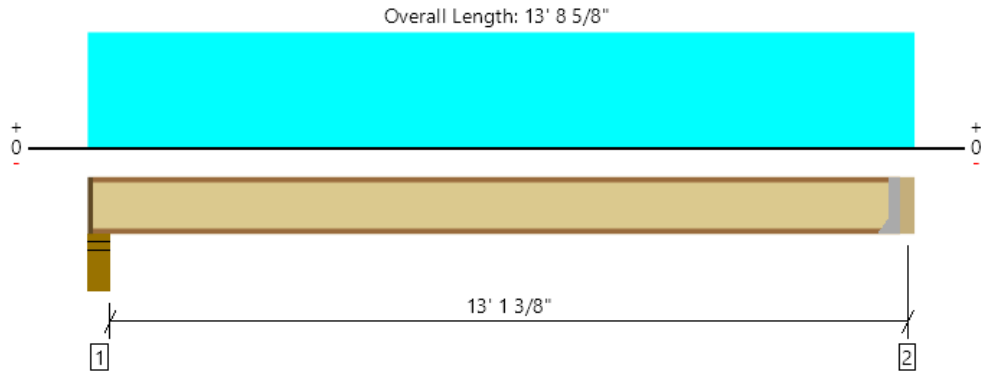
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, long bdrm joist
1 piece(s) 11 7/8" TJI® 110 @ 16" 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)	470 @ 13' 5 1/8"	910 (1.75")	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	470 @ 13' 5 1/8"	1560	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1533 @ 6' 10 13/16"	3160	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.134 @ 6' 10 13/16"	0.435	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.182 @ 6' 10 13/16"	0.653	Passed (L/863)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	47	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	4.25"	1.75"	129	368	497	1 1/4" Rim Board
2 - Hanger on 11 7/8" GLB beam	3.50"	Hanger[1]	1.75" / - [2]	127	364	491	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 7" o/c	
Bottom Edge (Lu)	13' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	IUS1.81/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 8 5/8"	16"	14.0	40.0	second floor

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

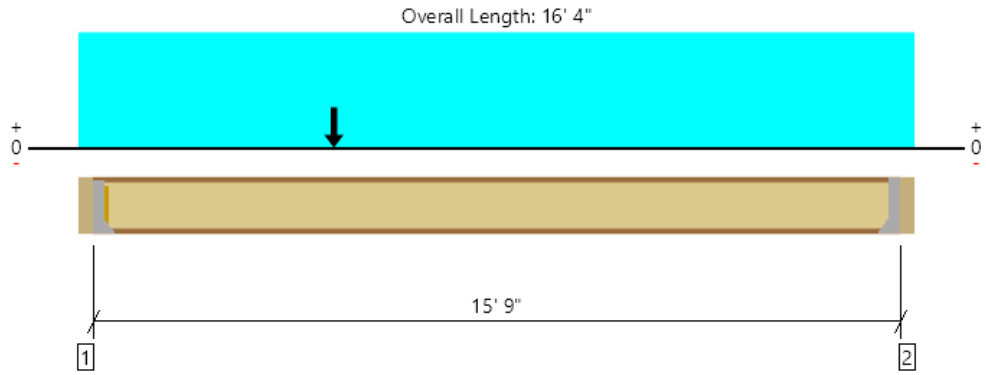
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, office floor joist
1 piece(s) 11 7/8" TJI® 560 @ 16" 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)	1265 @ 3 1/2"	1265 (1.75")	Passed (100%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1265 @ 3 1/2"	2050	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5148 @ 4' 11 7/8"	9500	Passed (54%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.198 @ 7' 9 5/16"	0.525	Passed (L/956)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.415 @ 7' 7 15/16"	0.788	Passed (L/456)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	54	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.75" / - [2]	742	544	345	1409	See note [1]
2 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.75" / - [2]	403	482	147	885	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.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 3" o/c	
Bottom Edge (Lu)	15' 9" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	U414	2.00"	N/A	16-10dx1.5	6-10d	Web Stiffeners
2 - Face Mount Hanger	IUS3.56/11.88	2.00"	N/A	12-10dx1.5	2-Strong-Grip	

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

Vertical Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 4"	16"	14.0	40.0	-	office floor
2 - Point (PLF)	4' 11 7/8"	16"	150.0	-	-	int. wall (~15' trib)
3 - Point (PLF)	4' 11 7/8"	16"	398.0	-	369.0	roof (~14.75' trib)
4 - Point (PLF)	4' 11 7/8"	16"	81.8	116.3	-	Linked from: long attic joist, Support 2

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

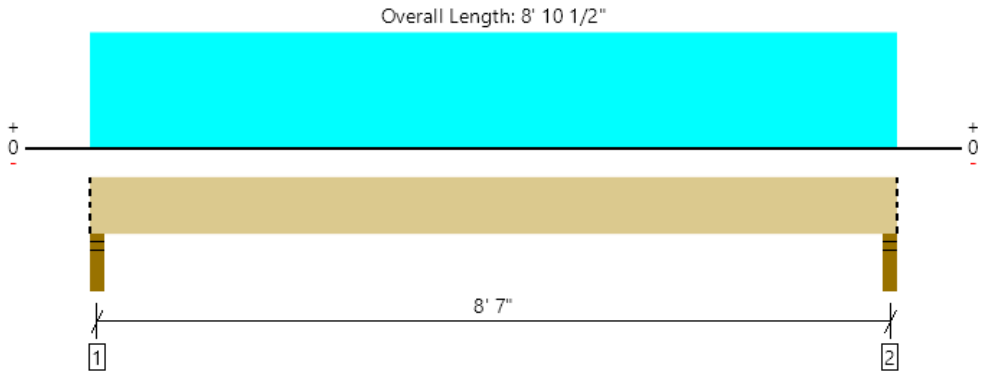
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, kitchen crawlspace beam
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)	2676 @ 2"	4961 (3.50")	Passed (54%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1972 @ 1' 2"	6493	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	5499 @ 4' 5 1/4"	12863	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.087 @ 4' 5 1/4"	0.285	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.119 @ 4' 5 1/4"	0.427	Passed (L/863)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 8' 6 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	3.50"	1.89"	723	1953	2676	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.89"	723	1953	2676	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)	8' 11" o/c	
Bottom Edge (Lu)	8' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 10 1/2"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 8' 10 1/2" (Top)	11'	14.0	40.0	kitchen floor

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

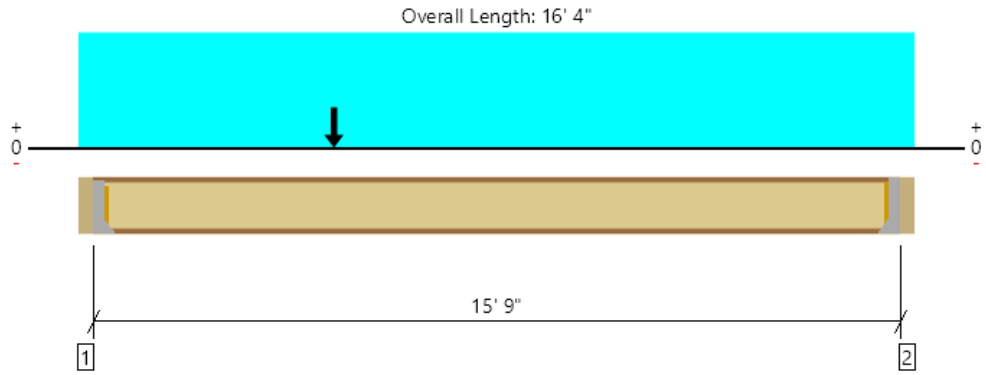
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, office FB below post
2 piece(s) 11 7/8" TJI® 560



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)	2020 @ 3 1/2"	2910 (1.75")	Passed (69%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2020 @ 3 1/2"	4715	Passed (43%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	8756 @ 4' 11 7/8"	21850	Passed (40%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.143 @ 7' 8 1/8"	0.525	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.317 @ 7' 7 1/4"	0.788	Passed (L/596)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.75" / - [2]	1123	561	658	2037	See note [1]
2 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.75" / - [2]	601	489	279	1178	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.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 6" o/c	
Bottom Edge (Lu)	15' 9" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	HU412-2	2.50"	N/A	22-10dx1.5	8-10d	Web Stiffeners
2 - Face Mount Hanger	HU410-2	2.50"	N/A	14-10dx1.5	6-10d	Web Stiffeners

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

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 16' 1/2"	N/A	8.0	--	--	
1 - Uniform (PSF)	0 to 16' 4"	1' 4"	14.0	40.0	-	office floor
2 - Point (lb)	4' 11 7/8"	N/A	150	-	-	int wall (~15' tall, 1' trib)
3 - Point (lb)	4' 11 7/8"	N/A	398	-	369	roof (~14.75' trib width, 1' trib length)
4 - Point (lb)	4' 11 7/8"	N/A	746	179	568	Linked from: E header, Support 1

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

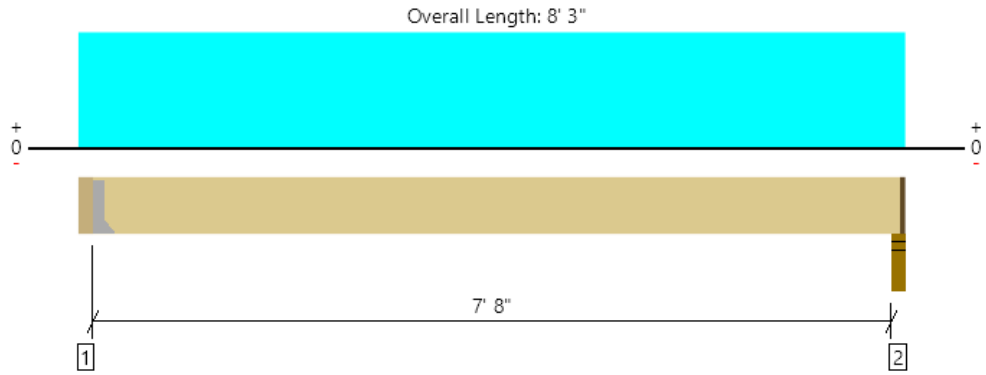
FORTEWEB

MEMBER REPORT

PASSED

Second Floor, stair header FB

2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL



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)	2054 @ 8' 1"	3189 (2.25")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1508 @ 1' 3 3/8"	7897	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3939 @ 4' 2 1/4"	17848	Passed (22%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.044 @ 4' 2 1/4"	0.260	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.055 @ 4' 2 1/4"	0.390	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.50"	449	1721	2170	See note [1]
2 - Stud wall - HF	3.50"	2.25"	1.50"	438	1670	2107	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

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

•Maximum allowable bracing intervals based on applied load.

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

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 8' 1 3/4"	N/A	12.1	--	
1 - Uniform (PSF)	0 to 8' 3" (Front)	6' 10 3/16"	14.0	60.0	entry stair

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

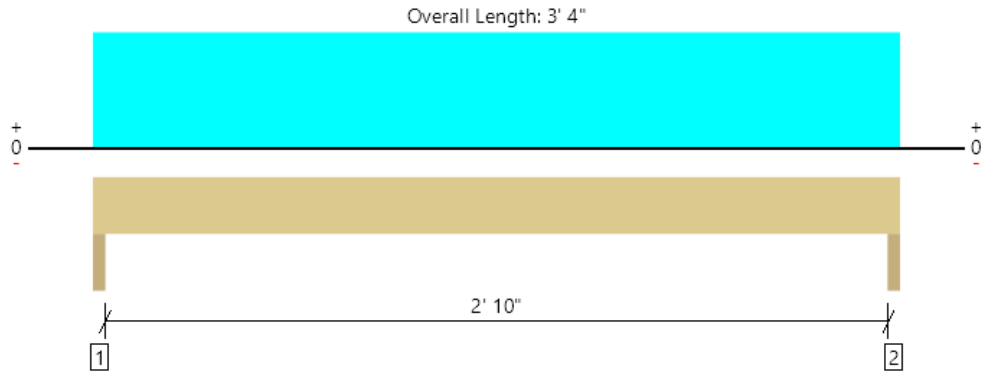
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, N-S int header
2 piece(s) 2 x 6 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)	1368 @ 1 1/2"	3645 (3.00")	Passed (38%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	787 @ 8 1/2"	1898	Passed (41%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	975 @ 1' 8"	1602	Passed (61%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.011 @ 1' 8"	0.103	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.031 @ 1' 8"	0.154	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 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	Floor Live	Snow	Factored	
1 - Trimmer - HF	3.00"	3.00"	1.50"	866	297	372	1368	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	866	297	372	1368	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 4" o/c	
Bottom Edge (Lu)	3' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 4"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 3' 4"	8' 11"	27.0	-	25.0	roof (conservative)
2 - Uniform (PSF)	0 to 3' 4"	15'	10.0	-	-	int. wall
3 - Uniform (PSF)	0 to 3' 4"	8' 11"	14.0	20.0	-	attic floor

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

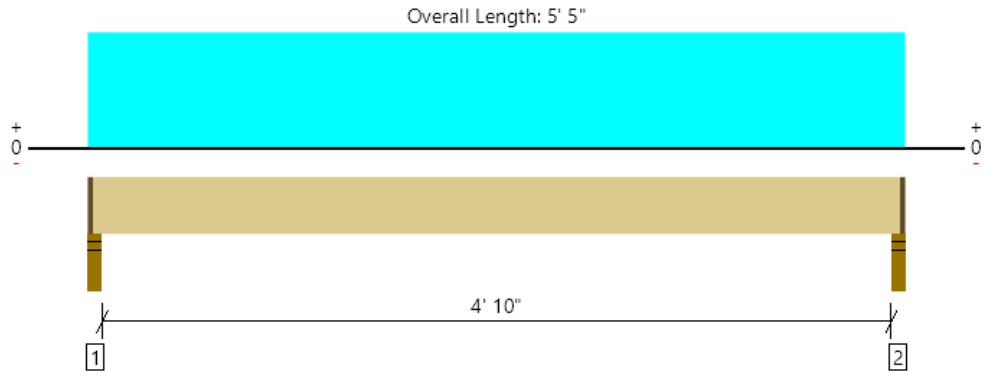
FORTEWEB

MEMBER REPORT

PASSED

Second Floor, N-S int short FB

1 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL



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)	895 @ 2"	1595 (2.25")	Passed (56%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	490 @ 1' 3 3/8"	3948	Passed (12%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1110 @ 2' 8 1/2"	8924	Passed (12%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.012 @ 2' 8 1/2"	0.169	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.017 @ 2' 8 1/2"	0.254	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.50"	253	677	930	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.50"	253	677	930	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 3" o/c	
Bottom Edge (Lu)	5' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 1/4" to 5' 3 3/4"	N/A	6.1	--	
1 - Uniform (PSF)	0 to 5' 5" (Top)	6' 3"	14.0	40.0	second floor

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

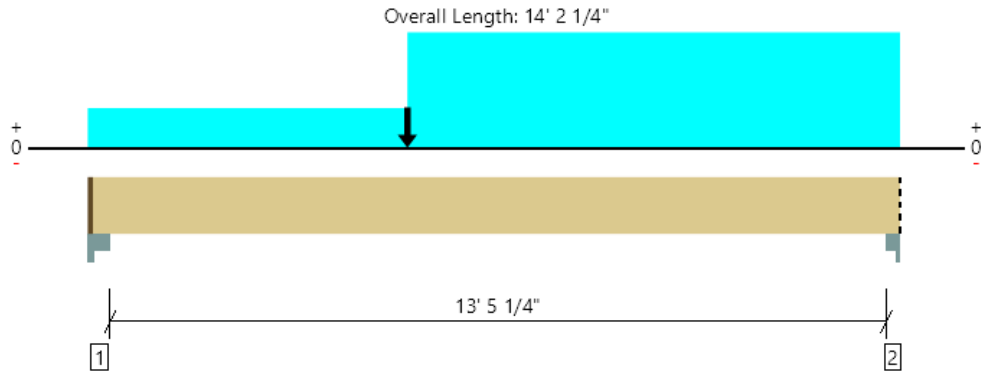
FORTEWEB

MEMBER REPORT

PASSED

Second Floor, N-S int long FB

1 piece(s) 6 3/4" x 12" 24F-V4 DF Glulam



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	9625 @ 14' 1/4"	15356 (3.50")	Passed (63%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	7821 @ 12' 10 3/4"	16457	Passed (48%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	31589 @ 7' 3 1/2"	37200	Passed (85%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.283 @ 7' 2 13/16"	0.456	Passed (L/581)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.595 @ 7' 3 1/8"	0.684	Passed (L/276)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- A 0.2% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 13' 8 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Column Cap - steel	5.50"	4.25"	1.59"	3425	3090	1684	7005	1 1/4" Rim Board
2 - Column Cap - steel	3.50"	3.50"	2.19"	5120	3249	2757	9625	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 14' 2 1/4"	N/A	19.7	--	--	
1 - Uniform (PSF)	0 to 14' 2 1/4" (Back)	3' 4"	14.0	40.0	-	second floor
2 - Uniform (PSF)	5' 7" to 14' 2 1/4" (Top)	12'	10.0	-	-	int. wall
3 - Uniform (PSF)	5' 7" to 14' 2 1/4" (Top)	3' 4"	14.0	20.0	-	attic floor
4 - Uniform (PSF)	5' 7" to 14' 2 1/4" (Top)	15' 7 1/16"	27.0	-	25.0	roof
5 - Point (lb)	5' 7" (Top)	N/A	1199	-	1088	Linked from: (ALT) N-S int. short header (bdrm), Support 2
6 - Uniform (PLF)	0 to 14' 2 1/4" (Front)	N/A	95.3	273.0	-	Linked from: long joist over garage, Support 2

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

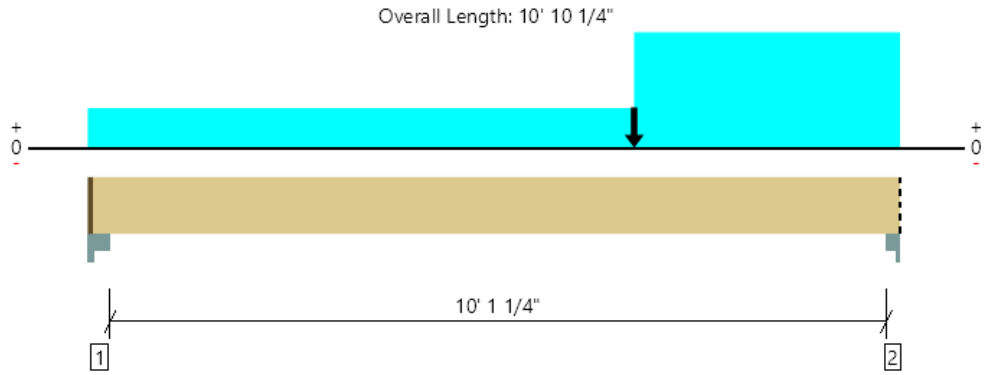
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, N-S int med FB
1 piece(s) 3 1/2" x 11 7/8" 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)	7024 @ 10' 8 1/4"	7963 (3.50")	Passed (88%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	5247 @ 9' 6 7/8"	8444	Passed (62%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	15049 @ 7' 3 5/8"	18797	Passed (80%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.155 @ 5' 8 3/4"	0.345	Passed (L/800)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.303 @ 5' 9 9/16"	0.518	Passed (L/411)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- A 0.6% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 10' 4 1/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Column Cap - steel	5.50"	4.25"	1.71"	1681	2276	686	3957	1 1/4" Rim Board
2 - Column Cap - steel	3.50"	3.50"	3.09"	3642	2371	2137	7024	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 10' 10 1/4"	N/A	10.1	--	--	
1 - Uniform (PSF)	0 to 10' 10 1/4" (Back)	3' 4"	14.0	40.0	-	second floor
2 - Uniform (PSF)	7' 3 5/8" to 10' 10 1/4" (Top)	12'	10.0	-	-	int. wall
3 - Uniform (PSF)	7' 3 5/8" to 10' 10 1/4" (Top)	3' 4"	14.0	20.0	-	attic floor
4 - Uniform (PSF)	7' 3 5/8" to 10' 10 1/4" (Top)	15' 7 1/16"	27.0	-	25.0	roof
5 - Point (lb)	7' 3 5/8" (Top)	N/A	1587	-	1439	Linked from: (ALT) N-S int. long header (bdrm), Support 1
6 - Uniform (PLF)	0 to 10' 10 1/4" (Front)	N/A	95.3	273.0	-	Linked from: long joist over garage, Support 2

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

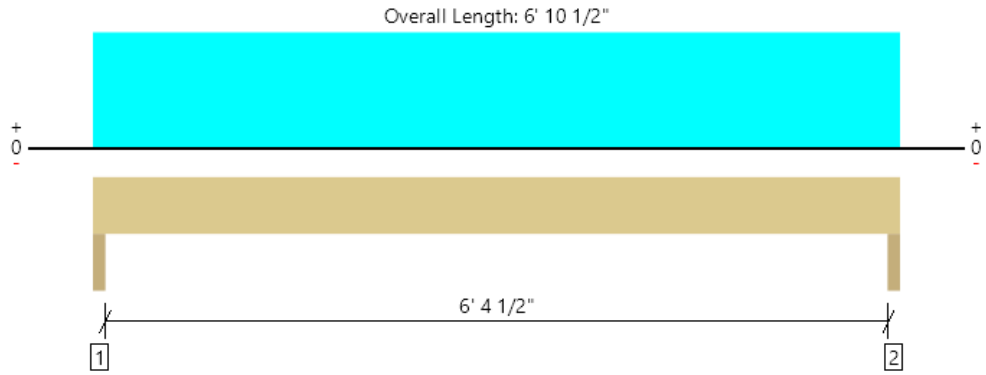
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

Second Floor, W header
2 piece(s) 2 x 10 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)	1305 @ 1 1/2"	3645 (3.00")	Passed (36%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	918 @ 1' 1/4"	2775	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2084 @ 3' 5 1/4"	3333	Passed (63%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.047 @ 3' 5 1/4"	0.221	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.064 @ 3' 5 1/4"	0.331	Passed (L/999+)	--	1.0 D + 1.0 L (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	Floor Live	Factored	
1 - Trimmer - HF	3.00"	3.00"	1.50"	357	949	1305	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	357	949	1305	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 11" o/c	
Bottom Edge (Lu)	6' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 6' 10 1/2"	N/A	7.0	--	
1 - Uniform (PLF)	0 to 6' 10 1/2"	N/A	96.8	276.0	Linked from: long bdrm 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

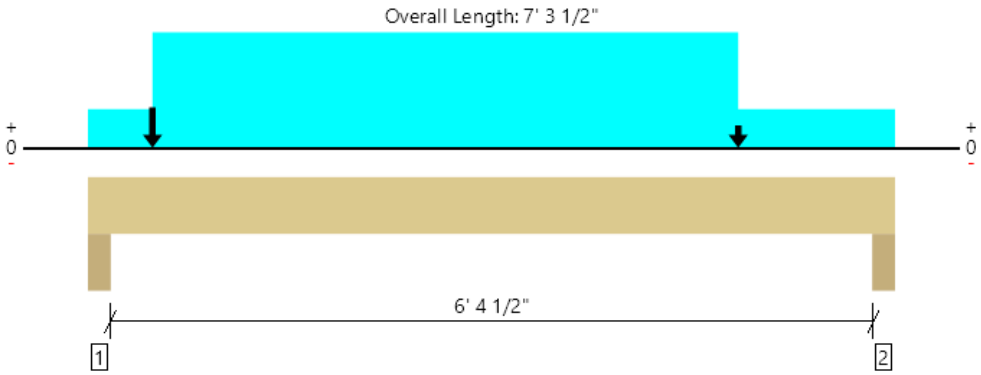
FORTEWEB

MEMBER REPORT

PASSED

Second Floor, W header w/ wall abv

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)	7749 @ 4"	12513 (5.50")	Passed (62%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	3286 @ 5' 11 1/2"	7466	Passed (44%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	6332 @ 3' 6 7/8"	14792	Passed (43%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.035 @ 3' 7 5/8"	0.221	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.084 @ 3' 7 9/16"	0.331	Passed (L/942)	--	1.0 D + 0.75 L + 0.75 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 = 6' 7 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Trimmer - HF	5.50"	5.50"	3.41"	4743	1006	3002	7749	None
2 - Trimmer - HF	5.50"	5.50"	1.63"	2106	1006	1123	3703	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 4" o/c	
Bottom Edge (Lu)	7' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 3 1/2"	N/A	8.9	--	--	
1 - Uniform (PSF)	7" to 5' 10 1/2"	7' 6"	14.0	-	-	ext. wall
2 - Uniform (PLF)	0 to 7' 3 1/2"	N/A	96.8	276.0	-	Linked from: long bdrm joist, Support 1
3 - Uniform (PLF)	7" to 5' 10 1/2"	N/A	363.5	-	278.0	Linked from: short cant. rafter, Support 1
4 - Point (lb)	7"	N/A	2972	-	2178	Linked from: long W bdrm header, Support 2
5 - Point (lb)	5' 10 1/2"	N/A	628	-	475	Linked from: short W bdrm header, Support 1

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

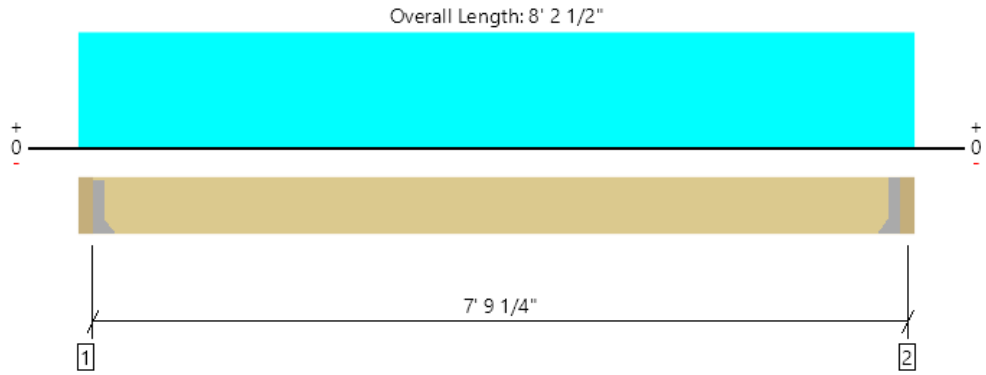
FORTEWEB

MEMBER REPORT

PASSED

First Floor, ext. garage joist (w/ slab)

1 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL @ 16" 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)	620 @ 3 1/2"	1969 (1.50")	Passed (32%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	522 @ 10 3/4"	2411	Passed (22%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1182 @ 4' 1 1/4"	3700	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.052 @ 4' 1 1/4"	0.254	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.106 @ 4' 1 1/4"	0.381	Passed (L/867)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	65	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling, Pour Flooring Overlay.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 7 1/4" HF Ledger	3.50"	Hanger[1]	1.50"	339	328	668	See note [1]
2 - Hanger on 7 1/4" HF beam	3.50"	Hanger[1]	1.50"	339	328	668	See note [1]

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 8" o/c	
Bottom Edge (Lu)	7' 8" 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	HU1.81/5	2.50"	N/A	12-10dx1.5	4-10dx1.5	
2 - Face Mount Hanger	HU1.81/5	2.50"	N/A	12-10dx1.5	4-10dx1.5	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8' 2 1/2"	16"	62.0	60.0	ext. first floor framing w/ 4" topping slab

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

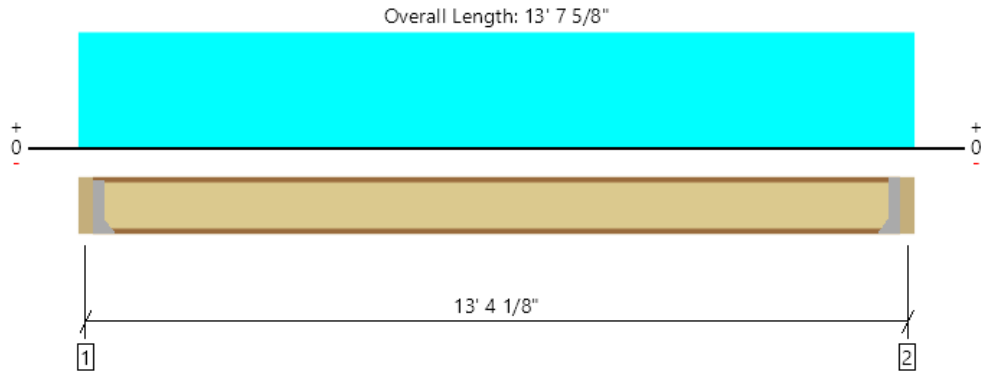
Weyerhaeuser

FORTEWEB

MEMBER REPORT

PASSED

First Floor, int. long garage joist
1 piece(s) 11 7/8" TJI® 110 @ 16" 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)	470 @ 3 1/2"	910 (1.75")	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	470 @ 3 1/2"	1560	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1533 @ 6' 9 13/16"	3160	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.134 @ 6' 9 13/16"	0.435	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.182 @ 6' 9 13/16"	0.653	Passed (L/863)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	52	40	Passed	--	--

System : Floor
Member Type : Joist
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.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" HF beam	3.50"	Hanger[1]	1.75" / - [2]	127	364	491	See note [1]
2 - Hanger on 11 7/8" HF beam	3.50"	Hanger[1]	1.75" / - [2]	127	364	491	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.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 7" o/c	
Bottom Edge (Lu)	13' 1" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- 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	IUS1.81/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	
2 - Face Mount Hanger	IUS1.81/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

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

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 7 5/8"	16"	14.0	40.0	first floor framing

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

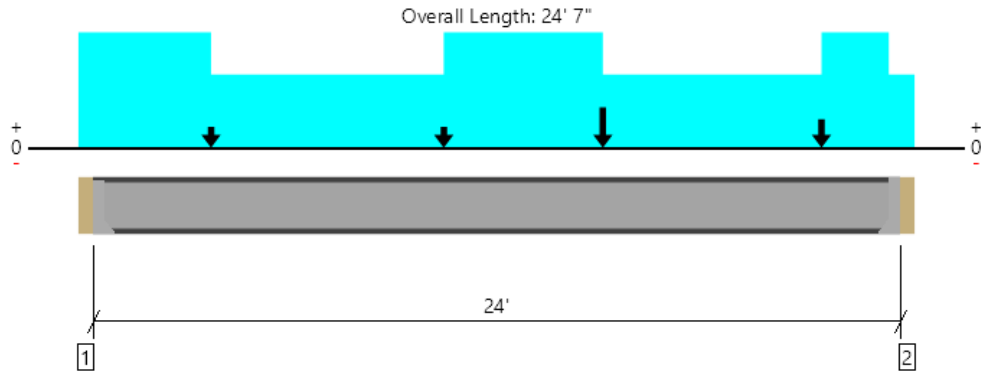
FORTEWEB

MEMBER REPORT

PASSED

First Floor, long N-S beam

1 piece(s) W12X65 (A992) ASTM Steel



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)	20987 @ 24' 3 1/2"	54405 (1.50")	Passed (39%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	20733 @ 24' 3 1/2"	94380	Passed (22%)	--	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	121430 @ 13' 7 1/2"	236988	Passed (51%)	--	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.383 @ 12' 3 13/16"	0.800	Passed (L/752)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.798 @ 12' 5 7/8"	1.200	Passed (L/361)	--	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).
- Bearing reinforcement may be required for support located at 0".
- Bearing reinforcement may be required for support located at 24'.
- Applicable calculations are based on ANSI/AISC 360-16.
- A lateral-torsional buckling factor (Cb) of 1.0 has been assumed.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Hanger on 12 1/8" HF Ledger	3.50"	Hanger[1]	1.50" / - [2]	8840	9814	1214	18654	See note [1]
2 - Hanger on 12 1/8" HF beam	3.50"	Hanger[1]	1.50" / - [2]	11223	9764	2911	20987	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.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

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

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

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

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 24' 3 1/2"	N/A	65.0	--	--	
1 - Uniform (PSF)	0 to 3' 9 5/8"	9'	14.0	-	-	ext. wall
2 - Uniform (PSF)	10' 8 5/8" to 15' 5 1/2"	9'	14.0	-	-	ext. wall
3 - Uniform (PSF)	21' 11 1/2" to 23' 11 1/2"	9'	14.0	-	-	ext. wall
4 - Uniform (PLF)	0 to 3' 9 5/8"	N/A	96.8	276.0	-	Linked from: long bdrm joist, Support 1
5 - Uniform (PLF)	10' 8 5/8" to 15' 5 1/2"	N/A	96.8	276.0	-	Linked from: long bdrm joist, Support 1
6 - Uniform (PLF)	21' 11 1/2" to 23' 11 1/2"	N/A	96.8	276.0	-	Linked from: long bdrm joist, Support 1
7 - Point (lb)	3' 9 5/8"	N/A	357	949	-	Linked from: W header, Support 1
8 - Point (lb)	10' 8 5/8"	N/A	357	949	-	Linked from: W header, Support 2
9 - Uniform (PLF)	0 to 24' 7"	N/A	95.3	273.0	-	Linked from: int. long garage joist, Support 1
10 - Point (lb)	15' 5 1/2"	N/A	4743	1006	3002	Linked from: W header w/ wall abv, Support 1
11 - Point (lb)	21' 11 1/2"	N/A	2106	1006	1123	Linked from: W header w/ wall abv, Support 2
12 - Uniform (PLF)	0 to 24' 7"	N/A	254.3	246.0	-	Linked from: ext. garage joist (w/ slab), 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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

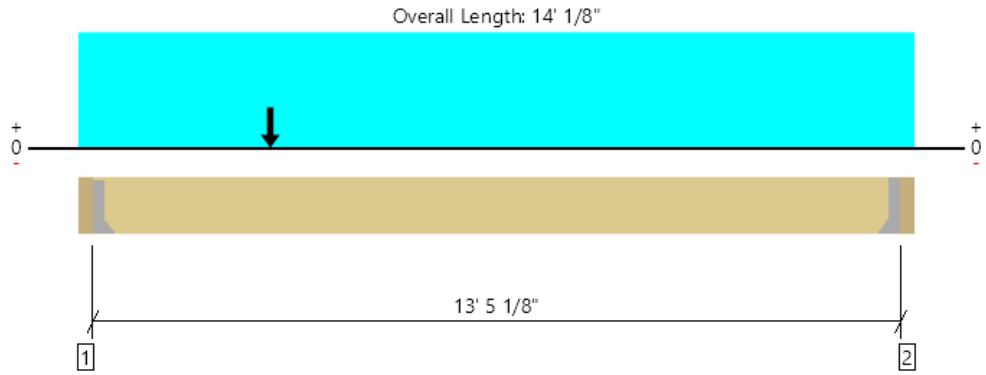
FORTEWEB

MEMBER REPORT

FAILED

First Floor, medium middle N-S beam

1 piece(s) 5 1/2" x 11 7/8" 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)	16086 @ 3 1/2"	16086 (4.50")	Passed (100%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	14441 @ 1' 3 3/8"	11539	Failed (125%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	41767 @ 3' 2 7/8"	25798	Failed (162%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.471 @ 6' 5 9/16"	0.448	Failed (L/342)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.900 @ 6' 4 15/16"	0.671	Failed (L/179)	--	1.0 D + 0.75 L + 0.75 S (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).
- A 0.2% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 13' 5 1/8".
- 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	Floor Live	Snow	Factored	
1 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	4.50"	7935	7221	3820	16215	See note [1]
2 - Hanger on 11 7/8" HF beam	3.50"	Hanger[1]	1.94"	3020	4069	1074	7089	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)	2' o/c	
Bottom Edge (Lu)	2' o/c	

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Face Mount Hanger	MGU5.62-SDS H=11.875	4.50"	N/A	24-SDS25212	16-SDS25212	

- 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)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 13' 8 5/8"	N/A	15.9	--	--	
1 - Uniform (PSF)	0 to 14' 1/8" (Back)	3' 3 1/2"	14.0	40.0	-	first floor
2 - Point (lb)	3' 2 7/8" (Top)	N/A	3642	2371	2137	Linked from: N-S int med FB, Support 2
3 - Uniform (PLF)	0 to 14' 1/8" (Front)	N/A	95.3	273.0	-	Linked from: int. long garage joist, Support 2
4 - Point (lb)	3' 2 7/8" (Top)	N/A	5120	3249	2757	Linked from: N-S int long FB, Support 2

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

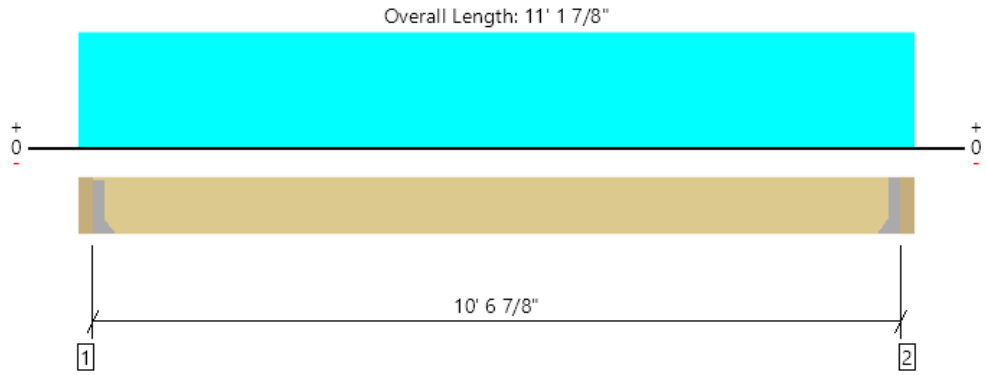
FORTEWEB

MEMBER REPORT

PASSED

First Floor, short middle N-S beam

1 piece(s) 3 1/2" x 11 7/8" 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)	2940 @ 3 1/2"	3413 (1.50")	Passed (86%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2390 @ 1' 3 3/8"	7343	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	7771 @ 5' 6 15/16"	16361	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.129 @ 5' 6 15/16"	0.352	Passed (L/980)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.178 @ 5' 6 15/16"	0.529	Passed (L/713)	--	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).
- A 0.6% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 10' 6 7/8".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.50"	842	2257	3099	See note [1]
2 - Hanger on 11 7/8" HF beam	3.50"	Hanger[1]	1.50"	842	2257	3099	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)	2' o/c	
Bottom Edge (Lu)	2' o/c	

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
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)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 10' 10 3/8"	N/A	10.1	--	
1 - Uniform (PSF)	0 to 11' 1 7/8" (Back)	3' 3 1/2"	14.0	40.0	first floor
2 - Uniform (PLF)	0 to 11' 1 7/8" (Front)	N/A	95.3	273.0	Linked from: int. long garage joist, Support 2

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

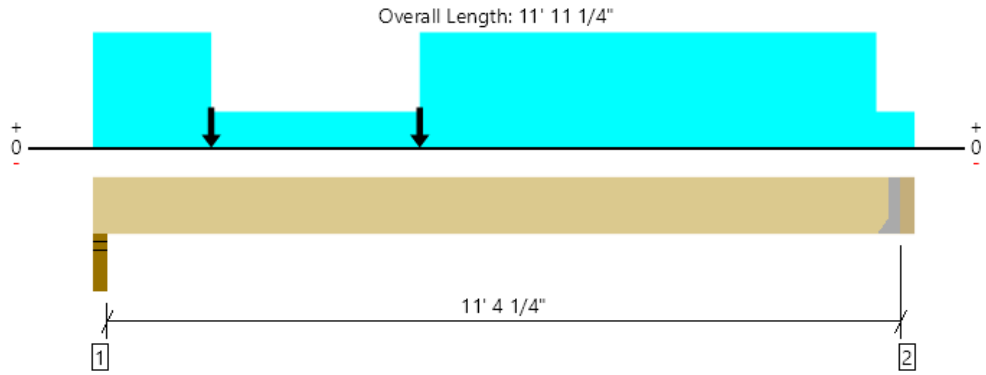
FORTEWEB

MEMBER REPORT

PASSED

First Floor, E N-S beam

1 piece(s) 3 1/2" x 11 7/8" 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)	3461 @ 11' 7 3/4"	3461 (1.52")	Passed (100%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3467 @ 1' 3 3/8"	7343	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	11258 @ 5' 4 5/16"	16361	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.123 @ 5' 10 3/4"	0.383	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.298 @ 5' 10 5/16"	0.574	Passed (L/462)	--	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).
- A 0.6% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 11' 5 3/4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - HF	3.50"	3.50"	2.96"	2523	1676	541	4199	None
2 - Hanger on 11 7/8" HF Ledger	3.50"	Hanger[1]	1.52"	1972	1540	203	3512	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)	2' o/c	
Bottom Edge (Lu)	2' o/c	

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

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 11' 7 3/4"	N/A	10.1	--	--	
1 - Uniform (PSF)	0 to 11' 11 1/4" (Top)	3' 3"	14.0	40.0	-	first floor
2 - Uniform (PSF)	0 to 1' 9" (Top)	21'	10.0	-	-	int. walls
3 - Uniform (PSF)	4' 10" to 11' 3 3/4" (Top)	21'	10.0	-	-	int. walls
4 - Uniform (PSF)	0 to 1' 9" (Top)	3' 3"	14.0	40.0	-	second floor
5 - Uniform (PSF)	4' 10" to 11' 3 3/4" (Top)	3' 3"	14.0	40.0	-	second floor
6 - Point (lb)	1' 9" (Top)	N/A	866	297	372	Linked from: N-S int header, Support 1
7 - Point (lb)	4' 10" (Top)	N/A	866	297	372	Linked from: N-S int header, Support 2

ForteWEB Software Operator	Job Notes
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

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
Conrad Beymer Harriott Valentine (602) 568-7460 cbeymer@harriottvalentine.com	

Weyerhaeuser

Harriott Valentine Engineers Inc.

CONCRETE BEAM ANALYSIS

C1 - LONG GARAGE BEAM

Moment

phiMn = phi [Asfy (d - Asfy / 1.7f'cb)]

fy =	60.00	ksi
f'c =	2.50	ksi
b =	8.00	in
d =	22.50	in
As =	1.80	in2
phi =	0.90	
phiMn =	156.52	kft

Minimum flexural reinforcement (rho = 200/fy):

As min = 0.60 in2

For structural slabs, temperature and shrinkage reinforcement shall be provided:

ratio =	0.0020	(Grade 40)
b =	8.00	in
cover =	2.50	in
h =	27.50	in
As min =	0.44	in2

ratio =	0.0018	(Grade 60)
b =	8.00	in
cover =	1.50	in
h =	27.50	in
As min =	0.40	in2

Shear

phiVc = phi [2 (f'c ^ 1/2) bd]

f'c =	2.50	ksi
b =	8.00	in
d =	22.50	in
phi =	0.75	
phiVc =	13.50	k

A minimum area of shear reinforcement shall be provided where Vu exceeds 1/2 phiVc:

1/2 phiVc = 6.75 k

Except for:

1. Slabs and footings.
2. Concrete joist construction (per 1908.11).
3. Beams with total depth not greater than 10", 2-1/2 x flange thickness, or 1/2 web width.

phiVs = phi Av fy d / s

s =	6.00	in
Av =	0.22	in2
phiVs =	37.13	k

phiVn = phiVc + phiVs

phiVn = 50.63 k

Minimum shear reinforcement Av = 50 bw s / fy

Av min = 0.04 in2

s = d/2 = 11.25 in

s = d/4 = 5.63 in

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel 206-624-4760 | fax 447-6971

SECTION 2: LATERAL

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

CRITERIA

LATERAL

wind	wind importance factor	1.0		
	basic wind speed	100	mph	
	wind exposure	B		
	topographical factor (Kzt)	1.25		
seismic	seismic importance factor	1.0		
	latitude	47.583	°	
	longitude	-122.246	°	
	accel. at short periods (Ss)	1.56	g	(from SEAOC Design Tool)
	accel. at 1-sec period (S1)	0.64	g	
	seismic design category	D		
	response modification factor (R)	6.5		

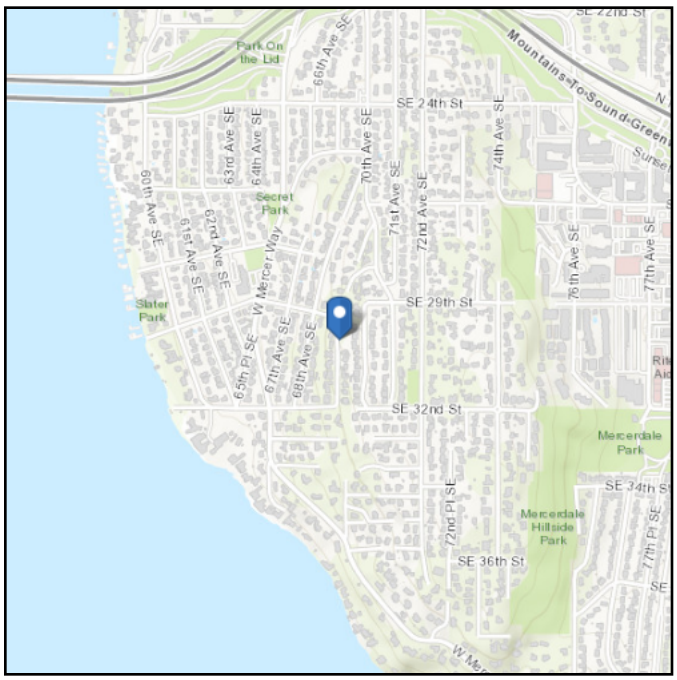
1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel 206-624-4760 | fax 447-6971

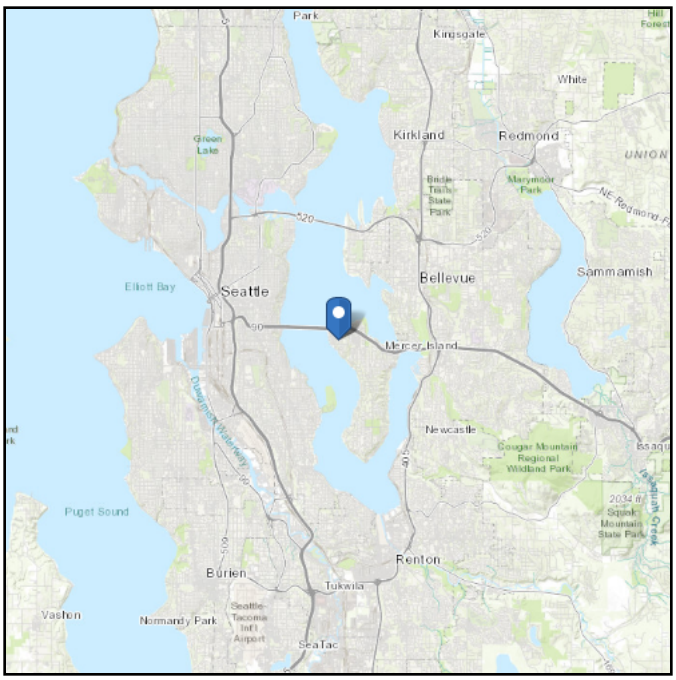
ASCE 7 Hazards Report

Address:
3024 69th Ave SE
Mercer Island, Washington
98040

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: Default

Latitude: 47.583477
Longitude: -122.246095
Elevation: 242.84 ft (NAVD 88)





Wind

Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	74 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph
300-year MRI	92 Vmph
700-year MRI	98 Vmph
1,700-year MRI	104 Vmph
3,000-year MRI	109 Vmph
10,000-year MRI	118 Vmph
100,000-year MRI	136 Vmph
1,000,000-year MRI	154 Vmph

Data Source: ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri Dec 02 2022

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2.

Seismic

Default

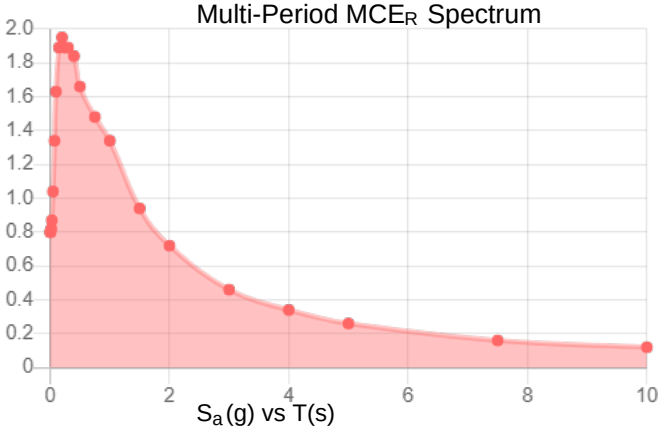
Site Soil Class:

Results:

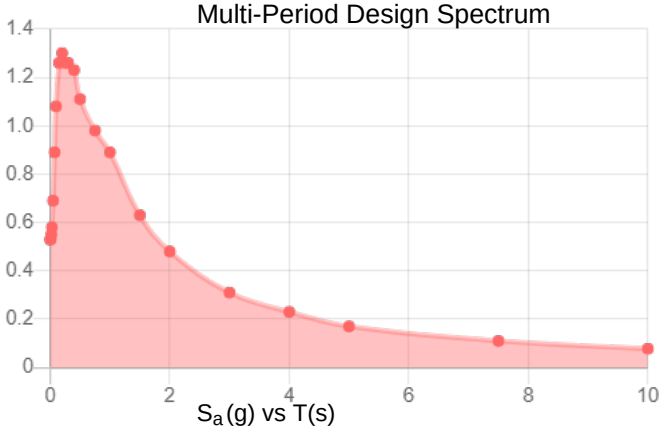
PGA_M :	0.73	T_L :	6
S_{MS} :	1.76	S_S :	1.56
S_{M1} :	1.34	S_1 :	0.64
S_{DS} :	1.17	V_{S30} :	260
S_{D1} :	0.89		

Seismic Design Category: D

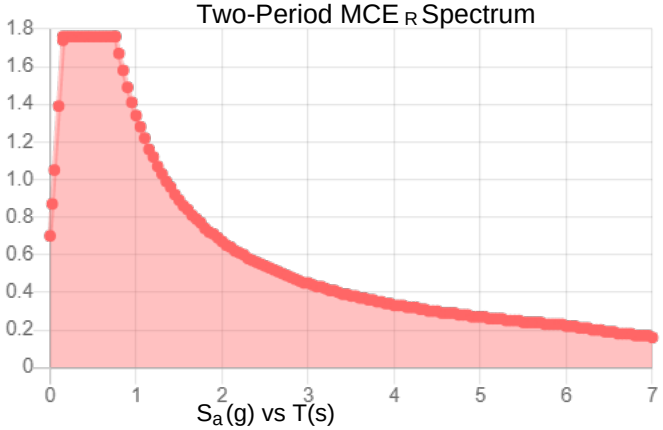
Multi-Period MCE_R Spectrum



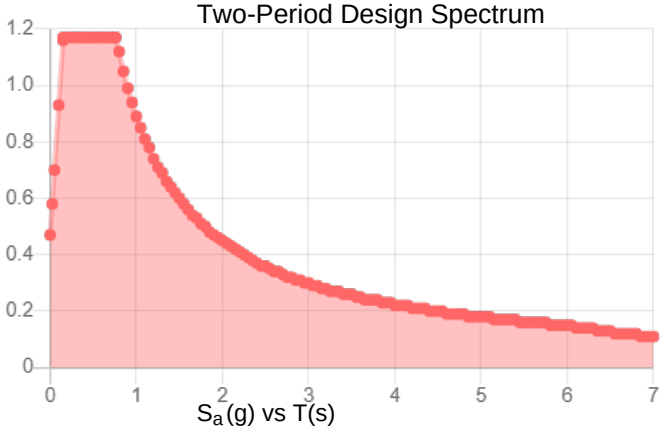
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: Fri Dec 02 2022

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

Snow

Results:

Ground Snow Load, p_g:	42 lb/ft^2
Allowable Stress Design Ground Snow Load:	29.4 lb/ft^2
20-year MRI Value:	8.83 lb/ft^2
Winter Wind Parameter:	0.35
Elevation:	242.8 ft
Data Source:	ASCE/SEI 7-22, Figures 7.6-1 and 7.6-2 A-D
Date Accessed:	Fri Dec 02 2022

Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow loads at elevations not covered.

WIND LOADS - DIRECTIONAL METHOD -- KITCHEN WING

ASCE 7-16, Chapter 27

$p_{1,2}$ = qGCp + qi (GCpi)		psf (equation 27.4-1)	Mean Roof Height, h =	14.24	ft	
Risk Category =	II	(table 11.5-1)	Length of Short Side =	23.34	ft	
V =	100	mph (figure 26.5-1)	Length of Long Side =	43.23	ft	
Exposure =	B	(ch. 26.7.3)	Roof Angle =	12.00	degrees (leeward)	12.00 degrees (windward)
k_d =	0.85	(table 26.6-1)	$\bar{z}$ =	30	ft	
k_{zt} =	1.25	(ch. 26.8.1)	$I_{\bar{z}}$ =	0.30	(ch. 26.9.4)	
±(GCpi) =	0.18	(table 26.11-1)	$L_{\bar{z}}$ =	461.5	(ch. 26.9.4)	
			1/Ta =	7	(rigid per ch. 26.2)	

Terrain Exposure Constants: Table 26.9-1

exp.	α	z_g	â	b̂	$\bar{\alpha}$	$\bar{b}$	c	l	$\bar{\epsilon}$	z_{min}
B	7	1200	0.143	0.84	0.25	0.45	0.3	320	0.333	30

Transverse Wind (E-W)

				Windward Walls	
	H (ft.)	K_z	qz	p1	p2
Mean Roof	**14.24**	0.57	15.63	7.8	13.4
ridge	15.86	0.58	15.88	8.0	13.6
T.O. main walls	12.63	0.57	15.63	7.8	13.4
	15.00	0.57	15.63	7.8	13.4

Leeward Walls	
p1	p2
-9.5	-3.8

Side Walls	
p1	p2
-12.1	-6.5

B =	43.23	ft.	h/L = 0.61
L =	23.34	ft.	L/B = 0.54
Q =	0.92		G = 0.85

Cp (figure 27.4-1)	
Windward	0.8
Leeward	-0.5
Side	-0.7

Roof Pressure: Wind Perp. to Ridge for Angle < 10 deg. and Parallel to Ridge for all angles

		0 to h/2		h/2 to h		h to 2h		>2h	
	Cp	-0.99	-0.27	-0.99	-0.27	-0.59	-0.27	-0.39	-0.27
Horizontal	p1	-3.31	-1.33	-3.31	-1.33	-2.21	-1.33	-1.66	-1.33
	p2	-2.14	-0.16	-2.14	-0.16	-1.04	-0.16	-0.49	-0.16
Vertical	p1	-15.59	-6.24	-15.59	-6.24	-10.40	-6.24	-7.80	-6.24
	p2	-10.09	-0.73	-10.09	-0.73	-4.89	-0.73	-2.29	-0.73

Roof Pressure: Wind Perp. to Ridge for Angle ≥ 10 deg.

		Windward Roof		Leeward Roof	
	Cp	-0.90	-0.18	-0.53	-0.53
Horizontal	p1	-3.07	-1.08	-2.06	-2.06
	p2	-1.90	0.09	-0.89	-0.89
Vertical	p1	-14.42	-5.09	-9.70	-9.70
	p2	-8.92	0.41	-4.20	-4.20

Notes: Use 16psf min. horizontal wind pressure for walls.
Use 8psf min. vertical wind pressure for roofs.

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

Longitudinal Wind (N-S)

	H (ft.)	K_z	qz	Windward Walls p1	Windward Walls p2
Mean Roof	**14.24**	0.57	15.63	7.8	13.4
ridge	15.86	0.58	15.88	8.0	13.6
T.O. main walls	12.63	0.57	15.63	7.8	13.4
	15.00	0.57	15.63	7.8	13.4

Leeward Walls p1	Leeward Walls p2
-6.8	-1.2

Side Walls p1	Side Walls p2
-12.1	-6.5

Cp (figure 27.4-1)	
Windward	0.8
Leeward	-0.3
Side	-0.7

B = 23.34 ft. h/L = 0.33
L = 43.23 ft. L/B = 1.85
Q = 0.94 G = 0.85

Roof Pressure: Wind Perp. to Ridge for Angle < 10 deg. and Parallel to Ridge for all angles

		0 to h/2		h/2 to h		h to 2h		>2h	
	Cp	-0.90	-0.18	-0.90	-0.18	-0.50	-0.18	-0.30	-0.18
Horizontal	p1	-3.07	-1.08	-3.07	-1.08	-1.97	-1.08	-1.41	-1.08
	p2	-1.90	0.09	-1.90	0.09	-0.80	0.09	-0.24	0.09
Vertical	p1	-14.45	-5.09	-14.45	-5.09	-9.25	-5.09	-6.65	-5.09
	p2	-8.95	0.41	-8.95	0.41	-3.75	0.41	-1.15	0.41

Roof Pressure: Wind Perp. to Ridge for Angle $\geq$ 10 deg.

		Windward Roof		Leeward Roof	
	Cp	0.40	0.40	-0.60	-0.60
Horizontal	p1	0.52	0.52	-2.24	-2.24
	p2	1.69	1.69	-1.07	-1.07
Vertical	p1	2.45	2.45	-10.55	-10.55
	p2	7.95	7.95	-5.05	-5.05

Notes: Use 16psf min. horizontal wind pressure for walls.
Use 8psf min. vertical wind pressure for roofs.

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

WIND LOADS - DIRECTIONAL METHOD -- BEDROOM WING

ASCE 7-16, Chapter 27

$p_{1,2}$ = qGCp + qi (GCpi)		psf (equation 27.4-1)	Mean Roof Height, h =	32.68	ft	
Risk Category =	II	(table 11.5-1)	Length of Short Side =	25.42	ft	
V =	100	mph (figure 26.5-1)	Length of Long Side =	43.42	ft	
Exposure =	B	(ch. 26.7.3)	Roof Angle =	12.00	degrees (leeward)	12.00 degrees (windward)
k_d =	0.85	(table 26.6-1)	$\bar{z}$ =	30	ft	
k_{zt} =	1.25	(ch. 26.8.1)	$I_{\bar{z}}$ =	0.30	(ch. 26.9.4)	
±(GCpi) =	0.18	(table 26.11-1)	$L_{\bar{z}}$ =	461.5	(ch. 26.9.4)	
			1/Ta =	4	(rigid per ch. 26.2)	

Terrain Exposure Constants: Table 26.9-1

exp.	α	z_g	â	b̂	$\bar{\alpha}$	$\bar{b}$	c	l	$\bar{\epsilon}$	z_{min}
B	7	1200	0.143	0.84	0.25	0.45	0.3	320	0.333	30

Transverse Wind (N-S)

				Windward Walls	
	H (ft.)	K_z	qz	p1	p2
Mean Roof	**32.68**	0.72	19.53	9.8	16.8
ridge	35.36	0.73	19.97	10.1	17.1
T.O. 2F walls	27.94	0.69	18.67	9.2	16.2
T.O. 1F walls	18.45	0.61	16.58	7.8	14.8
T.O. 0F walls	8.45	0.57	15.63	7.1	14.1
	15.00	0.57	15.63	7.1	14.1

Leeward Walls	
p1	p2
-11.8	-4.8

Side Walls	
p1	p2
-15.1	-8.1

B =	43.42	ft.	h/L = 1.29
L =	25.42	ft.	L/B = 0.59
Q =	0.91		G = 0.85

Cp (figure 27.4-1)

Windward	0.8
Leeward	-0.5
Side	-0.7

Roof Pressure: Wind Perp. to Ridge for Angle < 10 deg. and Parallel to Ridge for all angles

		0 to h/2		h/2 to h		h to 2h		>2h	
	Cp	-1.30	-0.18	-0.70	-0.18	-0.70	-0.18	-0.70	-0.18
Horizontal	p1	-5.22	-1.35	-3.15	-1.35	-3.15	-1.35	-3.15	-1.35
	p2	-3.76	0.11	-1.68	0.11	-1.68	0.11	-1.68	0.11
Vertical	p1	-24.54	-6.36	-14.80	-6.36	-14.80	-6.36	-14.80	-6.36
	p2	-17.67	0.52	-7.93	0.52	-7.93	0.52	-7.93	0.52

Roof Pressure: Wind Perp. to Ridge for Angle ≥ 10 deg.

		Windward Roof		Leeward Roof	
	Cp	-1.37	-0.18	-0.60	-0.60
Horizontal	p1	-5.47	-1.35	-2.80	-2.80
	p2	-4.01	0.11	-1.34	-1.34
Vertical	p1	-25.75	-6.36	-13.18	-13.18
	p2	-18.88	0.52	-6.30	-6.30

Notes: Use 16psf min. horizontal wind pressure for walls.
Use 8psf min. vertical wind pressure for roofs.

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

Longitudinal Wind (E-W)

				Windward Walls	
	H (ft.)	K_z	qz	p1	p2
Mean Roof	**32.68**	0.72	19.53	9.8	16.8
ridge	35.36	0.73	19.97	10.1	17.1
T.O. 2F walls	27.94	0.69	18.67	9.2	16.2
T.O. 1F walls	18.45	0.61	16.58	7.8	14.8
T.O. 0F walls	8.45	0.57	15.63	7.1	14.1
	15.00	0.57	15.63	7.1	14.1

Leeward Walls

p1	p2
-8.5	-1.5

Side Walls

p1	p2
-15.1	-8.1

Cp (figure 27.4-1)

Windward	0.8
Leeward	-0.3
Side	-0.7

B = 25.42 ft. h/L = 0.75
L = 43.42 ft. L/B = 1.71
Q = 0.92 G = 0.85

Roof Pressure: Wind Perp. to Ridge for Angle < 10 deg. and Parallel to Ridge for all angles

		0 to h/2		h/2 to h		h to 2h		>2h	
	Cp	-1.10	-0.38	-1.10	-0.38	-0.70	-0.38	-0.50	-0.38
Horizontal	p1	-4.53	-2.05	-4.53	-2.05	-3.15	-2.05	-2.46	-2.05
	p2	-3.07	-0.59	-3.07	-0.59	-1.69	-0.59	-1.00	-0.59
Vertical	p1	-21.33	-9.64	-21.33	-9.64	-14.84	-9.64	-11.59	-9.64
	p2	-14.46	-2.77	-14.46	-2.77	-7.96	-2.77	-4.71	-2.77

Roof Pressure: Wind Perp. to Ridge for Angle $\geq$ 10 deg.

		Windward Roof		Leeward Roof	
	Cp	-1.02	-0.25	-0.58	-0.58
Horizontal	p1	-4.26	-1.60	-2.73	-2.73
	p2	-2.80	-0.14	-1.27	-1.27
Vertical	p1	-20.03	-7.54	-12.84	-12.84
	p2	-13.16	-0.67	-5.97	-5.97

Notes: Use 16psf min. horizontal wind pressure for walls.
Use 8psf min. vertical wind pressure for roofs.

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

SEISMIC DESIGN -- KITCHEN WING

ASCE 7-16
Equivalent Lateral Force Procedure

Occupancy Category	II		Table 1-1
Seismic Design Category	D		Table 11.6-1
Importance Factor	1.00		Table 11.5-1
Site Class	D		Table 20.3-1
S_S	1.56	g	(from USGS National Seismic Hazard Maps, 2008 data)
S_1	0.64	g	(from USGS National Seismic Hazard Maps, 2008 data)
F_a	1.00		Table 11.4-1
F_v	1.80		Table 11.4-2
C_t	0.02		Table 12.8-2
x	0.75		Table 12.8-2
h_n	17.70	feet	(height to highest level)

$S_{MS} = Fa*Ss$	1.5600		Eq. 11.4-1
$S_{M1} = Fv*S1$	1.1520		Eq. 11.4-2
$S_{DS} = (2/3)*S_{MS}$	1.0400	g	Eq. 11.4-3
$S_{D1} = (2/3)*S_{M1}$	0.7680	g	Eq. 11.4-4
Period $T_a = C_t*h_n\text{^}x$	0.1726	s	Eq. 12.8-7
T_o	0.1477	s	per section 11.4.5
T_S	0.7385	s	per section 11.4.5
S_a	1.0400	g	per section 11.4.5

R	6.5	Table 12.2-1	(WSW)
Ωo	2.5	Table 12.2-1	
C_d	4	Table 12.2-1	
Section 9.5.5 ok?	Yes	Table 12.6-1	

Equivalent Lateral Force Procedure (section 12.8)

Cs	0.1600		Eq. 12.8-2
W, weight	49,300	lb	per table below
Q_E	7,888	lb	Eq. 12.8-1

Vertical Force Distribution (section 12.8.3)
k = 1.00

Level	Hx	Floor Area	Floor Wt.	Floor Wt.	Wall Length	Wall Wt.	Total Wt.	WxHx	Cvx	(LRFD) Q_E	**(ASD) $0.7Q_E$**
	(ft)	(ft2)	(psf)	(k)	(ft)	(k)	(k)	(k-ft)	(%)	(k)	**(k)**
roof	17.70	1363	32	43.6	91.75	5.7	49.3	872.6	100.0	7.89	**5.52**
							49.3	872.6	100.0	7.89	**5.52**

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

SEISMIC DESIGN -- BEDROOM WING

ASCE 7-16
Equivalent Lateral Force Procedure

Occupancy Category	II		Table 1-1
Seismic Design Category	D		Table 11.6-1
Importance Factor	1.00		Table 11.5-1
Site Class	D		Table 20.3-1
S_S	1.56	g	(from USGS National Seismic Hazard Maps, 2008 data)
S_1	0.64	g	(from USGS National Seismic Hazard Maps, 2008 data)
F_a	1.00		Table 11.4-1
F_v	1.80		Table 11.4-2
C_t	0.02		Table 12.8-2
x	0.75		Table 12.8-2
h_n	31.20	feet	(height to highest level)

$S_{MS} = Fa*Ss$	1.5600		Eq. 11.4-1
$S_{M1} = Fv*S1$	1.1520		Eq. 11.4-2
$S_{DS} = (2/3)*S_{MS}$	1.0400	g	Eq. 11.4-3
$S_{D1} = (2/3)*S_{M1}$	0.7680	g	Eq. 11.4-4
Period $T_a = C_t*h_n\text{^}x$	0.2640	s	Eq. 12.8-7
T_o	0.1477	s	per section 11.4.5
T_S	0.7385	s	per section 11.4.5
S_a	1.0400	g	per section 11.4.5

R	6.5	Table 12.2-1	(WSW)
Ωo	2.5	Table 12.2-1	
C_d	4	Table 12.2-1	
Section 9.5.5 ok?	Yes	Table 12.6-1	

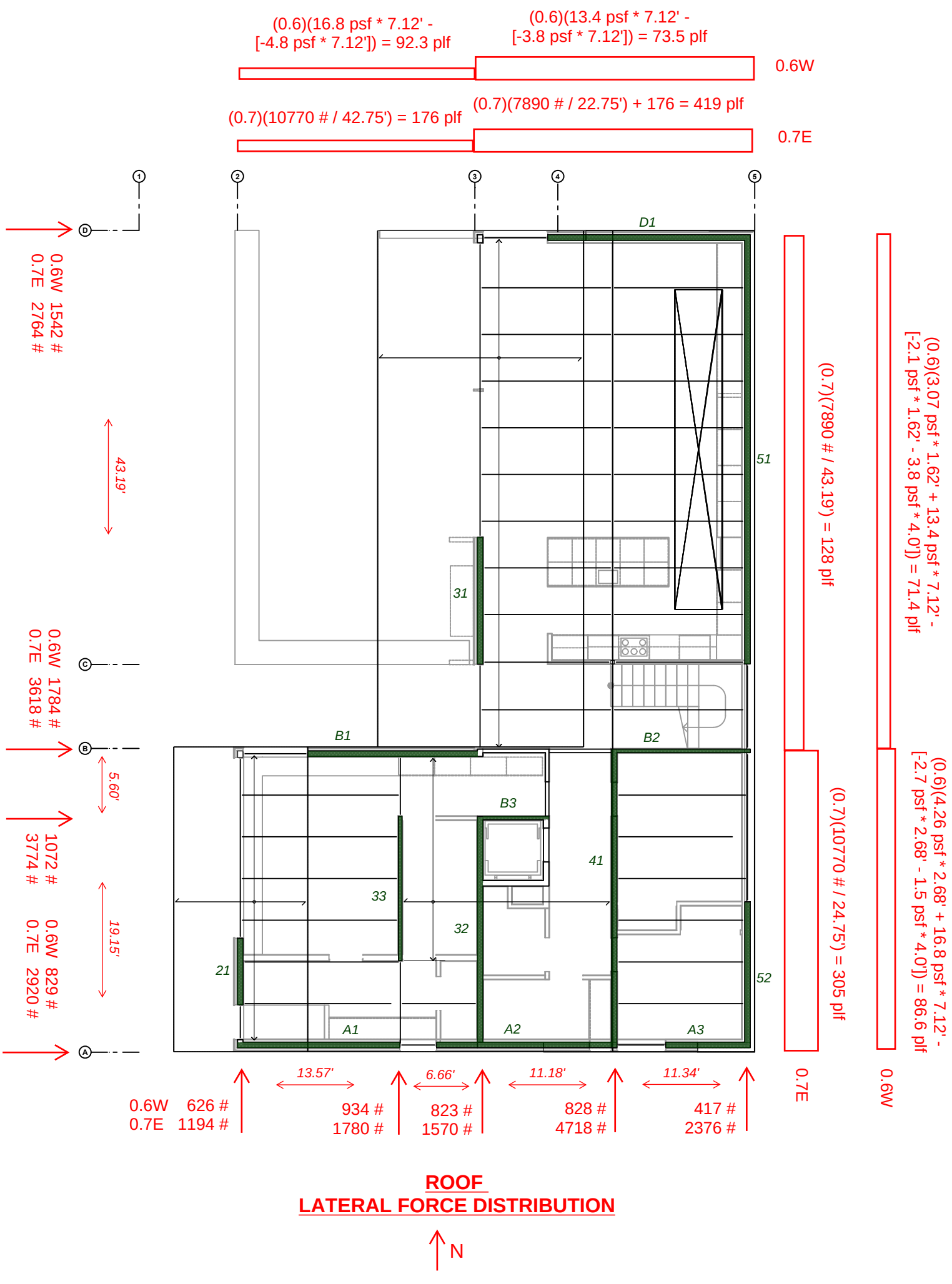
Equivalent Lateral Force Procedure (section 12.8)

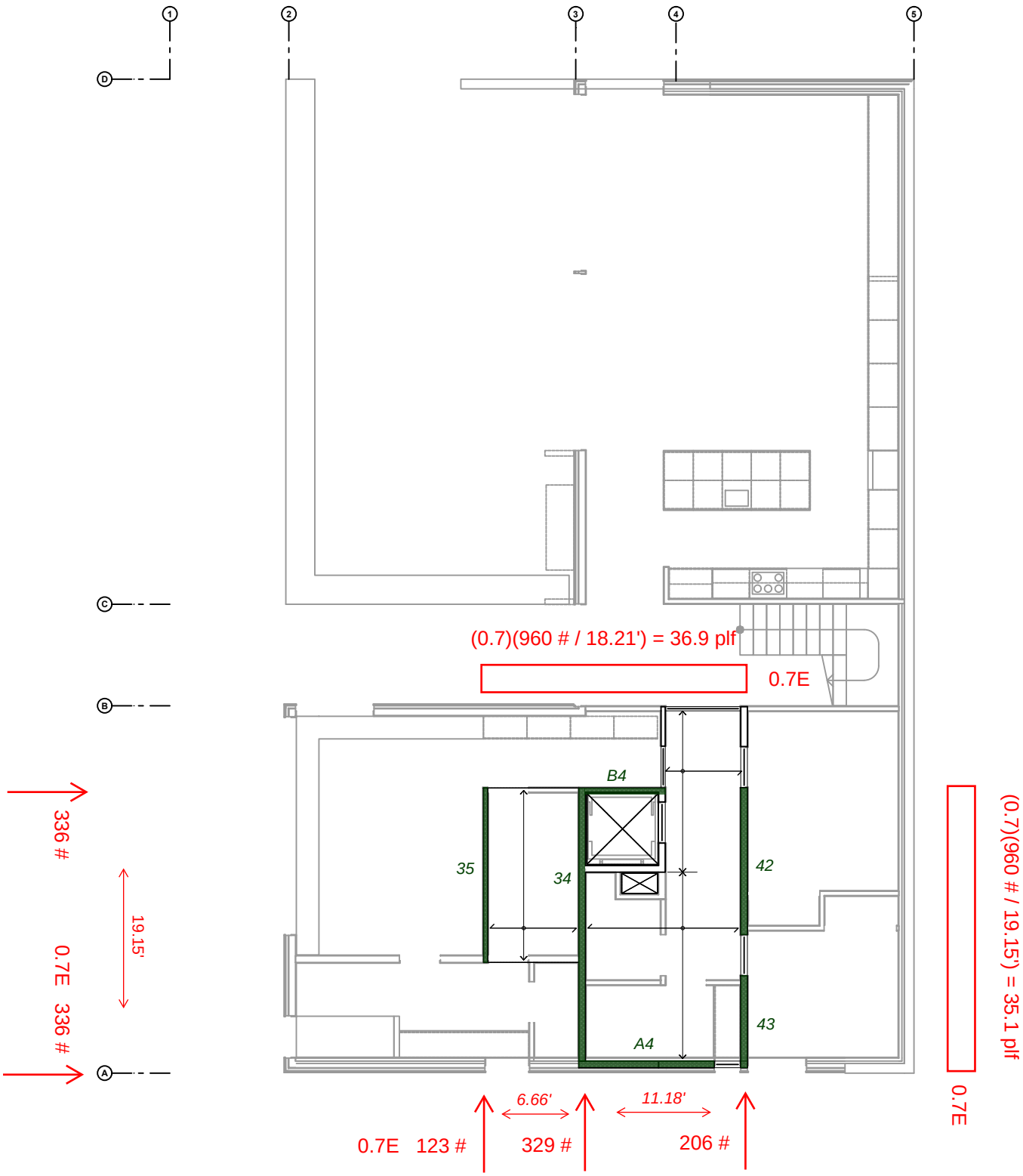
Cs	0.1600		Eq. 12.8-2
W, weight	108,470	lb	per table below
Q_E	17,355	lb	Eq. 12.8-1

Vertical Force Distribution (section 12.8.3)
k = 1.00

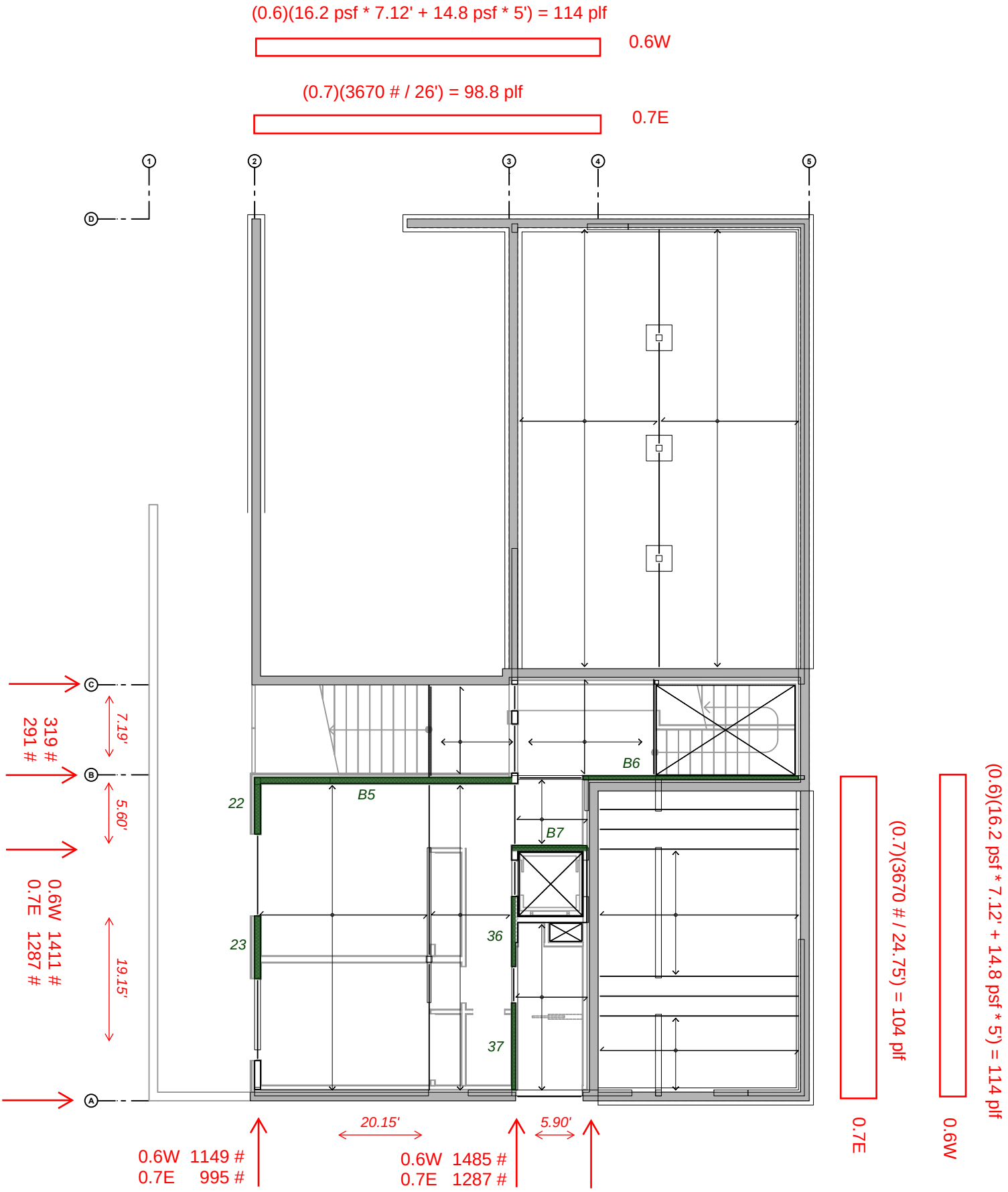
Level	Hx (ft)	Floor Area (ft2)	Floor Wt. (psf)	Floor Wt. (k)	Wall Length (ft)	Wall Wt. (k)	Total Wt. (k)	WxHx (k-ft)	Cvx (%)	(LRFD) Q_E (k)	**(ASD) $0.7Q_E$ (k)**
roof	31.20	1231	32	39.4	110.5	9.1	48.4	1511.4	62.0	10.77	**7.54**
attic floor	28.60	337	14	4.7	0	0.0	4.7	134.9	5.5	0.96	**0.67**
second floor	19.50	865	14	12.1	75.25	14.3	26.4	515.4	21.2	3.67	**2.57**
first floor (int.)	9.50	637	14	8.9	0	5.3	14.2	134.8	5.5	0.96	**0.67**
first floor (ext.)	9.50	237	62	14.7	0	0.0	14.7	139.6	5.7	0.99	**0.70**
							108.5	2436.1	100.0	17.36	**12.15**

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971


(0.6)(16.8 psf * 7.12' - [-4.8 psf * 7.12']) = 92.3 plf
(0.6)(13.4 psf * 7.12' - [-3.8 psf * 7.12']) = 73.5 plf
0.6W
(0.7)(10770 # / 42.75') = 176 plf
(0.7)(7890 # / 22.75') + 176 = 419 plf
0.7E
D1
51
31
B1
B2
B3
41
33
32
21
52
A1
A2
A3
0.6W 1542 #
0.7E 2764 #
43.19'
0.6W 1784 #
0.7E 3618 #
5.60'
1072 #
3774 #
19.15'
0.6W 829 #
0.7E 2920 #
(0.7)(7890 # / 43.19') = 128 plf
(0.7)(10770 # / 24.75') = 305 plf
(0.6)(3.07 psf * 1.62' + 13.4 psf * 7.12' - [-2.1 psf * 1.62' - 3.8 psf * 4.0']) = 71.4 plf
(0.6)(4.26 psf * 2.68' + 16.8 psf * 7.12' - [-2.7 psf * 2.68' - 1.5 psf * 4.0']) = 86.6 plf
13.57'
6.66'
11.18'
11.34'
0.6W 626 #
0.7E 1194 #
934 #
1780 #
823 #
1570 #
828 #
4718 #
417 #
2376 #
0.7E
0.6W
ROOF
LATERAL FORCE DISTRIBUTION
N



ATTIC FLOOR
LATERAL FORCE DISTRIBUTION



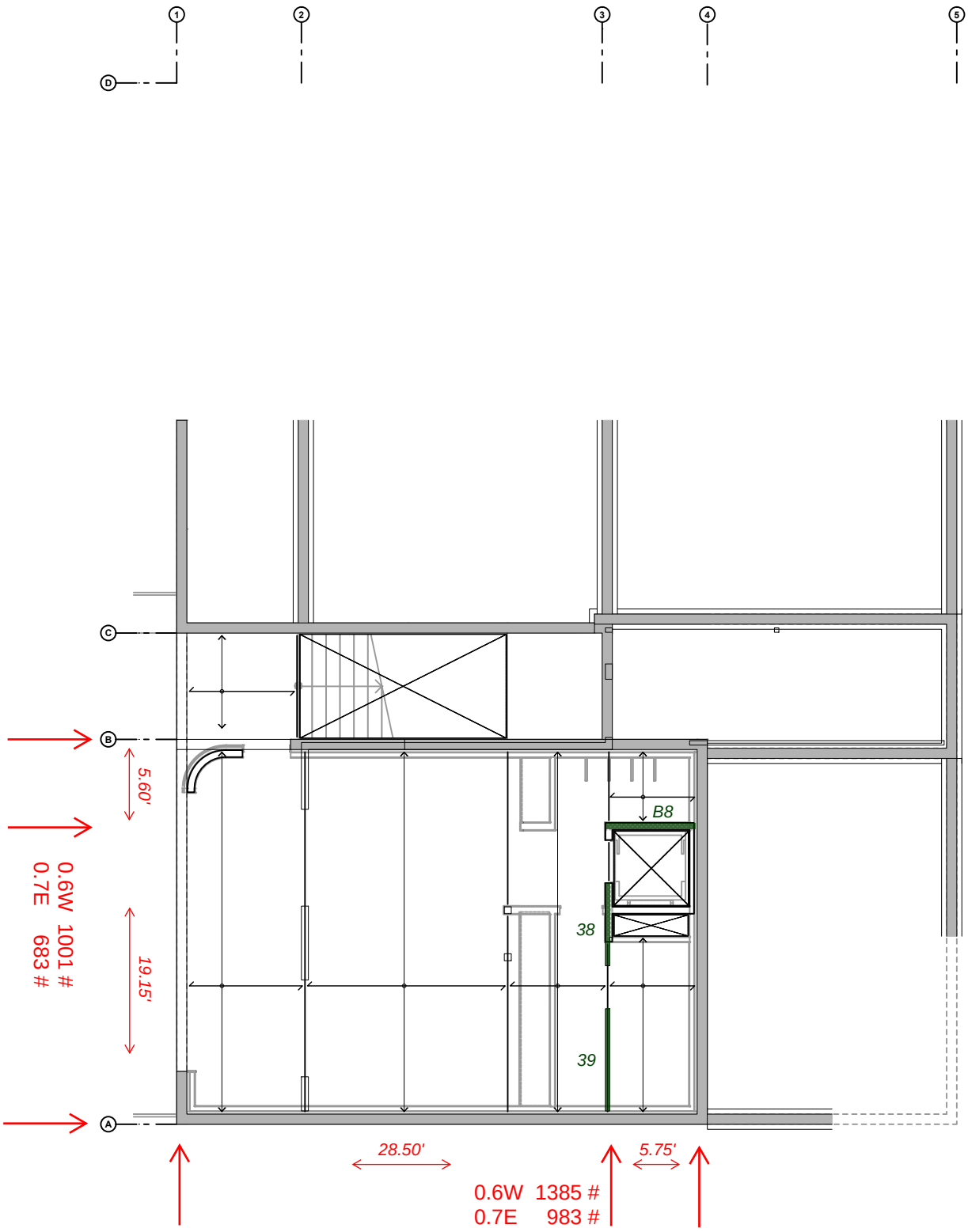
SECOND FLOOR
LATERAL FORCE DISTRIBUTION

(0.6)(14.8 psf * 5' + 14.1 psf * 4.23') = 80.9 plf

0.6W

(0.7)([960 + 990 #] / 34.25') = 39.9 plf

0.7E



FIRST FLOOR
LATERAL FORCE DISTRIBUTION

N

SECTION 3: FOUNDATION

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel. 206-624-4760 | fax 447-6971

Harriott Valentine Engineers Inc.

SPREAD FOOTING DESIGN -- SQUARE

for 2500 psf Allowable Bearing Pressure

f'c =	2,500	psi						
fy =	60	ksi						
1'-6" square								
P =	4.50	k	one-way:					
Pu =	7.34	k	phi Vc =	7.09	k	Vu =	1.53	k	o.k.
p =	2,000	psf	(2) #4 each way					
h =	9.00	in	phi Mn =	6.05	k-ft	Mu =	1.38	k-ft	o.k.
d =	5.25	in						
b =	18.00	in	two-way:					
bo =	35.00	in	phi Vc =	31.24	k	Vu =	5.60	k	o.k.
2'-0" square								
P =	8.00	k	one-way:					
Pu =	13.04	k	phi Vc =	9.45	k	Vu =	3.67	k	o.k.
p =	2,000	psf	(3) #4 each way					
h =	9.00	in	phi Mn =	9.03	k-ft	Mu =	3.26	k-ft	o.k.
d =	5.25	in						
b =	24.00	in	two-way:					
bo =	35.00	in	phi Vc =	31.24	k	Vu =	11.31	k	o.k.
2'-6" square								
P =	12.50	k	one-way:					
Pu =	20.38	k	phi Vc =	11.81	k	Vu =	6.62	k	o.k.
p =	2,000	psf	(3) #4 each way					
h =	9.00	in	phi Mn =	9.11	k-ft	Mu =	6.37	k-ft	o.k.
d =	5.25	in						
b =	30.00	in	two-way:					
bo =	35.00	in	phi Vc =	31.24	k	Vu =	18.64	k	o.k.
3'-0" square								
P =	18.00	k	one-way:					
Pu =	29.34	k	phi Vc =	14.18	k	Vu =	10.39	k	o.k.
p =	2,000	psf	(5) #4 each way					
h =	9.00	in	phi Mn =	14.95	k-ft	Mu =	11.00	k-ft	o.k.
d =	5.25	in						
b =	36.00	in	two-way:					
bo =	35.00	in	phi Vc =	31.24	k	Vu =	27.61	k	o.k.

1932 First Avenue, Suite 720
Seattle, Washington 98101-2447
tel 206-624-4760 | fax 447-6971

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

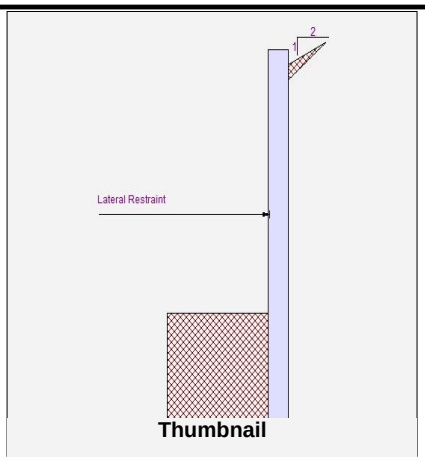
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	16.00 ft
Wall height above soil	=	0.67 ft
Total Wall Height	=	16.67 ft
Top Support Height	=	9.25 ft
Slope Behind Wal	=	2.00
Height of Soil over Toe	=	58.00 in

Soil Data

Allow Soil Bearing	=	3,333.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density	=	125.00 pcf
Footing||Soil Frictior	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	206.0 lbs
Axial Live Load	=	147.0 lbs
Axial Load Eccentricity	=	0.0 in

Uniform Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Earth Pressure Seismic Load

K_h Soil Density Multiplier = 0.160 g Added seismic per unit area = 224.0 psf

Design Summary

Total Bearing Load	=	6,849 lbs	
...resultant ecc.	=	2.35 in	
Soil Pressure @ Toe	=	918 psf	OK
Soil Pressure @ Heel	=	1,365 psf	OK
Allowable	=	3,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,109 psf	
ACI Factored @ Heel	=	1,650 psf	
Footing Shear @ Toe	=	14.0 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	75.0 psi	
Reaction at Top	=	7,135.6 lbs	
Reaction at Bottom	=	4,450.8 lbs	
Sliding Stability Ratio	=	1.42	Ratio < 1.5

Sliding Calcs

Lateral Sliding Force	=	4,450.8 lbs
less 100% Passive Force	= -	4,250.9 lbs
less 100% Friction Force	= -	2,054.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	370.6 lbs NG

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Concrete Stem Construction

Thickness = 12.00 in Fy = 60,000 psi
Wall Weight = 150.0 psf f'c = 2,500 psi
Stem is FREE to rotate at top of footing

	@ Top Support	Mmax Between Top & Base	@ Base of Wall
	Stem OK	Stem OK	Stem OK
Design Height Above Ftg =	9.25 ft	3.49 ft	0.00 ft
Rebar Size =	# 5	# 5	# 5
Rebar Spacing =	8.00 in	8.00 in	8.00 in
Rebar Placed at =	Edge	Edge	Edge
Rebar Depth 'd' =	9.50 in	10.00 in	9.50 in
Design Data			
fb/FB + fa/Fa =	0.630	0.463	0.000
Mu....Actual =	11,800.7 ft-#	9,160.2 ft-#	0.0 ft-#
Mn * Phi.....Allowable =	18,730.6 ft-#	19,776.8 ft-#	18,730.6 ft-#
Shear Force @ this height =	6,757.9 lbs		5,461.3 lbs
Shear.....Actual =	59.28 psi		47.91 psi
Shear.....Allowable =	75.00 psi		75.00 psi

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2856 in2/ft		
(4/3) * As :	0.3808 in2/ft	Min Stem T&S Reinf Area 2.664 in2	
200bd/fy : 200(12)(9.5)/60000 :	0.38 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.38 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.465 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.287 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2103 in2/ft		
(4/3) * As :	0.2804 in2/ft	Min Stem T&S Reinf Area 1.658 in2	
200bd/fy : 200(12)(10)/60000 :	0.4 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2804 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.465 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.3547 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 1.006 in2	
200bd/fy : 200(12)(9.5)/60000 :	0.38 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.465 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.287 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Footing Strengths & Dimensions

Toe Width	=	5.00 ft
Heel Width	=	1.00
Total Footing Width	=	6.00
Footing Thickness	=	13.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,109	1,650 psf
Mu' : Upward	=	15,744	0 ft-#
Mu' : Downward	=	11,500	0 ft-#
Mu: Design	=	4,244	0 ft-#
Actual 1-Way Shear	=	13.99	0.00 psi
Allow 1-Way Shear	=	75.00	0.00 psi

Other Acceptable Sizes & Spacings:

Toe: # 4 @ 8.00 in -or- #4@ 8.54 in, #5@ 13.24 in, #6@ 18.79 in, #7@ 25.
Heel: None Spec'd -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: Not req'd: Mu < phi* -or- Not req'd: Mu < phi*5*lambda*sqrt(f

Min footing T&S reinf Area 1.68 in2
Min footing T&S reinf Area per foot 0.28 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 8.55 in	#4@ 17.09 in
#5@ 13.25 in	#5@ 26.50 in
#6@ 18.80 in	#6@ 37.61 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Forces on Footing : Slab is NOT resisting sliding, stem is PINNED at footing

Forces acting on footing for overturning, sliding, & soil pressure

Overturning Moments...		Lateral lbs	Distance ft	Moment ft-#
Stem Shear @ Top of Footing	=	-3,465.2	1.08	-3,754.0
Heel Active Pressure	=	-985.6	0.54	-528.0
Sliding Force	**=**	**4,450.8**		
		Overturning Moment	=	-4,282.0

Footing Overturning Stability Ratio **6.11**

Net Moment Used For Soil Pressure Calculations **-1,341.8 ft-#**

Net Mom. at Stem/Ftg Interface = -1,341.8 ft-#

Allow. Mom. @ Stem/Ftg Interface = 11,706.6 ft-#

Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 1,141.6 psf

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

Resisting Moments...		Vertical lbs	Lateral lbs	Distance ft	Moment ft-#
Surcharge Over Heel	=				
Adjacent Footing Load	=				
Axial Dead Load on Stem	=	353.0		5.50	1,941.5
Soil Over Toe	=	3,020.8		2.50	7,552.1
Stem Weight	=	2,500.5			
Surcharge Over Toe	=			5.50	13,752.8
Soil Over Heel	=			6.00	
Footing Weight	=	975.0		3.00	2,925.5
Total Vertical Force	=	6,849.3 lbs			
			Resisting Moment	=	26,171.8

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

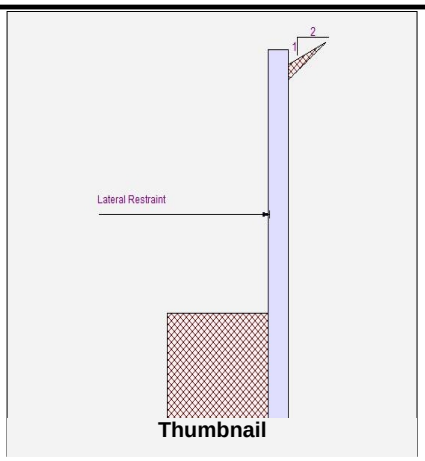
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	16.00 ft
Wall height above soil	=	0.67 ft
Total Wall Height	=	16.67 ft
Top Support Height	=	9.25 ft
Slope Behind Wal	=	2.00
Height of Soil over Toe	=	58.00 in

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density	=	125.00 pcf
Footing||Soil Frictior	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	206.0 lbs
Axial Live Load	=	147.0 lbs
Axial Load Eccentricity	=	0.0 in

Uniform Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Earth Pressure Seismic Load

K_h Soil Density Multiplier = 0.200 g
Added seismic per unit area = 0.0 psf

Design Summary

Total Bearing Load	=	6,849 lbs
...resultant ecc.	=	3.27 in
Soil Pressure @ Toe	=	830 psf OK
Soil Pressure @ Heel	=	1,453 psf OK
Allowable	=	2,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,004 psf
ACI Factored @ Heel	=	1,756 psf
Footing Shear @ Toe	=	12.8 psi OK
Footing Shear @ Heel	=	0.0 psi OK
Allowable	=	75.0 psi
Reaction at Top	=	4,044.3 lbs
Reaction at Bottom	=	3,966.5 lbs
Sliding Stability Ratio	=	1.59 OK

Sliding Calcs

Lateral Sliding Force	=	3,966.5 lbs
less 100% Passive Force	= -	4,250.9 lbs
less 100% Friction Force	= -	2,054.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	0.0 lbs OK

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Concrete Stem Construction

Thickness = 12.00 in Fy = 60,000 psi
Wall Weight = 150.0 psf f'c = 2,500 psi
Stem is FREE to rotate at top of footing

	@ Top Support	Mmax Between Top & Base	@ Base of Wall
	Stem OK	Stem OK	Stem OK
Design Height Above Ftg =	9.25 ft	3.90 ft	0.00 ft
Rebar Size =	# 4	# 4	# 4
Rebar Spacing =	8.00 in	8.00 in	8.00 in
Rebar Placed at =	Edge	Edge	Edge
Rebar Depth 'd' =	9.50 in	10.00 in	9.50 in
Design Data			
fb/FB + fa/Fa =	0.365	0.673	0.000
Mu....Actual =	4,510.7 ft-#	8,764.2 ft-#	0.0 ft-#
Mn * Phi.....Allowable =	12,347.1 ft-#	13,022.1 ft-#	12,347.1 ft-#
Shear Force @ this height =	4,489.8 lbs		4,769.4 lbs
Shear.....Actual =	39.38 psi		41.84 psi
Shear.....Allowable =	75.00 psi		75.00 psi

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1092 in2/ft		
(4/3) * As :	0.1456 in2/ft	Min Stem T&S Reinf Area 2.664 in2	
200bd/fy : 200(12)(9.5)/60000 :	0.38 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.287 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2012 in2/ft		
(4/3) * As :	0.2682 in2/ft	Min Stem T&S Reinf Area 1.541 in2	
200bd/fy : 200(12)(10)/60000 :	0.4 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2682 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.3547 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 1.123 in2	
200bd/fy : 200(12)(9.5)/60000 :	0.38 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.287 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Footing Strengths & Dimensions

Toe Width	=	5.00 ft
Heel Width	=	1.00
Total Footing Width	=	6.00
Footing Thickness	=	13.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,004	1,756 psf
Mu' : Upward	=	15,157	0 ft-#
Mu' : Downward	=	11,500	0 ft-#
Mu: Design	=	3,657	0 ft-#
Actual 1-Way Shear	=	12.82	0.00 psi
Allow 1-Way Shear	=	75.00	0.00 psi

Other Acceptable Sizes & Spacings:

Toe: # 4 @ 8.00 in -or- #4@ 8.54 in, #5@ 13.24 in, #6@ 18.79 in, #7@ 25.
Heel: None Spec'd -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: Not req'd: Mu < phi* -or- Not req'd: Mu < phi*5*lambda*sqrt(f

Min footing T&S reinf Area 1.68 in2
Min footing T&S reinf Area per foot 0.28 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 8.55 in	#4@ 17.09 in
#5@ 13.25 in	#5@ 26.50 in
#6@ 18.80 in	#6@ 37.61 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Forces on Footing : Slab is NOT resisting sliding, stem is PINNED at footing

Forces acting on footing for overturning, sliding, & soil pressure

Overturning Moments...		Lateral lbs	Distance ft	Moment ft-#
Stem Shear @ Top of Footing	=	-2,980.9	1.08	-3,229.3
Heel Active Pressure	=	-985.6	0.54	-528.0
Sliding Force	**=**	**3,966.5**		
		Overturning Moment	=	-3,757.4

Footing Overturning Stability Ratio **6.97**

Net Moment Used For Soil Pressure Calculations **-1,866.5 ft-#**

Net Mom. at Stem/Ftg Interface = -1,866.5 ft-#

Allow. Mom. @ Stem/Ftg Interface = 7,716.9 ft-#

Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 1,141.6 psf

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

Resisting Moments...		Vertical lbs	Lateral lbs	Distance ft	Moment ft-#
Surcharge Over Heel	=				
Adjacent Footing Load	=				
Axial Dead Load on Stem	=	353.0		5.50	1,941.5
Soil Over Toe	=	3,020.8		2.50	7,552.1
Stem Weight	=	2,500.5			
Surcharge Over Toe	=			5.50	13,752.8
Soil Over Heel	=			6.00	
Footing Weight	=	975.0		3.00	2,925.5
Total Vertical Force	=	6,849.3 lbs			
			Resisting Moment	=	26,171.8

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

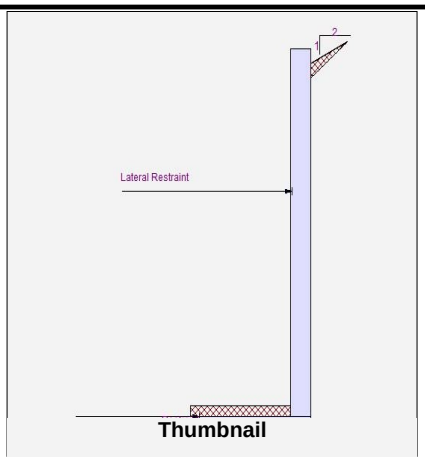
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	16.00 ft
Wall height above soil	=	0.67 ft
Total Wall Height	=	16.67 ft
Top Support Height	=	10.21 ft
Slope Behind Wal	=	2.00
Height of Soil over Toe	=	6.00 in

Soil Data

Allow Soil Bearing	=	3,333.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density	=	125.00 pcf
Footing||Soil Frictior	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

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

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Uniform Lateral Load Applied to Stem

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

Adjacent Footing Load

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

K_h Soil Density Multiplier = 0.160 g Added seismic per unit area = 224.0 psf

Design Summary

Total Bearing Load	=	3,938	lbs
...resultant ecc.	=	18.57	in
Soil Pressure @ Toe	=	0 psf	OK
Soil Pressure @ Heel	=	1,808 psf	OK
Allowable	=	3,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	0 psf	
ACI Factored @ Heel	=	2,169 psf	
Footing Shear @ Toe	=	1.6 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	75.0 psi	
Reaction at Top	=	6,462.4	lbs
Reaction at Bottom	=	5,281.3	lbs

Sliding Calcs
Lateral Sliding Force = 5,281.3 lbs

Concrete Stem Construction

Thickness = 12.00 in Fy = 60,000 psi
Wall Weight = 150.0 psf f'c = 2,500 psi
Stem is FREE to rotate at top of footing

		@ Top Support	Mmax Between Top & Base	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	10.21 ft	4.26 ft	0.00 ft
Rebar Size	=	# 5	# 4	# 4
Rebar Spacing	=	8.00 in	6.00 in	8.00 in
Rebar Placed at	=	Edge	Edge	Edge
Rebar Depth 'd'	=	8.50 in	10.00 in	8.50 in
Design Data				
fb/FB + fa/Fa	=	0.493	0.764	0.000
Mu....Actual	=	8,210.7 ft-#	13,096.5 ft-#	0.0 ft-#
Mn * Phi.....Allowable	=	16,638.1 ft-#	17,150.4 ft-#	10,997.1 ft-#
Shear Force @ this height	=	6,567.8 lbs		6,488.3 lbs
Shear.....Actual	=	64.39 psi		63.61 psi
Shear.....Allowable	=	75.00 psi		75.00 psi

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.223 in2/ft	
(4/3) * As :	0.2974 in2/ft	Min Stem T&S Reinf Area 2.940 in2
200bd/fy : 200(12)(8.5)/60000 :	0.34 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2974 in2/ft	#4@ 8.33 in #4@ 16.67 in
Provided Area :	0.465 in2/ft	#5@ 12.92 in #5@ 25.83 in
Maximum Area :	1.1515 in2/ft	#6@ 18.33 in #6@ 36.67 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.3006 in2/ft	
(4/3) * As :	0.4008 in2/ft	Min Stem T&S Reinf Area 1.712 in2
200bd/fy : 200(12)(10)/60000 :	0.4 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.4 in2/ft	#4@ 8.33 in #4@ 16.67 in
Provided Area :	0.4 in2/ft	#5@ 12.92 in #5@ 25.83 in
Maximum Area :	1.3547 in2/ft	#6@ 18.33 in #6@ 36.67 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0 in2/ft	
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 1.228 in2
200bd/fy : 200(12)(8.5)/60000 :	0.34 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in #4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in #5@ 25.83 in
Maximum Area :	1.1515 in2/ft	#6@ 18.33 in #6@ 36.67 in

Footing Strengths & Dimensions

Toe Width	=	5.00 ft
Heel Width	=	1.00
Total Footing Width	=	6.00
Footing Thickness	=	15.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	0	2,169 psf
Mu' : Upward	=	3,138	0 ft-#
Mu' : Downward	=	3,750	0 ft-#
Mu: Design	=	-612	0 ft-#
Actual 1-Way Shear	=	1.59	0.00 psi
Allow 1-Way Shear	=	75.00	0.00 psi

Other Acceptable Sizes & Spacings:

Toe: # 4 @ 12.00 in	-or-	Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: None Spec'd	-or-	Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: Slab Resists Sliding	-or-	Slab Resists Sliding - No Force on

Min footing T&S reinf Area 1.94 in2
Min footing T&S reinf Area per foot 0.32 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.41 in	#4@ 14.81 in
#5@ 11.48 in	#5@ 22.96 in
#6@ 16.30 in	#6@ 32.59 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Forces on Footing : Slab RESISTS sliding, stem is PINNED at footing

Forces acting on footing soil pressure

(taking moments about front of footing to find eccentricity)

Surcharge Over Heel	=	lbs		ft		ft-#
Axial Dead Load on Stem	=	lbs	0.00	ft		ft-#
Soil Over Toe	=	312.5	lbs	2.50	ft	781.3 ft-#
Adjacent Footing Load	=	lbs		ft		ft-#
Surcharge Over Toe	=	lbs		ft		ft-#
Stem Weight	=	2,500.5	lbs	5.50	ft	13,752.8 ft-#
Soil Over Heel	=	lbs		6.00	ft	ft-#
Footing Weight	=	1,125.0	lbs	3.00	ft	3,375.5 ft-#
Total Vertical Force	=	3,938.0	lbs	Moment =		17,909.5 ft-#

Net Mom. at Stem/Ftg Interface = -6,095.5 ft-#

Allow. Mom. @ Stem/Ftg Interface = 6,873.2 ft-#

Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 656.3 psf

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

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

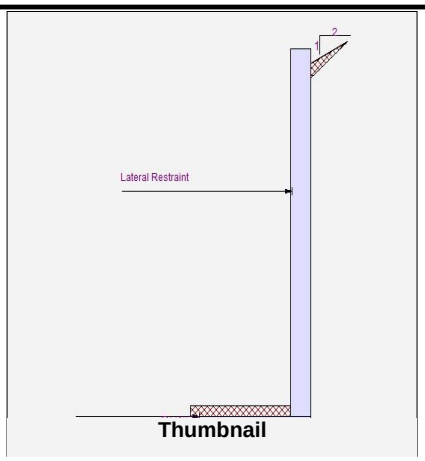
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	16.00 ft
Wall height above soil	=	0.67 ft
Total Wall Height	=	16.67 ft
Top Support Height	=	10.21 ft
Slope Behind Wal	=	2.00
Height of Soil over Toe	=	6.00 in

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density	=	125.00 pcf
Footing||Soil Frictior	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

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

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Uniform Lateral Load Applied to Stem

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

Adjacent Footing Load

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

K_h Soil Density Multiplier = 0.200 g Added seismic per unit area = 0.0 psf

Design Summary

Total Bearing Load	=	3,938	lbs
...resultant ecc.	=	18.57	in
Soil Pressure @ Toe	=	0 psf	OK
Soil Pressure @ Heel	=	1,808 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	0 psf	
ACI Factored @ Heel	=	2,169 psf	
Footing Shear @ Toe	=	1.6 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	75.0 psi	
Reaction at Top	=	3,663.3	lbs
Reaction at Bottom	=	4,505.5	lbs

Sliding Calcs
Lateral Sliding Force = 4,505.5 lbs

Concrete Stem Construction

Thickness = 12.00 in Fy = 60,000 psi
Wall Weight = 150.0 psf f'c = 2,500 psi
Stem is FREE to rotate at top of footing

		@ Top Support	Mmax Between Top & Base	@ Base of Wall
		Stem OK	As < Min %	Stem OK
Design Height Above Ftg	=	10.21 ft	4.47 ft	0.00 ft
Rebar Size	=	# 5	# 4	# 4
Rebar Spacing	=	8.00 in	8.00 in	8.00 in
Rebar Placed at	=	Edge	Edge	Edge
Rebar Depth 'd'	=	8.50 in	10.00 in	8.50 in
Design Data				
fb/FB + fa/Fa	=	0.171	1.000	0.000
Mu....Actual	=	2,846.9 ft-#	11,293.0 ft-#	0.0 ft-#
Mn * Phi.....Allowable	=	16,638.1 ft-#	13,022.1 ft-#	10,997.1 ft-#
Shear Force @ this height	=	4,408.8 lbs		5,380.1 lbs
Shear.....Actual	=	43.22 psi		52.75 psi
Shear.....Allowable	=	75.00 psi		75.00 psi

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0773 in2/ft		
(4/3) * As :	0.1031 in2/ft	Min Stem T&S Reinf Area 2.940 in2	
200bd/fy : 200(12)(8.5)/60000 :	0.34 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.465 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.1515 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2592 in2/ft		
(4/3) * As :	0.3456 in2/ft	Min Stem T&S Reinf Area 1.653 in2	
200bd/fy : 200(12)(10)/60000 :	0.4 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3456 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.3547 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 1.287 in2	
200bd/fy : 200(12)(8.5)/60000 :	0.34 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.3 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.1515 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Footing Strengths & Dimensions

Toe Width	=	5.00 ft
Heel Width	=	1.00
Total Footing Width	=	6.00
Footing Thickness	=	15.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	0	2,169	psf
Mu' : Upward	=	3,138	0	ft-#
Mu' : Downward	=	3,750	0	ft-#
Mu: Design	=	-612	0	ft-#
Actual 1-Way Shear	=	1.59	0.00	psi
Allow 1-Way Shear	=	75.00	0.00	psi

Other Acceptable Sizes & Spacings:

Toe: # 5 @ 16.00 in	-or-	Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: None Spec'd	-or-	Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: Slab Resists Sliding	-or-	Slab Resists Sliding - No Force on

Min footing T&S reinf Area 1.94 in2
Min footing T&S reinf Area per foot 0.32 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.41 in	#4@ 14.81 in
#5@ 11.48 in	#5@ 22.96 in
#6@ 16.30 in	#6@ 32.59 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

RetainPro (c) 1987-2019, Build 11.19.07.30
License : KW-06055874
License To : HARRIOTT VALENTINE

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Forces on Footing : Slab RESISTS sliding, stem is PINNED at footing

Forces acting on footing soil pressure

(taking moments about front of footing to find eccentricity)

Surcharge Over Heel	=	lbs		ft		ft-#
Axial Dead Load on Stem	=	lbs	0.00	ft		ft-#
Soil Over Toe	=	312.5	lbs	2.50	ft	781.3 ft-#
Adjacent Footing Load	=	lbs		ft		ft-#
Surcharge Over Toe	=	lbs		ft		ft-#
Stem Weight	=	2,500.5	lbs	5.50	ft	13,752.8 ft-#
Soil Over Heel	=	lbs		6.00	ft	ft-#
Footing Weight	=	1,125.0	lbs	3.00	ft	3,375.5 ft-#
Total Vertical Force	=	3,938.0	lbs	Moment =		17,909.5 ft-#

Net Mom. at Stem/Ftg Interface = -6,095.5 ft-#

Allow. Mom. @ Stem/Ftg Interface = 6,873.2 ft-#

Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 656.3 psf

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

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

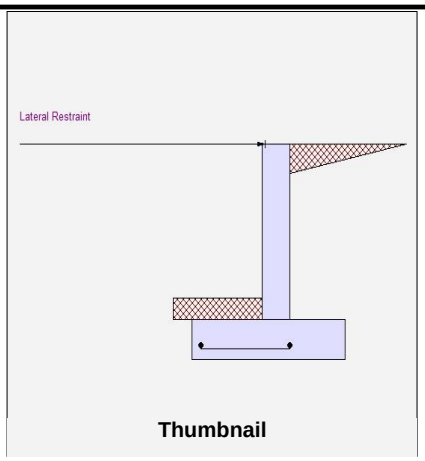
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.00 ft
Total Wall Height	=	4.00 ft
Top Support Height	=	4.00 ft
Slope Behind Wal	=	0.00
Height of Soil over Toe	=	6.00 in

Soil Data

Allow Soil Bearing	=	3,333.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density	=	125.00 pcf
Footing||Soil Frictior	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	206.0 lbs
Axial Live Load	=	147.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Uniform Lateral Load Applied to Stem

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

Adjacent Footing Load

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

K_h Soil Density Multiplier = 0.160 g Added seismic per unit area = 56.0 psf

Design Summary

Total Bearing Load	=	2,203 lbs	
...resultant ecc.	=	3.18 in	
Soil Pressure @ Toe	=	327 psf	OK
Soil Pressure @ Heel	=	729 psf	OK
Allowable	=	3,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	401 psf	
ACI Factored @ Heel	=	895 psf	
Footing Shear @ Toe	=	3.7 psi	OK
Footing Shear @ Heel	=	0.6 psi	OK
Allowable	=	75.0 psi	
Reaction at Top	=	256.8 lbs	
Reaction at Bottom	=	630.1 lbs	
Sliding Stability Ratio	=	1.25	Ratio < 1.5

Sliding Calcs

Lateral Sliding Force	=	630.1 lbs	
less 100% Passive Force	= -	125.9 lbs	
less 100% Friction Force	= -	660.9 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	158.4 lbs	NG

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Concrete Stem Construction

Thickness = 8.00 in Fy = 60,000 psi
Wall Weight = 100.0 psf f'c = 2,500 psi
Stem is FREE to rotate at top of footing

		@ Top Support	Mmax Between Top & Base	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	4.00 ft	1.80 ft	0.00 ft
Rebar Size	=	# 4	# 4	# 4
Rebar Spacing	=	12.00 in	12.00 in	12.00 in
Rebar Placed at	=	Center	Center	Center
Rebar Depth 'd'	=	4.00 in	4.00 in	4.00 in
Design Data				
fb/FB + fa/Fa	=	0.000	0.153	0.000
Mu....Actual	=	0.0 ft-#	518.6 ft-#	0.0 ft-#
Mn * Phi.....Allowable	=	3,387.6 ft-#	3,387.6 ft-#	3,387.6 ft-#
Shear Force @ this height	=	394.7 lbs		629.3 lbs
Shear.....Actual	=	8.22 psi		13.11 psi
Shear.....Allowable	=	75.00 psi		75.00 psi

RetainPro (c) 1987-2019, Build 11.19.07.30
License : KW-06055874
License To : HARRIOTT VALENTINE

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0313 in2/ft		
(4/3) * As :	0.0417 in2/ft	Min Stem T&S Reinf Area 0.423 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.345 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Strengths & Dimensions

Toe Width	=	2.00 ft
Heel Width	=	2.17
Total Footing Width	=	4.17
Footing Thickness	=	11.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	401	895	psf
Mu' : Upward	=	960	988	ft-#
Mu' : Downward	=	480	864	ft-#
Mu: Design	=	480	-124	ft-#
Actual 1-Way Shear	=	3.71	0.60	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Other Acceptable Sizes & Spacings:

Toe: # 4 @ 12.00 in -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: None Spec'd -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: Not req'd: Mu < phi* -or- Not req'd: Mu < phi*5*lambda*sqrt(f

Min footing T&S reinf Area 0.99 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Forces on Footing : Slab is NOT resisting sliding, stem is PINNED at footing

Forces acting on footing for overturning, sliding, & soil pressure

Overturning Moments...		Lateral lbs	Distance ft	Moment ft-#
Stem Shear @ Top of Footing	=	-405.3	0.92	-371.6
Heel Active Pressure	=	-224.8	0.44	-99.5
Sliding Force	**=**	**630.1**		
		Overturning Moment	=	-471.0

Footing Overturning Stability Ratio **11.99**

Net Moment Used For Soil Pressure Calculations **-583.0 ft-#**

Net Mom. at Stem/Ftg Interface = -583.0 ft-#

Allow. Mom. @ Stem/Ftg Interface = 2,117.3 ft-#

Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 528.3 psf

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

Resisting Moments...		Vertical lbs	Lateral lbs	Distance ft	Moment ft-#
Surcharge Over Heel	=				
Adjacent Footing Load	=				
Axial Dead Load on Stem	=	353.0		2.33	823.7
Soil Over Toe	=	125.0		1.00	125.0
Stem Weight	=	400.0			
Surcharge Over Toe	=			2.33	933.3
Soil Over Heel	=	751.7		3.42	2,569.4
Footing Weight	=	573.4		2.09	1,196.0
Total Vertical Force	=	2,203.0 lbs			
			Resisting Moment	=	5,647.4

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

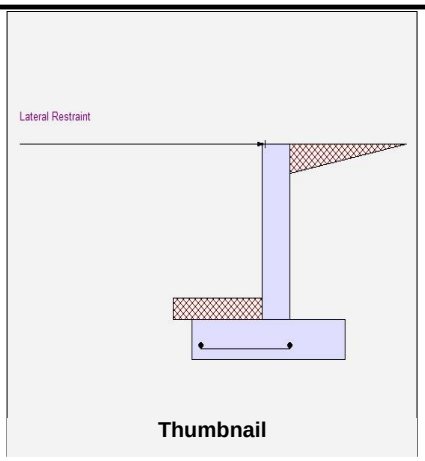
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.00 ft
Total Wall Height	=	4.00 ft
Top Support Height	=	4.00 ft
Slope Behind Wal	=	0.00
Height of Soil over Toe	=	6.00 in

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density	=	125.00 pcf
Footing||Soil Frictior	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	206.0 lbs
Axial Live Load	=	147.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Uniform Lateral Load Applied to Stem

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

Adjacent Footing Load

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

K_h Soil Density Multiplier = 0.200 g Added seismic per unit area = 0.0 psf

Design Summary

Total Bearing Load	=	2,203 lbs	
...resultant ecc.	=	3.74 in	
Soil Pressure @ Toe	=	292 psf	OK
Soil Pressure @ Heel	=	765 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	358 psf	
ACI Factored @ Heel	=	938 psf	
Footing Shear @ Toe	=	3.3 psi	OK
Footing Shear @ Heel	=	1.0 psi	OK
Allowable	=	75.0 psi	
Reaction at Top	=	145.7 lbs	
Reaction at Bottom	=	518.1 lbs	
Sliding Stability Ratio	=	1.52	OK

Sliding Calcs

Lateral Sliding Force	=	518.1 lbs	
less 100% Passive Force	= -	125.9 lbs	
less 100% Friction Force	= -	660.9 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Concrete Stem Construction

Thickness = 8.00 in Fy = 60,000 psi
Wall Weight = 100.0 psf f'c = 2,500 psi
Stem is FREE to rotate at top of footing

		@ Top Support	Mmax Between Top & Base	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	4.00 ft	1.70 ft	0.00 ft
Rebar Size	=	# 4	# 4	# 4
Rebar Spacing	=	12.00 in	12.00 in	12.00 in
Rebar Placed at	=	Center	Center	Center
Rebar Depth 'd'	=	4.00 in	4.00 in	4.00 in
Design Data				
fb/FB + fa/Fa	=	0.000	0.107	0.000
Mu....Actual	=	0.0 ft-#	361.3 ft-#	0.0 ft-#
Mn * Phi.....Allowable	=	3,387.6 ft-#	3,387.6 ft-#	3,387.6 ft-#
Shear Force @ this height	=	234.7 lbs		469.3 lbs
Shear.....Actual	=	4.89 psi		9.78 psi
Shear.....Allowable	=	75.00 psi		75.00 psi

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0218 in2/ft		
(4/3) * As :	0.0291 in2/ft	Min Stem T&S Reinf Area 0.441 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.327 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Strengths & Dimensions

Toe Width	=	2.00 ft
Heel Width	=	2.17
Total Footing Width	=	4.17
Footing Thickness	=	11.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	358	938	psf
Mu' : Upward	=	901	1,034	ft-#
Mu' : Downward	=	480	864	ft-#
Mu: Design	=	421	-169	ft-#
Actual 1-Way Shear	=	3.26	1.01	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Other Acceptable Sizes & Spacings:

Toe: # 4 @ 12.00 in -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: None Spec'd -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: Not req'd: Mu < phi* -or- Not req'd: Mu < phi*5*lambda*sqrt(f

Min footing T&S reinf Area 0.99 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Restrained Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Forces on Footing : Slab is NOT resisting sliding, stem is PINNED at footing

Forces acting on footing for overturning, sliding, & soil pressure

Overturning Moments...		Lateral lbs	Distance ft	Moment ft-#
Stem Shear @ Top of Footing	=	-293.3	0.92	-268.9
Heel Active Pressure	=	-224.8	0.44	-99.5
Sliding Force	**=**	**518.1**		
		Overturning Moment	=	-368.4

Footing Overturning Stability Ratio **15.33**

Net Moment Used For Soil Pressure Calculations **-685.7 ft-#**

Net Mom. at Stem/Ftg Interface = -685.7 ft-#

Allow. Mom. @ Stem/Ftg Interface = 2,117.3 ft-#

Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 528.3 psf

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

Resisting Moments...		Vertical lbs	Lateral lbs	Distance ft	Moment ft-#
Surcharge Over Heel	=				
Adjacent Footing Load	=				
Axial Dead Load on Stem	=	353.0		2.33	823.7
Soil Over Toe	=	125.0		1.00	125.0
Stem Weight	=	400.0			
Surcharge Over Toe	=			2.33	933.3
Soil Over Heel	=	751.7		3.42	2,569.4
Footing Weight	=	573.4		2.09	1,196.0
Total Vertical Force	=	2,203.0 lbs			
			Resisting Moment	=	5,647.4

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

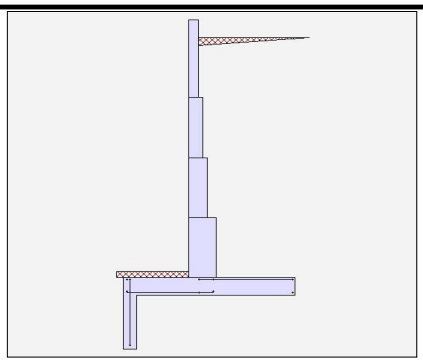
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	20.00 ft
Wall height above soil	=	1.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	6.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	3.35	OK
Sliding	=	1.53	OK
Total Bearing Load	=	23,885 lbs	
...resultant ecc.	=	7.65 in	
Soil Pressure @ Toe	=	2,455 psf	OK
Soil Pressure @ Heel	=	1,316 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	3,437 psf	
ACI Factored @ Heel	=	1,842 psf	
Footing Shear @ Toe	=	57.4 psi	OK
Footing Shear @ Heel	=	50.4 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	8,089.4 lbs	
less 100% Passive Force	= -	5,250.0 lbs	
less 100% Friction Force	= -	7,165.6 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	2.200
Wind, W	1.300
Seismic, E	1.000

Stem Construction

		4th	3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	15.00	10.00	5.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD	LRFD
Thickness	=	8.00	12.00	16.00	24.00
Rebar Size	=	# 4	# 5	# 8	# 8
Rebar Spacing	=	8.00	8.00	8.00	8.00
Rebar Placed at	=	Center	Edge	Edge	Edge
Design Data					
fb/FB + fa/Fa	=	**0.333**	**0.644**	**0.690**	**0.974**
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	962.5	3,850.0	8,662.5	15,400.0
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	1,604.2	12,833.3	43,312.5	102,666.7
Moment.....Allowable	ft-# =	4,802.6	19,882.2	62,668.2	105,328.2
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	20.1	31.5	53.5	59.7
Shear.....Allowable	psi =	67.1	67.1	67.1	67.1
Anet (Masonry)	in2 =				
Rebar Depth 'd'	in =	4.00	10.19	13.50	21.50
Masonry Data					
f'm	psi =				
Fs	psi =				
Solid Grouting	=				
Modular Ratio 'n'	=				
Wall Weight	psf =	100.0	150.0	200.0	300.0
Short Term Factor	=				
Equiv. Solid Thick.	=				
Masonry Block Type	=	Medium Weight			
Masonry Design Method	=	ASD			
Concrete Data					
f'c	psi =	2,000.0	2,000.0	2,000.0	2,000.0
Fy	psi =	60,000.0	60,000.0	60,000.0	60,000.0

Concrete Stem Rebar Area Details

4th Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0968 in2/ft		
(4/3) * As :	0.1291 in2/ft	Min Stem T&S Reinf Area 1.123 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.173 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.3 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.4335 in2/ft	#6@ 30.56 in	#6@ 61.11 in

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.289 in2/ft		
(4/3) * As :	0.3853 in2/ft	Min Stem T&S Reinf Area 1.296 in2	
200bd/fy : 200(12)(10.1875)/60000 :	0.4075 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.259 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3853 in2/ft	#4@ 9.26 in	#4@ 18.52 in
Provided Area :	0.465 in2/ft	#5@ 14.35 in	#5@ 28.70 in
Maximum Area :	1.1041 in2/ft	#6@ 20.37 in	#6@ 40.74 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.7302 in2/ft		
(4/3) * As :	0.9736 in2/ft	Min Stem T&S Reinf Area 1.728 in2	
200bd/fy : 200(12)(13.5)/60000 :	0.54 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.346 in2/ft	
0.0018bh : 0.0018(12)(16) :	0.3456 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.7302 in2/ft	#4@ 6.94 in	#4@ 13.89 in
Provided Area :	1.185 in2/ft	#5@ 10.76 in	#5@ 21.53 in
Maximum Area :	1.4631 in2/ft	#6@ 15.28 in	#6@ 30.56 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	1.0771 in2/ft		
(4/3) * As :	1.4362 in2/ft	Min Stem T&S Reinf Area 2.592 in2	
200bd/fy : 200(12)(21.5)/60000 :	0.86 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.518 in2/ft	
0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	1.0771 in2/ft	#4@ 4.63 in	#4@ 9.26 in
Provided Area :	1.185 in2/ft	#5@ 7.18 in	#5@ 14.35 in
Maximum Area :	2.3301 in2/ft	#6@ 10.19 in	#6@ 20.37 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Footing Data

Toe Width	=	4.83 ft
Heel Width	=	7.83
Total Footing Width	=	12.67
Footing Thickness	=	18.00 in
Key Width	=	12.00 in
Key Depth	=	54.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	3,437	1,842	psf
Mu' : Upward	=	453,466	426,198	ft-#
Mu' : Downward	=	56,433	779,074	ft-#
Mu: Design	=	26,139	20,001	ft-#
Actual 1-Way Shear	=	57.44	50.36	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 8 @ 16.00 in
Heel Reinforcing = # 8 @ 16.00 in
Key Reinforcing = # 8 @ 16.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 4.13 in, #5@ 6.40 in, #6@ 9.09 in, #7@ 12.40 in, #8@ 16.33 in, #9@ 20.6
Heel: #4@ 4.17 in, #5@ 6.47 in, #6@ 9.19 in, #7@ 12.54 in, #8@ 16.51 in, #9@ 20.9
Key: #4@ 6.4 in, #5@ 9.92 in, #6@ 14.08 in, #7@ 18 in, #8@ 1

Min footing T&S reinf Area 4.93 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		8,089.4	7.17	57,973.9	Soil Over HL (ab. water tbl)	14,585.0	9.75	142,218.3
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		9.75	142,218.3
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Hee	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	2.42	
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	3,900.0	5.54	21,610.9
					Earth @ Stem Transitions	=	1,875.0	6.30	11,806.8
					Footing Weight	=	2,850.3	6.33	18,053.8
					Key Weight	=	675.0	0.50	337.5
					Vert. Component	=			
Total	=	8,089.4	**O.T.M.** =	57,973.9	**Total =**	23,885.3 lbs	**R.M.=**	194,027.4

Resisting/Overturning Ratio = **3.35**
Vertical Loads used for Soil Pressure = 23,885.3 lbs

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.116	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,
because the wall would then tend to rotate into the retained soil.

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

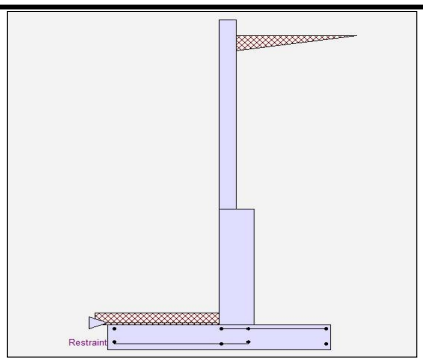
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	12.50 ft
Wall height above soil	=	0.67 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	6.00 in



Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	742.0 lbs
Axial Live Load	=	544.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Design Summary

Wall Stability Ratios

Overturning	=	2.33	OK
Slab Resists All Sliding !			
Total Bearing Load	=	9,666 lbs	
...resultant ecc.	=	9.72 in	
Soil Pressure @ Toe	=	1,787 psf	OK
Soil Pressure @ Heel	=	487 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,502 psf	
ACI Factored @ Heel	=	682 psf	
Footing Shear @ Toe	=	53.6 psi	OK
Footing Shear @ Heel	=	32.9 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	5,073.9 lbs

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	2.200
Wind, W	1.300
Seismic, E	1.000

Stem Construction

		2nd	Bottom
		Stem OK	Stem OK
Design Height Above Ftg	ft =	5.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete
Design Method	=	LRFD	LRFD
Thickness	=	8.00	16.00
Rebar Size	=	# 5	# 8
Rebar Spacing	=	8.00	8.00
Rebar Placed at	=	Edge	Edge
Design Data			
fb/FB + fa/Fa	=	**0.738**	**0.628**
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	3,403.1	9,453.1
Moment....Actual			
Service Level	ft-# =		
Strength Level	ft-# =	8,507.8	39,388.0
Moment.....Allowable	ft-# =	11,512.2	62,668.2
Shear.....Actual			
Service Level	psi =		
Strength Level	psi =	45.8	58.4
Shear.....Allowable	psi =	67.1	67.1
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =	6.19	13.50
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	=		
Wall Weight	psf =	100.0	200.0
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type	=	Medium Weight	
Masonry Design Method	=	ASD	
Concrete Data			
f'c	psi =	2,000.0	2,000.0
Fy	psi =	60,000.0	60,000.0

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.3222 in2/ft	
(4/3) * As :	0.4295 in2/ft	Min Stem T&S Reinf Area 1.411 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.173 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.3222 in2/ft	#4@ 13.89 in #4@ 27.78 in
Provided Area :	0.465 in2/ft	#5@ 21.53 in #5@ 43.06 in
Maximum Area :	0.6706 in2/ft	#6@ 30.56 in #6@ 61.11 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.664 in2/ft	
(4/3) * As :	0.8854 in2/ft	Min Stem T&S Reinf Area 1.728 in2
200bd/fy : 200(12)(13.5)/60000 :	0.54 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.346 in2/ft
0.0018bh : 0.0018(12)(16) :	0.3456 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.664 in2/ft	#4@ 6.94 in #4@ 13.89 in
Provided Area :	1.185 in2/ft	#5@ 10.76 in #5@ 21.53 in
Maximum Area :	1.4631 in2/ft	#6@ 15.28 in #6@ 30.56 in

Footing Data

Toe Width	=	4.25 ft
Heel Width	=	4.25
Total Footing Width	=	8.50
Footing Thickness	=	13.00 in
Key Width	=	8.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	3.08 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,502	682	psf
Mu' : Upward	=	238,313	45,426	ft-#
Mu' : Downward	=	34,138	123,266	ft-#
Mu: Design	=	11,534	3,500	ft-#
Actual 1-Way Shear	=	53.61	32.89	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 8 @ 16.00 in
Heel Reinforcing = # 4 @ 8.00 in
Key Reinforcing = # 4 @ 0.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 5.82 in, #5@ 9.02 in, #6@ 12.81 in, #7@ 17.47 in, #8@ 23.01 in, #9@ 29.
Heel: #4@ 8.54 in, #5@ 13.24 in, #6@ 18.79 in, #7@ 25.63 in, #8@ 33.75 in, #9@ 42
Key: No key defined

Min footing T&S reinf Area 2.39 in2
Min footing T&S reinf Area per foot 0.28 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 8.55 in	#4@ 17.09 in
#5@ 13.25 in	#5@ 26.50 in
#6@ 18.80 in	#6@ 37.61 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		5,073.9	4.53	22,973.7	Soil Over HL (ab. water tbl)	4,557.3	7.04	32,090.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		7.04	32,090.9
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Hee	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	= 1,286.0	4.92	3,648.2
Added Lateral Load	=				* Axial Live Load on Stem	= 544.0	4.92	2,674.7
Load @ Stem Above Soil	=				Soil Over Toe	=	2.13	
	=				Surcharge Over Toe	=		
					Stem Weight(s)	= 1,816.6	4.77	8,659.4
					Earth @ Stem Transitions	= 625.0	5.25	3,281.3
					Footing Weight	= 1,381.3	4.25	5,870.3
					Key Weight	=	3.42	
					Vert. Component	=		
Total	=	5,073.9	**O.T.M.** =	22,973.7	**Total =**	9,122.1 lbs	**R.M.=**	53,550.1

Resisting/Overturning Ratio = **2.33**
Vertical Loads used for Soil Pressure = 9,666.1 lbs

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.077	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

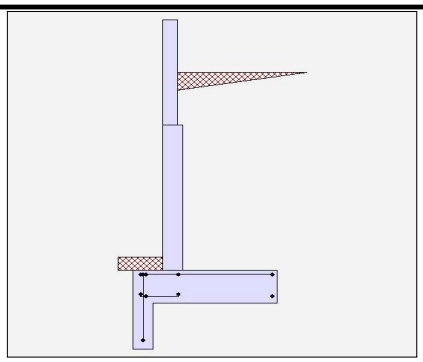
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	7.50 ft
Wall height above soil	=	2.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	6.00 in



Surcharge Loads

Surcharge Over Heel	=	250.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Design Summary

Wall Stability Ratios

Overturning	=	1.98	OK
Sliding	=	1.53	OK
Total Bearing Load	=	4,941 lbs	
...resultant ecc.	=	7.01 in	
Soil Pressure @ Toe	=	1,764 psf	OK
Soil Pressure @ Heel	=	281 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,865 psf	
ACI Factored @ Heel	=	456 psf	
Footing Shear @ Toe	=	0.7 psi	OK
Footing Shear @ Heel	=	18.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,952.3 lbs	
less 100% Passive Force	= -	1,500.0 lbs	
less 100% Friction Force	= -	1,482.4 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	2.200
Wind, W	1.300
Seismic, E	1.000

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	5.50	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	LRFD	LRFD	LRFD	LRFD
Thickness	=	6.00	8.00		
Rebar Size	=	# 4	# 5		
Rebar Spacing	=	12.00	6.00		
Rebar Placed at	=	Center	Edge		
Design Data					
fb/FB + fa/Fa	=	**0.168**	**0.661**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	462.0	3,320.6		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	410.7	9,745.3		
Moment.....Allowable	ft-# =	2,434.5	14,711.7		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	12.8	44.7		
Shear.....Allowable	psi =	67.1	67.1		
Anet (Masonry)	in2 =				
Rebar Depth 'd'	in =	3.00	6.19		
Masonry Data					
f'm	psi =				
Fs	psi =				
Solid Grouting	=				
Modular Ratio 'n'	=				
Wall Weight	psf =	75.0	100.0		
Short Term Factor	=				
Equiv. Solid Thick.	=				
Masonry Block Type	=	Medium Weight			
Masonry Design Method	=	ASD			
Concrete Data					
f'c	psi =	2,000.0	2,000.0		
Fy	psi =	60,000.0	60,000.0		

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.034 in2/ft		
(4/3) * As :	0.0454 in2/ft	Min Stem T&S Reinf Area 0.518 in2	
200bd/fy : 200(12)(3)/60000 :	0.12 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.130 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.3251 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.369 in2/ft		
(4/3) * As :	0.492 in2/ft	Min Stem T&S Reinf Area 0.950 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.173 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.369 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.62 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.6706 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.00 ft
Heel Width	=	3.83
Total Footing Width	=	4.83
Footing Thickness	=	15.00 in
Key Width	=	8.00 in
Key Depth	=	21.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,865	456	psf
Mu' : Upward	=	16,193	59,095	ft-#
Mu' : Downward	=	2,100	127,827	ft-#
Mu: Design	=	655	2,328	ft-#
Actual 1-Way Shear	=	0.66	18.57	psi
Allow 1-Way Shear	=	40.00	75.00	psi

Toe Reinforcing = # 5 @ 6.00 in
Heel Reinforcing = # 4 @ 6.00 in
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: #4@ 7.40 in, #5@ 11.47 in, #6@ 16.29 in, #7@ 22.21 in, #8@ 29.25 in, #9@ 37
Key: #4@ 14.58 in, #5@ 18 in, #6@ 18 in, #7@ 18 in, #8@ 18 i

Min footing T&S reinf Area 1.57 in2
Min footing T&S reinf Area per foot 0.32 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.41 in	#4@ 14.81 in
#5@ 11.48 in	#5@ 22.96 in
#6@ 16.30 in	#6@ 32.59 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,339.8	2.92	3,907.9	Soil Over HL (ab. water tbl)	2,968.4	3.25	9,646.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.25	9,646.9
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Hee	=		
Surcharge over Heel	=	612.5	4.38	2,679.7	Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	0.50	
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	850.0	1.30	1,108.3
					Earth @ Stem Transitions	=	41.7	1.58	66.0
					Footing Weight	=	906.2	2.42	2,189.8
					Key Weight	=	175.0	0.33	58.3
					Vert. Component	=			
Total	=	1,952.3	**O.T.M.** =	6,587.6	**Total =**		4,941.3 lbs	**R.M.=**	13,069.4

Resisting/Overturning Ratio = **1.98**
Vertical Loads used for Soil Pressure = 4,941.3 lbs

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.096	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

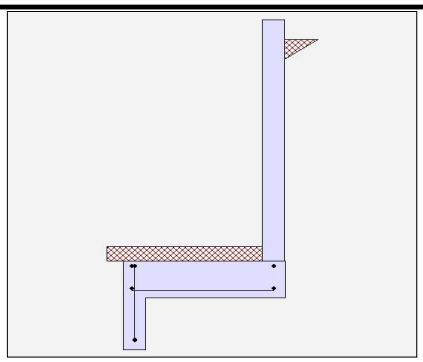
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	7.50 ft
Wall height above soil	=	0.67 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	6.00 in



Surcharge Loads

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

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	1.52	OK
Sliding	=	1.55	OK
Total Bearing Load	=	1,902 lbs	
...resultant ecc.	=	16.19 in	
Soil Pressure @ Toe	=	1,185 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,659 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	10.0 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,339.8 lbs	
less 100% Passive Force	= -	1,500.0 lbs	
less 100% Friction Force	= -	570.5 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	2.200
Wind, W	1.300
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD LRFD LRFD LRFD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	6.00
Rebar Placed at	=	Center
Design Data		
fb/FB + fa/Fa	=	**0.881**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	2,165.6
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	5,414.1
Moment.....Allowable	=	6,138.0
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	45.1
Shear.....Allowable	psi =	67.1
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.00
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	2,000.0
Fy	psi =	60,000.0

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3268 in2/ft		
(4/3) * As :	0.4358 in2/ft	Min Stem T&S Reinf Area 1.411 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.173 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3268 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.4 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.4335 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	4.17 ft
Heel Width	=	0.67
Total Footing Width	=	4.84
Footing Thickness	=	15.00 in
Key Width	=	8.00 in
Key Depth	=	21.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,659	0 psf
Mu' : Upward	=	98,956	0 ft-#
Mu' : Downward	=	36,464	0 ft-#
Mu: Design	=	1,740	0 ft-#
Actual 1-Way Shear	=	9.99	0.03 psi
Allow 1-Way Shear	=	75.00	40.00 psi

Toe Reinforcing = # 4 @ 6.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 7.40 in, #5@ 11.47 in, #6@ 16.29 in, #7@ 22.21 in, #8@ 29.25 in, #9@ 37
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: #4@ 14.99 in, #5@ 18 in, #6@ 18 in, #7@ 18 in, #8@ 18 i

Min footing T&S reinf Area 1.57 in2
Min footing T&S reinf Area per foot 0.32 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.41 in	#4@ 14.81 in
#5@ 11.48 in	#5@ 22.96 in
#6@ 16.30 in	#6@ 32.59 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,339.8	2.92	3,907.9			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)				3.1	4.84	15.1
Soil Over HL (bel. water tbl)					4.84	15.1
Watre Table						
Sloped Soil Over Hee =						
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =					2.08	
Surcharge Over Toe =						
Stem Weight(s) =				816.6	4.50	3,675.0
Earth @ Stem Transitions =						
Footing Weight =				906.9	2.42	2,193.4
Key Weight =				175.0	0.33	58.3
Vert. Component =						
Total =	1,339.8	**O.T.M.** =	3,907.9	**Total =** 1,901.7 lbs	**R.M.=**	5,941.8

Resisting/Overturning Ratio = **1.52**
Vertical Loads used for Soil Pressure = 1,901.7 lbs

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.056	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

RetainPro (c) 1987-2019, Build 11.19.07.30
License : KW-06055874
License To : HARRIOTT VALENTINE

Cantilevered Retaining Wall

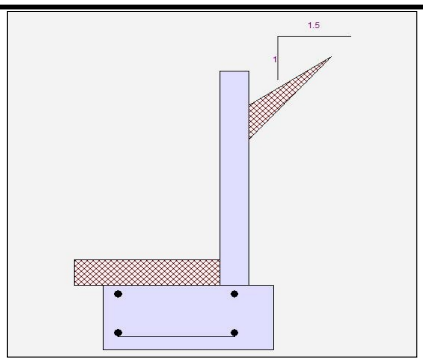
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	3.50 ft
Wall height above soil	=	0.67 ft
Slope Behind Wall	=	1.50
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	6.00 in



Surcharge Loads

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

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	2.88	OK
Sliding	=	1.51	OK
Total Bearing Load	=	1,049 lbs	
...resultant ecc.	=	2.47 in	
Soil Pressure @ Toe	=	512 psf	OK
Soil Pressure @ Heel	=	208 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	716 psf	
ACI Factored @ Heel	=	291 psf	
Footing Shear @ Toe	=	1.6 psi	OK
Footing Shear @ Heel	=	1.5 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	442.4 lbs	
less 100% Passive Force	= -	351.6 lbs	
less 100% Friction Force	= -	314.7 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	2.200
Wind, W	1.300
Seismic, E	1.000

Stem Construction

		Bottom			
		Stem OK			
Design Height Above Ftg	ft =	0.00			
Wall Material Above "Ht"	=	Concrete			
Design Method	=	LRFD	LRFD	LRFD	LRFD
Thickness	=	6.00			
Rebar Size	=	# 4			
Rebar Spacing	=	16.00			
Rebar Placed at	=	Center			
Design Data					
fb/FB + fa/Fa	=	**0.292**			
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	471.6			
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	550.2			
Moment.....Allowable	=	1,875.7			
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	13.1			
Shear.....Allowable	psi =	67.1			
Anet (Masonry)	in2 =				
Rebar Depth 'd'	in =	3.00			
Masonry Data					
f'm	psi =				
Fs	psi =				
Solid Grouting	=				
Modular Ratio 'n'	=				
Wall Weight	psf =	75.0			
Short Term Factor	=				
Equiv. Solid Thick.	=				
Masonry Block Type	=	Medium Weight			
Masonry Design Method	=	ASD			
Concrete Data					
f'c	psi =	2,000.0			
Fy	psi =	60,000.0			

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0456 in2/ft		
(4/3) * As :	0.0608 in2/ft	Min Stem T&S Reinf Area 0.540 in2	
200bd/fy : 200(12)(3)/60000 :	0.12 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.130 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.15 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.3251 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	2.00 ft
Heel Width	=	0.92
Total Footing Width	=	2.92
Footing Thickness	=	15.00 in
Key Width	=	8.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	1.08 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	716	291	psf
Mu' : Upward	=	14,857	324	ft-#
Mu' : Downward	=	8,400	947	ft-#
Mu: Design	=	307	35	ft-#
Actual 1-Way Shear	=	1.60	1.55	psi
Allow 1-Way Shear	=	40.00	40.00	psi

Toe Reinforcing = # 4 @ 16.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 0.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.95 in2
Min footing T&S reinf Area per foot 0.32 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.41 in	#4@ 14.81 in
#5@ 11.48 in	#5@ 22.96 in
#6@ 16.30 in	#6@ 32.59 in

This Wall in File: Z:\Shared\Data\Projects\active jobs\Sullivan (Shed)\Engineering\3 - FOUNDATIONS\S

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	442.4	1.58	741.5			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
				Soil Over HL (ab. water tbl)	182.4	2.71	494.1
				Soil Over HL (bel. water tbl)		2.71	494.1
				Watre Table			
				Sloped Soil Over Hee =	7.2	2.78	20.1
				Surcharge Over Heel =			
				Adjacent Footing Load =			
				Axial Dead Load on Stem =			
				* Axial Live Load on Stem =			
				Soil Over Toe =		1.00	
				Surcharge Over Toe =			
				Stem Weight(s) =	312.5	2.25	703.0
				Earth @ Stem Transitions =			
				Footing Weight =	546.9	1.46	797.7
				Key Weight =		1.42	
				Vert. Component =			
Total =	442.4	**O.T.M.** =	700.5	**Total =**	1,049.1 lbs	**R.M.=**	2,015.0

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

Resisting/Overturning Ratio = **2.88**
Vertical Loads used for Soil Pressure = 1,049.1 lbs

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.020	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.