

Harriott Valentine Engineers Inc.

## STRUCTURAL CALCULATIONS

**Project:**

Krebs Residence  
9025 SE 48th Street  
Mercer Island, WA 98040

**Architect:**

Marci Kastner Architect  
4424 Bryce Drive  
Anacortes, WA 98221

**Structural Engineer:**

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



7/17/24

**SECTION 1: GENERAL**

## CRITERIA

### Gravity

roof	dead	asphalt shingles	2.5	live snow	25.0 psf
		1/2" plywood	1.5		
		2x12 @ 24"oc	2.2		
		R38 insulation	1.4		
		slope factor	0.9		
		miscellaneous	3.5		
			<hr style="width: 100px; margin-left: 0;"/>		
			12.0		29%
			psf		
	total	dead + snow	37.0		psf
ceiling	dead	2x8 @ 16"oc	2.2	live ceiling	10.0 psf
		5/8" gyp. wallboard	2.8	no storage	
			<hr style="width: 100px; margin-left: 0;"/>		
			5.0		psf
	total	dead + snow	15.0		psf
floor	dead	3/4" hardwood	3.0	live residential	40.0 psf
		3/4" plywood	2.3		
		2x8 @ 16"oc	2.2		
		acoustic insulation	1.0		
		1/2" gyp. wallboard	2.2		
		miscellaneous	1.3		
			<hr style="width: 100px; margin-left: 0;"/>		11%
			12.0		psf
	total	dead + live	52.0		psf
walls		battens 2x2 @ 24"oc	0.3		
		1/2" plywood	1.5		
		2x6 @ 16"oc	1.7		
		R21 insulation	0.8		
		1/2" gyp. wallboard	2.2		
		miscellaneous	1.5		
			<hr style="width: 100px; margin-left: 0;"/>		19%
			8.0		psf







**SECTION 2: FRAMING**

Roof			
Member Name	Results (Max UTIL %)	Current Solution	Comments
R1	Passed (40% R)	1 piece(s) 2 x 12 HF No.2 @ 24" OC	
R2	Passed (92% M)	1 piece(s) 2 x 12 HF No.2 @ 24" OC	
R3	Passed (56% M)	1 piece(s) 2 x 12 HF No.2 @ 24" OC	
R4	Passed (27% R)	1 piece(s) 2 x 12 HF No.2 @ 24" OC	
R5	Passed (19% R)	1 piece(s) 2 x 12 HF No.2 @ 24" OC	
S1	Passed (65% R)	3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL	
S2	Passed (90% R)	1 piece(s) 7" x 14" 2.2E Parallam® PSL	
S3	Passed (91% R)	2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	
S4	Passed (49% R)	2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	
S5	Passed (85% R)	2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	
S6	Passed (65% R)	1 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	
S7	Passed (27% V)	1 piece(s) 3 1/2" x 11 1/4" 2.2E Parallam® PSL	
S8	Passed (51% M)	1 piece(s) 4 x 6 DF No.1	
S9	Passed (3% M)	2 piece(s) 2 x 6 HF No.2	
S10	Passed (5% M)	2 piece(s) 2 x 6 HF No.2	
S11	Passed (90% V)	1 piece(s) 4 x 10 DF No.1	
Ceiling			
Member Name	Results (Max UTIL %)	Current Solution	Comments
M1	Passed (35% R)	2 piece(s) 2 x 6 HF No.2	
M2	Passed (36% R)	2 piece(s) 2 x 6 HF No.2	
M3	Passed (36% R)	2 piece(s) 2 x 6 HF No.2	
M4	Passed (51% M)	2 piece(s) 2 x 6 HF No.2	
M5	Passed (20% M)	2 piece(s) 2 x 6 HF No.2	
M6	Passed (20% M)	2 piece(s) 2 x 6 HF No.2	
M7	Passed (29% R)	2 piece(s) 2 x 6 HF No.2	
M8	Passed (74% M)	1 piece(s) 4 x 6 DF No.1	
M9	Passed (23% M)	2 piece(s) 2 x 6 HF No.2	
M10	Passed (91% M)	1 piece(s) 4 x 8 DF No.1	
M11	Passed (84% M)	2 piece(s) 2 x 8 HF No.2	
C1	Passed (65% M)	1 piece(s) 2 x 8 HF No.2 @ 16" OC	
C2	Passed (41% M)	1 piece(s) 2 x 8 HF No.2 @ 16" OC	
C3	Passed (12% M)	1 piece(s) 2 x 8 HF No.2 @ 16" OC	
C4	Passed (80% ΔL)	1 piece(s) 3 1/2" x 14" 2.2E Parallam® PSL	
C5	Passed (26% M)	1 piece(s) 4 x 8 DF No.1	
L1	Passed (13% R)	1 piece(s) 2 x 8 HF No.2 @ 16" OC	
L2	Passed (11% R)	1 piece(s) 4 x 8 DF No.1	
L3	Passed (3% M)	1 piece(s) 4 x 8 DF No.1	
L4	Passed (84% ΔL)	2 piece(s) 2 x 6 HF No.2	
Floor			
Member Name	Results (Max UTIL %)	Current Solution	Comments
F1	Passed (28% M)	1 piece(s) 2 x 8 HF No.2 @ 16" OC	

ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



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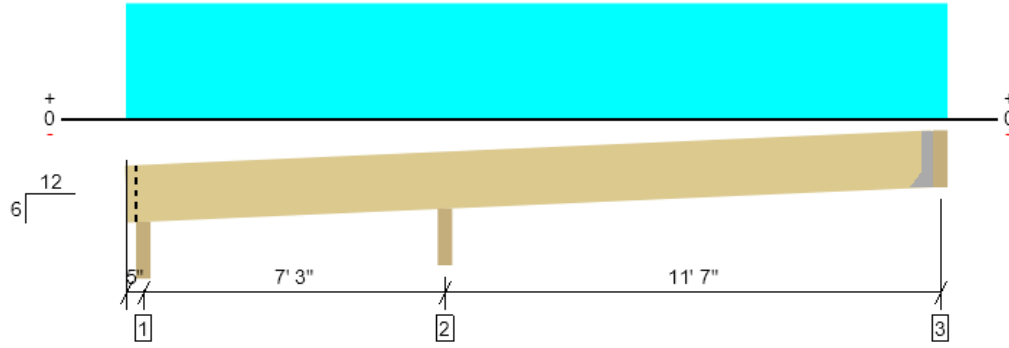
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File Name: Krebs

Roof, R1

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

Sloped Length: 21' 8 1/4"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	361 @ 19' 1 1/4"	911 (1.50")	Passed (40%)	--	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	448 @ 8' 7 13/16"	1941	Passed (23%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	-964 @ 7' 8"	2964	Passed (33%)	1.15	1.0 D + 1.0 S (Adj Spans)
Live Load Defl. (in)	0.062 @ 13' 10 5/16"	0.639	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.092 @ 13' 10 11/16"	0.853	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 21' 9 15/16"  
 System : Roof  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 6/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	62	151	213	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.50"	326	608	935	None
3 - Hanger on 11 1/4" SPF beam	3.50"	Hanger <sup>1</sup>	1.50"	131	251	382	See note <sup>1</sup>

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	15' 7" o/c	
Bottom Edge (Lu)	13' 8" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

**Connector: Simpson Strong-Tie**

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
3 - Face Mount Hanger	LRU28Z	1.94"	N/A	6-10dx1.5	5-10d	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 19' 4 3/4"	24"	12.0	25.0	Default Load

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

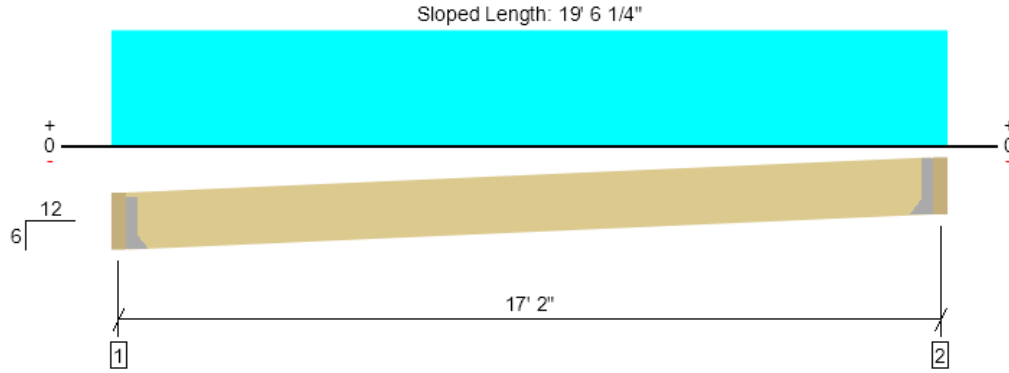
ForteWEB Software Operator	Job Notes
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 File Name: Krebs

Roof, R2

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	648 @ 3 1/2"	911 (1.50")	Passed (71%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	584 @ 1' 1 9/16"	1941	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2735 @ 8' 8 3/4"	2964	Passed (92%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.493 @ 8' 8 3/4"	0.943	Passed (L/459)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.757 @ 8' 8 3/4"	1.258	Passed (L/299)	--	1.0 D + 1.0 S (All Spans)

Member Length : 19' 4"  
 System : Roof  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 6/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 11 1/4" SPF beam	3.50"	Hanger <sup>1</sup>	1.50"	233	436	670	See note <sup>1</sup>
2 - Hanger on 11 1/4" SPF beam	3.50"	Hanger <sup>1</sup>	1.50"	233	436	670	See note <sup>1</sup>

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 9" o/c	
Bottom Edge (Lu)	18' 10" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

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

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 17' 5 1/2"	24"	12.0	25.0	Default Load

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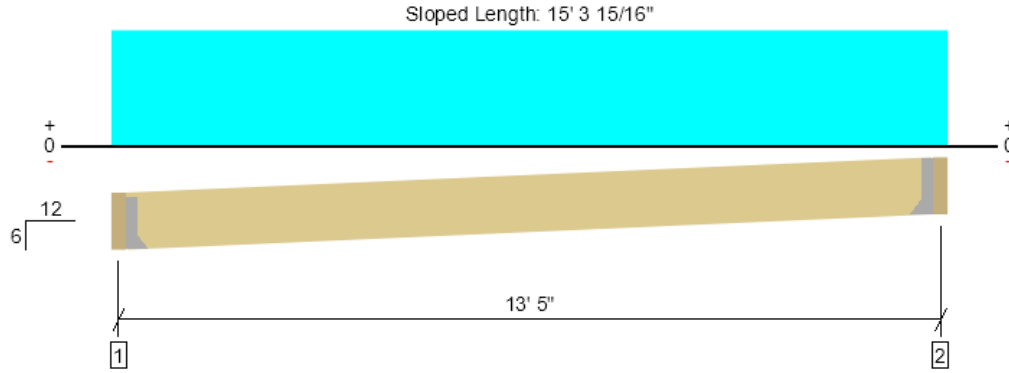
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Roof, R3

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	504 @ 3 1/2"	911 (1.50")	Passed (55%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	440 @ 1' 1 9/16"	1941	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1654 @ 6' 10 1/4"	2964	Passed (56%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.180 @ 6' 10 1/4"	0.734	Passed (L/976)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.277 @ 6' 10 1/4"	0.978	Passed (L/635)	--	1.0 D + 1.0 S (All Spans)

Member Length : 15' 1 11/16"  
 System : Roof  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 6/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Hanger on 11 1/4" SPF beam	3.50"	Hanger <sup>1</sup>	1.50"	183	343	526	See note <sup>1</sup>
2 - Hanger on 11 1/4" SPF beam	3.50"	Hanger <sup>1</sup>	1.50"	183	343	526	See note <sup>1</sup>

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 11" o/c	
Bottom Edge (Lu)	14' 8" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

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

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 13' 8 1/2"	24"	12.0	25.0	Default Load

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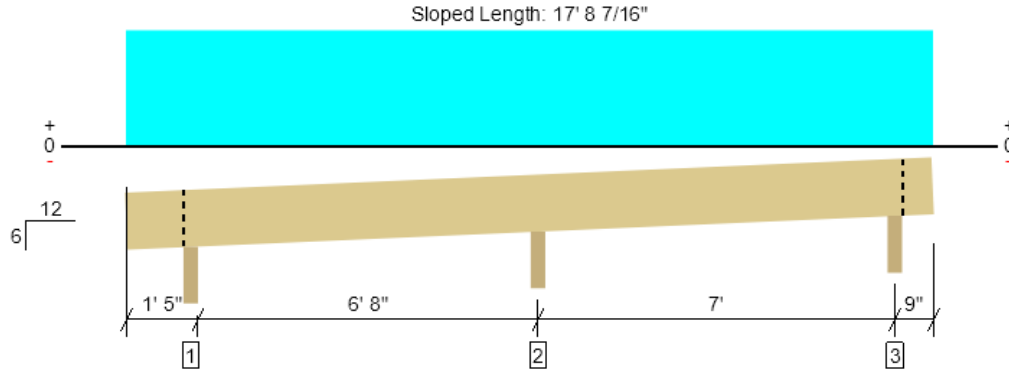
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
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Roof, R4

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	651 @ 8' 1"	2377 (3.50")	Passed (27%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	255 @ 9' 13/16"	1941	Passed (13%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	-444 @ 8' 1"	2964	Passed (15%)	1.15	1.0 D + 1.0 S (Adj Spans)
Live Load Defl. (in)	0.008 @ 11' 10 3/8"	0.391	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.012 @ 11' 11"	0.522	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 18' 2 1/16"  
 System : Roof  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 6/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	106	209	316	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.50"	225	426	651	None
3 - Beveled Plate - SPF	3.50"	3.50"	1.50"	93	184	277	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.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 15' 10"	24"	12.0	25.0	Default Load

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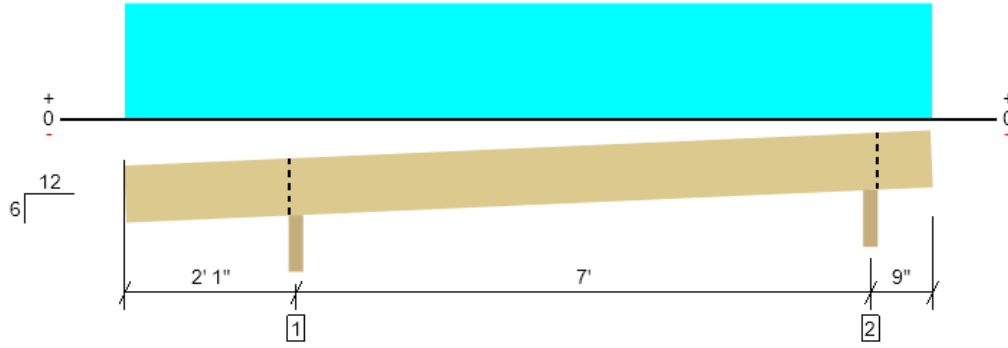


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Roof, R5

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

Sloped Length: 10' 11 15/16"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	451 @ 2' 1"	2377 (3.50")	Passed (19%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	215 @ 3' 13/16"	1941	Passed (11%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	408 @ 5' 9 3/16"	2964	Passed (14%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.013 @ 5' 7 9/16"	0.391	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.019 @ 5' 7 3/4"	0.522	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 11' 5 9/16"  
 System : Roof  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 6/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	157	294	451	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.50"	107	207	314	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' o/c	
Bottom Edge (Lu)	11' o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 9' 10"	24"	12.0	25.0	Default Load

**Weyerhaeuser Notes**

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

ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	

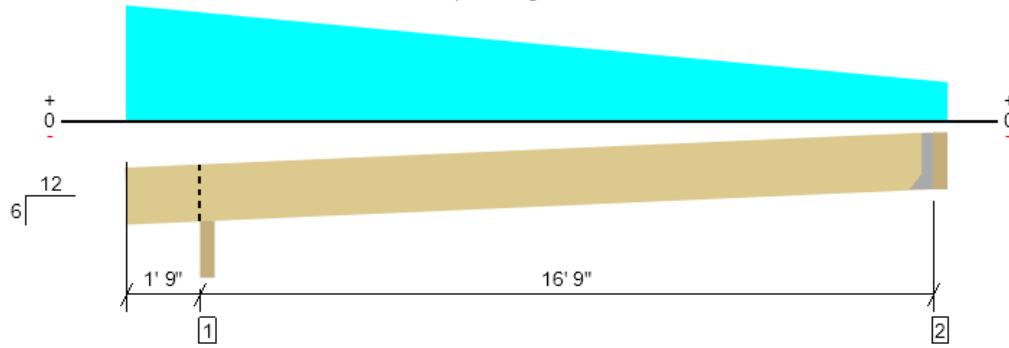


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 File Name: Krebs

Roof, S1

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

Sloped Length: 21' 1/8"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5689 @ 1' 10 3/4"	8731 (3.50")	Passed (65%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3770 @ 2' 10 9/16"	12905	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	15296 @ 9' 8 7/16"	27837	Passed (55%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.494 @ 10' 7/8"	0.928	Passed (L/451)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.785 @ 10' 1 1/16"	1.238	Passed (L/284)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 21' 1 13/16"  
 System : Roof  
 Member Type : Flush Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 6/12

- 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.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	2.28"	2116	3573	5689	Blocking
2 - Hanger on 11 1/4" SPF beam	3.50"	Hanger <sup>1</sup>	1.50"	1222	2011	3233	See note <sup>1</sup>

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	17' 9" o/c	
Bottom Edge (Lu)	20' 8" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

**Connector: Simpson Strong-Tie**

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	HU612X SLD26	2.50"	N/A	22-16d	8-16d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 18' 6"	N/A	17.2	--	
1 - Tapered (PSF)	0 to 18' 9 1/2"	8' 2" to 1'	12.0	25.0	Default Load
2 - Tapered (PSF)	0 to 18' 9 1/2"	9' 7" to 4' 11"	12.0	25.0	Default Load

- Side loads are assumed to not induce cross-grain tension.

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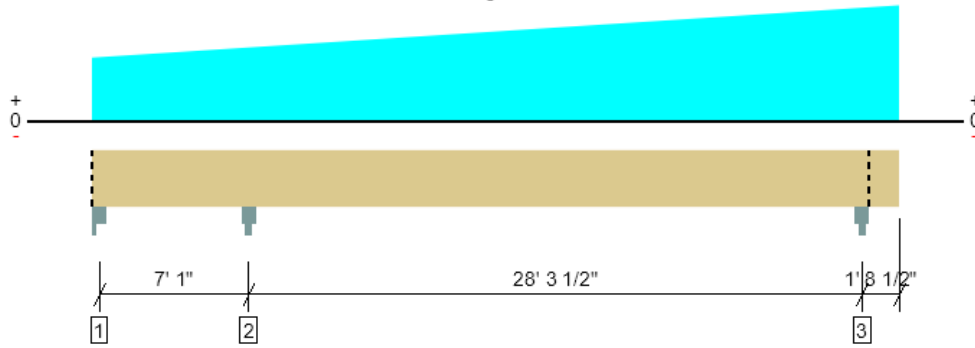
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Roof, S2

**1 piece(s) 7" x 14" 2.2E Parallam® PSL**

Overall Length: 37' 2 3/4"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	13726 @ 7' 2 3/4"	15313 (3.50")	Passed (90%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	6836 @ 8' 6 1/2"	21789	Passed (31%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	-36435 @ 7' 2 3/4"	62472	Passed (58%)	1.15	1.0 D + 1.0 S (Adj Spans)
Live Load Defl. (in)	0.659 @ 23' 3/8"	0.943	Passed (L/515)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	1.040 @ 23' 1/4"	1.415	Passed (L/326)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 37' 2 3/4"  
 System : Floor  
 Member Type : Flush Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Upward deflection on right cantilever exceeds overhang deflection criteria.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- An excessive uplift of -4279 lbs detected at support located at 2".
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Column Cap - steel	3.50"	3.50"	1.50"	-1425	-2854	-4279	Blocking
2 - Column Cap - steel	3.50"	3.50"	3.14"	5103	8623	13726	None
3 - Column Cap - steel	3.50"	3.50"	1.51"	2414	4201	6615	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)	37' 3" o/c	
Bottom Edge (Lu)	37' 3" 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 37' 2 3/4"	N/A	30.6	--	
1 - Tapered (PSF)	0 to 37' 2 3/4" (Front)	7' 10" to 14' 4"	12.0	25.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

Member Notes
(converted from: Roof Flush Beam)

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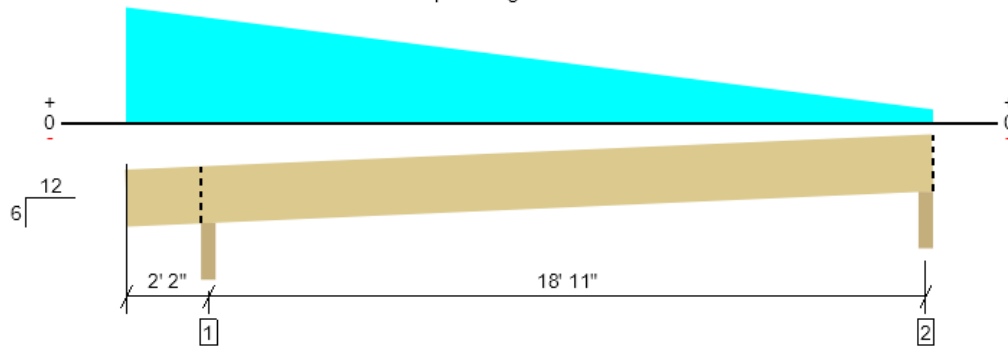


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Roof, S3

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

Sloped Length: 23' 8 13/16"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	5306 @ 2' 2"	5821 (3.50")	Passed (91%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3413 @ 3' 2 3/8"	9081	Passed (38%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	14554 @ 10' 7 7/8"	20525	Passed (71%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.768 @ 11' 4 7/16"	1.056	Passed (L/330)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	1.218 @ 11' 4 11/16"	1.408	Passed (L/208)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 24' 2 3/4"  
 System : Roof  
 Member Type : Flush Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 6/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Upward deflection on left cantilever exceeds overhang deflection criteria.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Upward deflection on left cantilever exceeds 0.4".

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	3.19"	1956	3349	5306	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.58"	895	1452	2346	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)	23' 9" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 21' 2 3/4"	N/A	12.1	--	
1 - Tapered (PSF)	0 to 21' 2 3/4"	16' 1 1/2" to 1' 10 1/2"	12.0	25.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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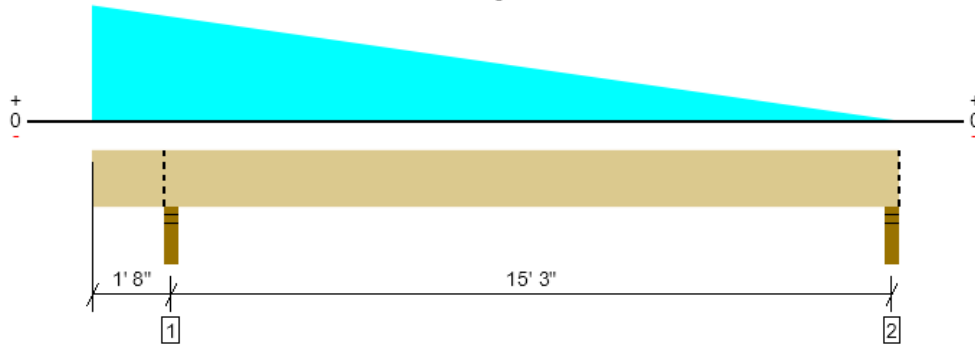


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Roof, S4

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

Overall Length: 17' 3/4"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2553 @ 1' 8"	5206 (3.50")	Passed (49%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1520 @ 2' 9 5/8"	9081	Passed (17%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5404 @ 8' 3 5/8"	20525	Passed (26%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.154 @ 9' 3/8"	0.761	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.241 @ 9' 11/16"	1.015	Passed (L/759)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 17' 3/4"  
 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).
- Overhang deflection criteria: LL (2L/240) and TL (2L/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 - Stud wall - SPF	3.50"	3.50"	1.72"	905	1648	2553	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	377	603	980	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' 1" o/c	
Bottom Edge (Lu)	17' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 17' 3/4"	N/A	12.1	--	
1 - Tapered (PSF)	0 to 17' 3/4" (Front)	10' 6" to 0	12.0	25.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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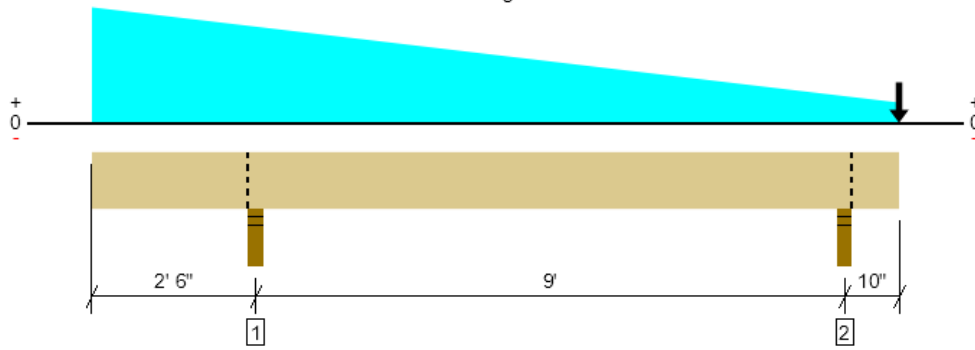


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 File Name: Krebs

Roof, S5

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

Overall Length: 12' 4"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4448 @ 11' 6"	5206 (3.50")	Passed (85%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	2311 @ 12' 4"	9081	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-2803 @ 11' 6"	20525	Passed (14%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.016 @ 0	0.250	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.017 @ 12' 4"	0.200	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 12' 4"  
 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).
- Overhang deflection criteria: LL (2L/240) and TL (0.2").
- 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 - Stud wall - SPF	3.50"	3.50"	1.50"	671	1364	2034	Blocking
2 - Stud wall - SPF	3.50"	3.50"	2.99"	1680	2768	4448	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)	12' 4" o/c	
Bottom Edge (Lu)	12' 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 12' 4"	N/A	12.1	--	
1 - Tapered (PSF)	0 to 12' 4" (Front)	5' 9" to 1' 10 1/2"	12.0	25.0	Default Load
2 - Tapered (PSF)	0 to 12' 4" (Front)	4' 11 1/4" to 0	12.0	25.0	Default Load
3 - Point (lb)	12' 4" (Front)	N/A	895	1452	Linked from: S3, Support 2
4 - Point (lb)	12' 4" (Front)	N/A	377	603	Linked from: S4, Support 2

• Side loads are assumed to not induce cross-grain tension.

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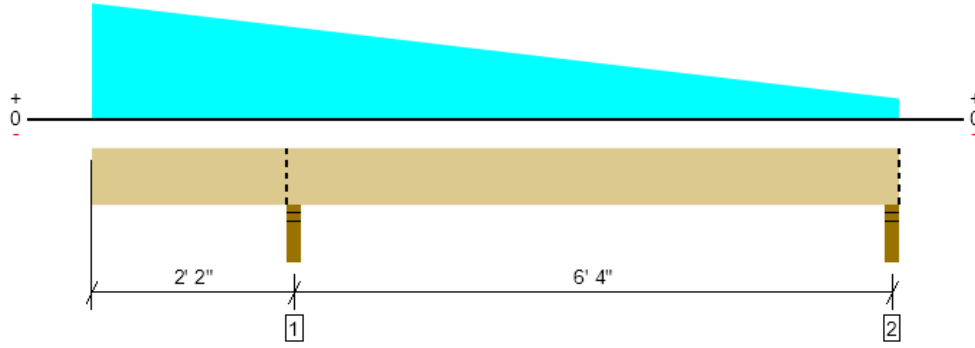
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File Name: Krebs

Roof, S6

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

Overall Length: 8' 7 3/4"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1679 @ 2' 2"	2603 (3.50")	Passed (65%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	559 @ 3' 3 5/8"	4541	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-878 @ 2' 2"	10263	Passed (9%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.010 @ 0	0.217	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.011 @ 0	0.289	Passed (2L/999+)	--	1.0 D + 1.0 S (Alt Spans)

Member Length : 8' 7 3/4"  
 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).
- Overhang deflection criteria: LL (2L/240) and TL (2L/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 - Stud wall - SPF	3.50"	3.50"	2.26"	568	1111	1679	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	136	292	429	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' 8" o/c	
Bottom Edge (Lu)	8' 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 8' 7 3/4"	N/A	6.1	--	
1 - Tapered (PSF)	0 to 8' 7 3/4" (Front)	5' 9" to 1' 10 1/2"	12.0	25.0	Default Load
2 - Tapered (PSF)	0 to 8' 7 3/4" (Front)	4' 11 1/4" to 0	12.0	25.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

**Weyerhaeuser Notes**

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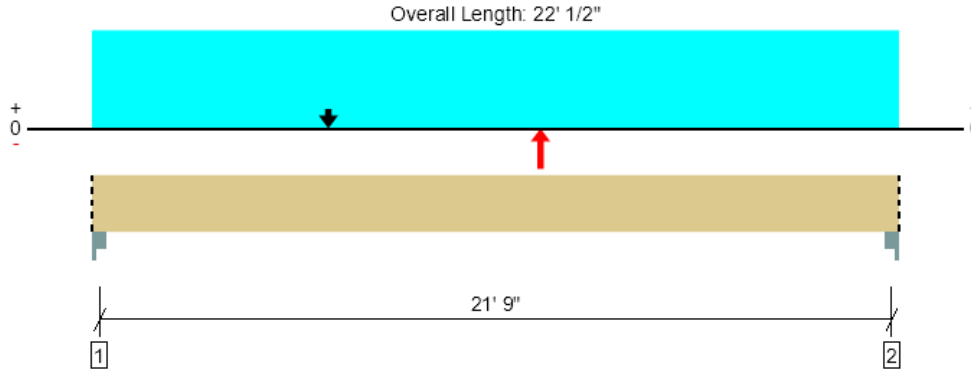
ForteWEB Software Operator	Job Notes
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Roof, S7

1 piece(s) 3 1/2" x 11 1/4" 2.2E Parallam® PSL



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1533 @ 2"	7656 (3.50")	Passed (20%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2370 @ 12' 3"	8754	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-5237 @ 12' 3"	20666	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	-0.057 @ 12' 3"	0.724	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.089 @ 5' 3 1/8"	1.085	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 22' 1/2"  
 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	Snow	Factored	
1 - Column Cap - steel	3.50"	3.50"	1.50"	570	962	1533	Blocking
2 - Column Cap - steel	3.50"	3.50"	1.50"	352	517	868	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)	22' 1" o/c	
Bottom Edge (Lu)	22' 1" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 22' 1/2"	N/A	12.3	--	
1 - Uniform (PSF)	0 to 22' 1/2" (Front)	7' 4"	12.0	25.0	Default Load
2 - Point (lb)	12' 3" (Front)	N/A	-1425	-2854	Linked from: S2, Support 1
3 - Point (lb)	6' 5 1/2" (Front)	N/A	136	292	Linked from: S6, Support 2

- Side loads are assumed to not induce cross-grain tension.

Member Notes
(converted from: Roof Flush Beam)

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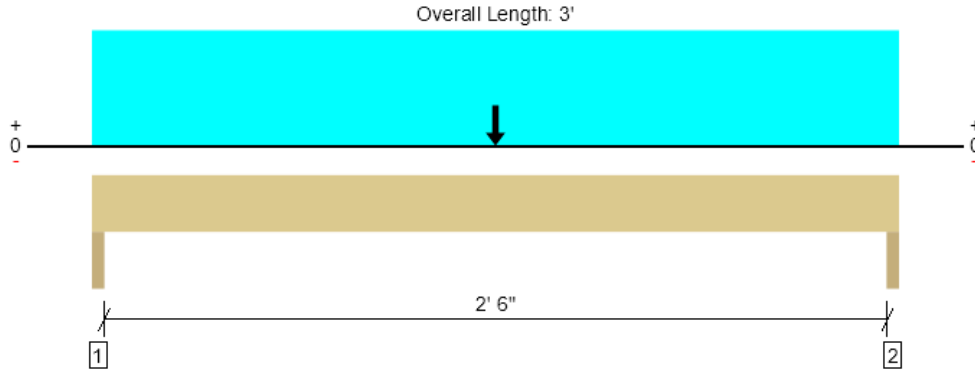
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Roof, S8

**1 piece(s) 4 x 6 DF No.1**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	884 @ 1 1/2"	6563 (3.00")	Passed (13%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	828 @ 8 1/2"	2657	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1128 @ 1' 6"	2198	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.010 @ 1' 6"	0.092	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.015 @ 1' 6"	0.138	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 3'  
 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 - SPF	3.00"	3.00"	1.50"	328	556	884	None
2 - Trimmer - SPF	3.00"	3.00"	1.50"	328	556	884	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3'	N/A	4.9	--	
1 - Uniform (PSF)	0 to 3'	2'	12.0	25.0	Default Load
2 - Point (lb)	1' 6"	N/A	570	962	Linked from: S7, Support 1

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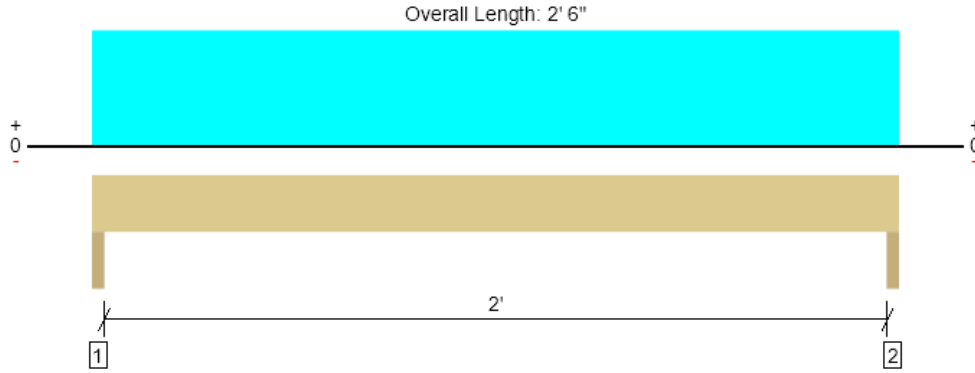
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Roof, S9

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	98 @ 1 1/2"	3645 (3.00")	Passed (3%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	42 @ 8 1/2"	1898	Passed (2%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	49 @ 1' 3"	1602	Passed (3%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.001 @ 1' 3"	0.075	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.001 @ 1' 3"	0.112	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 2' 6"  
 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 - SPF	3.00"	3.00"	1.50"	35	62	98	None
2 - Trimmer - SPF	3.00"	3.00"	1.50"	35	62	98	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 2' 6"	N/A	4.2	--	
1 - Uniform (PSF)	0 to 2' 6"	2'	12.0	25.0	Default Load

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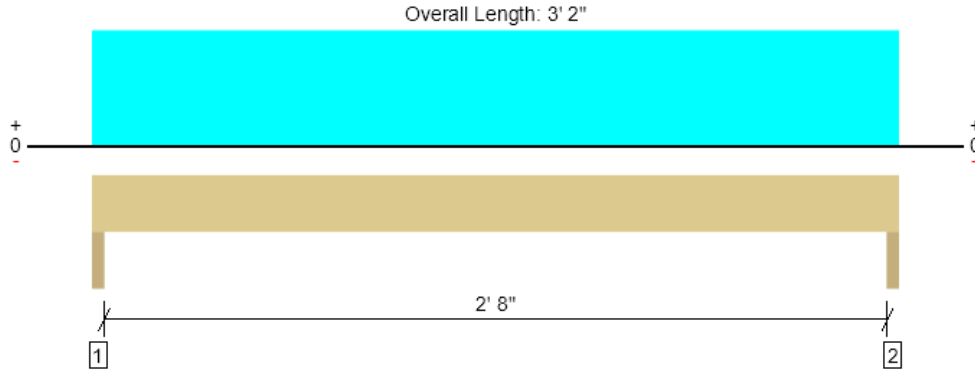
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Roof, S10

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	124 @ 1 1/2"	3645 (3.00")	Passed (3%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	68 @ 8 1/2"	1898	Passed (4%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	83 @ 1' 7"	1602	Passed (5%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.002 @ 1' 7"	0.097	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.002 @ 1' 7"	0.146	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 3' 2"  
 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 - SPF	3.00"	3.00"	1.50"	45	79	124	None
2 - Trimmer - SPF	3.00"	3.00"	1.50"	45	79	124	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 2" o/c	
Bottom Edge (Lu)	3' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 2"	N/A	4.2	--	
1 - Uniform (PSF)	0 to 3' 2"	2'	12.0	25.0	Default Load

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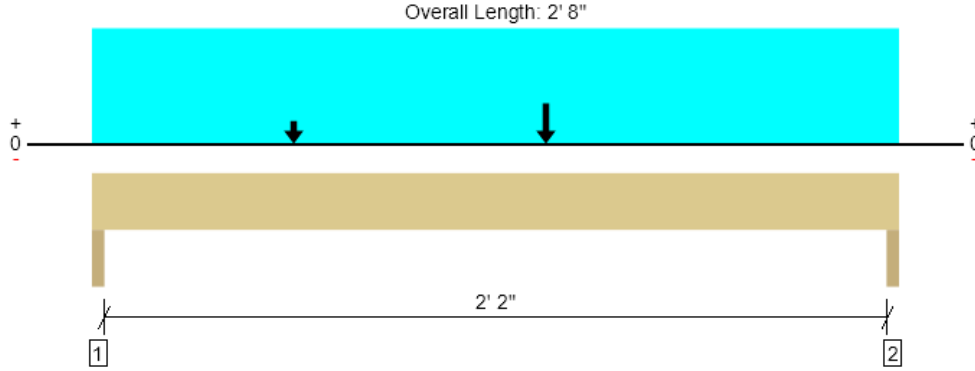
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Roof, S11  
**1 piece(s) 4 x 10 DF No.1**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4123 @ 2' 6 1/2"	6563 (3.00")	Passed (63%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	4039 @ 1' 7 3/4"	4468	Passed (90%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4239 @ 1' 6"	5740	Passed (74%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.006 @ 1' 3 7/8"	0.081	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.010 @ 1' 3 7/8"	0.121	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 2' 8"  
 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 - SPF	3.00"	3.00"	1.86"	1528	2551	4078	None
2 - Trimmer - SPF	3.00"	3.00"	1.88"	1547	2576	4123	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 8" o/c	
Bottom Edge (Lu)	2' 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 2' 8"	N/A	8.2	--	
1 - Uniform (PSF)	0 to 2' 8"	2'	12.0	25.0	Default Load
2 - Point (lb)	1' 6"	N/A	2419	4031	EX. RIDGE
3 - Point (lb)	8"	N/A	570	962	Linked from: S7, Support 1

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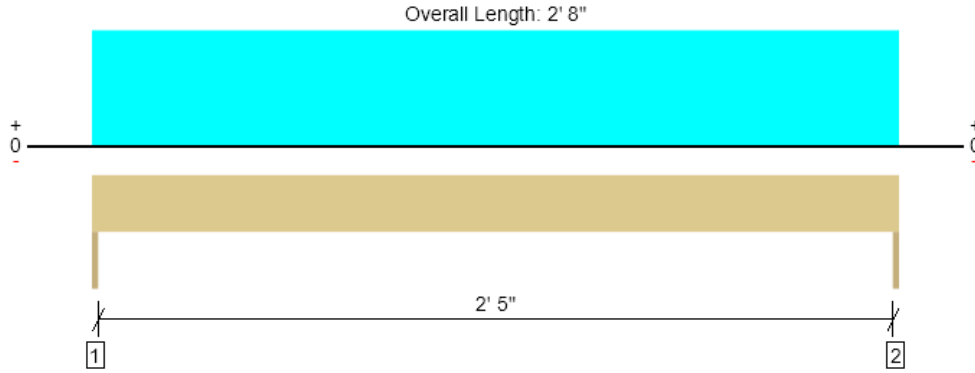
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Ceiling, M1  
2 piece(s) 2 x 6 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	630 @ 0	1823 (1.50")	Passed (35%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	354 @ 7"	1898	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	420 @ 1' 4"	1602	Passed (26%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.006 @ 1' 4"	0.089	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.010 @ 1' 4"	0.133	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 2' 8"  
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 - SPF	1.50"	1.50"	1.50"	246	113	383	630	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	246	113	383	630	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 8" o/c	
Bottom Edge (Lu)	2' 8" 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 2' 8"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 2' 8"	8' 6"	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 2' 8"	11' 6"	12.0	-	25.0	ROOF

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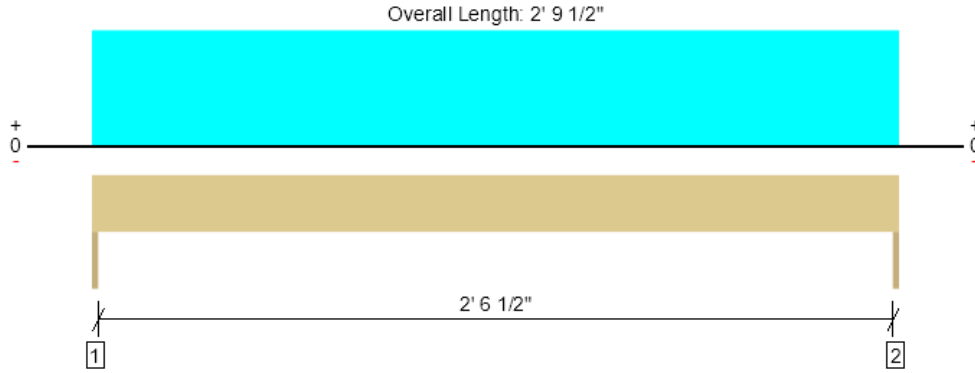
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File Name: Krebs

Ceiling, M2  
2 piece(s) 2 x 6 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	659 @ 0	1823 (1.50")	Passed (36%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	384 @ 7"	1898	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	460 @ 1' 4 3/4"	1602	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.007 @ 1' 4 3/4"	0.093	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.012 @ 1' 4 3/4"	0.140	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 2' 9 1/2"  
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 - SPF	1.50"	1.50"	1.50"	258	119	401	659	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	258	119	401	659	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 10" o/c	
Bottom Edge (Lu)	2' 10" 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 2' 9 1/2"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 2' 9 1/2"	8' 6"	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 2' 9 1/2"	11' 6"	12.0	-	25.0	ROOF

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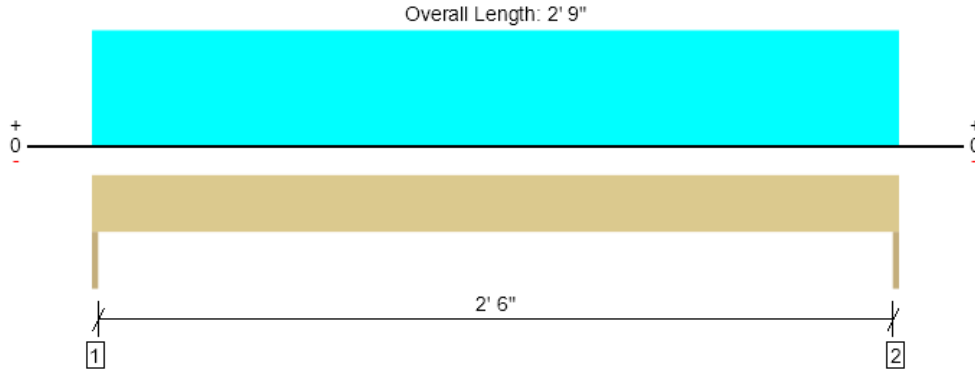
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File Name: Krebs

Ceiling, M3

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



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	649 @ 0	1823 (1.50")	Passed (36%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	374 @ 7"	1898	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	446 @ 1' 4 1/2"	1602	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.007 @ 1' 4 1/2"	0.092	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.011 @ 1' 4 1/2"	0.138	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 2' 9"  
 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 - SPF	1.50"	1.50"	1.50"	254	117	395	649	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	254	117	395	649	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 9" o/c	
Bottom Edge (Lu)	2' 9" 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 2' 9"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 2' 9"	8' 6"	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 2' 9"	11' 6"	12.0	-	25.0	ROOF

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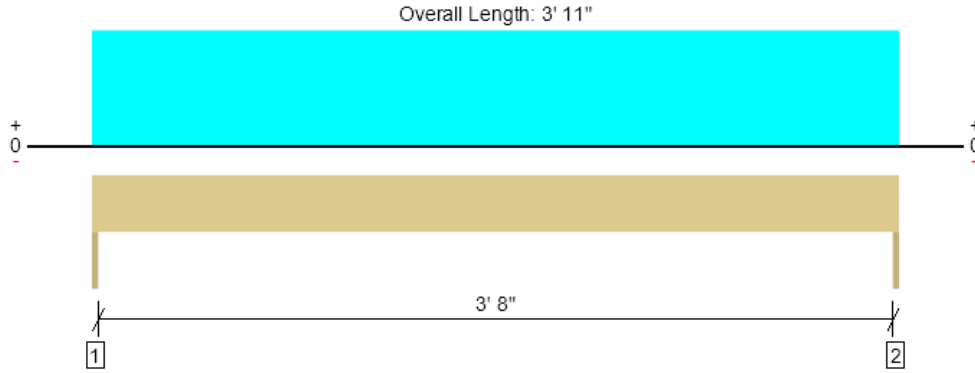
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File Name: Krebs

Ceiling, M4  
2 piece(s) 2 x 6 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	841 @ 0	1823 (1.50")	Passed (46%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	591 @ 7"	1898	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	824 @ 1' 11 1/2"	1602	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.028 @ 1' 11 1/2"	0.131	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.042 @ 1' 11 1/2"	0.196	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 3' 11"  
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 - SPF	1.50"	1.50"	1.50"	278	563	841	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	278	563	841	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 11" o/c	
Bottom Edge (Lu)	3' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 11"	N/A	4.2	--	
1 - Uniform (PSF)	0 to 3' 11"	11' 6"	12.0	25.0	ROOF

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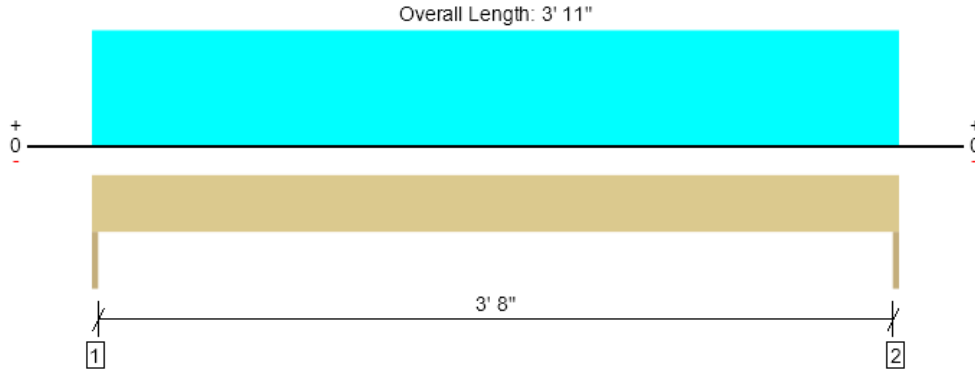
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Ceiling, M5  
2 piece(s) 2 x 6 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	330 @ 0	1823 (1.50")	Passed (18%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	232 @ 7"	1898	Passed (12%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	323 @ 1' 11 1/2"	1602	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.010 @ 1' 11 1/2"	0.131	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.016 @ 1' 11 1/2"	0.196	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 3' 11"  
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 - SPF	1.50"	1.50"	1.50"	134	64	196	330	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	134	64	196	330	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 11" o/c	
Bottom Edge (Lu)	3' 11" 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' 11"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 3' 11"	3' 3"	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 3' 11"	4'	12.0	-	25.0	ROOF

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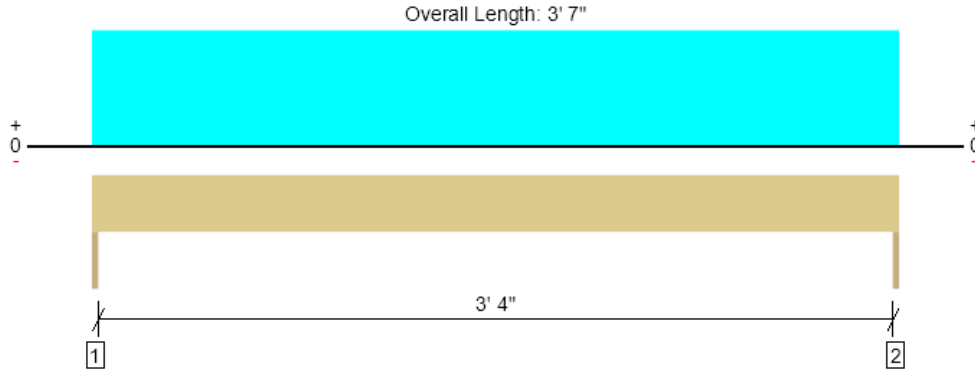
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File Name: Krebs

Ceiling, M6  
2 piece(s) 2 x 6 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	357 @ 0	1823 (1.50")	Passed (20%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	241 @ 7"	1898	Passed (13%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	320 @ 1' 9 1/2"	1602	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.009 @ 1' 9 1/2"	0.119	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.014 @ 1' 9 1/2"	0.179	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 3' 7"  
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 - SPF	1.50"	1.50"	1.50"	133	36	224	357	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	133	36	224	357	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 7" o/c	
Bottom Edge (Lu)	3' 7" 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' 7"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 3' 7"	2'	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 3' 7"	5'	12.0	-	25.0	ROOF

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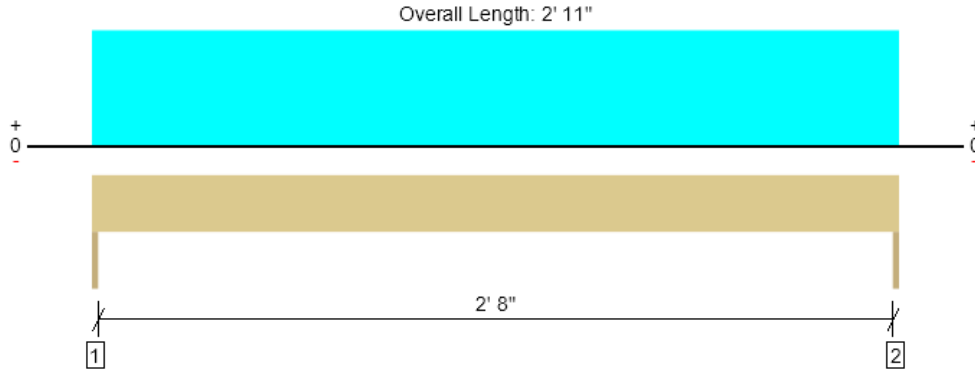
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Ceiling, M7  
**2 piece(s) 2 x 6 HF No.2**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	529 @ 0	1823 (1.50")	Passed (29%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	318 @ 7"	1650	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	386 @ 1' 5 1/2"	1393	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.008 @ 1' 5 1/2"	0.097	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 1' 5 1/2"	0.146	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 2' 11"  
 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 - SPF	1.50"	1.50"	1.50"	161	368	73	529	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	161	368	73	529	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	2' 11" o/c	
Bottom Edge (Lu)	2' 11" 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 2' 11"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 2' 11"	3' 3"	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 2' 11"	2'	12.0	-	25.0	ROOF
3 - Uniform (PSF)	0 to 2' 11"	5' 6"	12.0	40.0	-	FLOOR

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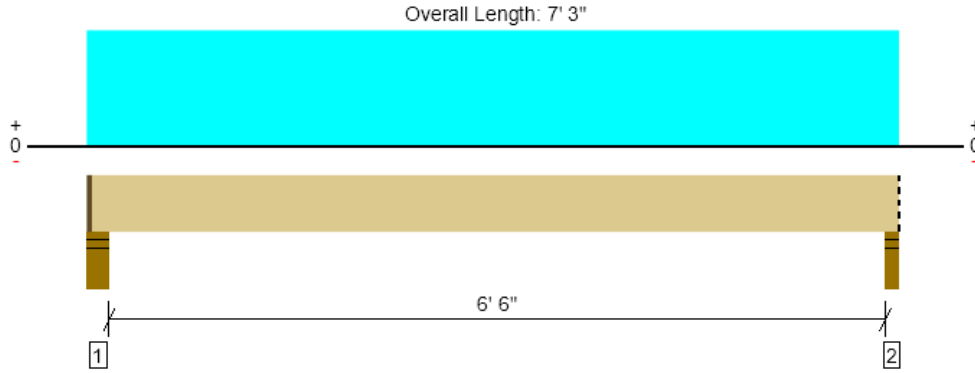
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Ceiling, M8

1 piece(s) 4 x 6 DF No.1



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1014 @ 7' 1"	5206 (3.50")	Passed (19%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	799 @ 11"	2657	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1630 @ 3' 8 1/2"	2198	Passed (74%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.104 @ 3' 8 1/2"	0.169	Passed (L/780)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.162 @ 3' 8 1/2"	0.338	Passed (L/500)	--	1.0 D + 1.0 S (All Spans)

Member Length : 7' 1 3/4"  
 System : Floor  
 Member Type : Flush Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- 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 - SPF	5.50"	4.25"	1.50"	381	74	680	1061	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	3.50"	1.50"	364	71	649	1014	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)	7' 2" o/c	
Bottom Edge (Lu)	7' 2" o/c	

- Maximum allowable bracing intervals based on applied load.

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 7' 3"	N/A	4.9	--	--	
1 - Uniform (PSF)	0 to 7' 3" (Front)	2'	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 7' 3" (Front)	7' 4"	12.0	-	25.0	ROOF

- Side loads are assumed to not induce cross-grain tension.

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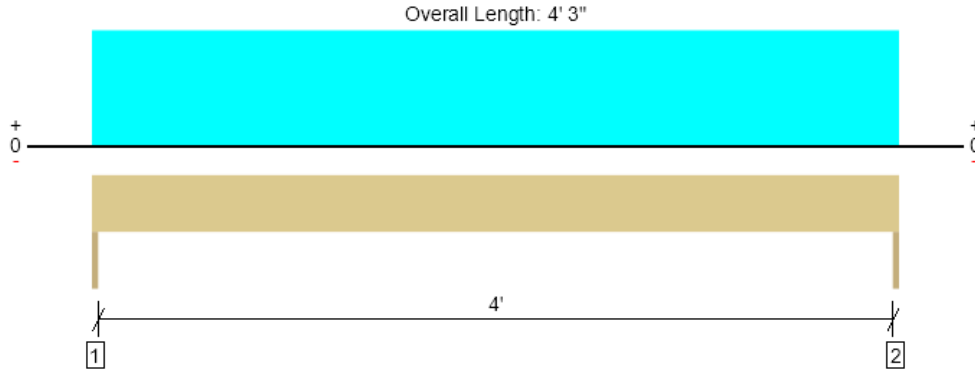
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Ceiling, M9  
2 piece(s) 2 x 6 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	345 @ 0	1823 (1.50")	Passed (19%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	250 @ 7"	1898	Passed (13%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	366 @ 2' 1 1/2"	1602	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.014 @ 2' 1 1/2"	0.142	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.022 @ 2' 1 1/2"	0.213	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

Member Length : 4' 3"  
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 - SPF	1.50"	1.50"	1.50"	132	43	212	345	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	132	43	212	345	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 3" o/c	
Bottom Edge (Lu)	4' 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 4' 3"	N/A	4.2	--	--	
1 - Uniform (PSF)	0 to 4' 3"	2'	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 4' 3"	4'	12.0	-	25.0	ROOF

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

ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	

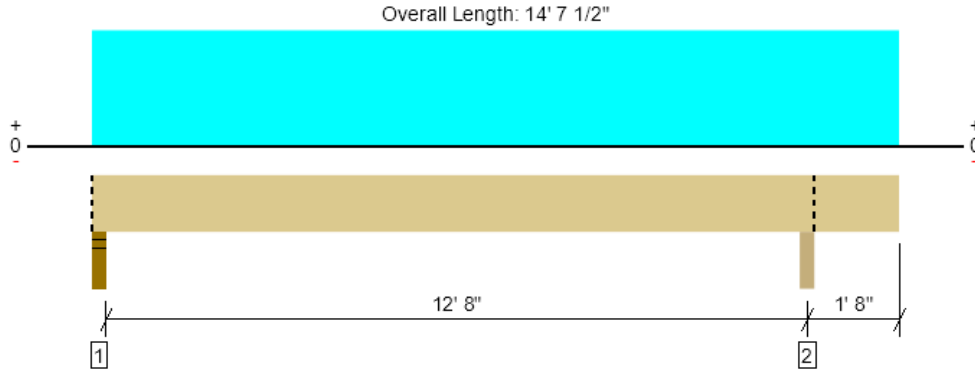


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ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2

File Name: Krebs

Ceiling, M10

1 piece(s) 4 x 8 DF No.1



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1131 @ 2"	5206 (3.50")	Passed (22%)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Shear (lbs)	1003 @ 12' 2 1/2"	3502	Passed (29%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	3488 @ 6' 5 15/16"	3820	Passed (91%)	1.15	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Live Load Defl. (in)	0.320 @ 6' 6 5/8"	0.640	Passed (L/480)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Total Load Defl. (in)	0.541 @ 6' 6 1/2"	0.853	Passed (L/284)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)

Member Length : 14' 7 1/2"  
 System : Roof  
 Member Type : Drop Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	467	235/-4	651	1131	Blocking
2 - Column - HF	3.50"	3.50"	1.50"	591	293	817	1424	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)	14' 8" o/c	
Bottom Edge (Lu)	14' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 14' 7 1/2"	N/A	6.4	--	--	
1 - Uniform (PSF)	0 to 14' 7 1/2" (Front)	4'	12.0	-	25.0	ROOF
2 - Uniform (PSF)	0 to 14' 7 1/2" (Front)	3' 7"	5.0	10.0	-	CEILING

• Side loads are assumed to not induce cross-grain tension.

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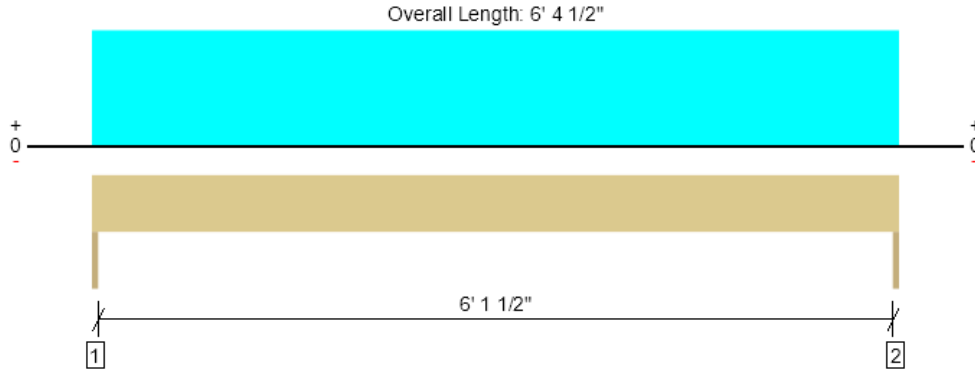
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



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 File Name: Krebs

Ceiling, M11  
2 piece(s) 2 x 8 HF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1360 @ 0	1823 (1.50")	Passed (75%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1049 @ 8 3/4"	2501	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2167 @ 3' 2 1/4"	2569	Passed (84%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.078 @ 3' 2 1/4"	0.213	Passed (L/987)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.128 @ 3' 2 1/4"	0.313	Passed (L/598)	--	1.0 D + 1.0 S (All Spans)

Member Length : 6' 4 1/2"  
System : Wall  
Member Type : Header  
Building Use : Residential  
Building Code : IBC 2018  
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (5/16").
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Trimmer - SPF	1.50"	1.50"	1.50"	536	247	823	1360	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	536	247	823	1360	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 5" o/c	
Bottom Edge (Lu)	6' 5" 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 6' 4 1/2"	N/A	5.5	--	--	
1 - Uniform (PSF)	0 to 6' 4 1/2"	7' 9"	5.0	10.0	-	CEILING
2 - Uniform (PSF)	0 to 6' 4 1/2"	10' 4"	12.0	-	25.0	ROOF

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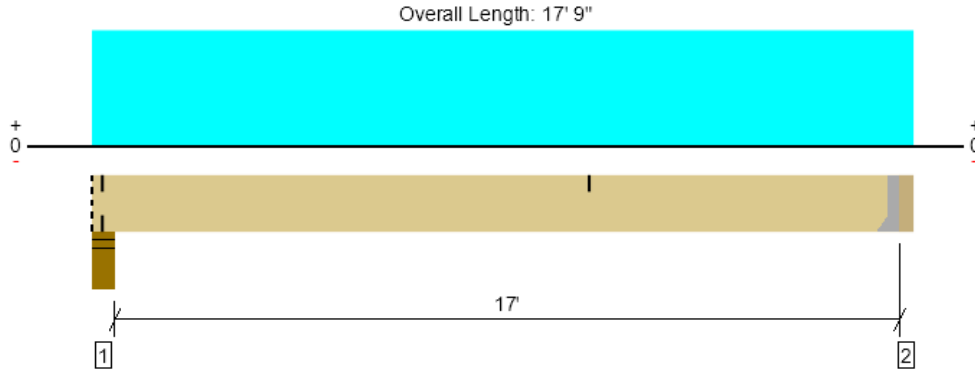
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File Name: Krebs

Ceiling, C1  
**1 piece(s) 2 x 8 HF No.2 @ 16" OC**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	171 @ 17' 5 1/2"	911 (1.50")	Passed (19%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	159 @ 16' 10 1/4"	1088	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	730 @ 8' 11"	1117	Passed (65%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.413 @ 8' 11"	0.854	Passed (L/497)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.619 @ 8' 11"	1.139	Passed (L/331)	--	1.0 D + 1.0 L (All Spans)

Member Length : 17' 5 1/2"  
 System : Ceiling  
 Member Type : Attic Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 0/12

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor/Ceiling Live	Factored	
1 - Stud wall - HF	5.50"	5.50"	1.50"	59	119	178	Blocking
2 - Hanger on 7 1/4" PSL beam	3.50"	Hanger <sup>1</sup>	1.50"	59	118	177	See note <sup>1</sup>

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 10" o/c	
Bottom Edge (Lu)	17' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

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

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor/Ceiling Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17' 9"	16"	5.0	10.0	Default Load

- Only vertical loads are available for Attic Joist member types. No tension loading will be considered in the design for these members.

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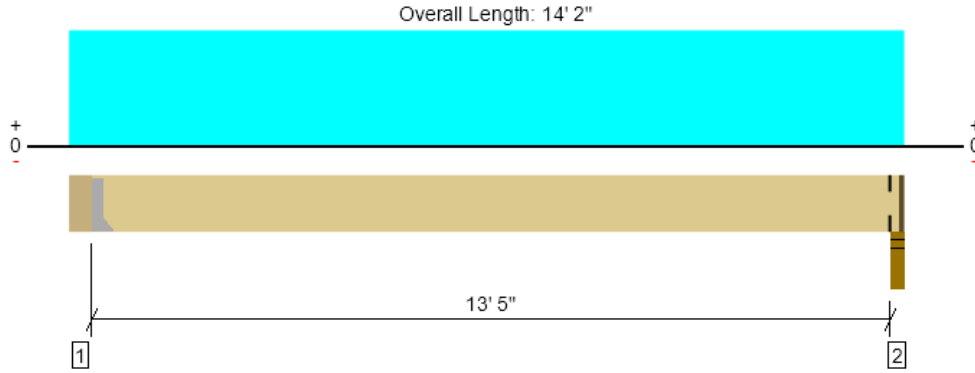
ForteWEB Software Operator	Job Notes
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File Name: Krebs

Ceiling, C2  
**1 piece(s) 2 x 8 HF No.2 @ 16" OC**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	135 @ 5 1/2"	911 (1.50")	Passed (15%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	123 @ 1' 3/4"	1088	Passed (11%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	456 @ 7' 2 1/2"	1117	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.161 @ 7' 2 1/2"	0.675	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.241 @ 7' 2 1/2"	0.900	Passed (L/671)	--	1.0 D + 1.0 L (All Spans)

Member Length : 13' 7 1/4"  
 System : Ceiling  
 Member Type : Attic Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 0/12

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor/Ceiling Live	Factored	
1 - Hanger on 7 1/4" PSL beam	5.50"	Hanger <sup>1</sup>	1.50"	48	96	144	See note <sup>1</sup>
2 - Stud wall - HF	3.50"	2.25"	1.50"	46	93	139	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
- <sup>1</sup> See Connector grid below for additional information and/or requirements.

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

- Maximum allowable bracing intervals based on applied load.

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

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor/Ceiling Live (1.00)	Comments
1 - Uniform (PSF)	0 to 14' 2"	16"	5.0	10.0	Default Load

- Only vertical loads are available for Attic Joist member types. No tension loading will be considered in the design for these members.

**Weyerhaeuser Notes**

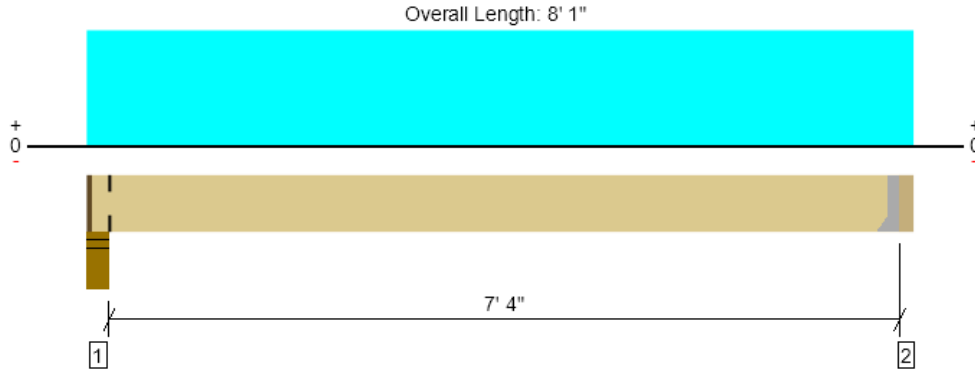
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ForteWEB Software Operator	Job Notes
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Ceiling, C3  
**1 piece(s) 2 x 8 HF No.2 @ 16" OC**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	74 @ 7' 9 1/2"	911 (1.50")	Passed (8%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	62 @ 7' 2 1/4"	1088	Passed (6%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	138 @ 4' 1"	1117	Passed (12%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.015 @ 4' 1"	0.371	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.022 @ 4' 1"	0.494	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 7' 8 1/4"  
 System : Ceiling  
 Member Type : Attic Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 0/12

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor/Ceiling Live	Factored	
1 - Stud wall - HF	5.50"	4.25"	1.50"	27	54	82	1 1/4" Rim Board
2 - Hanger on 7 1/4" DF beam	3.50"	Hanger <sup>1</sup>	1.50"	27	53	80	See note <sup>1</sup>

- 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
- <sup>1</sup> 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
2 - Face Mount Hanger	LU26	1.50"	N/A	6-10dx1.5	4-10dx1.5	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor/Ceiling Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8' 1"	16"	5.0	10.0	Default Load

- Only vertical loads are available for Attic Joist member types. No tension loading will be considered in the design for these members.

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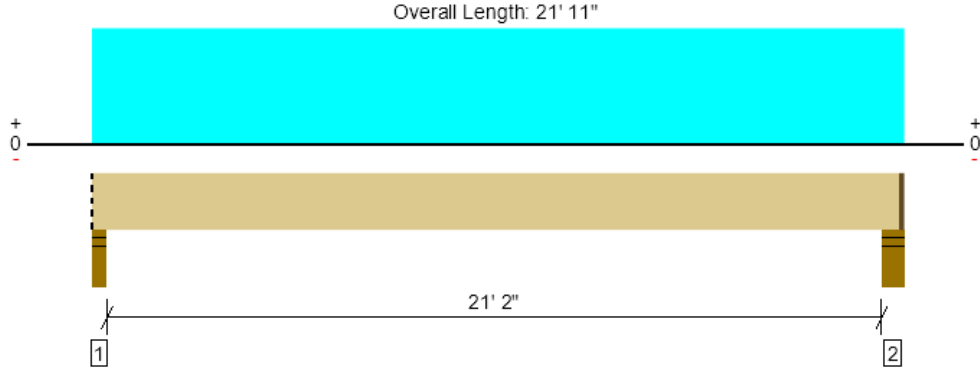
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Ceiling, C4

**1 piece(s) 3 1/2" x 14" 2.2E Parallam® PSL**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2654 @ 2"	5206 (3.50")	Passed (51%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2298 @ 1' 5 1/2"	9473	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	13993 @ 10' 10 1/2"	27162	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.429 @ 10' 10 1/2"	0.535	Passed (L/600)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.686 @ 10' 10 1/2"	1.071	Passed (L/375)	--	1.0 D + 1.0 L (All Spans)

Member Length : 21' 9 3/4"  
 System : Floor  
 Member Type : Flush Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.78"	996	1658	2654	Blocking
2 - Stud wall - SPF	5.50"	4.25"	1.79"	1009	1684	2693	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)	21' 10" o/c	
Bottom Edge (Lu)	21' 10" 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 21' 9 3/4"	N/A	15.3	--	
1 - Uniform (PSF)	0 to 21' 11" (Front)	15' 3"	5.0	10.0	Default Load

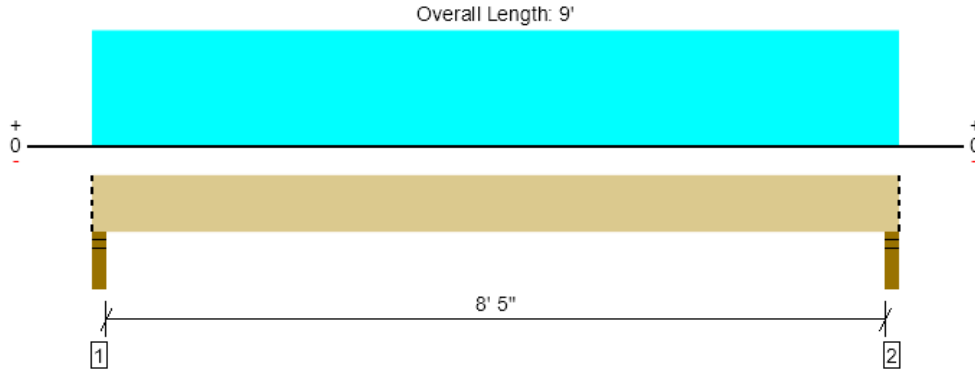
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 The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



Ceiling, C5  
**1 piece(s) 4 x 8 DF No.1**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	417 @ 2"	5206 (3.50")	Passed (8%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	334 @ 10 3/4"	3045	Passed (11%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	870 @ 4' 6"	3322	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.039 @ 4' 6"	0.217	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.062 @ 4' 6"	0.433	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 9'  
 System : Floor  
 Member Type : Flush Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	158	259	417	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	158	259	417	Blocking

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

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 9'	N/A	6.4	--	
1 - Uniform (PSF)	0 to 9' (Front)	5' 9"	5.0	10.0	Default Load

• Side loads are assumed to not induce cross-grain tension.

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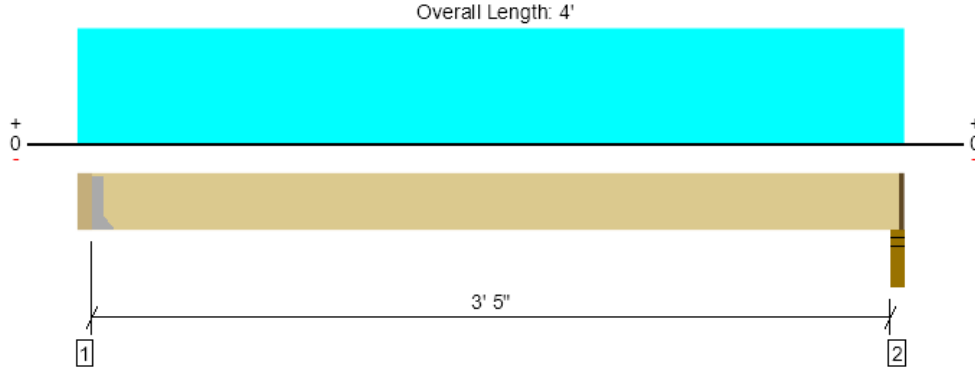
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



Ceiling, L1

1 piece(s) 2 x 8 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	121 @ 3 1/2"	911 (1.50")	Passed (13%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	79 @ 10 3/4"	1088	Passed (7%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	106 @ 2' 1/2"	1284	Passed (8%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 1/2"	0.117	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.004 @ 2' 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 3' 7 1/4"  
 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 - Hanger on 7 1/4" SPF beam	3.50"	Hanger <sup>1</sup>	1.50"	33	109	142	See note <sup>1</sup>
2 - Stud wall - SPF	3.50"	2.25"	1.50"	31	104	136	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
- <sup>1</sup> See Connector grid below for additional information and/or requirements.

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

•Maximum allowable bracing intervals based on applied load.

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

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

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

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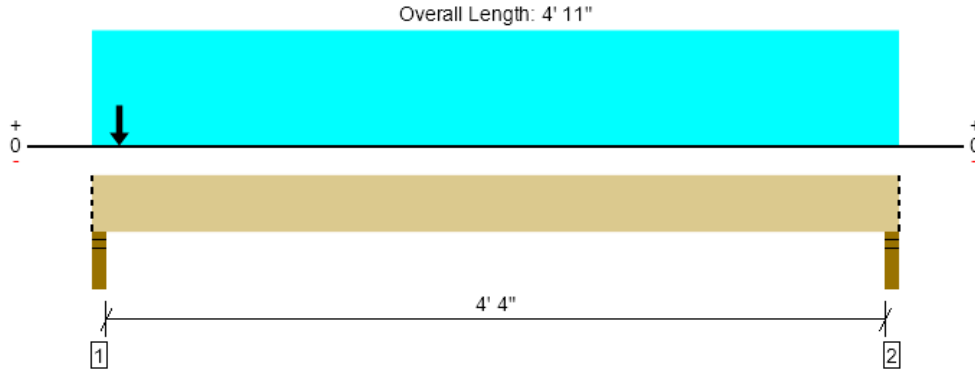
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ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



7/16/2024 7:10:30 PM UTC  
 ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2  
 File Name: Krebs

Ceiling, L2  
**1 piece(s) 4 x 8 DF No.1**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	578 @ 2"	5206 (3.50")	Passed (11%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	176 @ 10 3/4"	3045	Passed (6%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	297 @ 2' 5 1/2"	3322	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.004 @ 2' 5 1/2"	0.153	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.006 @ 2' 5 1/2"	0.229	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 4' 11"  
 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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	177	401	578	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	77	201	278	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' 11" o/c	
Bottom Edge (Lu)	4' 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 4' 11"	N/A	6.4	--	
1 - Point (lb)	2" (Front)	N/A	100	200	
2 - Uniform (PLF)	0 to 4' 11" (Front)	N/A	24.8	81.8	Linked from: L1, Support 1

• Side loads are assumed to not induce cross-grain tension.

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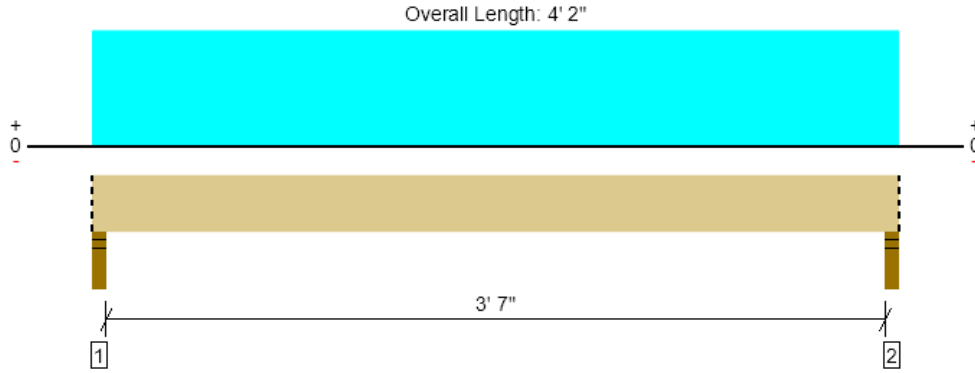
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



Ceiling, L3

1 piece(s) 4 x 8 DF No.1



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	122 @ 2"	5206 (3.50")	Passed (2%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	69 @ 10 3/4"	3045	Passed (2%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	107 @ 2' 1"	3322	Passed (3%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.001 @ 2' 1"	0.128	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.002 @ 2' 1"	0.192	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

Member Length : 4' 2"  
 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.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	38	83	122	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	38	83	122	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' 2" o/c	
Bottom Edge (Lu)	4' 2" 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 4' 2"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 4' 2" (Front)	1'	12.0	40.0	

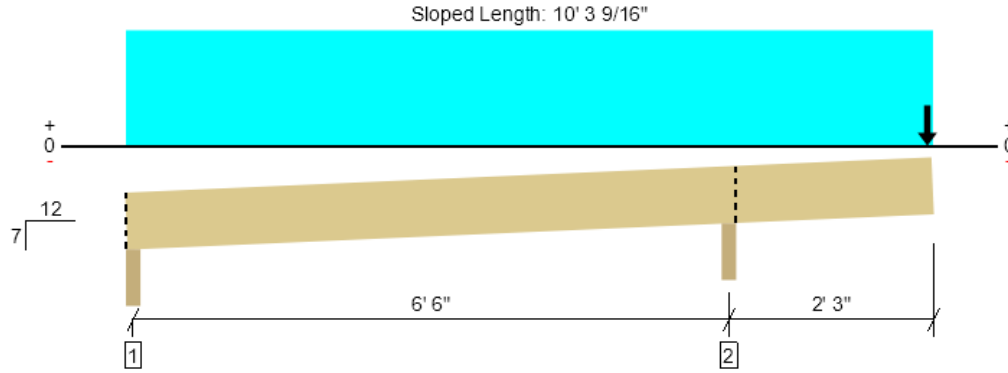
• Side loads are assumed to not induce cross-grain tension.

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ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



Ceiling, L4  
**2 piece(s) 2 x 6 HF No.2**



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	905 @ 6' 7 3/4"	4923 (3.50")	Passed (18%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	432 @ 7' 2 1/4"	1650	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-854 @ 6' 7 3/4"	1393	Passed (61%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.169 @ 8' 10 3/4"	0.200	Passed (2L/370)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.206 @ 8' 10 3/4"	0.260	Passed (2L/304)	--	1.0 D + 1.0 L (Alt Spans)

Member Length : 10' 6 13/16"  
 System : Roof  
 Member Type : Flush Beam  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD  
 Member Pitch : 7/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (0.2") and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	54	216/-95	270/-40	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.50"	262	643	905	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)	10' 4" o/c	
Bottom Edge (Lu)	10' 4" o/c	

- Maximum allowable bracing intervals based on applied load.
- Dimensions for lateral bracing intervals are measured along the length of the member for sloped conditions.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 10 3/4"	N/A	4.2	--	
1 - Uniform (PSF)	0 to 8' 10 3/4"	1' 7"	12.0	40.0	Default Load
2 - Point (lb)	8' 10"	N/A	77	201	Linked from: L2, Support 2

- Side loads are assumed to not induce cross-grain tension.

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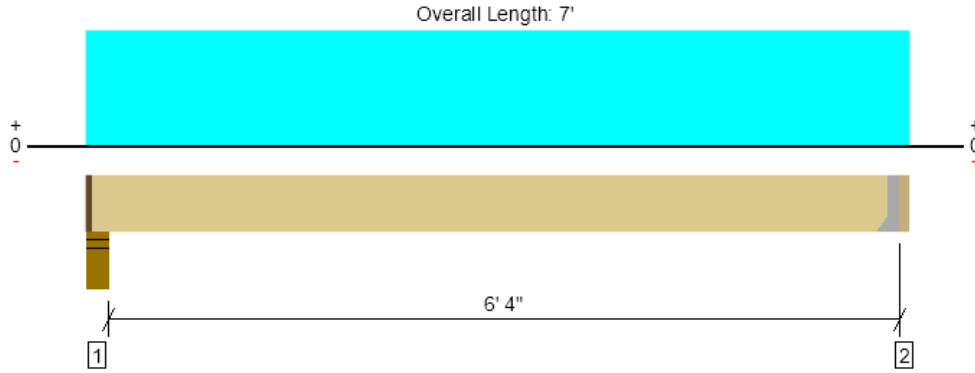
ForteWEB Software Operator	Job Notes
Lexee Navarre Harriott Valentine Engineers (206) 697-1700 lnavarre@harriottvalentine.com	



7/16/2024 7:10:30 PM UTC  
 ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2  
 File Name: Krebs

Floor, F1

1 piece(s) 2 x 8 HF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	222 @ 6' 9 1/2"	911 (1.50")	Passed (24%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	181 @ 6' 2 1/4"	1088	Passed (17%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	357 @ 3' 7"	1284	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.033 @ 3' 7"	0.160	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.043 @ 3' 7"	0.321	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

Member Length : 6' 8"  
 System : Floor  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2018  
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	5.50"	4.00"	1.50"	57	191	248	1 1/2" Rim Board
2 - Hanger on 7 1/4" HF Ledger	2.50"	Hanger <sup>1</sup>	1.50"	55	182	237	See note <sup>1</sup>

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 8" o/c	
Bottom Edge (Lu)	6' 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	
2 - Face Mount Hanger	LU26	1.50"	N/A	6-10dx1.5	4-10dx1.5		

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 7'	16"	12.0	40.0	Default Load

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7/16/2024 7:10:30 PM UTC  
 ForteWEB v3.8, Engine: V8.4.1.22, Data: V8.1.6.2  
 File Name: Krebs

## WOOD COLUMN

4x OR 6x

Species: DF #2  
Size: 4x

Fc\* = 1300 psi      Fc<sub>⊥</sub> = 405 psi      << sill plate is  
E = 1.60E+06 psi      Hem-Fir  
c' = 0.8  
d = 3.5 in  
KcE = 0.3

				4x4	4x6
le	le	FcE	F'c	Pa	Pa
(ft)	(in)	(psi)	(psi)	(lb)	(lb)

Pa (perp)				4961	7796
-----------	--	--	--	------	------

8.00	96.00	638	555	6802	10688	<< crushing governs up to a height of 9'-7" w/ Hem-Fir (7'-5" if Doug-Fir)
8.50	102.00	565	502	6150	9664	
9.00	108.00	504	455	5575	8760	
9.50	114.00	452	414	5069	7966	
10.00	120.00	408	377	4624	7266	
10.50	126.00	370	345	4231	6649	
11.00	132.00	337	317	3883	6103	
11.50	138.00	309	292	3575	5618	
12.00	144.00	284	269	3301	5187	

Species: DF #1  
Size: 6x

Fc\* = 925 psi      Fc<sub>⊥</sub> = 405 psi      << sill plate is  
E = 1.60E+06 psi      Hem-Fir  
c' = 0.8  
d = 5.5 in  
KcE = 0.3

				6x6	4x6
le	le	FcE	F'c	Pa	Pa
(ft)	(in)	(psi)	(psi)	(lb)	(lb)

Pa (perp)				12251	7796
-----------	--	--	--	-------	------

8.00	96.00	1576	775	23443	14918	<< crushing governs up to a height of 14'-8" w/ Hem-Fir (10'-8" if Doug-Fir)
8.50	102.00	1396	750	22701	14446	
9.00	108.00	1245	724	21897	13934	
9.50	114.00	1117	696	21041	13389	
10.00	120.00	1008	666	20145	12819	
10.50	126.00	915	636	19225	12234	
11.00	132.00	833	605	18296	11643	
11.50	138.00	762	574	17373	11056	
12.00	144.00	700	544	16470	10481	

**SECTION 3: LATERAL**

⚠ This is a beta release of the new ATC Hazards by Location website. Please [contact us](#) with feedback.

ℹ The ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

## ATC Hazards by Location

### Search Information

**Address:** 9025 SE 48th St, Mercer Island, WA 98040, USA  
**Coordinates:** 47.5598696, -122.218052  
**Elevation:** 370 ft  
**Timestamp:** 2024-06-20T04:33:35.015Z  
**Hazard Type:** Wind



### ASCE 7-16

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

### ASCE 7-10

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

### ASCE 7-05

ASCE 7-05 Wind Speed ..... 85 mph

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

*Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)*

### Disclaimer

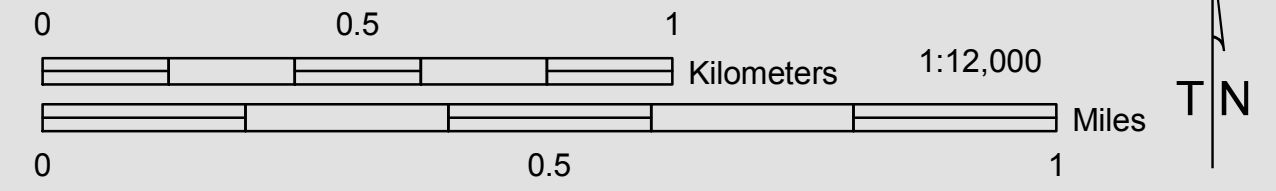
Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour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

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

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

# Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

by Development Services Group (DSG), City of Mercer Island  
April 2009



## WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS (ICC Section 1609 & ASCE 7-05 Chapter 6)

It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the  $K_{zt}$  factor to be utilized for each specific project. The  $K_{zt}$  factors and wind exposure categories indicated on this map are the minimum values accepted by the City of Mercer Island without requiring the design professional to submit additional calculations and supporting topographic documentation (to verify the values utilized in their wind load determination).

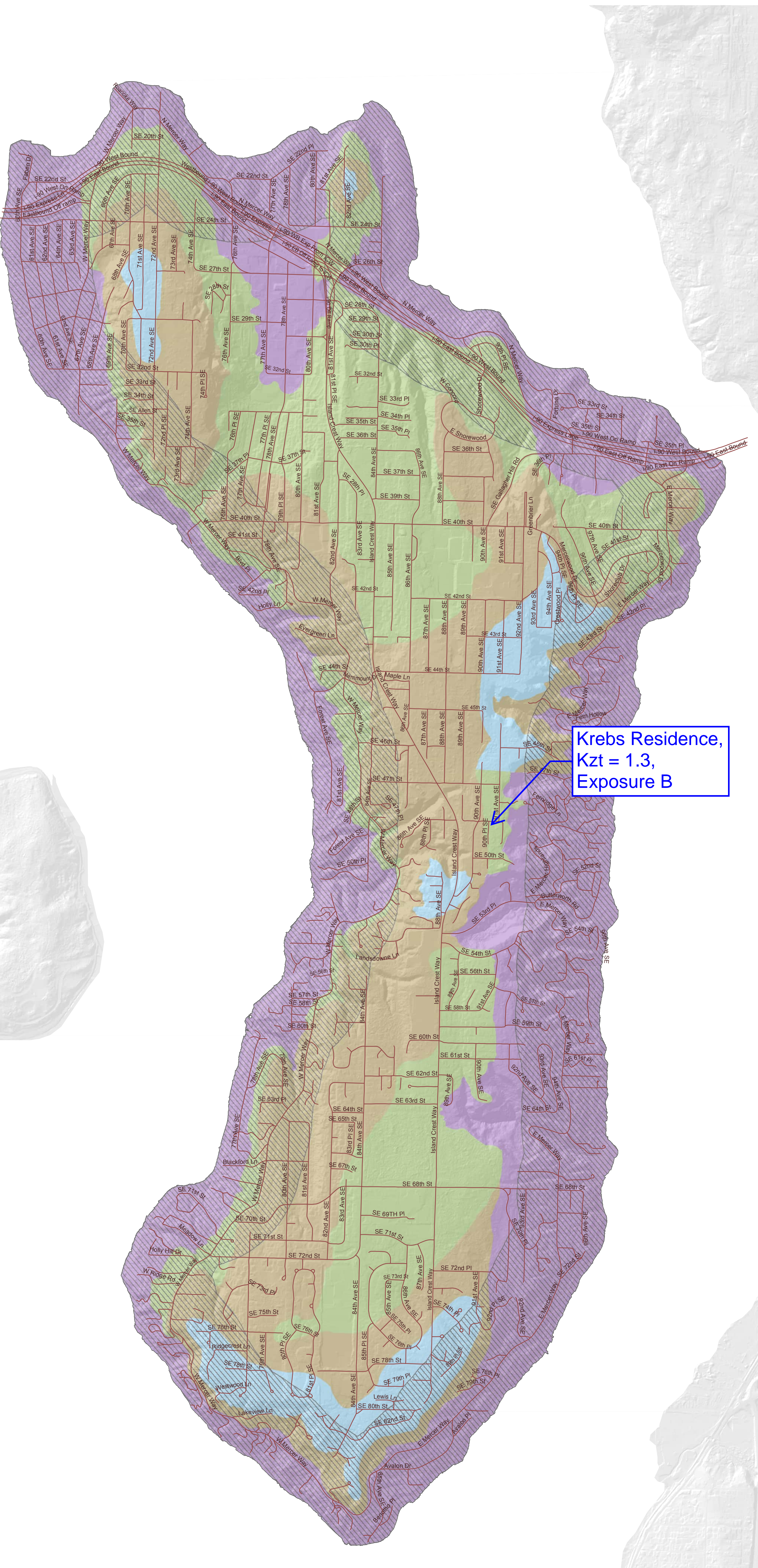
Please note – The  $K_{zt}$  values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

### WIND EXPOSURE CATEGORIES:

Wind Exposure Category		Exposure 'C' (1500 feet from Lake)
		Exposure 'B' (all other areas)

### WIND SPEED-UP (TOPOGRAPHIC EFFECT) - $K_{zt}$ Factor :

$K_{zt}$ Factor		$K_{zt} = 1.0$
		$K_{zt} = 1.3$
		$K_{zt} = 1.6$
		$K_{zt} = 1.9$



### GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer Island. This map shows the minimum wind exposure category and the minimum wind speed-up, " $K_{zt}$ " factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically identified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

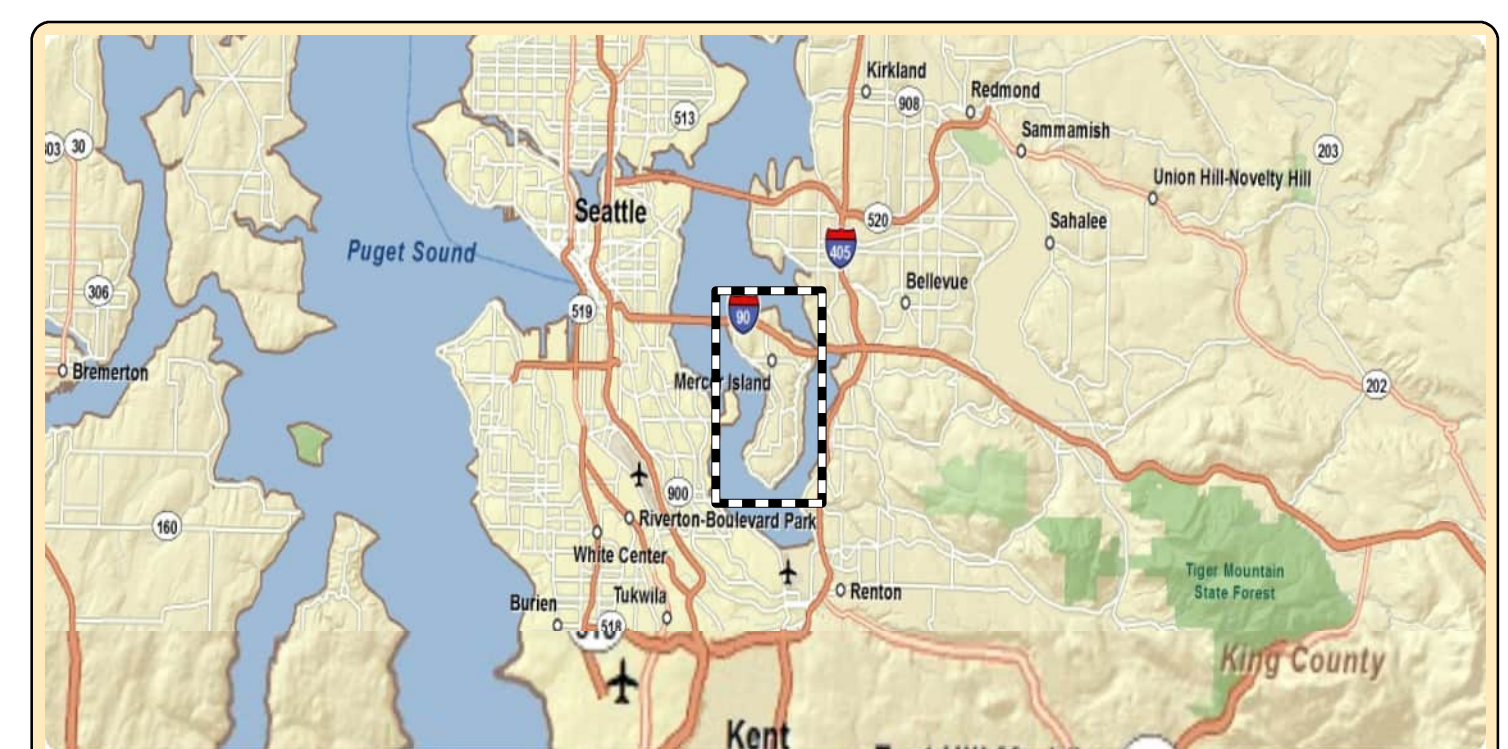
### DEFINITIONS:

**$K_{zt}$  factor:** The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.

**Exposure B:** The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.

**Exposure C:** The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.

**Wind Speed:** Minimum 85 mph 3-second gust per IRC Figure R301.2(4)



# WIND DESIGN

ASCE 7-16

Simplified Envelope Method (Chapter 28)

$p_s = \lambda K_z t I p_{s30}$

Ex. House

$\lambda$  = adjustment factor = 1.00  
 I = importance factor = 1.00  
 K<sub>z</sub>t = topographic factor = 1.30

Part of Figure 28.6-1 - Adjustment Factor for Building Height and Exposure,  $\lambda$

Mean Roof Height (ft)	Exposure		
	B	C	D
15	1.00	1.21	1.47
16	1.00	1.23	1.49
17	1.00	1.24	1.50
18	1.00	1.26	1.52
19	1.00	1.27	1.53
20	1.00	1.29	1.55
21	1.00	1.30	1.56
22	1.00	1.31	1.57
23	1.00	1.33	1.59
24	1.00	1.34	1.60
25	1.00	1.35	1.61
26	1.00	1.36	1.62
27	1.00	1.37	1.63
28	1.00	1.38	1.64
29	1.00	1.39	1.65
30	1.00	1.40	1.66

Zone Computation

a = 10% of least horizontal dimension or 0.4 x h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 feet.

w = 42.00 ft x 0.1 = 4.20 ft  
 h = 19.38 ft x 0.4 = 7.75 ft  
 w = 42.00 ft x 0.04 = 1.68 ft

a = 4.20 ft  
 2a = 8.40 ft

Zone B - end zone of roof  
 Zone A - end zone of wall

Zone D - interior zone of roof  
 Zone C - interior zone of wall

Part of Figure 28.6-1 - Method 2 Design Wind Pressure, p<sub>s30</sub>

Basic Speed	Roof Angle	Roof Pitch	Horizontal Pressures (psf)			
			A	B	C	D
97	0 to 5	flat	16.1	-7.7	9.9	-4.6
	10	2	16.8	-7.0	11.2	-4.1
	15	3	18.8	-6.2	12.5	-3.6
	20	4	20.7	-5.4	13.8	-3.0
	25	6	18.8	3.0	13.6	3.1
30 to 45	7 to 12		16.8	11.5	13.4	9.2

high roof h = 8.67 ft  
 main wall h = 9.00 ft

Design Wind Pressure, p<sub>s</sub>

Basic Speed	Roof Angle	Roof Pitch	Horizontal Pressures (psf)			
			A	B	C	D
97	0 to 5	flat	21.0	-10.0	12.9	-6.0
	10	2	21.9	-9.1	14.5	-5.3
	15	3	24.4	-8.1	16.3	-4.6
	20	4	26.9	-7.1	17.9	-3.9
	25	6	24.4	3.9	17.6	4.1
30 to 45	7 to 12		21.8	14.9	17.4	12.0

Horizontal Pressures E-W (plf)

Ext.	Int.	Level
20	21	roof
66	48	wall

Horizontal Pressures N-S (plf)

Ext.	Int.	Level
63	46	roof
66	48	wall

⚠ This is a beta release of the new ATC Hazards by Location website. Please [contact us](#) with feedback.

ℹ The ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

## ATC Hazards by Location

### Search Information

**Address:** 9025 SE 48th St, Mercer Island, WA 98040, USA  
**Coordinates:** 47.5598696, -122.218052  
**Elevation:** 370 ft  
**Timestamp:** 2024-06-20T04:32:49.106Z  
**Hazard Type:** Seismic  
**Reference Document:** ASCE7-16  
**Risk Category:** II  
**Site Class:** D-default



### Basic Parameters

Name	Value	Description
$S_S$	1.436	$MCE_R$ ground motion (period=0.2s)
$S_1$	0.498	$MCE_R$ ground motion (period=1.0s)
$S_{MS}$	1.723	Site-modified spectral acceleration value
$S_{M1}$	* null	Site-modified spectral acceleration value
$S_{DS}$	1.149	Numeric seismic design value at 0.2s SA
$S_{D1}$	* null	Numeric seismic design value at 1.0s SA

\* See Section 11.4.8

### Additional Information

Name	Value	Description
SDC	* null	Seismic design category
$F_a$	1.2	Site amplification factor at 0.2s
$F_v$	* null	Site amplification factor at 1.0s
$CR_S$	0.902	Coefficient of risk (0.2s)
$CR_1$	0.898	Coefficient of risk (1.0s)
PGA	0.615	$MCE_G$ peak ground acceleration
$F_{PGA}$	1.2	Site amplification factor at PGA
$PGA_M$	0.738	Site modified peak ground acceleration
$T_L$	6	Long-period transition period (s)
$SsRT$	1.436	Probabilistic risk-targeted ground motion (0.2s)
$SsUH$	1.591	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
$SsD$	4	Factored deterministic acceleration value (0.2s)
$S1RT$	0.498	Probabilistic risk-targeted ground motion (1.0s)
$S1UH$	0.555	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
$S1D$	1.563	Factored deterministic acceleration value (1.0s)
$PGAd$	1.345	Factored deterministic acceleration value (PGA)

\* See Section 11.4.8

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### Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

## SEISMIC DESIGN

ASCE 7-16  
Equivalent Lateral Force Procedure

RISK Category	<b>II</b>	Table 1.5-1
Seismic Design Category	<b>D</b>	Table 11.6-1
Importance Factor	<b>1.00</b>	Table 1.5-2
Site Class	<b>D</b>	Table 20.3-1 <b>per Geotech or DEFAULT</b>
S <sub>s</sub>	<b>143.60</b> %g	(from ATC Hazard website tool)
S <sub>1</sub>	<b>49.80</b> %g	(from ATC Hazard website tool)
F <sub>a</sub>	<b>1.20</b>	Table 11.4-1 <b>USE Fa=1.2 for DEFAULT Site Class D</b>
F <sub>v</sub>	<b>1.70</b>	Table 11.4-2
C <sub>t</sub>	<b>0.02</b>	Table 12.8-2
x	<b>0.75</b>	Table 12.8-2
h <sub>n</sub>	<b>19.38</b> feet	(height to highest level)
S <sub>MS</sub> = F <sub>a</sub> *S <sub>s</sub>	1.723	Eq. 11.4-1
S <sub>M1</sub> = F <sub>v</sub> *S <sub>1</sub>	0.847	Eq. 11.4-2
S <sub>DS</sub> = (2/3)*S <sub>MS</sub>	1.149 g	Eq. 11.4-3
S <sub>D1</sub> = (2/3)*S <sub>M1</sub>	0.564 g	Eq. 11.4-4
Period T <sub>a</sub> = C <sub>t</sub> *h <sub>n</sub> <sup>0.75</sup>	0.185 s	Eq. 12.8-7
T <sub>o</sub>	0.098 s	per section 11.4.6
T <sub>s</sub>	0.491 s	per section 11.4.6
S <sub>a</sub>	1.149 g	per section 11.4.6
R	<b>6.5</b>	Table 12.2-1
Ω <sub>o</sub>	<b>3</b>	Table 12.2-1
C <sub>d</sub>	<b>4</b>	Table 12.2-1
Section 12.8 (ELF) ok?	Yes	Table 12.6-1

### Equivalent Lateral Force Procedure (section 12.8)

C <sub>s</sub>	0.1767	Eq. 12.8-2
W, weight	87,300 lb	per table below
Q <sub>E</sub>	15,429 lb	Eq. 12.8-1

### Vertical Force Distribution (section 12.8.3)

k = 1.00

Level	Hx (ft)	Floor Area (ft <sup>2</sup> )	Seismic Dead Ld (psf)	Floor Wt. (k)	Wall Length (ft)	Wall Wt. (k)	Total Wt. (k)	WxHx (k-ft)	Cvx (%)	(LRFD) Q <sub>E</sub> (k)	(ASD) 0.7Q <sub>E</sub> (k)
roof	15.50	2740	15	41.1	0	0.0	41.1	637.1	87.6	13.52	9.464
attic floor	7.00	577	15	8.7	100	4.2	12.9	90.0	12.4	1.91	1.337
main	0.00	2223	15	33.3	180	0.0	33.3	0.0	0.0	0.00	0.000

87.30    727.04    100.00    15.43    **10.80**

**SHEAR WALL DESIGN**

KREBS

Wall Weight (EXT.)	10	psf	rho q =	1.30
Wall Weight (INT.)	10	psf	rho w =	1.0
Floor Weight	15	psf		
Roof Weight	18	psf		

**SEISMIC**

**UNDER ROOF**

va' = allowable shear values multiplied by 1.25-0.125 h / L  
for wall aspect ratios greater than 2:1

**EAST WEST**

WALL	FQ (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS											
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)	POST	Capacity
SWAA	1645	7.83	14.33	0.55	0	2138	149	SW1	241.0	16749	1169	0	1169	0	0	0	832	CS20	1030	1730	(2)2x4	3593
											1169	0	1169	0	0	0	832	CS20	1030	1730	(2)2x4	3593
SWBB	1348	7.83	11.75	0.67	0	1753	149	SW1	241.0	13730	1169	0	1169	0	0	0	892	CS20	1030	1629	(2)2x4	3593
											1169	0	1169	0	0	0	892	CS20	1030	1629	(2)2x4	3593

**NORTH SOUTH**

WALL	FQ (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS											
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)	POST	Capacity

**UNDER LOFT**

va' = allowable shear values multiplied by 1.25-0.125 h / L  
for wall aspect ratios greater than 2:1

**EAST WEST**

WALL	FQ (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS											
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)	POST	Capacity
SWA	2601	9.42	31.00	0.30	0	3381	109	SW1	241.0	31835	1027	0	1027	0	0	0	151	HDU2	2215	2486	(2)2x4	2548
								SW1			1027	0	1027	0	0	0	151	HDU2	2215	2486	(2)2x4	2548
													790				-86	none		2249		
SWB	845	6.08	21.83	0.28	3891	4989	229	SW1	241.0	30352	1390	0	1390	0	0	0	992	HDU2	2215	2054	(2)2x4	4253
											1390	1169	2559	0	0	0	2160	HDU2	2215	3223	(2)2x4	4253
SWC	2118	7.50	7.00	1.07	0	2753	393	SW3	455.0	20651	2950	0	2950	0	0	0	2793	HDU4	3285	3213	(2)2x6	5724
								SW4			2950	0	2950	0	0	0	2793	HDU4	3285	3213	(2)2x6	5724
													2269				2112	HDU2		2532		

**NORTH SOUTH**

WALL	FQ (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS											
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)	POST	Capacity
SWD	2172	11.09	16.08	0.69	675	3499	218	SW1	241.0	38782	2411	0	2411	0	0	0	1876	HDU2	2215	3303	(3)2x6	8792
								SW3			2411	0	2411	0	0	0	1876	HDU2	2215	3303	(3)2x6	8792
													1959				1424	HDU2		2850		
SWE	988	11.33	5.75	1.97	0	1285	223	SW1	241.0	14555	2531	0	2531	0	0	0	2336	HDU4	3285	2857	(3)2x4	3604
											2531	0	2531	0	0	0	2336	HDU4	3285	2857	(3)2x4	3604
SWF (EXISTING)	3509	6.08	20.42	0.30	567	5128	251	SW2	353.0	31198	1528	0	1528	0	0	0	1155	HDU2	2215	2149	(2)2x4	4253
											1528	0	1528	0	0	0	1155	HDU2	2215	2149	(2)2x4	4253

**SHEAR WALL DESIGN**

KREBS

Wall Weight (EXT.)	10	psf	rho q =	1.30
Wall Weight (INT.)	10	psf	rho w =	1.0
Floor Weight	15	psf		
Roof Weight	18	psf		

**WIND**

**UNDER ROOF**

va' = allowable shear values multiplied by 1.25-0.125 h / L  
for wall aspect ratios greater than 2:1

**EAST WEST**

WALL	FW (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS											
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)	POST	Capacity
SWAA	535	7.83	14.33	0.55	0	535	37	SW1	337.0	4191	292	0	292	0	0	0	-44	none	n/a	854	(2)2x4	3593
											292	0	292	0	0	0	-44	none	n/a	854	(2)2x4	3593
SWBB	448	7.83	12.00	0.65	0	448	37	SW1	337.0	3509	292	0	292	0	0	0	10	CS20	1030	762	(2)2x4	3593
											292	0	292	0	0	0	10	CS20	1030	762	(2)2x4	3593

**NORTH SOUTH**

WALL	FW (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS									
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)

**UNDER LOFT**

va' = allowable shear values multiplied by 1.25-0.125 h / L  
for wall aspect ratios greater than 2:1

**EAST WEST**

WALL	FW (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS											
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)	POST	Capacity
SWA	928	9.42	31.00	0.30	0	928	30	SW1	337.0	8737	282	0	282	0	0	0	-594	none	n/a	1741	(2)2x4	2548
								SW1			282	0	282	0	0	0	-594	none	n/a	1741	(2)2x4	2548
													282				-594	none		1741		
SWB	0	6.08	22.08	0.28	983	983	45	SW1	337.0	5980	271	0	271	0	0	0	-132	none	n/a	942	(2)2x4	4253
											271	292	563	0	0	0	160	HDU2	2215	1235	(2)2x4	4253
SWC	696	7.50	7.00	1.07	0	696	99	SW1	337.0	5220	746	0	746	0	0	0	588	HDU2	2215	1008	(2)2x6	5724
								SW3			746	0	746	0	0	0	588	HDU2	2215	1008	(2)2x6	5724
													1985				1828	HDU2		2248		

**NORTH SOUTH**

WALL	FW (lb)	h (ft)	L (ft)	h/L	V (abv)	V (total)	v (plf)	SW	Capacity	M <sub>ot</sub> (lbft)	APPLIED LOADS											
											OT (lb)	OT (abv)	OT (total)	DL (lb)	LL (lb)	SL (lb)	T (lb)	HD	Capacity	C (lb)	POST	Capacity
SWD	1853	11.09	16.08	0.69	0	1853	115	SW1	337.0	20541	1277	0	1277	0	0	0	742	HDU2	2215	2169	(2)2x6	2863
								SW1			1277	0	1277	0	0	0	742	HDU2	2215	2169	(2)2x6	2863
													479				-56	none		1370		
SWE	650	11.33	5.75	1.97	0	650	113	SW1	337.0	7362	1280	0	1280	0	0	0	1085	HDU2	2215	1606	(2)2x4	1787
											1280	0	1280	0	0	0	1085	HDU2	2215	1606	(2)2x4	1787
SWF (EXISTING)	2307	6.08	20.42	0.30	0	2307	113	SW1	337.0	14036	687	0	687	0	0	0	315	HDU2	2215	1308	(2)2x4	4253
											687	0	687	0	0	0	315	HDU2	2215	1308	(2)2x4	4253



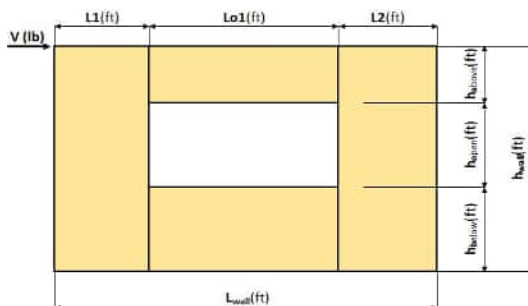
# Force Transfer Around Openings Calculator

## ONE OPENING

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

### Project Information

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	South Wall (0.7E)		



Shear Wall Calculation Variables

Variable	Value	Opening 1	Wall Pier Aspect Ratio	Adj. Factor
V	2118 lbf	ha1	P1=ho1/L1= 2.05	0.9940
L1	1.75 ft	ho1	P2=ho1/L2= 1.87	N/A
L2	1.92 ft	hb1		
h <sub>wall</sub>	7.50 ft	Lo1		
L <sub>wall</sub>	7.00 ft			

1. Hold-down forces:  $H = Vh_{wall}/L_{wall} = 2269$  lbf

2. Unit shear above + below opening  
 First opening:  $va1 = vb1 = H/(ha1+hb1) = 579$  plf

3. Total boundary force above + below openings  
 First opening:  $O1 = va1 \times (Lo1) = 1931$  lbf

4. Corner forces  
 $F1 = O1(L1)/(L1+L2) = 922$  lbf  
 $F2 = O1(L2)/(L1+L2) = 1010$  lbf

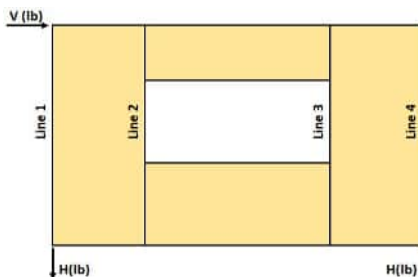
5. Tributary length of openings  
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.59$  ft  
 $T2 = (L2 \times Lo1)/(L1+L2) = 1.74$  ft

6. Unit shear beside opening  
 $V1 = (V/L)(L1+T1)/L1 = 578$  plf  
 $V2 = (V/L)(T2+L2)/L2 = 578$  plf  
 Check  $V1 \times L1 + V2 \times L2 = V?$  2118 lbf **OK**

7. Resistance to corner forces  
 $R1 = V1 \times L1 = 1011$  lbf  
 $R2 = V2 \times L2 = 1107$  lbf

8. Difference corner force + resistance  
 $R1 - F1 = 89$  lbf  
 $R2 - F2 = 98$  lbf

9. Unit shear in corner zones  
 $vc1 = (R1 - F1)/L1 = 51$  plf  
 $vc2 = (R2 - F2)/L2 = 51$  plf



### Check Summary of Shear Values for One Opening

Line 1: $vc1(ha1+hb1)+V1(ho1)=H?$		199	2070	2269 lbf
Line 2: $va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?$	2269	199	2070	0
Line 3: $vc2(ha1+hb1)+V2(ho1)=H?$		199	2070	2269 lbf

### Design Summary

Req. Sheathing Capacity	581 plf	4-Term Deflection		3-Term Deflection	
Req. Strap Force	1010 lbf	4-Term Story Drift %		3-Term Story Drift %	
Req. HD Force (H)	2269 lbf	See Page 2		See Page 3	

Req. Sheathing Capacity has been adjusted per the Aspect Ratio Factor in SDPWS 4.3.4.2

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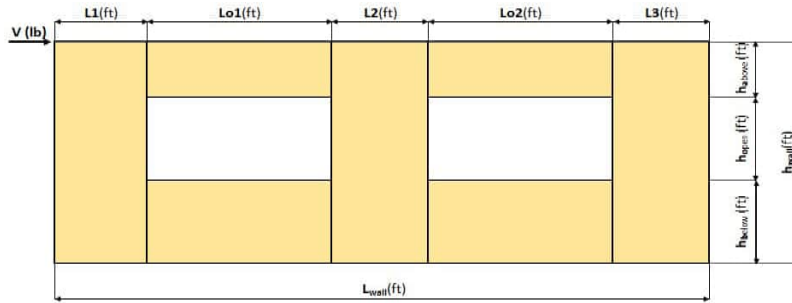
# Force Transfer Around Openings Calculator

## TWO OPENINGS

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

### Project Information

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	West Wall (0.7E)		



### Shear Wall Calculation Variables

Variable	Value	Opening 1	Opening 2	Wall Pier Aspect Ratio	Adj. Factor
V	2847 lbf	ha1 = 4.51 ft	ha2 = 4.51 ft	P1=ho1/L1= 1.29	N/A
L1	2.00 ft	ho1 = 2.58 ft	ho2 = 2.58 ft	P2=ho2/L2= 0.77	N/A
L2	3.38 ft	hb1 = 4.00 ft	hb2 = 4.00 ft	P3=ho2/L3= 0.76	N/A
L3	3.42 ft	Lo1 = 3.67 ft	Lo2 = 3.67 ft		
h <sub>wall</sub>	11.09 ft				
L <sub>wall</sub>	16.13 ft				

**1. Hold-down forces: H = V<sub>wall</sub>/L<sub>wall</sub>** = 1959 lbf

**2. Unit shear above + below opening**

First opening:  $va1 = vb1 = H / (ha1 + hb1) = 230$  plf

Second opening:  $va2 = vb2 = H / (ha2 + hb2) = 230$  plf

**3. Total boundary force above + below openings**

First opening:  $O1 = va1 \times (Lo1) = 844$  lbf

Second opening:  $O2 = va2 \times (Lo2) = 844$  lbf

**4. Corner forces**

$F1 = O1(L1) / (L1 + L2) = 314$  lbf

$F2 = O1(L2) / (L1 + L2) = 530$  lbf

$F3 = O2(L2) / (L2 + L3) = 419$  lbf

$F4 = O2(L3) / (L2 + L3) = 425$  lbf

**5. Tributary length of openings**

$T1 = (L1 * Lo1) / (L1 + L2) = 1.36$  ft

$T2 = (L2 * Lo1) / (L1 + L2) = 2.30$  ft

$T3 = (L2 * Lo2) / (L2 + L3) = 1.82$  ft

$T4 = (L3 * Lo2) / (L2 + L3) = 1.84$  ft

**6. Unit shear beside opening**

$V1 = (V/L)(L1 + T1) / L1 = 297$  plf

$V2 = (V/L)(T2 + L2 + T3) / L2 = 392$  plf

$V3 = (V/L)(T4 + L3) / L3 = 272$  plf

Check  $V1 * L1 + V2 * L2 + V3 * L3 = V?$  = 2847 lbf **OK**

**7. Resistance to corner forces**

$R1 = V1 * L1 = 594$  lbf

$R2 = V2 * L2 = 1324$  lbf

$R3 = V3 * L3 = 929$  lbf

**8. Difference corner force + resistance**

$R1 - F1 = 280$  lbf

$R2 - F2 - F3 = 375$  lbf

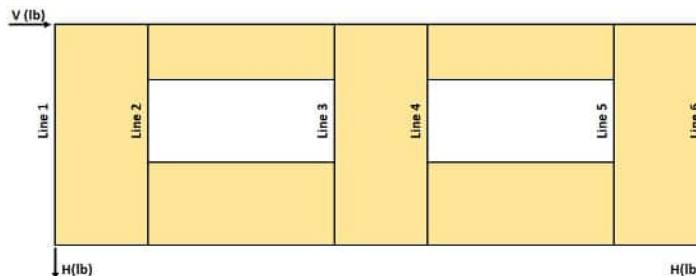
$R3 - F4 = 504$  lbf

**9. Unit shear in corner zones**

$vc1 = (R1 - F1) / L1 = 140$  plf

$vc2 = (R2 - F2 - F3) / L2 = 111$  plf

$vc3 = (R3 - F4) / L3 = 148$  plf



### Check Summary of Shear Values for Two Openings

Line 1: $vc1(ha1 + hb1) + V1(ho1) = H?$		1191	767	1959 lbf
Line 2: $va1(ha1 + hb1) - vc1(ha1 + hb1) - V1(ho1) = 0?$	1959	1191	767	0
Line 3: $vc2(ha1 + hb1) + V2(ho1) - va1(ha1 + hb1) = 0?$	945	1013	1959	0
Line 4: $va2(ha2 + hb2) - V2(ho2) - vc2(ha2 + hb2) = 0?$	1959	1013	945	0
Line 5: $va2(ha2 + hb2) - vc3(ha2 + hb2) - V3(ho2) = 0?$	1959	1256	702	0
Line 6: $vc3(ha2 + hb2) + V3(ho2) = H?$		1256	702	1959 lbf

### Design Summary

Req. Sheathing Capacity **392 plf**

4-Term Deflection

3-Term Deflection

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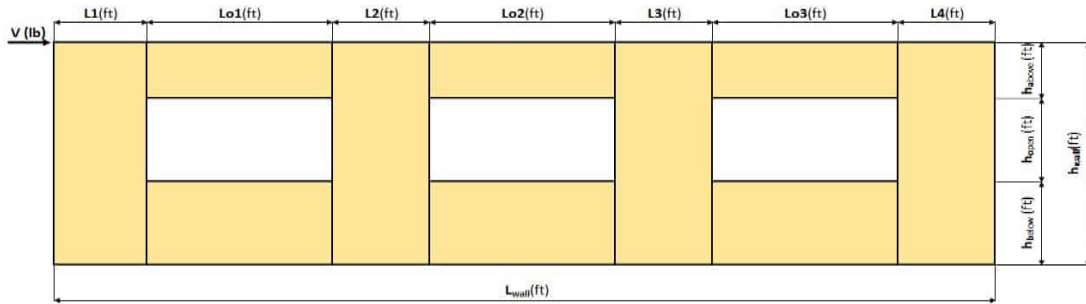
# Force Transfer Around Openings Calculator

## THREE OPENINGS

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

### Project Information

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	North Wall (0.7E)		



### Shear Wall Calculation Variables

V	2601 lbf	Opening 1		Opening 2		Opening 3		Wall Pier Aspect Ratio		Adj. Factor
L1	2.63 ft	ha1	3.00 ft	ha2	3.00 ft	ha3	3.00 ft	P1=ho1/L1=	0.98	N/A
L2	3.46 ft	ho1	2.58 ft	ho2	2.58 ft	ho3	2.58 ft	P2=ho2/L2=	0.75	N/A
L3	6.38 ft	hb1	3.83 ft	hb2	3.83 ft	hb3	3.83 ft	P3=ho3/L3=	0.41	N/A
L4	3.04 ft	Lo1	4.00 ft	Lo2	5.75 ft	Lo3	5.75 ft	P4=ho3/L4=	0.85	N/A
h <sub>wall</sub>	9.42 ft									
L <sub>wall</sub>	31.00 ft									

1. Hold-down forces:  $H = Vh_{wall}/L_{wall}$  = 790 lbf

2. Unit shear above + below opening

First opening:  $va1 = vb1 = H/(ha1+hb1) = 116$  plf

Second opening:  $va2 = vb2 = H/(ha2+hb2) = 116$  plf

Third opening:  $va3 = vb3 = H/(ha3+hb3) = 116$  plf

3. Total boundary force above + below openings

First opening:  $O1 = va1 \times (Lo1) = 462$  lbf

Second opening:  $O2 = va2 \times (Lo2) = 665$  lbf

Third opening:  $O3 = va3 \times (Lo3) = 665$  lbf

4. Corner forces

$F1 = O1(L1)/(L1+L2) = 200$  lbf

$F2 = O1(L2)/(L1+L2) = 263$  lbf

$F3 = O2(L2)/(L2+L3) = 234$  lbf

$F4 = O2(L3)/(L2+L3) = 431$  lbf

$F5 = O3(L3)/(L3+L4) = 450$  lbf

$F6 = O3(L4)/(L3+L4) = 215$  lbf

5. Tributary length of openings

$T1 = (L1 \times Lo1)/(L1+L2) = 1.73$  ft

$T2 = (L2 \times Lo1)/(L1+L2) = 2.27$  ft

$T3 = (L2 \times Lo2)/(L2+L3) = 2.02$  ft

$T4 = (L3 \times Lo2)/(L2+L3) = 3.73$  ft

$T5 = (L3 \times Lo3)/(L3+L4) = 3.89$  ft

$T6 = (L4 \times Lo3)/(L3+L4) = 1.86$  ft

6. Unit shear beside opening

$V1 = (V/L)/(L1+T1)/L1 = 139$  plf

$V2 = (V/L)/(T2+L2+T3)/L2 = 188$  plf

$V3 = (V/L)/(T4+L3+T5)/L3 = 184$  plf

$V4 = (V/L)/(T6+L4)/L4 = 135$  plf

Check  $V1 \times L1 + V2 \times L2 + V3 \times L3 + V4 \times L4 = V?$  = 2601 lbf **OK**

7. Resistance to corner forces

$R1 = V1 \times L1 = 365$  lbf

$R2 = V2 \times L2 = 651$  lbf

$R3 = V3 \times L3 = 1174$  lbf

$R4 = V4 \times L4 = 411$  lbf

8. Difference corner force + resistance

$R1-F1 = 165$  lbf

$R2-F2-F3 = 154$  lbf

$R3-F4-F5 = 293$  lbf

$R4-F6 = 196$  lbf

9. Unit shear in corner zones

$vc1 = (R1-F1)/L1 = 63$  plf

$vc2 = (R2-F2-F3)/L2 = 44$  plf

$vc3 = (R3-F4-F5)/L3 = 46$  plf

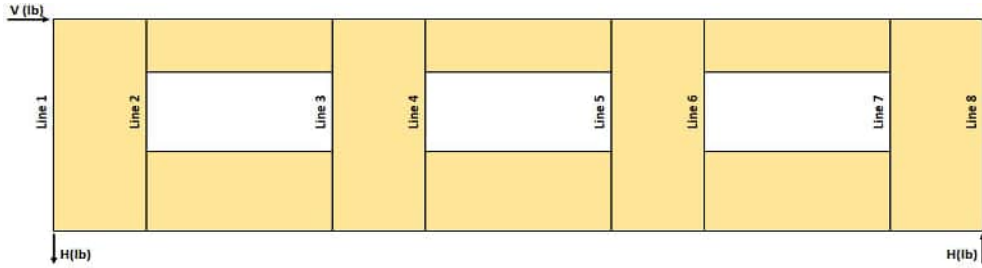
$vc4 = (R4-F6)/L4 = 65$  plf

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**Project Information**

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	North Wall (0.7E)		



**Check Summary of Shear Values for Three Openings**

Line 1: $vc1(ha1+hb1)+V1(ho1)=H?$		431	359	790 lbf
Line 2: $va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?$	790	431	359	0
Line 3: $vc2(ha1+hb1)+V2(ho1)-va1(ha1+hb1)=0?$	304	486	790	0
Line 4: $va2(ha2+hb2)-vc2(ho2)-vc2(ha2+hb2)=0?$	790	486	304	0
Line 5: $va2(ha2+hb2)-vc3(ha2+hb2)-V3(ho2)=0?$	790	314	476	0
Line 6: $va3(ha3+hb3)-V3(ho3)-vc3(ha3+hb3)=0?$	790	476	314	0
Line 7: $va3(ha3+hb3)-vc4(ha3+hb3)-V4(ho3)=0?$	790	441	349	0
Line 8: $vc4(ha3+hb3)+V4(ho3)=H?$		441	349	790 lbf

**Design Summary**

Req. Sheathing Capacity	188 plf
Req. Strap Force	450 lbf
Req. HD Force (H)	790 lbf

4-Term Deflection	
4-Term Story Drift %	See Page 3

3-Term Deflection	
3-Term Story Drift %	See Page 4

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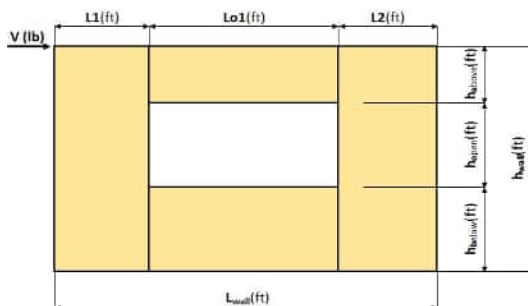
# Force Transfer Around Openings Calculator

## ONE OPENING

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

### Project Information

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	South Wall (0.6W)		



### Shear Wall Calculation Variables

Variable	Value	Opening 1	Wall Pier Aspect Ratio	Adj. Factor
V	1853 lbf	ha1	P1=ho1/L1= 2.05	0.9940
L1	1.75 ft	ho1	P2=ho1/L2= 1.87	N/A
L2	1.92 ft	hb1		
h <sub>wall</sub>	7.50 ft	Lo1		
L <sub>wall</sub>	7.00 ft			

1. Hold-down forces:  $H = Vh_{wall}/L_{wall} = 1985 \text{ lbf}$

2. Unit shear above + below opening  
First opening:  $va1 = vb1 = H/(ha1+hb1) = 507 \text{ plf}$

3. Total boundary force above + below openings  
First opening:  $O1 = va1 \times (Lo1) = 1690 \text{ lbf}$

4. Corner forces  
 $F1 = O1(L1)/(L1+L2) = 806 \text{ lbf}$   
 $F2 = O1(L2)/(L1+L2) = 883 \text{ lbf}$

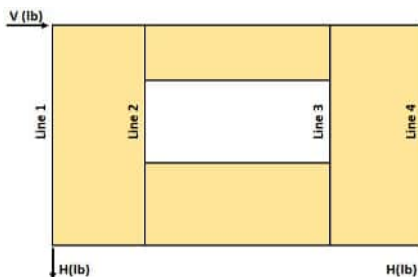
5. Tributary length of openings  
 $T1 = (L1 \times Lo1)/(L1+L2) = 1.59 \text{ ft}$   
 $T2 = (L2 \times Lo1)/(L1+L2) = 1.74 \text{ ft}$

6. Unit shear beside opening  
 $V1 = (V/L)(L1+T1)/L1 = 505 \text{ plf}$   
 $V2 = (V/L)(T2+L2)/L2 = 505 \text{ plf}$   
Check  $V1 \times L1 + V2 \times L2 = V?$  **1853 lbf OK**

7. Resistance to corner forces  
 $R1 = V1 \times L1 = 884 \text{ lbf}$   
 $R2 = V2 \times L2 = 969 \text{ lbf}$

8. Difference corner force + resistance  
 $R1 - F1 = 78 \text{ lbf}$   
 $R2 - F2 = 85 \text{ lbf}$

9. Unit shear in corner zones  
 $vc1 = (R1 - F1)/L1 = 45 \text{ plf}$   
 $vc2 = (R2 - F2)/L2 = 45 \text{ plf}$



### Check Summary of Shear Values for One Opening

Line 1: $vc1(ha1+hb1)+V1(ho1)=H?$		174	1811	1985 lbf
Line 2: $va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?$	1985	174	1811	0
Line 3: $vc2(ha1+hb1)+V2(ho1)=H?$		174	1811	1985 lbf

### Design Summary

Req. Sheathing Capacity	508 plf	4-Term Deflection		3-Term Deflection	
Req. Strap Force	883 lbf	4-Term Story Drift %		3-Term Story Drift %	
Req. HD Force (H)	1985 lbf		See Page 2		See Page 3

Req. Sheathing Capacity has been adjusted per the Aspect Ratio Factor in SDPWS 4.3.4.2

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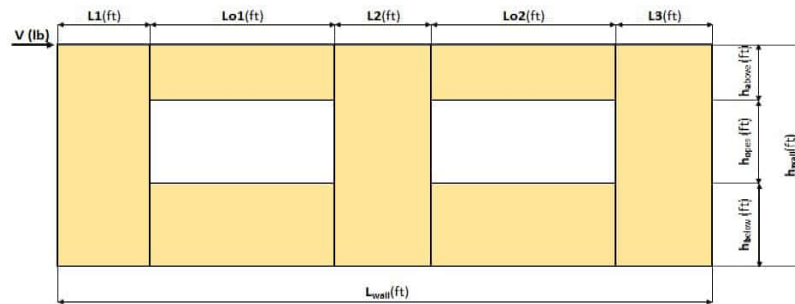
# Force Transfer Around Openings Calculator

## TWO OPENINGS

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

### Project Information

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	West Wall (0.6W)		



### Shear Wall Calculation Variables

Variable	Value	Opening 1	Opening 2	Wall Pier Aspect Ratio	Adj. Factor
V	696 lbf	ha1 = 4.51 ft	ha2 = 4.51 ft	P1=ho1/L1= 1.29	N/A
L1	2.00 ft	ho1 = 2.58 ft	ho2 = 2.58 ft	P2=ho2/L2= 0.77	N/A
L2	3.38 ft	hb1 = 4.00 ft	hb2 = 4.00 ft	P3=ho2/L3= 0.76	N/A
L3	3.42 ft	Lo1 = 3.67 ft	Lo2 = 3.67 ft		
h <sub>wall</sub>	11.09 ft				
L <sub>wall</sub>	16.13 ft				

1. Hold-down forces:  $H = Vh_{wall}/L_{wall}$  = 479 lbf

2. Unit shear above + below opening  
 First opening:  $va1 = vb1 = H/(ha1+hb1) = 56$  plf  
 Second opening:  $va2 = vb2 = H/(ha2+hb2) = 56$  plf

3. Total boundary force above + below openings  
 First opening:  $O1 = va1 \times (Lo1) = 206$  lbf  
 Second opening:  $O2 = va2 \times (Lo2) = 206$  lbf

4. Corner forces  
 $F1 = O1(L1)/(L1+L2) = 77$  lbf  
 $F2 = O1(L2)/(L1+L2) = 130$  lbf  
 $F3 = O2(L2)/(L2+L3) = 103$  lbf  
 $F4 = O2(L3)/(L2+L3) = 104$  lbf

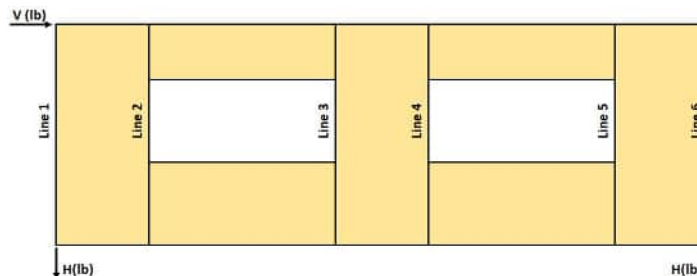
5. Tributary length of openings  
 $T1 = (L1*Lo1)/(L1+L2) = 1.36$  ft  
 $T2 = (L2*Lo1)/(L1+L2) = 2.30$  ft  
 $T3 = (L2*Lo2)/(L2+L3) = 1.82$  ft  
 $T4 = (L3*Lo2)/(L2+L3) = 1.84$  ft

6. Unit shear beside opening  
 $V1 = (V/L)(L1+T1)/L1 = 73$  plf  
 $V2 = (V/L)(T2+L2+T3)/L2 = 96$  plf  
 $V3 = (V/L)(T4+L3)/L3 = 66$  plf  
 Check  $V1*L1+V2*L2+V3*L3=V?$  = 696 lbf **OK**

7. Resistance to corner forces  
 $R1 = V1*L1 = 145$  lbf  
 $R2 = V2*L2 = 324$  lbf  
 $R3 = V3*L3 = 227$  lbf

8. Difference corner force + resistance  
 $R1-F1 = 68$  lbf  
 $R2-F2-F3 = 92$  lbf  
 $R3-F4 = 123$  lbf

9. Unit shear in corner zones  
 $vc1 = (R1-F1)/L1 = 34$  plf  
 $vc2 = (R2-F2-F3)/L2 = 27$  plf  
 $vc3 = (R3-F4)/L3 = 36$  plf



### Check Summary of Shear Values for Two Openings

Line 1: $vc1(ha1+hb1)+V1(ho1)=H?$		291	188	479 lbf
Line 2: $va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?$	479	291	188	0
Line 3: $vc2(ha1+hb1)+V2(ho1)-va1(ha1+hb1)=0?$	231	248	479	0
Line 4: $va2(ha2+hb2)-V2(ho2)-vc2(ha2+hb2)=0?$	479	248	231	0
Line 5: $va2(ha2+hb2)-vc3(ha2+hb2)-V3(ho2)=0?$	479	307	172	0
Line 6: $vc3(ha2+hb2)+V3(ho2)=H?$		307	172	479 lbf

### Design Summary

Req. Sheathing Capacity 96 plf

4-Term Deflection

3-Term Deflection

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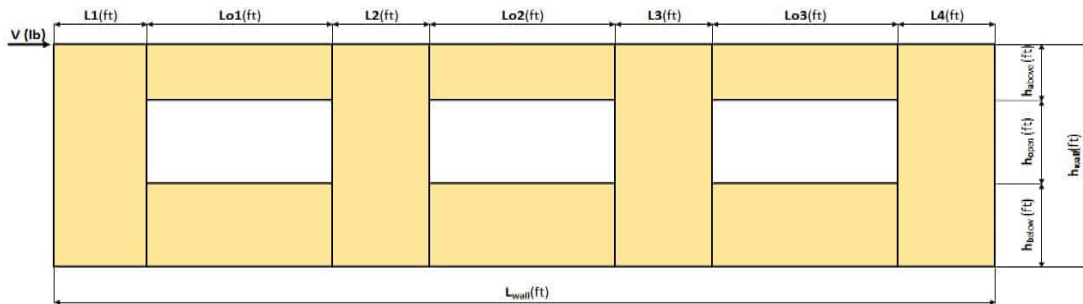
# Force Transfer Around Openings Calculator

## THREE OPENINGS

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

### Project Information

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	North Wall (0.6W)		



### Shear Wall Calculation Variables

V	928 lbf	Opening 1		Opening 2		Opening 3		Wall Pier Aspect Ratio		Adj. Factor
L1	2.63 ft	ha1	3.00 ft	ha2	3.00 ft	ha3	3.00 ft	P1=ho1/L1=	0.98	N/A
L2	3.46 ft	ho1	2.58 ft	ho2	2.58 ft	ho3	2.58 ft	P2=ho2/L2=	0.75	N/A
L3	6.38 ft	hb1	3.83 ft	hb2	3.83 ft	hb3	3.83 ft	P3=ho3/L3=	0.41	N/A
L4	3.04 ft	Lo1	4.00 ft	Lo2	5.75 ft	Lo3	5.75 ft	P4=ho3/L4=	0.85	N/A
h <sub>wall</sub>	9.42 ft									
L <sub>wall</sub>	31.00 ft									

1. Hold-down forces:  $H = Vh_{wall}/L_{wall}$  = 282 lbf

2. Unit shear above + below opening

First opening:  $va1 = vb1 = H/(ha1+hb1) = 41$  plf

Second opening:  $va2 = vb2 = H/(ha2+hb2) = 41$  plf

Third opening:  $va3 = vb3 = H/(ha3+hb3) = 41$  plf

3. Total boundary force above + below openings

First opening:  $O1 = va1 \times (Lo1) = 165$  lbf

Second opening:  $O2 = va2 \times (Lo2) = 237$  lbf

Third opening:  $O3 = va3 \times (Lo3) = 237$  lbf

4. Corner forces

$F1 = O1(L1)/(L1+L2) = 71$  lbf

$F2 = O1(L2)/(L1+L2) = 94$  lbf

$F3 = O2(L2)/(L2+L3) = 83$  lbf

$F4 = O2(L3)/(L2+L3) = 154$  lbf

$F5 = O3(L3)/(L3+L4) = 161$  lbf

$F6 = O3(L4)/(L3+L4) = 77$  lbf

5. Tributary length of openings

$T1 = (L1 \times Lo1)/(L1+L2) = 1.73$  ft

$T2 = (L2 \times Lo1)/(L1+L2) = 2.27$  ft

$T3 = (L2 \times Lo2)/(L2+L3) = 2.02$  ft

$T4 = (L3 \times Lo2)/(L2+L3) = 3.73$  ft

$T5 = (L3 \times Lo3)/(L3+L4) = 3.89$  ft

$T6 = (L4 \times Lo3)/(L3+L4) = 1.86$  ft

6. Unit shear beside opening

$V1 = (V/L)(L1+T1)/L1 = 50$  plf

$V2 = (V/L)(T2+L2+T3)/L2 = 67$  plf

$V3 = (V/L)(T4+L3+T5)/L3 = 66$  plf

$V4 = (V/L)(T6+L4)/L4 = 48$  plf

Check  $V1 \times L1 + V2 \times L2 + V3 \times L3 + V4 \times L4 = V?$  = 928 lbf **OK**

7. Resistance to corner forces

$R1 = V1 \times L1 = 130$  lbf

$R2 = V2 \times L2 = 232$  lbf

$R3 = V3 \times L3 = 419$  lbf

$R4 = V4 \times L4 = 147$  lbf

8. Difference corner force + resistance

$R1-F1 = 59$  lbf

$R2-F2-F3 = 55$  lbf

$R3-F4-F5 = 105$  lbf

$R4-F6 = 70$  lbf

9. Unit shear in corner zones

$vc1 = (R1-F1)/L1 = 22$  plf

$vc2 = (R2-F2-F3)/L2 = 16$  plf

$vc3 = (R3-F4-F5)/L3 = 16$  plf

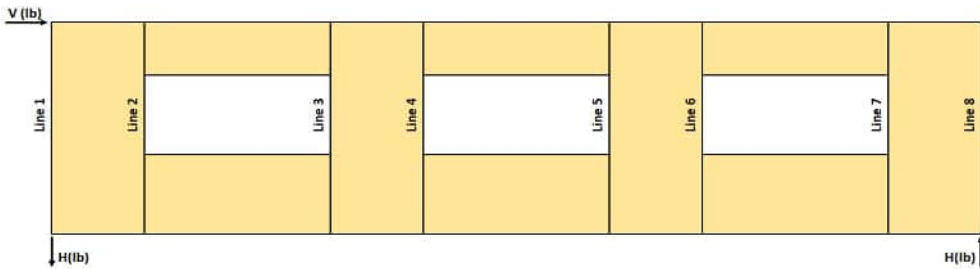
$vc4 = (R4-F6)/L4 = 23$  plf

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**Project Information**

Code:	2018 IBC	Date:	6/20/2024
Designer:	LN		
Client:			
Project:	Krebs		
Wall Line:	North Wall (0.6W)		



**Check Summary of Shear Values for Three Openings**

Line 1: $vc1(ha1+hb1)+V1(ho1)=H?$		154	128	282 lbf
Line 2: $va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?$	282	154	128	0
Line 3: $vc2(ha1+hb1)+V2(ho1)-va1(ha1+hb1)=0?$	108	173	282	0
Line 4: $va2(ha2+hb2)-V2(ho2)-vc2(ha2+hb2)=0?$	282	173	108	0
Line 5: $va2(ha2+hb2)-vc3(ha2+hb2)-V3(ho2)=0?$	282	112	170	0
Line 6: $va3(ha3+hb3)-V3(ho3)-vc3(ha3+hb3)=0?$	282	170	112	0
Line 7: $va3(ha3+hb3)-vc4(ha3+hb3)-V4(ho3)=0?$	282	157	125	0
Line 8: $vc4(ha3+hb3)+V4(ho3)=H?$		157	125	282 lbf

**Design Summary**

Req. Sheathing Capacity	67 plf	4-Term Deflection		3-Term Deflection	
Req. Strap Force	161 lbf	4-Term Story Drift %		3-Term Story Drift %	
Req. HD Force (H)	282 lbf		See Page 3		See Page 4

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**SECTION 4: FOUNDATION**

## SPREAD FOOTING DESIGN -- SQUARE

for 2000 psf Allowable Bearing Pressure

$f'_c = 2,500$  psi  
 $f_y = 40$  ksi

### 2'-0" square

P = 8.00 k	one-way:				
P <sub>u</sub> = 13.04 k	phi V <sub>c</sub> = 9.45 k	V <sub>u</sub> = 3.67 k			o.k.
p = 2,000 psf	(3) #4 each way				
h = 9.00 in	phi M <sub>n</sub> = 9.03 k-ft	M <sub>u</sub> = 3.26 k-ft			o.k.
d = 5.25 in					
b = 24.00 in	two-way:				
bo = 35.00 in	phi V <sub>c</sub> = 31.24 k	V <sub>u</sub> = 11.31 k			o.k.

### 3'-0" square

P = 18.00 k	one-way:				
P <sub>u</sub> = 29.34 k	phi V <sub>c</sub> = 14.18 k	V <sub>u</sub> = 10.39 k			o.k.
p = 2,000 psf	(5) #4 each way				
h = 9.00 in	phi M <sub>n</sub> = 14.95 k-ft	M <sub>u</sub> = 11.00 k-ft			o.k.
d = 5.25 in					
b = 36.00 in	two-way:				
bo = 35.00 in	phi V <sub>c</sub> = 31.24 k	V <sub>u</sub> = 27.61 k			o.k.



Company:		Date:	5/30/2024
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

### 1. Project information

Customer company:  
Customer contact name:  
Customer e-mail:  
Comment:

Project description:  
Location:  
Fastening description:

### 2. Input Data & Anchor Parameters

#### General

Design method: ACI 318-14  
Units: Imperial units

#### Anchor Information:

Anchor type: Cast-in-place  
Material: F1554 Grade 36  
Diameter (inch): 0.625  
Effective Embedment depth,  $h_{ef}$  (inch): 4.000  
Anchor category: -  
Anchor ductility: Yes  
 $h_{min}$  (inch): 5.38  
 $C_{min}$  (inch): 1.11  
 $S_{min}$  (inch): 2.50

#### Base Material

Concrete: Normal-weight  
Concrete thickness,  $h$  (inch): 9.00  
State: Cracked  
Compressive strength,  $f'_c$  (psi): 2500  
 $\Psi_{c,v}$ : 1.0  
Reinforcement condition: B tension, B shear  
Supplemental reinforcement: Not applicable  
Reinforcement provided at corners: Yes  
Ignore concrete breakout in tension: No  
Ignore concrete breakout in shear: No  
Ignore 6do requirement: Yes  
Build-up grout pad: No

#### Recommended Anchor

Anchor Name: Heavy Hex Bolt - 5/8"Ø Heavy Hex Bolt, F1554 Gr. 36





Company:		Date:	5/30/2024
Engineer:		Page:	2/5
Project:			
Address:			
Phone:			
E-mail:			

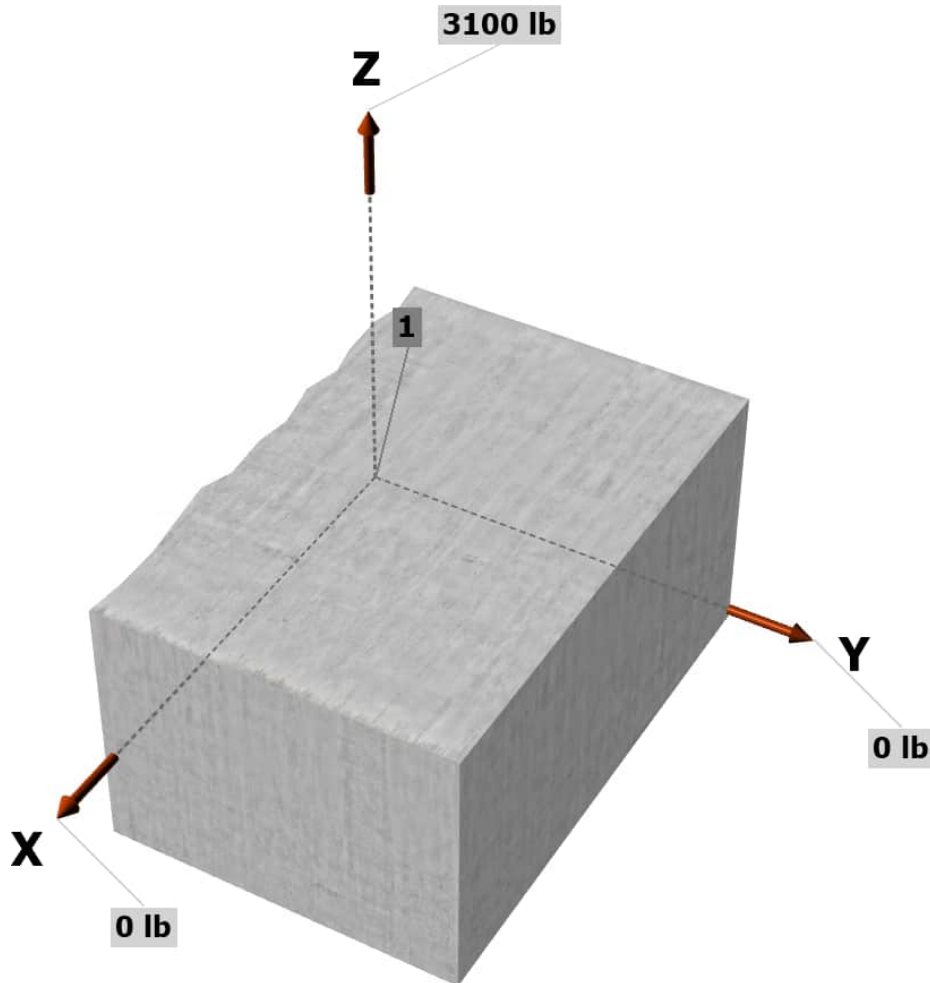
**Load and Geometry**

Load factor source: ACI 318 Section 5.3  
Load combination: not set  
Seismic design: Yes  
Anchors subjected to sustained tension: Not applicable  
Ductility section for tension: 17.2.3.4.2 not applicable  
Ductility section for shear: 17.2.3.5.2 not applicable  
 $\Omega_0$  factor: not set  
Apply entire shear load at front row: No  
Anchors only resisting wind and/or seismic loads: Yes

Strength level loads:

$N_{ua}$  [lb]: 3100  
 $V_{uax}$  [lb]: 0  
 $V_{uay}$  [lb]: 0

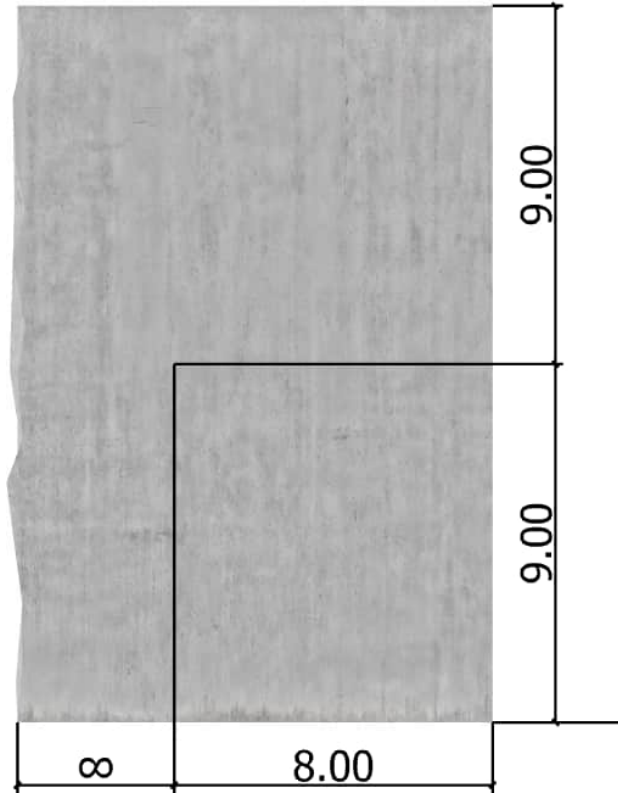
<Figure 1>





Company:		Date:	5/30/2024
Engineer:		Page:	3/5
Project:			
Address:			
Phone:			
E-mail:			

<Figure 2>





Company:		Date:	5/30/2024
Engineer:		Page:	4/5
Project:			
Address:			
Phone:			
E-mail:			

### 3. Resulting Anchor Forces

Anchor	Tension load, N <sub>ua</sub> (lb)	Shear load x, V <sub>uax</sub> (lb)	Shear load y, V <sub>uay</sub> (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	3100.0	0.0	0.0	0.0
Sum	3100.0	0.0	0.0	0.0

Maximum concrete compression strain (%): 0.00  
 Maximum concrete compression stress (psi): 0  
 Resultant tension force (lb): 3100  
 Resultant compression force (lb): 0  
 Eccentricity of resultant tension forces in x-axis, e'<sub>Nx</sub> (inch): 0.00  
 Eccentricity of resultant tension forces in y-axis, e'<sub>Ny</sub> (inch): 0.00

### 4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N <sub>sa</sub> (lb)	φ	φN <sub>sa</sub> (lb)
13100	0.75	9825

### 5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k <sub>c</sub>	λ <sub>a</sub>	f <sub>c</sub> (psi)	h <sub>ef</sub> (in)	N <sub>b</sub> (lb)
24.0	1.00	2500	4.000	9600

$$0.75 \phi N_{cb} = 0.75 \phi (A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.3.1 \& Eq. 17.4.2.1a)}$$

A <sub>Nc</sub> (in <sup>2</sup> )	A <sub>Nco</sub> (in <sup>2</sup> )	c <sub>a,min</sub> (in)	Ψ <sub>ed,N</sub>	Ψ <sub>c,N</sub>	Ψ <sub>cp,N</sub>	N <sub>b</sub> (lb)	φ	0.75 φN <sub>cb</sub> (lb)
144.00	144.00	8.00	1.000	1.00	1.000	9600	0.70	5040

### 6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$$0.75 \phi N_{pn} = 0.75 \phi \Psi_{c,P} N_p = 0.75 \phi \Psi_{c,P} 8 A_{brg} f_c \text{ (Sec. 17.3.1, Eq. 17.4.3.1 \& 17.4.3.4)}$$

Ψ <sub>c,P</sub>	A <sub>brg</sub> (in <sup>2</sup> )	f <sub>c</sub> (psi)	φ	0.75 φN <sub>pn</sub> (lb)
1.0	0.67	2500	0.70	7046



Company:		Date:	5/30/2024
Engineer:		Page:	5/5
Project:			
Address:			
Phone:			
E-mail:			

## 11. Results

### 11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Tension	Factored Load, $N_{ua}$ (lb)	Design Strength, $\phi N_n$ (lb)	Ratio	Status
Steel	3100	9825	0.32	Pass
<b>Concrete breakout</b>	<b>3100</b>	<b>5040</b>	<b>0.62</b>	<b>Pass (Governs)</b>
Pullout	3100	7046	0.44	Pass

**5/8"Ø Heavy Hex Bolt, F1554 Gr. 36 with hef = 4.000 inch meets the selected design criteria.**

## 12. Warnings

- Minimum spacing and edge distance requirement of  $6d_a$  per ACI 318 Sections 17.7.1 and 17.7.2 for torqued cast-in-place anchor is waived per designer option.
- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.
- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.