

Structural Calculations for

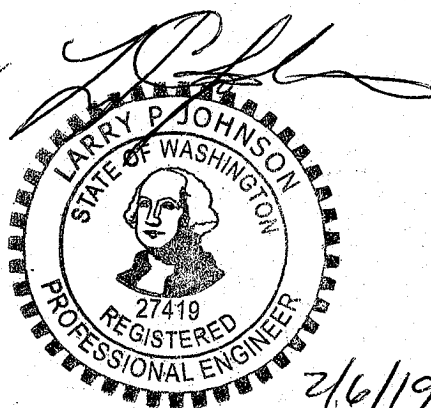
Banbury - Single Family Residence Addition

8275 SE 61st Street
Mercer Island, WA

Prepared by:
Johnson Structural Engineering, Inc.

Larry P. Johnson, PE

152 West Short Street
Bozeman, MT 59715
Ph 406-585-2939



2/6/19
Revised Calcs
6/24/19

**DESIGN DATA
INFORMATION SHEET**

**Banbury - Single Family Residence Addition
8275 SE 61st Street
Mercer Island, WA**

Sheet 2 of 29
JN 19-446
DATE 2/6/2019

PREPARED BY Larry P. Johnson, PE

REFERENCES **IBC/IRC 2015** **ASCE 7 2010**

Allowable Stress Design - Basic Load Combinations Used:

	For Soils Loadings For Concrete Design		Allowable Design Strength Design, Factored Loads				
DEAD LOADS	Roof	15	psf	LIVE LOADS	Roof	20	psf
	Floor	12	psf		Floor	40	psf
	Int. Walls	10	psf		Deck	60	psf
	Ext. Walls	12	psf				
SNOW:	Pg			25	Psf		
	Ce			1.0			
	Ct			1.0			
	I			1.0			
	Pf min = 20 I			20	Psf		
	pf = 0.7 Pg Ce Ct I			25.0	Psf		
WIND	Basic Wind Speed			110	MPH		
	Exposure Category			B			
	Enclosed Structure						<i>K_{zt} = 1.0</i>
	Structure Category			II			
	Importance Factor			1.00			
	Internal Pressure Coeff.			N/A			
SEISMIC	Structure Category			II			
	Importance Factor			1.00			
	Seismic Use Group			II			
	Site Soil Profile			D	'D' if unknown		
	Seismic Design Category			D			
	Basic Seismic System Analysis Procedure						Wood Framed Shear Wall / <i>Steel Braced Frame</i> Equivalent Lateral Force Procedure, ASCE 7, Chap 9.5.5
SOILS	Soils Bearing Capacity, per Table 1806.2					1,500 psf	
CONCRETE	Fc = 2500 psi						Responsibility of Contractor and/or Owner to verify soil condition suitable to support foundation.
REBAR	Grade 40, 40 ksi, #3 bar Grade 60, 60 ksi, all others						

TABLE OF CONTENTS

DESIGN DATA	SHEET	2
TABLE OF CONTENTS	SHEET	3
A. VERTICAL ANALYSIS	SHEET	4 - 22
B. LATERAL ANALYSIS	SHEET	23 - 28 40

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Project: Banbury - SFR Addition
 Job No.: 19-446
 Date: 2-5-19
 Sheet No.: 4

A. Vertical Analysis

Proj. Location: 8275 SE 61st Street
Mercer Island, WA
 Roof Snow = 25^{PSF}

1. Kitchen Bay Window - H1

span = 6.5'
 roof trib. = $\frac{3.1'}{2} = 15.5'$

Use (2) 7³/₄" x 7¹/₄" LVL ←

2. South Window header - H2

span = 6.5'
 roof trib. = 4'
 wall ht. = 5'

Use 4x8 DF#2 ←

3. Dining West door header - H3

span = 12.5'
 roof trib. = 15.5'

Use 5¹/₂ x 12 24F-V4 GLB ←

4. Main level floor joist - FJ1

span = 8'-3"

Use 2x8 DF#2 @ 16" O.C. ←

5. Main level floor beam at South Addition - FB1

FB1

span = 12'
 floor trib. = $\frac{4'}{2} = 2'$ to $\frac{8'}{2} = 4'$ 2' to 4'
 wall height = 8' to 11'
 roof trib. = $\cos 60^\circ (14') = 7'$ to $\cos 60^\circ (8') = 4'$

Use 5¹/₂ x 10¹/₂ Glulam ←

Brq Area Req'd
 = 2.18 in x 5.5"
 Custom Col. Cap.
 brq Area = 5.5 x 6" min.
 OK

FB1a midspan = 9030[#]
 Use 2¹/₂ x 2¹/₂ x 8" ftg

FB1a

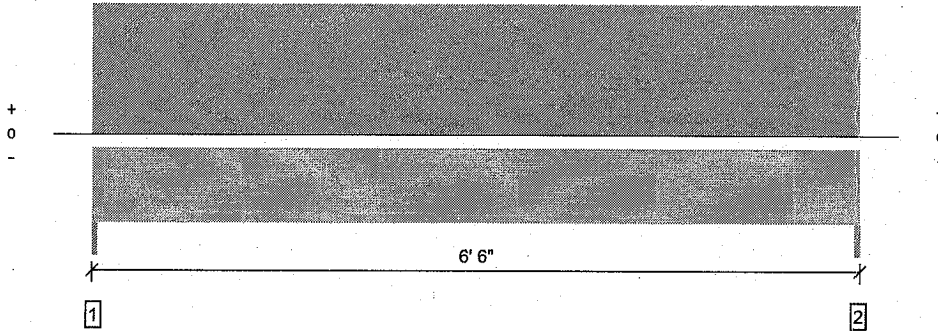
span = 7.5' + 7.75' 10.5' + 8.5'
 floor trib. = 4' 0' x < 15.5', = 1' 15.5' x < 15'
 wall ht = 12' 0' x < 15.5'
 roof trib = 4' 0' x < 15.5'
 FB3 @ 15.5'
 1984[#] DL / 2145[#] UL / 1590[#] SL

Use 5¹/₂ x 10¹/₂ Glulam ←

FB1R_{TL} = 3112[#]
 FB1a R_{TL} = 1627[#] 2213[#]
4739[#] 5325[#]
 use 2' x 2' x 8" ftg

FB1a midspan = 5003[#]
 use 2' x 2' x 8" ftg

Overall Length: 6' 6"



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

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	2190 @ 0	3806 (1.50")	Passed (58%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1699 @ 8 3/4"	5544	Passed (31%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3559 @ 3' 3"	8182	Passed (43%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.079 @ 3' 3"	0.217	Passed (L/984)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.138 @ 3' 3"	0.313	Passed (L/566)	--	1.0 D + 1.0 S (All Spans)

System : Wall
 Member Type : Header
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (5/16").
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6' 6" o/c unless detailed otherwise.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - SPF	1.50"	1.50"	1.50"	931	1259	2190	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	931	1259	2190	None

Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 6"	N/A	7.4		
1 - Uniform (PSF)	0 to 6' 6"	15' 6"	18.0	25.0	Roof snow load

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

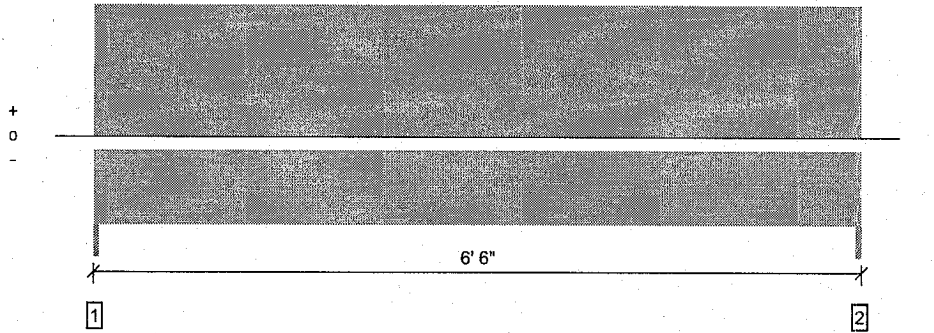


Forte Software Operator Larry Johnson Johnson Structural Engineering (406) 585-2939 larry@johnsonengineer.com	Job Notes
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1 piece(s) 4 x 8 Douglas Fir-Larch No. 2

6

Overall Length: 6' 6"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	775 @ 0	3281 (1.50")	Passed (24%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	601 @ 8 3/4"	3502	Passed (17%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1259 @ 3' 3"	3438	Passed (37%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.023 @ 3' 3"	0.217	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.054 @ 3' 3"	0.313	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Wall
 Member Type : Header
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (5/16").
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6' 6" o/c unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - SPF	1.50"	1.50"	1.50"	450	325	775	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	450	325	775	None

Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 6"	N/A	6.4		
1 - Uniform (PSF)	0 to 6' 6"	4'	18.0	25.0	Roof snow load
2 - Uniform (PSF)	0 to 6' 6"	5'	12.0	-	Wall load

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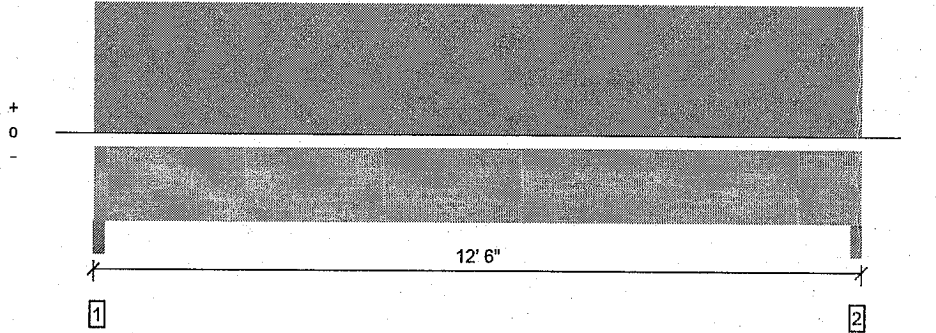
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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



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Overall Length: 12' 6"



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

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	4266 @ 1 1/2"	10725 (3.00")	Passed (40%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3413 @ 1' 3"	13409	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	12803 @ 6' 3"	30360	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.138 @ 6' 3"	0.408	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.243 @ 6' 3"	0.613	Passed (L/606)	--	1.0 D + 1.0 S (All Spans)

System : Wall
 Member Type : Header
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 12' 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 12' 6" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 12' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - SPF	3.00"	3.00"	1.50"	1844	2422	4266	None
2 - Trimmer - SPF	3.00"	3.00"	1.50"	1844	2422	4266	None

Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12' 6"	N/A	16.0		
1 - Uniform (PSF)	0 to 12' 6"	15' 6"	18.0	25.0	Roof snow load

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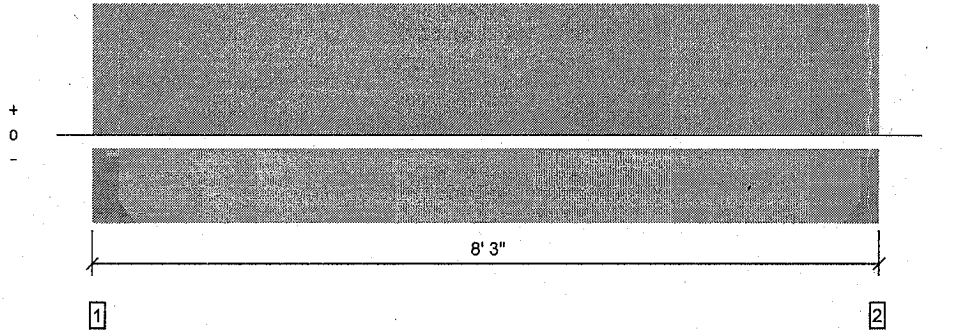


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1 piece(s) 2 x 8 Douglas Fir-Larch No. 2 @ 16" OC

8

Overall Length: 8' 3"



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

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	272 @ 3 1/2"	1406 (1.50")	Passed (19%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	230 @ 10 3/4"	1305	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	532 @ 4' 2 1/2"	1360	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.059 @ 4' 2 1/2"	0.261	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.077 @ 4' 2 1/2"	0.392	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	--	--	--

System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' 10" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 7' 10" o/c unless detailed otherwise.
- 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	Total	
1 - Hanger on 7 1/4" SPF beam	3.50"	Hanger ¹	1.50"	67	224	291	See note ¹
2 - Hanger on 7 1/4" SPF beam	1.50"	Hanger ¹	1.50"	65	216	281	See note ¹

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

Connector: Simpson Strong-Tie Connectors							
Support	Model	Seat Length	Top Nails	Face Nails	Member Nails	Accessories	
1 - Face Mount Hanger	LU26	1.50"	N/A	6-10d	4-10dx1.5	None	
2 - Face Mount Hanger	LU26	1.50"	N/A	6-10d	4-10dx1.5	None	

Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8' 3"	16"	12.0	40.0	Residential - Living Areas

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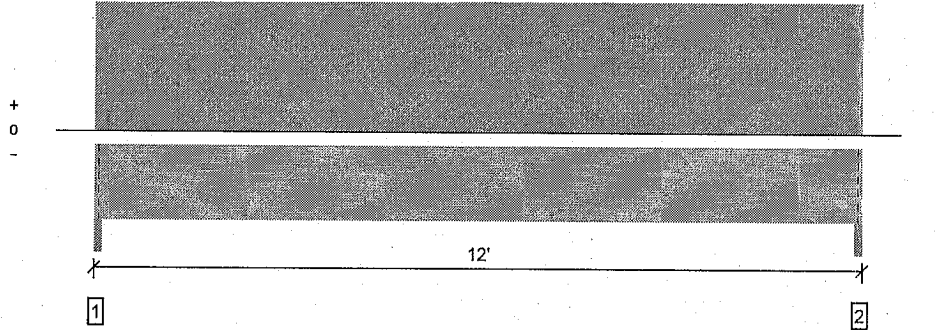
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Overall Length: 12'



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load Combination (Pattern)
Member Reaction (lbs)	2747 @ 11' 11 1/2"	7150 (2.00")	Passed (38%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	2267 @ 10' 11 1/2"	11733	Passed (19%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	8097 @ 6' 1/8"	23244	Passed (35%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.092 @ 6'	0.397	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.217 @ 6'	0.596	Passed (L/660)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 12' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lb): Bottom compression edge must be braced at 12' o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 11' 11".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Column - SPF	2.00"	2.00"	1.50"	1572	639	901	3112	Blocking
2 - Column - SPF	2.00"	2.00"	1.50"	1584	801	749	3134	Blocking

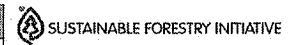
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 12'	N/A	14.0			
1 - Tapered (PSF)	0 to 12' (Front)	2' to 4'	12.0	40.0	-	Residential - Living Areas
2 - Tapered (PSF)	0 to 12' (Top)	8' to 11'	12.0	-	-	Wall load
3 - Tapered (PSF)	0 to 12' (Top)	7' to 4'	18.0	-	25.0	Roof snow load

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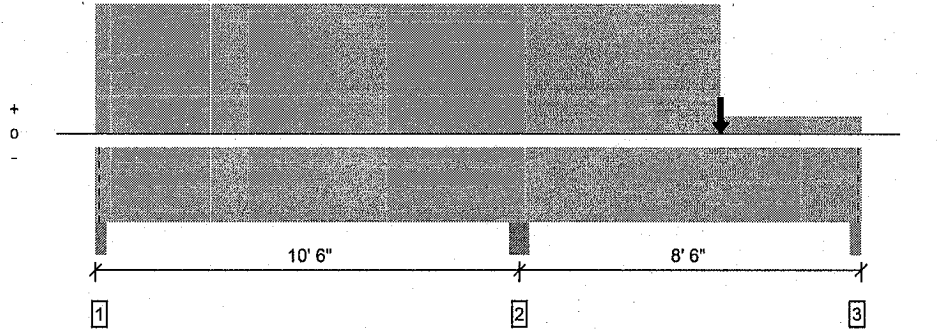
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10

Overall Length: 19'



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7803 @ 10' 6"	19663 (5.50")	Passed (40%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	3632 @ 11' 7 1/4"	10203	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	8408 @ 15' 6"	20213	Passed (42%)	1.00	1.0 D + 1.0 L (Alt Spans)
Neg Moment (Ft-lbs)	-7172 @ 10' 6"	15580	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.055 @ 15' 1/4"	0.279	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)
Total Load Defl. (in)	0.087 @ 15' 1 1/4"	0.419	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (Alt Spans)

System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 19' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 19' o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 8 5/8".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 5' 1 3/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Column - SPF	3.00"	3.00"	1.50"	1080	735/-180	398	2213/-180	Blocking
2 - Column - SPF	5.50"	5.50"	2.18"	4123	2956	1951	9030	None
3 - Column - SPF	3.00"	3.00"	1.50"	1181	1466/-142	906	3553/-142	Blocking

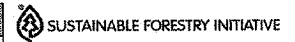
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 19'	N/A	14.0			
1 - Uniform (PSF)	0 to 15' 6" (Front)	4'	12.0	40.0	-	Residential - Living Areas
2 - Uniform (PSF)	0 to 15' 6" (Top)	12'	12.0	-	-	Wall load
3 - Uniform (PSF)	0 to 15' 6" (Top)	4'	18.0	-	25.0	Roof snow load
4 - Uniform (PSF)	15' 6" to 19' (Front)	1'	12.0	60.0	-	Deck floor load
5 - Point (lb)	15' 6" (Front)	N/A	1984	2145	1598	FB3 reaction

Weyerhaeuser Notes

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



Forte Software Operator	Job Notes
Larry Johnson Johnson Structural Engineering (406) 585-2939 larry@johnsonengineer.com	

2/6/2019

Johnson Structural Engineering, Inc.
 440 North Grand Ave.
 Bozeman, MT 59715

SHEET

11

PROJECT:

Banbury - SFR Addition
 Mercer Island, WA

JN 19-446

FOOTING DESIGN F2.0
 ITEM VALUE

NOTES

FB1a Column

Soils Bearing Capacity	1500 psf	Post Area Req'd,	Full	@ .73*
Uplift, U =	0 lbs	DF2 Beam	7.58	10.39 in ²
Footing Load P =	4739 lbs	HF2 Beam	11.70	16.03 in ²
Footing Depth D =	8 in	Post =	6	X 6
Post Dimensions b =	5.50 in	Area Provided =		30.25 in ²
	w =	Contact Pressure		157 psi
Approximate Bearing B =	1480 psf	(Footing wt removed)		
Estimated Area A =	3.20 sf	(P / B)		
Estimated base Be =	1.79 Ft	(Sq. Root of A)		
Footing Base b =	2.00 Ft			
Footing Weight =	387 lbs	UPLIFT OKAY		
Total Load Pt =	5.14 Kips	(P + Conc. Wt.)		
Allowable Bearing =	1.50 ksf			
Actual bearing q =	1.28 ksf	OKAY (Pt / b ²)		
Bending Moment M =	0.36 K-ft	(q *(b- 0.5) ² /8)		
Embedment Depth d =	5 in	(D - 3")		
Min Stl Area Amin =	0.05 in ² /ft	(M*12/(Fb*0.875*d))		
Reinforcing Bar Size (#) =	4			
USE 2'-0" x 2'-0" x 8" w /	2	- # 4's E.W.		

2/6/2019

Johnson Structural Engineering, Inc.
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 Bozeman, MT 59715

SHEET

12

PROJECT:

Banbury - SFR Addition
 Mercer Island, WA

JN 19-446

FOOTING DESIGN F2.0
 ITEM VALUE

NOTES

FB1a Column

Soils Bearing Capacity	1500 psf	Post Area Req'd,	Full	@ .73*
Uplift, U =	0 lbs	DF2 Beam	8.00	10.97 in ²
Footing Load P =	5003 lbs	HF2 Beam	12.35	16.92 in ²
Footing Depth D =	8 in	Post =	6	X 6
Post Dimensions b =	5.50 in	Area Provided =		30.25 in ²
w =	5.50 in	Contact Pressure		165 psi
Approximate Bearing B =	1480 psf	(Footing wt removed)		
Estimated Area A =	3.38 sf	(P / B)		
Estimated base Be =	1.84 Ft	(Sq. Root of A)		
Trial Footing Base b =	2.00 Ft			
Footing Weight =	387 lbs	UPLIFT OKAY		
Total Load Pt =	5.40 Kips	(P + Conc. Wt.)		
Allowable Bearing =	1.50 ksf			
Actual bearing q =	1.35 ksf	OKAY (Pt / b ²)		
Bending Moment M =	0.38 K-ft	(q *(b- 0.5) ² /8)		
Embedment Depth d =	5 in	(D - 3")		
Min Stl Area Amin =	0.05 in ² /ft	(M*12/(Fb*0.875*d))		
Reinforcing Bar Size (#) =	4			
USE 2'-0" x 2'-0" x 8" w /	2	- # 4's E.W.		

6/4/2019

Johnson Structural Engineering, Inc.
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Bozeman, MT 59715

SHEET

121

PROJECT:

Banbury - SFR Addition
Mercer Island, WA

JN 19-446

FOOTING DESIGN F2.75
ITEM VALUE

NOTES

FB1a midspan Column

Soils Bearing Capacity	1500 psf	Post Area Req'd,	Full	@ .73*
Uplift, U =	0 lbs	DF2 Beam	14.45	19.79 in ²
Footing Load P =	9030 lbs	HF2 Beam	22.30	30.54 in ²
Footing Depth D =	8 in	Post =	6	X 6
Post Dimensions b =	5.50 in	Area Provided =		30.25 in ²
w =	5.50 in	Contact Pressure		299 psi
Approximate Bearing B =	1480 psf	(Footing wt removed)		

Estimated Area A =	6.10 sf
Estimated base Be =	2.47 Ft
Trial Footing base =	2.75 Ft
Footing Weight =	731 lbs
Total Load Pt =	9.79 Kips
Allowable Bearing =	1.50 ksf
Actual bearing q =	1.29 ksf
Bending Moment M =	0.82 K-ft

UPLIFT OKAY

OKAY

Embedment Depth d = 5 in

Min Stl Area Amin = 0.11 in²/ft

Reinforcing Bar Size (#) = **4**

USE 2'-9" x 2'-9" x 8" w /

3

- # 4's E.W.

Johnson Structural Engineering, Inc.

152 W. Short St.

Bozeman, MT 59715

(406) 585-2939 phone

larry@johnsonengineering.com

Project: Bamberg - SFR Addition

Job No.: 19-446

Date: 2-5-19

Sheet No.: 13

6. East Floor beam - FB 2

span = 4'
floor trib = 1'
wall height = 8'
roof trib = 15.5'

$$FB1 R_{TL} = 3134 \#$$

$$FB2 R_{TL} = 1748 \#$$

$$4882 \#$$

USE 2'x2'x8" ftg

Use 4x10 P&T ←

$$Brq Area Rigid = 3.5' \times 1.5' =$$

$$Cust Col cap Area = 3.5 \times 6 \Rightarrow ok$$

7. West Floor beam - FB 3

span = 8'
floor trib = 1'
deck trib. = $\frac{16}{2} = 8'$
wall ht = 8'
roof trib = 15.5'

$$FB3 R_{TL} = 5727 \#$$

$$FB3a R_{TL} = 1772 \#$$

$$7499 \#$$

USE 2'-6" x 2'-6" x 8" ftg

Use 5 1/2" x 10 1/2" 2AF-146LB ←

8. Deck floor joist - FJ 2

span = 16' 1/4"

USE 2x10 HF#1 P.T @ 16" o.c. ←

9. Deck floor beam West - FB 4

span = 8.5'
floor trib = 7'

$$LL load = .08(13 \times 14 - 150) =$$

USE 6x10 PT. HF#2 ←

FB4a

span = 13' 1/6"

floor trib = $\frac{8'}{2} = 4'$

USE 6x10 P.T. HF#2

10. Spiral stairway

$$\pi \left(\frac{6.5^2}{4} \right) \times 1.5 \times (40 + 20) = 1990 \# \rightarrow 3000 \# TL$$

span = 15' FB4b

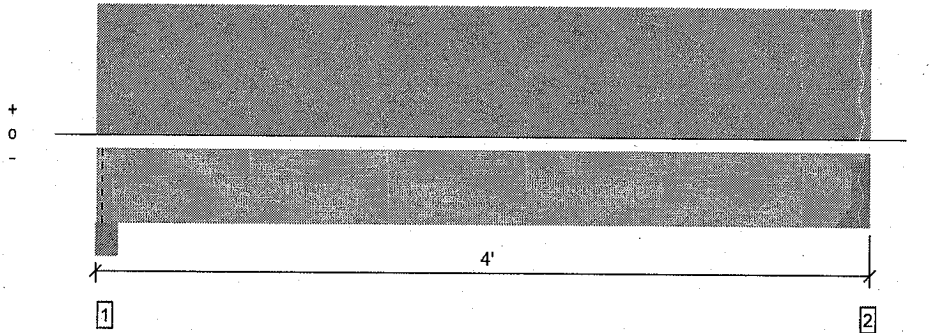
floor trib. = 4' + 2' 0" x 6'

floor trib. = 2' 6" x 15'

USE 6x10 P.T. HF#2

14

Overall Length: 4'



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1370 @ 3' 10 1/2"	2126 (1.50")	Passed (64%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	766 @ 3' 1 1/4"	3723	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1199 @ 2' 1 1/2"	4879	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.004 @ 2' 1 1/2"	0.117	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.009 @ 2' 1 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 3' 11" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 3' 11" o/c unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Column - SPF	6.00"	6.00"	1.50"	840	85	823	1748	Blocking
2 - Hanger on 9 1/4" SPF beam	1.50"	Hanger ¹	1.50"	740	75	727	1542	See note ¹

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

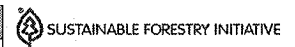
Connector: Simpson Strong-Tie Connectors							
Support	Model	Seat Length	Top Nails	Face Nails	Member Nails	Accessories	
2 - Face Mount Hanger	LUS410	2.00"	N/A	8-16d	6-16d	None	

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 10 1/2"	N/A	8.2			
1 - Uniform (PSF)	0 to 4' (Front)	1'	12.0	40.0	-	Residential - Living Areas
2 - Uniform (PSF)	0 to 4' (Top)	8'	12.0	-	-	Wall load
3 - Uniform (PSF)	0 to 4' (Top)	15' 6"	18.0	-	25.0	Roof snow load

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



Forte Software Operator	Job Notes
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2/6/2019

Johnson Structural Engineering, Inc.
440 North Grand Ave.
Bozeman, MT 59715

SHEET

15

PROJECT:

Banbury - SFR Addition
Mercer Island, WA

JN 19-446

FOOTING DESIGN F2.0
ITEM VALUE

NOTES

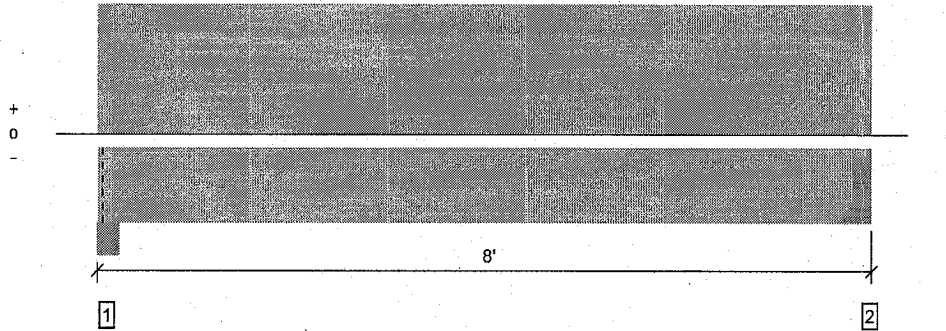
FB2 Column

Soils Bearing Capacity	1500 psf	Post Area Req'd,	Full	@ .73*
Uplift, U =	0 lbs	DF2 Beam	7.81	10.70 in ²
Footing Load P =	4882 lbs	HF2 Beam	12.05	16.51 in ²
Footing Depth D =	8 in	Post =	6	X 6
Post Dimensions b =	5.50 in	Area Provided =		30.25 in ²
	w =	Contact Pressure		161 psi
Approximate Bearing B =	1480 psf	(Footing wt removed)		
Estimated Area A =	3.30 sf	(P / B)		
Estimated base Be =	1.82 Ft	(Sq. Root of A)		
Trial Footing Base b =	2.00 Ft			
Footing Weight =	387 lbs	UPLIFT OKAY		
Total Load Pt =	5.28 Kips	(P + Conc. Wt.)		
Allowable Bearing =	1.50 ksf			
Actual bearing q =	1.32 ksf	OKAY (Pt / b ²)		
Bending Moment M =	0.37 K-ft	(q *(b- 0.5) ² /8)		
Embedment Depth d =	5 in	(D - 3")		
Min Stl Area Amin =	0.05 in ² /ft	(M*12/(Fb*0.875*d))		
Reinforcing Bar Size (#) =	4			
USE 2'-0" x 2'-0" x 8" w /	2	- # 4's E.W.		

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

16

Overall Length: 8'



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

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	4356 @ 7' 10 1/2"	5363 (1.50")	Passed (81%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	3340 @ 7'	11733	Passed (28%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	8168 @ 4' 1 1/2"	23244	Passed (35%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.051 @ 4' 1 1/2"	0.250	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.087 @ 4' 1 1/2"	0.375	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' 11" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 7' 11" o/c unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 7' 6".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Column - SPF	6.00"	6.00"	1.50"	1984	2145	1598	5727	Blocking
2 - Hanger on 10 1/2" SPF beam	1.50"	Hanger ¹	1.50"	1862	2015	1502	5379	See note ¹

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

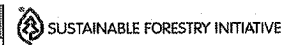
Connector: Simpson Strong-Tie Connectors						
Support	Model	Seat Length	Top Nails	Face Nails	Member Nails	Accessories
2 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 7' 10 1/2"	N/A	14.0			
1 - Uniform (PSF)	0 to 8' (Front)	1'	12.0	40.0	-	Residential - Living Areas
2 - Uniform (PSF)	0 to 8' (Top)	8'	12.0	-	-	Wall load
3 - Uniform (PSF)	0 to 8' (Top)	15' 6"	18.0	-	25.0	Roof snow load
4 - Uniform (PSF)	0 to 8' (Back)	8'	10.0	60.0	-	Deck floor load

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2/6/2019

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SHEET

17

PROJECT:

Banbury - SFR Addition
Mercer Island, WA

JN 19-446

FOOTING DESIGN F2.5
ITEM VALUE

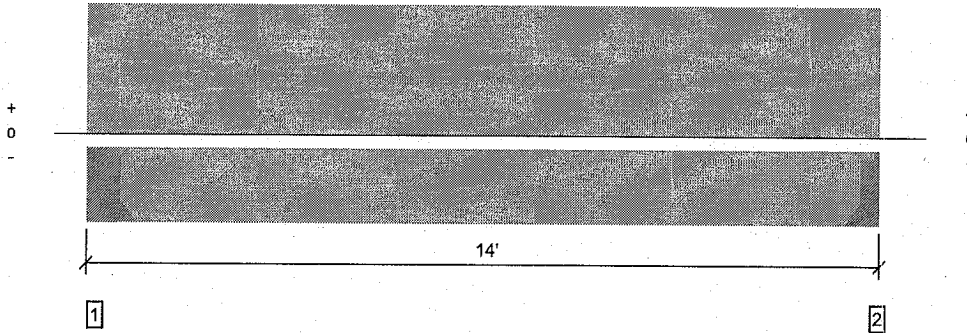
NOTES

FB1a end + FB3 Column

Soils Bearing Capacity	1500 psf	Post Area Req'd,	Full	@ .73*
Uplift, U =	0 lbs	DF2 Beam	12.00	16.44 in ²
Footing Load P =	7499 lbs	HF2 Beam	18.52	25.36 in ²
Footing Depth D =	8 in	Post =	6	X 6
Post Dimensions b =	5.50 in	Area Provided =		30.25 in ²
w =	5.50 in	Contact Pressure		248 psi
Approximate Bearing B =	1480 psf	(Footing wt removed)		
Estimated Area A =	5.07 sf			
Estimated base Be =	2.25 Ft			
Trial Footing base =	2.50 Ft			
Footing Weight =	604 lbs	UPLIFT OKAY		
Total Load Pt =	8.12 Kips			
Allowable Bearing =	1.50 ksf			
Actual bearing q =	1.30 ksf	OKAY		
Bending Moment M =	0.65 K-ft			
Embedment Depth d =	5 in			
Min Stl Area Amin =	0.09 in ² /ft			
Reinforcing Bar Size (#) =	4			
USE 2'-6" x 2'-6" x 8" w /	3	- # 4's E.W.		

18

Overall Length: 14'



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load Combination (Pattern)
Member Reaction (lbs)	626 @ 5 1/2"	911 (1.50")	Passed (69%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	554 @ 1' 2 3/4"	1388	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2100 @ 7' 2"	2199	Passed (96%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.393 @ 7' 2"	0.447	Passed (L/410)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.459 @ 7' 2"	0.671	Passed (L/351)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	--	--	--

System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 2' 11" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 13' 5" o/c unless detailed otherwise.
- 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	Total	
1 - Hanger on 9 1/4" SPF beam	5.50"	Hanger ¹	1.50"	96	573	669	See note ¹
2 - Hanger on 9 1/4" SPF beam	1.50"	Hanger ¹	1.50"	91	547	638	See note ¹

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

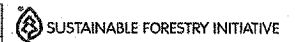
Connector: Simpson Strong-Tie Connectors							
Support	Model	Seat Length	Top Nails	Face Nails	Member Nails	Accessories	
1 - Face Mount Hanger	LU28	1.50"	N/A	8-10d	6-10dx1.5	None	
2 - Face Mount Hanger	LU28	1.50"	N/A	8-10d	6-10dx1.5	None	

Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 14'	16"	10.0	60.0	Deck floor load

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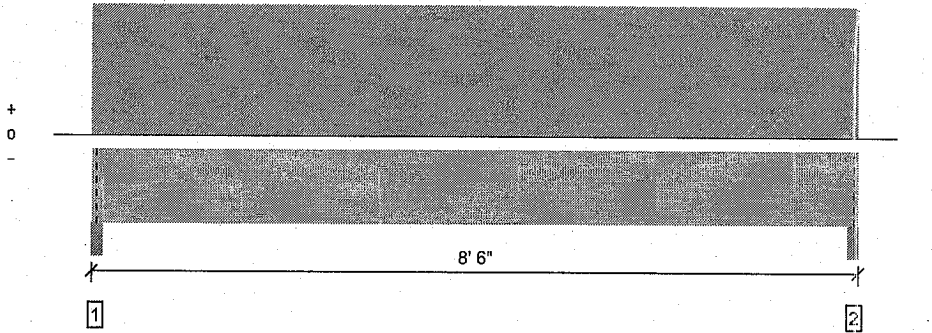


Forta Software Operator	Job Notes
Larry Johnson Johnson Structural Engineering (408) 585-2939 larry@johnsonengineer.com	

1 piece(s) 6 x 10 Hem-Fir No. 2

19

Overall Length: 8' 6"



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

Design Results	Actual @ Location	Allowed	Result	LDf	Load Combination (Pattern)
Member Reaction (lbs)	2139 @ 1' 1/2"	6683 (3.00")	Passed (32%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1615 @ 1' 1/2"	4877	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4281 @ 4' 3"	4654	Passed (92%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.101 @ 4' 3"	0.275	Passed (L/978)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.121 @ 4' 3"	0.412	Passed (L/816)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 6" o/c unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - SPF	3.00"	3.00"	1.50"	354	1785	2139	Blocking
2 - Beam - SPF	3.00"	3.00"	1.50"	354	1785	2139	Blocking

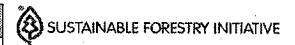
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 6"	N/A	13.2		
1 - Uniform (PSF)	0 to 8' 6" (Back)	7'	10.0	60.0	Deck floor load

Weyerhaeuser Notes

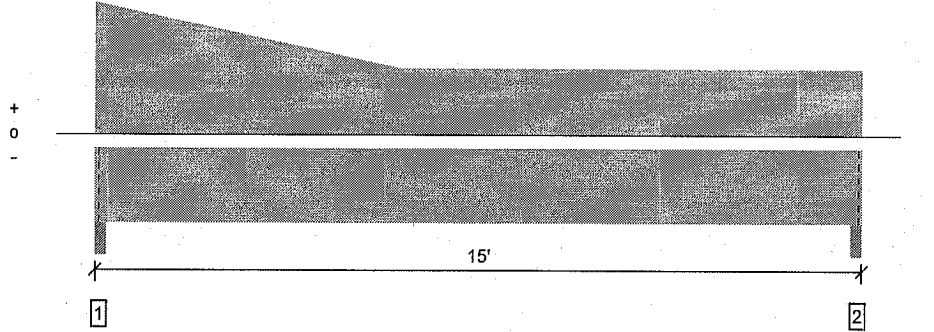
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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Larry Johnson Johnson Structural Engineering (406) 585-2939 larry@ohnsonengineer.com	

Overall Length: 15'



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1516 @ 1 1/2"	6683 (3.00")	Passed (23%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1223 @ 1' 1/2"	4877	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4571 @ 7' 1 13/16"	4654	Passed (98%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.330 @ 7' 4 7/8"	0.492	Passed (L/536)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.418 @ 7' 4 15/16"	0.738	Passed (L/424)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 15' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' o/c unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - SPF	3.00"	3.00"	1.50"	302	1214	1516	Blocking
2 - Beam - SPF	3.00"	3.00"	1.50"	257	946	1203	Blocking

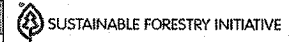
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 15'	N/A	13.2		
1 - Tapered (PSF)	0 to 6' (Back)	4' to 2'	10.0	60.0	Deck floor load
2 - Tapered (PSF)	6' to 15' (Back)	2'	10.0	60.0	Deck floor load

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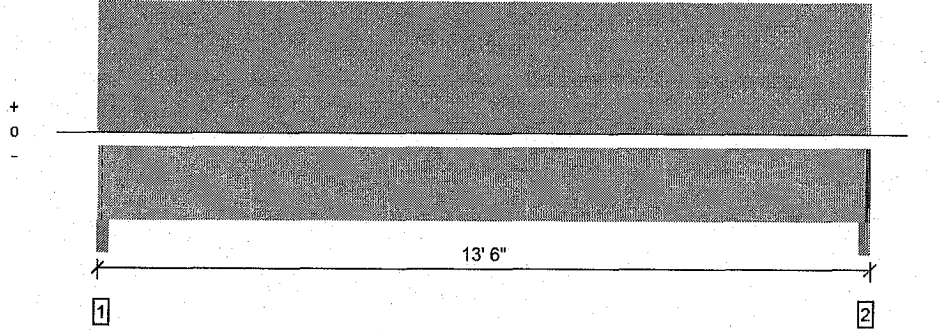
The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
Larry Johnson Johnson Structural Engineering (406) 585-2939 larry@ohnsonengineer.com	

21
 (no p. 22)

Overall Length: 13' 6"



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

Design Results	Actual @ Location	Allowed	Result	IDF	Load: Combination (Pattern)
Member Reaction (lbs)	1949 @ 13' 4 1/2"	3898 (1.75")	Passed (50%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1674 @ 1' 1/2"	4877	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	6435 @ 6' 9"	7239	Passed (89%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.362 @ 6' 9"	0.442	Passed (L/439)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.442 @ 6' 9"	0.663	Passed (L/359)	--	1.0 D + 1.0 L (All Spans)

System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2015
 Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 13' 5" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 13' 5" o/c unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - SPF	3.00"	3.00"	1.50"	359	1620	1979	Blocking
2 - Beam - SPF	3.00"	1.75"	1.50"	358	1620	1978	1 1/4" Rim Board

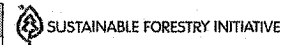
- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 13' 4 3/4"	N/A	13.2		
1 - Uniform (PSF)	0 to 13' 6" (Top)	4'	10.0	60.0	Deck floor load

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



Forta Software Operator	Job Notes
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Project: Banbury - SFR Addition

Job No.: 19-496

Date: 2-5-19

Sheet No.: 23

B. Lateral Design

Wind - Per ASCE Chapter 28.5

step 1: Risk Group 2, step 2: $V = 110$ mph step 3: Exp B, $K_{ex} = 1.0$

step 4: $P_A = 25.4$ psf, $P_B = -4.0$ psf, $P_C = 17.5$ psf, $P_D = 0 \rightarrow$ min 8.0 psf

step 5: $\lambda = 1.0$

step 6: $P_A = 25.4$ psf, $P_B = -8.0$ psf, $P_C = 17.5$ psf, $P_D = 8.0$ psf, $z_a = z(2.7) = 59'$

$P_A = 40.6$ psf, $P_B = -12.8$ psf, $P_C = 28.0$ psf, $P_D = 12.8$ psf

- E/W Wind

V_A main level

$$V_A = 40.6 (55 \times 3.75) + 28.0 (55 \times 3.75) + 12.8 (12.5 \times 6.5) = 2,456 \#$$

$$V_A (ASD \text{ level}) = .6 (2,456 \#) = 1,474 \#$$

$$V_A \text{ Lower} = 40.6 (55 \times 5') + 28.0 (55 \times 5')$$

$$= 1,887 \#$$

$$V_A (ASD \text{ level}) = .6 (1,887 \#) = 1,132 \#$$

$$V_A (ASD) \text{ total} = 1,474 + 1,132 = 2,606 \#$$

- N/S Wind main level

$$V_B = 40.6 (55 \times \frac{4.5 \times 7}{2}) + 28.0 (8 \times \frac{7 \times 10}{2}) = 3,188 \#$$

$$V_B \rightarrow ASD \text{ level} = .6 (3,188 \#) = 1,913 \#$$

$$V_B = 3,188 \# \rightarrow ASD \text{ level} = .6 (3,188 \#) = 1,913 \#$$

$$V_{N/S} (ASD) \text{ total} = 3,826 \#$$

- Seismic

$$V_{\text{seismic base of Addition}} = 4,140 \# + \text{trib. of existing}$$

$$\rightarrow ASD \text{ level} = .7 (4,140 \#) = 2,898 \#$$

$$V_{\text{seismic (ASD)}} = 2,898 \#$$

$$V_{\text{seismic upper}} = 2,528 \# \rightarrow ASD$$

$$1,770 \#$$

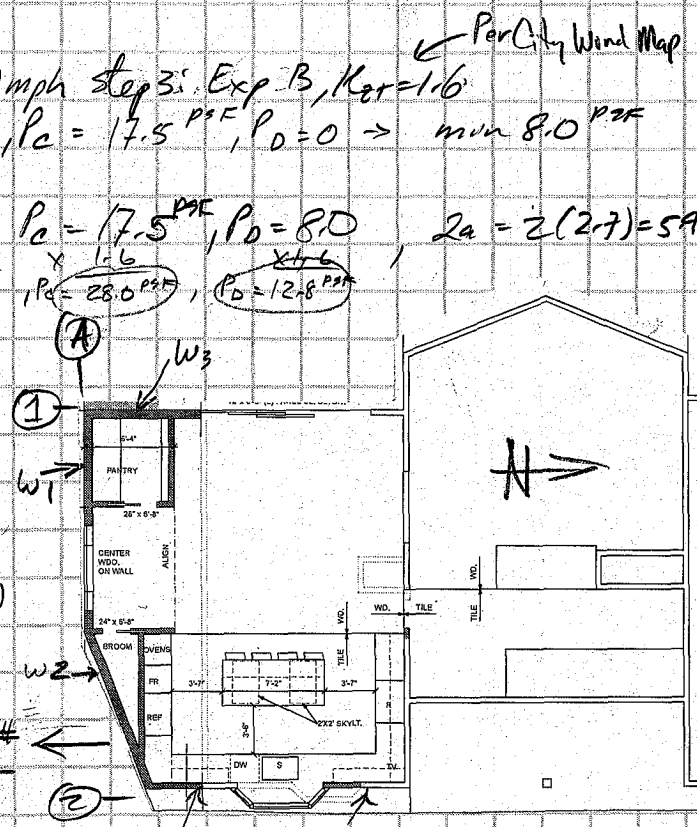
$$V_{\text{seismic lower}} = 1,612 \# \rightarrow ASD$$

$$1,128 \#$$

$$2,898 \#$$

$V_{\text{seismic (ASD) base}}$

- Wind Control N/S, Seismic Controls E/W



1535

PROJECT
LOCATION:

Banbury - SFR Addition
Bozeman, MT

JN 19-446

SEISMIC LOADING CALCULATIONS PER ASCE 7-10

STRUC CATEGORY = II TABLE 1.5-1 IMPORTANCE, I = 1.00 TABLE 1.5-2

DETERMINE FREQUENCY OF STRUCTURE

SOIL PROFILE	D	'D' IF UNKNOWN
Ss	1.460	Fa
S1	0.560	Fv
		1.000
		1.500

FROM USGS HAZARDS, ZIPCODE DIRECTORY

Sms = Fa*Ss = 1.460
Sm1 = Fv*S1 = 0.840

Sds = 2/3 Sms = 0.973 g
Sd1 = 2/3 Sm1 = 0.560 g

SEISMIC DESIGN CATEGORY		PER 1-SEC PERIOD RESPONSE
PER SHORT PERIOD RESPONSE		
D	TABLE 9.4.2.1a	D

USE MAXIMUM SEISMIC DESIGN CATEGORY D

RESPONSE SPECTRUM
To = .2Sd1 / Sds = 0.115
Ts = Sd1 / Sds = 0.575

APPROXIMATE PERIOD		Cu = 1.40
Ta = Ct*hn^x	0.210 SEC	Ct = 0.020
	EQN 9.5.5.3.2	x = 0.75
		hn = hridge = 23.0 FT

T' IS THE UPPER LIMIT FOR THE STRUCTURE'S PERIOD
FUNDAMENTAL PERIOD
T = Cu * Ta = 0.294 SEC

STRUCTURE FREQUENCY (f) IS THE INVERSE OF 'Ta'
f = 4.76 Hz RIGID STRUCTURE

COMMENTARY TO SECTION 6 OFFERS AN ALTERNATIVE METHOD FOR ESTIMATING IF THE STRUCTURE IS RIGID -

IF h / LEAST WIDTH, B OR L, IS < 4.0, STRUCTURE IS DEEMED RIGID	C6.2
h = 23.0 FT	RIDGE
heave = 16.0 FT	EAVE
hmn = 19.5 FT	MEAN
B = 66.0 FT	WIDTH OF STRUCTURE
L = 27.0 FT	DEPTH OF STRUCTURE

PROJECT
LOCATION:

Banbury - SFR Addition
Bozeman, MT

JN 19-446

SEISMIC LOADING CALCULATIONS PER ASCE 7-10

h / LEAST WIDTH = 0.85 RIGID

EQUIVALENT LATERAL FORCE PROCEDURE

$V = C_s * W$

$S_{ds} = 0.973$

$S_{d1} = 0.560$

$I = 1.000$

$T = 0.210$

$R = 3.25$

Steel Ord Conc. Braced Frame

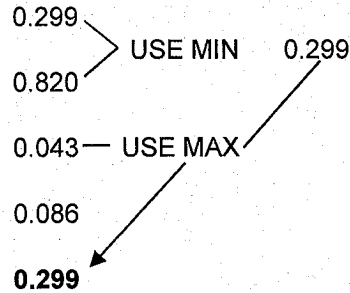
$C_s = S_{ds} / (R / I)$

$C_s \leq S_{d1} / T (R / I)$

$C_s > 0.044 S_{ds} I$

$C_s > 0.5 S_1 / (R / I)$

$C_s =$



DETERMINE WEIGHT OF STRUCTURE

	PSF	HEIGHT	LENGTH	AREA	WEIGHT	
Upper Roofing @	15			343	5145	5145
2nd Level Ext Walls @	12	8	45	360	4320	2160
2nd Level Int Walls @	10	8	26	208	2080	1040
2nd Level Floor @	12			190	2280	2280
Deck @	5			340	1700	1700
Spiral Stairs @	5				300	300
TOTAL WEIGHT					13825	LBS

RECALL, $V = C_s * W$

Base shear, V = 4140 Lbs

PROJECT
LOCATION:

Banbury - SFR Addition
Bozeman, MT

JN 19-446

SEISMIC LOADING CALCULATIONS PER ASCE 7-10

FRONTAL VERTICAL SEISMIC DISTRIBUTION

LEVEL	Hx	Wx	Hx*Wx*k	Cvx	Fx	Load Comb 16-12 0.7*Fx
Roof Level			0	0.00	0	0
Upper Level	16	8345	0.61	0.61	2528	1770
Main Level	8	5320	0.39	0.39	1612	1128
SUMS		13665	1.00	1.00	4140	2898

SIDE VERTICAL SEISMIC DISTRIBUTION

LEVEL	Hx	Wx	Hx*Wx*k	Cvx	Fx	Load Comb 16-12 .7*Fx
Roof Level			0	0.00	0	0
Upper Level	16	8345	0.61	0.61	2528	1770
Main Level	8	5320	0.39	0.39	1612	1128
SUMS		13665	1.00	1.00	4140	2898

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Project: Banbury - SFR Addition
Job No.: 19-446
Date: 2-5-19
Sheet No.: 28

Panel Design

main level

E/W Seismic

(A) $f_{w1, w2} = \frac{1770 \#}{8' + 12'} = 89 \#/ft < 255 \#/ft$ (S1) $7/16" \text{ OSB/CDX w/ } 2d \times 6" \text{ o.c.}$

N/S Wind

(1) $f_{w3} = \frac{1913 \#}{8'} = 239 \#/ft < 255 \#/ft$ (S1)

(2) $f_{w4, w5} = \frac{1913 \#}{7' + 5.5'} = 153 \#/ft < 255 \#/ft$ (S1)

Strap Design

(A) $T_{w1, w2} = [89 \#/ft (8') (7.75) - 6(18(4) + 12(8)) \frac{8^2}{2}] \frac{1}{8} = 287 \#$ - disregard, reached by nailing

(1) $T_{w3} = [239 \#/ft (8') (7.75) - 6(18(15.5) + 12(8)) \frac{8^2}{2}] \frac{1}{8} = 952 \# < 1235 \#$ LSTA 24 strap

(2) $T_{w4, w5} = [153 \#/ft (7') (7.75) - 6(18(15.5) + 12(8)) \frac{7^2}{2}] \frac{1}{7} = 398 \#$ - disregard, reached by nailing

Low level

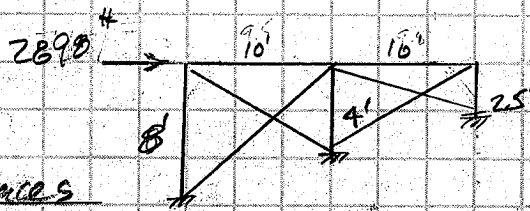
Steel Ord. Conc. Braced Frame

$R = 3/4, \Omega = 2$

see V.A. Model

max. Braced Force = 1115 #

use L 2x 2x 3/16 diagonal braces



Brace connection to Column Cap / Column Base = 1952 #

$F = 2.0(1115) \# = 2230 \#$

Allowable Shear A307 5/8" ϕ SS ASD = 3.7k > 2.2k ok

use (1) 5/8" ϕ A307 bolt each end

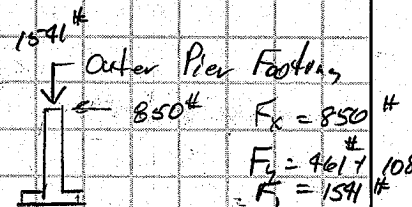
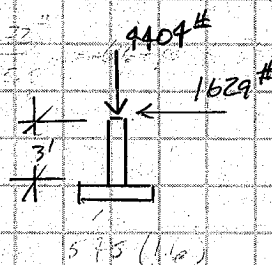
- Middle Pier Footing

Concrete Pier design for Lateral force

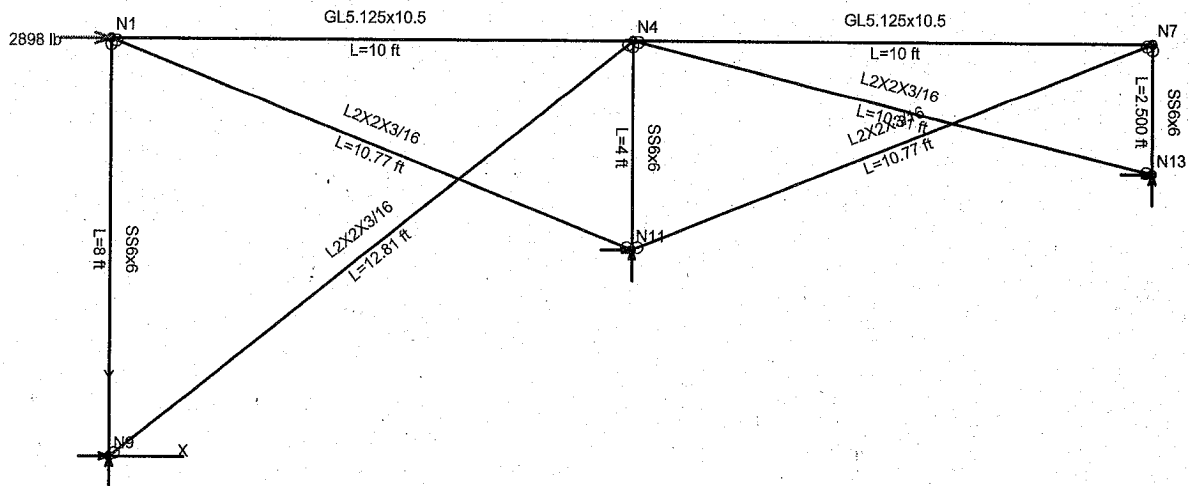
$F_x = 1629 \#$

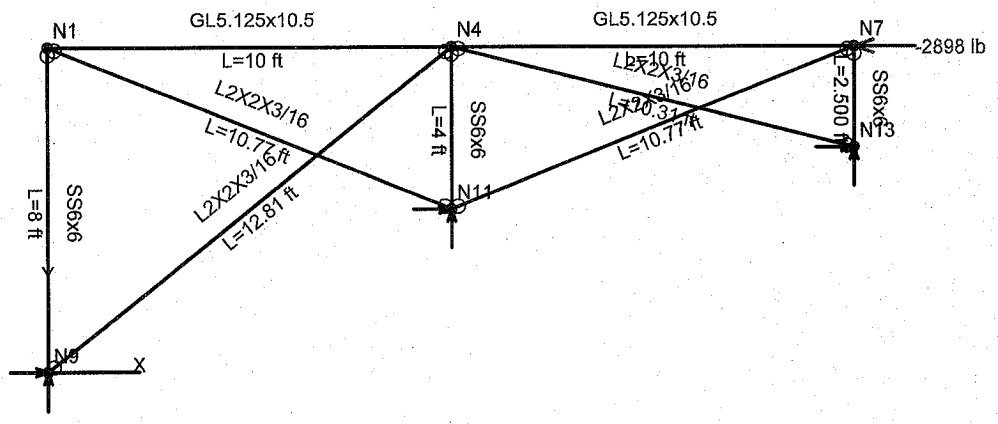
$F_y = 281 \# + 4(23 \#) = 440 \#$
DL (see FB1a)

Use 39" x 39" x 8" ftg (F3.3)



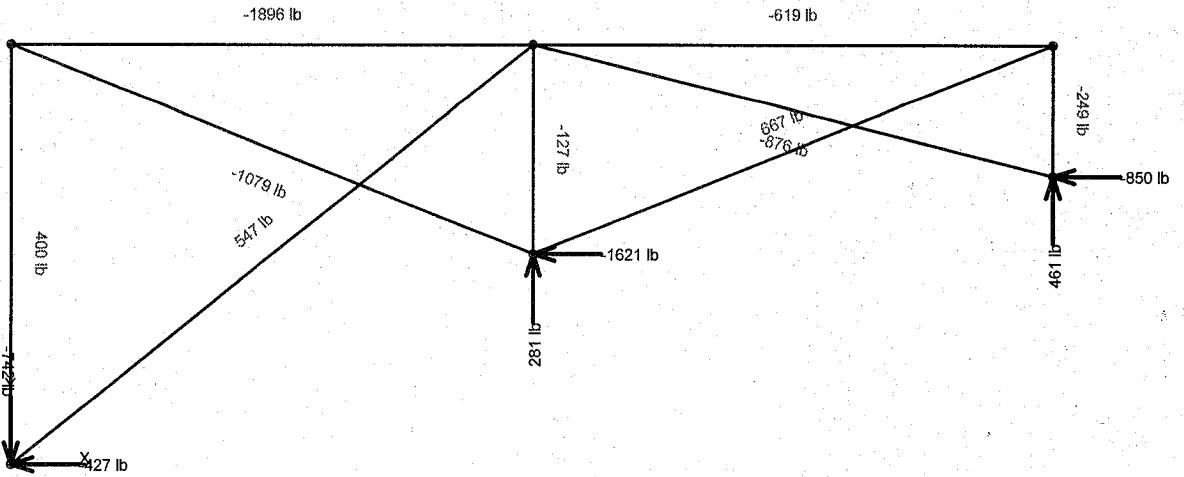
Use 39" x 39" x 8" ftg (F3.3)





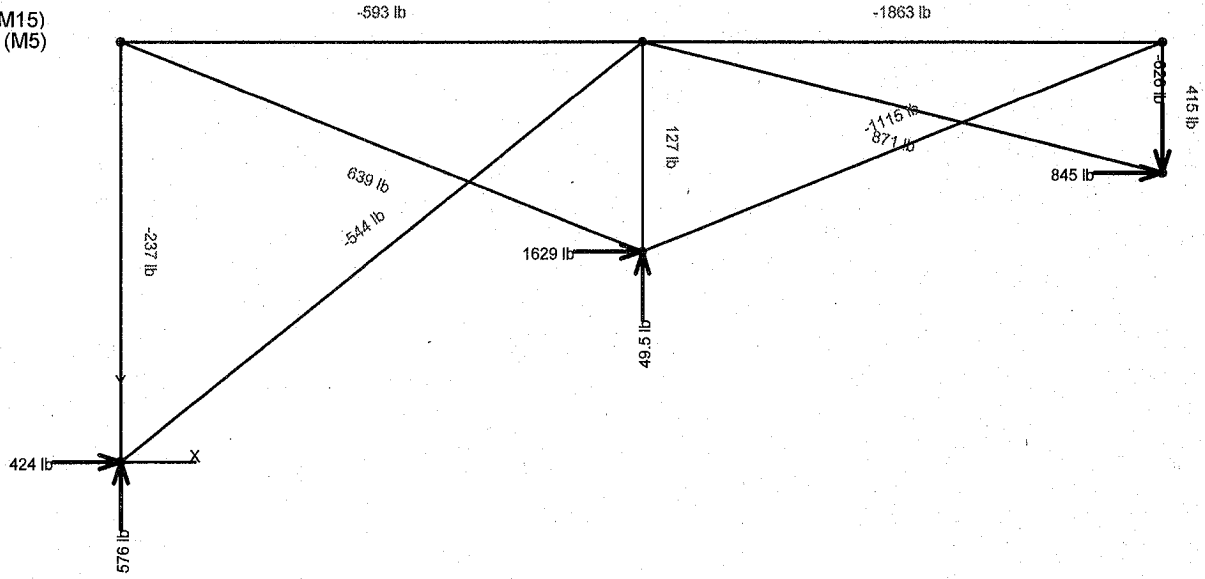
Axial Force, Fx

All Members:
Max = 667 lb (M16)
Min = -1896 lb (M2)

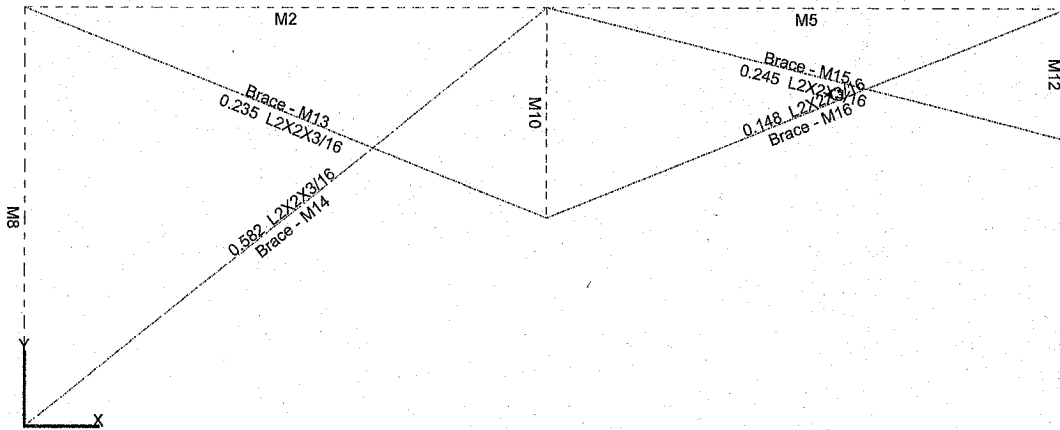
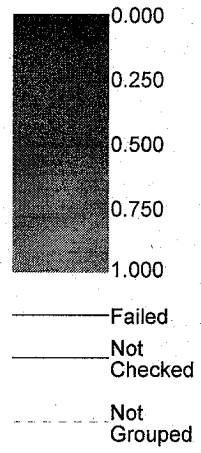


Axial Force, Fx

All Members:
Max = 871 lb (M15)
Min = -1863 lb (M5)



Unity Check Values



Untitled Project

VisualAnalysis 5.10 Report

Company: Engineering

Project File: Brace Frame A.vap

Folder: C:\Users\JSE\Documents\2019 Jobs\19-424 thru 19-449\19-446\

Member Unity Checks

Unity Member	Status	Group	Model Shape Design Shape Messages?
0.5822 M14	Designed	Brace	L2X2X3/ L2X2X3/16 Warning, see design report

Design Member Results

Design Load Cases

Strength ID Number	Serviceability ID Number	Load Case (Deflection Type) Name
1	2	Dead loads First Order (Other)
-	3	Seismic +X loads First Order ('W or S')
-	4	Wind +X loads First Order ('W or S')

AISC Steel (ASD)

Design Group: Brace, Group Report, Designed As: L2X2X3/16

SIZE CONSTRAINTS: none

BRACING INFORMATION:

Lateral bracing at top flange (+y): Pattern = Unbraced
 Lateral bracing at bottom flange (-y): Pattern = Unbraced
 Strong axis bracing (parallel to y): Pattern = Unbraced

STEEL PARAMETERS:

Fy = 36.00Ksi

FRAME INFORMATION:

Braced frame for strong axis bending.
 Effective length factors: Kz = 1.00, Ky = 1.00

L2X2X3/16 INFORMATION:

A = 0.72 in²; d = 0.17, bf = 0.17, tf = 0.02, tw = 0.02 ft
 Iz = 0.27, Iy = 0.27, I1 = 0.43, I2 = 0.11, J = 0.01 in⁴
 r1 = 0.06, r2 = 0.03 ft
 Sz(+y) = 0.19, Sz(-y) = 0.48, Sy(+z) = 0.19, Sy(-z) = 0.48 in³
 S1 = 0.31, S2(+1) = 0.14, S2(-1) = 0.18 in³
 βw = 0.00

Extreme Checks Only

Combined Stresses Check:

Member Code	Load Name	Unity Case #	Offset ft	fa Ksi	Fa Ksi	M1 lb-ft	fb1 Ksi	Fb1 Ksi	M2 lb-ft	fb2 Ksi	Fb2 Ksi
H1-1	M14	1	5.98	-0.36	0.96	27.73	-1.09	15.66	-27.73	-1.88	23.76
					0.58						

Axial Check:

Member Name	Load Case #	Offset ft	P lb	fa Ksi	KL/r	Cc	Q	Fa Ksi	Code Ref.	Unity Check
M14	1	0.00	-270.99	-0.38	394.72	126.10	1.00	0.96	E2-2	0.39

Strong Shear Check:

Member Name	Load Case #	Offset ft	Vy lb	fvy Ksi	h/tw	Fvy Ksi	Code Ref.	Unity Check
M14	1	0.00	12.30	0.05	9.67	14.40	F4-1	0.00

PROJECT :
LOCATION :

Banbury - SFR Addition
Mercer Island, WA

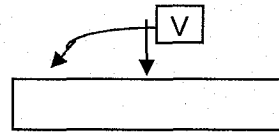
JN 19-446

ECCENTRICALLY LOADED PIER FOOTINGS

FB1a Middle Column Fo

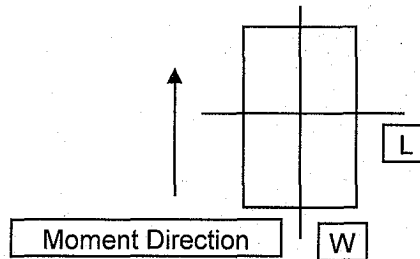
Column at Steel Beam

V pt. load= 4404 # (positive down)
H pt. load= 1629 # @ h= 3.00 ' above top of fgt.
(M)h= 5978 '#
(M)ext= 0 '# positive in direction of horizontal load
(M)total= 5978 '#
Column Load= 200 #



PIER DESIGN

Lv= 1.67 distance to pt. load from edge
W= 3.33 '
t= 0.67 '
L= 3.33 '
(W)fnd= 1314 #
F.S. uplift= N.A.
F.S. overturning= **1.60**
Reaction= 5718 #
x= 2.77
e= 1.11 ' outside kern
(L)kern= 0.56 '
(L)bearing= 3.33 '
(S)static= 516 psf
(S)max= 1031 psf
(S)min= 0 psf



del= 310 psf/ft
(S)toe= 617 psf
(S)heel= 411 psf

Load Duration Factor= 1.00

(S)base= 2000 psf
(S)allow= 2080 psf (with increase for footing depth)
(S)allow= 2080 psf (with increase for duration of load)

Reinforcement design: - footing in 'L' direction

Mtoe=	1102 #'	Mheel=	273 #'
Mu=	1873 #'		
#	4 bar at	12 "O.C.	
As=	0.200 s.i.		
fy=	60000 psi	ROmin=	0.003333
fc=	2500 psi	RO=	0.002073
t=	8.04 "		
d=	4.54 "		
a=	0.471 "		
Mn=	4305 #'	DESIGN FOR 1.3 Mu	
phi=	0.90	1.3 Mu=	2435
phi* Mn=	3874 #'		

Reinforcement design: - footing in 'W' direction

Mw=	456 #'		
Mu=	775 #'		
#	4 bar at	12 "O.C.	
As=	0.2 s.i.		
fy=	60000 psi	ROmin=	0.003333
fc=	2500 psi	RO=	0.002073
t=	8.04 "		
d=	4.04 "		
a=	0.471 "		
Mn=	3805 #'	DESIGN FOR 1.3 Mu	
phi=	0.90	1.3 Mu=	1007
phi* Mn=	3424 #'		

COLUMN DESIGN

$h = 3.00'$
 $l = 8''$
 $w = 8''$
 $A = 64.00 \text{ s.i.}$
 $V \text{ pt. load} = 4404 \#$
 $(M)_{\text{tot}} = 4887 \#'$

Reinforcement Design: - Column

$M_c = 4887 \#'$
 $M_u = 8308 \#'$
 $\# = 4 \text{ bar with } 2 \text{ per side}$
 $A_s = 0.4 \text{ s.i.}$
 $f_y = 60000 \text{ psi}$
 $f_c = 2500 \text{ psi}$
 $l = 8.00''$
 $d = 6.75''$
 $a = 1.41''$
 $M_n = 12088 \#'$
 $\phi = 0.85$
 $\phi * M_n = 10275 \#'$
 $1.33 * \phi * M_n = 13697 \#'$
 0
 $V_{\text{max}} = 1629 \#$
 $V_u = 2769 \#$
 $f * V_c = 5440 \#$
 $R_{\text{Omin}} = 0.003333$
 $R_O = 0.00625$
 $1.3 M_u = 10800$
 0
 $V \text{ steel req'd}$

Vsteel design:

$(V_s)_{\text{req'd}} = -3142 \#$
 $\text{USE } 3 \text{ bar at } 6'' \text{ O.C. } \times 6 \text{ square}$
 $A_s = 0.44 \text{ s.i.}$
 $V_s = 29700 \#$
 $V_s + V_c = 35140 \#$
 $f * (V_s + V_c) = 29869 \#$
 OKAY

Use 39"x39"x8" Footing with (4) #4 each way and
with 10" dia column with (4) #4 verticals

PROJECT :
 LOCATION:

Banbury - SFR Addition
 Mercer Island, WA

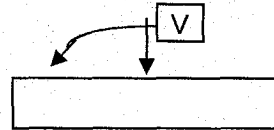
JN 19-446

ECCENTRICALLY LOADED PIER FOOTINGS

FB1a Outer Column Fo

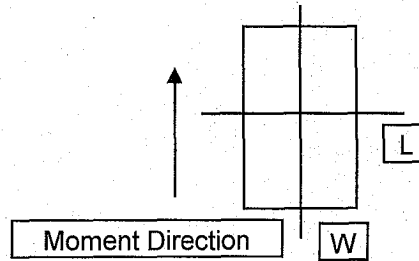
Column at Steel Beam

V pt. load= 1541 # (positive down)
 H pt. load= 850 # @ h= 3.00 ' above top of ftg.
 (M)h= 3120 #
 (M)ext= 0 # positive in direction of horizontal load
 (M)total= 3120 #
 Column Load= 200 #



PIER DESIGN

Lv= 1.67 distance to pt. load from edge
 W= 3.33 '
 t= 0.67 '
 L= 3.33 '
 (W)fnd= 1314 #
 F.S. uplift= N.A.
 F.S. overturning= **1.53**
 Reaction= 2855 #
 x= 2.88
 e= 1.21 ' outside kern
 (L)kern= 0.56 '
 (L)bearing= 3.33 '
 (S)static= 258 psf
 (S)max= 515 psf
 (S)min= 0 psf



del= 155 psf/ft
 (S)toe= 308 psf
 (S)heel= 205 psf

Load Duration Factor= 1.00

(S)base= 2000 psf
 (S)allow= 2080 psf (with increase for footing depth)
 (S)allow= 2080 psf (with increase for duration of load)

Reinforcement design: - footing in 'L' direction

Mtoe=	550 #'	Mheel=	136 #'
Mu=	935 #'		
#	4 bar at	12 "O.C.	
As=	0.200 s.i.		
fy=	60000 psi	ROmin=	0.003333
fc=	2500 psi	RO=	0.002073
t=	8.04 "		
d=	4.54 "		
a=	0.471 "		
Mn=	4305 #'	DESIGN FOR 1.3 Mu	
phi=	0.90	1.3 Mu=	1216
phi* Mn=	3874 #'		

Reinforcement design: - footing in 'W' direction

Mw=	228 #'		
Mu=	387 #'		
#	4 bar at	12 "O.C.	
As=	0.2 s.i.		
fy=	60000 psi	ROmin=	0.003333
fc=	2500 psi	RO=	0.002073
t=	8.04 "		
d=	4.04 "		
a=	0.471 "		
Mn=	3805 #'	DESIGN FOR 1.3 Mu	
phi=	0.90	1.3 Mu=	503
phi* Mn=	3424 #'		

COLUMN DESIGN

$h = 3.00'$
 $l = 8''$
 $w = 8''$
 $A = 64.00 \text{ s.i.}$
 $V \text{ pt. load} = 1541 \#$
 $(M)_{\text{tot}} = 2550 \#'$

Reinforcement Design: - Column

$M_c = 2550 \#'$
 $M_u = 4335 \#'$
 $\#$ 4 bar with 2 per side
 $A_s = 0.4 \text{ s.i.}$
 $f_y = 60000 \text{ psi}$ $R_{Omin} = 0.003333$
 $f_c = 2500 \text{ psi}$ $R_O = 0.00625$
 $l = 8.00''$
 $d = 6.75''$
 $a = 1.41''$
 $M_n = 12088 \#'$
 $\phi = 0.85$ $1.3 M_u = 5636$
 $\phi M_n = 10275 \#'$
 $1.33 \phi M_n = 13697 \#'$
 0 0
 $V_{max} = 850 \#$
 $V_u = 1445 \#$
 $f'V_c = 5440 \#$ $V \text{ steel not req'd.}$

Vsteel design:

$(V_s)_{\text{req'd}} = -4700 \#$
 USE 3 bar at 6 "O.C. x 6 square
 $A_s = 0.44 \text{ s.i.}$
 $V_s = 29700 \#$
 $V_s + V_c = 35140 \#$
 $f'(V_s + V_c) = 29869 \#$ $OKAY$

Use 39"x39"x8" Footing with (4) #4 each way and
with 10" dia column with (4) #4 verticals