Structural Calculations Cover Sheet

Project Number: **2020.050**   **Date:** **August 13, 2020**
Project Name: **Zahr residence**   **Architect:** **Suzanne Zahr**

Structural Design For: Structural design for a new residence and DADU
Construction Type: Conventional wood framed construction.

CODES

2015 International Building Code (IBC)
2015 NDS
ASCE 7-10

LOADS

Floor Live Load	40 psf
Dead Loads	As required
Roof snow Load	25 psf
Wind	110 mph, Exposure B, Per ASCE 7-10 Section 28, Kzt = 1.60
Seismic	Per ASCE 7-10 Section 12

Peak Ground Accelerations (PGA) based on USGS Hazards Program 2003, by Lat/Lon.
PGA 1 sec = 0.507   PGA .2 sec = 1.466   %V = 0.150 * DL

Material Design Values

Soils	Per Geotech report by PanGeo Dated August 6, 2020. 2,000 psf allowed bearing (subject to field verification)
Concrete	f'c=2,500 psi; 5-1/2 sack mix, or alternate mix pre-approved by bldg. dept.
Reinforcing	Grade 60; Fy=60,000 psi minimum

Sawn Lumber

Joists, Rafters:		Hem-Fir #2 and better
Beams:	4x_:	DF-L #2
	6x_:	DF-L #2
	Posts:	DF-L #2
Studs & Plates:	Hem-Fir Standard	

Glu-Lam Beams	24F-V4 for simple span beams, 24F-V8 for cantilevered beams
Parallam Beams	2.0E PSL, Fb=2,900 psi, Fv=290 psi, E=2.0*10^6 psi (minimum)
Microllam Beams	1.9E LVL, Fb=2,600 psi, Fv=285 psi, E=1.9*10^6 psi (minimum)
Anchor Bolts	F1554 Anchor Bolts, A307 other bolts

Roof, West Roof Joists: N & S
1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam
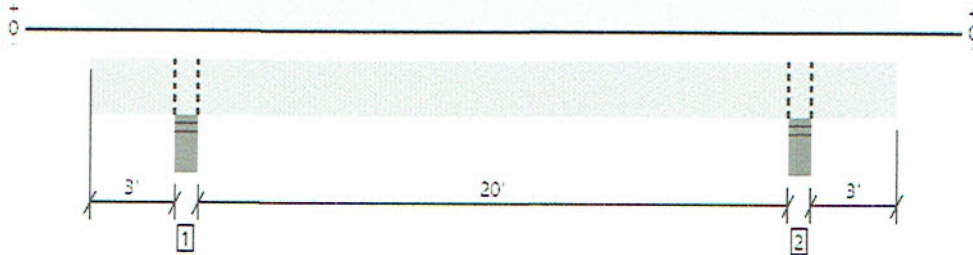
Overall Length: 26' 11"

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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1310 @ 3' 2 3/4"	7305 (5.50")	Passed (18%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	902 @ 22' 8 1/2"	5714	Passed (16%)	1.15	1.0 D + 1.0 S (Adj Spans)
Pos Moment (Ft-lbs)	4692 @ 13' 5 1/2"	9703	Passed (48%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-505 @ 3' 2 3/4"	7479	Passed (7%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.542 @ 13' 5 1/2"	0.682	Passed (L/453)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	1.018 @ 13' 5 1/2"	1.023	Passed (L/241)	--	1.0 D + 1.0 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).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240). Upward deflection on left and right cantilevers exceeds overhang deflection criteria.
- Top Edge Bracing (Lu): Top compression edge must be braced at 26' 11" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 26' 11" o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 19' 8 1/4".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 3' 9".
- Upward deflection on left and right cantilevers exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - SPF	5.50"	5.50"	1.50"	630	679	1309	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	630	679	1309	Blocking

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 26' 11"	N/A	6.8	--	
1 - Uniform (PSF)	0 to 26' 11" (Front)	2'	20.0	25.0	Default Load

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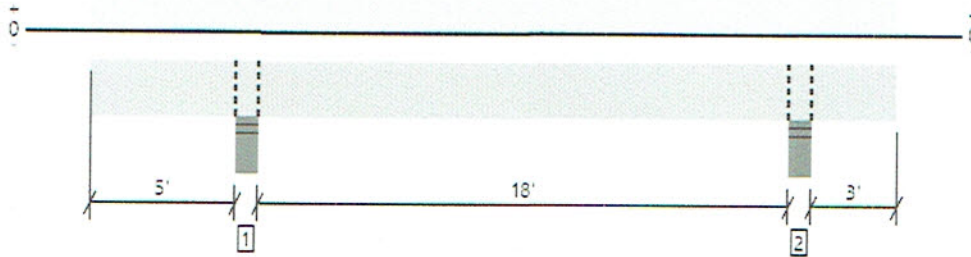
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator.

ForteWEB Software Operator	Job Notes
Evan Apolis CSES, Inc (206) 369-3984 episoen@gmail.com	Zahr

6/22/2020 5:07:44 PM UTC
ForteWEB v2.4, Engine: V8.0.1.5, Data: V7.3.2.0
File Name: Zahr
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Roof, West Roof Joists: Center
1 piece(s) 3 1/8" x 9" 24F-V4 DF Glulam

Overall Length: 26' 11"

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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1452 @ 5' 2 3/4"	7305 (5.50")	Passed (20%)	--	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	850 @ 6' 2 1/2"	5714	Passed (15%)	1.15	1.0 D + 1.0 S (Adj Spans)
Pos Moment (Ft-lbs)	3451 @ 14' 9 9/16"	9703	Passed (36%)	1.15	1.0 D + 1.0 S (Alt Spans)
Neg Moment (Ft-lbs)	-1324 @ 5' 2 3/4"	7479	Passed (18%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.331 @ 14' 6 9/16"	0.615	Passed (L/668)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.594 @ 14' 7 1/8"	0.923	Passed (L/373)	--	1.0 D + 1.0 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).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 26' 11" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 26' 11" o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 16' 10 5/8".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 9 1/8".
- Upward deflection on left cantilever exceeds 0.4".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - SPF	5.50"	5.50"	1.50"	699	753	1452	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	562	619	1181	Blocking

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 26' 11"	N/A	6.8	--	
1 - Uniform (PSF)	0 to 26' 11" (Front)	2'	20.0	25.0	Default Load

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes	
Evan Apolis CSES, Inc (206) 369-3984 episoen@gmail.com	Zahr	

Weyerhaeuser

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File Name: Zahr

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BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC) **2015 NDS**

Beam Description: WEST ROOF UPPER BEAM (EAST BEAM, ABOVE JOISTS)

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	8 ft	Tributary Width:	13 ft	$P@x > (L-x)=$	8 ft
Add'l uniform DL:		DL unit load:	20 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1040 lbs	DL Reaction 2:	1040 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	1300 lbs	SL Reaction 2:	1300 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2340 lbs**	Total Reaction 2:	**2340 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2760 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240
For LL only: Allowed deflection criteria, span/ 360

Max. allowed total defl:	0.4 ft in	Max LL defl:	0.266666667 in
Total defl. * I:	30.0	Required I:	75 in^4
LL defl. * I:	16.6	Required I:	62 in^4
Actual deflections:	TOTAL: 0.166 inches		0.092 inches

Force analysis:

Max. moment:	4680 ft-lb	Max Shear:	2340 lbs

Selected Member:	(1) GLB	5.125	x	7.5

Member properties:	Provided:	Required:
Moment of inertia:	180.2 in^4	74.9 in^4
Section Modulus:	48.0 in^3	20.3 in^3
Section Area:	38.4 in^2	11.5 in^2
Bearing Area:		3.6 in^2
Minimum bearing dimensions:	5.1 x	0.7 inches

ROOF CONNECTIONS

WEST ROOF, EAST BEAM-JOIST CONNECTION — DETAIL D3, CONNECTING R1,R2 & R3

$N = 2,558^{\#}$ $V = 13.82 psf \times 4' \times 13' = 719^{\#}$

$1/2"\emptyset$ THREADED ROD $T_{CAP} = 4,275^{\#} > 2,558^{\#}$ OK

$2,558^{\#} / 560 psi \ (F_{C\perp}) = 4.57 in^2$ BEARING AREA

$3"\emptyset$ WASHER $- 5/8"\emptyset$ HOLE $= 6.76 in^2 > 4.57 in^2$

(2) A34 $_{CAP} = 465^{\#} \times 2 = 930^{\#} > 719^{\#}$ OK $\leftarrow$ NOT USED

Project No. 2020   Date 7/28/20
Project Name ZAHR
Comments
Revision _____ Page R4

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: WEST ROOF CENTRAL WESTBEAM

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	12.5 ft	Tributary Width:	15 ft	P@x > (L-x)=	12.5 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1406 lbs	DL Reaction 2:	1406 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	2344 lbs	SL Reaction 2:	2344 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**3750 lbs**	Total Reaction 2:	**3750 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
F_b	2400 psi	F_b'	2760 psi
F_v	265 psi	F_v'	305 psi
F_c perp	650 psi	F_c perp'	650 psi
E_{min}	0.95 msi	E_{min}'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.625 ft in	Max LL defl:	0.416666667 in
Total defl. * I:	183.1	Required I:	293 in^4
LL defl. * I:	114.4	Required I:	275 in^4
Actual deflections:	TOTAL:	0.407 inches	0.254 inches

Force analysis:

Max. moment:	11719 ft-lb	Max Shear:	3750 lbs

Selected Member:	(1) GLB	**3.125**	x	**12**

Member properties: | **Provided:** | **Required:**
Moment of inertia:	450.0 in^4	293.0 in^4
Section Modulus:	75.0 in^3	51.0 in^3
Section Area:	37.5 in^2	18.5 in^2
Bearing Area:		5.8 in^2
Minimum bearing dimensions:	3.1 x	1.8 inches

BEAM DESIGN (Cantilever, Uniform Load+Concentrated Load)

2015 International Building Code (IBC)(concentrated load at tip of cantilever   **2015 NDS**

Beam Description: SW CANTILEVER BEAM

Enter '1' for snow load:	1
Enter '1' for repetitive member:	
Enter '1' for wet use:	

Geometry and Loads:

Span:	6.5 ft		Tributary Width:	14	ft
DL unit load:	20 psf		LL unit load:	25	psf
Add'l unif. DL:	lb/ft		Add'l unif. LL:		lb/ft
Concentrated DL:	lbs		Concentrated LL:		lbs
Cantilever a:	7 ft				
			Total point load:	0	lbs
DL uniform load:	280 lb/ft		Max DL reaction:	3,925	lbs
LL uniform load:	350 lb/ft		Max LL reaction:	4,907	lbs
Total load:	630 lb/ft		Max Total reaction:	8,832	lbs
			Rsmall	-327	lbs

Material Properties:

E	1.8×10^6 psi		E'	1.8×10^6 psi
F_b	2400 psi		F_b'	3003 psi
F_v	265 psi		F_v'	305 psi
$F_c\ perp$	650 psi		$F_c\ perp'$	650 psi
E_{min}	0.93×10^6 psi		E_{min}'	0.93×10^6 psi

Deflection analysis:

For total load: Allowed deflection criteria, span/			240	
For LL only: Allowed deflection criteria, span/			360	
Max. allowed total defl:	0.325 in	Max LL defl:	0.2166667 in	
Cantilever Deflections, TL:	0.7 in	LL:	0.4666667 in	
Total Required I:	560 in^4	LL Required I:	484 in^4	
Actual midspan δ: TOTAL:	0.035 inches	LL	0.011 inches	
Actual Cantilever δ: TOTAL:	0.531 inches	LL	0.306 inches	

Force analysis:

		Max Shear:	4422 lbs
Max. moment:	15435 ft-lb	Shear @ d =	3792 lbs

Selected Member:	(1) GLB	**5.125**	x	**12**

Member properties:	Provided:		Required:	
Moment of inertia:	738.0 in^4		559.9 in^4	
Section Modulus:	123.0 in^3		61.7 in^3	
Section Area:	61.5 in^2		18.7 in^2	
Bearing Area:			13.6 in^2	
Minimum bearing dimensions:	5.1	x	2.7	inches

Post Design (Combined Axial and Moment Loading)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: POST SUPPORTING RG

Enter '1' for **wind load**:

Enter '1' for **repetitive member**:

Enter '1' for **wet use**:

Geometry and loads:

Height	8 ft		$w(d)$	23.7 plf
P	8832 lbs		$w(b)$	0 plf
$Le(d)$	8 ft		$Le(b)$	1 ft

Material Properties:

$Fb1$	900 psi	$Fb(d)'$	900 psi
$Fb2$	900 psi	$Fb(b)'$	900 psi
Fc	1350 psi	Fc'	998 psi
E	1.6×10^6 psi	E'	1.6×10^6 psi
$Emin$	0.58×10^6 psi	$Emin'$	0.58×10^6 psi

Selected Member:	DF #2	3.5	x	5.5
		b		d

Member properties:

		Variables:	
Section Modulus (d):	17.6 in^3	$Rb(d)$	3.33
Section Modulus (b):	11.2 in^3	$Rb(b)$	2.32
Section Area:	19.3 in^2	c	0.8

Member stresses: Provided   Required

$FcE(d)$	1565 psi	>	fc	459 psi
$FcE(b)$	40558 psi	>	fc	459 psi
FbE	62661 psi	>	$fb(d)$	129 psi
FbE	62661 psi	>	$fb(b)$	0 psi

Bending and Axial Compression Check:

NDS 2010 EQ 3.9-3	0.41	<	1.0

BEAM DESIGN (Cantilever, Uniform Load+Concentrated Load)

2015 International Building Code (IBC)(concentrated load at tip of cantilever   **2015 NDS**

Beam Description: *N W CANTILEVER BEAM (N-S)*

Enter '1' for snow load:	1
Enter '1' for repetitive member:	
Enter '1' for wet use:	

Geometry and Loads:

Span:	8.75 ft	Tributary Width:	14 ft
DL unit load:	20 psf	LL unit load:	25 psf
Add'l unif. DL:	lb/ft	Add'l unif. LL:	lb/ft
Concentrated DL:	lbs	Concentrated LL:	lbs
Cantilever a:	3.5 ft		
		Total point load:	0 lbs
DL uniform load:	280 lb/ft	Max DL reaction:	2,401 lbs
LL uniform load:	350 lb/ft	Max LL reaction:	3,001 lbs
Total load:	630 lb/ft	Max Total reaction:	5,402 lbs
		Rsmall	2315 lbs

Material Properties:

E	1.8×10^6 psi	E'	1.8×10^6 psi
Fb	2400 psi	Fb'	2991 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.93×10^6 psi	Emin'	0.93×10^6 psi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.4375 in	Max LL defl:	0.2916667 in
Cantilever Deflections, TL:	0.35 in	LL:	0.2333333 in
Total Required I:	118 in^4	LL Required I:	117 in^4
Actual midspan δ: TOTAL:	0.070 inches	LL	0.035 inches
Actual Cantilever δ: TOTAL:	0.043 inches	LL	0.037 inches

Force analysis:

		Max Shear:	3197 lbs
Max. moment:	5458 ft-lb	Shear @ d =	2567 lbs

Selected Member:	(1) GLB	**5.125**	x	**12**

Member properties:

	Provided:		Required:
Moment of inertia:	738.0 in^4		117.5 in^4
Section Modulus:	123.0 in^3		21.9 in^3
Section Area:	61.5 in^2		12.6 in^2
Bearing Area:			8.3 in^2
Minimum bearing dimensions:	5.1	x	1.6 inches

BEAM DESIGN (Cantilever, Uniform Load+Concentrated Load)

2015 International Building Code (IBC)(concentrated load at tip of cantilever   **2015 NDS**

Beam Description: *NE CANT. BEAM SUPPORTING R8 (E-W)*

Enter '1' for snow load:	1
Enter '1' for repetitive member:	
Enter '1' for wet use:	

Geometry and Loads:

Span:	9.5 ft	Tributary Width:	2 ft	
DL unit load:	20 psf	LL unit load:	25 psf	
Add'l unif. DL:	lb/ft	Add'l unif. LL:	lb/ft	
Concentrated DL:	2401 lbs	Concentrated LL:	3001 lbs	*REF R8*
Cantilever a:	5.25 ft			
		Total point load:	5402 lbs	
DL uniform load:	40 lb/ft	Max DL reaction:	4,186 lbs	
LL uniform load:	50 lb/ft	Max LL reaction:	5,232 lbs	
Total load:	90 lb/ft	Max Total reaction:	9,418 lbs	
		Rsmall	-2688 lbs	

Material Properties:

E	2×10^6 psi	E'	2×10^6 psi
Fb	2900 psi	Fb'	3278 psi
Fv	290 psi	Fv'	334 psi
Fc perp	750 psi	Fc perp'	750 psi
Emin	0×10^6 psi	Emin'	0×10^6 psi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.475 in	Max LL defl:	0.3166667 in
Cantilever Deflections, TL:	0.525 in	LL:	0.35 in
Total Required I:	910 in^4	LL Required I:	1,044 in^4
Actual midspan δ:	TOTAL: 0.042 inches	LL	0.004 inches
Actual Cantilever δ:	TOTAL: 0.398 inches	LL	0.304 inches

Force analysis:

		Max Shear:	5875 lbs
Max. moment:	29601 ft-lb	Shear @ d =	5770 lbs

Selected Member:	(1) PSL	**5.25**	x	**14**

Member properties:	Provided:		Required:	
Moment of inertia:	1,200.5 in^4		1,043.9 in^4	
Section Modulus:	171.5 in^3		108.3 in^3	
Section Area:	73.5 in^2		25.9 in^2	
Bearing Area:			12.6 in^2	
Minimum bearing dimensions:	5.3	x	2.4 inches	

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: *BEAM R9 AS WIND GIRT*

Fully Supported:	1	Snow Load:		Wind Load:	1
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	15 ft	Tributary Width:	5 ft	P@x > (L-x)=	15 ft
Add'l uniform DL:		DL unit load:		Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:	23.7 psf	Concentrated WL:	

DL Reaction 1:	0 lbs	DL Reaction 2:	0 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	889 lbs	WL Reaction 2:	889 lbs	
Total Reaction 1:	**889 lbs**	**Total Reaction 2:**	**889 lbs**	

Material Properties:

E	1.7 msi	E'	1.7 msi
Fb	1550 psi	Fb'	2726 psi
Fv	230 psi	Fv'	368 psi
Fc perp	560 psi	Fc perp'	560 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/   240
For LL only: Allowed deflection criteria, span/   360

Max. allowed total defl:	0.75 ft in	Max LL defl:	0.5 in
Total defl. * I:	79.4	Required I:	106 in^4
LL defl. * I:	0.0	Required I:	0 in^4
Actual deflections:	TOTAL:	0.590 inches	0.000 inches

Force analysis:

Max. moment:	3333 ft-lb	Max Shear:	889 lbs

Selected Member:	(1) GLB	12	x	5.125

Member properties:	Provided:	Required:
Moment of inertia:	134.6 in^4	105.9 in^4
Section Modulus:	52.5 in^3	14.7 in^3
Section Area:	61.5 in^2	3.6 in^2
Bearing Area:		1.6 in^2
Minimum bearing dimensions:	12.0 x	0.1 inches

Post Design (Combined Axial and Moment Loading)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: POST @ R9 BACKSPAN

Enter '1' for **wind load**:	1
Enter '1' for **repetitive member**:	
Enter '1' for **wet use**:	

Geometry and loads:

Height	13 ft		w(d)	72.923077 plf	
P	900 lbs		w(b)	0 plf	
Le(d)	13 ft		Le(b)	1 ft	

Material Properties:

Fb1	900 psi	Fb(d)'	1035 psi	
Fb2	900 psi	Fb(b)'	1035 psi	
Fc	1350 psi	Fc'	536 psi	
E	1.6 x10^6psi	E'	1.6 x10^6psi	
Emin	0.58 x10^6psi	Emin'	0.58 x10^6psi	

Selected Member:	DF #2	5.5	x	5.5
		b		d

Member properties: **Variables:**

Section Modulus (d):	27.7 in^3	Rb(d)	5.33
Section Modulus (b):	27.7 in^3	Rb(b)	1.48
Section Area:	30.3 in^2	c	0.8

Member stresses: Provided   Required

FcE(d)	593 psi	>	fc	30 psi
FcE(b)	100153 psi	>	fc	30 psi
FbE	24538 psi	>	fb(d)	667 psi
FbE	24538 psi	>	fb(b)	0 psi

Bending and Axial Compression Check:

NDS 2010 EQ 3.9-3	0.68	<	1.0

Post Design (Combined Axial and Moment Loading)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: SOUTH POSTS

Enter '1' for <u>wind load</u>:		1
Enter '1' for <u>repetitive member</u>:		
Enter '1' for <u>wet use</u>:		

Geometry and loads:

Height	13.5 ft		$w(d)$	118.5 plf
P	400 lbs		$w(b)$	0 plf
$Le(d)$	13.5 ft		$Le(b)$	1 ft

Material Properties:

$Fb1$	2400 psi	$Fb(d)'$	2760 psi
$Fb2$	2400 psi	$Fb(b)'$	2760 psi
Fc	2500 psi	Fc'	804 psi
E	1.8 x10^6 psi	E'	1.8 x10^6 psi
$Emin$	0.915 x10^6 psi	$Emin'$	0.915 x10^6 psi

Selected Member: PSL   3.5   x   5.5

                                                          b   d

Member properties:		Variables:	
Section Modulus (d):	17.6 in^3	$Rb(d)$	4.33
Section Modulus (b):	11.2 in^3	$Rb(b)$	2.32
Section Area:	19.3 in^2	c	0.8

Member stresses: Provided				Required	
$FcE(d)$	867 psi	>	fc	21 psi
$FcE(b)$	63983 psi	>	fc	21 psi
FbE	58579 psi	>	$fb(d)$	1836 psi
FbE	58579 psi	>	$fb(b)$	0 psi

Bending and Axial Compression Check:

NDS 2010 EQ 3.9-3   0.68   <   1.0

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: INTERIOR HEADERS (3 TYPICAL HEADER)

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	5 ft	Tributary Width:	15.5 ft	$P@x > (L-x)=$	4 ft
Add'l uniform DL:		DL unit load:	20 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	775 lbs	DL Reaction 2:	775 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	969 lbs	SL Reaction 2:	969 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**1744 lbs**	Total Reaction 2:	**1744 lbs**	

Material Properties:

E	1.6 msi	E'	1.6 msi
Fb	900 psi	Fb'	1346 psi
Fv	180 psi	Fv'	207 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.58 msi	Emin'	0.58 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.25 ft in	Max LL defl:	0.166666667 in
Total defl. * I:	6.1	Required I:	25 in^4
LL defl. * I:	3.4	Required I:	20 in^4
Actual deflections:	TOTAL:	0.055 inches	0.031 inches

Force analysis:

Max. moment:	2180 ft-lb	Max Shear:	1744 lbs

Selected Member:	(1) DF #2	3.5	x	7.25

Member properties:	Provided:	Required:
Moment of inertia:	111.1 in^4	24.5 in^4
Section Modulus:	30.7 in^3	19.4 in^3
Section Area:	25.4 in^2	12.6 in^2
Bearing Area:		2.8 in^2
Minimum bearing dimensions:	3.5 x	0.8 inches

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: VALLEY BEAM

Fully Supported:	1	Snow Load:	1	Wind Load:
Repetitive Member:		P.T. Lumber:		Wet Use:

Geometry and Loads:

Span:	19 ft	Tributary Width:	5.06 ft	$P@x > (L-x)=$	19 ft
Add'l uniform DL:		DL unit load:	20 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	961 lbs	DL Reaction 2:	961 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	1202 lbs	SL Reaction 2:	1202 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2163 lbs**	Total Reaction 2:	**2163 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2760 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/   240

For LL only: Allowed deflection criteria, span/   360

Max. allowed total defl:	0.95 ft in	Max LL defl:	0.633333333 in
Total defl. * I:	370.9	Required I:	390 in^4
LL defl. * I:	206.1	Required I:	325 in^4
Actual deflections:	TOTAL: 0.905 inches		0.503 inches

Force analysis:

Max. moment:	10275 ft-lb	Max Shear: 2163 lbs

Selected Member:	(1) GLB	**6.75**	x	9

Member properties:	Provided:	Required:
Moment of inertia:	410.1 in^4	390.4 in^4
Section Modulus:	91.1 in^3	44.7 in^3
Section Area:	60.8 in^2	10.6 in^2
Bearing Area:		3.3 in^2
Minimum bearing dimensions:	6.8 x	0.5 inches

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: *GARAGE DOOR HEADERS*

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	9.5 ft	Tributary Width:	13.5 ft	$P@x > (L-x)=$	9.5 ft
Add'l uniform DL:		DL unit load:	20 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1283 lbs	DL Reaction 2:	1283 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	1603 lbs	SL Reaction 2:	1603 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2886 lbs**	Total Reaction 2:	**2886 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2760 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.475 ft in	Max LL defl:	0.316666667 in
Total defl. * I:	61.9	Required I:	130 in^4
LL defl. * I:	34.4	Required I:	109 in^4
Actual deflections:	TOTAL: 0.326 inches		0.181 inches

Force analysis:

Max. moment:	6853 ft-lb	Max Shear:	2886 lbs

Selected Member:	(1) GLB	**3.125**	x	**9**

Member properties:	Provided:	Required:
Moment of inertia:	189.8 in^4	130.2 in^4
Section Modulus:	42.2 in^3	29.8 in^3
Section Area:	28.1 in^2	14.2 in^2
Bearing Area:		4.4 in^2
Minimum bearing dimensions:	3.1 x	1.4 inches

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: *GARAGE CLERESTORY HEADERS*

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	10 ft	Tributary Width:	13.5 ft	$P@x > (L-x)=$	9.5 ft
Add'l uniform DL:		DL unit load:	20 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1350 lbs	DL Reaction 2:	1350 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	1688 lbs	SL Reaction 2:	1688 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**3038 lbs**	Total Reaction 2:	**3038 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
F_b	2400 psi	F_b'	2760 psi
F_v	265 psi	F_v'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/   240
For LL only: Allowed deflection criteria, span/   360

Max. allowed total defl:	0.5 ft in	Max LL defl:	0.333333333 in
Total defl. * I:	75.9	Required I:	152 in^4
LL defl. * I:	42.2	Required I:	127 in^4
Actual deflections:	TOTAL:	0.421 inches	0.234 inches

Force analysis:

Max. moment:	7594 ft-lb	Max Shear:	3038 lbs

Selected Member:	(1) GLB	**5.125**	x	**7.5**

Member properties:	Provided:		Required:	
Moment of inertia:	180.2 in^4		151.9 in^4	
Section Modulus:	48.0 in^3		33.0 in^3	
Section Area:	38.4 in^2		15.0 in^2	
Bearing Area:			4.7 in^2	
Minimum bearing dimensions:	5.1	x	0.9 inches	

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: WEST BEAM (SOUTH)

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	10 ft	Tributary Width:	10.5 ft	P@x > (L-x)=	6.5 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	3925 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	4907 lbs
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	3339 lbs	DL Reaction 2:	2161 lbs	Note: Design automatically uses
LL Reaction 1:	2100 lbs	LL Reaction 2:	2100 lbs	load combinations
SL Reaction 1:	3190 lbs	SL Reaction 2:	1717 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**7306 lbs**	Total Reaction 2:	**5024 lbs**	

Material Properties:

E	2 msi	E'	2 msi
F_b	2900 psi	F_b'	3339 psi
F_v	290 psi	F_v'	334 psi
F_c perp	625 psi	F_c perp'	625 psi
E_{min}	0.914 msi	E_{min}'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		600	
Max. allowed total defl:	0.5 ft in	Max LL defl:	0.2 in
Total defl. * I:	205.8	Required I:	412 in^4
LL defl. * I:	125.5	Required I:	627 in^4
Actual deflections:	TOTAL: 0.281 inches		0.171 inches

Force analysis:

Max. moment:	22034 ft-lb	Max Shear:	7306 lbs

Selected Member:	(1) PSL	**5.25**	x	**11.875**

Member properties:	Provided:	Required:
Moment of inertia:	732.6 in^4	627.5 in^4
Section Modulus:	123.4 in^3	79.2 in^3
Section Area:	62.3 in^2	32.9 in^2
Bearing Area:		11.7 in^2
Minimum bearing dimensions:	5.3 x	2.2 inches

BEAM DESIGN (Cantilever, Uniform Load+Concentrated Load)

2015 International Building Code (IBC)(concentrated load at tip of cantilever   **2015 NDS**

Beam Description: SOUTH BEAM OVER FIRE PLACE

Enter '1' for snow load:		1
Enter '1' for repetitive member:		
Enter '1' for wet use:		

Geometry and Loads:

Span:	16 ft		Tributary Width:	2 ft
DL unit load:	30 psf		LL unit load:	65 psf
Add'l unif. DL:	64 lb/ft		Add'l unif. LL:	lb/ft
Concentrated DL:	3339 lbs		Concentrated LL:	3968 lbs
Cantilever a:	4 ft			
			Total point load:	7306.5 lbs
DL uniform load:	124 lb/ft		Max DL reaction:	5,724 lbs
LL uniform load:	130 lb/ft		Max LL reaction:	6,584 lbs
Total load:	254 lb/ft		Max Total reaction:	12,308 lbs
			Rsmall	78 lbs

Material Properties:

E	1.8×10^6 psi		E'	1.8×10^6 psi
F_b	2400 psi		F_b'	2801 psi
F_v	265 psi		F_v'	305 psi
F_c perp	650 psi		F_c perp'	650 psi
E_{min}	0.93×10^6 psi		E_{min}'	0.93×10^6 psi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240		
For LL only: Allowed deflection criteria, span/		480		
Max. allowed total defl:	0.8 in		Max LL defl:	0.4 in
Cantilever Deflections, TL:	0.4 in		LL:	0.2 in
Total Required I:	1,351 in^4		LL Required I:	2,158 in^4
Actual midspan δ:	TOTAL: 0.143 inches		LL	0.043 inches
Actual Cantilever δ:	TOTAL: 0.217 inches		LL	0.173 inches

Force analysis:

		Max Shear:	8323 lbs
Max. moment:	31258 ft-lb	Shear @ d =	7942 lbs

Selected Member: (1) GLB   **5.125**   x   **18**

Member properties:	Provided:		Required:	
Moment of inertia:	2,490.8 in^4		2,157.8 in^4	
Section Modulus:	276.8 in^3		133.9 in^3	
Section Area:	92.3 in^2		39.1 in^2	
Bearing Area:			18.9 in^2	
Minimum bearing dimensions:	5.1	x	3.7 inches	

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: SOUTH DOOR HEADER

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	20 ft	Tributary Width:	2 ft	$P@x > (L-x)=$	20 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	300 lbs	DL Reaction 2:	300 lbs	Note: Design automatically uses
LL Reaction 1:	800 lbs	LL Reaction 2:	800 lbs	load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**1100 lbs**	Total Reaction 2:	**1100 lbs**	

Material Properties:

E	2 msi	E'	2 msi
Fb	2900 psi	Fb'	3339 psi
Fv	290 psi	Fv'	334 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.914 msi	Emin'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		600	
Max. allowed total defl:	1 ft in	Max LL defl:	0.4 in
Total defl. * I:	198.0	Required I:	198 in^4
LL defl. * I:	144.0	Required I:	360 in^4
Actual deflections:	TOTAL:	0.405 inches	0.295 inches

Force analysis:

Max. moment:	5500 ft-lb	Max Shear:	1100 lbs

Selected Member:	(1) PSL	**3.5**	x	**11.875**

Member properties:	Provided:	Required:
Moment of inertia:	488.4 in^4	360.0 in^4
Section Modulus:	82.3 in^3	19.8 in^3
Section Area:	41.6 in^2	4.9 in^2
Bearing Area:		1.8 in^2
Minimum bearing dimensions:	3.5 x	0.5 inches
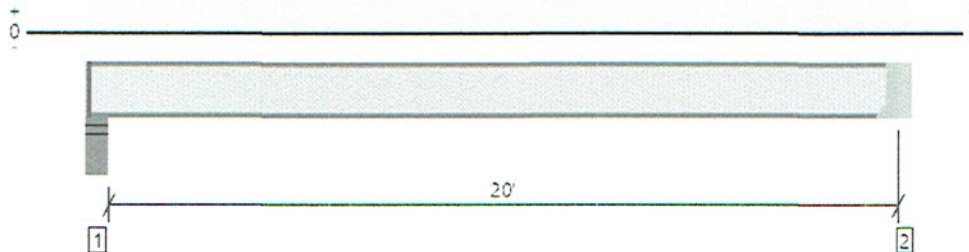
Overall Length: 20' 9"

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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	736 @ 20' 5 1/2"	1060 (1.75")	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	736 @ 20' 5 1/2"	1655	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3697 @ 10' 5"	4215	Passed (88%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.512 @ 10' 5"	0.502	Passed (L/471)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.704 @ 10' 5"	1.004	Passed (L/342)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	31	Any	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
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 structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	5.50"	4.25"	1.75"	208	556	764	1 1/4" Rim Board
2 - Hanger on 11 7/8" SPF beam	3.50"	Hanger¹	1.75" / - ²	207	551	758	See note ¹

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 3" o/c	
Bottom Edge (Lu)	20' 4" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	IUS2.37/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 9"	16"	15.0	40.0	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
Evan Apolis CSES, Inc (206) 369-3984 episoen@gmail.com	Zahr

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: CENTRAL HEADERS

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	4 ft	Tributary Width:	16 ft	P@x > (L-x)=	4 ft
Add'l uniform DL:		DL unit load:	30 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	960 lbs	DL Reaction 2:	960 lbs	Note: Design automatically uses
LL Reaction 1:	1280 lbs	LL Reaction 2:	1280 lbs	load combinations
SL Reaction 1:	800 lbs	SL Reaction 2:	800 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2520 lbs**	Total Reaction 2:	**2520 lbs**	

Material Properties:

E	1.6 msi	E'	1.6 msi
Fb	900 psi	Fb'	1346 psi
Fv	180 psi	Fv'	207 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.58 msi	Emin'	0.58 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		600	
Max. allowed total defl:	0.2 ft in	Max LL defl:	0.08 in
Total defl. * I:	5.5	Required I:	27 in^4
LL defl. * I:	3.7	Required I:	47 in^4
Actual deflections:	TOTAL:	0.049 inches	0.034 inches

Force analysis:

Max. moment:	2520 ft-lb	Max Shear:	2520 lbs

Selected Member:	(1) DF #2	**3.5**	x	**7.25**

Member properties:	Provided:	Required:	
Moment of inertia:	111.1 in^4	46.8 in^4	
Section Modulus:	30.7 in^3	22.5 in^3	
Section Area:	25.4 in^2	18.3 in^2	
Bearing Area:		4.0 in^2	
Minimum bearing dimensions:	3.5	x	1.2 inches

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC) **2015 NDS**

Beam Description: MASTER BED/BATH BEAMS

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	20 ft	Tributary Width:	1.33 ft	$P@x > (L-x)=$	18 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	1680 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	2800 lbs
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1712 lbs	DL Reaction 2:	368 lbs
LL Reaction 1:	532 lbs	LL Reaction 2:	532 lbs
SL Reaction 1:	2520 lbs	SL Reaction 2:	280 lbs
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs
Total Reaction 1:	**4232 lbs**	Total Reaction 2:	**977 lbs**

Note: Design automatically uses load combinations

Material Properties:

E	2 msi	E'	2 msi
Fb	2900 psi	Fb'	3339 psi
Fv	290 psi	Fv'	334 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.914 msi	Emin'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240
For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	1 ft in	Max LL defl:	0.5 in
Total defl. * I:	327.3	Required I:	327 in^4
LL defl. * I:	218.1	Required I:	436 in^4
Actual deflections:	TOTAL: 0.670 inches		0.446 inches

Force analysis:

Max. moment:	8317 ft-lb	Max Shear:	4232 lbs

Selected Member:	(1) PSL	**3.5**	x	**11.875**

Member properties:	Provided:	Required:
Moment of inertia:	488.4 in^4	436.1 in^4
Section Modulus:	82.3 in^3	29.9 in^3
Section Area:	41.6 in^2	19.0 in^2
Bearing Area:		6.8 in^2
Minimum bearing dimensions:	3.5 x	1.9 inches

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: SAUNA BEAM

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	7 ft	Tributary Width:	16 ft	$P@x > (L-x)=$	5.5 ft
Add'l uniform DL:		DL unit load:	30 psf	Concentrated DL:	368 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	532 lbs
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	280 lbs
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1969 lbs	DL Reaction 2:	1759 lbs	Note: Design automatically uses
LL Reaction 1:	2658 lbs	LL Reaction 2:	2354 lbs	load combinations
SL Reaction 1:	1620 lbs	SL Reaction 2:	1460 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**5178 lbs**	Total Reaction 2:	**4619 lbs**	

Material Properties:

E	2 msi	E'	2 msi	
Fb	2900 psi	Fb'	3339 psi	
Fv	290 psi	Fv'	334 psi	
Fc perp	625 psi	Fc perp'	625 psi	
Emin	0.914 msi	Emin'	0.914 msi	

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240
For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.35 ft in	Max LL defl:	0.175 in
Total defl. * I:	45.5	Required I:	130 in^4
LL defl. * I:	31.2	Required I:	178 in^4
Actual deflections:	TOTAL: 0.093 inches		0.064 inches

Force analysis:

Max. moment:	8468 ft-lb	Max Shear:	5178 lbs

Selected Member:	(1) PSL	**3.5**	x	**11.875**

Member properties:	Provided:	Required:
Moment of inertia:	488.4 in^4	178.1 in^4
Section Modulus:	82.3 in^3	30.4 in^3
Section Area:	41.6 in^2	23.3 in^2
Bearing Area:		8.3 in^2
Minimum bearing dimensions:	3.5 x	2.4 inches

Main Floor, Beam Under North Wall
1 piece(s) 7" x 11 7/8" 2.0E Parallam® PSL

Overall Length: 20' 9"
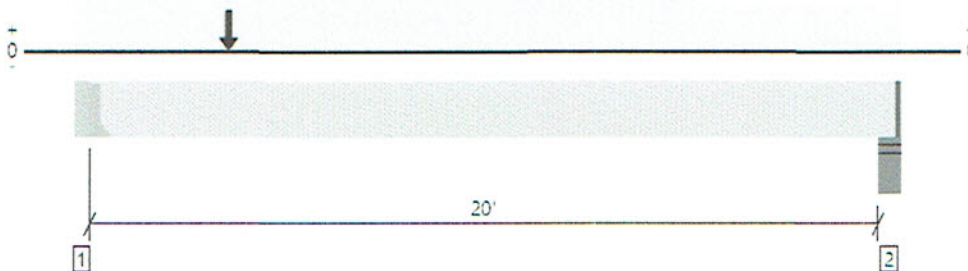
All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	7435 @ 3 1/2"	7435 (1.70")	Passed (100%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	7271 @ 1' 3 3/8"	18481	Passed (39%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	24721 @ 3' 9"	45776	Passed (54%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.308 @ 8' 11 3/4"	0.503	Passed (L/784)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.845 @ 9' 6 13/16"	1.006	Passed (L/286)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

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

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Hanger on 11 7/8" SPF beam	3.50"	Hanger¹	1.70"	4235	552	3241	8028	See note ¹
2 - Stud wall - SPF	5.50"	4.25"	1.50"	1711	554	673	2938	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	20' 4" o/c	
Bottom Edge (Lu)	20' 4" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	HGUS7.25/10	4.00"	N/A	46-16d	16-16d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	3 1/2" to 20' 7 3/4"	N/A	26.0	--	--	
1 - Uniform (PSF)	0 to 20' 9" (Front)	1' 4"	15.0	40.0	-	Default Load
2 - Point (lb)	3' 9" (Front)	N/A	3131	-	3914	
3 - Uniform (PLF)	0 to 15' 7" (Front)	N/A	120.0	-	-	

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Evan Apolis CSES, Inc (206) 369-3984 episoen@gmail.com	Zahr

Weyerhaeuser

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: *BEDROOM 1 RIM (WEST)*

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	6.5 ft	Tributary Width:	2 ft	P@x > (L-x)=	6.5 ft
Add'l uniform DL:	120 lbs/ft	DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	488 lbs	DL Reaction 2:	488 lbs	Note: Design automatically uses
LL Reaction 1:	260 lbs	LL Reaction 2:	260 lbs	load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**748 lbs**	Total Reaction 2:	**748 lbs**	

Material Properties:

E	2 msi	E'	2 msi
F_b	2600 psi	F_b'	2604 psi
F_v	285 psi	F_v'	285 psi
F_c perp	750 psi	F_c perp'	750 psi
E_{min}	1.016 msi	E_{min}'	1.016 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		480	
Max. allowed total defl:	0.325 ft in	Max LL defl:	0.1625 in
Total defl. * I:	4.6	Required I:	14 in^4
LL defl. * I:	1.6	Required I:	10 in^4
Actual deflections:	TOTAL: 0.019 inches		0.007 inches

Force analysis:

Max. moment:	1215 ft-lb	Max Shear:	748 lbs

Selected Member:	(1) LVL	**1.75**	x	**11.875**

Member properties:	Provided:	Required:
Moment of inertia:	244.2 in^4	14.2 in^4
Section Modulus:	41.1 in^3	5.6 in^3
Section Area:	20.8 in^2	3.9 in^2
Bearing Area:		1.0 in^2
Minimum bearing dimensions:	1.8 x	0.6 inches

MEMBER REPORT

Main Floor, East Bedroom 1 Beam
1 piece(s) 7" x 11 7/8" 2.0E Parallam® PSL

OK ~~FAILED~~
M 10-A
STRESS CASE ONLY - Ω = 2.5

Overall Length: 14' 9"
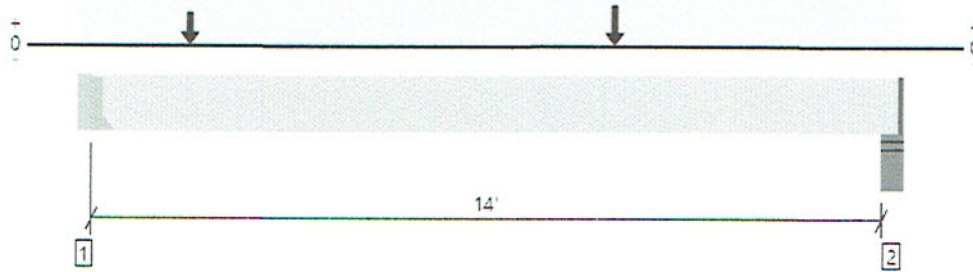
All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	13136 @ 3 1/2"	13136 (3.00")	Passed (100%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	11386 @ 1' 3 3/8"	18481	Passed (62%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	27635 @ 7' 4 5/16"	39805	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.457 @ 7' 6 3/8"	0.353	Failed (L/371)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.779 @ 7' 5"	0.706	Failed (L/218)	--	1.0 D + 0.525 E + 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/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -354 lbs uplift at support located at 14' 5". Strapping or other restraint may be required.
- 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	Floor Live	Snow	Seismic	Total	
1 - Hanger on 11 7/8" SPF beam	3.50"	Hanger¹	3.00"	6642	3868	3580	2083/-2083	16173/-2083	See note ¹
2 - Stud wall - SPF	5.50"	4.25"	3.32"	3960	3469	1761	3900/-3900	13090/-3900	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	14' 4" o/c	
Bottom Edge (Lu)	14' 4" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

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

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

| Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	3 1/2" to 14' 7 3/4"	N/A	26.0	--	--	--	
1 - Uniform (PSF)	0 to 14' 9" (Front)	11' 6"	15.0	40.0	-	-	Default Load
2 - Uniform (PLF)	0 to 14' 9" (Front)	N/A	120.0	-	-	-	
3 - Point (lb)	9' 6" (Front)	N/A	1680	-	2100	5983	Seismic x2.5
4 - Point (lb)	2' (Front)	N/A	4235	552	3241	-	

Main Floor, East Bedroom 1 Beam
1 piece(s) 7" x 11 7/8" 2.0E Parallam® PSL
DEFLECTION CASE
Overall Length: 14' 9"
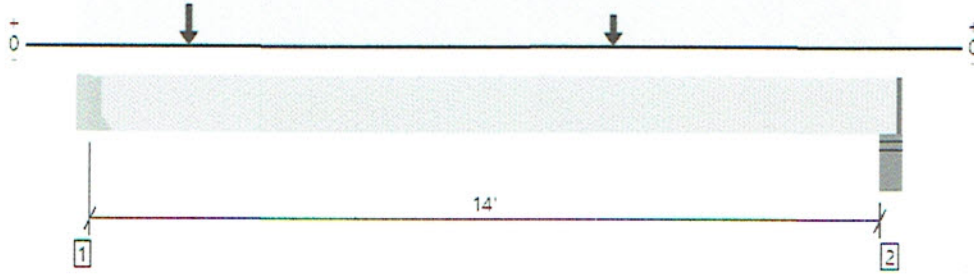
M10-B

14'

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

Design Results

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	12480 @ 3 1/2"	12480 (2.85")	Passed (100%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	11386 @ 1' 3 3/8"	18481	Passed (62%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	27635 @ 7' 4 5/16"	39805	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.365 @ 7' 5 1/8"	0.471	Passed (L/465)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.687 @ 7' 4 3/16"	0.706	Passed (L/247)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Member should be side-loaded from both sides of the member or braced to prevent rotation.

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

Supports

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Seismic	Total	
1 - Hanger on 11 7/8" SPF beam	3.50"	Hanger¹	2.85"	6642	3868	3580	833/-833	14923/-833	See note ¹
2 - Stud wall - SPF	5.50"	4.25"	2.90"	3960	3469	1761	1560/-1560	10750/-1560	1 1/4" Rim Board

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

Lateral Bracing

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	14' 4" o/c	
Bottom Edge (Lu)	14' 4" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

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

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

Vertical Loads

| Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	3 1/2" to 14' 7 3/4"	N/A	26.0	--	--	--	
1 - Uniform (PSF)	0 to 14' 9" (Front)	11' 6"	15.0	40.0	-	-	Default Load
2 - Uniform (PLF)	0 to 14' 9" (Front)	N/A	120.0	-	-	-	
3 - Point (lb)	9' 6" (Front)	N/A	1680	-	2100	2393	
4 - Point (lb)	2' (Front)	N/A	4235	552	3241	-	

MEMBER REPORT

Main Floor, North Cantilever Beam

1 piece(s) 5 1/4" x 11 7/8" 2.0E Parallam® PSL

An excessive uplift of -1000 lbs at support located at 13' 6 3/4" failed this product. *OHAY BY DETAILING* (handwritten)
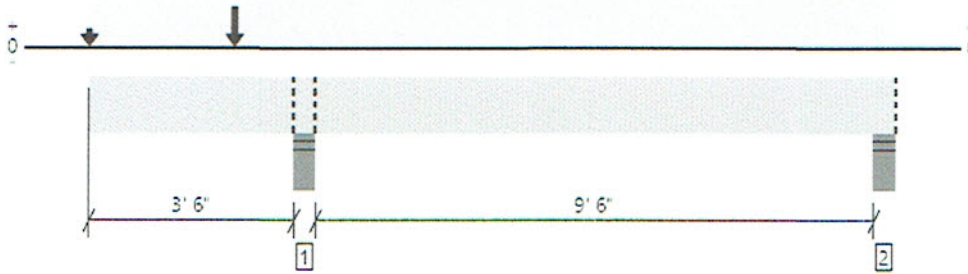
OR FAILED (handwritten)
MII (handwritten)

Overall Length: 13' 10 3/4"

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)	17496 @ 3' 8 5/8"	17227 (5.25")	Passed (102%)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	11684 @ 2' 6 1/8"	12053	Passed (97%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-16763 @ 3' 8 5/8"	29854	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.167 @ 0	0.200	Passed (2L/534)	--	1.0 D + 0.525 E + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.352 @ 0	0.372	Passed (2L/254)	--	1.0 D + 0.525 E + 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/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/0.2") and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports

Supports	Bearing Length			Loads to Supports (lbs)					Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Seismic	Total	
1 - Stud wall - PSL	5.25"	5.25"	5.33"	9720	4705	4023	2341/-2341	20789/-2341	Blocking
2 - Stud wall - SPF	5.50"	5.50"	1.50"	-235	-577	-443	258/-258	258/-1513	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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 11" o/c	
Bottom Edge (Lu)	13' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	0 to 13' 10 3/4"	N/A	19.5	--	--	--	
1 - Uniform (PSF)	0 to 13' 10 3/4" (Front)	2'	75.0	-	-	-	Default Load
2 - Point (lb)	0 (Front)	N/A	488	260	-	-	
3 - Point (lb)	2' 6" (Front)	N/A	6642	3868	3580	2083	

Weyerhaeuser Notes

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

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: *DECK BEAM*

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	23 ft	Tributary Width:	4 ft	P@x > (L-x)=	23 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	690 lbs	DL Reaction 2:	690 lbs	Note: Design automatically uses
LL Reaction 1:	2760 lbs	LL Reaction 2:	2760 lbs	load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**3450 lbs**	Total Reaction 2:	**3450 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2334 psi
Fv	265 psi	Fv'	265 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/   240
For LL only: Allowed deflection criteria, span/   360

Max. allowed total defl:	1.15 ft in	Max LL defl:	0.766666667 in
Total defl. * I:	1049.4	Required I:	913 in^4
LL defl. * I:	839.5	Required I:	1,095 in^4
Actual deflections:	TOTAL:	0.931 inches	0.744 inches

Force analysis:

Max. moment:	19838 ft-lb	Max Shear:	3450 lbs

Selected Member:	(1) GLB	5.5	x	13.5	

Member properties:	Provided:	Required:	
Moment of inertia:	1,127.7 in^4	1,095.0 in^4	
Section Modulus:	167.1 in^3	102.0 in^3	
Section Area:	74.3 in^2	19.5 in^2	
Bearing Area:		5.3 in^2	
Minimum bearing dimensions:	5.5	x	1.0 inches

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: DECK JOISTS

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:	1	P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	10 ft	Tributary Width:	1.33 ft	P@x > (L-x)=	10 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	100 lbs	DL Reaction 2:	100 lbs	Note: Design automatically uses
LL Reaction 1:	399 lbs	LL Reaction 2:	399 lbs	load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**499 lbs**	Total Reaction 2:	**499 lbs**	

Material Properties:

E	1.3 msi	E'	1.3 msi
F_b	850 psi	F_b'	1075 psi
F_v	150 psi	F_v'	150 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.47 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240
For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.5 ft in	Max LL defl:	0.25 in
Total defl. * I:	17.3	Required I:	35 in^4
LL defl. * I:	13.8	Required I:	55 in^4
Actual deflections:	TOTAL: 0.175 inches		0.140 inches

Force analysis:

Max. moment:	1247 ft-lb	Max Shear:	499 lbs

Selected Member:	(1) HF #2	1.5	x	9.25

Member properties:	Provided:	Required:
Moment of inertia:	98.9 in^4	55.2 in^4
Section Modulus:	21.4 in^3	13.9 in^3
Section Area:	13.9 in^2	5.0 in^2
Bearing Area:		1.2 in^2
Minimum bearing dimensions:	1.5 x	0.8 inches

Main Floor, Short Span Floor Joists
1 piece(s) 11 7/8" TJI® 110 @ 16" OC

Overall Length: 17' 5"
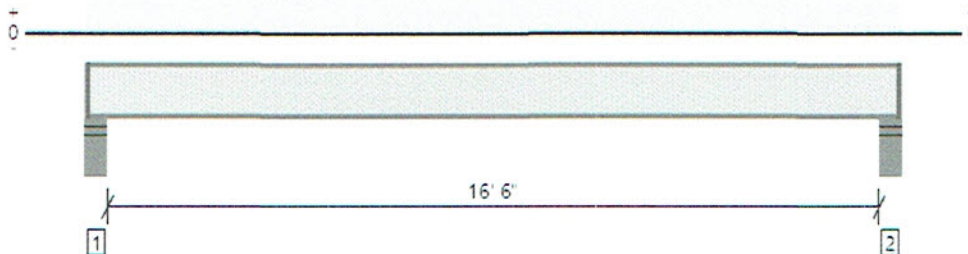
16' 6"

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)	631 @ 4 1/2"	1375 (3.50")	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	605 @ 5 1/2"	1560	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2546 @ 8' 8 1/2"	3160	Passed (81%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.309 @ 8' 8 1/2"	0.417	Passed (L/647)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.425 @ 8' 8 1/2"	0.833	Passed (L/471)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	41	Any	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
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 structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	5.50"	4.25"	1.75"	174	464	638	1 1/4" Rim Board
2 - Stud wall - SPF	5.50"	4.25"	1.75"	174	464	638	1 1/4" Rim Board

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 6" o/c	
Bottom Edge (Lu)	17' 3" o/c	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17' 5"	16"	15.0	40.0	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
Evan Apolis CSES, Inc (206) 369-3984 episoen@gmail.com	Zahr

Weyerhaeuser

8/12/2020 10:25:21 PM UTC

ForteWEB v3.0, Engine: V8.1.2.3, Data: V8.0.0.0

File Name: Zahr

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BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: *DECK HEADERS*

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	11 ft	Tributary Width:	10 ft	$P@x > (L-x)=$	8 ft
Add'l uniform DL:	60 lbs/ft	DL unit load:	15 psf	Concentrated DL:	1712 lbs
Add'l uniform LL:	240 lbs/ft	LL unit load:	40 psf	Concentrated LL:	532 lbs
Add'l uniform SL:		SL unit load:		Concentrated SL:	2520 lbs
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	2400 lbs	DL Reaction 2:	1622 lbs	Note: Design automatically uses
LL Reaction 1:	3907 lbs	LL Reaction 2:	3665 lbs	load combinations
SL Reaction 1:	1833 lbs	SL Reaction 2:	687 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**6705 lbs**	Total Reaction 2:	**5287 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2760 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	480		
Max. allowed total defl:	0.55 ft in	Max LL defl:	0.275 in
Total defl. * I:	250.4	Required I:	455 in^4
LL defl. * I:	177.9	Required I:	647 in^4
Actual deflections:	TOTAL:	0.339 inches	0.241 inches

Force analysis:

Max. moment:	16289 ft-lb	Max Shear:	6705 lbs

Selected Member: (1) GLB   **5.125**   x   **12**

Member properties:	Provided:	Required:
Moment of inertia:	738.0 in^4	646.9 in^4
Section Modulus:	123.0 in^3	70.8 in^3
Section Area:	61.5 in^2	33.0 in^2
Bearing Area:		10.3 in^2
Minimum bearing dimensions:	5.1 x	2.0 inches

John S. Apolis, P.E.   **CSES, Inc.**

	Job number:	**2020.050**
Project: **Zahr**	Date:	14-Oct-20
Architect: **Suzanne Zahr**	Page number:	*M16*

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: *EAST HEADER*

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	16.5 ft	Tributary Width:	6 ft	P@x > (L-x)=	16.5 ft
Add'l uniform DL:	135 lbs/ft	DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:	225 lbs/ft	SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1856 lbs	DL Reaction 2:	1856 lbs	Note: Design automatically uses
LL Reaction 1:	1980 lbs	LL Reaction 2:	1980 lbs	load combinations
SL Reaction 1:	1856 lbs	SL Reaction 2:	1856 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**4733 lbs**	Total Reaction 2:	**4733 lbs**	

Material Properties:

E	2 msi	E'	2 msi
Fb	2900 psi	Fb'	3339 psi
Fv	290 psi	Fv'	334 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.914 msi	Emin'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.825 ft in	Max LL defl:	0.55 in
Total defl. * I:	575.4	Required I:	697 in^4
LL defl. * I:	387.7	Required I:	705 in^4
Actual deflections:	TOTAL:	0.785 inches	0.529 inches

Force analysis:

Max. moment:	19525 ft-lb	Max Shear:	4733 lbs

Selected Member:	(1) PSL	**5.25**	x	**11.875**

Member properties:	Provided:	Required:
Moment of inertia:	732.6 in^4	705.0 in^4
Section Modulus:	123.4 in^3	70.2 in^3
Section Area:	62.3 in^2	21.3 in^2
Bearing Area:		7.6 in^2
Minimum bearing dimensions:	5.3 x	1.4 inches

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Date: 10 AUG 2020

HOUSE 3 DADU RETAINING WALLS

This Wall in File: c:\users\brett johnson\documents\retainpro 10 project files\zahr.rpx

Cantilevered Retaining Wall

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

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	130.00 pcf
Soil Density, Toe	=	130.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	200.0 lbs
Axial Live Load	=	340.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	7.000
(Multiplier used on soil density)		

Lateral Load Applied to Stem

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

Uniform Seismic Force	=	70.000
Total Seismic Force	=	700.000

Adjacent Footing Load

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

Design Summary

Wall Stability Ratios

Overturning	=	1.57 OK
Slab Resists All Sliding !		

Total Bearing Load	=	3,746 lbs
...resultant ecc.	=	2.44 in
Soil Pressure @ Toe	=	719 psf OK
Soil Pressure @ Heel	=	433 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,006 psf
ACI Factored @ Heel	=	607 psf
Footing Shear @ Toe	=	21.0 psi OK
Footing Shear @ Heel	=	19.0 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	2,347.7 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

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

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	6.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	0.993
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	3,053.1
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	10,336.8
Moment.....Allowable	=	10,400.4
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	40.7
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	60,000.0

Use menu item Settings > Printing & Title Block
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This Wall in File: c:\users\brett johnson\documents\retainpro 10 project files\zahr.rpx

Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.3873 in2/ft	
(4/3) * As :	0.5164 in2/ft	Min Stem T&S Reinf Area 1.824 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :

============

		One layer of :	Two layers of :
Required Area :	0.3873 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.4 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	3.75 ft
Heel Width	=	1.17
Total Footing Width	=	4.92
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

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

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,006	607 psf
Mu' : Upward	=	76,344	0 ft-#
Mu' : Downward	=	15,188	937 ft-#
Mu: Design	=	5,096	937 ft-#
Actual 1-Way Shear	=	20.96	19.04 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 6.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm
Key: No key defined

Min footing T&S reinf Area	1.27	in2
Min footing T&S reinf Area per foot	0.26	in2 /ft

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

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Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....				.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,750.0	3.33	5,833.3	Soil Over HL (ab. water tbl)	585.4	4.67	2,731.9
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.67	2,731.9
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =	107.7	5.00	538.5	Surcharge Over Heel =	20.0	4.67	93.4
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =	540.0	4.08	816.7
Added Lateral Load =				* Axial Live Load on Stem =	340.0	4.08	1,388.3
Load @ Stem Above Soil =				Soil Over Toe =			
Seismic Earth Load =	490.0	5.00	2,450.0	Surcharge Over Toe =			
=				Stem Weight(s) =	950.0	4.08	3,879.2
				Earth @ Stem Transitions =			
Total =	2,347.7	O.T.M. =	8,821.8	Footing Weight =	737.6	2.46	1,813.3
				Key Weight =			
				Vert. Component =	912.9	4.92	4,488.9
				Total =	3,405.9 lbs	R.M.=	13,823.3

Resisting/Overturning Ratio   =   **1.57**
Vertical Loads used for Soil Pressure =   3,745.9 lbs

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

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

Vertical component of active lateral soil pressure IS considered in the
calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the
calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.039	in

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

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SWIM SPA WALL

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Cantilevered Retaining Wall

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

Criteria

Retained Height	=	5.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	130.00 pcf
Soil Density, Toe	=	130.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in
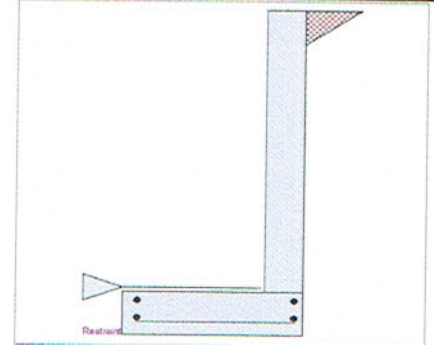
Surcharge Loads

Surcharge Over Heel	=	50.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	320.0
NOT Used for Sliding & Overturning		

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Axial Load Applied to Stem

Axial Dead Load	=	400.0 lbs
Axial Live Load	=	700.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform

Multiplier Used	=	7.000
(Multiplier used on soil density)		

Uniform Seismic Force	=	44.333
Total Seismic Force	=	280.778

Design Summary

Wall Stability Ratios

Overturning	=	1.59 OK
Slab Resists All Sliding !		
Total Bearing Load	=	2,442 lbs
...resultant ecc.	=	8.46 in
Soil Pressure @ Toe	=	0 psf OK
Soil Pressure @ Heel	=	1,553 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	0 psf
ACI Factored @ Heel	=	3,024 psf
Footing Shear @ Toe	=	1.6 psi OK
Footing Shear @ Heel	=	6.6 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	1,208.7 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

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

Stem Construction

Bottom

Stem OK

Design Height Above Ftg ft =		0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	11.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	0.524

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	1,485.1

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	3,085.9
Moment.....Allowable	=	5,883.6

Shear.....Actual

Service Level	psi =	
Strength Level	psi =	19.8
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	60,000.0

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Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1156 in2/ft	
(4/3) * As :	0.1542 in2/ft	Min Stem T&S Reinf Area 1.056 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :

		One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2182 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	2.50 ft
Heel Width	=	0.67
Total Footing Width	=	3.17
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

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

Footing Design Results

		Toe	Heel	
Factored Pressure	=	0	3,024	psf
Mu' : Upward	=	17,504	0	ft-#
Mu' : Downward	=	24,825	0	ft-#
Mu: Design	=	-610	0	ft-#
Actual 1-Way Shear	=	1.65	6.60	psi
Allow 1-Way Shear	=	75.00	40.00	psi

Toe Reinforcing = # 4 @ 11.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings
Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm
Key: No key defined

Min footing T&S reinf Area	0.68	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

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## Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	902.5	2.11	1,905.3	Soil Over HL (ab. water tbl)		0.2	3.17	0.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)			3.17	0.8
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=	109.6	3.17	347.1	Surcharge Over Heel	=		
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=	1,100.0	2.83	1,133.3
Added Lateral Load	=			* Axial Live Load on Stem	=	700.0	2.83	1,983.3
Load @ Stem Above Soil	=			Soil Over Toe	=			
Seismic Earth Load	=	196.5	3.17	622.4	Surcharge Over Toe	=			
	=			Stem Weight(s)	=	550.0	2.83	1,558.3
				Earth @ Stem Transitions	=			
Total	=	1,208.7	O.T.M. =	2,874.8	Footing Weight	=	395.9	1.58	626.9
				Key Weight	=		2.50	
				Vert. Component	=	396.2	3.17	1,254.6

Resisting/Overturning Ratio   =   **1.59**
Vertical Loads used for Soil Pressure =   2,442.3 lbs

Total =   1,742.3 lbs   R.M.=   4,573.9
* Axial live load NOT included in total displayed, or used for overturning
resistance, but is included for soil pressure calculation.

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

Vertical component of active lateral soil pressure IS considered in the
calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the
calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0 pci
Horizontal Defl @ Top of Wall (approximate only)	0.059 in

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

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SHORTER WALLS B SITE WALLS

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Cantilevered Retaining Wall

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

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	130.00 pcf
Soil Density, Toe	=	130.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in
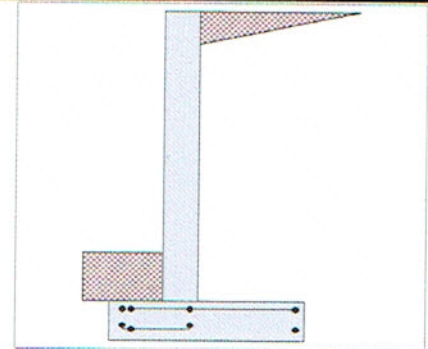
Surcharge Loads

Surcharge Over Heel	=	50.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Axial Load Applied to Stem

Axial Dead Load	=	200.0 lbs
Axial Live Load	=	340.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform

Multiplier Used	=	7.000
(Multiplier used on soil density)		

Uniform Seismic Force	=	47.833
Total Seismic Force	=	326.861

Design Summary

Wall Stability Ratios

Overturning	=	2.60 OK
Sliding	=	1.55 OK
Total Bearing Load	=	3,715 lbs
...resultant ecc.	=	2.08 in
Soil Pressure @ Toe	=	1,151 psf OK
Soil Pressure @ Heel	=	642 psf OK
Allowable	=	2,000 psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,661 psf
ACI Factored @ Heel	=	926 psf
Footing Shear @ Toe	=	7.4 psi OK
Footing Shear @ Heel	=	8.5 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	1,137.9 lbs
less 100% Passive Force	= −	413.2 lbs
less 100% Friction Force	= −	1,350.0 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	0.0 lbs OK

Vertical component of active lateral soil pressure IS
considered in the calculation of soil bearing pressures.

Load Factors

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

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg ft =		0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	0.603
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,424.2
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	3,264.7
Moment.....Allowable	=	5,412.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	19.0
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	60,000.0

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

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1223 in2/ft	
(4/3) * As :	0.1631 in2/ft	Min Stem T&S Reinf Area 1.152 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0012bh : 0.0012(12)(8) :	0.1152 in2/ft	Horizontal Reinforcing Options :

		One layer of :	Two layers of :
Required Area :	0.1631 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.00 ft
Heel Width	=	2.67
Total Footing Width	=	3.67
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c =   2,500 psi   Fy =   60,000 psi
Footing Concrete Density =   150.00 pcf
Min. As %   =   0.0012
Cover @ Top   2.00   @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,661	926 psf
Mu' : Upward	=	9,566	2,121 ft-#
Mu' : Downward	=	1,836	3,697 ft-#
Mu: Design	=	644	1,576 ft-#
Actual 1-Way Shear	=	7.39	8.45 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	= # 4 @ 12.00 in		
Heel Reinforcing	= # 4 @ 12.00 in		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs	
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs	

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

Other Acceptable Sizes & Spacings

Toe: #4@ 16.66 in, #5@ 25.83 in, #6@ 36.66 in, #7@ 50.00 in, #8@ 65.83 in, #9@ 8
Heel: #4@ 16.66 in, #5@ 25.83 in, #6@ 36.66 in, #7@ 50.00 in, #8@ 65.83 in, #9@ 8
Key: No key defined

Min footing T&S reinf Area	0.79	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

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Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING.....				.....RESISTING.....		
		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	1,560.3	2.67	4,161.0
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.67	4,161.0
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=	92.0	3.42	314.3	Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem =	540.0	1.33	266.7
Added Lateral Load	=				* Axial Live Load on Stem =	340.0	1.33	453.3
Load @ Stem Above Soil	=				Soil Over Toe	=	130.0	0.50	65.0
Seismic Earth Load	=	228.8	3.42	781.7	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	600.0	1.33	800.0
					Earth @ Stem Transitions =			
Total	=	1,137.9	O.T.M. =	2,957.3	Footing Weight	=	458.4	1.83	840.4
					Key Weight	=		2.50	
					Vert. Component	=	426.3	3.67	1,563.2

Resisting/Overturning Ratio   =   2.60
Vertical Loads used for Soil Pressure =   3,714.9 lbs

Total =   3,374.9 lbs R.M.=   7,696.3
* Axial live load NOT included in total displayed, or used for overturning
resistance, but is included for soil pressure calculation.

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

Vertical component of active lateral soil pressure IS considered in the
calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the
calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus   250.0 pci
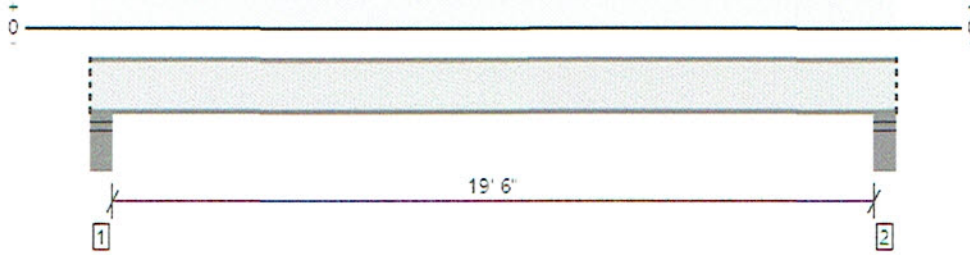Horizontal Defl @ Top of Wall (approximate only)   0.052 in

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

DADU Roof, Roof Joists
1 piece(s) 14" TJI® 360 @ 24" OC

Overall Length: 20' 5"

19' 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)	1429 @ 4 1/2"	1731 (3.50")	Passed (83%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1365 @ 5 1/2"	2248	Passed (61%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	6769 @ 10' 2 1/2"	8435	Passed (80%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.312 @ 10' 2 1/2"	0.656	Passed (L/757)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.873 @ 10' 2 1/2"	0.983	Passed (L/270)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - SPF	5.50"	5.50"	2.42"	919	510	1429	Blocking
2 - Stud wall - SPF	5.50"	5.50"	2.42"	919	510	1429	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 9" o/c	
Bottom Edge (Lu)	20' 5" o/c	

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

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 20' 5"	24"	45.0	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
Evan Apolis CSES, Inc (206) 369-3984 episoen@gmail.com	Zahr

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ForteWEB v3.0, Engine: V8.1.4.2, Data: V8.0.0.0
File Name: Zahr
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BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: FACIA CURVED BEAMS

| Fully Supported: | 1 | Snow Load: | 1 | Wind Load: | |
| Repetitive Member: | | P.T. Lumber: | | Wet Use: | |

Geometry and Loads:

Span:	20 ft	Tributary Width:	3 ft	P@x > (L-x)=	20 ft
Add'l uniform DL:		DL unit load:	45 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:		Concentrated LL:	
Add'l uniform SL:		SL unit load:	25 psf	Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1350 lbs	DL Reaction 2:	1350 lbs	Note: Design automatically uses
LL Reaction 1:	0 lbs	LL Reaction 2:	0 lbs	load combinations
SL Reaction 1:	750 lbs	SL Reaction 2:	750 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2100 lbs**	Total Reaction 2:	**2100 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2760 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/   240
For LL only: Allowed deflection criteria, span/   360

Max. allowed total defl:	1 ft in	Max LL defl:	0.666666667 in
Total defl. * I:	420.0	Required I:	420 in^4
LL defl. * I:	150.0	Required I:	225 in^4
Actual deflections:	TOTAL: 0.478 inches		0.171 inches

Force analysis:

Max. moment:	10500 ft-lb	Max Shear:	2100 lbs

Selected Member:	(1) GLB	**3.125**	x	**15**

Member properties:

	Provided:	Required:
Moment of inertia:	878.9 in^4	420.0 in^4
Section Modulus:	117.2 in^3	45.7 in^3
Section Area:	46.9 in^2	10.3 in^2
Bearing Area:		3.2 in^2
Minimum bearing dimensions:	3.1 x	1.0 inches

BEAM DESIGN (Cantilever, Uniform Load+Concentrated Load)

2015 International Building Code (IBC)(concentrated load at tip of cantilever   **2015 NDS**

Beam Description: _FRONT FACIA BEAM_

Enter '1' for snow load:	1
Enter '1' for repetitive member:	
Enter '1' for wet use:	

Geometry and Loads:

Span:	12.5 ft	Tributary Width:	1 ft	
DL unit load:	45 psf	LL unit load:	25 psf	
Add'l unif. DL:	lb/ft	Add'l unif. LL:	lb/ft	
Concentrated DL:	1350 lbs	Concentrated LL:	750 lbs	
Cantilever a:	5.5 ft			
		Total point load:	2100 lbs	
DL uniform load:	45 lb/ft	Max DL reaction:	2,527 lbs	
LL uniform load:	25 lb/ft	Max LL reaction:	1,404 lbs	
Total load:	70 lb/ft	Max Total reaction:	3,931 lbs	
		Rsmall	-571 lbs	

Material Properties:

E	2 x 10^6 psi	E'	2 x 10^6 psi
Fb	2900 psi	Fb'	3278 psi
Fv	290 psi	Fv'	334 psi
Fc perp	750 psi	Fc perp'	750 psi
Emin	0 x 10^6 psi	Emin'	0 x 10^6 psi

Deflection analysis:

For total load: Allowed deflection criteria, span/	240		
For LL only: Allowed deflection criteria, span/	360		
Max. allowed total defl:	0.625 in	Max LL defl:	0.4166667 in
Cantilever Deflections, TL:	0.55 in	LL:	0.3666667 in
Total Required I:	521 in^4	LL Required I:	348 in^4
Actual midspan δ: TOTAL:	0.081 inches	LL	0.009 inches
Actual Cantilever δ: TOTAL:	0.358 inches	LL	0.159 inches

Force analysis:

		Max Shear:	2485 lbs
Max. moment:	12609 ft-lb	Shear @ d =	2403 lbs

Selected Member:	(1) PSL	**3.5**	x	**14**

Member properties:	Provided:		Required:	
Moment of inertia:	800.3 in^4		521.4 in^4	
Section Modulus:	114.3 in^3		46.2 in^3	
Section Area:	49.0 in^2		10.8 in^2	
Bearing Area:			5.2 in^2	
Minimum bearing dimensions:	3.5	x	1.5 inches	

BEAM DESIGN (Cantilever, Uniform Load+Concentrated Load)

2015 International Building Code (IBC)(concentrated load at tip of cantilever   **2015 NDS**

Beam Description: CANTILEVERED CURVED BEAMS

Enter '1' for snow load:	1
Enter '1' for repetitive member:	
Enter '1' for wet use:	

Geometry and Loads:

Span:	15.5 ft	Tributary Width:	9 ft
DL unit load:	45 psf	LL unit load:	25 psf
Add'l unif. DL:	lb/ft	Add'l unif. LL:	lb/ft
Concentrated DL:	2527 lbs	Concentrated LL:	1404 lbs
Cantilever a:	5 ft		
		Total point load:	3931 lbs
DL uniform load:	405 lb/ft	Max DL reaction:	8,833 lbs
LL uniform load:	225 lb/ft	Max LL reaction:	4,907 lbs
Total load:	630 lb/ft	Max Total reaction:	13,740 lbs
		Rsmall	3106 lbs

Material Properties:

E	1.8 x 10^6 psi	E'	1.8 x 10^6 psi
Fb	2400 psi	Fb'	2907 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.93 x 10^6 psi	Emin'	0.93 x 10^6 psi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.775 in	Max LL defl:	0.5166667 in
Cantilever Deflections, TL:	0.5 in	LL:	0.3333333 in
Total Required I:	1,142 in^4	LL Required I:	951 in^4
Actual midspan δ:	TOTAL: 0.433 inches	LL	0.113 inches
Actual Cantilever δ:	TOTAL: 0.396 inches	LL	0.220 inches

Force analysis:

		Max Shear:	7081 lbs
Max. moment:	27530 ft-lb	Shear @ d =	6294 lbs

Selected Member: (1) GLB   **5.125**   x   **15**

Member properties:	Provided:	Required:
Moment of inertia:	1,441.4 in^4	1,142.0 in^4
Section Modulus:	192.2 in^3	113.7 in^3
Section Area:	76.9 in^2	31.0 in^2
Bearing Area:		21.1 in^2
Minimum bearing dimensions:	5.1 x	4.1 inches

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: DECK JOISTS

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:	1	P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	9 ft	Tributary Width:	1.33 ft	P@x > (L-x)=	9 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	90 lbs	DL Reaction 2:	90 lbs	Note: Design automatically uses
LL Reaction 1:	359 lbs	LL Reaction 2:	359 lbs	load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**449 lbs**	Total Reaction 2:	**449 lbs**	

Material Properties:

E	1.3 msi	E'	1.3 msi
Fb	850 psi	Fb'	1075 psi
Fv	150 psi	Fv'	150 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.47 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		360	
Max. allowed total defl:	0.45 ft in	Max LL defl:	0.3 in
Total defl. * I:	11.3	Required I:	25 in^4
LL defl. * I:	9.1	Required I:	30 in^4
Actual deflections:	TOTAL: 0.114 inches		0.092 inches

Force analysis:

Max. moment:	1010 ft-lb	Max Shear:	449 lbs

Selected Member:	(1) HF #2	**1.5**	x	**9.25**

Member properties:	Provided:	Required:
Moment of inertia:	98.9 in^4	30.2 in^4
Section Modulus:	21.4 in^3	11.3 in^3
Section Area:	13.9 in^2	4.5 in^2
Bearing Area:		1.1 in^2
Minimum bearing dimensions:	1.5 x	0.7 inches

Dowel-Type Fastener Design (single shear)

2015 International Building Code (IBC)   **2015 NDS**

Connection Description: DECK LEDGER CONNECTION

Dowel Properties:

D	0.625 in	Dowel Diameter	Fyb	45000 psi	dowel bending yield strength

Member Properties: Single Shear

	Main member	Side Member		
L	4	1.5	in	dowel bearing length
Fell	7500	5600	psi	dowel bearing strength
FeT	7500	2824	psi	dowel bearing strength
Feθ	7500	2824	psi	dowel bearing strength
Cd	1	1		Load Duration Factor (use 1.6 for seismic)
Ctn	1	1		Toenail Factor
CΔ	1	1		Geometry Factor
Θ	0	90		maximum angle of load to grain (0 to 90)
Rd1	4.0	5.0		reduction term (see table 11.3.1B NDS)
Rd2	3.6	4.5		reduction term (see table 11.3.1B NDS)
Rd3	3.2	4.0		reduction term (see table 11.3.1B NDS)
k1	1.98	1.98		NDS pg. 71
k2	1.82	1.82		NDS pg. 71
k3	1.45	1.45		NDS pg. 71
Re	2.66	2.66		Fem/Fs
Rt	2.67	2.67		Lm/Ls

NDS EQ.				Failure mechanism (NDS fig. I1)
11.3-1	4688	3750	lbs	Im
11.3-2	662	530	lbs	Is
11.3-3	1454	1163	lbs	II
11.3-4	1686	1348	lbs	IIIm
11.3-5	683	546	lbs	IIIs
11.3-6	958	766	lbs	IV
Z	662	530	lbs	

Shear Capacity: Main Member: 662 #   Side Member: 530 #

530# > 449# REF D1   5/8"∅ BOLTS @ 16" O.C.

BEAM DESIGN (Uniform Load+Concentrated Load)

2015 International Building Code (IBC)   **2015 NDS**

Beam Description: DECK BEAMS

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	9 ft	Tributary Width:	4.5 ft	P@x > (L-x)=	9 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	304 lbs	DL Reaction 2:	304 lbs	Note: Design automatically uses
LL Reaction 1:	1215 lbs	LL Reaction 2:	1215 lbs	load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**1519 lbs**	Total Reaction 2:	**1519 lbs**	

Material Properties:

E	1.6 msi	E'	1.52 msi
Fb	900 psi	Fb'	864 psi
Fv	180 psi	Fv'	144 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.58 msi	Emin'	0.551 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/		240	
For LL only: Allowed deflection criteria, span/		480	
Max. allowed total defl:	0.45 ft in	Max LL defl:	0.225 in
Total defl. * I:	32.8	Required I:	73 in^4
LL defl. * I:	26.2	Required I:	117 in^4
Actual deflections:	TOTAL: 0.142 inches		0.114 inches

Force analysis:

Max. moment:	3417 ft-lb	Max Shear:	1519 lbs

Selected Member:	(1) DF #2	**3.5**	x	**9.25**

Member properties:	Provided:	Required:
Moment of inertia:	230.8 in^4	116.5 in^4
Section Modulus:	49.9 in^3	47.5 in^3
Section Area:	32.4 in^2	15.8 in^2
Bearing Area:		2.4 in^2
Minimum bearing dimensions:	3.5 x	0.7 inches

8110 SE 70th St, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5415984, -122.2298193

Date	6/18/2020, 4:31:56 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.466	MCE_R ground motion. (for 0.2 second period)
S_1	0.507	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.759	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.173	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Exp B
$K_{zt} = 1.6$
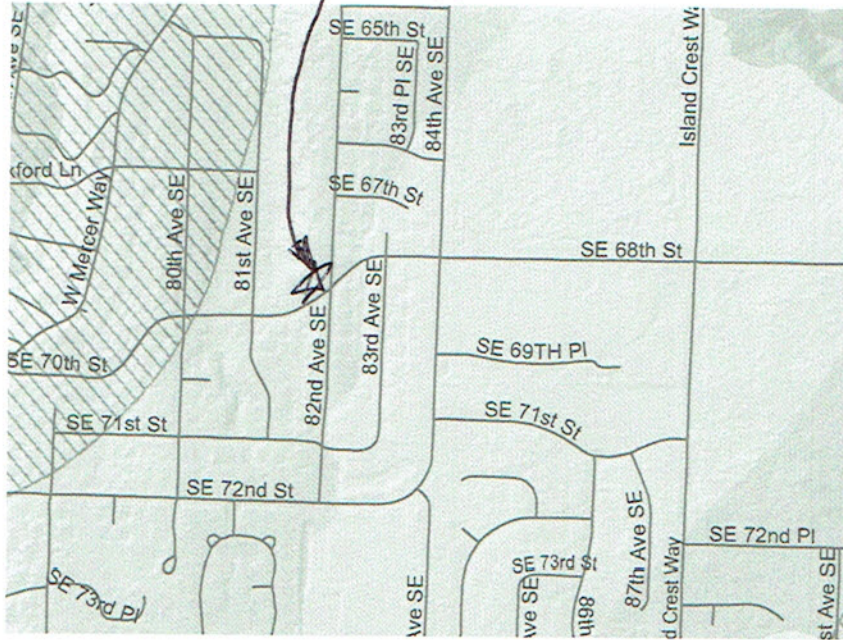
Lateral Loads Design per ASCE 7-10, Wind: Section 28 Seismic: Section 12

(Simplified Envelope Procedure Part 2)   2015 International Building Code (IBC)

WIND LOADS   **110**   mph Basic Wind Speed   2015 NDS

$Ps = lambda * Kzt * Ps(30) * 0.6$ Exposure **B**   Roof Slope: **3.50** : 12 =   16.3

Least Horizontal Dimension, feet: **60**   Mean Roof Ht, feet: **28**   (degrees)

lambda =   1.00   a =   6.0   ft,   2a =   12.0   ft

Iw =   1.00   KzT =   **1.60**

Tabulated Ps(30): (Refer to ASCE 7-10, Figure 28.6-1)	Zone	Tabulated Wind Pressure		Calc'd Design Pressure (*lambda*KzT*0.6)	Min Design Pressure	(Per section 28.6.4 minimum wind pressure is 16 PSF for zones A,C, and 8 PSF for zones B, D)
(horizontal)	A	24.7	psf	**23.7**	23.7	
"	B	-7.7	psf	**-7.4**	7.7	
"	C	16.4	psf	**15.8**	15.8	
"	D	-4.4	psf	**-4.2**	7.7	
(vertical)	E	-23.1	psf	**-22.2**		
"	F	-15.3	psf	**-14.7**		
"	G	-16.0	psf	**-15.4**		
"	H	-11.7	psf	**-11.2**		
(uplift on overhangs)	E(oh)	-32.3	psf	**-31.0**		
"	G(oh)	-25.3	psf	**-24.3**		

(Equivalent Lateral Force Procedure, Section 12.8)

SEISMIC LOADS   Ie   1.0   R =   6.5   ASCE 7-10, Table 12.2.1

Seismic Parameters   Group I   Site Class: **D**

per ASCE 7-10)   PGA (.2 sec)   1.466   Fa =   1.00   ASCE 7-10 Table 11.4-1

   PGA (1 sec)   0.507   Fv =   1.50   ASCE 7-10 Table 11.4-2

Seismic Design Categories per ASCE 7-10 Tables 11.6-1, 11.6-2

Based on Sds: **D**   Based on Sd1:   **D**

PGA's based on peak ground accelerations per latest USGS Hazards Program (based on lat/lon).

Ss =   1.4660   Sms = Fa * Ss =   1.47   Equation 11.4-1

S1 =   0.5070   Sm1 = Fv * S1 =   0.76   Equation 11.4-2

Equations 11.4-3, 11.4-4   Sds = 2/3 * Sms =   0.98   Sd1 = 2/3 * Sm1 =   0.51

Equation 12.14-11 Cs (or %V) = (Sds / (R/I)) =   0.150   **Building period < 0.5 s per IBC eq 12.8-7**

Base Shear = %V * W * 0.7 =   4.84   psf, uniformly distributed over floor area

(0.7 reduction factor per ASCE 7-10, Section 2.4.1, Eq 5 (seismic vertical distribution per IBC eqs 12.8-11 & 12)

Base = top of foundation	Roof or Floor DL (psf)	Wall DL (psf) dist. over floor area	Story Height Above Base (ft)	Lateral Load (psf)	R=1.5
Top Framing	16	6	21	3.19	13.82
Main Floor	12	12	10	1.66	2.19
Lower Floor				0.00	
Total Seismic DL:	**46**			Sum 4.84	

SHEAR WALL DESIGN

SOUTH ENTRY WALLS - UPPER FLOOR - $L_{upper} = 8.75'$, $L_{lower} = 2.25 \times 2 = 5.5'$

ASPECT = 3.18' < 3.5 OK

$$P_w = 12' \times 10.5 \times 23.7 psf \times \frac{33.5}{26} + 8.5 \times 28 \times 15.8 psf \times \frac{14}{26}$$

$$+ 28' \times 3' \times 7.7 psf \times \frac{14}{26} = \underline{6,459\#}$$

$$P_E = (28' \times 41^2/(2 \times 26)) + 14.5' \times \frac{29.5^2}{2 \times 26}) \times 3.19 psf = 3,662\#$$

UPPER ROOF DIAPHRAGM TO BEAM CONNECTION -

$$P_w = 12' \times 10.5 \times 23.7 psf \times \frac{33.5}{26} = 3,848\# < 4583\# \quad \underline{SEE\ L3}$$

$$V = \frac{6,459\#}{5.5'} = 1,175 plf < 1420 plf \quad \underline{SW7}$$

$$UPLIFT = 1,175 plf \times 9.5' = 11,163\# < 11,350\# \quad \underline{HD12\ w/PAB8\ SE\ PAGES}$$

GARAGE SOUTH HALL - UPPER FLOOR - $L = 6'$

$$P_w = 23.5' \times 9.5' \times 15.8 psf + 23.5 \times 3' \times 7.7 psf = \underline{4,070\#}$$

$$P_E = 23.5' \times (27 + 14) \times 3.19 psf = 3,074\#$$

$$V = \frac{4,070\#}{6'} = 678 plf < 710 plf \quad \underline{SW3x}$$

$$UPLIFT = 678 plf \times 9' = 6,105\# < 6,580\# \quad \underline{HDU8}$$

Dowel-Type Fastener Design (single shear)

2015 International Building Code (IBC)   **2015 NDS**

Connection Description: ROOF BEAM- BEAM CONNECTION

Dowel Properties:

D	1 in	Dowel Diameter	Fyb	45000 psi	dowel bending yield strength

Member Properties: Single Shear

	Main member	Side Member		
L	5	5	in	dowel bearing length
Fell	5600	5600	psi	dowel bearing strength
FeT	2233	2233	psi	dowel bearing strength
Feθ	5600	5600	psi	dowel bearing strength
Cd	1.6	1.6		Load Duration Factor
Ctn	1	1		Toenail Factor
CΔ	1	1		Geometry Factor
Θ	0	0		maximum angle of load to grain (0 to 90)
Rd1	4.0	4.0		reduction term (see table 11.3.1B NDS)
Rd2	3.6	3.6		reduction term (see table 11.3.1B NDS)
Rd3	3.2	3.2		reduction term (see table 11.3.1B NDS)
k1	0.41	0.41		NDS pg. 71
k2	1.15	1.15		NDS pg. 71
k3	1.15	1.15		NDS pg. 71
Re	1.00	1.00		Fem/Fs
Rt	1.00	1.00		Lm/Ls

NDS EQ.				Failure mechanism (NDS fig. I1)
11.3-1	11200	11200	lbs	Im
11.3-2	11200	11200	lbs	Is
11.3-3	5155	5155	lbs	II
11.3-4	5389	5389	lbs	IIIm
11.3-5	5389	5389	lbs	IIIs
11.3-6	4583	4583	lbs	IV
Z	4583	4583	lbs	

Shear Capacity: Main Member: 4583 #   Side Member: 4583 #

NORTH SHEAR WALL - UPPER FLOOR - L = 4' + 3.67' = 7.67'

$P_W = 12.5' \times 13.5' \times 23.7 psf = 3,999^\#$

$V = \dfrac{3,999^\#}{7.67} = 521 \, plf < 710 \, plf$ SW/3x

UPLIFT = $521 \, plf \times 10' = 5,214^\# < 6,580^\#$ HDU8

GARAGE SOUTH WALL - UPPER FLOOR - L = 3.5' + 3.5' = 7'

$P_W = 12.5' \times 6' \times 15.8 psf = 1,185^\#$

$P_E = 12.5' \times 3.5' \times 3.19 psf = 1,396^\#$

$V = \dfrac{1,396^\#}{7'} = 199 \, plf < 230 \, plf$ SW1

UPLIFT = $199 \, plf \times 10' = 1,994^\# < 4,065^\#$ HDU5

GARAGE EAST WALL - L = 24'

$P_W = 7.5' \times 14' \times 23.7 psf = 2,489^\#$

$P_E = 14' \times 28' \times 3.19 psf = 1,251^\#$

$V = \dfrac{2,489^\#}{24'} = 104 \, plf < 230 \, plf$ SW1

UPLIFT = $104 \, plf \times 11' = 1,141^\# < 2,215^\#$ HDU2

GARAGE WEST WALL - L = 16'

$P_W = 7.5' \times 16.5' \times 15.8 \text{ psf} = 1,956^\#$

$V = \dfrac{1,956^\#}{16'} = 122 \text{ plf} < 230 \text{ plf}$ SW/1

UPLIFT = $122 \text{ plf} \times 11' = 1,344^\# < 2,215^\#$ HDU2

ENTRY EAST WALL - L = 20'

$P_W = 8.5' \times 7.5' \times 15.8 \text{ psf} = 1,008^\#$

$V = \dfrac{1,008^\#}{20'} = 50.4 \text{ plf} < 100 \text{ plf}$ UNBLOCKED DIAPHRAGM

ENTRY/GREATROOM WALL - L = 12.33' + 8.5' + 16.5' = 37.33'

$P_W = 6' \times 7.5' \times 15.8 \text{ psf} + 10.5' \times 8.5' \times 15.8 \text{ psf} = 2,121^\#$

$P_E = (6' \times 52' + 10.5' \times 61') \times 3.19 \text{ psf} = 3,039^\#$

$V = \dfrac{3,039^\#}{37.33} = 82 \text{ plf} < 100 \text{ plf}$ UNBLOCKED DIAPHRAGM

UPLIFT = $82 \text{ plf} \times 15' = 1,221^\# < 1,705^\#$ CS16

WEST WALL - L = 3.33' + 3.75' = 7.08'

$P_W = 10.5' \times 7' \times 23.7 \text{ psf} = 1,742^\#$

$P_E = 14' \times 61' \times 3.19 \text{ psf} = 2,725^\#$

$385/(1.25 - 0.125 \times \frac{9}{3.33})$
$= 422 < 550$ OH

$V = \dfrac{2,725^\#}{7.08} = 385 \text{ plf} < 550 \text{ plf}$ SW/3

UPLIFT = $385 \text{ plf} \times 9' = 3,464^\# \approx 3,410^\#$ (2)CS16

<u>SOUTH FIREPLACE WALL - LOWER FLOOR - L = 3'</u>

$P_W = 8' \times 9.5' \times 23.7 \text{psf} = 1,802^\#$

$V = \dfrac{1,802^\#}{3} = 600 \text{plf} / (1.25 - 0.125 \frac{9}{3} - 1) = 687 \text{plf} \approx 760 \text{plf}$ <u>SW3x</u>

$\text{UPLIFT} = 600 \text{plf} \times 10' = 6,000^\# < 6,580^\#$ HDU8

<u>SOUTH DRAG STRUT TO ENTRANCE WALL</u>

$P_W = 14.5' \times 9.5' \times 15.8 \text{psf} = 2,177^\# < 4,585^\#$ <u>CMSTC16</u>

$\text{DIAPHRAGM} \quad V = \dfrac{2,177^\#}{8} = 272 \text{plf} < 350 \text{plf}$ <u>SW2</u>

<u>NORTH DRAG STRUT TO GARAGE HALL WALL</u>

$P_W = 21' \times 9.5' \times 15.8 \text{psf} = 3,153^\# < 4,585^\#$ <u>CMSTC16</u>

<u>NORTH SHEAR WALL - LOWER FLOOR - L = 9.5'</u>

$P_W = 13' \times 9.5' \times 23.7 \text{psf} = 2,927^\# < 4,585^\#$ <u>CMSTC16</u>

$V = \dfrac{2,927^\#}{9.5} = 309 \text{plf} < 350 \text{plf}$ <u>SW2</u>

$\text{UPLIFT} = 309 \text{plf} \times 10' = 3,081^\# < 4,065^\#$ <u>HDU5</u>

WEST SHEAR WALL - LOWER FLOOR - L = $7.5' + 9' = 16.5'$

$P_W = 10.5' \times 11' \times 23.7\,psf + 8' \times 8.5' \times 15.9\,psf + 1,742^{\#} = 5,554^{\#}$

$P_E = (10.5' \times 57' + 8' \times 87.5') \times 1.66\,psf + 2,725^{\#} = 4,084^{\#}$

$V = \dfrac{5,554^{\#}}{16.5'} = 337\,plf < 350\,plf \quad \underline{SW2}$

UPLIFT $= 337\,plf \times 10' = 3,366^{\#} < 4,065^{\#} \quad \underline{HDU5}$

$3,366^{\#} + 3,464^{\#} = 6,830^{\#} < 7,870^{\#} \qquad \underline{HDU8 \ w/\ DF\ POST}$

CENTRAL WALL - LOWER FLOOR - L $= 11.5' + 16' + 11' = 38.5'$

$P_W = 20' \times 11' \times 15.8\,psf + 2,121^{\#} = \underline{5,597^{\#}}$

$P_E = (10.5' \times 60' + 47' \times 6.5') \times 1.66\,psf + 3,039^{\#} = 4,592^{\#}$

$V = \dfrac{5,597^{\#}}{38.5'} = 146\,plf < 230\,plf \quad \underline{SW1}$

UPLIFT $= 146\,plf \times 10' = 1,453^{\#} + 1,185^{\#} = 2,639^{\#} < 4,065^{\#} \ \underline{HDU5}$

Lateral Loads Design per ASCE 7-10, Wind: Section 28 Seismic: Section 12

(Simplified Envelope Procedure Part 2)   2015 International Building Code (IBC)

<u>WIND LOADS</u>   **110**   mph Basic Wind Speed   2015 NDS

$Ps = lambda * Kzt * Ps(30) * 0.6$ Exposure   **B**   Roof Slope: **0.00** $: 12 =$ 0.0

Least Horizontal Dimension, feet: **21**   Mean Roof Ht, feet: **13**   (degrees)

$lambda =$ 1.00 $a =$ 3.0 ft, $2a =$ 6.0 ft

$Iw =$ 1.00 $KzT =$ **1.60**

Tabulated Ps(30): (Refer to ASCE 7-10, Figure 28.6-1)	Zone	Tabulated Wind Pressure		Calc'd Design Pressure (*lambda*KzT*0.6)	Min Design Pressure	(Per section 28.6.4 minimum wind pressure is 16 PSF for zones A,C, and 8 PSF for zones B, D)
(horizontal)	A	19.2	psf	**18.4**	18.4	
"	B	-10.0	psf	**-9.6**	9.6	
"	C	12.7	psf	**12.2**	15.4	
"	D	-5.9	psf	**-5.7**	7.7	
(vertical)	E	-23.1	psf	**-22.2**		
"	F	-13.1	psf	**-12.6**		
"	G	-16.0	psf	**-15.4**		DADU
"	H	-10.1	psf	**-9.7**		
(uplift on overhangs)	E(oh)	-32.3	psf	**-31.0**		
"	G(oh)	-25.3	psf	**-24.3**		

(Equivalent Lateral Force Procedure, Section 12.8)

<u>SEISMIC LOADS</u> Ie 1.0 $R =$ 6.5   ASCE 7-10, Table 12.2.1

Seismic Parameters   Group I   Site Class: **D**

per ASCE 7-10)   PGA (.2 sec)   1.466 $Fa =$ 1.00   ASCE 7-10 Table 11.4-1

               PGA (1 sec)   0.507 $Fv =$ 1.50   ASCE 7-10 Table 11.4-2

Seismic Design Categories per ASCE 7-10 Tables 11.6-1, 11.6-2

Based on Sds: **D**   Based on Sd1:   **D**

PGA's based on peak ground accelerations per latest USGS Hazards Program (based on lat/lon).

$Ss =$ 1.4660 $Sms = Fa * Ss =$ 1.47   Equation 11.4-1

$S1 =$ 0.5070 $Sm1 = Fv * S1 =$ 0.76   Equation 11.4-2

Equations 11.4-3, 11.4-4 $Sds = 2/3 * Sms =$ 0.98 $Sd1 = 2/3 * Sm1 =$ 0.51

Equation 12.14-11 Cs (or $\%V$) $= (Sds / (R/I)) =$ 0.150   **Building period < 0.5 s per IBC eq 12.8-7**

Base Shear $= \%V * W * 0.7 =$ 5.58   psf, uniformly distributed over floor area

(0.7 reduction factor per ASCE 7-10, Section 2.4.1, Eq 5 (seismic vertical distribution per IBC eqs 12.8-11 & 12)

Base = top of foundation	Roof or Floor DL (psf)	Wall DL (psf) dist. over floor area	Story Height Above Base (ft)	Lateral Load (psf)
Roo Framing	45	8	11.5	5.58
				0.00
				0.00
Total Seismic DL:	**53**		Sum	**5.58**

DADU EAST WALL   L = 52'

$P_E = 60' \times 27 \times 5.58\,psf = 9,040^{\#}$ (CONTROLS BY INSPECTION)

$V = \dfrac{9,040^{\#}}{52'} = 174\,plf < 230\,plf$ __SW1__

NO HD REQUIRED

NORTH & SOUTH WALLS — L = 9.25'

$P_{E1} = 9,040^{\#} \times 135/52' = 2,347^{\#}$

$P_{E2} = 9,040^{\#}/2 = \underline{4,520^{\#}}$

$V = \dfrac{4,520^{\#}}{9.25'} = 489\,plf < 550\,plf$ __SW3__

UPLIFT = $489\,plf \times 11.5' = 5,620^{\#} < 6,970^{\#}$ __HDU8__