EVERGREEN DESIGN COMPANY

Structural Calculations for the Ravensdale Residence

Location: 310th Avenue SE, Ravensdale, WA 98051

Prepared for: Lane Williams Architects

Prepared by: Lori D. Brown, P.E., S.E.
Structural Engineer

Date: October 21, 2019

1044 WYNDHAM WAY
CAMANO ISLAND, WA 98282
PHONE 360.387.8480

Project: **Ravensdale residence**

Design Criteria: 2015 International Building Code
Assumed allowable soil pressure 2000 psf

Live Loads:

Roof	38 psf	(Snow load, drift to 60 psf)
Floor	40 psf	

Dead Loads:

Roof:	Roofing	3.0	
	5/8" plywood sheathing	1.8	
	Prefab trusses @ 24" oc	3.0	
	Mech/Elect/Misc	0.5	
	5/8" gypboard	2.8	
		11.1 psf	Use 15 psf
First Floor:	Finish flooring	4.0	
	3/4" plywood sheathing (or 1-1/8")	3.3	
	11.875" TJI 360 @ 16"oc	2.3	
	Mech/Elect/Misc	0.5	
		10.1 psf	Use 12 psf
Interior walls:	2x4 studs @ 16"oc	1.0	
	5/8" gypboard ea side	5.6	
	15/32" Plywood	1.5	
		8.1 psf	Use 10 psf
Exterior walls:	2x6 studs @ 16"oc	1.6	
	5/8" gypboard	2.8	
	15/32" plywood	1.5	
	Exterior siding	3.0	
		8.9 psf	Use 10 psf

EVERGREEN DESIGN COMPANY, PLLC
1044 Wyndham Way
Camano Island, WA 98282

JOB RAVENSDALE
SHEET NO. _____ OF _____
CALCULATED BY UB DATE _____
CHECKED BY _____ DATE _____
SCALE _____

SNOW LOAD

Elevation 825'

Isoline 0.054

$P_g = 0.054 \times 825' = 45$ psf ground snow

$C_t = 1.0$

$C_e = 1.2$ (Exp. B sheltered)

$I_s = 1.0$

$P_f = (0.7)(1.2)(1.0)(1.0)(45) = 38$ psf flat roof snow

Drifted snow at parapet (3')

78' width Fig 7-9 ASCE 7-10

32' width. Fig. 7-9 ASCE 7-10

(see following page)

60 psf max drift

8.75' drift width

ASCE 7-10 Snow Loads

Description : Ravensdale

Flat Roof Snow Loads

Description :			per ASCE 7-10, Chapter 7
Ground Snow Load, per Fig 7-1	45.00 psf	Roof Slope, Sec .7.3.4	0.00
Terrain Category	B (see ASCE 7-10 Section 26.7)	Roof Configuration	Monoslope
Exposure of Roof	Sheltered		
Ce : Exposure Factor, Table 7-2	1.20		
Ct : Thermal Factor	1.0 : All not otherwise defined	pm, Minimum required	**20.00** psf
Risk Category, per Table 1.5-1	II	pf, Calculated Snow Load per Equation 7-1	**37.80** psf
Importance Factor, Is, Table 1.5-2	1.00	pf, Design Snow Load Max(pm min, pf calc)	**37.80** psf

Snow Drifts on Roof Projections

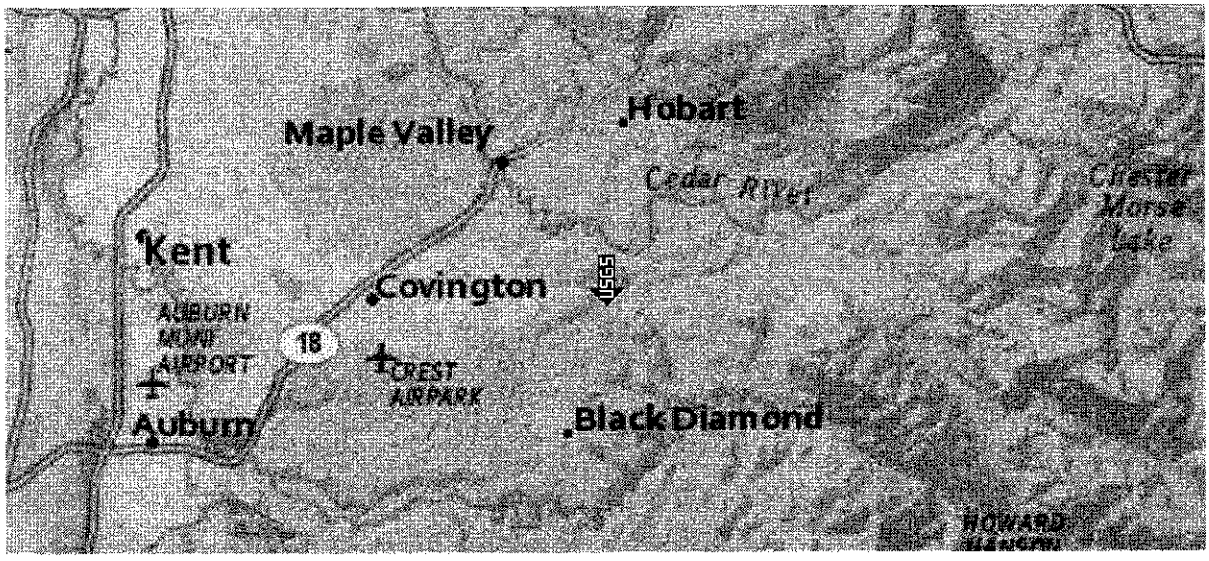
Description : Longitudinal			per ASCE 7-10, Chapt
Balanced Snow Load	38.00 psf	hd : windward	2.63 ft
Ground Snow Load	45.00 psf	hd : Design	1.09 ft
lu-upwind	78.00 ft	pd : Max Drift Only	21.55 psf
Height of Projection	3.00 ft	pd + Balanced	59.55 psf
Snow Density	19.85 pcf	W : Drift Width	8.69 ft
hb : Balanced	1.91 ft		
hc : Ht. of Projection - hb	1.09 ft		
hc / hb	0.57		

Description : Transverse			per ASCE 7-10, Chapt
Balanced Snow Load	38.00 psf	hd : windward	1.66 ft
Ground Snow Load	45.00 psf	hd : Design	1.09 ft
lu-upwind	32.00 ft	pd : Max Drift Only	21.55 psf
Height of Projection	3.00 ft	pd + Balanced	59.55 psf
Snow Density	19.85 pcf	W : Drift Width	8.69 ft
hb : Balanced	1.91 ft		
hc : Ht. of Projection - hb	1.09 ft		
hc / hb	0.57		

USGS Design Maps Summary Report

User–Specified Input

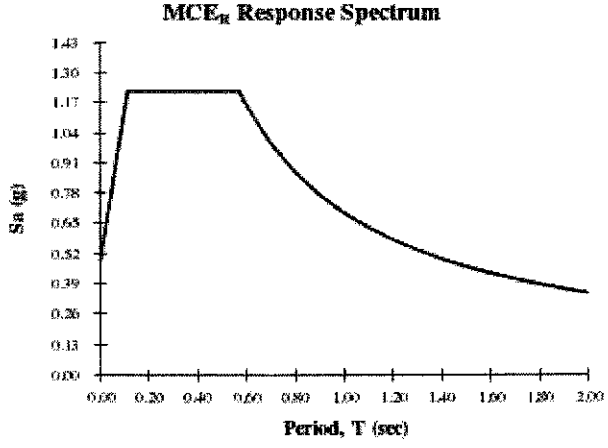
Report Title	Ravensdale Mon October 8, 2018 18:27:32 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	47.3642°N, 121.9831°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

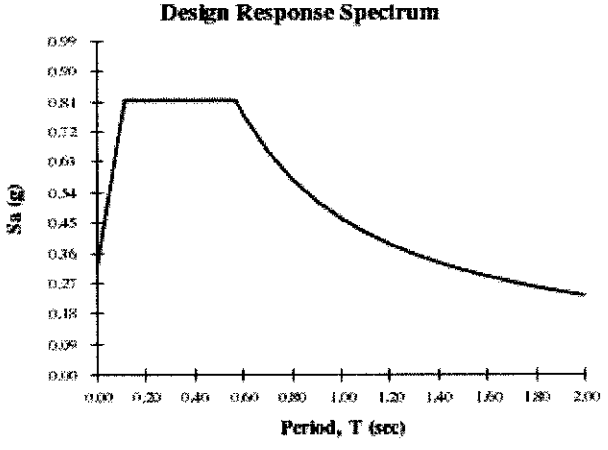


USGS–Provided Output

S_S =	1.193 g	S_{MS} =	1.220 g	S_{DS} =	0.814 g
S_1 =	0.448 g	S_{M1} =	0.695 g	S_{D1} =	0.463 g

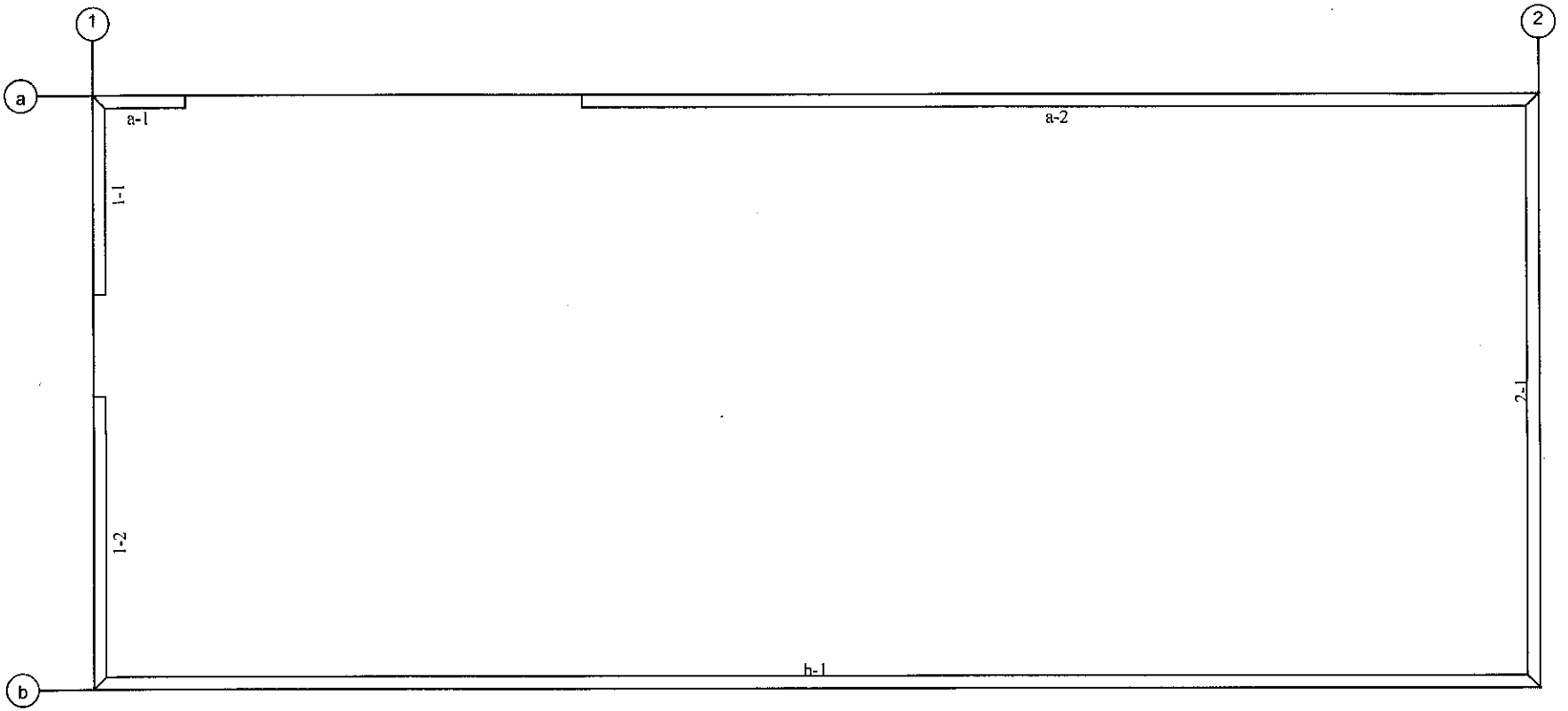
For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





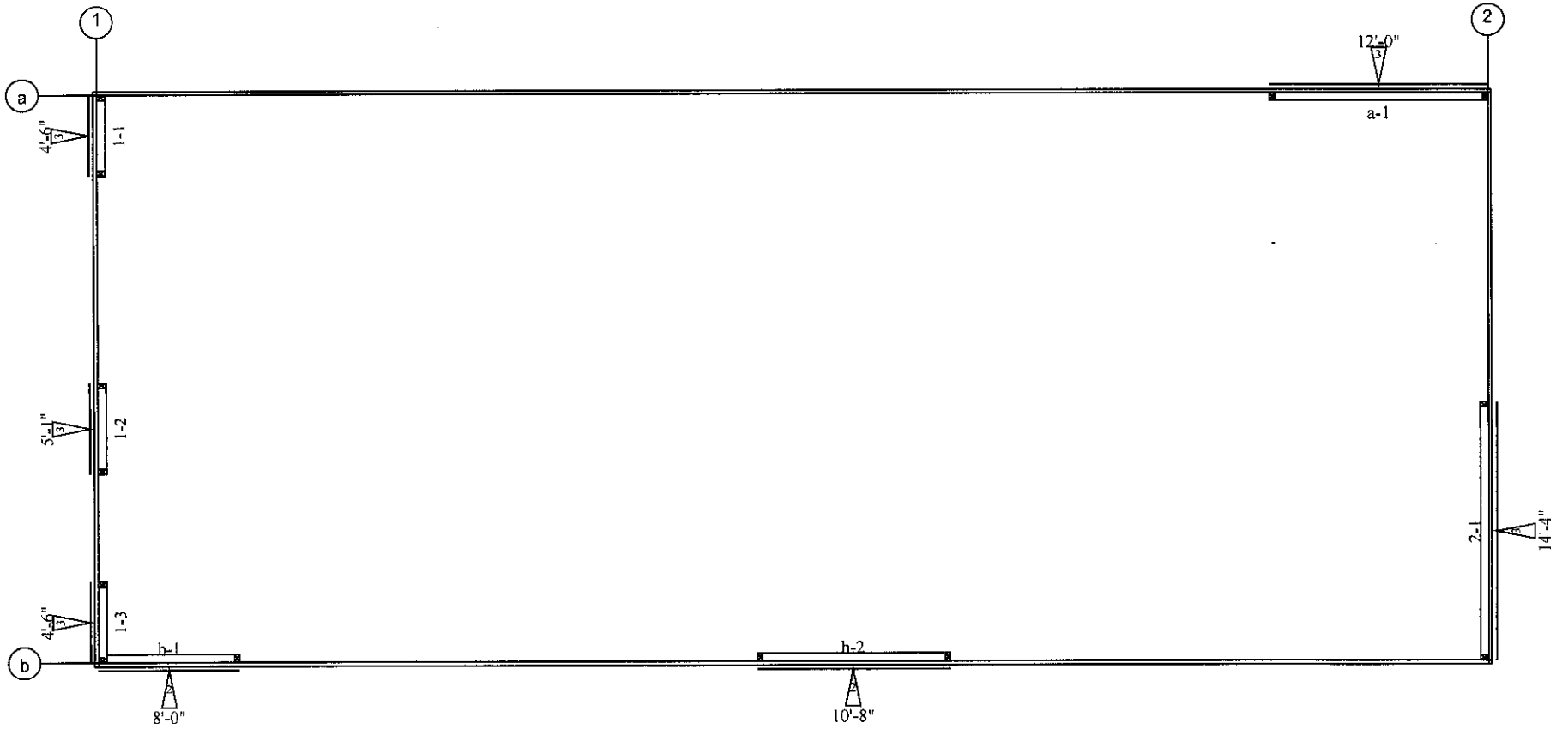
For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

SHEAR WALL LAYOUT OF (1ST)



PROJECT NAME: RAVENSDALE

SHEAR WALL LAYOUT OF (2ND)



PROJECT NAME: RAVENSDALE

Evergreen Design Company		DESIGNED		JOB NO.	
PROJECT	Ravensdale	CHECKED		SHT	OF
SUBJECT		DATE			

Building Information

No. of stories	2
Building height for lateral calculations (ft)	21.77
Building weight (lbs)	121159
Redundancy Factor:	
N-S:	1.3
E-W:	1.3

Floor Information

Floor_ID	1st
Floor net area (sf)	2382
Floor opening area (sf)	114
Average height (ft)	9.00

Diaphragms

Floor diaphragms for 1st									
Diaphragm name	Area (sf)	Effective seismic weight (psf)						Type	Remarks
		DL	Walls	Snow	Storage	Partitions	Total		
D1	2382	12.00	10.00	0.00	0.00	0.00	22.00	Floor	

Floor_ID	2nd
Floor net area (sf)	2491
Floor opening area (sf)	0
Average height (ft)	9.00

Diaphragms

Floor diaphragms for 2nd									
Diaphragm name	Area (sf)	Effective seismic weight (psf)						Type	Remarks
		DL	Walls	Snow	Storage	Partitions	Total		
D1	2491	15.00	5.00	7.60	0.00	0.00	27.60	Roof	Ignore opening in weight calculations

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Seismic Loads

Design code	2015 IBC (ASCE 7-10) ~~2009 IBC (ASCE 7-05)~~
Lateral force calculation method	Equivalent Lateral Force Procedure

Seismic data:

Building occupancy category	II. Standard		Table 1-1
Importance factor I	1.00		Table 11.5-1
Soil site class	D. Stiff soil profile		Table 20-3-1
Response Spectral Acc. (0.2 sec) (S_S)	1.20		Fig 22-1 through 22-14
Design Response Spectral Acc. (0.2 sec) (S_S)	1.20		Fig 22-1 through 22-14
Response Spectral Acc. (1.0 sec) (S_1)	0.45		Fig 22-1 through 22-14
T_L (sec)	6.00		Fig 22-15 through 22-20
Fa	1.02		Table 11.4-1
Fv	1.55		Table 11.4-2
Max. Considered earthquake acc. S_{MS}	1.22		(11.4-1)
Max. Considered earthquake acc. S_{M1}	0.70		(11.4-2)
Design spectral acc. at short period S_{DS}	0.82		(11.4-3)
Design spectral acc. at 1 s period S_{D1}	0.46		(11.4-4)
Seismic design category based on short period	D		Table 11.6-1
Seismic design category based on 1 S period	D		Table 11.6-2
Is S_1 >0.75	False		Sec 11.6
Project seismic design category	D		
Seismic force resisting system	13. Light-framed walls sheathed with wood structural panels rated for shear resistance or steel sheets		Table 12.2-1
Response modification coefficient R	6.50		Table 12.2-1
System overstrength coefficient Ωo	3.00		
Subtract 0.50 of Resistance Factor for flexible diaphragms	True		
Approximate fundamental period parameters	Ct = 0.02	x = 0.75	Table 12.8-2
Building height (ft)	21.77		
Building period T=T_a (sec)	0.20		(12.8-7)
Regular structure and 5 stories or less?	True		
Maximum S_{ss} =1.50	False		Sec 12.8.1.3
Base Shear Adjustment Factor	1		
Minimum C_s	0.01		12.8.5
Seismic response coefficient C_s	0.13		(12.8-2)
Adjusted C_s	0.13		

Seismic load: **V= Cs W = 0.13 W**

For allowable stress design 0.7 E = 0.7 * 0.13 = 0.0879 W

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Total effective weight (lbs) = 121159

Total seismic force (ASD) (lbs) = 10647

Vertical seismic load distribution:

Fx = Cvx V

$$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^{n} w_i h_i^k}$$ (12.8-11)

T = 0.20

K = 1.00 Sec 12.8.3

Floor	Wx (lbs)	hx (ft)	Wx * hx lb.ft	Wx * hx / sum(Wi*Hi)	Fx (lbs)
1st	52396	10.05	526689	0.2603	2771
2nd	68763	21.77	1497031	0.7397	7876

Sum(W)= 121159 Sum(W*h)= 2023719

Diaphragm design force:

$$F_{px} = \frac{\sum_{i=x}^{n} F_i}{\sum_{i=x}^{n} w_i} w_{px}$$ 12.10.1

Minimum value = 0.2 S_{SD}Wpx Sec 12.10.1

Needn't to exceed = 0.4 S_{SD}Wpx

Diaphragm seismic forces:

Floor	Sum(Fi) (lbs)	Sum(Wi) (lbs)	Wpx (lbs)	Sum(Fi) / Sum(Wi) Wpx	Min. Value	Max. Value	Fpx (lbs)
1st	10647	121159	52396	4604	8551	17102	8551
2nd	7876	68763	68763	7876	11222	22444	11222

Seismic force verification:

Direction	Base Seismic Forces (lbs)							Sum Wall Forces (lbs)	% Difference
	Masses			Forces		Point Seismic	Total Base Shear		
	Sum of diaphragm masses	Sum point mass	Total mass	Seismic factor	Seismic force from mass				
N-S	121159	0	121159	0.0879	10647	0	10647	10647	0.001
E-W	121159	0	121159	0.0879	10647	0	10647	10647	0.002

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Wind Loads

Design Code: International Building Code ~~2009~~ 2015

Wind Standard: ASCE7-~~05~~ 10 (Method 2 - All Heights)

Wind Data

Exposure	C	
Enclosure	Enclosed Building	
Category	II	
Wind Speed	~~85 MPH~~ → 110 mph (0.6 ASD)	
Mean Roof Height	23.77 ft	
Importance Factor Iw	1	
Hill Shape:	No Topographic Obstructions	
Velocity Coefficient q_z	$0.00256\ K_z K_{zt} K_d V^2 I_w$	(6-15)
Velocity Coefficient q_h	$0.00256\ K_h K_{zt} K_d V^2 I_w$	(6-15)
Directionality Factor K_d	0.85	Table 6-4
Gust Effect Factor G	0.85	6.5.8.1
Pressures for MWFRS p	qGC_p	(6-17)
K_h	0.94	

North/South C_p :

Windward Wall C_p	0.80
Leeward Wall C_p	-0.50
(L/B)	0.41

East/West C_p :

Windward Wall C_p	0.80
Leeward Wall C_p	-0.28
(L/B)	2.44

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Wind Load Distribution (North/South)

Elev. Z (ft)	K_z	K_{zt}	q_z (psf)	p (Wall-Windward) (psf)
0-15	0.85	1.00	13.35	9.08
20.00	0.90	1.00	14.18	9.64
23.77	0.94	1.00	14.70	10.00

p (Wall-Leeward) (psf) -6.25

p (Roof Windward) (psf) 22.06

p (Roof Leeward) (psf) -14.70

Wind Load Distribution (East/West)

Elev. Z (ft)	K_z	K_{zt}	q_z (psf)	p (Wall-Windward) (psf)
0-15	0.85	1.00	13.35	9.08
20.00	0.90	1.00	14.18	9.64
23.77	0.94	1.00	14.70	10.00

p (Wall-Leeward) (psf) -3.48

p (Roof Windward) (psf) 22.06

p (Roof Leeward) (psf) -14.70

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Shear line reactions and shear wall forces

Floor ID: 1st

Shear line ID	Reaction (lbs)		Shear wall ID	Shear wall forces (lbs)		R*	Wall type
	Seismic	Wind		Seismic	Wind		
1	1387	6518	1-1	561	2634	6.50	Solid wall
			1-2	827	3884	6.50	Solid wall
2	1384	6518	2-1	1384	6518	6.50	Solid wall
a	1335	2191	a-1	118	194	6.50	Solid wall
			a-2	1217	1997	6.50	Solid wall
b	1436	2191	b-1	1436	2191	6.50	Solid wall

Floor ID: 2nd

Shear line ID	Reaction (lbs)		Shear wall ID	Shear wall forces (lbs)		R*	Wall type
	Seismic	Wind		Seismic	Wind		
1	3940	6430	1-1	1259	2055	6.50	Segmented
			1-2	1422	2321	6.50	Segmented
			1-3	1259	2055	6.50	Segmented
2	3936	6430	2-1	3936	6430	6.50	Segmented
a	3933	2361	a-1	3933	2361	6.50	Segmented
b	3943	2361	b-1	1686	1010	6.50	Segmented
			b-2	2257	1351	6.50	Segmented

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Shear Wall Schedule

Mark	Sheathing	No. of sides	Edge Nail	Field Nail	Plate Nail	Shear Clip	Mudsill Anchors		Allowable Shear (plf)	Material	Remarks
							2X Mudsill	3X Mudsill			
1	15/32" Sheathing, plywood siding except Group 5 Species	Single	8d @ 6"	8d @ 12"	1/4"x6" SDS @ 1'-4"	A35 @ 2'-0"	5/8" x 10" @ 4'-0"	5/8" x 12" @ 4'-0"	242	SPF	1
2	15/32" Sheathing, plywood siding except Group 5 Species	Single	8d @ 4"	8d @ 12"	1/4"x6" SDS @ 1'-0"	A35 @ 1'-4"	5/8" x 10" @ 3'-0"	5/8" x 12" @ 4'-0"	350	SPF	1
3	15/32" Sheathing, plywood siding except Group 5 Species	Single	8d @ 3"	8d @ 12"	1/4"x6" SDS @ 0'-8"	A35 @ 1'-0"	5/8" x 10" @ 2'-9"	5/8" x 12" @ 3'-0"	455	SPF	1,2
5	15/32" Sheathing, plywood siding except Group 5 Species	Double	8d @ 4"	8d @ 12"	1/4"x6" SDS @ 0'-6"	A35 @ 0'-8"	5/8" x 10" @ 1'-9"	5/8" x 12" @ 2'-0"	707	SPF	1,2
7	15/32" Sheathing, plywood siding except Group 5 Species	Double	10d @ 3"	10d @ 12"	1/4"x6" SDS @ 0'-4"	A35 @ 0'-4"	5/8" x 10" @ 1'-1"	5/8" x 12" @ 1'-4"	1,116	SPF	1,2

1 USE PLYWOOD SHEATHING ONLY.

2 ALL FRAMING MEMBERS RECEIVING EDGE NAILING FROM ABUTTING PANELS SHALL NOT BE LESS THAN A SINGLE 3-INCH NOMINAL MEMBER OR TWO 2-INCH NOMINAL MEMBERS FASTEND IN ACCORDANCE WITH SECTION 2306.1 TO TRANSFER THE DESIGN SHEAR VALUE BETWEEN FRAMING MEMBERS. WOOD STRUCTURAL PANEL JOINT AND SILL PLATE NAILING SHALL BE STAGGERED IN ALL CASES.

3 ALL HARDWARE SHALL BE USP STRUCTURAL CONNECTORS U.O.N.

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Shear Wall Design

1st walls

Wall ID	Length (ft)	Net Height (ft)	H / W	Shear (plf)		Wall type	Allowable shear (plf)	Adjusted allowable shear (plf)		Wall Drift (in)	Hold-Down		Remarks
				Wind	Seismic			Wind	Seismic		End I	End J	
1-1	10'-8"	9'-0"											1
1-2	15'-9"	9'-0"											1
2-1	32'-0"	9'-0"											1
a-1	5'-0"	10'-0"											1
a-2	51'-6"	10'-0"											1
b-1	78'-0"	10'-0"											1

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2nd walls

Wall ID	Length (ft)	Net Height (ft)	H / W	Shear (plf)		Wall type	Allowable shear (plf)	Adjusted allowable shear (plf)		Wall Drift (in)	Hold-Down		Remarks
				Wind	Seismic			Wind	Seismic		End I	End J	
1-1	4'-6"	8'-11"	2.00	457	364	3	455	637	455	2.13	HDQ8-SDS3 4x	HDQ8-SDS3 4x	
1-2	5'-1"	8'-11"	1.77	457	364	3	455	637	455	2.03	HDQ8-SDS3 4x	HDQ8-SDS3 4x	
1-3	4'-6"	8'-11"	2.00	457	364	3	455	637	455	2.13	HDQ8-SDS3 4x	HDQ8-SDS3 4x	
2-1	14'-4"	8'-11"	0.63	447	356	3	455	637	455	1.50	HDQ8-SDS3 4x	HDQ8-SDS3 4x	
a-1	12'-0"	8'-11"	0.75	197	426	3	455	637	455	1.80	HDQ8-SDS3 4x	HDQ8-SDS3 4x	
b-1	8'-0"	8'-11"	1.12	126	274	2	350	490	350	1.56	HDQ8-SDS3 4x	HDU4-SDS2.5	
b-2	10'-8"	8'-11"	0.84	126	274	2	350	490	350	1.44	HDU4-SDS2.5	HDU4-SDS2.5	

1 Solid Wall

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HOLD-DOWN SCHEDULE

Mark	Fastener	Minimum Wood Member	Anchor Bolt	Capacity (lbs)	Remarks
HDU4-SDS2.5	10-SDS 1/4" X 2.5"	(2) 2 x 4	5/8"	3285	
HDQ8-SDS3 4x	20-SDS 1/4" X 3.5"	4 x 4	7/8"	5495	

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Uplift Calculations

Load Cases:

0.6D + W

$(0.6 - 0.14S_{DS})D + 0.7pQ_E$

2nd Walls

Post ID	Shear Wall	Reactions (lbs)			Wall Height (ft)	Net Uplift (lbs)	Hold Down
		DL	W	0.7E			
UP2	b-1	339	-1479	-3211	11.72	-3046	HDQ8-SDS3 4x
	1-3	202	-5351	-4262	11.72	-5229	
UP1	1-3	202	-5351	-4262	11.72	-5229	HDQ8-SDS3 4x
UP4	1-2	229	-5351	-4262	11.72	-5213	HDQ8-SDS3 4x
UP3	1-2	229	-5351	-4262	11.72	-5213	HDQ8-SDS3 4x
UP6	1-1	202	-5351	-4262	11.72	-5229	HDQ8-SDS3 4x
UP5	1-1	202	-5351	-4262	11.72	-5229	HDQ8-SDS3 4x
UP7	b-1	339	-1479	-3211	11.72	-3046	HDU4-SDS2.5
UP9	b-2	482	-1479	-3211	11.72	-2977	HDU4-SDS2.5
UP8	b-2	482	-1479	-3211	11.72	-2977	HDU4-SDS2.5
UP11	a-1	540	-2306	-4993	11.72	-4731	HDQ8-SDS3 4x
UP10	a-1	540	-2306	-4993	11.72	-4731	HDQ8-SDS3 4x
UP13	2-1	647	-5242	-4171	11.72	-4854	HDQ8-SDS3 4x
UP12	2-1	647	-5242	-4171	11.72	-4854	HDQ8-SDS3 4x

- NR indicates that no hold-down is required because there is no net uplift.
- No Selection indicates that uplift value is larger than available hold-down capacities defined in database.
- PP indicates hold-down attached to a pre-manufactured shear wall panel.

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Diaphragm Design

Floor_ID: 1st
Diaphragm_ID: D1

Code Check
Diaphragm Shear: Passed

Nailing

Load Direction: E-W

Span	Sheathing		Nailing		Min. member thickness (in)	Diaphragm type	Case ID	Effective depth (ft)		Seismic shear (plf)		Wind shear (plf)		Chord force (lbs)		Check
	Grade	Thickness (in)	Boundary	Other edges				For shear	For bending	Applied shear	Allowable shear	Applied shear	Allowable shear	Seismic	Wind	
a-b	Sheathing and Single-Floor	19/32	10d@6	10d@6	2	Unblocked	3	55.96	78.00	68	215	36	300	627	225	P

Load Direction: N-S

Span	Sheathing		Nailing		Min. member thickness (in)	Diaphragm type	Case ID	Effective depth (ft)		Seismic shear (plf)		Wind shear (plf)		Chord force (lbs)		Check
	Grade	Thickness (in)	Boundary	Other edges				For shear	For bending	Applied shear	Allowable shear	Applied shear	Allowable shear	Seismic	Wind	
1-2	Sheathing and Single-Floor	19/32	10d@6	10d@6	2	Unblocked	1	32.00	32.00	134	285	204	400	2518	3972	P

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Floor_ID: 2nd
Diaphragm_ID: D1

Code Check
Diaphragm Shear: Passed

Nailing

Load Direction: E-W

Span	Sheathing		Nailing		Min. member thickness (in)	Diaphragm type	Case ID	Effective depth (ft)		Seismic shear (plf)		Wind shear (plf)		Chord force (lbs)		Check
	Grade	Thickness (in)	Boundary	Other edges				For shear	For bending	Applied shear	Allowable shear	Applied shear	Allowable shear	Seismic	Wind	
a-b	Sheathing and Single-Floor	19/32	10d@6	10d@6	2	Unblocked	3	77.96	77.96	71	215	30	300	562	239	P

Load Direction: N-S

Span	Sheathing		Nailing		Min. member thickness (in)	Diaphragm type	Case ID	Effective depth (ft)		Seismic shear (plf)		Wind shear (plf)		Chord force (lbs)		Check
	Grade	Thickness (in)	Boundary	Other edges				For shear	For bending	Applied shear	Allowable shear	Applied shear	Allowable shear	Seismic	Wind	
1-2	Sheathing and Single-Floor	19/32	10d@6	10d@6	2	Unblocked	1	31.96	31.96	175	285	201	400	3389	3903	P

Project: Ravensdale

Location: Roof - south header 4' - multi-span (10-21-19)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
5.5 IN x 7.5 IN x 12.0 FT (4 + 4 + 4)
#2 - Hem-Fir - Dry Use
Section Adequate By: 35.0%
Controlling Factor: Moment

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Evergreen Design Company pllc

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DEFLECTIONS	Left		Center		Right	
Live Load	0.02	IN L/2785	0.01	IN L/4081	0.02	IN L/2785
Dead Load	0.00	in	0.00	in	0.00	in
Total Load	0.02	IN L/2177	0.01	IN L/3960	0.02	IN L/2177

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A	B	C	D
Live Load	1505 lb	4013 lb	4013 lb	1505 lb
Dead Load	540 lb	1486 lb	1486 lb	540 lb
Total Load	2045 lb	5499 lb	5499 lb	2045 lb
Bearing Length	0.92 in	2.47 in	2.47 in	0.92 in

BEAM DATA	Left	Center	Right
Span Length	4 ft	4 ft	4 ft
Unbraced Length-Top	0 ft	0 ft	0 ft
Unbraced Length-Bottom	4 ft	4 ft	4 ft
Live Load Duration Factor	1.15		
Notch Depth	0.00		

MATERIAL PROPERTIES

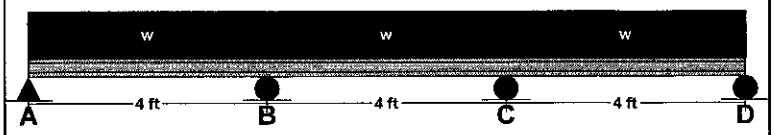
#2 - Hem-Fir

	Base Values	Adjusted
Bending Stress:	Fb = 575 psi	Fb' = 660 psi
	Cd=1.15 Cl=1.00 CF=1.00	
Shear Stress:	Fv = 140 psi	Fv' = 161 psi
	Cd=1.15	
Modulus of Elasticity:	E = 1100 ksi	E' = 1100 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 405 psi	Fc - ⊥' = 405 psi

Controlling Moment: -2101 ft-lb
Over right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2, 3
Controlling Shear: 2873 lb
At left support of span 3 (Right Span)
Created by combining all dead loads and live loads on span(s) 2, 3

Comparisons with required sections:	Req'd	Provided
Section Modulus:	38.19 in3	51.56 in3
Area (Shear):	26.76 in2	41.25 in2
Moment of Inertia (deflection):	16.66 in4	193.36 in4
Moment:	-2101 ft-lb	2836 ft-lb
Shear:	2873 lb	4428 lb

LOADING DIAGRAM



UNIFORM LOADS	Left		Center		Right	
Uniform Live Load	836	plf	836	plf	836	plf
Uniform Dead Load	330	plf	330	plf	330	plf
Beam Self Weight	8	plf	8	plf	8	plf
Total Uniform Load	1174	plf	1174	plf	1174	plf

Project: Ravensdale

Location: Roof - south header 4' - single span (10-21-19)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
5.5 IN x 7.5 IN x 4.0 FT
#2 - Hem-Fir - Dry Use
Section Adequate By: 21.0%
Controlling Factor: Moment

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Evergreen Design Company pllc

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DEFLECTIONS	Center	
Live Load	0.02	IN L/2121
Dead Load	0.01	in
Total Load	0.03	IN L/1510

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A	B
Live Load	1672 lb	1672 lb
Dead Load	675 lb	675 lb
Total Load	2347 lb	2347 lb
Bearing Length	1.05 in	1.05 in

BEAM DATA	Center
Span Length	4 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	4 ft
Live Load Duration Factor	1.15
Notch Depth	0.00

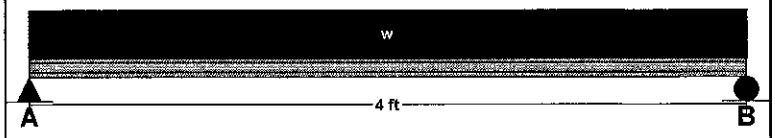
MATERIAL PROPERTIES
#2 - Hem-Fir

	Base Values		Adjusted	
Bending Stress:	Fb =	575 psi	Fb' =	661 psi
	Cd=1.15 CF=1.00			
Shear Stress:	Fv =	140 psi	Fv' =	161 psi
	Cd=1.15			
Modulus of Elasticity:	E =	1100 ksi	E' =	1100 ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	405 psi	Fc - ⊥' =	405 psi

Controlling Moment: 2347 ft-lb
2.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 2347 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	42.6 in3	51.56 in3
Area (Shear):	21.87 in2	41.25 in2
Moment of Inertia (deflection):	23.04 in4	193.36 in4
Moment:	2347 ft-lb	2841 ft-lb
Shear:	2347 lb	4428 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	836 plf
Uniform Dead Load	330 plf
Beam Self Weight	8 plf
Total Uniform Load	1174 plf

Project: Ravensdale

Location: Roof - east and west headers (10-21-19)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 5.5 IN x 6.5 FT
#2 - Hem-Fir - Dry Use
Section Adequate By: 105.9%
Controlling Factor: Moment

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DEFLECTIONS	Center	
Live Load	0.04	IN L/1750
Dead Load	0.05	in
Total Load	0.10	IN L/820

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	195 lb	195 lb
Dead Load	221 lb	221 lb
Total Load	416 lb	416 lb
Bearing Length	0.34 in	0.34 in

BEAM DATA	Center
Span Length	6.5 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	6.5 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

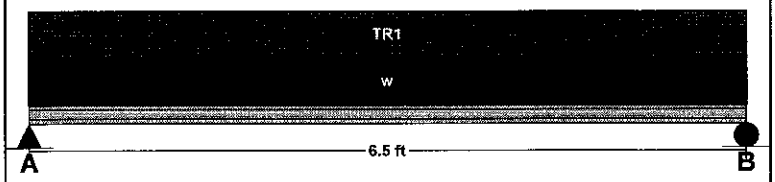
MATERIAL PROPERTIES
#2 - Hem-Fir

	Base Values	Adjusted
Bending Stress:	Fb = 850 psi	Fb' = 1105 psi
	Cd=1.00 CF=1.30	
Shear Stress:	Fv = 150 psi	Fv' = 150 psi
	Cd=1.00	
Modulus of Elasticity:	E = 1300 ksi	E' = 1300 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 405 psi	Fc - ⊥' = 405 psi

Controlling Moment: 676 ft-lb
3.25 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -416 lb
6.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	7.35 in3	15.13 in3
Area (Shear):	4.16 in2	16.5 in2
Moment of Inertia (deflection):	12.17 in4	41.59 in4
Moment:	676 ft-lb	1393 ft-lb
Shear:	-416 lb	1650 lb

LOADING DIAGRAM



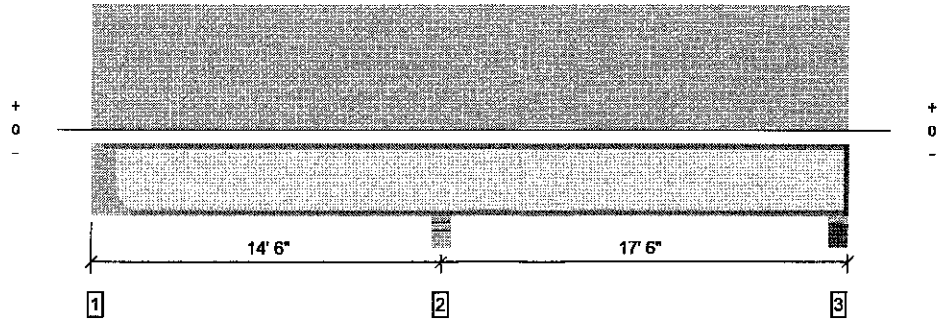
UNIFORM LOADS	Center
Uniform Live Load	60 plf
Uniform Dead Load	15 plf
Beam Self Weight	3 plf
Total Uniform Load	78 plf

TRAPEZOIDAL LOADS - CENTER SPAN	
Load Number	One
Left Live Load	0 plf
Left Dead Load	50 plf
Right Live Load	0 plf
Right Dead Load	50 plf
Load Start	0 ft
Load End	6.5 ft
Load Length	6.5 ft

FORTE® MEMBER REPORT *Level, Floor: Joist* **PASSED**

1 piece(s) 11 7/8" TJI® 360 @ 16" OC

Overall Length: 32'



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1367 @ 14' 6"	3000 (5.25")	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	677 @ 14' 8 3/4"	1876	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-2182 @ 14' 6"	6180	Passed (35%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.175 @ 23' 7 1/16"	0.428	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.216 @ 23' 8 1/4"	0.856	Passed (L/949)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	52	50	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).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' 1" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6' 5" o/c unless detailed otherwise.
- 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: 1/2" Gypsum ceiling.

Supports	Bearing			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 11 7/8" SPF beam	3.50"	Hanger[1]	1.75" / - [2]	83	351/-60	434/-60	See note [1]
2 - Stud wall - SPF	5.50"	5.50"	3.50"	316	1052	1368	None
3 - Plate on concrete - SPF	5.50"	4.25"	1.75"	114	414/-30	528/-30	1 1/4" Rim Board

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

Connector: Simpson Strong-Tie Connectors

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

Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 32'	16"	12.0	40.0	Residential - Living Areas

Member Notes

Floor: Joist

Weyerhaeuser Notes

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

SUSTAINABLE FORESTRY INITIATIVE

Forte Software Operator	Job Notes
Lori Brown Evergreen Design Company pllc (360) 387-8480 loribrown@att.net	

10/8/2018 11:50:00 AM
Forte v5.4, Design Engine: V7.1.1.3
Ravensdale.4te

Project: Ravensdale

Location: First - west header (10-21-19)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
3.5 IN x 11.875 IN x 6.0 FT
2.0E Parallam - iLevel Trus Joist
Section Adequate By: 823.6%
Controlling Factor: Shear

Lori D. Brown, P.E., S.E.
Evergreen Design Company pllc

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DEFLECTIONS	Center	
Live Load	0.00	IN L/MAX
Dead Load	0.01	in
Total Load	0.01	IN L/8319

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	300 lb	300 lb
Dead Load	570 lb	570 lb
Total Load	870 lb	870 lb
Bearing Length	0.33 in	0.33 in

BEAM DATA	Center
Span Length	6 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	6 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

2.0E Parallam - iLevel Trus Joist

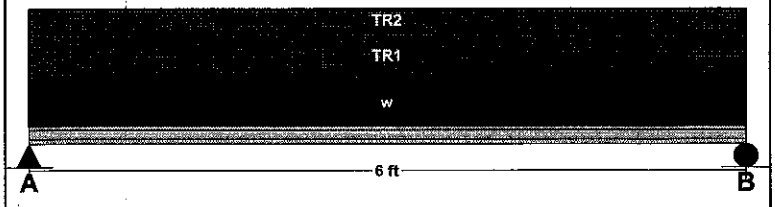
	Base Values		Adjusted	
Bending Stress:	Fb =	2900 psi	Fb' =	2903 psi
	Cd=1.00 CF=1.00			
Shear Stress:	Fv =	290 psi	Fv' =	290 psi
	Cd=1.00			
Modulus of Elasticity:	E =	2000 ksi	E' =	2000 ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	750 psi	Fc - ⊥' =	750 psi

Controlling Moment: 1305 ft-lb
3.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: 870 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	5.39 in3	82.26 in3
Area (Shear):	4.5 in2	41.56 in2
Moment of Inertia (deflection):	14.09 in4	488.41 in4
Moment:	1305 ft-lb	19902 ft-lb
Shear:	870 lb	8035 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	40 plf
Uniform Dead Load	12 plf
Beam Self Weight	13 plf
Total Uniform Load	65 plf

TRAPEZOIDAL LOADS - CENTER SPAN		
Load Number	One	Two
Left Live Load	0 plf	60 plf
Left Dead Load	150 plf	15 plf
Right Live Load	0 plf	60 plf
Right Dead Load	150 plf	15 plf
Load Start	0 ft	0 ft
Load End	6 ft	6 ft
Load Length	6 ft	6 ft

Project: Ravensdale

Location: First - north beam at garage opening in north elevation (10-21-19)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
5.5 IN x 27.0 IN x 22.0 FT
24F-V4 - Visually Graded Western Species - Dry Use
Section Adequate By: 51.4%
Controlling Factor: Moment

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Evergreen Design Company pllc

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DEFLECTIONS	Center	
Live Load	0.28	IN L/940
Dead Load	0.15	in
Total Load	0.43	IN L/612

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	9515	lb	9515	lb
Dead Load	5117	lb	5117	lb
Total Load	14632	lb	14632	lb
Bearing Length	4.09	in	4.09	in

BEAM DATA	Center
Span Length	22 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	22 ft
Live Load Duration Factor	1.00
Camber Adj. Factor	1
Camber Required	0.15
Notch Depth	0.00

MATERIAL PROPERTIES

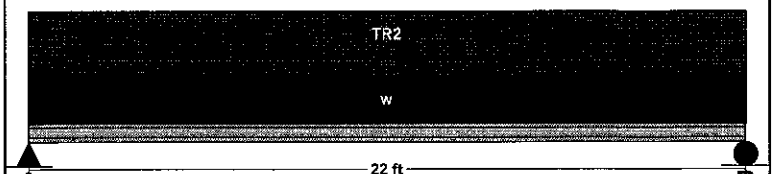
24F-V4 - Visually Graded Western Species

	Base Values		Adjusted	
Bending Stress:	Fb =	2400 psi	*Controlled by:*	
	Fb_cmpr =	1850 psi	Fb' =	2187 psi
	Cd=1.00 Cv=0.91			
Shear Stress:	Fv =	265 psi	Fv' =	265 psi
	Cd=1.00			
Modulus of Elasticity:	E =	1800 ksi	E' =	1800 ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	650 psi	Fc - ⊥' =	650 psi

Controlling Moment: 80477 ft-lb
11.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 14632 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	441.51 in3	668.25 in3
Area (Shear):	82.82 in2	148.5 in2
Moment of Inertia (deflection):	3540.41 in4	9021.38 in4
Moment:	80477 ft-lb	121805 ft-lb
Shear:	14632 lb	26235 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	160 plf
Uniform Dead Load	48 plf
Beam Self Weight	32 plf
Total Uniform Load	240 plf

TRAPEZOIDAL LOADS - CENTER SPAN		
Load Number	One	Two
Left Live Load	0 plf	705 plf
Left Dead Load	145 plf	240 plf
Right Live Load	0 plf	705 plf
Right Dead Load	145 plf	240 plf
Load Start	0 ft	0 ft
Load End	22 ft	22 ft
Load Length	22 ft	22 ft

Project: Ravensdale

Location: First - OH door header
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
5.5 IN x 15.0 IN x 18.5 FT
24F-V4 - Visually Graded Western Species - Dry Use
Section Adequate By: 91.6%
Controlling Factor: Deflection

Lori D. Brown, P.E., S.E.
Evergreen Design Company pllc
1044 Wyndham Way
Camano Island, WA 98282

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DEFLECTIONS	Center
Live Load	0.32 IN L/690
Dead Load	0.11 in
Total Load	0.44 IN L/510

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	3145 lb	3145 lb
Dead Load	1109 lb	1109 lb
Total Load	4254 lb	4254 lb
Bearing Length	1.19 in	1.19 in

BEAM DATA	Center
Span Length	18.5 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	18.5 ft
Live Load Duration Factor	1.00
Camber Adj. Factor	1.5
Camber Required	0.17
Notch Depth	0.00

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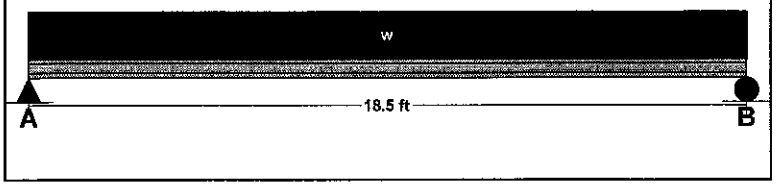

UNIFORM LOADS	Center
Uniform Live Load	340 plf
Uniform Dead Load	102 plf
Beam Self Weight	18 plf
Total Uniform Load	460 plf

MATERIAL PROPERTIES

24F-V4 - Visually Graded Western Species

	Base Values		Adjusted	
Bending Stress:	Fb =	2400 psi	*Controlled by:*	
	Fb_cmpr =	1850 psi	Fb' =	2360 psi
	Cd=1.00 Cv=0.98			
Shear Stress:	Fv =	265 psi	Fv' =	265 psi
	Cd=1.00			
Modulus of Elasticity:	E =	1800 ksi	E' =	1800 ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	650 psi	Fc - ⊥' =	650 psi

Controlling Moment: 19674 ft-lb
9.25 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: 4254 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	100.03 in3	206.25 in3
Area (Shear):	24.08 in2	82.5 in2
Moment of Inertia (deflection):	807.15 in4	1546.88 in4
Moment:	19674 ft-lb	40567 ft-lb
Shear:	4254 lb	14575 lb

Project: Ravensdale

Location: First - interior beam over garage - steel
Multi-Loaded Multi-Span Beam
[2015 International Building Code(AISC 14th Ed ASD)]
A992-50 W14x53 x 27.5 FT
Section Adequate By: 132.9%
Controlling Factor: Deflection

Lori D. Brown, P.E., S.E.
Evergreen Design Company pllc
1044 Wyndham Way
Camano Island, WA 98282

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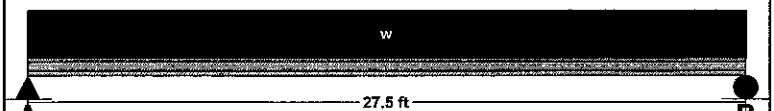
DEFLECTIONS	Center	
Live Load	0.39	IN L/838
Dead Load	0.16	in
Total Load	0.56	IN L/594

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	6600	lb	6600	lb
Dead Load	2709	lb	2709	lb
Total Load	9309	lb	9309	lb
Bearing Length	1.25	in	1.25	in

BEAM DATA	Center	
Span Length	27.5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	27.5	ft

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	480	plf
Uniform Dead Load	144	plf
Beam Self Weight	53	plf
Total Uniform Load	677	plf

STEEL PROPERTIES
W14x53 - A992-50

Properties:

Yield Stress:	Fy =	50	ksi
Modulus of Elasticity:	E =	29000	ksi
Depth:	d =	13.9	in
Web Thickness:	tw =	0.37	in
Flange Width:	bf =	8.06	in
Flange Thickness:	tf =	0.66	in
Distance to Web Toe of Fillet:	k =	1.25	in
Moment of Inertia About X-X Axis:	Ix =	541	in4
Section Modulus About X-X Axis:	Sx =	77.8	in3
Plastic Section Modulus About X-X Axis:	Zx =	87.1	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	6.11	
Allowable Flange Buckling Ratio:	AFBR =	9.15	
Web Buckling Ratio:	WBR =	30.81	
Allowable Web Buckling Ratio:	AWBR =	90.55	
Controlling Unbraced Length:	Lb =	0	ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	6.78	ft
Nominal Flexural Strength w/ safety factor:	Mn =	217315	ft-lb
Controlling Equation:	F2-1		
Web height to thickness ratio:	h/tw =	30.81	
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95	
Cv Factor:	Cv =	1	
Controlling Equation:	G2-2		
Nominal Shear Strength w/ safety factor:	Vn =	102860	lb

Controlling Moment: 63998 ft-lb
13.75 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 9309 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	232.31 in4	541 in4
Moment:	63998 ft-lb	217315 ft-lb
Shear:	9309 lb	102860 lb

Project: Ravensdale

Location: First - header at storage 4'
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
3.5 IN x 7.25 IN x 4.0 FT
#2 - Hem-Fir - Dry Use
Section Adequate By: 86.4%
Controlling Factor: Shear

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DEFLECTIONS	Center
Live Load	0.02 IN L/2316
Dead Load	0.01 in
Total Load	0.03 IN L/1769

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	1040 lb	1040 lb
Dead Load	321 lb	321 lb
Total Load	1361 lb	1361 lb
Bearing Length	0.96 in	0.96 in

BEAM DATA	Center
Span Length	4 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	4 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

#2 - Hem-Fir

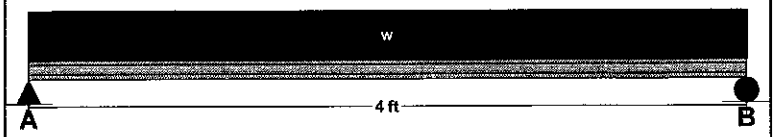
	Base Values	Adjusted
Bending Stress:	Fb = 850 psi	Fb' = 1105 psi
	Cd=1.00 CF=1.30	
Shear Stress:	Fv = 150 psi	Fv' = 150 psi
	Cd=1.00	
Modulus of Elasticity:	E = 1300 ksi	E' = 1300 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 405 psi	Fc - ⊥' = 405 psi

Controlling Moment: 1361 ft-lb
2.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: -1361 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	14.79 in3	30.66 in3
Area (Shear):	13.61 in2	25.38 in2
Moment of Inertia (deflection):	17.28 in4	111.15 in4
Moment:	1361 ft-lb	2823 ft-lb
Shear:	-1361 lb	2538 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	520 plf
Uniform Dead Load	156 plf
Beam Self Weight	5 plf
Total Uniform Load	681 plf

Project: Ravensdale

Location: First - header at future game room 3'
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 5.5 IN x 3.0 FT
#2 - Hem-Fir - Dry Use
Section Adequate By: 31.7%
Controlling Factor: Shear

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DEFLECTIONS	Center	
Live Load	0.02	IN L/1669
Dead Load	0.01	in
Total Load	0.03	IN L/1279

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	960 lb	960 lb
Dead Load	293 lb	293 lb
Total Load	1253 lb	1253 lb
Bearing Length	1.03 in	1.03 in

BEAM DATA	Center
Span Length	3 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	3 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

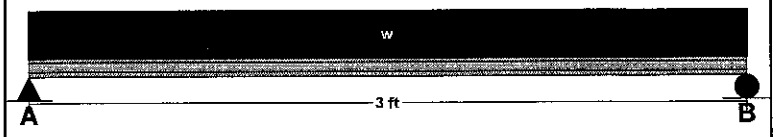
#2 - Hem-Fir

	Base Values	Adjusted
Bending Stress:	Fb = 850 psi	Fb' = 1105 psi
	Cd=1.00 CF=1.30	
Shear Stress:	Fv = 150 psi	Fv' = 150 psi
	Cd=1.00	
Modulus of Elasticity:	E = 1300 ksi	E' = 1300 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 405 psi	Fc - ⊥' = 405 psi

Controlling Moment: 939 ft-lb
1.5 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -1253 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	10.2 in3	15.13 in3
Area (Shear):	12.53 in2	16.5 in2
Moment of Inertia (deflection):	8.97 in4	41.59 in4
Moment:	939 ft-lb	1393 ft-lb
Shear:	-1253 lb	1650 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	640 plf
Uniform Dead Load	192 plf
Beam Self Weight	3 plf
Total Uniform Load	835 plf

Project: Ravensdale

Location: First - EW beam south of stair opening
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
3.5 IN x 11.875 IN x 11.5 FT
2.0E Parallam - iLevel Trus Joist
Section Adequate By: 270.5%
Controlling Factor: Moment

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DEFLECTIONS	Center	
Live Load	0.10	IN L/1428
Dead Load	0.03	in
Total Load	0.13	IN L/1054

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	1380 lb	1380 lb
Dead Load	489 lb	489 lb
Total Load	1869 lb	1869 lb
Bearing Length	0.71 in	0.71 in

BEAM DATA	Center
Span Length	11.5 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	11.5 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

2.0E Parallam - iLevel Trus Joist

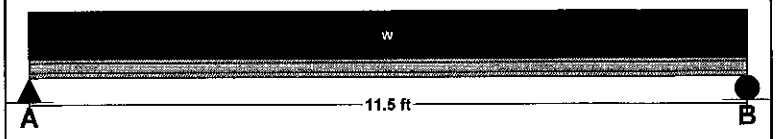
	Base Values	Adjusted
Bending Stress:	Fb = 2900 psi	Fb' = 2903 psi
	Cd=1.00 CF=1.00	
Shear Stress:	Fv = 290 psi	Fv' = 290 psi
	Cd=1.00	
Modulus of Elasticity:	E = 2000 ksi	E' = 2000 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750 psi	Fc - ⊥' = 750 psi

Controlling Moment: 5372 ft-lb
5.75 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: -1869 lb
12.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	22.21 in3	82.26 in3
Area (Shear):	9.67 in2	41.56 in2
Moment of Inertia (deflection):	123.17 in4	488.41 in4
Moment:	5372 ft-lb	19902 ft-lb
Shear:	-1869 lb	8035 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	240 plf
Uniform Dead Load	72 plf
Beam Self Weight	13 plf
Total Uniform Load	325 plf

Project: Ravensdale

Location: First - NS beam west of stair opening
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
3.5 IN x 11.875 IN x 6.5 FT
2.0E Parallam - iLevel Trus Joist
Section Adequate By: 443.0%
Controlling Factor: Shear

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DEFLECTIONS	Center	
Live Load	0.01	IN L/8533
Dead Load	0.00	in
Total Load	0.01	IN L/6044

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	1062 lb	318 lb
Dead Load	418 lb	155 lb
Total Load	1480 lb	473 lb
Bearing Length	0.56 in	0.18 in

BEAM DATA	Center
Span Length	6.5 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	6.5 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

2.0E Parallam - iLevel Trus Joist

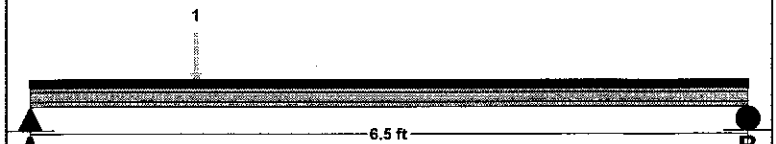
	Base Values	Adjusted
Bending Stress:	Fb = 2900 psi	Fb' = 2903 psi
	Cd=1.00 CF=1.00	
Shear Stress:	Fv = 290 psi	Fv' = 290 psi
	Cd=1.00	
Modulus of Elasticity:	E = 2000 ksi	E' = 2000 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750 psi	Fc - ⊥' = 750 psi

Controlling Moment: 2198 ft-lb
1.49 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: 1480 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	9.08 in3	82.26 in3
Area (Shear):	7.65 in2	41.56 in2
Moment of Inertia (deflection):	20.61 in4	488.41 in4
Moment:	2198 ft-lb	19902 ft-lb
Shear:	1480 lb	8035 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	0 plf
Uniform Dead Load	0 plf
Beam Self Weight	13 plf
Total Uniform Load	13 plf

POINT LOADS - CENTER SPAN	
Load Number	One
Live Load	1380 lb
Dead Load	489 lb
Location	1.5 ft

Project: Ravensdale

Location: First - EW beam south of curbless shower
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
3.5 IN x 11.875 IN x 5.5 FT
2.0E Parallam - iLevel Trus Joist
Section Adequate By: 542.2%
Controlling Factor: Shear

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DEFLECTIONS	Center	
Live Load	0.01	IN L/9211
Dead Load	0.00	in
Total Load	0.01	IN L/6883

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	935 lb	935 lb
Dead Load	316 lb	316 lb
Total Load	1251 lb	1251 lb
Bearing Length	0.48 in	0.48 in

BEAM DATA	Center
Span Length	5.5 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	5.5 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

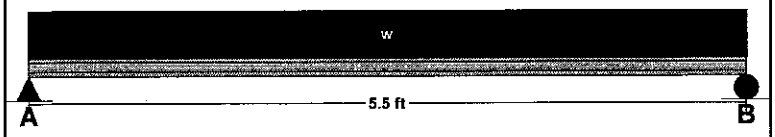
2.0E Parallam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb =	2900 psi	Fb' =	2903 psi
	Cd=1.00 CF=1.00			
Shear Stress:	Fv =	290 psi	Fv' =	290 psi
	Cd=1.00			
Modulus of Elasticity:	E =	2000 ksi	E' =	2000 ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	750 psi	Fc - ⊥' =	750 psi

Controlling Moment: 1720 ft-lb
2.75 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -1251 lb
6.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	7.11 in3	82.26 in3
Area (Shear):	6.47 in2	41.56 in2
Moment of Inertia (deflection):	19.09 in4	488.41 in4
Moment:	1720 ft-lb	19902 ft-lb
Shear:	-1251 lb	8035 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	340 plf
Uniform Dead Load	102 plf
Beam Self Weight	13 plf
Total Uniform Load	455 plf

Project: Ravensdale

Location: First - NS beam west of curbless shower
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
3.5 IN x 11.875 IN x 17.0 FT
2.0E Parallam - iLevel Trus Joist
Section Adequate By: 275.5%
Controlling Factor: Deflection

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DEFLECTIONS	Center	
Live Load	0.15	IN L/1354
Dead Load	0.08	in
Total Load	0.23	IN L/901

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	330 lb	605 lb
Dead Load	222 lb	315 lb
Total Load	552 lb	920 lb
Bearing Length	0.21 in	0.35 in

BEAM DATA	Center
Span Length	17 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	17 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

2.0E Parallam - iLevel Trus Joist

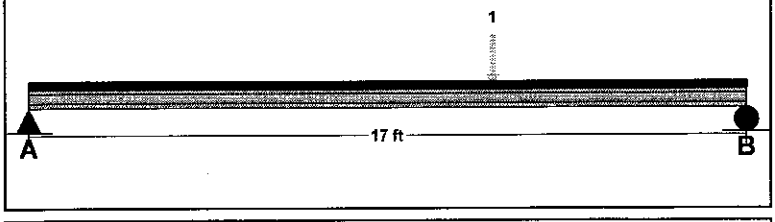
	Base Values	Adjusted
Bending Stress:	Fb = 2900 psi	Fb' = 2903 psi
	Cd=1.00 CF=1.00	
Shear Stress:	Fv = 290 psi	Fv' = 290 psi
	Cd=1.00	
Modulus of Elasticity:	E = 2000 ksi	E' = 2000 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750 psi	Fc - ⊥' = 750 psi

Controlling Moment: 5243 ft-lb
11.05 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: -920 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	21.67 in3	82.26 in3
Area (Shear):	4.76 in2	41.56 in2
Moment of Inertia (deflection):	130.08 in4	488.41 in4
Moment:	5243 ft-lb	19902 ft-lb
Shear:	-920 lb	8035 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	0 plf
Uniform Dead Load	0 plf
Beam Self Weight	13 plf
Total Uniform Load	13 plf

POINT LOADS - CENTER SPAN	
Load Number	One
Live Load	935 lb
Dead Load	316 lb
Location	11 ft

Wood Ledger

Lic. # : KW-06005808 — Licensee : EVERGREEN DESIGN COMPANY

Description : Foundation ledger

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : ASCE 7-16

General Information

Ledger Width	3.50 in
Ledger Depth	11.250 in
Ledger Wood Species	Hem-Fir
G : Specific Gravity	0.43
Bolt Diameter	5/8" in
Bolt Spacing	16.0 in
Cm - Wet Service Factor	1.0
Ct - Temperature Factor	1.0
Cg - Group Action Factor	1.0
C Λ - Geometry Factor	1.0

Design Method: ASD (using Service Load Combinations
Wood Stress Grade : Hem Fir, No.2
Fb Allow 850 psi
Fv Allow 150 psi
Fyb : Bolt Bending Yield 45,000 psi

Concrete as Main Supporting Member
Using 6" anchor embedment length in equations.
Using dowel bearing strength fixed at 7.5 ksi per NDS Table 11E

Analytical model actually uses 100 spans to ensure that all possible combinations of bolt location and point load location are evaluated. Final results are an envelope solution.

Load Data

	Dead	Roof Live	Floor Live	Snow	Wind	Seismic	Earth
Uniform Load...	90.0 plf	plf	300.0 plf	plf	plf	plf	plf
Point Load...	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Spacing	in						
Offset	in						
Horizontal Shear	lbs	lbs	lbs	lbs	lbs	lbs	lbs

Wood Ledger

Lic. # : KW-06005808 — Licensee : EVERGREEN DESIGN COMPANY

Description : Foundation ledger

DESIGN SUMMARY — Design OK

Maximum Ledger Bending

Load Combination . . . +D+L+H

Moment	57.778	ft-lb
fb : Actual Stress	9.391	psi
Fb : Allowable Stress		psi
Stress Ratio	**0.01105**	:1

Maximum Ledger Shear

Load Combination . . . +D+L+H

Shear	260.0	lbs
fv : Actual Stress	19.810	psi
Fv : Allowable Stress		psi
Stress Ratio	**0.1321**	:1

Maximum Bolt Bearing Summary

Load Combination . . . +D+L+H

Max. Vertical Load	520.0	lbs
Bolt Allow Vertical Load		lbs
Max. Horizontal Load	0.0	lbs
Bolt Allow Horizontal Load	1,143.85	lbs
Angle of Resultant	90.0	deg
Diagonal Component	520.0	lbs
Allow Diagonal Bolt Force	623.81	lbs
Stress Ratio, Wood @ Bolt	**0.8336**	:1

Dowel Bearing Strengths (for specific gravity & bolt diameter)

Ledger, Perp to Grain	7,500.0 ksi
Ledger, Parallel to Grain	7,500.0 ksi
Supporting Member, Perp to Grain	2,250.0 ksi
Supporting Member, Parallel to Grain	4,800.0 ksi

Allowable Bolt Capacity

Note ! Refer to NDS Section 11.3 for Bolt Capacity calculation method.

Governing Load Combination . . . **+D+L+H**

Resutant Load Angle : Theta = 90.0 deg Ktheta = 1.250 Fe theta = 623.81

Bolt Capacity - Load Perpendicular to Grain

Fem	7,500.0	Fes	2,250.0	Fyb	45,000.0
Re	3.333	Rt	1.714		
k1	1.471	k2	2.0	k3	0.8112

Im : Eq 11.3-1	Rd =	5.0	Z =	0.0 lbs
Is : Eq 11.3-2	Rd =	5.0	Z =	984.38 lbs
II : Eq 11.3-3	Rd =	4.50	Z =	1,608.61 lbs
IIIm : Eq 11.3-4	Rd =	4.0	Z =	1,834.15 lbs
IIIs : Eq 11.3-5	Rd =	4.0	Z =	623.81 lbs
IV : Eq 11.3-6	Rd =	4.0	Z =	703.69 lbs
	Zmin : Basic Design Value =			623.81 lbs

Bolt Capacity - Load Parallel to Grain

Fem	7,500.0	Fes	4,800.0	Fyb	45,000.0
Re	1.563	Rt	1.714		
k1	0.8246	k2	1.303	k3	0.9325

Im : Eq 11.3-1	Rd =	4.0	Z =	0.0 lbs
Is : Eq 11.3-2	Rd =	4.0	Z =	2,625.0 lbs
II : Eq 11.3-3	Rd =	3.60	Z =	2,405.19 lbs
IIIm : Eq 11.3-4	Rd =	3.20	Z =	2,776.38 lbs
IIIs : Eq 11.3-5	Rd =	3.20	Z =	1,341.94 lbs
IV : Eq 11.3-6	Rd =	3.20	Z =	1,143.85 lbs
	Zmin : Basic Design Value =			1,143.85 lbs

Reference design value - Perpendicular to Grain :
Z * CM * CD* Ct * Cg * Cdelta = **623.81 lbs**

Reference design value - Parallel to Grain :
Z * CM * CD* Ct * Cg * Cdelta = **1,143.85 lbs**

Project: Ravensdale

Location: Footing at garage beam
Footing
[2015 International Building Code(2015 NDS)]
Footing Size: 2.5 FT x 2.5 FT x 10.00 IN
Reinforcement: #4 Bars @ 7.00 IN. O.C. E/W / (4) min.
Section Footing Design Adequate

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FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs =	2000	psf
Concrete Compressive Strength:	F'c =	2500	psi
Reinforcing Steel Yield Strength:	Fy =	40000	psi
Concrete Reinforcement Cover:	c =	3	in

FOOTING SIZE

Width:	W =	2.5	ft
Length:	L =	2.5	ft
Depth:	Depth =	10	in
Effective Depth to Top Layer of Steel:	d =	6.25	in

COLUMN AND BASEPLATE SIZE

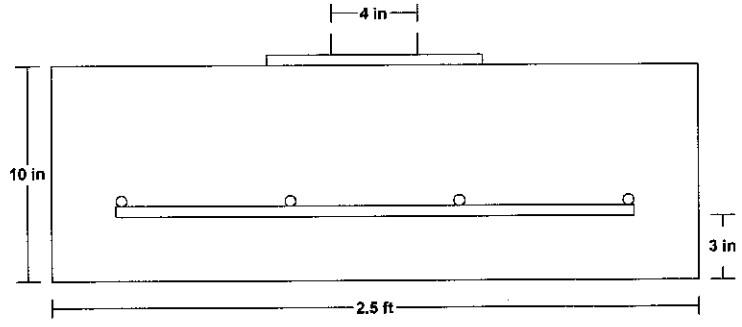
Column Type:	Steel		
Column Width:	m =	4	in
Column Depth:	n =	4	in
Baseplate Width:	bsw =	10	in
Baseplate Length:	bsl =	10	in

FOOTING CALCULATIONS

Bearing Calculations:			
Ultimate Bearing Pressure:	Qu =	1504	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1875	psf
Required Footing Area:	Areq =	5.01	sf
Area Provided:	A =	6.25	sf
Baseplate Bearing:			
Bearing Required:	Bear =	13920	lb
Allowable Bearing:	Bear-A =	276250	lb
Beam Shear Calculations (One Way Shear):			
Beam Shear:	Vu1 =	2436	lb
Allowable Beam Shear:	Vc1 =	14063	lb
Punching Shear Calculations (Two Way Shear):			
Critical Perimeter:	Bo =	53	in
Punching Shear:	Vu2 =	11205	lb
Allowable Punching Shear (ACI 11-35):	vc2-a =	74531	lb
Allowable Punching Shear (ACI 11-36):	vc2-b =	83438	lb
Allowable Punching Shear (ACI 11-37):	vc2-c =	49688	lb
Controlling Allowable Punching Shear:	vc2 =	49688	lb
Bending Calculations:			
Factored Moment:	Mu =	30682	in-lb
Nominal Moment Strength:	Mn =	169665	in-lb
Reinforcement Calculations:			
Concrete Compressive Block Depth:	a =	0.49	in
Steel Required Based on Moment:	As(1) =	0.14	in2
Min. Code Req'd Reinf. Shrink./Temp. (ACI-10.5.4):	As(2) =	0.60	in2
Controlling Reinforcing Steel:	As-reqd =	0.60	in2
Selected Reinforcement:	#4's @ 7.0 in. o.c. e/w (4) Min.		
Reinforcement Area Provided:	As =	0.79	in2
Development Length Calculations:			
Development Length Required:	Ld =	15	in
Development Length Supplied:	Ld-sup =	8.5	in

Note: Plain concrete adequate for bending,
therefore adequate development length not required.

LOADING DIAGRAM



FOOTING LOADING

Live Load:	PL =	6600	lb
Dead Load:	PD =	2800	lb
Total Load:	PT =	9400	lb
Ultimate Factored Load:	Pu =	13920	lb
Footing plus soil above footing weight:	Wt =	503	lb

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Restrained Retaining Wall

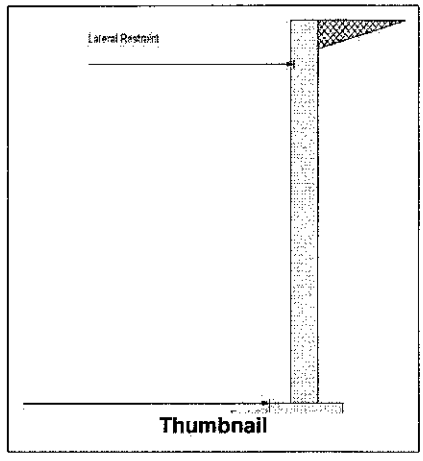
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.00 ft
Total Wall Height	=	9.00 ft
Top Support Height	=	8.00 ft
Slope Behind Wal	=	0.00
Height of Soil over Toe	=	0.00 in

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
At-rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	200.0 psf/ft
Soil Density	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

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

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Stem Weight Seismic Load

Uniform Lateral Load Applied to Stem

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

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

F_p / W_p Weight Multiplier = 0.000 g — Added seismic per unit area = 0.0 psf

Adjacent Footing Load

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

Design Summary

Total Bearing Load	=	1,807 lbs
...resultant ecc.	=	2.94 in
Soil Pressure @ Toe	=	241 psf OK
Soil Pressure @ Heel	=	1,566 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	289 psf
ACI Factored @ Heel	=	1,879 psf
Footing Shear @ Toe	=	0.3 psi OK
Footing Shear @ Heel	=	2.0 psi OK
Allowable	=	75.0 psi
Reaction at Top	=	832.5 lbs
Reaction at Bottom	=	1,823.8 lbs

Sliding Calcs
Lateral Sliding Force = 1,823.8 lbs

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

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Concrete Stem Construction

Thickness = 8.00 in — Fy = 60,000 psi
Wall Weight = 100.0 psf — f'c = 3,000 psi
Stem is FREE to rotate at top of footing

	@ Top Support	Mmax Between Top & Base	@ Base of Wall
	Stem OK	Stem OK	Stem OK
Design Height Above Ftg =	8.00 ft	3.53 ft	0.00 ft
Rebar Size =	# 4	# 4	# 4
Rebar Spacing =	10.00 in	10.00 in	10.00 in
Rebar Placed at =	Center	Center	Center
Rebar Depth 'd' =	4.00 in	4.00 in	4.00 in
Design Data			
fb/FB + fa/Fa =	0.004	0.879	0.000
Mu....Actual =	14.7 ft-#	3,574.1 ft-#	0.0 ft-#
Mn * Phi.....Allowable =	4,065.1 ft-#	4,065.1 ft-#	4,065.1 ft-#
Shear Force @ this height =	1,292.5 lbs		2,227.5 lbs
Shear.....Actual =	26.93 psi		46.41 psi
Shear.....Allowable =	82.16 psi		82.16 psi

Other Acceptable Sizes & Spacings:

Toe: None Spec'd -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: None Spec'd -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined -or- No key defined

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0009 in2/ft	
(4/3) * As :	0.0012 in2/ft	Min Stem T&S Reinf Area 1.536 in2
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.6503 in2/ft	#6@ 27.50 in #6@ 55.00 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.2158 in2/ft	
(4/3) * As :	0.2877 in2/ft	Min Stem T&S Reinf Area 0.857 in2
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2158 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.6503 in2/ft	#6@ 27.50 in #6@ 55.00 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0 in2/ft	
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.679 in2
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.6503 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Strengths & Dimensions

Toe Width	=	0.67 ft
Heel Width	=	1.33
Total Footing Width	=	2.00
Footing Thickness	=	10.00 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 in @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	289	1,879 psf
Mu' : Upward	=	105	376 ft-#
Mu' : Downward	=	34	294 ft-#
Mu: Design	=	71	-81 ft-#
Actual 1-Way Shear	=	0.31	2.05 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Min footing T&S reinf Area 0.43 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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Summary of Forces on Footing : Slab RESISTS sliding, stem is PINNED at footing

Forces acting on footing soil pressure

(taking moments about front of footing to find eccentricity)

Surcharge Over Heel	=	lbs	ft	ft-#
Axial Dead Load on Stem	=	lbs	ft	ft-#
Soil Over Toe	=	lbs	ft	ft-#
Adjacent Footing Load	=	lbs	ft	ft-#
Surcharge Over Toe	=	lbs	ft	ft-#
Stem Weight	=	900.0 lbs	1.00 ft	903.0 ft-#
Soil Over Heel	=	656.7 lbs	1.67 ft	1,095.6 ft-#
Footing Weight	=	250.0 lbs	1.00 ft	250.0 ft-#
Total Vertical Force	=	1,806.7 lbs	Moment =	2,248.6 ft-#

Net Mom. at Stem/Ftg Interface = -441.9 ft-#

Allow. Mom. @ Stem/Ftg Interface = 2,540.7 ft-#

Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 903.4 psf

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