

# Structural Calculations

For

**Park Residence**

**Single Family House Addition / Remodel**

**8244 SE 30<sup>th</sup> Street  
Mercer Island, WA 98040  
(Parcel # 545230-0816)**



**Prepared By: Sung U. Cho, P.E.**  
**Prepared Date: March 28, 2022**  
**Revision Date: August 15, 2023**  
**CS2 No.: 2207**



*8/28/2023*

## I. Scope of Work

Provide structural design calculations of remodel construction of existing single-family residential house. The house is located on 8244 SE 30<sup>th</sup> Street at City of Mercer Island. The information in this report summarizes the requirements for construction of structural elements for the gravity loads and lateral loads resisting in conformance with the International Building Code 2018. The engineering of such structural elements and connections are designed to resist the vertical (gravity) loading particular to concrete foundation. Unless noted otherwise, all means and methods used shall be in keeping with good and generally accepted construction practices.

Please refer to the following calculations and supporting sketches as well as the architectural drawing package as provided by others.

## II. Loads/Design Criteria: (IBC 2018 & ASCE 7-16)

Please refer to the following calculations

1. Dead Load – See calculation
2. Live Load – Roof = 25 psf (snow load)  
Floor = 40 psf  
Deck = 60 psf
3. Seismic –  $S_s = 1.395g$ ,  $S_1 = 0.486g$ ,  $S_{DS} = 1.116g$ ,  $S_{D1} = N/A$   
Site Class D,  $I = 1.0$ ,  $R = 6.5$
4. Wind – Exposure C, Basic Wind Speed ( $V_{3S}$ ) = 98 mph,  $I = 1.0$  (per ASCE)
5. Concrete compressive strength,  $f'_c = 3,000$  psi
6. Concrete steel reinforcing strength,  $f_y = 60,000$  psi
7. Allowable soil bearing pressure = 2,000 psf
8. Passive Soil Pressure = 250 pcf

## References:

1. IBC 2018
2. ASCE 7-16
3. ACI 318-14
4. SPDWS 2015
5. NDS 2018

## III. Conclusions and Recommendations

**General contractor** shall verify all existing dimensions, member sizes and conditions prior to commencing any work. All dimensions of existing condition shown on the reference are intended as guidelines only and must be verified in field. Any discrepancies shall be called to the attention of the architect or engineer and shall be resolved before proceeding with the work. Contractor shall provide temporary bracing for the structure and structural components until all final connections have been completed in accordance with the plans

# Gravity Load Design Calculation

**Project:** House Remodel (8244 SE 30th St, Mercer Island)**Client:** Owner**Job No.:** 2207**By:** S. Cho**Date:** 8/5/23**Subject:** Design Calculations**Page:****Design & Loading Criteria**

## Roof Dead Load:

Roofing =	2.8	psf
Insulation =	2.5	psf
Roof sheathing =	1.7	psf
Rafters @ 24" o.c. =	3.0	psf
5/8" GWB =	2.8	psf
M & E =	0.5	psf
Miscellaneous =	1.0	psf

Roof dead load total = **14.3 psf****USE = 15.0 psf**Roof Live Load: **25 psf****Total Roof Load = 40.0 psf**

## Floor Dead Load:

Floor Cover =	1.0	psf
Insulation =	1.0	psf
Floor sheathing =	2.7	psf
Joists @ 16" o.c. =	2.8	psf
5/8" GWB =	2.8	psf
M & E =	1.0	psf
Miscellaneous =	0.5	psf

Floor dead load total = **11.8 psf****USE = 12.0 psf**Floor Live Load: **40 psf****Total Floor Load = 52.0 psf**

## Wall Dead Load:

2x Stud @ 16" o.c. =	2.0	psf
7/16" Sheathing =	1.8	psf
Gypsum sheathing =	2.0	psf
Insulation =	1.0	psf
Siding =	2.0	psf
Miscellaneous =	0.5	psf

Wall dead load total = **9.3 psf****USE = 10.0 psf****DESIGN REFERENCES:**

- ASCE 7-16, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURE.
- IBC 2018, INTERNATIONAL BUILDING CODE 2018.
- ACI 318-14, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY.
- NDS 2018, NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION WITH COMMENTARY.
- AWC SDPWS-2015, SPECIAL DESIGN PROVISIONS FOR WIND AND SEISMIC WITH COMMENTARY.
- AISC 360-16, SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS: STEEL DESIGN MANUAL

## JOIST & BEAM DESIGN

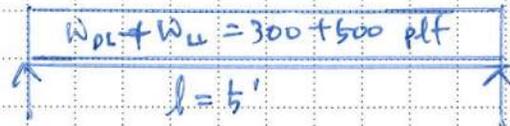
### HDR

MAIN FLOOR HEADER (TYPICAL)

(6X8 DF #2)

$$W_{DL} = (15 \text{ psf})(4\frac{1}{2}) = 300 \text{ plf}$$

$$W_{SL} = (25 \text{ psf})(4\frac{1}{2}) = 500 \text{ plf}$$



$$P_R = 804 \#$$

$$P_U = 1312 \#$$

$$P_R = 804 \#$$

$$P_U = 1312 \#$$

### DJ1a

DECK JOIST @ MAIN FLOOR & BASEMENT

$$W_{DL} = (10 \text{ psf})(16\frac{1}{12}) = 13.33 \text{ plf}$$

$$W_{UL} = (60 \text{ psf})(16\frac{1}{12}) = 80 \text{ plf}$$

(P.T. 2X10 DF #2)



$$R_R = 75 \#$$

$$R_U = 452 \#$$

$$R_R = 85 \#$$

$$R_U = 512 \#$$

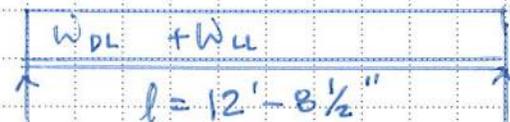
### DB1a

DECK BEAM @ MAIN FLOOR

(P.T. 6X10 DF #2)

$$W_{DL} = (85 \#)(12/16) = 63.8 \text{ plf}$$

$$W_{UL} = (512 \#)(12/16) = 384 \text{ plf}$$



$$R_R = 507$$

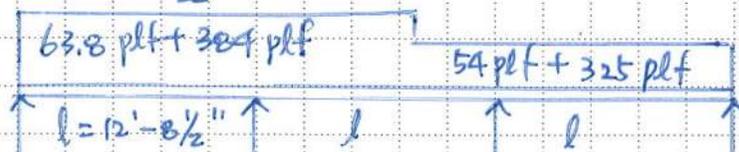
$$22' \quad R_U = 2528 \#$$

$$507 \#$$

$$2528 \#$$

$$W_{DL} = (72 \#)(12/16) = 54 \text{ plf}$$

$$W_{UL} = (433 \#)(12/16) = 325 \text{ plf}$$



$$P_R = 461 \#$$

$$1234 \#$$

$$P_U = 2626 \#$$

$$6701 \#$$

$$995 \#$$

$$5411 \#$$

$$353 \#$$

$$1976 \#$$

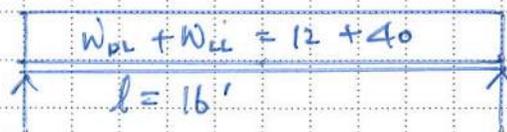
## FJ 1a

FLOOR JOIST @ MAIN FLOOR

$$W_{DL} = (12 \text{ psf}) (12' / 12) = 12 \text{ plf}$$

$$W_{LL} = (40 \text{ psf}) (12' / 12) = 40 \text{ plf}$$

(2x10 DF #2 @ 12" o.c.)



$$R_{DL} = 95 \#$$

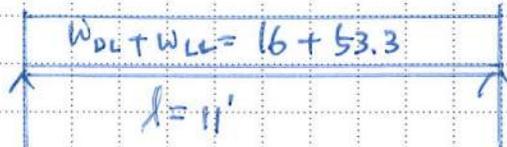
$$R_{LL} = 317 \#$$

## FJ 1b

$$W_{DL} = (12 \text{ psf}) (16' / 12) = 16 \text{ plf}$$

$$W_{LL} = (40 \text{ psf}) (16' / 12) = 53.3 \text{ plf}$$

(2x10 DF #2 @ 16" o.c.)



$$R_{DL} = 93 \#$$

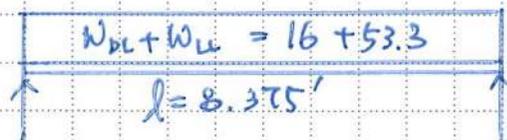
$$R_{LL} = 309 \#$$

## FJ 1c

$$W_{DL} = 16 \text{ plf}$$

$$W_{LL} = 53.3 \text{ plf}$$

(2x10 DF #2 @ 16" o.c.)



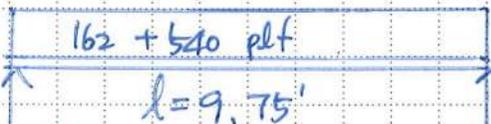
$$R_{DL} = 72 \#$$

$$R_{LL} = 239 \#$$

## FBIa (INTERIOR BEAM)

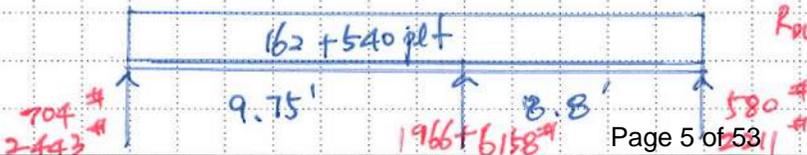
$$W_{DL} = (12 \text{ psf}) (16' / 2 + 11' / 2) = 162 \text{ plf}$$

$$W_{LL} = (40 \text{ psf}) (16' / 2 + 11' / 2) = 540 \text{ plf}$$



$$R_{DL} = 866 \#$$

$$R_{LL} = 2711 \#$$



FOOTING DESIGN

(SEE COMPUTER DESIGN OUTCOME)

## - SLAB-ON-GRADE

4" THICK. :  $A_{s\text{REQ}} = \rho_s b d = (0.0018) (4 \frac{1}{2}) (12 \frac{1}{2})$   
 $= 0.0006 \text{ in}^2$

USE WWF 6x6-W6xW6 ( $A_s = 0.12 \text{ in}^2$ )

## - WALL FOOTING.

ROOF  $W_{DL} = (15 \text{ psf}) (40 \frac{1}{2}) = 300 \text{ plf}$

ROOF  $W_{LL} = (25 \text{ psf}) (40 \frac{1}{2}) = 500 \text{ plf}$

$W_{DL \text{ WALL}} = (10 \text{ psf}) (8' + 8') = 160 \text{ plf}$

FLOOR  $W_{DL} = (95 \#) (12 \frac{1}{16}) = 71.25 \text{ plf}$

$W_{LL} = (317 \#) (12 \frac{1}{16}) = 237.75 \text{ plf}$

$W_{TL} = W_{DL} + W_{LL} + W_{SL}$

$= (300 + 160 + 71.25) + (237.75 \text{ plf}) + (500 \text{ plf})$

$= (531.25 \text{ plf}) + (237.75 \text{ plf}) + (500 \text{ plf})$

DL                      LL                      SL

## - DECK FOOTING

F3.5

$P_{DL} + P_{LL} = (1234 \# \times 2) + (6701 \# \times 2) = 2468 \# + 13402 \#$

DL                      LL

F2.0

$P_{DL} + P_{LL} = (461 \# \times 2) + (2636 \# \times 2) = 922 \# + 5272 \#$

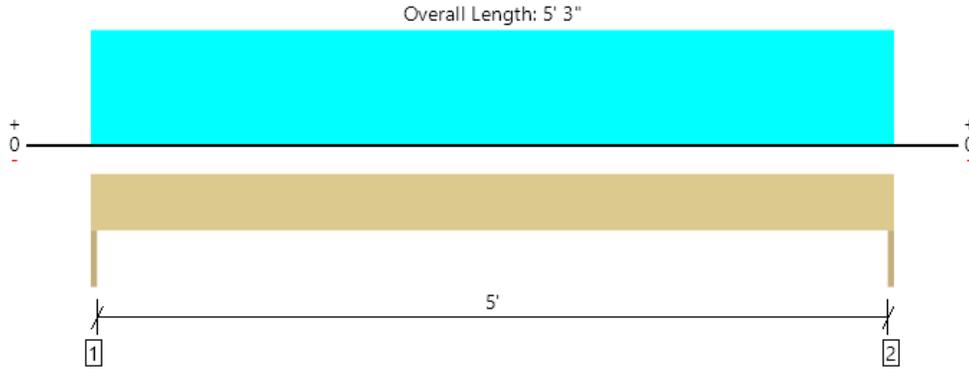
DL                      LL

Roof			
Member Name	Results	Current Solution	Comments
Wall: Header	Passed	1 piece(s) 4 x 8 DF No.2	
Main Level			
Member Name	Results	Current Solution	Comments
Wall: Header (Exterior)	Passed	1 piece(s) 6 x 8 DF No.2	
Deck: Joist (DJ1a)	Passed	1 piece(s) 2 x 10 DF No.2 @ 16" OC	
Deck: Joist (DJ1b)	Passed	1 piece(s) 2 x 10 DF No.2 @ 16" OC	
Floor: Joist (FJ1a)	Passed	1 piece(s) 2 x 10 DF No.2 @ 12" OC	
Floor: Joist (FJ1b)	Passed	1 piece(s) 2 x 10 DF No.2 @ 16" OC	
Floor: Joist (FJ1c)	Passed	1 piece(s) 2 x 10 DF No.2 @ 16" OC	
Deck: Drop Beam	Passed	1 piece(s) 6 x 10 DF No.1	
Deck: Drop Beam	Passed	1 piece(s) 6 x 10 DF No.1	
Floor: Flush Beam(FB1a)	Passed	1 piece(s) 3 1/2" x 9 1/2" 2.2E Parallam® PSL	
Copy of Floor: Flush Beam(FB1a)	Passed	1 piece(s) 3 1/2" x 9 1/2" 2.2E Parallam® PSL	
Basement			
Member Name	Results	Current Solution	Comments
Deck: Joist	Passed	1 piece(s) 2 x 10 DF No.2 @ 16" OC	
Deck: Drop Beam	Passed	1 piece(s) 6 x 10 DF No.1	

ForteWEB Software Operator	Job Notes
Sung Cho CS2 Engineers.com (425) 408-2748 sung.cho@cs2engineers.com	8244 SE 30th Street Mercer Island, WA 98040



Roof, Wall: Header  
1 piece(s) 4 x 8 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2117 @ 0	3281 (1.50")	Passed (65%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1529 @ 8 3/4"	3502	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2778 @ 2' 7 1/2"	3438	Passed (81%)	1.15	1.0 D + 1.0 S (All Spans)
Vert Live Load Defl. (in)	0.048 @ 2' 7 1/2"	0.175	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Vert Total Load Defl. (in)	0.078 @ 2' 7 1/2"	0.262	Passed (L/813)	--	1.0 D + 1.0 S (All Spans)
Lat Member Reaction (lbs)	193 @ 5' 3"	N/A	Passed (N/A)	1.60	1.0 D + 0.6 W
Lat Shear (lbs)	162 @ 5"	4872	Passed (3%)	1.60	1.0 D + 0.6 W
Lat Moment (Ft-lbs)	253 @ mid-span	2425	Passed (10%)	1.60	1.0 D + 0.6 W
Lat Deflection (in)	0.021 @ mid-span	0.350	Passed (L/999+)	--	1.0 D + 0.6 W
Bi-Axial Bending	0.58	1.00	Passed (58%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

System : Wall  
Member Type : Header  
Building Use : Residential  
Building Code : IBC 2018  
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Lateral deflection criteria: Wind (L/180)
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - HF	1.50"	1.50"	1.50"	804	1312	2116	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	804	1312	2116	None

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

•Maximum allowable bracing intervals based on applied load.

Lateral Connections						
Supports	Plate Size	Plate Material	Connector	Type/Model	Quantity	Nailing
Left	2X	Hem Fir	Nails	10d x 3" Box (End)	3	
Right	2X	Hem Fir	Nails	10d x 3" Box (End)	3	

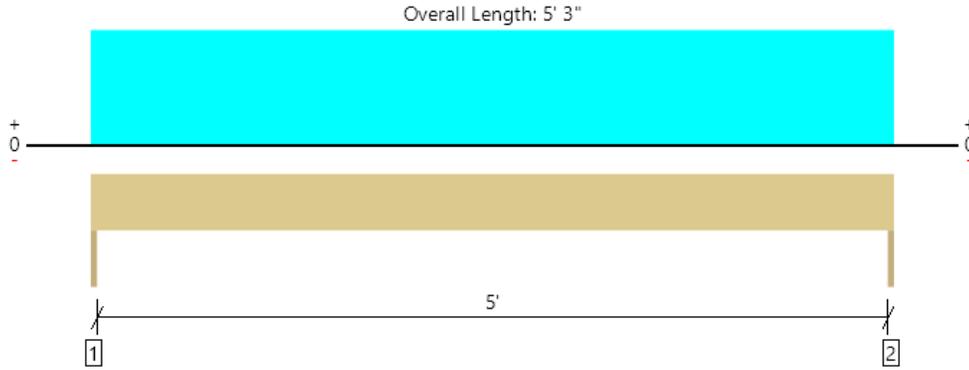
Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 3"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 5' 3"	20'	15.0	25.0	Default Load

Lateral Load	Location	Tributary Width	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	4'	30.6	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (C), Mean Roof Height (16' 9 5/8"), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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Main Level, Wall: Header (Exterior)  
1 piece(s) 6 x 8 DF No.2



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2648 @ 0	5156 (1.50")	Passed (51%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	1891 @ 9"	5376	Passed (35%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	3475 @ 2' 7 1/2"	3706	Passed (94%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Vert Live Load Defl. (in)	0.042 @ 2' 7 1/2"	0.175	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Vert Total Load Defl. (in)	0.069 @ 2' 7 1/2"	0.262	Passed (L/918)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Lat Member Reaction (lbs)	193 @ 5' 3"	N/A	Passed (N/A)	1.60	1.0 D + 0.6 W
Lat Shear (lbs)	150 @ 7"	7480	Passed (2%)	1.60	1.0 D + 0.6 W
Lat Moment (Ft-lbs)	253 @ mid-span	3781	Passed (7%)	1.60	1.0 D + 0.6 W
Lat Deflection (in)	0.007 @ mid-span	0.350	Passed (L/999+)	--	1.0 D + 0.6 W
Bi-Axial Bending	0.73	1.00	Passed (73%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

System : Wall  
Member Type : Header  
Building Use : Residential  
Building Code : IBC 2018  
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Lateral deflection criteria: Wind (L/180)
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Trimmer - HF	1.50"	1.50"	1.50"	1043	893	1247	3183	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	1043	893	1247	3183	None

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

•Maximum allowable bracing intervals based on applied load.

Lateral Connections						
Supports	Plate Size	Plate Material	Connector	Type/Model	Quantity	Nailing
Left	2X	Hem Fir	Nails	8d x 2.5" Box (Toe)	3	
Right	2X	Hem Fir	Nails	8d x 2.5" Box (Toe)	3	

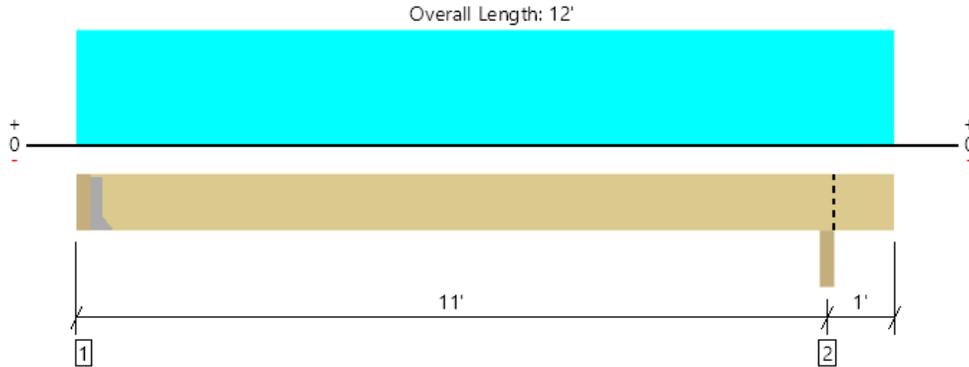
Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 3"	N/A	10.4	--	--	
1 - Uniform (PSF)	0 to 5' 3"	19'	15.0	-	25.0	Roof Load
2 - Uniform (PSF)	0 to 5' 3"	8' 6"	12.0	40.0	-	Floor Load

Lateral Load	Location	Tributary Width	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	4'	30.6	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (C), Mean Roof Height (16' 9 5/8"), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

Forteweb Software Operator	Job Notes
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Main Level, Deck: Joist (DJ1a)  
1 piece(s) 2 x 10 DF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	499 @ 3 1/2"	1406 (1.50")	Passed (35%)	--	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	427 @ 1' 3/4"	1665	Passed (26%)	1.00	1.0 D + 1.0 L (Alt Spans)
Moment (Ft-lbs)	1334 @ 5' 7 11/16"	2029	Passed (66%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.150 @ 5' 7 3/4"	0.268	Passed (L/859)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.174 @ 5' 7 3/4"	0.535	Passed (L/739)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger <sup>1</sup>	1.50"	75	452	527	See note <sup>1</sup>
2 - Beam - HF	3.50"	3.50"	1.50"	85	512	597	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 2" o/c	
Bottom Edge (Lu)	11' 9" 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	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

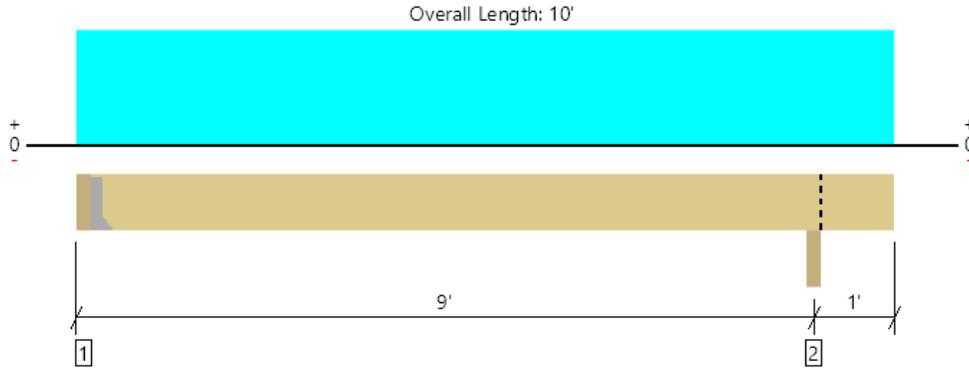
- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 12'	16"	10.0	60.0	Deck Load

Member Notes
Deck Joist (DJ1a)

ForteWEB Software Operator	Job Notes
Sung Cho CS2 Engineers.com (425) 408-2748 sung.cho@cs2engineers.com	8244 SE 30th Street Mercer Island, WA 98040

Main Level, Deck: Joist (DJ1b)  
1 piece(s) 2 x 10 DF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	406 @ 3 1/2"	1406 (1.50")	Passed (29%)	--	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	334 @ 1' 3/4"	1665	Passed (20%)	1.00	1.0 D + 1.0 L (Alt Spans)
Moment (Ft-lbs)	881 @ 4' 7 5/8"	2029	Passed (43%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.065 @ 4' 7 3/4"	0.218	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.076 @ 4' 7 3/4"	0.435	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger <sup>1</sup>	1.50"	61	372	433	See note <sup>1</sup>
2 - Beam - HF	3.50"	3.50"	1.50"	72	433	505	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 9" o/c	
Bottom Edge (Lu)	9' 9" 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	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

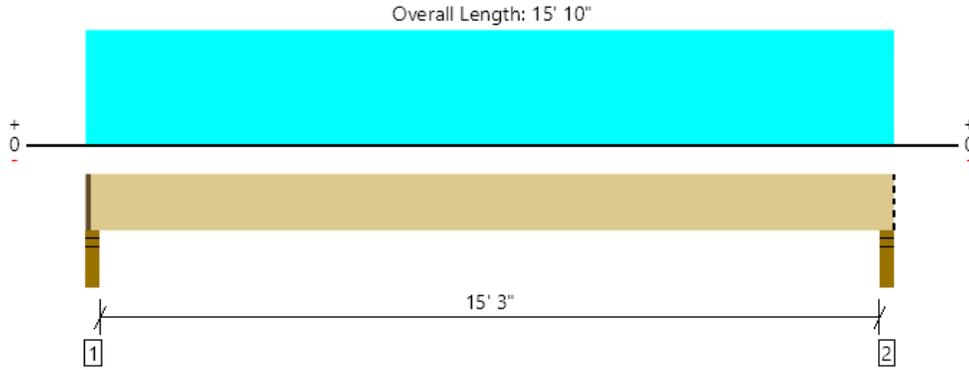
- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 10'	16"	10.0	60.0	Deck Load

Member Notes
Deck Joist (DJ1b)

ForteWEB Software Operator	Job Notes
Sung Cho CS2 Engineers.com (425) 408-2748 sung.cho@cs2engineers.com	8244 SE 30th Street Mercer Island, WA 98040

Main Level, Floor: Joist (FJ1a)  
 1 piece(s) 2 x 10 DF No.2 @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	406 @ 2 1/2"	1367 (2.25")	Passed (30%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	356 @ 1' 3/4"	1665	Passed (21%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1545 @ 7' 11"	2029	Passed (76%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.321 @ 7' 11"	0.385	Passed (L/576)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.418 @ 7' 11"	0.771	Passed (L/443)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - HF	3.50"	2.25"	1.50"	95	317	412	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	3.50"	1.50"	95	317	412	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 2" o/c	
Bottom Edge (Lu)	15' 9" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 15' 10"	12"	12.0	40.0	Default Load

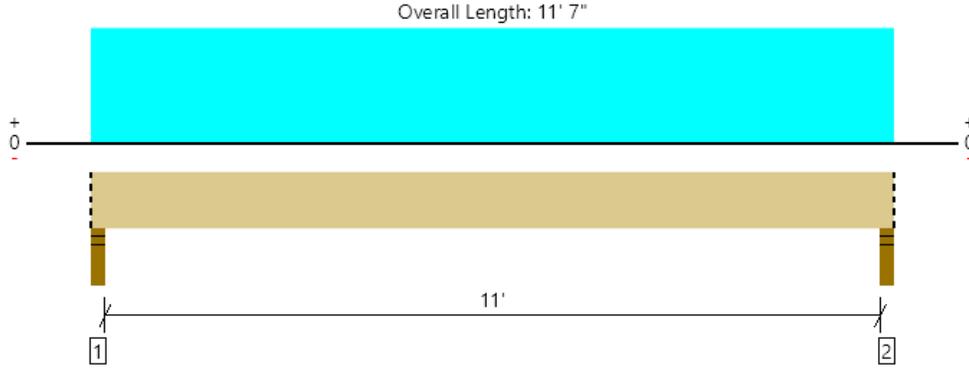
Member Notes
Floor joist (FJ1a)

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The product application, input design loads, dimensions and support information have been provided by S. Cho

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Main Level, Floor: Joist (FJ1b)  
1 piece(s) 2 x 10 DF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	402 @ 2 1/2"	2126 (3.50")	Passed (19%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	328 @ 1' 3/4"	1665	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1081 @ 5' 9 1/2"	2029	Passed (53%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.118 @ 5' 9 1/2"	0.279	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.153 @ 5' 9 1/2"	0.558	Passed (L/874)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - HF	3.50"	3.50"	1.50"	93	309	402	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	93	309	402	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 7" o/c	
Bottom Edge (Lu)	11' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 11' 7"	16"	12.0	40.0	Default Load

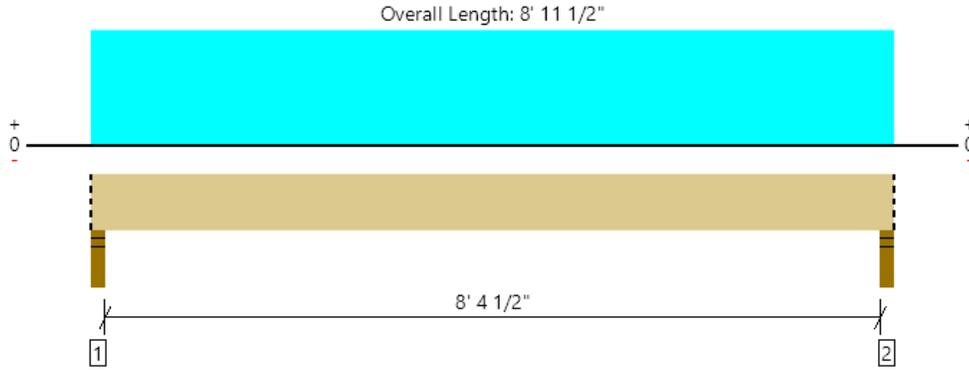
Member Notes
Floor joist (FJ1b)

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Main Level, Floor: Joist (FJ1c)  
1 piece(s) 2 x 10 DF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	311 @ 2 1/2"	2126 (3.50")	Passed (15%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	237 @ 1' 3/4"	1665	Passed (14%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	632 @ 4' 5 3/4"	2029	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.040 @ 4' 5 3/4"	0.214	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.052 @ 4' 5 3/4"	0.427	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - HF	3.50"	3.50"	1.50"	72	239	311	Blocking
2 - Stud wall - HF	3.50"	3.50"	1.50"	72	239	311	Blocking

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

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

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8' 11 1/2"	16"	12.0	40.0	Default Load

**Member Notes**

Floor joist (FJ1b)

**Weyerhaeuser Notes**

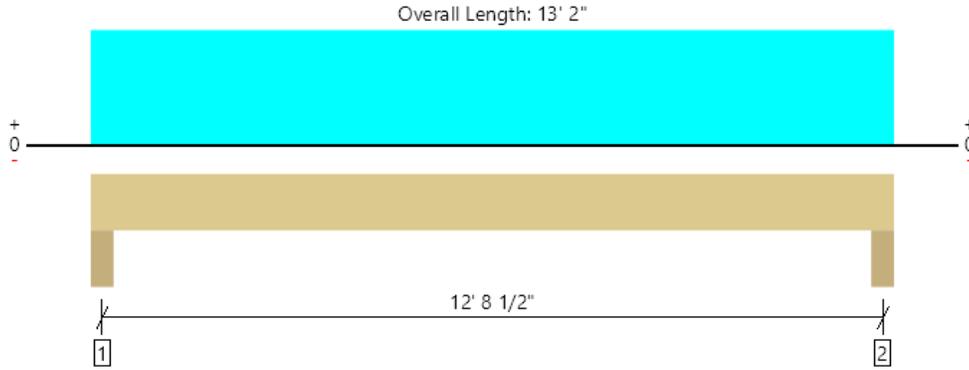
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Main Level, Deck: Drop Beam  
1 piece(s) 6 x 10 DF No.1



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)	3035 @ 4"	18906 (5.50")	Passed (16%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2459 @ 1' 3"	5922	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	9004 @ 6' 7"	9307	Passed (97%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.335 @ 6' 7"	0.417	Passed (L/447)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.403 @ 6' 7"	0.625	Passed (L/372)	--	1.0 D + 1.0 L (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - HF	5.50"	5.50"	1.50"	507	2528	3035	None
2 - Column - HF	5.50"	5.50"	1.50"	507	2528	3035	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 2" o/c	
Bottom Edge (Lu)	13' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 13' 2"	N/A	13.2	--	
1 - Uniform (PLF)	0 to 13' 2" (Top)	N/A	63.8	384.0	Linked from: Deck: Joist, Support 2

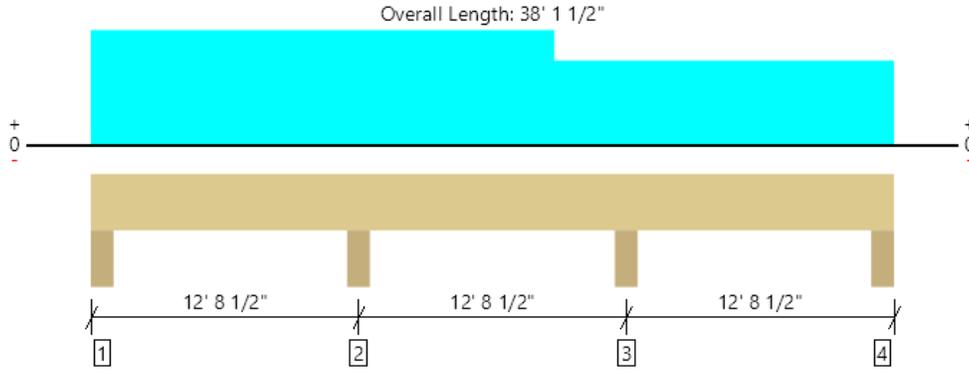
Member Notes
Deck Beam (DB1a)

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The product application, input design loads, dimensions and support information have been provided by S. Cho

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Main Level, Deck: Drop Beam  
1 piece(s) 6 x 10 DF No.1



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)	7935 @ 12' 8 1/2"	18906 (5.50")	Passed (42%)	--	1.0 D + 1.0 L (Adj Spans)
Shear (lbs)	3550 @ 11' 8 1/4"	5922	Passed (60%)	1.00	1.0 D + 1.0 L (Adj Spans)
Moment (Ft-lbs)	-9520 @ 12' 8 1/2"	9307	Passed (102%)	1.00	1.0 D + 1.0 L (Adj Spans)
Live Load Defl. (in)	0.281 @ 6' 3 1/16"	0.412	Passed (L/528)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.318 @ 6' 2 3/8"	0.619	Passed (L/466)	--	1.0 D + 1.0 L (Alt Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - HF	5.50"	5.50"	1.50"	461	2636/-288	3097/-288	None
2 - Column - HF	5.50"	5.50"	2.31"	1234	6701	7935	None
3 - Column - HF	5.50"	5.50"	1.86"	995	5411	6406	None
4 - Column - HF	5.50"	5.50"	1.50"	353	1976/-278	2329/-278	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	38' 2" o/c	
Bottom Edge (Lu)	6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 38' 1 1/2"	N/A	13.2	--	
1 - Uniform (PSF)	0 to 22' (Top)	7' 6"	10.0	60.0	
2 - Uniform (PSF)	22' to 38' 1 1/2" (Top)	5' 6"	10.0	60.0	

**Member Notes**

Deck Beam (DB1a)

**Weyerhaeuser Notes**

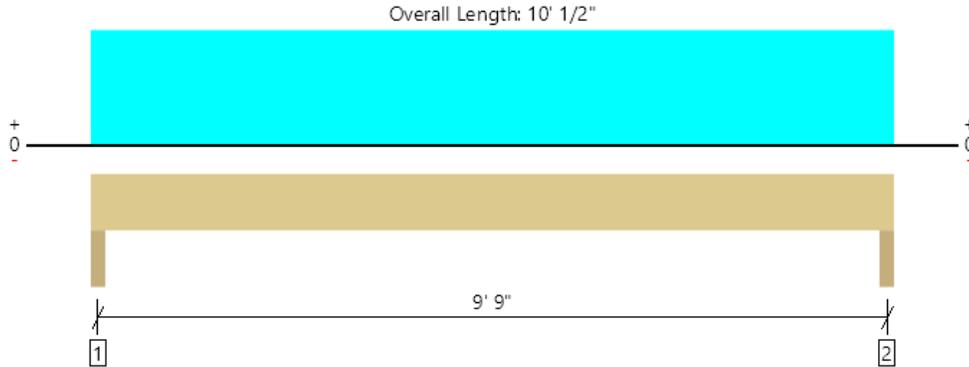
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Main Level, Floor: Flush Beam(FB1a)  
 1 piece(s) 3 1/2" x 9 1/2" 2.2E Parallam® PSL



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)	3577 @ 2"	7656 (3.50")	Passed (47%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2805 @ 1' 1"	6428	Passed (44%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	8393 @ 5' 1/4"	13057	Passed (64%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.216 @ 5' 1/4"	0.243	Passed (L/539)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.285 @ 5' 1/4"	0.485	Passed (L/408)	--	1.0 D + 1.0 L (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - HF	3.50"	3.50"	1.64"	866	2711	3577	None
2 - Column - HF	3.50"	3.50"	1.64"	866	2711	3577	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 1" o/c	
Bottom Edge (Lu)	10' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 10' 1/2"	N/A	10.4	--	
1 - Uniform (PSF)	0 to 10' 1/2" (Front)	8'	12.0	40.0	Default Load
2 - Uniform (PSF)	0 to 10' 1/2" (Back)	5' 6"	12.0	40.0	Default Load

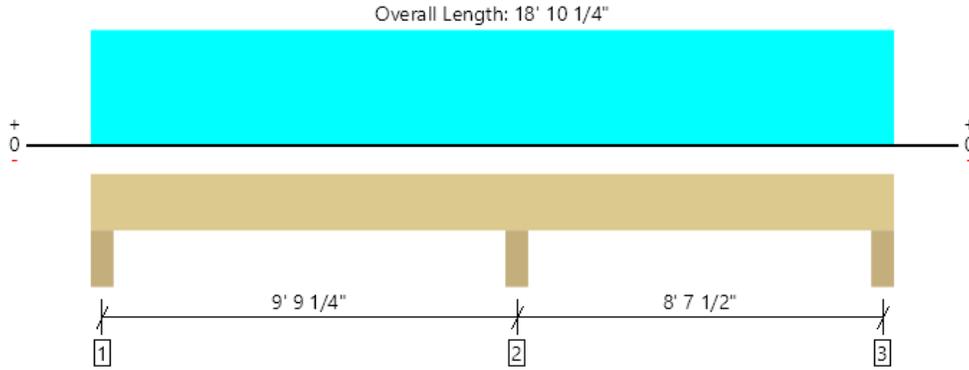
Member Notes
Interior Floor Beam (FB1a)

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Main Level, Copy of Floor: Flush Beam(FB1a)  
 1 piece(s) 3 1/2" x 9 1/2" 2.2E Parallam® PSL



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)	8124 @ 10'	12031 (5.50")	Passed (68%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3487 @ 8' 11 3/4"	6428	Passed (54%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-7452 @ 10'	13057	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.152 @ 4' 10 9/16"	0.242	Passed (L/764)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.187 @ 4' 9 3/4"	0.483	Passed (L/620)	--	1.0 D + 1.0 L (Alt Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - HF	5.50"	5.50"	1.50"	704	2443/-238	3147/-238	None
2 - Column - HF	5.50"	5.50"	3.71"	1966	6158	8124	None
3 - Column - HF	5.50"	5.50"	1.50"	580	2211/-393	2791/-393	None

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 18' 10 1/4"	N/A	10.4	--	
1 - Uniform (PSF)	0 to 18' 10 1/4" (Front)	8'	12.0	40.0	Default Load
2 - Uniform (PSF)	0 to 18' 10 1/4" (Back)	5' 6"	12.0	40.0	Default Load

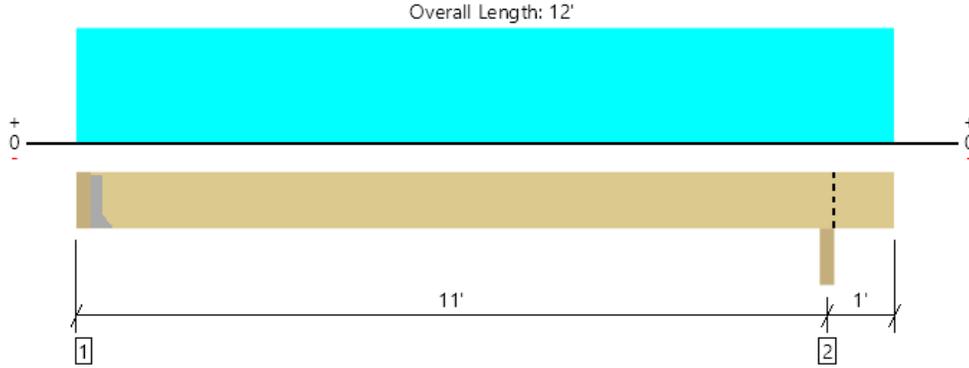
Member Notes
Interior Floor Beam (FB1a)

Weyerhaeuser Notes
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The product application, input design loads, dimensions and support information have been provided by S. Cho

ForteWEB Software Operator	Job Notes
Sung Cho CS2 Engineers.com (425) 408-2748 sung.cho@cs2engineers.com	8244 SE 30th Street Mercer Island, WA 98040



Basement, Deck: Joist  
1 piece(s) 2 x 10 DF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	499 @ 3 1/2"	1406 (1.50")	Passed (35%)	--	1.0 D + 1.0 L (Alt Spans)
Shear (lbs)	427 @ 1' 3/4"	1665	Passed (26%)	1.00	1.0 D + 1.0 L (Alt Spans)
Moment (Ft-lbs)	1334 @ 5' 7 11/16"	2029	Passed (66%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.150 @ 5' 7 3/4"	0.268	Passed (L/859)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.174 @ 5' 7 3/4"	0.535	Passed (L/739)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

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

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 9 1/4" HF beam	3.50"	Hanger <sup>1</sup>	1.50"	75	452	527	See note <sup>1</sup>
2 - Beam - DF	3.50"	3.50"	1.50"	85	512	597	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 2" o/c	
Bottom Edge (Lu)	11' 9" 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	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

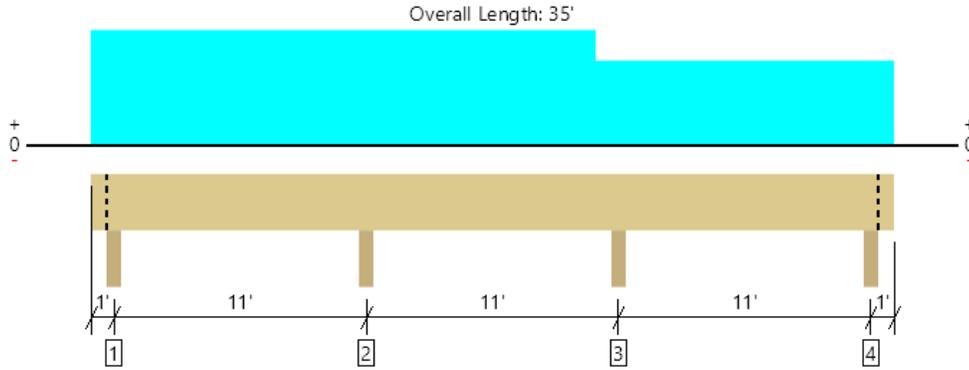
- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 12'	16"	10.0	60.0	Deck Load

Member Notes
Deck Joist

ForteWEB Software Operator	Job Notes
Sung Cho CS2 Engineers.com (425) 408-2748 sung.cho@cs2engineers.com	8244 SE 30th Street Mercer Island, WA 98040

Basement, Deck: Drop Beam  
1 piece(s) 6 x 10 DF No.1



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)	7025 @ 12'	12031 (3.50")	Passed (58%)	--	1.0 D + 1.0 L (Adj Spans)
Shear (lbs)	3129 @ 11' 3/4"	5922	Passed (53%)	1.00	1.0 D + 1.0 L (Adj Spans)
Moment (Ft-lbs)	-7452 @ 12'	9307	Passed (80%)	1.00	1.0 D + 1.0 L (Adj Spans)
Live Load Defl. (in)	0.175 @ 6' 2 15/16"	0.367	Passed (L/756)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.197 @ 6' 2 3/8"	0.550	Passed (L/669)	--	1.0 D + 1.0 L (Alt Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Lumber grading provisions must be extended over the length of the member per NDS 4.2.5.5.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column - HF	3.50"	3.50"	1.50"	478	2681	3159	Blocking
2 - Column - HF	3.50"	3.50"	2.04"	1084	5941	7025	None
3 - Column - HF	3.50"	3.50"	1.71"	902	4972	5874	None
4 - Column - HF	3.50"	3.50"	1.50"	365	2005	2370	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)	35' o/c	
Bottom Edge (Lu)	35' o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 35'	N/A	13.2	--	
1 - Uniform (PSF)	0 to 22' (Top)	7' 6"	10.0	60.0	
2 - Uniform (PSF)	22' to 35' (Top)	5' 6"	10.0	60.0	

**Member Notes**

Deck Beam (DB1a)

**Weyerhaeuser Notes**

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The product application, input design loads, dimensions and support information have been provided by S. Cho

ForteWEB Software Operator	Job Notes
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**CS2 ENGINEERS**

Challenge & Success - Civil & Structural

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 Mill Creek, WA 98082  
 TEL. 425.408.2748  
 info@cs2engineers.com

Project Title: Park's Residence Addition  
 Engineer: S. Cho  
 Project ID: 2207  
 Project Descr: Remodel and addition of Single Family Residential House

**Wall Footing**

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC#: KW-06013944, Build:20.23.08.01

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**DESCRIPTION:** Typical Wall Footing

**Code References**

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : IBC 2018

**General Information**

**Material Properties**

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

**Analysis Settings**

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
AutoCalc Footing Weight as DL :	=	Yes

**Soil Design Values**

Allowable Soil Bearing	=	3.0 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

**Increases based on footing Depth**

Reference Depth below Surface	=	ft
Allow. Pressure Increase per foot of depth when base footing is below	=	ksf
	=	ft

**Increases based on footing Width**

Allow. Pressure Increase per foot of width when footing is wider than	=	ksf
	=	ft

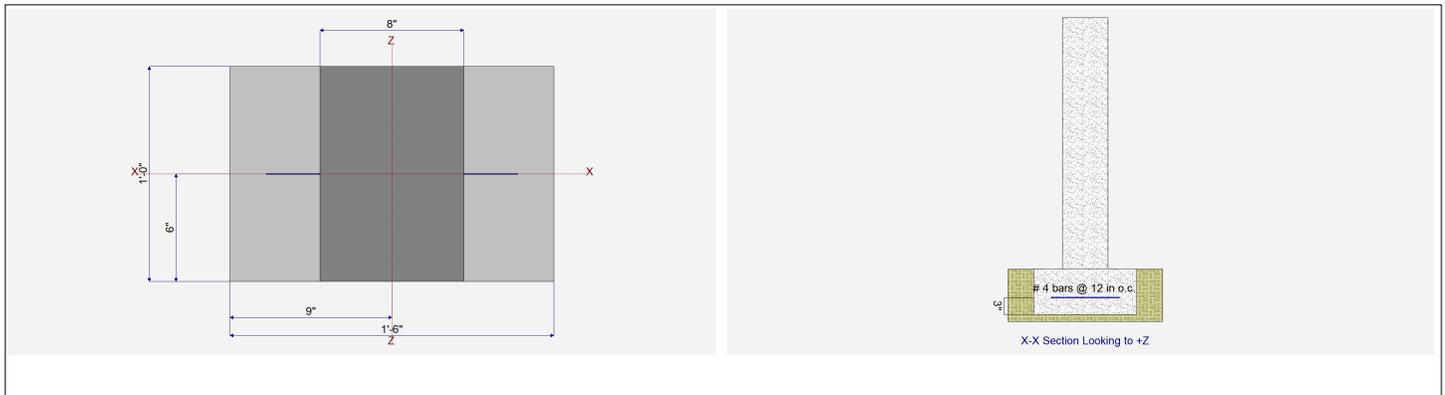
**Adjusted Allowable Bearing Pressure**

= 3.0 ksf

**Dimensions**

**Reinforcing**

Footing Width	=	1.50 ft	Footing Thickness	=	8.0 in	Bars along X-X Axis	=	
Wall Thickness	=	8.0 in	Rebar Centerline to Edge of Concrete... at Bottom of footing =	=	3.0 in	Bar spacing	=	12.00
Wall center offset from center of footing	=	0 in				Reinforcing Bar Size	=	# 4



**Applied Loads**

	D	Lr	L	S	W	E	H
P : Column Load	=	0.5313		0.2378	0.50		k
OB : Overburden	=						ksf
V-x	=						k
M-zz	=						k-ft
Vx applied	=						in above top of footing



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Wall Footing

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC#: KW-06013944, Build:20.23.08.01

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(c) ENERCALC INC 1983-2023

DESCRIPTION: Typical Wall Footing

DESIGN SUMMARY

Design OK

Table with 6 columns: Factor of Safety, Item, Applied, Capacity, Governing Load Combination. Rows include Overturning - Z-Z, Sliding - X-X, and Uplift, all with PASS status.

Table with 6 columns: Utilization Ratio, Item, Applied, Capacity, Governing Load Combination. Rows include Soil Bearing, Z Flexure (+X), Z Flexure (-X), 1-way Shear (+X), and 1-way Shear (-X), all with PASS status.

Detailed Results

Soil Bearing

Table with 6 columns: Rotation Axis & Load Combination..., Gross Allowable, Xecc, Actual Soil Bearing Stress (-X, +X), Actual / Allowable Ratio. Lists various load combinations and their corresponding ratios.

Overturning Stability

Table with 5 columns: Rotation Axis & Load Combination..., Overturning Moment, Resisting Moment, Stability Ratio, Status. Note: Footing Has NO Overturning.

Sliding Stability

Table with 5 columns: Force Application Axis Load Combination..., Sliding Force, Resisting Force, Sliding SafetyRatio, Status. Note: Footing Has NO Sliding.

Footing Flexure

Table with 9 columns: Flexure Axis & Load Combination, Mu k-ft, Which Side?, Tension @ Bot. or Top?, As Req'd in^2, Gvrn. As in^2, Actual As in^2, Phi\*Mn k-ft, Status. Lists various load combinations and their corresponding flexure values and status.

One Way Shear

Table with 7 columns: Load Combination..., Vu @ -X, Vu @ +X, Vu:Max, Phi Vn, Vu / Phi\*Vn, Status. Lists load combinations and their corresponding shear values and status.



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## Wall Footing

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

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**DESCRIPTION:** Typical Wall Footing

### One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D+0.50L	0 psi	0 psi	0 psi	75 psi	0	OK
+1.20D	0 psi	0 psi	0 psi	75 psi	0	OK
+1.20D+0.50L+1.60S	0 psi	0 psi	0 psi	75 psi	0	OK
+1.20D+1.60S	0 psi	0 psi	0 psi	75 psi	0	OK
+1.20D+0.50L+0.50S	0 psi	0 psi	0 psi	75 psi	0	OK
+1.20D+0.50L+0.70S	0 psi	0 psi	0 psi	75 psi	0	OK
+0.90D	0 psi	0 psi	0 psi	75 psi	0	OK



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Project Title: Park's Residence Addition  
 Engineer: S. Cho  
 Project ID: 2207  
 Project Descr: Remodel and addition of Single Family Residential House

**General Footing**

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC#: KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

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**DESCRIPTION:** Deck footing (F3.0)

**Code References**

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : IBC 2018

**General Information**

**Material Properties**

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

**Soil Design Values**

Allowable Soil Bearing	=	3.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

**Analysis Settings**

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

**Increases based on footing depth**

Footing base depth below soil surface	=	0.750 ft
Allow press. increase per foot of depth when footing base is below	=	0.250 ksf ft

**Increases based on footing plan dimension**

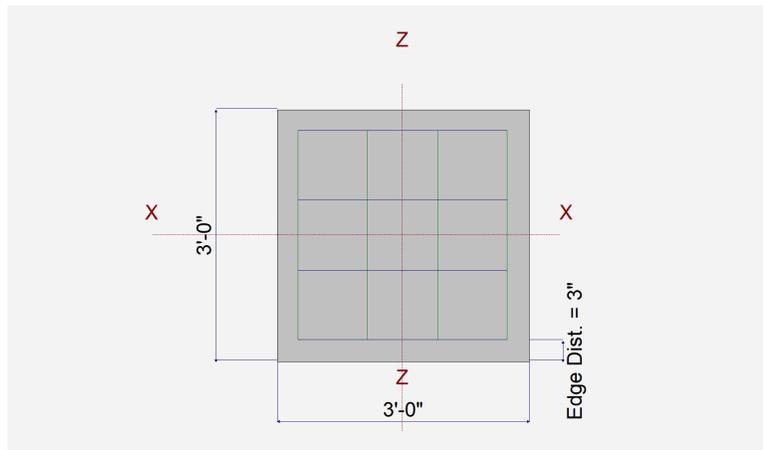
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
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**Dimensions**

Width parallel to X-X Axis	=	3.0 ft
Length parallel to Z-Z Axis	=	3.0 ft
Footing Thickness	=	10.0 in

**Pedestal dimensions...**

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



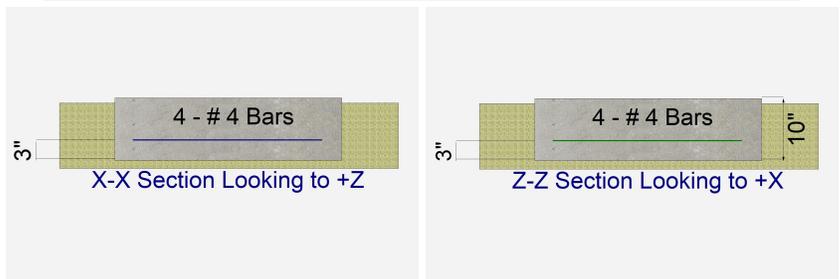
**Reinforcing**

Bars parallel to X-X Axis	=	
Number of Bars	=	4.0
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	
Number of Bars	=	4.0
Reinforcing Bar Size	=	# 4

**Bandwidth Distribution Check (ACI 15.4.4.2)**

Direction Requiring Closer Separation	=	n/a
# Bars required within zone	=	n/a
# Bars required on each side of zone	=	n/a



**Applied Loads**

	D	Lr	L	S	W	E	H
P : Column Load	=	2.468		13.402			k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



General Footing

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC#: KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

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DESCRIPTION: Deck footing (F3.0)

DESIGN SUMMARY

Design OK

Table with 6 columns: Min. Ratio, Item, Applied, Capacity, Governing Load Combination. Rows include Soil Bearing, Overturning, Sliding, Uplift, and Z/X Flexure and Shear checks.

Detailed Results

Soil Bearing

Table for Soil Bearing with columns: Rotation Axis & Load Combination, Gross Allowable, Xecc, Zecc, Actual Soil Bearing Stress @ Location (Bottom, Top, Left, Right), Actual / Allow Ratio.

Overturning Stability

Table for Overturning Stability with columns: Rotation Axis & Load Combination, Overturning Moment, Resisting Moment, Stability Ratio, Status.

All units k

Sliding Stability

Table for Sliding Stability with columns: Force Application Axis Load Combination, Sliding Force, Resisting Force, Stability Ratio, Status.

Footing Flexure

Table for Footing Flexure with columns: Flexure Axis & Load Combination, Mu k-ft, Side, Tension Surface, As Req'd in^2, Gvrn. As in^2, Actual As in^2, Phi\*Mn k-ft, Status.



**CS2 ENGINEERS**

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 Engineer: S. Cho  
 Project ID: 2207  
 Project Descr: Remodel and addition of Single Family Residential House

**General Footing**

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

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**DESCRIPTION:** Deck footing (F3.0)

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.3702	+X	Bottom	0.2160	AsMin	0.2667	8.024	OK
Z-Z, +0.90D	0.2777	-X	Bottom	0.2160	AsMin	0.2667	8.024	OK
Z-Z, +0.90D	0.2777	+X	Bottom	0.2160	AsMin	0.2667	8.024	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	4.25 psi	75.00 psi	0.06	OK				
+1.20D+1.60L	30.02 psi	75.00 psi	0.40	OK				
+1.20D+0.50L	11.89 psi	75.00 psi	0.16	OK				
+1.20D	3.64 psi	75.00 psi	0.05	OK				
+0.90D	2.73 psi	75.00 psi	0.04	OK				

All units k

**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	16.92 psi	150.00psi	0.1128	OK
+1.20D+1.60L	119.53 psi	150.00psi	0.7969	OK
+1.20D+0.50L	47.33 psi	150.00psi	0.3155	OK
+1.20D	14.51 psi	150.00psi	0.09671	OK
+0.90D	10.88 psi	150.00psi	0.07253	OK



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**General Footing**

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

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**DESCRIPTION:** Deck footing (F2.0)

**Code References**

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : IBC 2018

**General Information**

**Material Properties**

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

**Soil Design Values**

Allowable Soil Bearing	=	3.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

**Analysis Settings**

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

**Increases based on footing Depth**

Footing base depth below soil surface	=	0.750 ft
Allow press. increase per foot of depth when footing base is below	=	0.250 ksf ft

**Increases based on footing plan dimension**

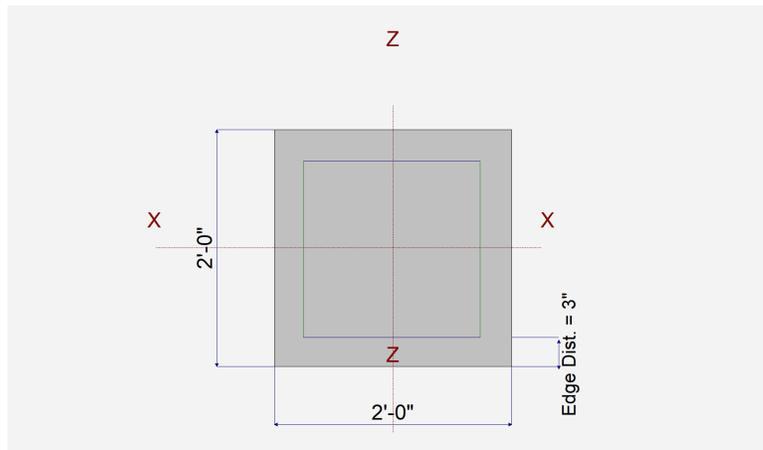
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
---	---	--------

**Dimensions**

Width parallel to X-X Axis	=	2.0 ft
Length parallel to Z-Z Axis	=	2.0 ft
Footing Thickness	=	8.0 in

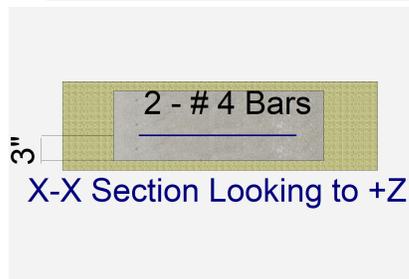
**Pedestal dimensions...**

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



**Reinforcing**

Bars parallel to X-X Axis	=	2.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis	=	2.0
Number of Bars	=	# 4
Reinforcing Bar Size	=	# 4
<b>Bandwidth Distribution Check (ACI 15.4.4.2)</b>		
Direction Requiring Closer Separation		n/a
# Bars required within zone		n/a
# Bars required on each side of zone		n/a



**Applied Loads**

	D	Lr	L	S	W	E	H
P : Column Load	=	0.9220		5.272			k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



General Footing

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC#: KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

(c) ENERCALC INC 1983-2023

DESCRIPTION: Deck footing (F2.0)

DESIGN SUMMARY

Design OK

Table with 6 columns: Min. Ratio, Item, Applied, Capacity, Governing Load Combination. Rows include Soil Bearing, Overturning, Sliding, Uplift, and various Flexure and Shear checks.

Detailed Results

Soil Bearing

Table for Soil Bearing with columns: Rotation Axis & Load Combination, Gross Allowable, Xecc, Zecc, Actual Soil Bearing Stress @ Location (Bottom, Top, Left, Right), Actual / Allow Ratio.

Overturning Stability

Table for Overturning Stability with columns: Rotation Axis & Load Combination, Overturning Moment, Resisting Moment, Stability Ratio, Status.

Footing Has NO Overturning

All units k

Sliding Stability

Table for Sliding Stability with columns: Force Application Axis Load Combination, Sliding Force, Resisting Force, Stability Ratio, Status.

Footing Has NO Sliding

Footing Flexure

Table for Footing Flexure with columns: Flexure Axis & Load Combination, Mu k-ft, Side, Tension Surface, As Req'd in^2, Gvrn. As in^2, Actual As in^2, Phi\*Mn k-ft, Status.



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 Engineer: S. Cho  
 Project ID: 2207  
 Project Descr: Remodel and addition of Single Family Residential House

**General Footing**

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Deck footing (F2.0)

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in <sup>2</sup>	Gvrn. As in <sup>2</sup>	Actual As in <sup>2</sup>	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.1383	+X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +0.90D	0.1037	-X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +0.90D	0.1037	+X	Bottom	0.1728	AsMin	0.20	4.288	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.12 psi	75.00 psi	0.04	OK				
+1.20D+1.60L	23.06 psi	75.00 psi	0.31	OK				
+1.20D+0.50L	9.04 psi	75.00 psi	0.12	OK				
+1.20D	2.67 psi	75.00 psi	0.04	OK				
+0.90D	2.01 psi	75.00 psi	0.03	OK				

All units k

**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	12.39 psi	150.00psi	0.08261	OK
+1.20D+1.60L	91.60 psi	150.00psi	0.6107	OK
+1.20D+0.50L	35.93 psi	150.00psi	0.2395	OK
+1.20D	10.62 psi	150.00psi	0.07081	OK
+0.90D	7.97 psi	150.00psi	0.05311	OK



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LIC# : KW-06013944, Build:20.23.08.01

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**DESCRIPTION:** Interior Beam footing (F2.0)

**Code References**

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : IBC 2018

**General Information**

**Material Properties**

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

**Soil Design Values**

Allowable Soil Bearing	=	3.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

**Analysis Settings**

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

**Increases based on footing depth**

Footing base depth below soil surface	=	0.750 ft
Allow press. increase per foot of depth when footing base is below	=	0.250 ksf ft

**Increases based on footing plan dimension**

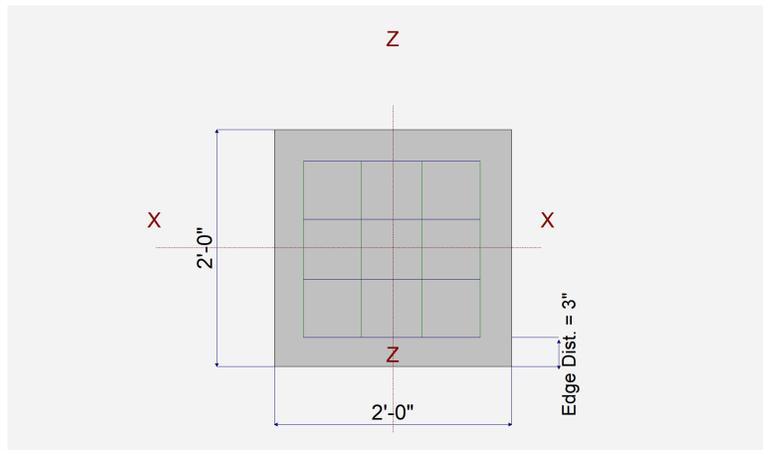
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
---	---	--------

**Dimensions**

Width parallel to X-X Axis	=	2.0 ft
Length parallel to Z-Z Axis	=	2.0 ft
Footing Thickness	=	8.0 in

**Pedestal dimensions...**

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0 in



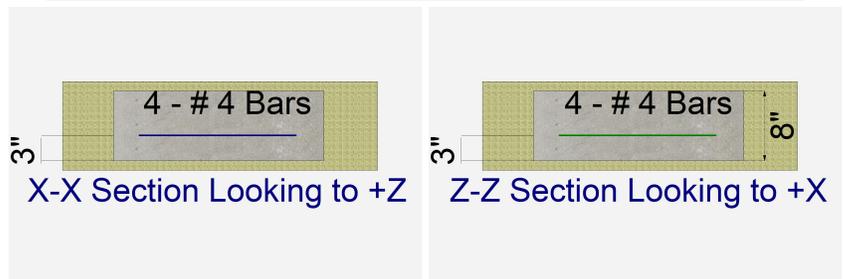
**Reinforcing**

Bars parallel to X-X Axis	=	
Number of Bars	=	4.0
Reinforcing Bar Size	=	# 4

Bars parallel to Z-Z Axis	=	
Number of Bars	=	4.0
Reinforcing Bar Size	=	# 4

**Bandwidth Distribution Check (ACI 15.4.4.2)**

Direction Requiring Closer Separation	=	n/a
# Bars required within zone	=	n/a
# Bars required on each side of zone	=	n/a



**Applied Loads**

	D	Lr	L	S	W	E	H
P : Column Load	=	1.966		6.158			k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k



General Footing

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC#: KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

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DESCRIPTION: Interior Beam footing (F2.0)

DESIGN SUMMARY

Design OK

Table with 6 columns: Min. Ratio, Item, Applied, Capacity, Governing Load Combination. Rows include Soil Bearing, Overturning, Sliding, Uplift, and Z/X Flexure checks.

Detailed Results

Soil Bearing

Table for Soil Bearing with columns: Rotation Axis & Load Combination, Gross Allowable, Xecc, Zecc, Actual Soil Bearing Stress @ Location (Bottom, Top, Left, Right), Actual / Allow Ratio.

Overturning Stability

Table for Overturning Stability with columns: Rotation Axis & Load Combination, Overturning Moment, Resisting Moment, Stability Ratio, Status.

All units k

Sliding Stability

Table for Sliding Stability with columns: Force Application Axis & Load Combination, Sliding Force, Resisting Force, Stability Ratio, Status.

Footing Flexure

Table for Footing Flexure with columns: Flexure Axis & Load Combination, Mu k-ft, Side, Tension Surface, As Req'd in^2, Gvrn. As in^2, Actual As in^2, Phi\*Mn k-ft, Status.



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 Engineer: S. Cho  
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**General Footing**

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

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**DESCRIPTION: Interior Beam footing (F2.0)**

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in <sup>2</sup>	Gvrn. As in <sup>2</sup>	Actual As in <sup>2</sup>	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.2949	+X	Bottom	0.1728	AsMin	0.40	8.153	OK
Z-Z, +0.90D	0.2212	-X	Bottom	0.1728	AsMin	0.40	8.153	OK
Z-Z, +0.90D	0.2212	+X	Bottom	0.1728	AsMin	0.40	8.153	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	6.65 psi	75.00 psi	0.09	OK				
+1.20D+1.60L	29.51 psi	75.00 psi	0.39	OK				
+1.20D+0.50L	13.14 psi	75.00 psi	0.18	OK				
+1.20D	5.70 psi	75.00 psi	0.08	OK				
+0.90D	4.28 psi	75.00 psi	0.06	OK				

All units k

**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	26.42 psi	150.00psi	0.1762	OK
+1.20D+1.60L	117.24 psi	150.00psi	0.7816	OK
+1.20D+0.50L	52.21 psi	150.00psi	0.348	OK
+1.20D	22.65 psi	150.00psi	0.151	OK
+0.90D	16.99 psi	150.00psi	0.1132	OK

## Restrained Retaining Wall

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

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### DESCRIPTION: Restrained Stem Wall

#### Code Reference

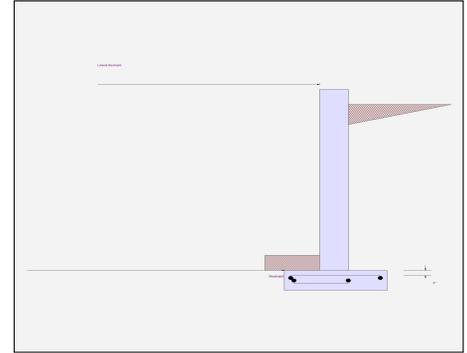
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

Retained Height	=	5.50 ft
Wall height above soil	=	0.50 ft
Total Wall Height	=	6.0 ft
Top Support Height	=	6.0 ft
Slope Behind Wall	=	0
Height of Soil over Toe	=	6 in

#### Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure Method		
At-Rest Heel Pressure	=	32.0 psf/ft
	=	0.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density	=	110 pcf
Footing  Soil Frictior	=	0.4 psf
Soil height to ignore for passive pressure	=	12 in



#### Surcharge Loads

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

#### Axial Load Applied to Stem

Axial Dead Load	=	531.25 lbs
Axial Live Load	=	737.75 lbs
Axial Load Eccentricity	=	in

#### Earth Pressure Seismic Load

#### Uniform Lateral Load Applied to Stem

Lateral Load	=	#/ft
...Height to Top	=	ft
...Height to Bottom	=	ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem	=	0.00 psf (Service Level)
Wind acts left-to-right toward retention side.		
$K_h$ Soil Density Multiplier	=	0.2 g

#### Adjacent Footing Load

Adjacent Footing Load	=	lbs
Footing Width	=	ft
Eccentricity	=	in
Wall to Ftg CL Dist	=	ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	ft
Poisson's Ratio	=	0.3
Added seismic per unit area	=	0.0 psf

#### Design Summary

Total Bearing Load	=	2,835.90 lbs
...resultant ecc.	=	-1.798 in
Soil Pressure @ Toe	=	704.96 psf OK
Soil Pressure @ Heel	=	1,421.70 psf OK
Allowable	=	psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	919.31 psf
ACI Factored @ Heel	=	1,853.98 psf
Footing Shear @ Toe	=	9.014 psi OK
Footing Shear @ Heel	=	12.621 psi OK
Allowable	=	75.0 psi
Reaction at Top	=	146.889 lbs
Reaction at Bottom	=	460.556 lbs

#### Sliding Calcs

Lateral Sliding Force	=	460.556 lbs
-----------------------	---	-------------

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

#### Concrete Stem Construction

Thickness	=	8.00 in
Wall Weight	=	100.0 psf
Stem is FREE to rotate at top of footing		

	@ Top Support	Mmax Between Top & Base	@ Base of Wall
<b>Design Height Above Ftg</b>	Stem OK = 6.0 ft	Stem OK = 2.482 ft	Stem OK = 0.00 ft
Rebar Size	# 4	# 4	# 4
Rebar Spacing	12.00 in	12.00 in	12.00 in
Rebar Placed at	Center	Center	Center
Rebar Depth 'd'	4.0 in	4.0 in	4.0 in
<b>Design Data</b>			
fb/FB + fa/Fa	=	0.176	
Moment.....Actual	=	0.0 ft-#	0.0 ft-#
Moment.....Allowable	=	3,387.60 ft-#	3,387.60 ft-#
Shear Force @ this height	=	236.622 lbs	537.78 lbs
Shear.....Actual	=	4.930 psi	11.204 psi
Shear.....Allowable	=	75.0 psi	75.0 psi

#### Load Factors

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



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Project Title: Park's Residence Addition  
 Engineer: S. Cho  
 Project ID: 2207  
 Project Descr: Remodel and addition of Single Family Residential House

**Restrained Retaining Wall**

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

CS2 ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION: Restrained Stem Wall**

**Footing Strengths & Dimensions**

Toe Width	=	1.0 ft
Heel Width	=	1.667
Total Footing Width	=	2.667
Footing Thickness	=	8.0 in
Key Width	=	in
Key Depth	=	in
Key Distance from Toe	=	ft
f'c =	2,500.0 psi	Fy = 60000 psi
Footing Concrete Density	=	150 pcf
Min. As %	=	0.0018
Cover @ Top	=	2 in @ Btm.= 3 in

**Footing Design Results**

		<b>Toe</b>	<b>Heel</b>
Factored Pressure	=	919.31	1,853.98 psf
Mu' : Upward	=	518.06	ft-#
Mu' : Downward	=	125.0	ft-#
Mu: Design	=	393	-446 ft-#
Actual 1-Way Shear	=	9.014	psi
Allow 1-Way Shear	=	75.0	75.0 psi

**Other Acceptable Sizes & Spacings:**

Toe: # 4 @ 13.89 in	-or-	#4@ 13.88 in, #5@ 21.52 in, #6@ 30.55 in, #7@ 41
Heel: # 4 @ 13.89 in	-or-	#4@ 13.88 in, #5@ 21.52 in, #6@ 30.55 in, #7@ 41
Key: # 0 @ 0.00 in	-or-	No key defined
Min footing T&S reinf Area		0.46 in2
Min footing T&S reinf Area per foot		0.17 in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 13.89 in		#4@ 27.78 in
#5@ 21.53 in		#5@ 43.06 in
#6@ 30.56 in		#6@ 61.11 in

**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	=	0.0lbs	0.0 ft	0.0ft-#
Axial Dead Load on Stem	=	1,269.0lbs	1.333 ft	1,692.0ft-#
Soil Over Toe	=	55.0lbs	0.50 ft	27.50ft-#
Adjacent Footing Load	=	0.0lbs	0.0 ft	0.0ft-#
Surcharge Over Toe	=	40.0lbs	0.50 ft	20.0ft-#
Stem Weight	=	600.0lbs	1.333 ft	800.0ft-#
Soil Over Heel	=	605.20lbs	2.167 ft	1,311.37ft-#
Footing Weight	=	266.70lbs	1.334 ft	355.644ft-#
<b>Total Vertical Force</b>	=	2,835.90lbs	Moment =	4,206.52ft-#

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



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## Restrained Retaining Wall

Project File: 2207 Mercer Island Park Residence Remodel.ec6

LIC# : KW-06013944, Build:20.23.08.01

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**DESCRIPTION:** Restrained Stem Wall

---

### Rebar Lap & Embedment Lengths Information



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### Restrained Retaining Wall

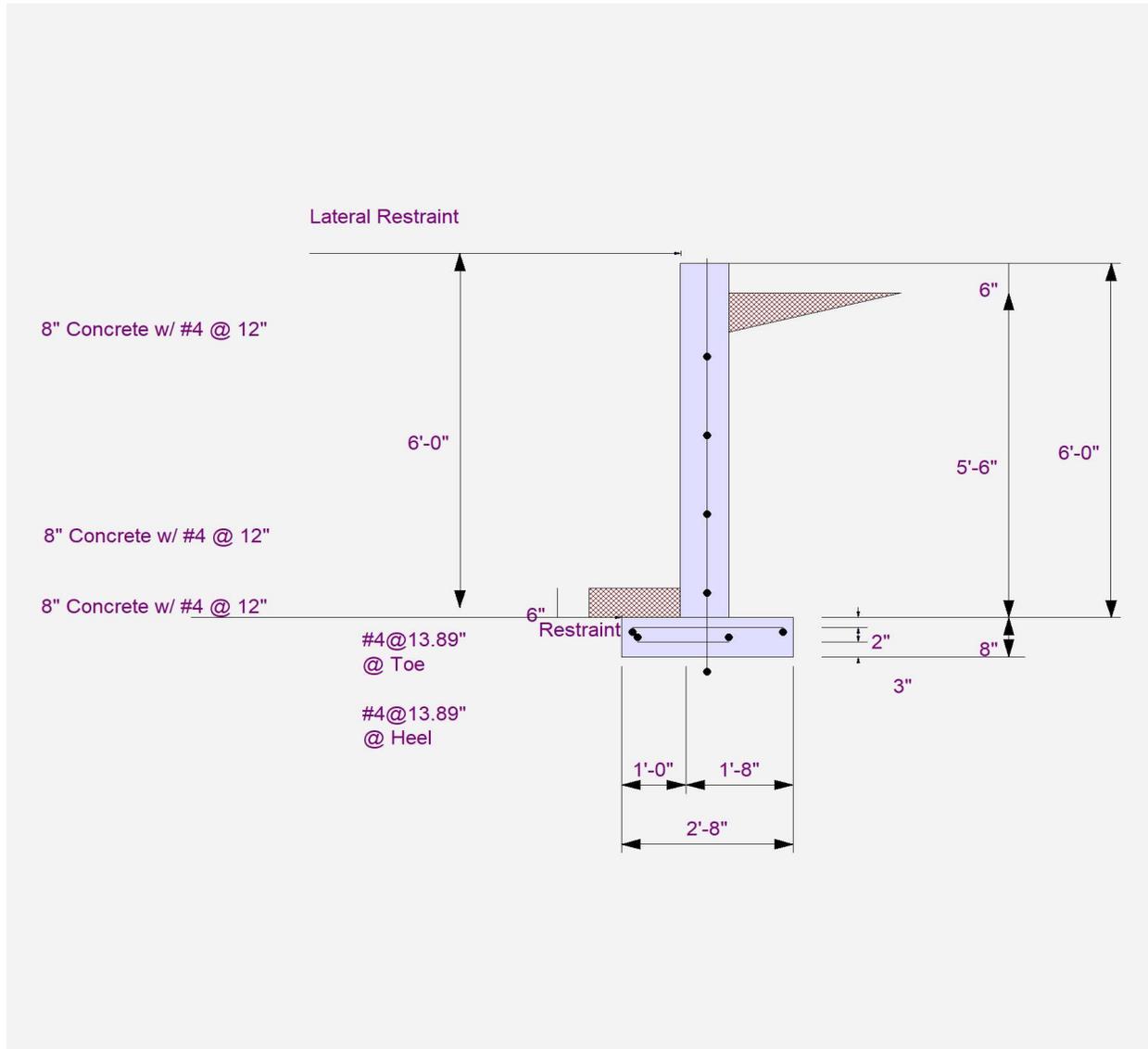
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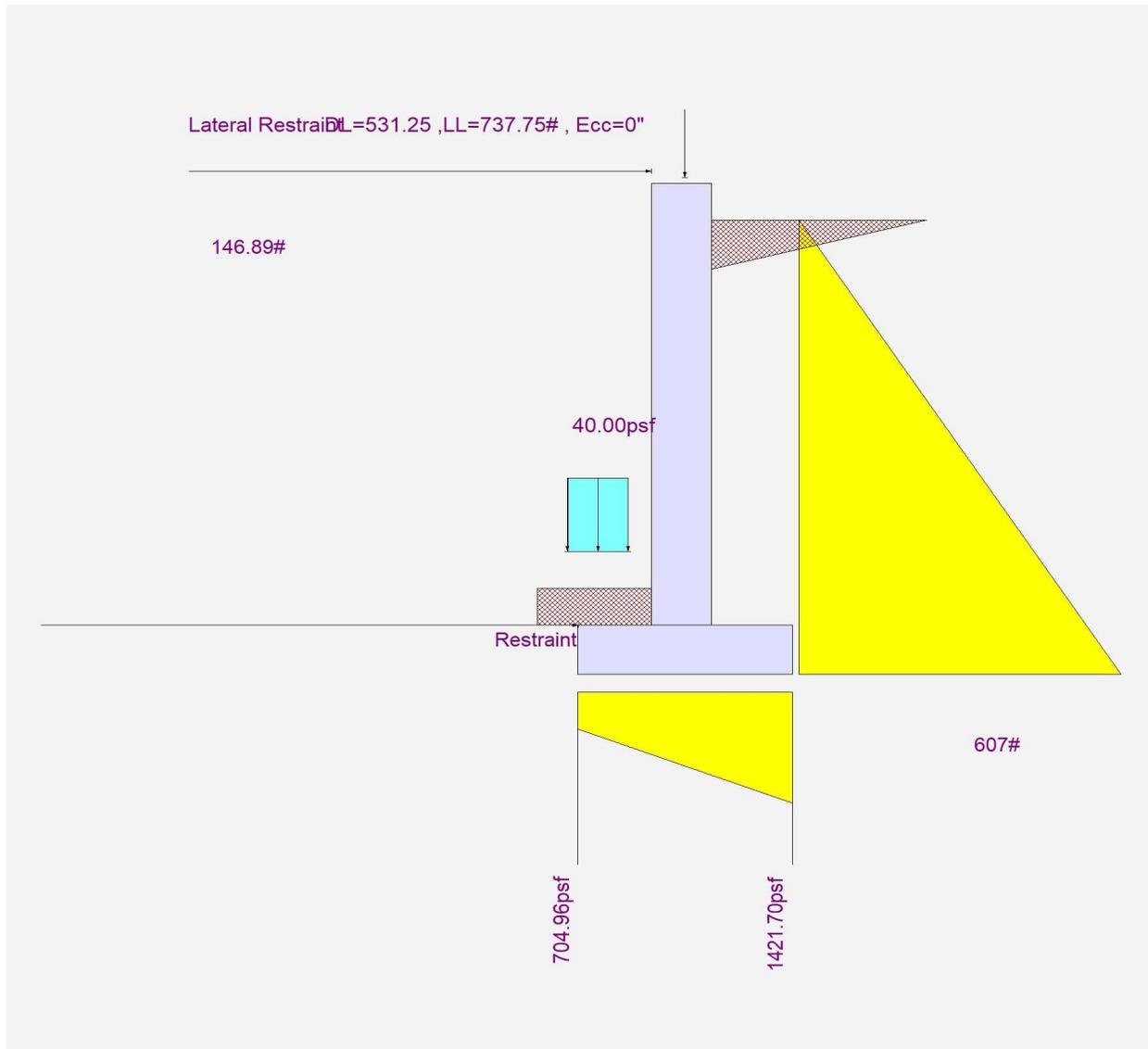
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**DESCRIPTION:** Restrained Stem Wall



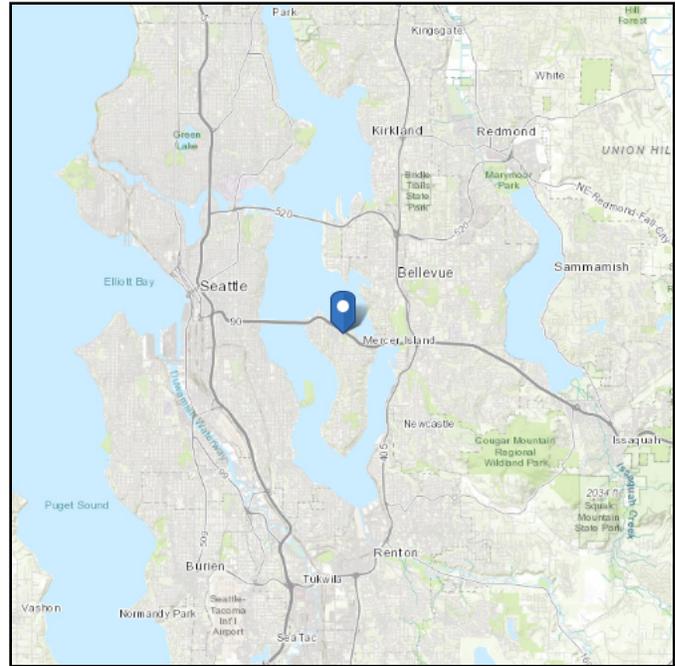
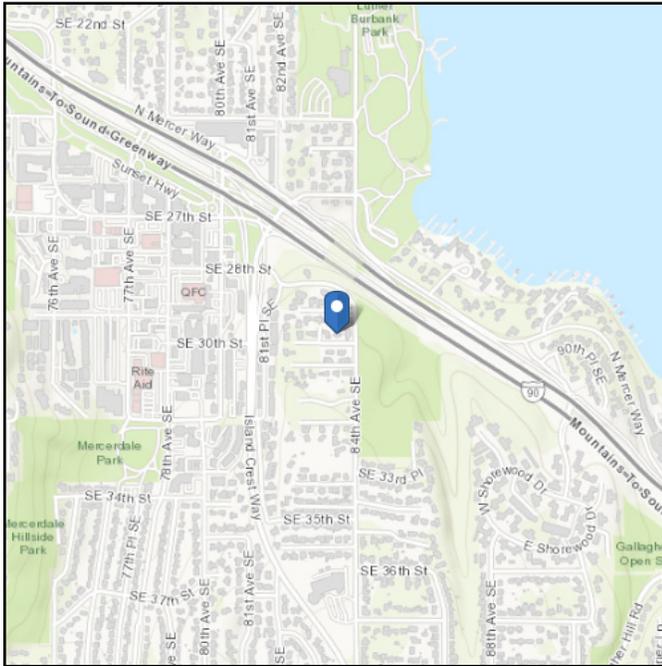
# Lateral Load Design Calculation

# ASCE 7 Hazards Report

**Address:**  
8244 SE 30th St  
Mercer Island, Washington  
98040

**Standard:** ASCE/SEI 7-16  
**Risk Category:** II  
**Soil Class:** D - Default (see Section 11.4.3)

**Elevation:** 200.54 ft (NAVD 88)  
**Latitude:** 47.58388  
**Longitude:** -122.227601



## Wind

### Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	74 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2

Date Accessed: Sat Apr 09 2022

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

**Site Soil Class:** D - Default (see Section 11.4.3)

**Results:**

$S_s$ :	1.395	$S_{D1}$ :	N/A
$S_1$ :	0.486	$T_L$ :	6
$F_a$ :	1.2	PGA :	0.597
$F_v$ :	N/A	PGA <sub>M</sub> :	0.716
$S_{MS}$ :	1.674	$F_{PGA}$ :	1.2
$S_{M1}$ :	N/A	$I_e$ :	1
$S_{DS}$ :	1.116	$C_v$ :	1.379

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

**Data Accessed:** Sat Apr 09 2022

**Date Source:** [USGS Seismic Design Maps](#)

## Snow

---

### Results:

Elevation:

Data Source:

Date Accessed: Sat Apr 09 2022

In "Case Study" areas, site-specific case studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2 percent annual probability of being exceeded (50-year mean recurrence interval).

Site is outside ASCE/SEI 7-16, Table 7.2-5 boundaries. For ground snow loads in this area, see SEAW Snow Load Analysis for Washington, 2nd Ed. (1995). [Structural Engineers Association of Washington](#), Seattle, WA.

Statutory requirements of the Authority Having Jurisdiction are not included.

---

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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**Project:** House Remodel (8244 SE 30th St, Mercer Island)**Client:** Owner**Job No.:** 2207**By:** S. Cho**Date:** 8/5/23**Subject:** Design Calculations**Page:****Design & Loading Criteria**

## Roof Dead Load:

Roofing =	2.8	psf
Insulation =	2.5	psf
Roof sheathing =	1.7	psf
Rafters @ 24" o.c. =	3.0	psf
5/8" GWB =	2.8	psf
M & E =	0.5	psf
Miscellaneous =	1.0	psf

Roof dead load total = **14.3 psf****USE = 15.0 psf**Roof Live Load: **25 psf****Total Roof Load = 40.0 psf**

## Floor Dead Load:

Floor Cover =	1.0	psf
Insulation =	1.0	psf
Floor sheathing =	2.7	psf
Joists @ 16" o.c. =	2.8	psf
5/8" GWB =	2.8	psf
M & E =	1.0	psf
Miscellaneous =	0.5	psf

Floor dead load total = **11.8 psf****USE = 12.0 psf**Floor Live Load: **40 psf****Total Floor Load = 52.0 psf**

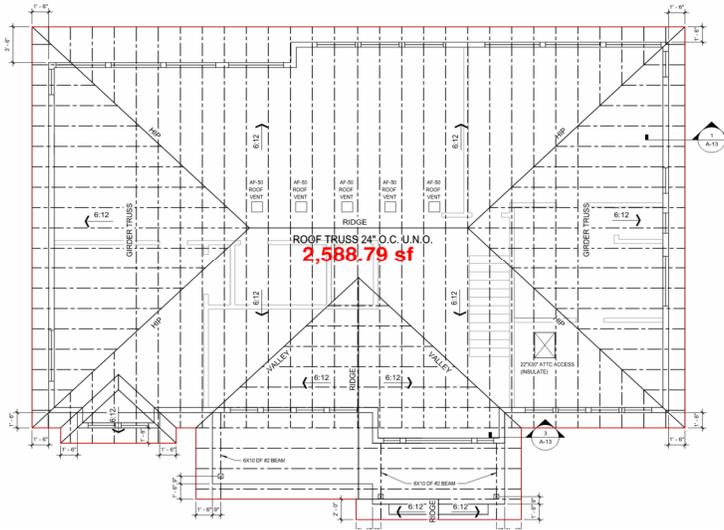
## Wall Dead Load:

2x Stud @ 16" o.c. =	2.0	psf
7/16" Sheathing =	1.8	psf
Gypsum sheathing =	2.0	psf
Insulation =	1.0	psf
Siding =	2.0	psf
Miscellaneous =	0.5	psf

Wall dead load total = **9.3 psf****USE = 10.0 psf****DESIGN REFERENCES:**

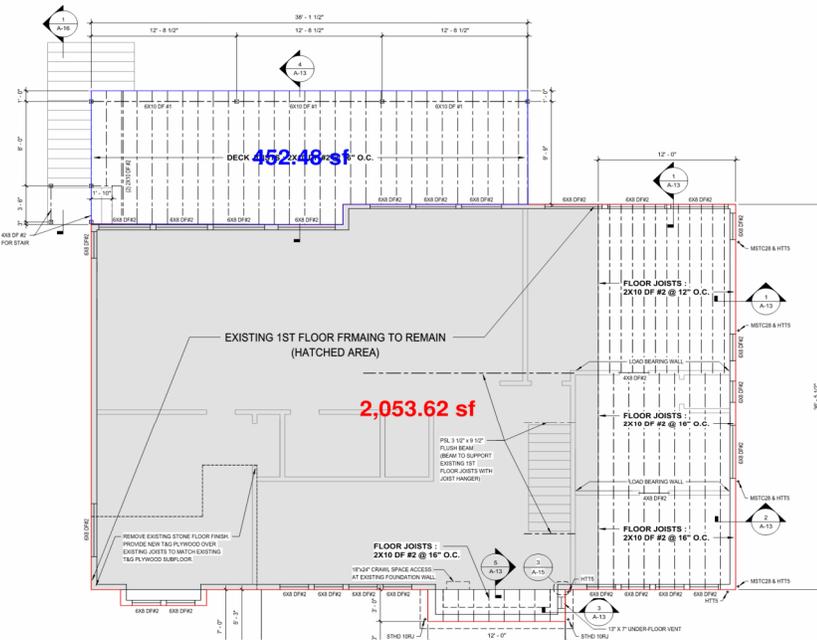
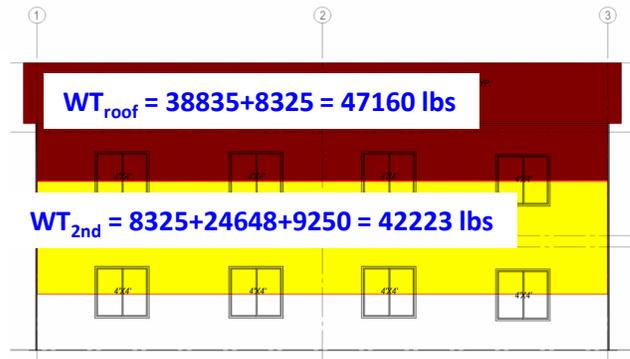
- ASCE 7-16, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURE.
- IBC 2018, INTERNATIONAL BUILDING CODE 2018.
- ACI 318-14, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY.
- NDS 2018, NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION WITH COMMENTARY.
- AWC SDPWS-2015, SPECIAL DESIGN PROVISIONS FOR WIND AND SEISMIC WITH COMMENTARY.
- AISC 360-16, SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS: STEEL DESIGN MANUAL

<b>Project:</b>	House Remodel (8244 SE 30th St, Mercer Island)	
<b>Client:</b>	Owner	<b>Job No.:</b> 2207
<b>By:</b>	S. Cho	<b>Date:</b> 8/5/23
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Roof Area (ft<sup>2</sup>) = 2589  
 Roof DL (psf) = 15  
**Roof Weight (lbs) = 38835**

Wall DL (psf) = 10  
 Total Wall Length (ft) = 185  
 Wall Height (ft) = 9  
**1/2 Upper Wall (lbs) = 8325**



Wall DL (psf) = 10  
 Total Wall Length (ft) = 185  
 Wall Height (ft) = 9  
**1/2 Upper Wall (lbs) = 8325**

2nd Floor Area (ft<sup>2</sup>) = 2054  
 Floor DL (psf) = 12  
**Floor Weight (lbs) = 24648**

Wall DL (psf) = 10  
 Total Wall Length (ft) = 185  
 Wall Height (ft) = 10  
**1/2 Lower Wall (lbs) = 9250**

<b>Project:</b>	House Remodel (8244 SE 30th St, Mercer Island)	
<b>Client:</b>	Owner	<b>Job No.:</b> 2207
<b>By:</b>	S. Cho	<b>Date:</b> 8/5/23
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### Calculate Seismic Design Base Shear

Per USGS

Structure Height, $h_n$ , (ft)	=	<b>16.8</b>	(Mean roof height)	$S_s =$	<b>1.395</b>
$S_{DS} = 2/3 S_{MS}$	=	<b>1.116</b>	(per USGS)	$S_1 =$	<b>0.486</b>
$S_{D1} = 2/3 S_{M1}$	=	<b>N/A</b>	(per USGS)	$S_{MS} =$	<b>1.674</b>
Risk Category=	<b>Standard-Occupancy Buildings</b>	=	<b>II</b>	$S_{M1} =$	<b>N/A</b>
Seismic Design Category per $S_{DS}$		=	<b>D</b>		
Occupancy Importance Factor, $I_E$	=	<b>1</b>	(ASCE 7, Table 11.5.1)		
Response Modification Factor, $R$	=	<b>6.5</b>	(ASCE 7, Table 12.2-1)		
Building Period Coefficient, $C_t$	=	<b>0.02</b>	(ASCE 7, Table 12.8-2)		
$T = C_t \times (h_n)^{3/4}$	=	<b>0.166</b>	(ASCE 7, Eq 12.8-7)		
$T_L =$ long-period transaction	=	<b>6</b>	(ASCE 7, Fig 22-15)		
$C_s = S_{DS}/(R/I_E)$	=	<b>0.172</b>	(ASCE 7, Eq 12.8-2)		
But need not exceed:					
$C_s = S_{D1}/[T(R/I_E)]$	=	<b>N/A</b>	(ASCE 7, Eq 12.8-3)		
But not less than:					
$C_s = 0.44S_{DS}I_E$ ;(not less than 0.01)	=	<b>0.049</b>	(ASCE 7, Eq 12.8-5)		
$C_s = 0.5S_1/(R/I_E)$ (if $S_1 > \text{or} = 0.6g$ )	=	<b>N/A</b>	(ASCE 7, Eq 12.8-6)		

<b>Seismic Base Shear, <math>V_s = C_s W</math>, (kips)</b>	<b>= 0.172 x Weight</b>
<b>Seismic Base Shear, <math>V_s/1.4 = C_s W</math>, (kips)</b>	<b>= 0.123 x Weight (ASD)</b>

$F_{px, min} =$   
 $F_{px, max} =$

### Calculate Seismic Force for Components (Per ASCE7-16 Chapter 13)

Component amplification factor, $a_p$	=	<b>1</b>	(ASCE 7, Table 13.5.1 & 13.6.1)
Component Importance factor, $I_p$	=	<b>1</b>	(ASCE 7, Section 13.3)
Component operating weight, $W_p$	=	<b><math>W_p</math></b>	(lb)
Component response modification factor, $R_p$	=	<b>2.5</b>	(ASCE 7, Table 13.5.1 & 13.6.1)
Height of attachment / Mean roof height, $z/h$	=	<b>1</b>	( $z/h$ need not exceed 1.0)
Seismic Design Force, $F_p = \frac{(0.4a_p S_{DS} W_p) (1+2xz/h)}{R_p/I_p}$	=	<b>0.536 <math>W_p</math></b>	(Eq. 13.3-1)
Max. seismic design force, $F_{pmax} = 1.6S_{DS}I_p W_p$	=	<b>1.786 <math>W_p</math></b>	(Eq. 13.3-2)
Min. seismic design force, $F_{pmin} = 0.3S_{DS}I_p W_p$	=	<b>0.335 <math>W_p</math></b>	(Eq. 13.3-3)

<b>Seismic Design Force, <math>F_p = 0.536 W_p</math></b>
<b>Seismic Design Force, <math>F_p/1.4 = 0.383 W_p</math></b>

Longitudinal Direction	Level	Height $h_x$ (ft)	Weight $w_x$ (lbs)	$w_x h_x$ (lb-ft)	%	$F_{x Long}$ (lbs)	$F_x$ Coef.	Story Shear ( $V_x$ )
	R	16.8	47160	792288	70%	7685	0.163	7685
	2	8	42223	337784	30%	3277	0.078	10962
	1			0	0%	0	0.000	10962
	$\Sigma$			89383	1130072	100%	10962	

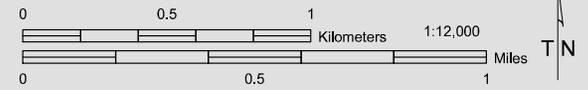
$F_{px, min} =$   
**7519**

$F_{px, max} =$   
**15037**

Transverse Direction	Level	Height $h_x$ (ft)	Weight $w_x$ (lbs)	$w_x h_x$ (lb-ft)	%	$F_{x Tras}$ (lbs)	$F_x$ Coef.	Story Shear ( $V_x$ )
	R	16.8	47160	792288	70%	7685	0.163	7685
	2	8	42223	337784	30%	3277	0.078	10962
	1			0	0%	0	0.000	10962
	$\Sigma$			89383	1130072	100%	10962	

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

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



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

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

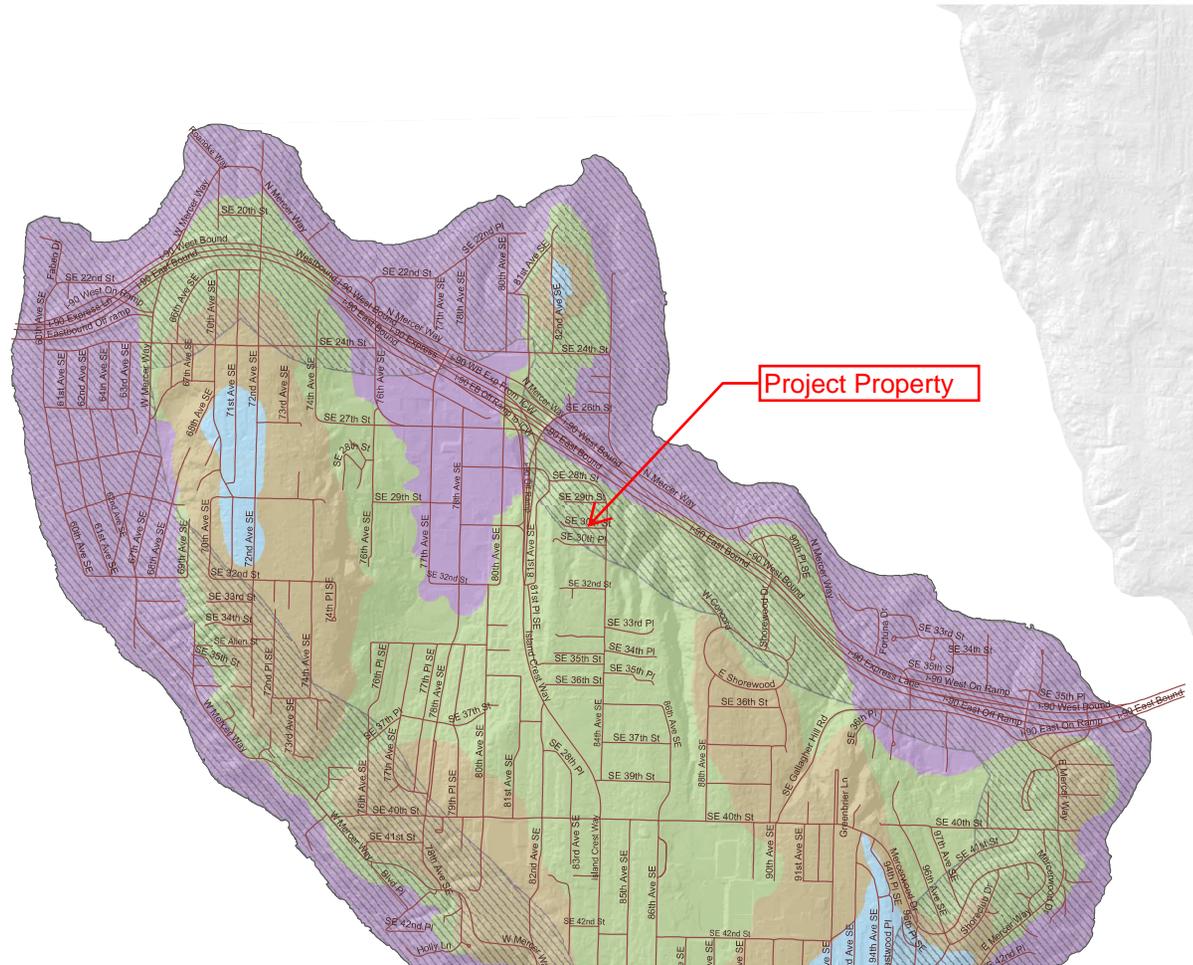
Please note – The  $K_{zt}$  values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

### WIND EXPOSURE CATEGORIES:

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

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

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



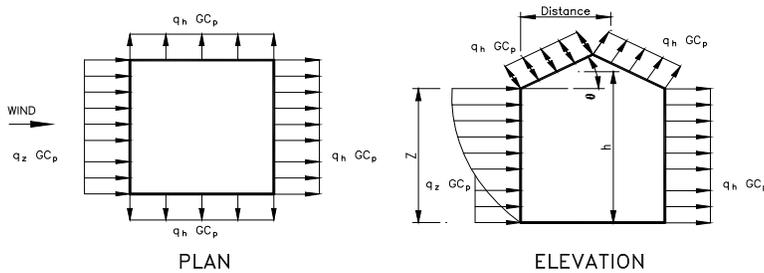
<b>Project:</b> House Remodel (8244 SE 30th St, Mercer Island)	<b>Job No.:</b> 2207
<b>Client:</b> Owner	<b>Date:</b> 8/5/23
<b>By:</b> S. Cho	<b>Page:</b>
<b>Subject:</b> Design Calculations	

**Wind Load Calculation (Method 2 - Analytical)**

(Reference: IBC 2018, Section 1609 & ASCE 7-16, Chapter 27)

**Wind Velocity Pressure:**

- Basic Wind Speed,  $V_{3s}$ , (mph) = **98** (ASCE 7-16, Figure 6-1)
- Exposure Category = **C** (ASCE 7-16, Section 6.5.6)
- Building Category = **II** (IBC Table 1604.5)
- Wind Load Importance Factor,  $I_w$  = **1.3** (IBC Table 1604.5)
- Velocity pressure exposure coefficient,  $K_z$  = **See Table** (ASCE 7-16, Table 6-3)
- Topographic Factor,  $K_{zt}$  = **1.00** (ASCE 7-16, Figure 6-4)
- Wind Directionality Factor,  $K_d$  = **0.85** (ASCE 7-16, Table 6-4).
- Velocity Pressure,  $q_z$ , (lb/ft<sup>2</sup>) = **0.00256K<sub>z</sub>K<sub>zt</sub>K<sub>d</sub>V<sup>2</sup>I<sub>w</sub>** (ASCE 7-16, Eq. 6-15)
- = **27.17 K<sub>z</sub>** (ASCE 7-16, Section 6.5.10)
- Gust effect factor,  $G$  = **0.85** (ASCE 7-16, Section 6.5.8)



- Width, B = **36.5** ft
- Length, L = **56** ft
- Height to eave,  $h_e$  = **12.5** ft
- Height to ridge,  $h_r$  = **21** ft
- Mean roof height = **16.8** ft
- $\theta$  = **22.6** deg
- $q_h$ , (lb/ft<sup>2</sup>) = **24.76**
- L/B = **1.5**
- h/L = **0.3**

Internal Pressure Coefficient,  $C_{pi}$  = **0.18** →  $q_h GC_{pi}$  = **3.79**  
 $p = qGC_p - q_i(GC_{pi})$  (ASCE 7-16, Eq 6-17)

**MWFRS Pressure:**

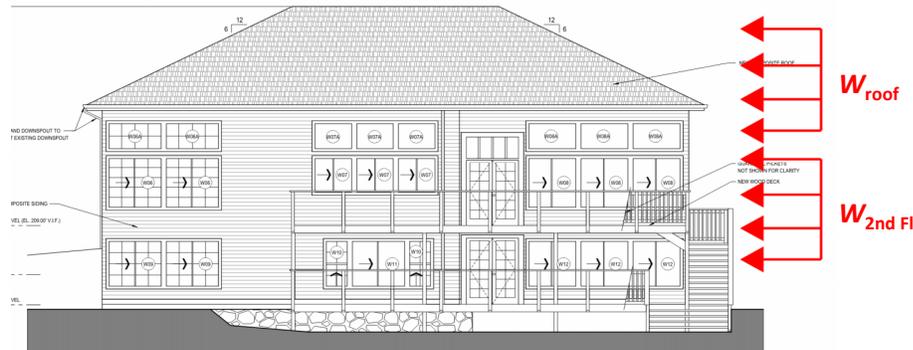
	Height Z, (ft)	$K_z$	$q_z$ or $q_h$	$C_p$	$qGC_p$	Net Pressure (p), psf		Total Wind Load
						(+GC <sub>pi</sub> )	(-GC <sub>pi</sub> )	
Winward Wall	0-15	0.85	23.06	0.8	15.68	11.89	19.47	30.41
	<b>21</b>	<b>0.91</b>	<b>24.76</b>	<b>0.8</b>	16.83	13.05	20.62	31.56
	25	0.95	25.68	0.8	17.46	13.68	21.25	32.19
	27.5	0.96	26.20	0.8	17.82	14.03	21.60	32.55
Side Wall	All		24.76	-0.7	-14.73	-18.52	-10.94	
Windward Roof	-		24.76	-0.8	-16.83	-20.62	-13.05	-6.31
			24.76	-0.18	-3.79	-7.58	0.00	6.73
Leeward Roof	-		24.76	-0.5	-10.52	-14.31	-6.73	
Horizontal Distance from windward edge								
	0 to h		24.76	-0.9	-18.94	-22.73	-15.15	
	h to 2h		24.76	-0.5	10.52	-14.31	-6.73	
	> 2h		24.76	-0.3	-6.31	-10.10	-2.53	

(Where h = 21 ft)

- Vertical Wall = **31.56 psf**
  - Vertical Roof = **6.22 psf**
  - Horizontal Roof = **2.59 psf**
- OR **Not less than (16psf)x $A_f$  for Wall**

<b>Project:</b>	House Remodel (8244 SE 30th St, Mercer Island)	
<b>Client:</b>	Owner	<b>Job No.:</b> 2207
<b>By:</b>	S. Cho	<b>Date:</b> 8/5/23
<b>Subject:</b>	Design Calculations	<b>Page:</b>

## Calculate Wind Force (addition only)



Wind load = 31.56 psf  
 Tributary height @ roof (ft) = 9 ft  
 Tributary height @ 2nd Floor (ft) = 8 ft  
 Width (B) = 36.5 ft  
 Length (L) = 56 ft

**Wind force ( $W_{roof}$ ) = 284.0 plf**  
**Wind force at longitudinal direction = ( $W_{ROOF} \times B$ ) = 10367 lbs**  
**Wind force at transverse direction = ( $W_{ROOF} \times L$ ) = 15906 lbs**

**Seismic Force**  
 7685 (Longitudinal)  
 3277 (Transverse)

**Wind force ( $W_{2nd Fl.}$ ) = 252.5 plf**  
**Wind force at longitudinal direction = ( $W_{2ND FL} \times B$ ) = 9216 lbs**  
**Wind force at transverse direction = ( $W_{2ND FL} \times L$ ) = 14139 lbs**

**Seismic Force**  
 7685 (Longitudinal)  
 3277 (Transverse)

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**Allowable Shear Wall Capacity** (per SDPWS 2015 Table 4.3A)

% Assume Hem. Fir Stud Wall ( $G = 0.43$ )

% Assume 3/32" Wood Structural Panel - Structural I with 10D common nails

% Assume 12" o.c. on field fastener spacing

%Nominal unit shear capacities shall based on 15/32 of 10d per Table 4.3A & footnote-2 in 2015 SDPWS.

A) Seismic Force Panel Edge Fastener

at 6" o.c. =  $(680\#/2) [1-(0.5-0.43)] = 316$  plf (SW-1)

at 4" o.c. =  $(1020\#/2) [1-(0.5-0.43)] = 474$  plf (SW-2)

at 3" o.c. =  $(1330\#/2) [0.93] = 618$  plf (SW-3)

at 2" o.c. =  $(1740\#/2) [0.93] = 809$  plf (SW-4)

B) Wind Force Panel Edge Fastener

at 6" o.c. =  $(950\#/2) [1-(0.5-0.43)] = 442$  plf (SW-1)

at 4" o.c. =  $(1430\#/2) [1-(0.5-0.43)] = 665$  plf (SW-2)

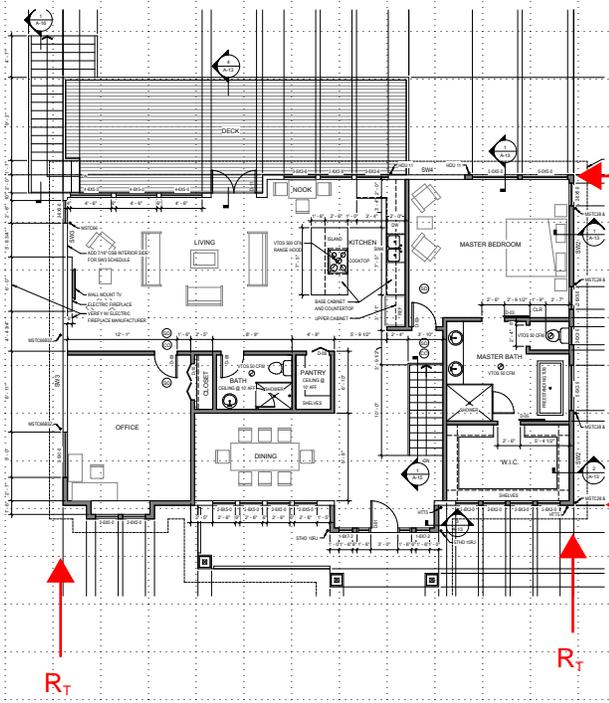
at 3" o.c. =  $(1860\#/2) [0.93] = 865$  plf (SW-3)

at 2" o.c. =  $(2435\#/2) [0.93] = 1132$  plf (SW-4)

Assumed the existing shear wall type is SW-1

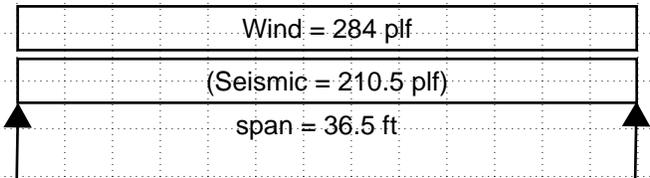
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## Shear Wall Design (Roof Level - Longitudinal Direction)



Seismic Story Force,  $F_x = 7,685$  lbs  
 Floor Area (BxL) =  $36.5' \times 56' = 2,044$  sf  
 Uniform Seismic Force,  $Z_r = (F_x / A_r) \times L = 210.5$  plf  
 Uniform Wind Force,  $W_r = 284$  plf

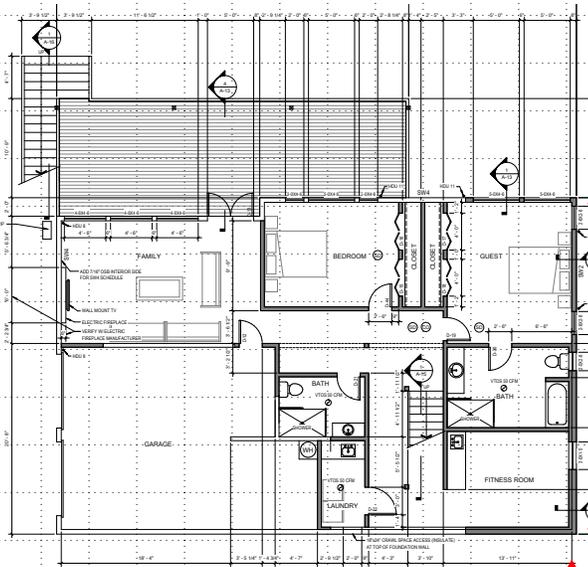
\* ( ) denote seismic force.



Roof Diaphragm Reaction, R (lbs) =	$R_L$ 5183 # (3842#)	$R_L$ 5183 # (3842#)
Shear Wall Length (ft) =	4.75'	9'
Unit Shear Force (plf) =	1091 plf (808 plf)	576 plf (427 plf)
Shear Wall Type =	SW-4	SW-2
Hold-down =	HDU14	MST60
	$1091 \text{ plf} \times 4.75' \times 9/4.25'$ = 10974 #	$576 \text{ plf} \times 9' \times 9/8.5'$ = 5489 #

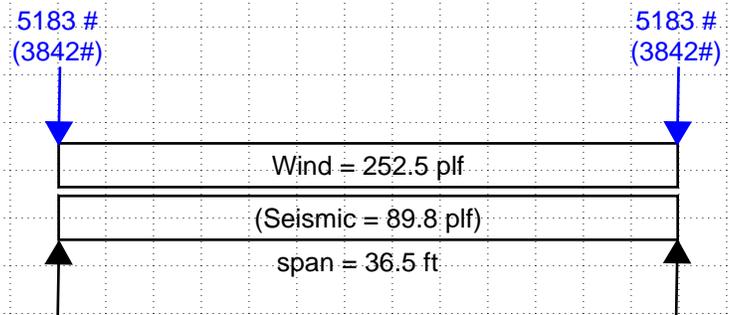
Project:	By:	Page:
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## Shear Wall Design (2nd Floor Level - Longitudinal Direction)



Seismic Story Force,  $F_x = 3,277$  lbs  
 Floor Area (BxL) =  $36.5' \times 56' = 2,044$  sf  
 Uniform Seismic Force,  $Z_s = (F_x / A_s) \times L = 89.8$  plf  
 Uniform Wind Force,  $W_s = 252.5$  plf

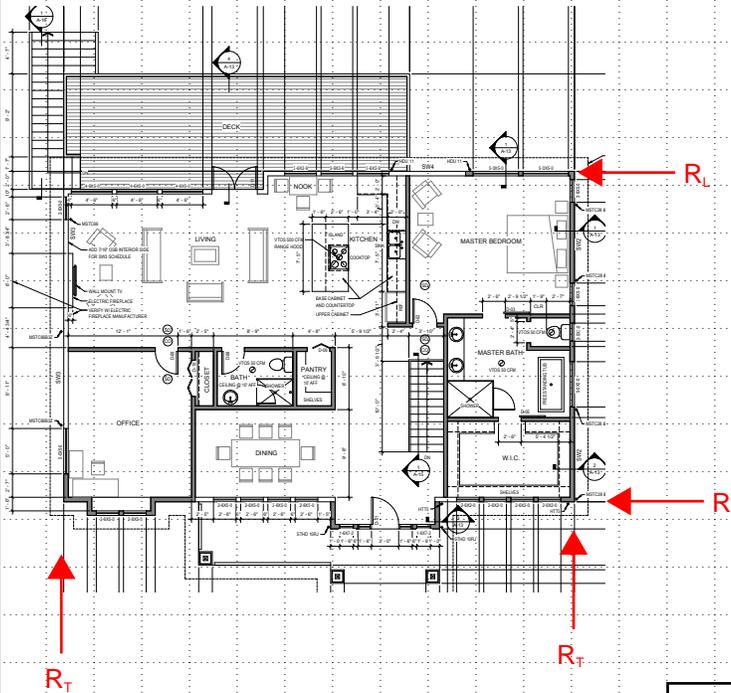
\* ( ) denote seismic force.



Roof Diaphragm Reaction, R (lbs) =	5183 + 4608 = 9791 # (3842 + 1639 = 5481 #)	5183 + 4608 = 9791 # (3842 + 1639 = 5481 #)
Shear Wall Length (ft) =	56' of Concrete Wall	10'
Unit Shear Force (plf) =	175 plf (98 plf)	979 plf (548 plf)
Shear Wall Type =	N/A	SW-4
Hold-down =	N/A	HDU11
		979 plf x 10' x 8'/9.5' = 8244 #

Project:	By:	Page:
Location:	Date:	
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## Shear Wall Design (Roof Level - Transverse Direction)



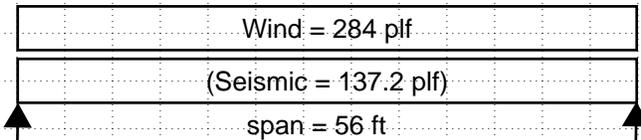
Seismic Story Force,  $F_x = 7,685$  lbs

Floor Area (BxL) =  $36.5' \times 56' = 2,044$  sf

Uniform Seismic Force,  $Z_r = (F_x / A_r) \times B = 137.2$  plf

Uniform Wind Force,  $W = 284$  plf

\* ( ) denote seismic force.



Roof Diaphragm Reaction, R (lbs) =

7952 #  
(3842#)

7952 #  
(3842#)

Shear Wall Length (ft) =

23'

10.5' + 8.5' = 19'

Unit Shear Force (plf) =

346 plf  
(167 plf)

419 plf  
(202 plf)

Shear Wall Type =

SW-2

SW-2

Hold-down =

MST 48

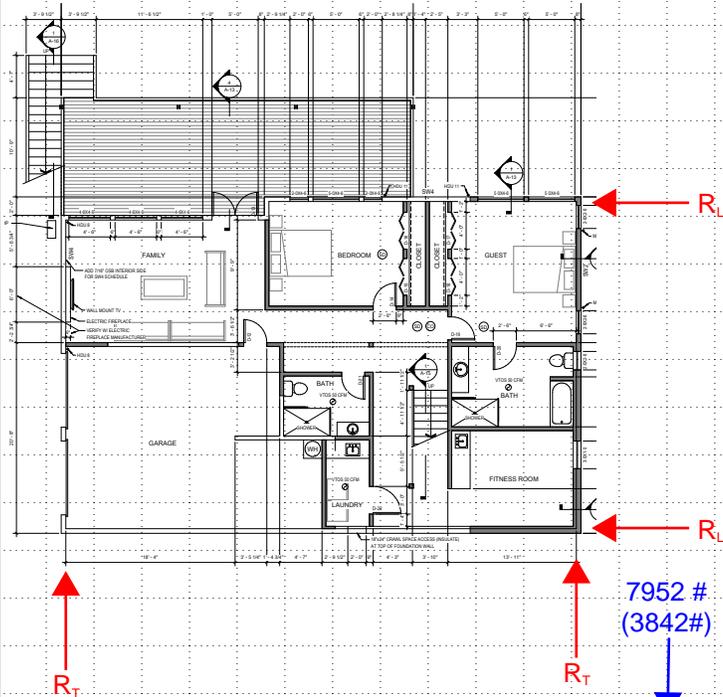
MST 48

$346 \text{ plf} \times 23' \times 9'/22.5'$   
= 3183 #

$419 \text{ plf} \times 8.5' \times 9'/8'$   
= 4007 #

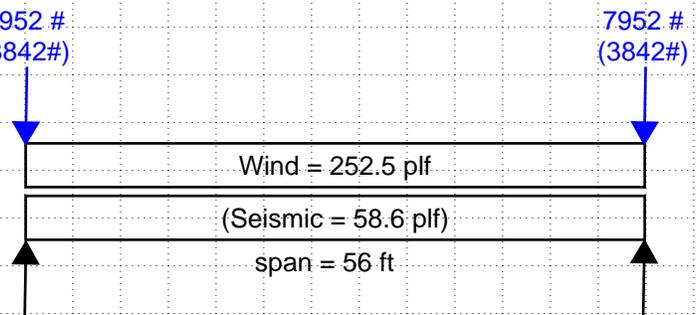
Project:	By:	Page:
Location:	Date:	
Client:	Check:	Job No:
Subject:	Date:	

## Shear Wall Design (2nd Floor Level - Transverse Direction)



Seismic Story Force,  $F_x = 3,277$  lbs  
 Floor Area (BxL) =  $36.5' \times 56' = 2,044$  sf  
 Uniform Seismic Force,  $Z_r = (F_x / A_r) \times B = 58.6$  plf  
 Uniform Wind Force,  $W_r = 252.5$  plf

\* ( ) denote seismic force.



Roof Diaphragm Reaction, R (lbs) =	$7952 + 7070 = 15022 \#$ $(3842 + 1641 = 5483 \#)$	$7952 + 7070 = 15022 \#$ $(3842 + 1641 = 5483 \#)$
Shear Wall Length (ft) =	15'	$7' + 7.5' + 8.5' = 23'$
Unit Shear Force (plf) =	1001 plf (366 plf)	653 plf (238 plf)
Shear Wall Type =	SW-4	SW-2
Hold-down =	HDU11	HDU8
	$1001 \text{ plf} \times 15' \times 8'/14.5'$ = 8288 #	$653 \text{ plf} \times 8' \times 8'/7.5'$ = 5572 #

# Appendix

# LTT/HTT

## Tension Ties

Holdowns and  
Tension Ties

Tension ties offer a solution for resisting tension loads that are fastened with nails or Strong-Drive® SD Connector screws. The new LTTP2 light tension tie, designed for wood joist attachments to concrete or masonry walls, features two separate nailing patterns: obround holes spaced 3" apart for I-joist purlins and square holes spaced to accommodate the narrow face of 2x solid-sawn purlins. LTTP2 may also be installed vertically on the wide face of a minimum 2x4 stud for holddown application. It features an extruded anchor bolt hole to accommodate 3/4", 5/8" and 1/2" bolt diameters.

The LTTI31 is designed for wood chord open-web truss attachments to concrete or masonry walls and may also be installed vertically on a minimum 2x6 stud.

The HTT4 and HTT5 tension ties feature an optimized nailing pattern which results in better performance with less deflection. HTT5KT is sold as a kit with the holddown, bearing plate washer and Strong-Drive SD Connector screws.

The HTT5-3/4 is designed to use a 3/4"-diameter anchor bolt.

When using LTT or HTT tension ties with unreinforced concrete masonry, 3/4" post-installed anchor bolts are commonly used.

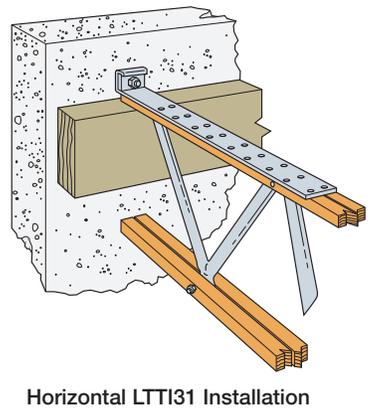
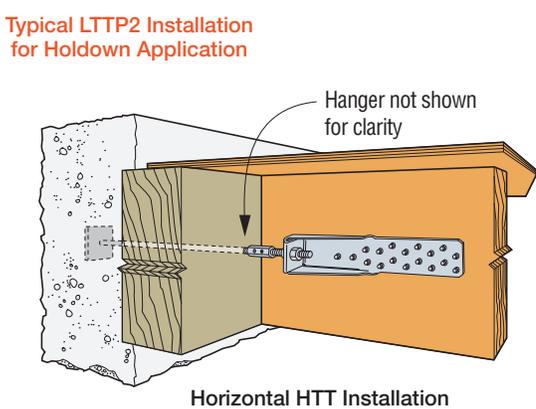
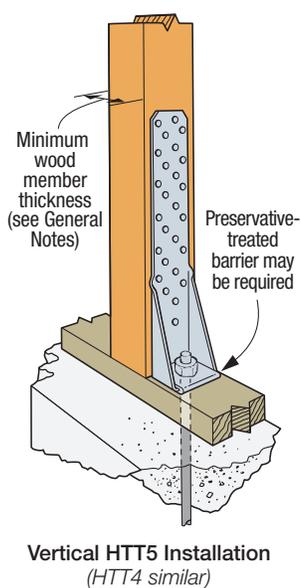
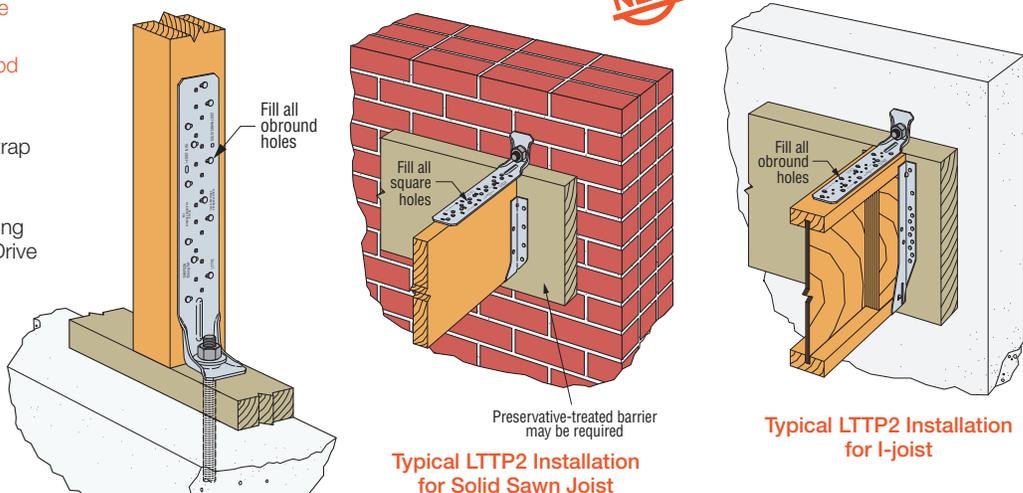
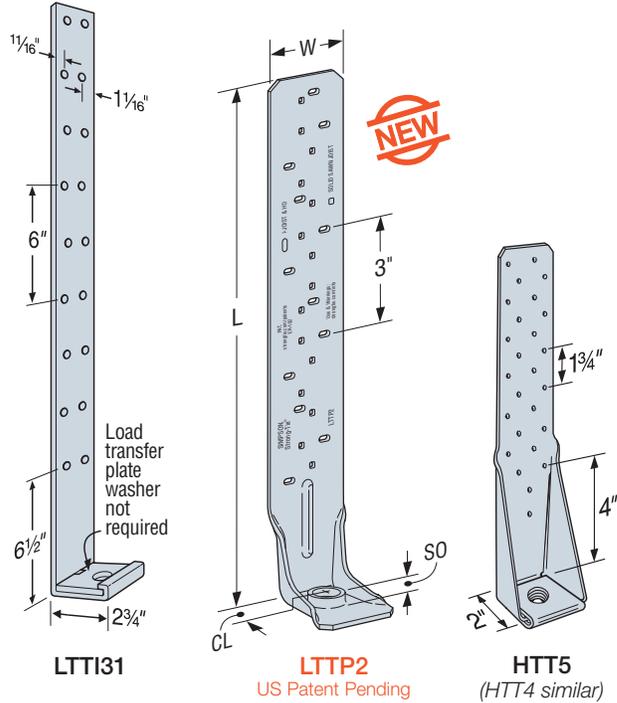
**Material:** See table

**Finish:** Galvanized. May be ordered HDG; contact Simpson Strong-Tie.

**Installation:**

- See Holddown and Tension Tie General Notes on pp. 49–50.
- LTTP2 — one standard cut-washer is required when using 1/2" and 5/8" anchor bolts; and no additional washer is required for 3/4" anchor bolts.
- LTTP2 — For installations on narrow edge of solid sawn (2x, 3x) joists use (15) square holes; for all other installations use (12) obround holes.
- For tension ties installed over wood structural panel sheathing, use a 2 1/2"-long fastener minimum.
- For information about marriage strap at panelized roof applications, see [strongtie.com](http://strongtie.com).
- HTT5-KT requires BP 5/8-2 bearing plate and #10 x 2 1/2" SD Strong-Drive screws (included in kit).

**Codes:** See p. 11 for Code Reference Key Chart



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# LTT/HTT

## Tension Ties (cont.)

These products are available with additional corrosion protection. For more information, see p. 14.

**SD** Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 348–352 for more information.

Model No.	Ga.	Dimensions (in.)			SO (in.)	Fasteners (in.)		Minimum Wood Member Size (in.)	Allowable Tension Loads (160)		Deflection at Highest Allowable Load (in.)	Code Ref.
		W	L	CL		Anchor Rod Diameter	Wood Fasteners		DF/SP	SPF/HF		
LTPP2	10	2 3/16	14 15/16	1 1/8	7/16	1/2, 5/8, 3/4	(15) 0.148 x 2 1/2	1 1/2 x 3 1/2 (narrow edge) <sup>4,5</sup>	1,845	1,695	0.104	IBC, FL, LA
						1/2	(12) 0.148 x 1 1/2	1 1/2 x 3 1/2	1,680 <sup>6</sup>	1,545 <sup>6</sup>	0.138	
						5/8, 3/4	(12) #9 x 1 1/2" SD	1 1/2 x 3 1/2	2,135	1,965	0.112	
						1/2			2,320	1,970	0.112	
						5/8, 3/4			2,570	2,045	0.136	
1/2, 5/8, 3/4	(12) 0.148 x 2 1/2	3 x 3 1/2	2,275	2,230	0.128							
LTTI31	18	3 3/4	31	1 3/8	1/4	5/8	(18) 0.148 x 1 1/2	3 x 3 1/2	1,350	1,160	0.193	
HTT4	11	2 1/2	12 3/8	1 5/16	7/16	5/8	(18) 0.148 x 1 1/2	1 1/2 x 3 1/2	3,000	2,580	0.090	—
							(18) 0.148 x 1 1/2	3 x 3 1/2	3,610	3,105	0.086	IBC, FL, LA
							(18) 0.162 x 2 1/2	3 x 3 1/2	4,235	3,640	0.123	—
							(18) #10 x 1 1/2" SD	1 1/2 x 5 1/2	4,455	3,830	0.112	—
							(18) #10 x 1 1/2" SD	3 x 3 1/2	4,455	3,830	0.112	—
HTT5	11	2 1/2	16	1 7/16	7/16	5/8	(26) 0.148 x 1 1/2	3 x 3 1/2	4,350	3,740	0.120	IBC, FL, LA
							(26) 0.148 x 3	3 x 3 1/2	4,670	4,015	0.116	
							(26) 0.162 x 2 1/2	3 x 3 1/2	5,090	4,375	0.135	
							(26) #10 x 1 1/2" SD	1 1/2 x 5 1/2	4,555	3,915	0.114	
HTT5KT	11	2 1/2	16	1 7/16	7/16	5/8	(26) #10 x 2 1/2" SD	3 x 3 1/2	5,445	5,360	0.103	—
HTT5-3/4	11	2 1/2	16	1 7/16	7/16	3/4	(26) 0.148 x 1 1/2	1 1/2 x 5 1/2	4,065	3,495	0.103	IBC, FL
							(26) 0.162 x 2 1/2	3 x 3 1/2	5,090	4,375	0.121	
							(26) #10 x 1 1/2" SD	1 1/2 x 7 1/4	4,830	4,155	0.100	

- LTTI31 installed flush with concrete or masonry has an allowable load of 2,285 lb.
- Allowable load for HTT5 with a BP5/8-2 bearing-plate washer installed in the seat of the holdown is 5,295 lb. for DF/SP and 4,555 lb. for SPF/HF.
- For LTPP2, standard cut washer is required when using 1/2" and 5/8" anchor rods.
- For (15) nail installations on narrow edge of 2x4 (minimum) joist, LTPP2 installed flush with concrete or masonry has an allowable load of 2,560 lb. for DF/SP and 2,355 lb. for SPF/HF.
- LTPP2 installed with (15) #9 x 1 1/2" SD screws on narrow edge of 2x joist has an allowable load of 2,105 lb. for DF/SP and 1,935 lb. for SPF/HF.
- For (12) nail installations on I-joist or wide face of 2x member, LTPP2 installed flush with concrete or masonry has an allowable load of 1,950 lb. for DF/SP and 1,795 lb. for SPF/HF.
- Fasteners:** Nail dimensions are listed diameter by length. SD screws are Simpson Strong-Tie® Strong-Drive SD Connector screws. See pp. 21–22 for fastener information.

Table 1 — Anchorage Selection Guide for Holdowns Attached to DF/SP Lumber

Holdown on DF/SP Lumber	Stemwall Width (in.)	Stemwall				Slab on Grade			
		Wind and Seismic Design Category A&B		Seismic Design Category C-F		Wind and Seismic Design Category A&B		Seismic Design Category C-F	
		Midwall/Corner	End Wall	Midwall/Corner	End Wall	Midwall/Corner	Garage Curb	Midwall/Corner	Garage Curb
HDU2	6	SSTB16		SSTB24		SSTB16		SSTB16	
HDU4	6	SB5/8X24		SB5/8X24		SSTB16	SB5/8X24	SSTB20	SB5/8X24
HDU5	6	SB5/8X24		SB5/8X24		SSTB20	SB5/8X24	SSTB24	SB5/8X24

Table 2 — Anchorage Selection Guide for Holdowns Attached to SPF/HF Lumber

Holdown on SPF/HF Lumber	Stemwall Width (in.)	Stemwall				Slab on Grade			
		Wind and Seismic Design Category A&B		Seismic Design Category C-F		Wind and Seismic Design Category A&B		Seismic Design Category C-F	
		Midwall/Corner	End Wall	Midwall/Corner	End Wall	Midwall/Corner	Garage Curb	Midwall/Corner	Garage Curb
HDU2	6	SSTB16		SSTB16		SSTB16		SSTB16	
HDU4	6	SSTB16		SSTB24		SSTB16		SSTB16	
HDU5	6	SSTB24* (4.295)		SB5/8X24		SSTB16	SSTB24* (4.295)	SSTB20	SB5/8X24
HDU8	8	SSTB28		SSTB28		SSTB28* (6.395)		SSTB28	
HD08	8	SSTB28		SSTB28		SSTB28* (6.395)		SSTB28	
HDU11	8	SB1X30* (9.505)	PAB8	PAB8	PAB8	SB1X30		SB1X30	
HHQ11	8	SB1X30	PAB8	PAB8	PAB8	SB1X30		SB1X30	
HDU14	—	PAB8		PAB8		SB1X30		SB1X30	
HDU12	—	PAB8		PAB8		SB1X30		SB1X30	
LTPP2	6	SSTB16		SSTB16		SSTB16		SSTB16	
LTTI31	6	SSTB16		SSTB16		SSTB16		SSTB16	
HTT4	6	SSTB20		SB5/8X24		SSTB16	SSTB20	SSTB16* (3.780)	SB5/8X24
HTT5	6	SB5/8X24		SB5/8X24		SSTB20	SB5/8X24	SSTB24	SB5/8X24

We've made selecting the right anchor bolt for the holdown easier. Check out our Holdown Anchorage Solutions table on p. 44 or the Post-to-Foundation Designer at [app.strongtie.com/pfd](http://app.strongtie.com/pfd).

# HDU/DTT

## Holdowns



This product is preferable to similar connectors because of (a) easier installation, (b) higher loads, (c) lower installed cost, or a combination of these features.

HDU holdowns are pre-deflected during the manufacturing process, virtually eliminating deflection under load due to material stretch. They use Strong-Drive® SDS Heavy-Duty Connector screws which install easily, reduce fastener slip and provide a greater net section when compared to bolts.

The DTT tension ties are designed for lighter-duty holddown applications on single 2x posts. The DTT1Z is installed with nails or Strong-Drive SD Connector screws and the DTT2 installs easily with the Strong-Drive SDS Heavy-Duty Connector screws (included). The DTT1Z holdowns have been tested for use in designed shearwalls and prescriptive braced wall panels as well as prescriptive wood-deck applications (see p. 295 for deck applications).

For more information on holddown options, contact Simpson Strong-Tie.

### HDU Features:

- Uses Strong-Drive SDS Heavy-Duty Connector screws which install easily, reduce fastener slip and provide a greater net section area of the post compared to bolts
- Strong-Drive SDS Heavy-Duty Connector screws are supplied with the holdowns to ensure proper fasteners are used
- No stud bolts to countersink at openings

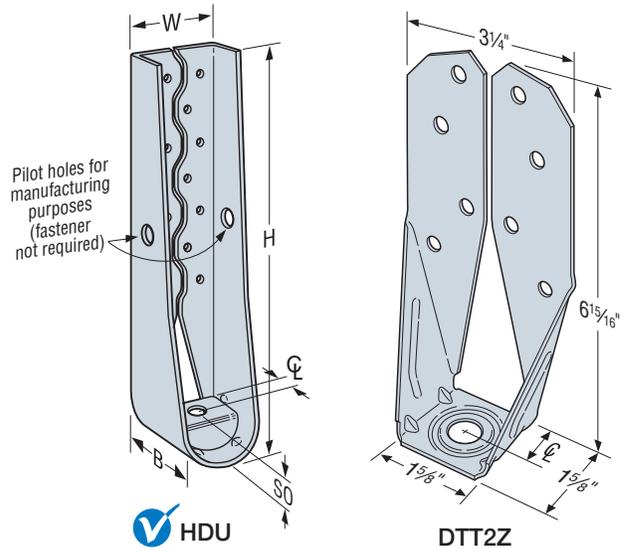
**Material:** See table

**Finish:** HDU — galvanized; DTT1Z and DTT2Z — ZMAX® coating; DTT2SS — stainless steel

### Installation:

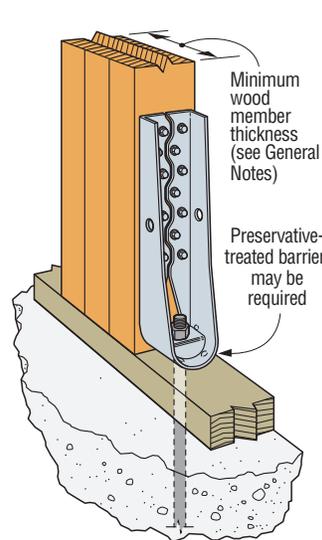
- See Holdown and Tension Tie General Notes on pp. 49–50.
- The HDU requires no additional washer; the DTT requires a standard-cut washer (included) be installed between the nut and the seat.
- Strong-Drive SDS Heavy-Duty Connector screws install best with a low-speed high-torque drill with a 3/8" hex-head driver.
- Fasteners and crescent washer are included with the holdowns. For replacements, order part no. SDS25212-HDU\_ (Fill in the size needed, e.g., HDU2.)

**Codes:** See p. 11 for Code Reference Key Chart

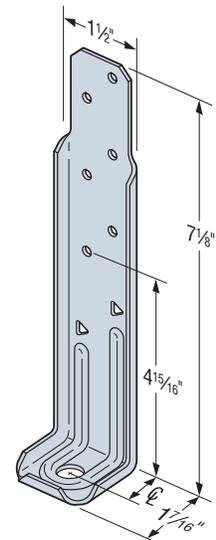


**HDU**

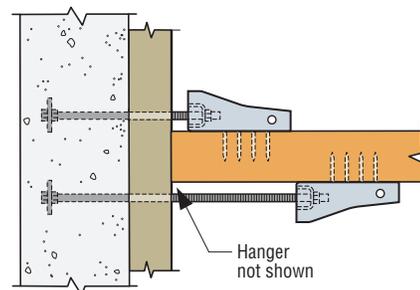
**DTT2Z**  
US Patent  
8,555,580



**Vertical HDU Installation**



**DTT1Z**  
US Patent  
10,865,558



**Horizontal HDU Offset Installation**  
(plan view)

See Holdown and Tension Tie General Notes.

# HDU/DTT

## Holdowns (cont.)

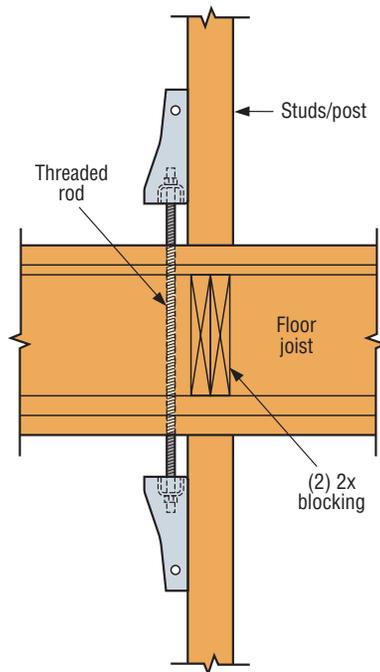
These products are available with additional corrosion protection. For more information, see p. 14.

**SS** For stainless-steel fasteners, see p. 21.

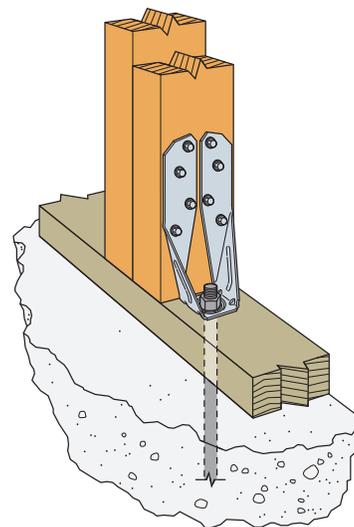
**SD** Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 348–352 for more information.

Model No.	Ga.	Dimensions (in.)					Fasteners (in.)		Minimum Wood Member Size (in.)	Allowable Tension Loads (160)			Code Ref.
		W	H	B	CL	SO	Anchor Bolt Dia. (in.)	Wood Fasteners		DF/SP	SPF/HF	Deflection at Allowable Load (in.)	
DTT1Z	14	1 ½	7 ⅞	1 ⅞	¾	¾	¾	(6) #9 x 1 ½" SD	1 ½ x 5 ½	840	840	0.17	IBC, FL, LA
								(6) 0.148 x 1 ½		910	640	0.167	
								(8) 0.148 x 1 ½		910	850	0.167	
DTT2Z	14	3 ¼	6 ⅝	1 ⅝	¾	¾	½	(8) ¼ x 1 ½ SDS	1 ½ x 3 ½	1,825	1,800	0.105	
								(8) ¼ x 1 ½ SDS	3 x 3 ½	2,145	1,835	0.128	
DTT2Z-SDS2.5								(8) ¼ x 2 ½ SDS	3 x 3 ½	2,145	2,105	0.128	
HDU2-SDS2.5	14	3	8 ⅞	3 ¼	1 ⅝	1 ⅝	¾	(6) ¼ x 2 ½ SDS	3 x 3 ½	3,075	2,215	0.088	
HDU4-SDS2.5	14	3	10 ⅝	3 ¼	1 ⅝	1 ⅝	¾	(10) ¼ x 2 ½ SDS	3 x 3 ½	4,565	3,285	0.114	
HDU5-SDS2.5	14	3	13 ⅞	3 ¼	1 ⅝	1 ⅝	¾	(14) ¼ x 2 ½ SDS	3 x 3 ½	5,645	4,340	0.115	
HDU8-SDS2.5	10	3	16 ⅝	3 ½	1 ⅝	1 ½	7 ⅞	(20) ¼ x 2 ½ SDS	3 x 3 ½	6,765	5,820	0.11	
									3 ½ x 3 ½	6,970	5,995	0.116	
									3 ½ x 4 ½	7,870	6,580	0.113	
HDU11-SDS2.5	10	3	22 ¼	3 ½	1 ⅝	1 ½	1	(30) ¼ x 2 ½ SDS	3 ½ x 5 ½	9,535	8,030	0.137	
									3 ½ x 7 ¼	11,175	9,610	0.137	
HDU14-SDS2.5	7	3	25 ⅞	3 ½	1 ⅝	1 ⅝	1	(36) ¼ x 2 ½ SDS	3 ½ x 5 ½	10,770	9,260	0.122	
									3 ½ x 7 ¼	14,390	12,375	0.177	
									5 ½ x 5 ½	14,445	12,425	0.172	

1. HDU14 requires heavy-hex anchor nut to achieve tabulated loads (supplied with holddown).
2. HDU14 loads on 4x6 post are applicable to installation on either the narrow or the wide face of the post.
3. **Fasteners:** Nail dimensions are listed diameter by length. SD and SDS screws are Simpson Strong-Tie® Strong-Drive SD Connector and SDS Heavy-Duty Connector screws. See pp. 21–22 for fastener information.



Typical HDU Tie Between Floors



Typical DTT2Z Installation

# MSTC48B3/MSTC66B3Z

## Pre-Bent Straps

The MSTC48B3 and MSTC66B3Z are pre-bent straps designed to transfer tension load from an upper-story shearwall to a beam on the story below.

**Material:** 14 gauge

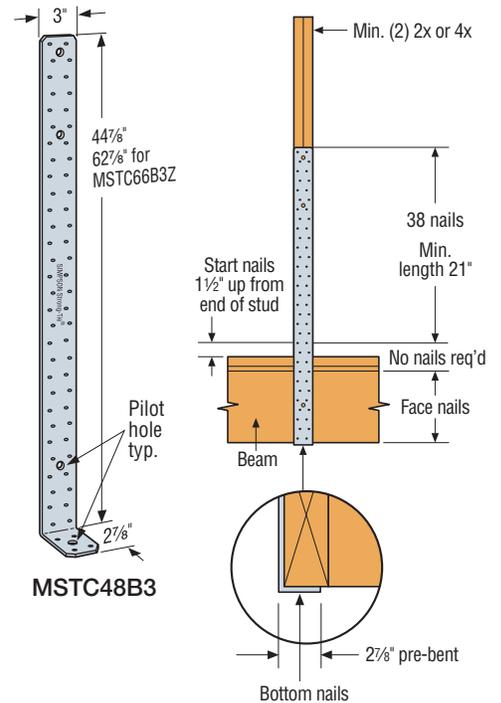
**Finish:** Galvanized. Some products available in ZMAX® coating; see Corrosion Information, pp. 12–15.

**Codes:** See p. 11 for Code Reference Key Chart

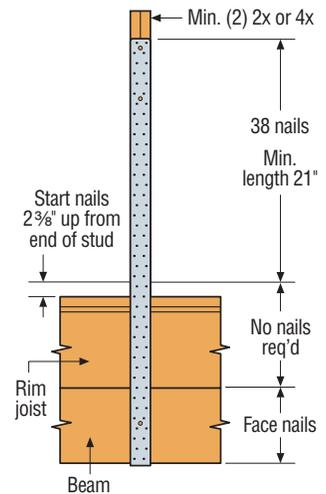
These products are available with additional corrosion protection. For more information, see p. 14.

Model No.	Min. Wood Beam Dimension (in.)		Fasteners (in.)			Allowable Tension Loads		Code Ref.
	Width (min.)	Depth (min.)	Beam		Studs/ Post	DF/SP	SPF/HF	
			Face	Bottom		(160)	(160)	
MSTC48B3	3	9¼	(12) 0.148 x 3	(4) 0.148 x 3	(38) 0.148 x 3	3,975	3,900	IBC, FL, LA
MSTC66B3Z	3½	11¼	(14) 0.148 x 3			4,490	4,490	

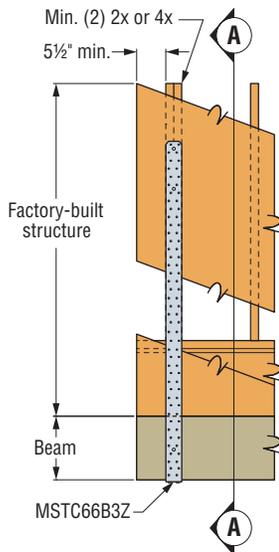
- Using fewer than 38 nails in the studs/post will reduce the allowable load of the connection. To calculate a reduced allowable load, use 199 lb. per nail for DF/SP or 172 lb. per nail for HF/SPF. Minimum length of extent of reduced nails may not be less than 21" as is shown in graphic.
- Nails in studs/post shall be installed symmetrically. Nails may be installed over the entire length of the strap in the studs/post.
- The minimum 3"-wide beam may be made up of two 2x members.
- MSTC48B3 and MSTC66B3Z installed over wood structural panel sheathing up to ½" thick achieve 0.85 of table loads.
- PSL beam may be used in lieu of a standard-dimension lumber beam with no load reductions.
- Multiply allowable loads by 1.85 to attain an allowable load for installations where two straps have been installed with a 1½" clear space between straps.
- Structural composite lumber columns have sides that show either the wide face or the edges of the lumber strands/veneers known as the narrow face. Values in the tables reflect installation into the wide face. See technical bulletin T-C-SCLCLM at [strongtie.com](http://strongtie.com) for load reductions resulting from narrow-face installations.
- Fasteners:** Nail dimensions are listed diameter by length. See pp. 21–22 for fastener information.



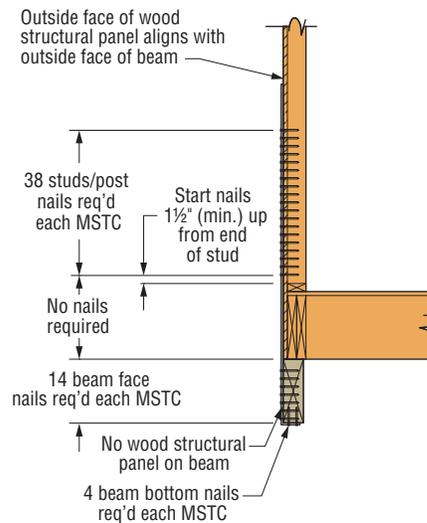
**MSTC48B3 Installation with No Rim Board**



**MSTC66B3Z Installation with Rim Board**



**MSTC66B3Z Installation**



**Section A-A**

# MST/MSTA/MSTC

## Strap Ties (cont.)

**Codes:** See p. 11 for Code Reference Key Chart

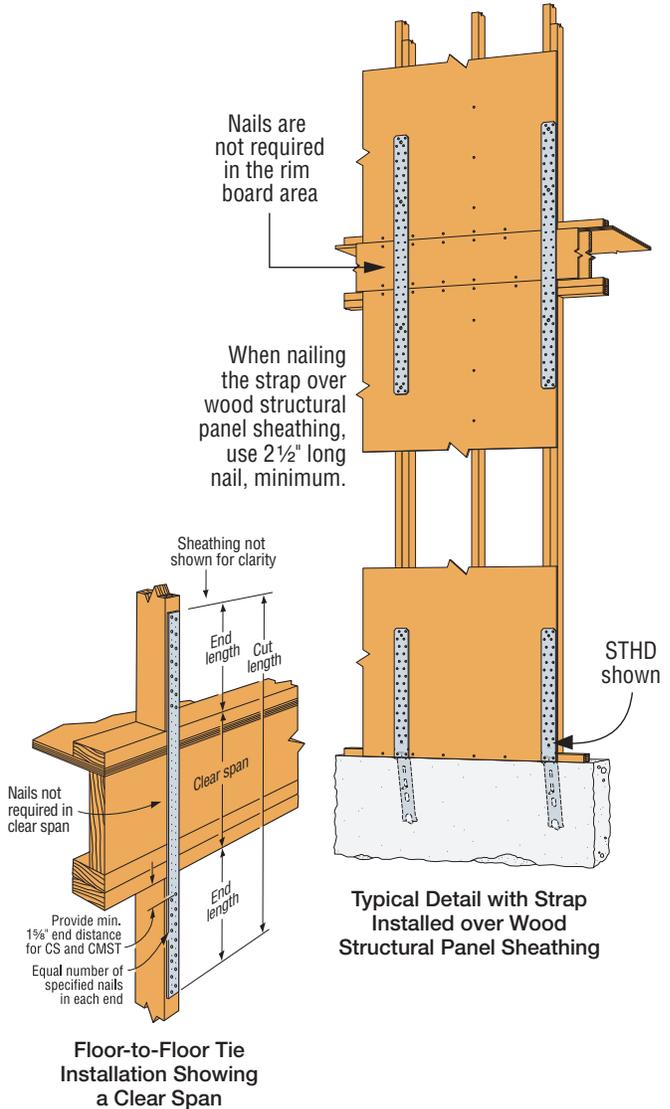
These products are available with additional corrosion protection. For more information, see p. 14.

**SD** Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 348–352 for more information.

### Floor to Floor Span Table

Model No.	Clear Span (in.)	Fasteners (Total) (in.)	Allowable Tension Loads (DF/SP)	Allowable Tension Loads (SPF/HF)
			(160)	(160)
MSTA49	18	(26) 0.148 x 2½	2,020	2,020
	16	(26) 0.148 x 2½	2,020	2,020
MSTC28	18	(12) 0.148 x ¾	1,150	995
	16	(16) 0.148 x ¾	1,535	1,330
MSTC40	24	(20) 0.148 x ¾	1,920	1,660
	18	(28) 0.148 x ¾	2,690	2,325
	16	(32) 0.148 x ¾	3,070	2,655
MSTC52	24	(36) 0.148 x ¾	3,455	2,990
	18	(44) 0.148 x ¾	4,225	3,650
	16	(48) 0.148 x ¾	4,610	3,985
MSTC66	30	(48) 0.148 x ¾	4,775	4,130
	24	(54) 0.148 x ¾	5,375	4,645
	18	(64) 0.148 x ¾	5,850	5,505
	16	(68) 0.148 x ¾	5,850	5,850
MSTC78	30	(64) 0.148 x ¾	5,850	5,505
	24	(72) 0.148 x ¾	5,850	5,850
	18	(76) 0.148 x ¾	5,850	5,850
MST37	24	(14) 0.162 x 2½	1,720	1,500
	18	(20) 0.162 x 2½	2,460	2,140
	16	(22) 0.162 x 2½	2,705	2,355
MST48	24	(26) 0.162 x 2½	3,210	2,780
	18	(32) 0.162 x 2½	3,950	3,425
	16	(34) 0.162 x 2½	4,200	3,640
MST60	30	(34) 0.162 x 2½	4,605	3,995
	24	(40) 0.162 x 2½	5,240	4,700
	18	(46) 0.162 x 2½	6,235	5,405
MST72	30	(48) 0.162 x 2½	6,505	5,640
	24	(54) 0.162 x 2½	6,730	6,345
	18	(62) 0.162 x 2½	6,730	6,475

See footnotes below.



Straps and Ties

Model No.	Ga.	Dimensions (in.)		Fasteners (Total)			Allowable Tension Loads (DF/SP)		Allowable Tension Loads (SPF/HF)		Code Ref.
		W	L	Nails (in.)	Bolts		Nails (160)	Bolts (160)	Nails (160)	Bolts (160)	
					Qty.	Dia.					
MST27	12	2¼	27	(30) 0.162 x 2½	4	½	3,700	2,165	3,210	2,000	IBC, FL, LA
MST37		2¼	37½	(42) 0.162 x 2½	6	½	5,070	3,030	4,495	2,800	
MST48		2¼	48	(50) 0.162 x 2½	8	½	5,310	3,675	5,190	3,395	
MST60	10	2¼	60	(68) 0.162 x 2½	10	½	6,730	4,490	6,475	4,150	
MST72		2¼	72	(68) 0.162 x 2½	10	½	6,730	4,490	6,475	4,150	

- See pp. 266–267 for Straps and Ties General Notes.
- Install bolts or nails as specified by designer. Bolt and nail values may not be combined.
- Allowable bolt loads are based on parallel-to-grain loading and minimum member thickness: MST – 2½".
- Splitting may be a problem with installations on lumber smaller than 3½"; either fill every nail hole with 0.148" x 1½" nails or fill every other hole with 0.162" x 2½" nails. Reduce the allowable load based on the size and quantity of fasteners used.
- Fasteners:** Nail dimensions are listed diameter by length. See pp. 21–22 for fastener information.