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CS2 ENGINEERS
Civil & Structural Challenge & Success

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Structural Calculations

For

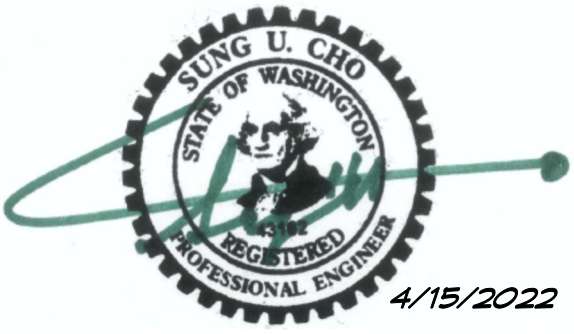
Park Residence

Single Family House Addition / Remodel

8244 SE 30th Street
Mercer Island, WA 98040
(Parcel # 545230-0816)

CS2 ENGINEERS
Civil & Structural Challenge & Success

Prepared By: Sung U. Cho, P.E.
Prepared Date: March 28, 2022
CS2 No.: 2207



I. Scope of Work

Provide structural design calculations of remodel construction of existing single-family residential house. The house is located on 8244 SE 30th 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, fy = 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

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

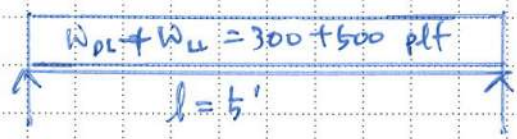
HDR

- MAIN FLOOR HEADER (TYPICAL)

(6X8 DF #2)

$W_{DL} = (15\ psf)(40'/2) = 300\ plf$

$W_{SL} = (25\ psf)(40'/2) = 500\ plf$



$P_{DL} = 804\#$ $P_{SL} = 1312\#$ $P_{DL} = 804\#$ $P_{LL} = 1312\#$

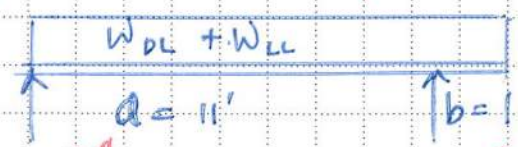
DJ 1a

DECK JOIST @ MAIN FLOOR & BASEMENT

(P.T. 2X10 DF #2)

$W_{DL} = (10\ psf)(16''/12) = 13.33\ plf$

$W_{LL} = (60\ psf)(16''/12) = 80\ plf$



$R_{DL} = 75\#$ $R_{LL} = 452\#$ $R_{DL} = 85\#$ $R_{LL} = 512\#$

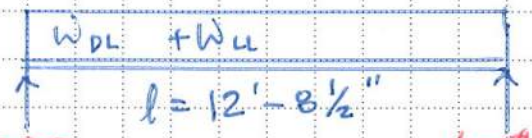
DB 1a

DECK BEAM @ MAIN FLOOR

(P.T. 6X10 DF #2)

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

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



$R_{DL} = 507$ $R_{LL} = 2528\#$ $507\#$ $2528\#$

22'

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

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

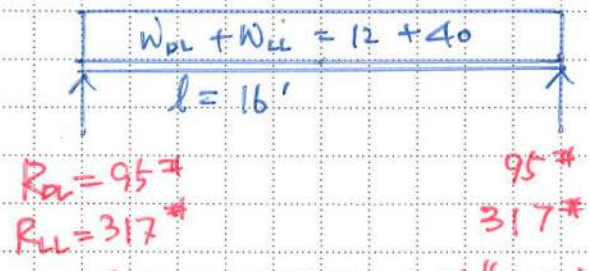
$P_{DL} = 461\#$ $P_{LL} = 2636\#$ $1234\#$ $6701\#$ $995\#$ $5411\#$ $353\#$ $1976\#$

FJ 1a

FLOOR JOIST @ MAIN FLOOR

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

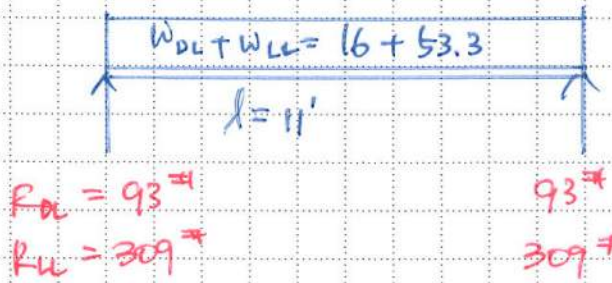
(2x10 DF #2 @ 12" O.C.)



FJ 1b

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

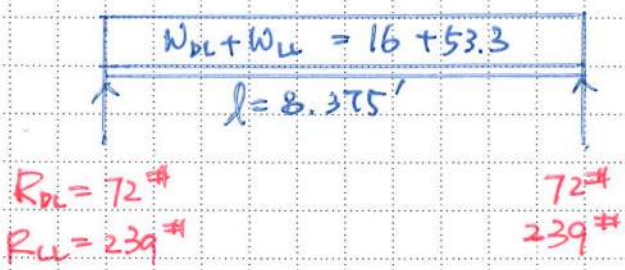
(2x10 DF #2 @ 16" O.C.)



FJ 1c

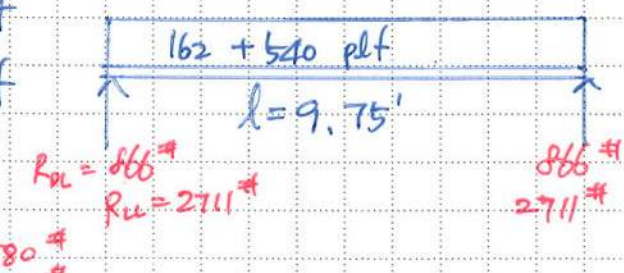
$W_{DL} = 16\ plf$
$W_{LL} = 53.3\ plf$

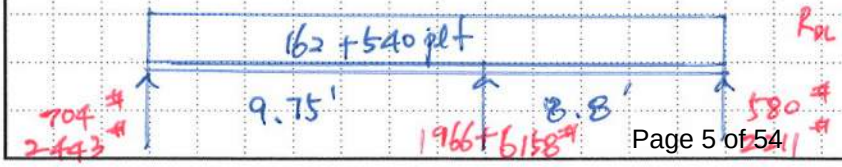
(2x10 DF #2 @ 16" O.C.)



FB1a (INTERIOR BEAM)

$W_{DL} = (12\ psf)(16'/2 + 11'/2) = 162\ plf$
$W_{LL} = (40\ psf)(16'/2 + 11'/2) = 540\ plf$





FOOTING DESIGN (SEE COMPUTER DESIGN OUTCOME)

- SLAB-ON-GRADE

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

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

- WALL FOOTING.

ROOF $W_{DL} = (15\ psf)(40'/2) = 300\ plf$
ROOF $W_{LL} = (25\ psf)(40'/2) = 500\ plf$

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

FLOOR $W_{DL} = (95^{\#})(12"/16") = 71.25\ plf$
$W_{LL} = (317^{\#})(12"/16") = 237.75\ plf$

$W_{TL} = W_{DL} + W_{LL} + W_{SL}$
$= (300 + 160 + 71.25) + (237.75\ plf) + (500\ plf)$
$= (531.25\ plf)_{DL} + (237.75\ plf)_{LL} + (500\ plf)_{SL}$

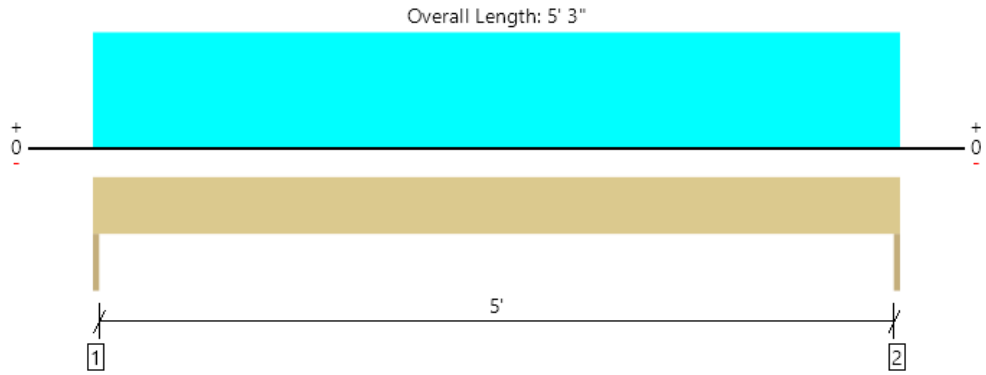
- DECK FOOTING

F3.5 $P_{DL} + P_{LL} = (1234^{\#} \times 2) + (6701^{\#} \times 2) = 2468^{\#}_{DL} + 13402^{\#}_{LL}$ ✓

F2.0 $P_{DL} + P_{LL} = (461^{\#} \times 2) + (2636^{\#} \times 2) = 922^{\#}_{DL} + 5272^{\#}_{LL}$ ✓

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	

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.

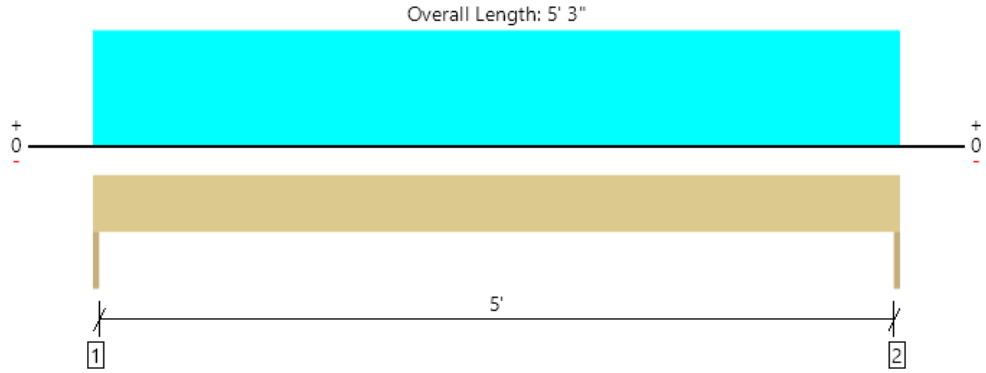
Lateral Connections						
Supports	Plate Size	Plate Material	Connector	Type/Model	Quantity	Nailing
Left	2X	Hem Fir	Nails	10d x 3" Box (End)	3	
Right	2X	Hem Fir	Nails	10d x 3" Box (End)	3	

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.

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.

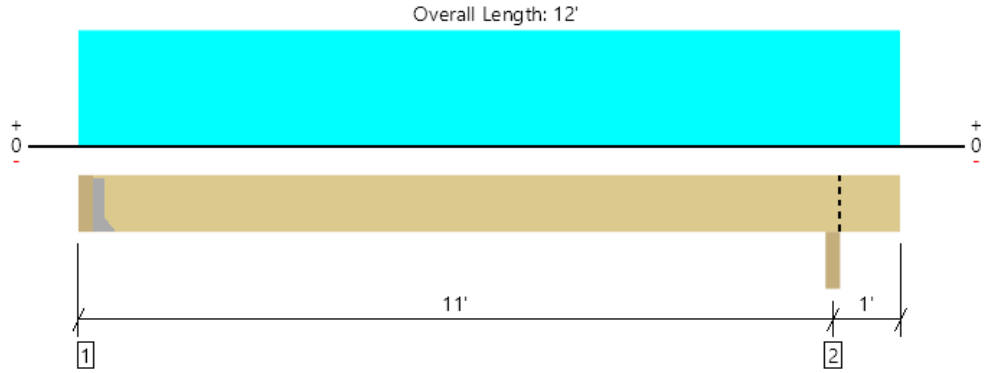
Lateral Connections						
Supports	Plate Size	Plate Material	Connector	Type/Model	Quantity	Nailing
Left	2X	Hem Fir	Nails	8d x 2.5" Box (Toe)	3	
Right	2X	Hem Fir	Nails	8d x 2.5" Box (Toe)	3	

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.

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[1]	1.50"	75	452	527	See note [1]
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
- [1] 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.

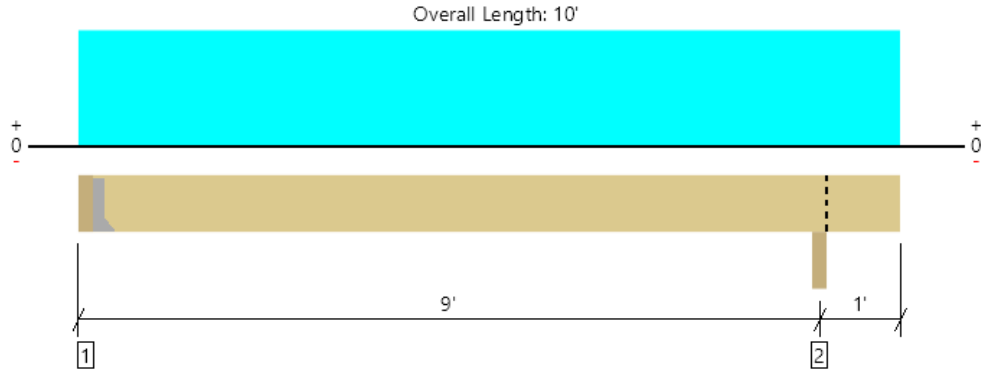
Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

- 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)

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[1]	1.50"	61	372	433	See note [1]
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
- [1] 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.

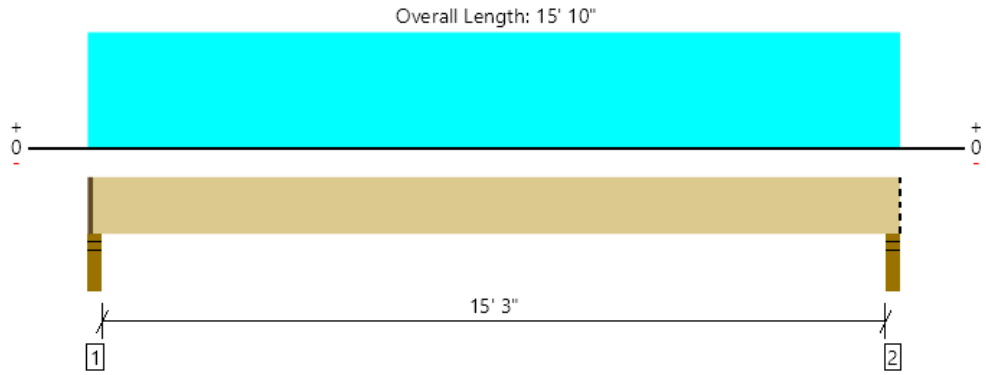
Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

- 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)

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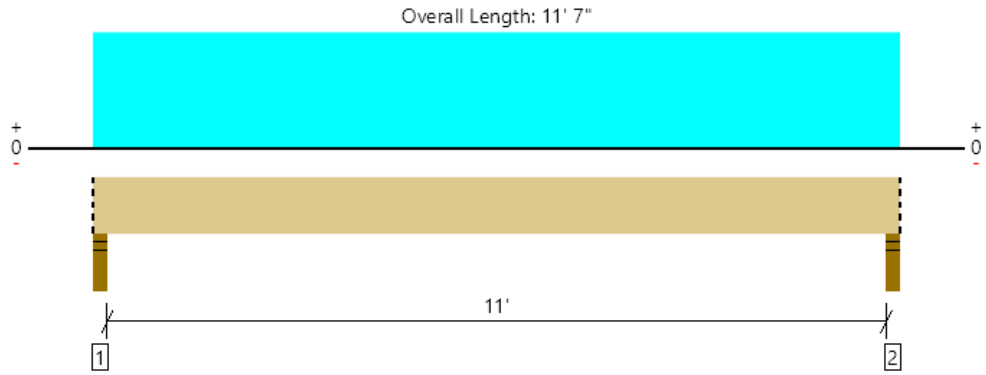
The product application, input design loads, dimensions and support information have been provided by S. Cho

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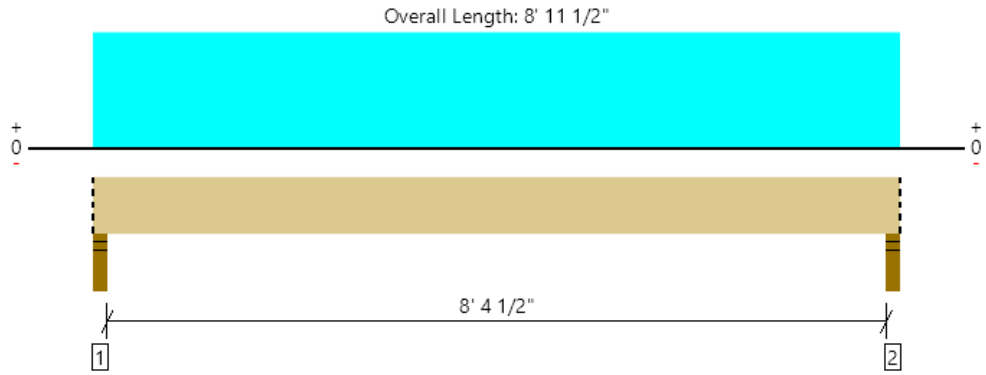
The product application, input design loads, dimensions and support information have been provided by S. Cho

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)

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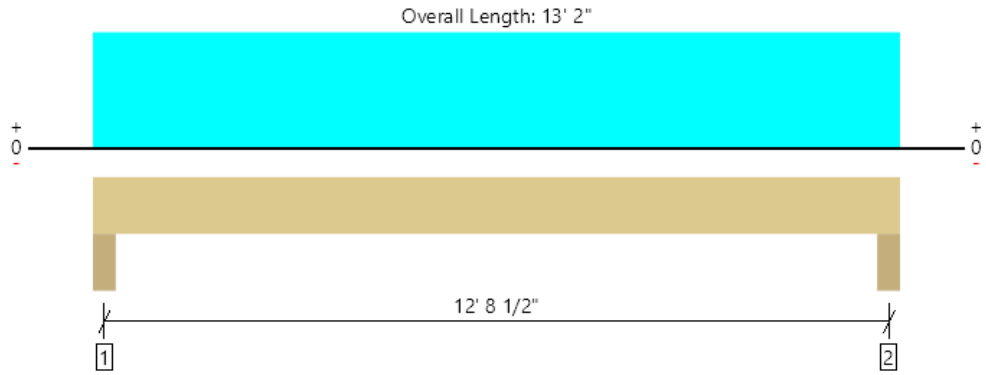
The product application, input design loads, dimensions and support information have been provided by S. Cho

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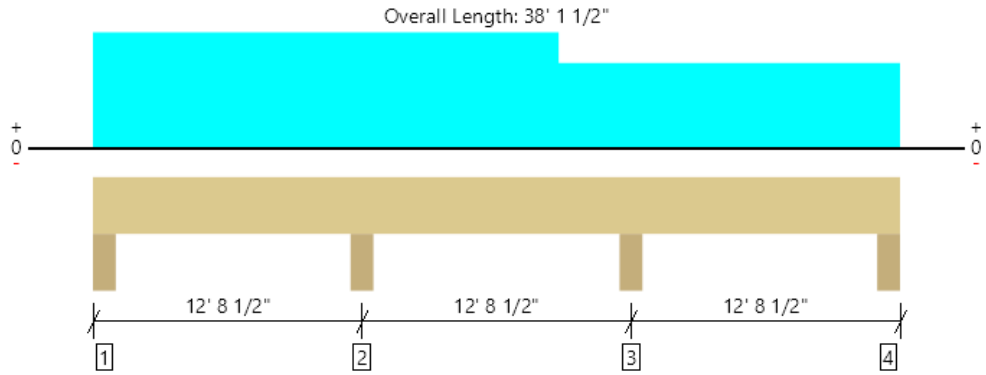
The product application, input design loads, dimensions and support information have been provided by S. Cho

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)

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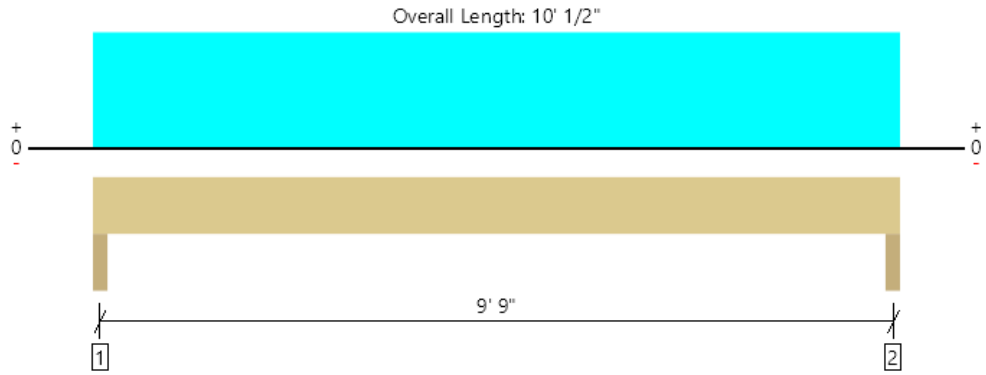
The product application, input design loads, dimensions and support information have been provided by S. Cho

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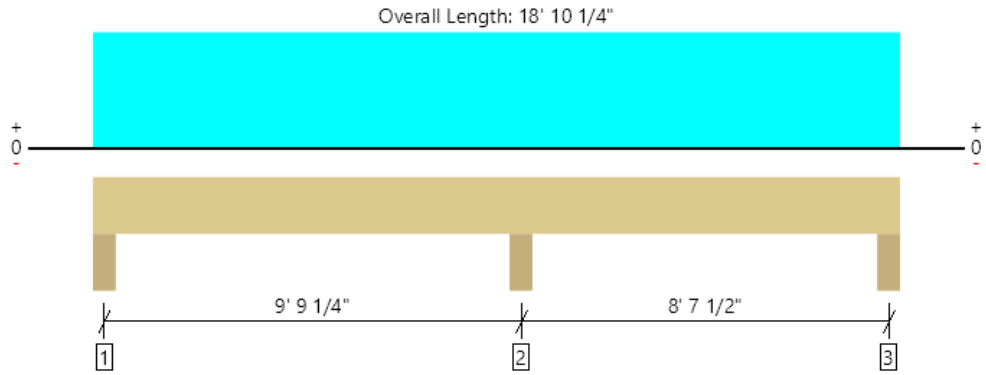
The product application, input design loads, dimensions and support information have been provided by S. Cho

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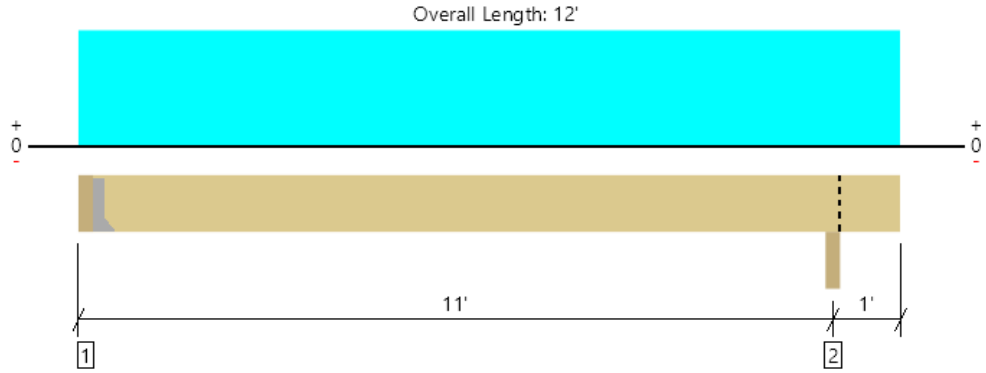
The product application, input design loads, dimensions and support information have been provided by S. Cho

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[1]	1.50"	75	452	527	See note [1]
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
- [1] 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.

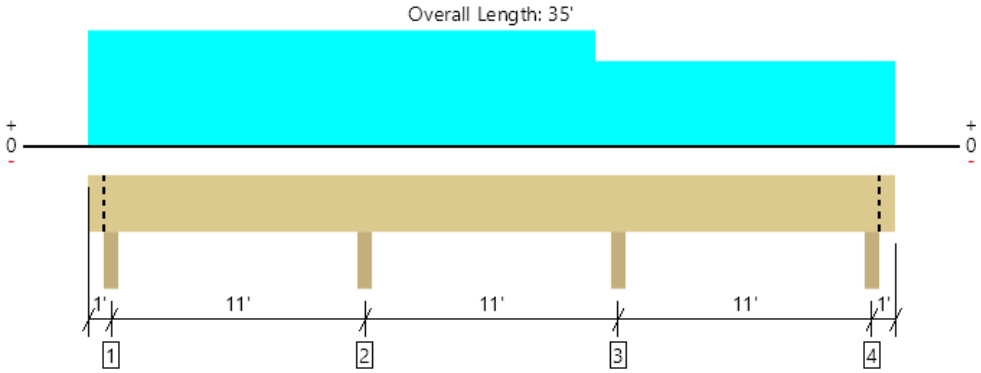
Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LU28	1.50"	N/A	8-10dx1.5	6-10dx1.5	

- 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

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)

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

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Project Title:
Engineer:
Project ID:
Project Descr:

Wall Footing

Project File: 2207 Mercer Island Park Residence Remodel.ec6

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	=	1.50 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	=	ksf
when base footing is below	=	ft

Increases based on footing Width

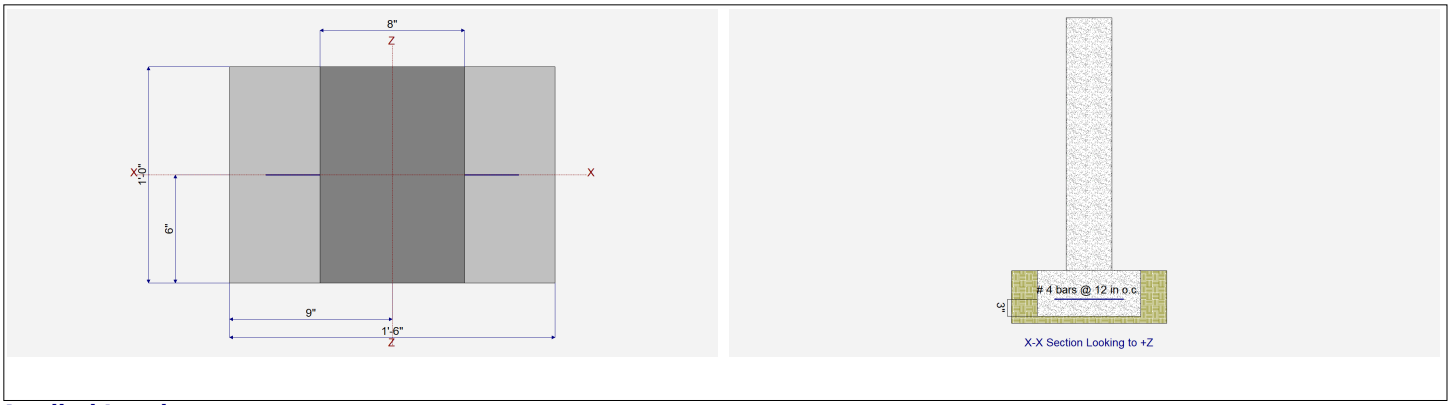
Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

Adjusted Allowable Bearing Pressure = 1.50 ksf

Dimensions

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...			Bar spacing	= 12.00
Wall center offset from center of footing	=	0 in	at Bottom of footing	=	3.0 in	Reinforcing Bar Size	= # 4

Reinforcing



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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Project Title:
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Project ID:
Project Descr:

Wall Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Typical Wall Footing

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.5465	Soil Bearing	0.8198 ksf	1.50 ksf	+D+0.750L+0.750S
PASS	0.02335	Z Flexure (+X)	0.1001 k-ft	4.288 k-ft	+1.20D+0.50L+1.60S
PASS	0.008214	Z Flexure (-X)	0.03522 k-ft	4.288 k-ft	+0.90D
PASS	n/a	1-way Shear (+X)	0.0 psi	75.0 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
, D Only	1.50 ksf	0.0 in	0.4509 ksf	0.4509 ksf	0.301
, +D+L	1.50 ksf	0.0 in	0.6094 ksf	0.6094 ksf	0.406
, +D+S	1.50 ksf	0.0 in	0.7842 ksf	0.7842 ksf	0.523
, +D+0.750L	1.50 ksf	0.0 in	0.5698 ksf	0.5698 ksf	0.380
, +D+0.750L+0.750S	1.50 ksf	0.0 in	0.8198 ksf	0.8198 ksf	0.547
, +0.60D	1.50 ksf	0.0 in	0.2705 ksf	0.2705 ksf	0.180

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding Safety Ratio	Status
Footing Has NO Sliding				

Footing Flexure

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
, +1.40D	0.05479	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.40D	0.05479	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L	0.06898	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L	0.06898	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L+0.50S	0.08345	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L+0.50S	0.08345	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L	0.05384	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L	0.05384	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D	0.04696	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D	0.04696	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L+1.60S	0.1001	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L+1.60S	0.1001	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60S	0.09326	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60S	0.09326	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L+0.50S	0.06831	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L+0.50S	0.06831	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L+0.70S	0.0741	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+0.50L+0.70S	0.0741	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +0.90D	0.03522	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +0.90D	0.03522	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK

One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0 psi	0 psi	0 psi	75 psi	0	OK
+1.20D+1.60L	0 psi	0 psi	0 psi	75 psi	0	OK
+1.20D+1.60L+0.50S	0 psi	0 psi	0 psi	75 psi	0	OK

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Project Title:
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Project ID:
Project Descr:

Wall Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

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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General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Deck footing (F3.5)

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
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

Soil Design Values

Allowable Soil Bearing	=	1.50	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	

Increases based on footing Depth

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

Increases based on footing plan dimension

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

Dimensions

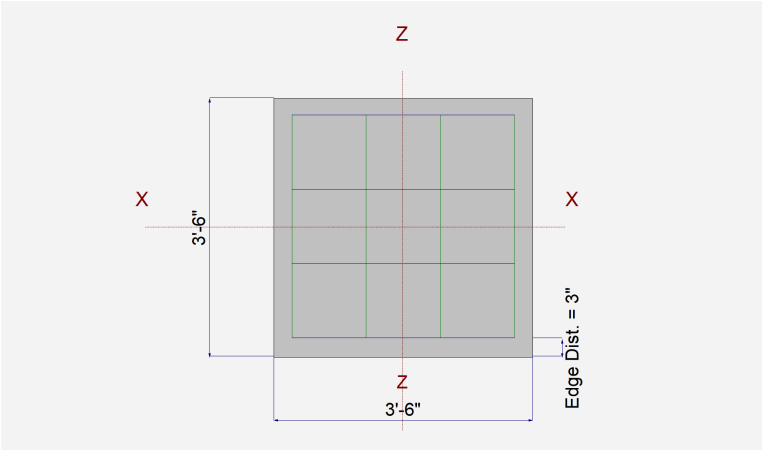
Width parallel to X-X Axis	=	3.50	ft
Length parallel to Z-Z Axis	=	3.50	ft
Footing Thickness	=	10.0	in

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

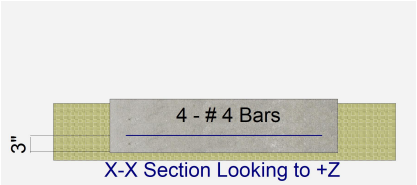


Reinforcing

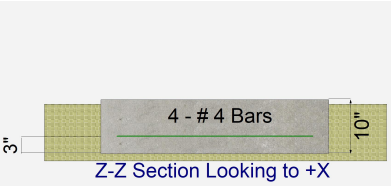
Bars parallel to X-X Axis			
Number of Bars	=		4.0
Reinforcing Bar Size	=	#	4
Bars parallel to Z-Z Axis			
Number of Bars	=		4.0
Reinforcing Bar Size	=	#	4

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



X-X Section Looking to +Z



Z-Z Section Looking to +X

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

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Project Title:
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Project Descr:

General Footing

Project File: 2207 Mercer Island Park Residence Remodel.ec6

DESCRIPTION: Deck footing (F3.5)

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8391	Soil Bearing	1.416 ksf	1.688 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.4406	Z Flexure (+X)	3.051 k-ft/ft	6.923 k-ft/ft	+1.20D+1.60L
PASS	0.4406	Z Flexure (-X)	3.051 k-ft/ft	6.923 k-ft/ft	+1.20D+1.60L
PASS	0.4406	X Flexure (+Z)	3.051 k-ft/ft	6.923 k-ft/ft	+1.20D+1.60L
PASS	0.4406	X Flexure (-Z)	3.051 k-ft/ft	6.923 k-ft/ft	+1.20D+1.60L
PASS	0.3652	1-way Shear (+X)	27.393 psi	75.0 psi	+1.20D+1.60L
PASS	0.3652	1-way Shear (-X)	27.393 psi	75.0 psi	+1.20D+1.60L
PASS	0.3652	1-way Shear (+Z)	27.393 psi	75.0 psi	+1.20D+1.60L
PASS	0.3652	1-way Shear (-Z)	27.393 psi	75.0 psi	+1.20D+1.60L
PASS	0.8088	2-way Punching	121.327 psi	150.0 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.688	n/a	0.0	0.3223	0.3223	n/a	n/a	0.191
X-X, +D+L	1.688	n/a	0.0	1.416	1.416	n/a	n/a	0.839
X-X, +D+0.750L	1.688	n/a	0.0	1.143	1.143	n/a	n/a	0.677
X-X, +0.60D	1.688	n/a	0.0	0.1934	0.1934	n/a	n/a	0.115
Z-Z, D Only	1.688	0.0	n/a	n/a	n/a	0.3223	0.3223	0.191
Z-Z, +D+L	1.688	0.0	n/a	n/a	n/a	1.416	1.416	0.839
Z-Z, +D+0.750L	1.688	0.0	n/a	n/a	n/a	1.143	1.143	0.677
Z-Z, +0.60D	1.688	0.0	n/a	n/a	n/a	0.1934	0.1934	0.115

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

All units k

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

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
X-X, +1.40D	0.4319	+Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +1.40D	0.4319	-Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +1.20D+1.60L	3.051	+Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +1.20D+1.60L	3.051	-Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +1.20D+0.50L	1.208	+Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +1.20D+0.50L	1.208	-Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +1.20D	0.3702	+Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +1.20D	0.3702	-Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +0.90D	0.2777	+Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
X-X, +0.90D	0.2777	-Z	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +1.40D	0.4319	-X	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +1.40D	0.4319	+X	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +1.20D+1.60L	3.051	-X	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +1.20D+1.60L	3.051	+X	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +1.20D+0.50L	1.208	-X	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +1.20D+0.50L	1.208	+X	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +1.20D	0.3702	-X	Bottom	0.2160	AsMin	0.2286	6.923	OK

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Project Title:
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Project Descr:

General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Deck footing (F3.5)

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	0.2286	6.923	OK
Z-Z, +0.90D	0.2777	-X	Bottom	0.2160	AsMin	0.2286	6.923	OK
Z-Z, +0.90D	0.2777	+X	Bottom	0.2160	AsMin	0.2286	6.923	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.88 psi	3.88 psi	3.88 psi	3.88 psi	3.88 psi	75.00 psi	0.05	OK
+1.20D+1.60L	27.39 psi	27.39 psi	27.39 psi	27.39 psi	27.39 psi	75.00 psi	0.37	OK
+1.20D+0.50L	10.85 psi	10.85 psi	10.85 psi	10.85 psi	10.85 psi	75.00 psi	0.14	OK
+1.20D	3.32 psi	3.32 psi	3.32 psi	3.32 psi	3.32 psi	75.00 psi	0.04	OK
+0.90D	2.49 psi	2.49 psi	2.49 psi	2.49 psi	2.49 psi	75.00 psi	0.03	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	17.18 psi	150.00 psi	0.1145	OK
+1.20D+1.60L	121.33 psi	150.00 psi	0.8088	OK
+1.20D+0.50L	48.04 psi	150.00 psi	0.3202	OK
+1.20D	14.72 psi	150.00 psi	0.09816	OK
+0.90D	11.04 psi	150.00 psi	0.07362	OK

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General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

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	

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

Soil Design Values

Allowable Soil Bearing	=	1.50	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	

Increases based on footing Depth

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

Increases based on footing plan dimension

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

Dimensions

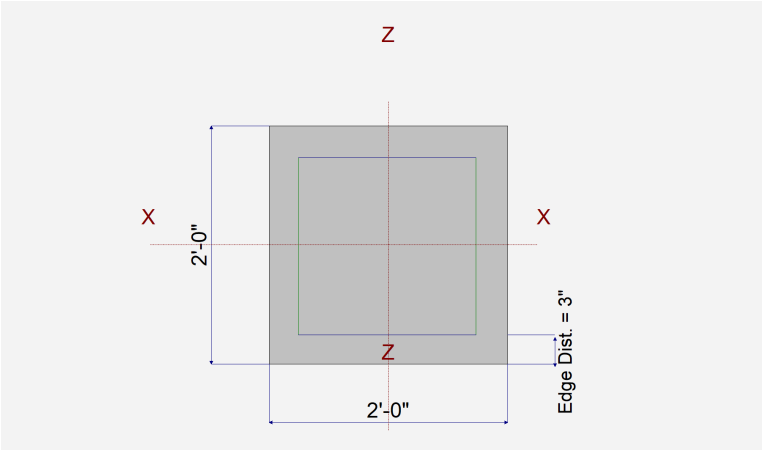
Width parallel to X-X Axis	=	2.0	ft
Length parallel to Z-Z Axis	=	2.0	ft
Footing Thickness	=	8.0	in

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

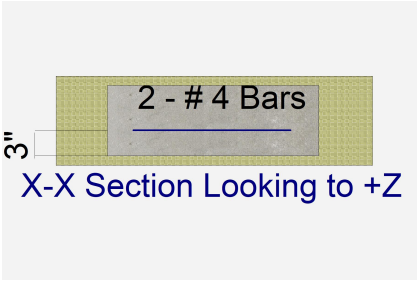


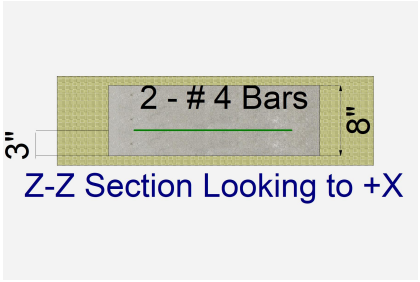
Reinforcing

Bars parallel to X-X Axis			
Number of Bars	=		2
Reinforcing Bar Size	=	#	4
Bars parallel to Z-Z Axis			
Number of Bars	=		2
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	=	0.9220		5.272					k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

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General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Deck footing (F2.0)

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9801	Soil Bearing	1.654 ksf	1.688 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.2781	Z Flexure (+X)	1.193 k-ft/ft	4.288 k-ft/ft	+1.20D+1.60L
PASS	0.2781	Z Flexure (-X)	1.193 k-ft/ft	4.288 k-ft/ft	+1.20D+1.60L
PASS	0.2781	X Flexure (+Z)	1.193 k-ft/ft	4.288 k-ft/ft	+1.20D+1.60L
PASS	0.2781	X Flexure (-Z)	1.193 k-ft/ft	4.288 k-ft/ft	+1.20D+1.60L
PASS	0.3075	1-way Shear (+X)	23.059 psi	75.0 psi	+1.20D+1.60L
PASS	0.3075	1-way Shear (-X)	23.059 psi	75.0 psi	+1.20D+1.60L
PASS	0.3075	1-way Shear (+Z)	23.059 psi	75.0 psi	+1.20D+1.60L
PASS	0.3075	1-way Shear (-Z)	23.059 psi	75.0 psi	+1.20D+1.60L
PASS	0.6107	2-way Punching	91.599 psi	150.0 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.688	n/a	0.0	0.3363	0.3363	n/a	n/a	0.199
X-X, +D+L	1.688	n/a	0.0	1.654	1.654	n/a	n/a	0.980
X-X, +D+0.750L	1.688	n/a	0.0	1.325	1.325	n/a	n/a	0.785
X-X, +0.60D	1.688	n/a	0.0	0.2018	0.2018	n/a	n/a	0.120
Z-Z, D Only	1.688	0.0	n/a	n/a	n/a	0.3363	0.3363	0.199
Z-Z, +D+L	1.688	0.0	n/a	n/a	n/a	1.654	1.654	0.980
Z-Z, +D+0.750L	1.688	0.0	n/a	n/a	n/a	1.325	1.325	0.785
Z-Z, +0.60D	1.688	0.0	n/a	n/a	n/a	0.2018	0.2018	0.120

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

All units k

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

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
X-X, +1.40D	0.1614	+Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +1.40D	0.1614	-Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +1.20D+1.60L	1.193	+Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +1.20D+1.60L	1.193	-Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +1.20D+0.50L	0.4678	+Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +1.20D+0.50L	0.4678	-Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +1.20D	0.1383	+Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +1.20D	0.1383	-Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +0.90D	0.1037	+Z	Bottom	0.1728	AsMin	0.20	4.288	OK
X-X, +0.90D	0.1037	-Z	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +1.40D	0.1614	-X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +1.40D	0.1614	+X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +1.20D+1.60L	1.193	-X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +1.20D+1.60L	1.193	+X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +1.20D+0.50L	0.4678	-X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +1.20D+0.50L	0.4678	+X	Bottom	0.1728	AsMin	0.20	4.288	OK
Z-Z, +1.20D	0.1383	-X	Bottom	0.1728	AsMin	0.20	4.288	OK

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Project Title:
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Project Descr:

General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Deck footing (F2.0)

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	0.1383	+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	3.12 psi	3.12 psi	3.12 psi	3.12 psi	75.00 psi	0.04	OK
+1.20D+1.60L	23.06 psi	23.06 psi	23.06 psi	23.06 psi	23.06 psi	75.00 psi	0.31	OK
+1.20D+0.50L	9.04 psi	9.04 psi	9.04 psi	9.04 psi	9.04 psi	75.00 psi	0.12	OK
+1.20D	2.67 psi	2.67 psi	2.67 psi	2.67 psi	2.67 psi	75.00 psi	0.04	OK
+0.90D	2.01 psi	2.01 psi	2.01 psi	2.01 psi	2.01 psi	75.00 psi	0.03	OK

Two-Way "Punching" Shear

All units k

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

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General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Interior Beam footing (F2.5)

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
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

Soil Design Values

Allowable Soil Bearing	=	1.50	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	

Increases based on footing Depth

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

Increases based on footing plan dimension

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

Dimensions

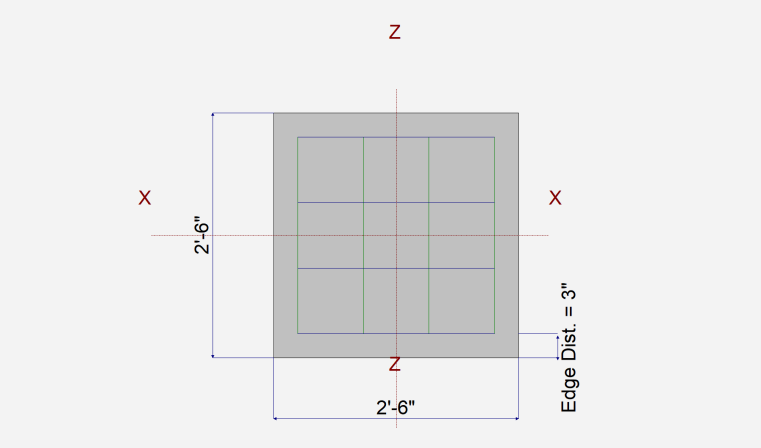
Width parallel to X-X Axis	=	2.50	ft
Length parallel to Z-Z Axis	=	2.50	ft
Footing Thickness	=	8.0	in

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



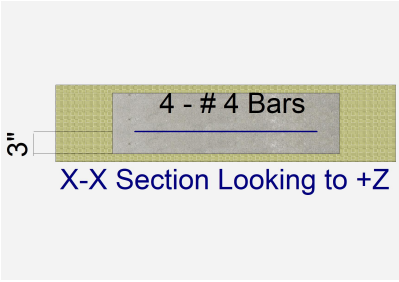
Reinforcing

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

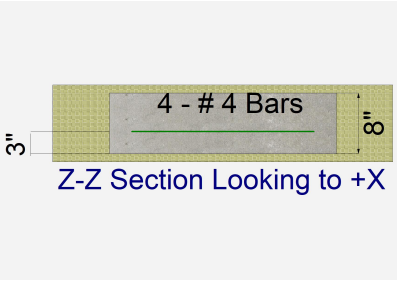
Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

Bars required within zone
Bars required on each side of zone



X-X Section Looking to +Z



Z-Z Section Looking to +X

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

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General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Interior Beam footing (F2.5)

DESIGN SUMMARY

Design N.G.

Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	Soil Bearing	ksf	ksf	
FAIL	Overturning - X-X	k-ft	k-ft	
FAIL	Overturning - Z-Z	k-ft	k-ft	
FAIL	Sliding - X-X	k	k	
FAIL	Sliding - Z-Z	k	k	
FAIL	Uplift	k	k	
PASS	Z Flexure (+X)	k-ft/ft	k-ft/ft	
PASS	Z Flexure (-X)	k-ft/ft	k-ft/ft	
PASS	X Flexure (+Z)	k-ft/ft	k-ft/ft	
PASS	X Flexure (-Z)	k-ft/ft	k-ft/ft	
PASS	1-way Shear (+X)	psi	psi	
PASS	1-way Shear (-X)	psi	psi	
PASS	1-way Shear (+Z)	psi	psi	
PASS	1-way Shear (-Z)	psi	psi	
PASS	2-way Punching	psi	psi	

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.688	n/a	0.0	0.4204	0.4204	n/a	n/a	0.249
X-X, +D+L	1.688	n/a	0.0	1.406	1.406	n/a	n/a	0.833
X-X, +D+0.750L	1.688	n/a	0.0	1.159	1.159	n/a	n/a	0.687
X-X, +0.60D	1.688	n/a	0.0	0.2522	0.2522	n/a	n/a	0.150
Z-Z, D Only	1.688	0.0	n/a	n/a	n/a	0.4204	0.4204	0.249
Z-Z, +D+L	1.688	0.0	n/a	n/a	n/a	1.406	1.406	0.833
Z-Z, +D+0.750L	1.688	0.0	n/a	n/a	n/a	1.159	1.159	0.687
Z-Z, +0.60D	1.688	0.0	n/a	n/a	n/a	0.2522	0.2522	0.150

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

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
X-X, +1.40D	0.3441	+Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +1.40D	0.3441	-Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +1.20D+1.60L	1.527	+Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +1.20D+1.60L	1.527	-Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +1.20D+0.50L	0.6798	+Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +1.20D+0.50L	0.6798	-Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +1.20D	0.2949	+Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +1.20D	0.2949	-Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +0.90D	0.2212	+Z	Bottom	0.1728	AsMin	0.320	6.658	OK
X-X, +0.90D	0.2212	-Z	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +1.40D	0.3441	-X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +1.40D	0.3441	+X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +1.20D+1.60L	1.527	-X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +1.20D+1.60L	1.527	+X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +1.20D+0.50L	0.6798	-X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +1.20D+0.50L	0.6798	+X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +1.20D	0.2949	-X	Bottom	0.1728	AsMin	0.320	6.658	OK

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Project Title:
Engineer:
Project ID:
Project Descr:

General Footing

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Interior Beam footing (F2.5)

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	0.2949	+X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +0.90D	0.2212	-X	Bottom	0.1728	AsMin	0.320	6.658	OK
Z-Z, +0.90D	0.2212	+X	Bottom	0.1728	AsMin	0.320	6.658	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	6.06 psi	6.06 psi	6.06 psi	6.06 psi	6.06 psi	75.00 psi	0.08	OK
+1.20D+1.60L	26.87 psi	26.87 psi	26.87 psi	26.87 psi	26.87 psi	75.00 psi	0.36	OK
+1.20D+0.50L	11.96 psi	11.96 psi	11.96 psi	11.96 psi	11.96 psi	75.00 psi	0.16	OK
+1.20D	5.19 psi	5.19 psi	5.19 psi	5.19 psi	5.19 psi	75.00 psi	0.07	OK
+0.90D	3.89 psi	3.89 psi	3.89 psi	3.89 psi	3.89 psi	75.00 psi	0.05	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	26.82 psi	150.00 psi	0.1788	OK
+1.20D+1.60L	118.99 psi	150.00 psi	0.7933	OK
+1.20D+0.50L	52.99 psi	150.00 psi	0.3533	OK
+1.20D	22.99 psi	150.00 psi	0.1533	OK
+0.90D	17.24 psi	150.00 psi	0.1149	OK

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Project ID:
Project Descr:

Restrained Retaining Wall

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Restrained Stem Wall

Code Reference

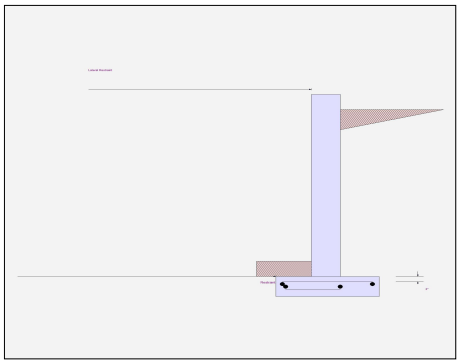
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

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	=	1,500.0 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 Friction	=	0.4 psf
Soil height to ignore for passive pressure	=	12 in



Surcharge Loads

Surcharge Over Heel	=	0 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	=	0 in

Uniform Lateral Load Applied to Stem

Lateral Load	=	0 #/ft
...Height to Top	=	0 ft
...Height to Bottom	=	0 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem	=	0.00 psf (Service Level)

Wind acts left-to-right toward retention side.

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0 ft
Eccentricity	=	0 in
Wall to Ftg CL Dist	=	0 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0 ft
Poisson's Ratio	=	0.3

Earth Pressure Seismic Load

K_h Soil Density Multiplier = 0.2 g 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	=	0 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

Load Factors

Building Code	
Dead Load	0.000
Live Load	0.000
Earth, H	0.000
Wind, W	0.000
Seismic, E	0.000

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
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	6.0 ft	2.482 ft	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
Design Data				
fb/FB + fa/Fa	=	0	0	0
Moment....Actual	=	0.0 ft-#	597.91 ft-#	0.0 ft-#
Moment.....Allowable	=	3,387.60 ft-#	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

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Project ID:
Project Descr:

Restrained Retaining Wall

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

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	=	0 in
Key Depth	=	0 in
Key Distance from Toe	=	0 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

		Toe	Heel	
Factored Pressure	=	919.31	1,853.98	psf
Mu' : Upward	=	518.06	0	ft-#
Mu' : Downward	=	125.0	0	ft-#
Mu: Design	=	393	-446	ft-#
Actual 1-Way Shear	=	9.014	0	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	=	0.0 lbs	0.0 ft	0.0	ft-#
Axial Dead Load on Stem	=	1,269.0 lbs	1.333 ft	1,692.0	ft-#
Soil Over Toe	=	55.0 lbs	0.50 ft	27.50	ft-#
Adjacent Footing Load	=	0.0 lbs	0.0 ft	0.0	ft-#
Surcharge Over Toe	=	40.0 lbs	0.50 ft	20.0	ft-#
Stem Weight	=	600.0 lbs	1.333 ft	800.0	ft-#
Soil Over Heel	=	605.20 lbs	2.167 ft	1,311.37	ft-#
Footing Weight	=	266.70 lbs	1.334 ft	355.644	ft-#
Total Vertical Force	=	2,835.90 lbs	Moment =	4,206.52	ft-#

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

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Engineer:
Project ID:
Project Descr:

DESCRIPTION: Restrained Stem Wall

Rebar Lap & Embedment Lengths Information

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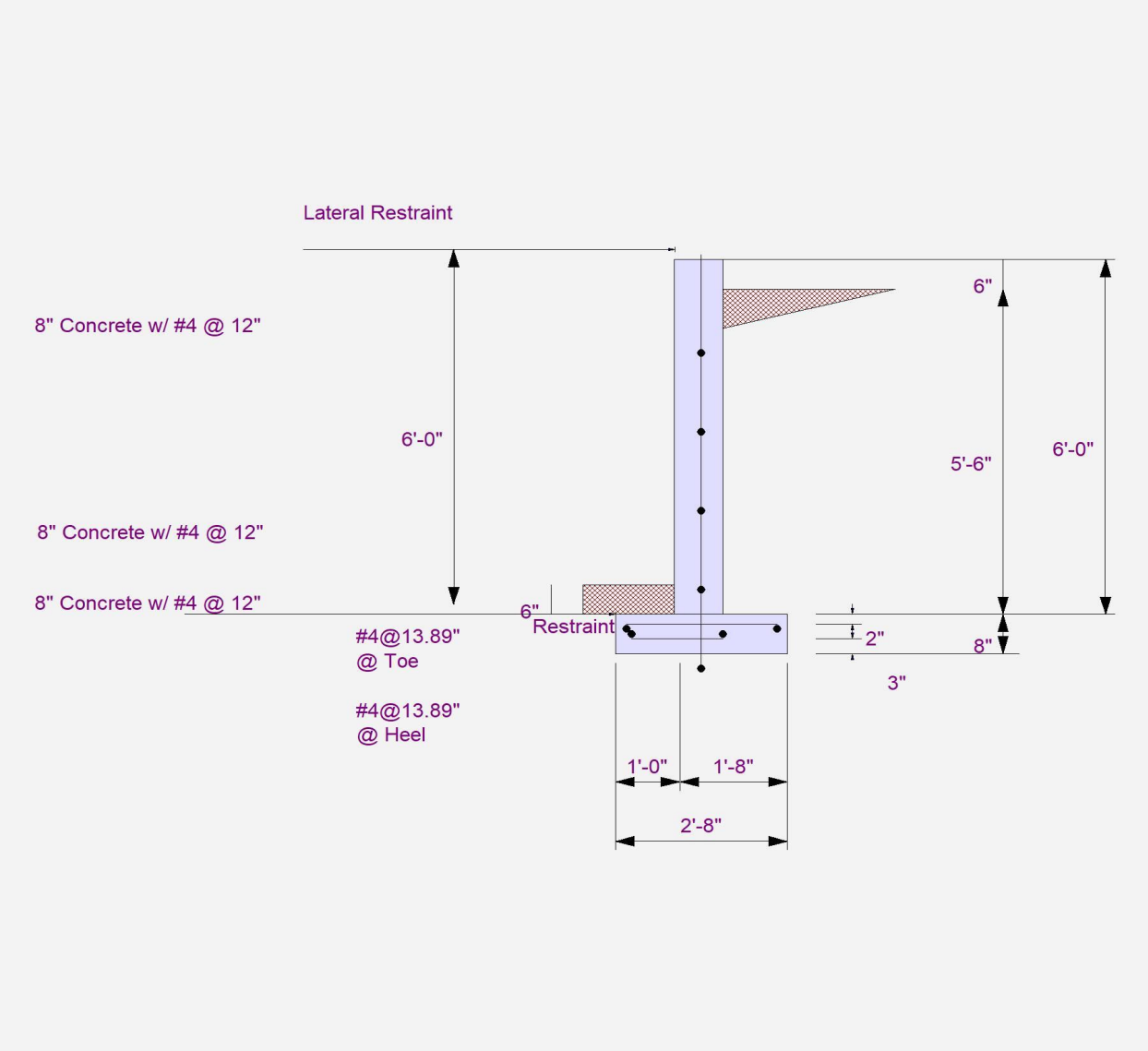
Project Title:
Engineer:
Project ID:
Project Descr:

Restrained Retaining Wall

Project File: 2207 Mercer Island Park Residence Remodel.ec6

DESCRIPTION: Restrained Stem Wall



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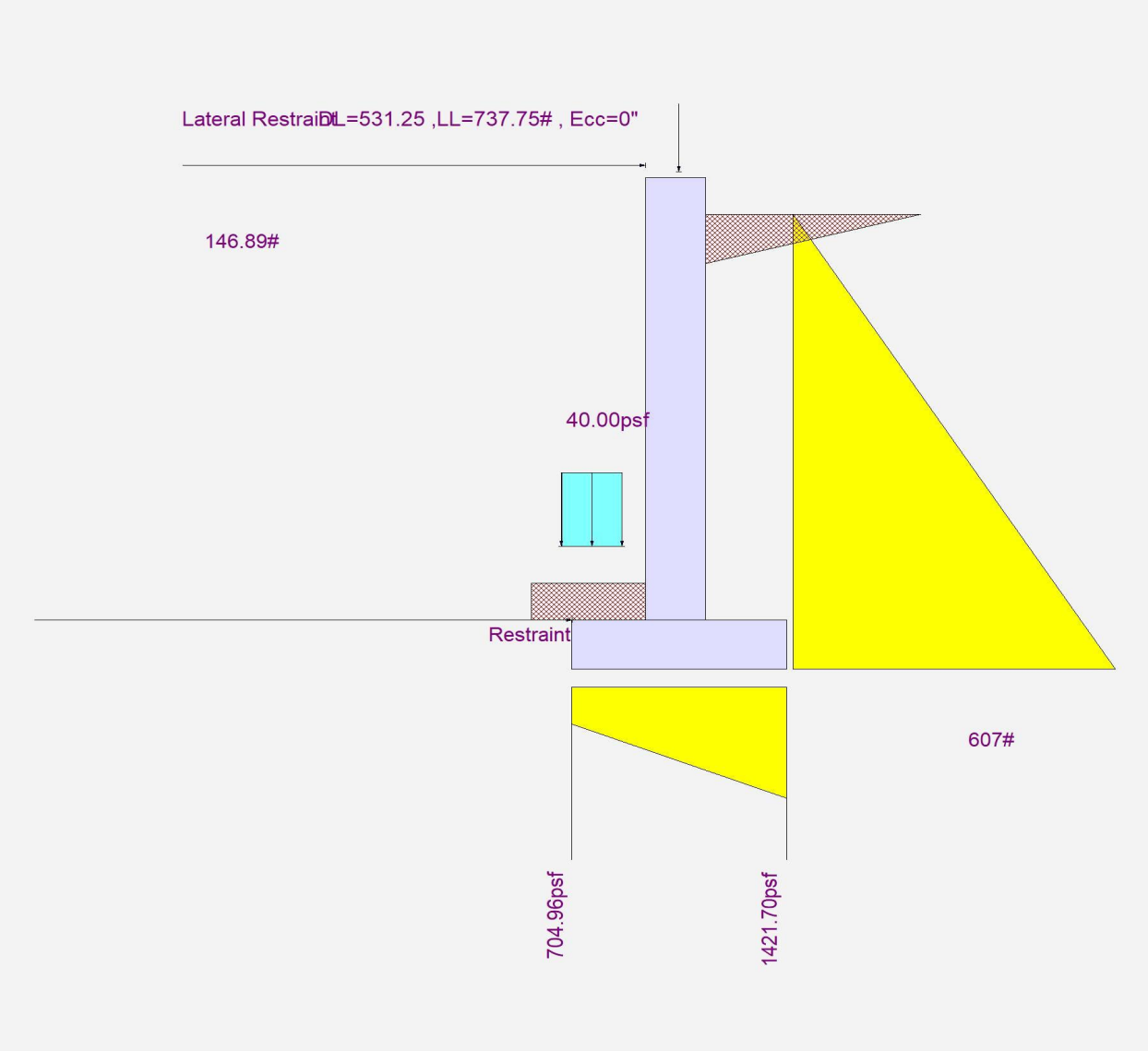
Project Descr:

Restrained Retaining Wall

LIC# : KW-06013944, Build:20.22.3.31 CS2 ENGINEERS (c) ENERCALC INC 1983-2022

DESCRIPTION: Restrained Stem Wall



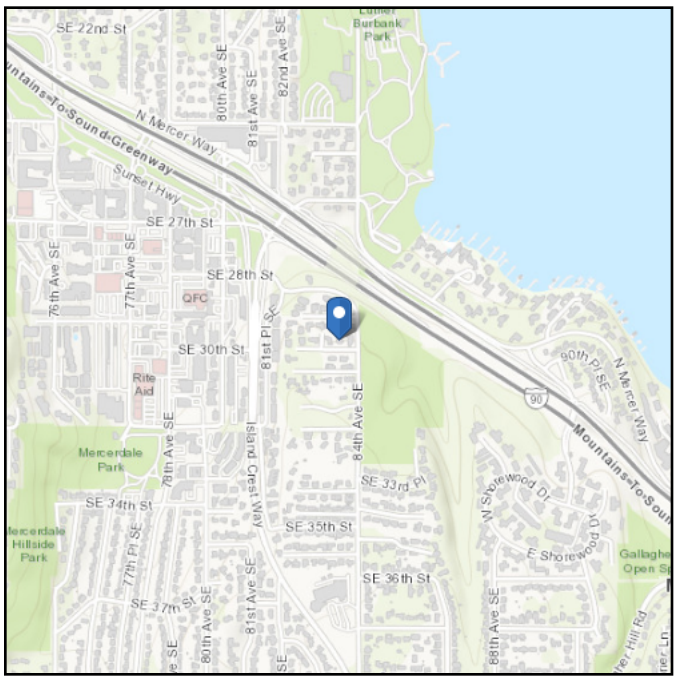
Lateral Load Design Calculation

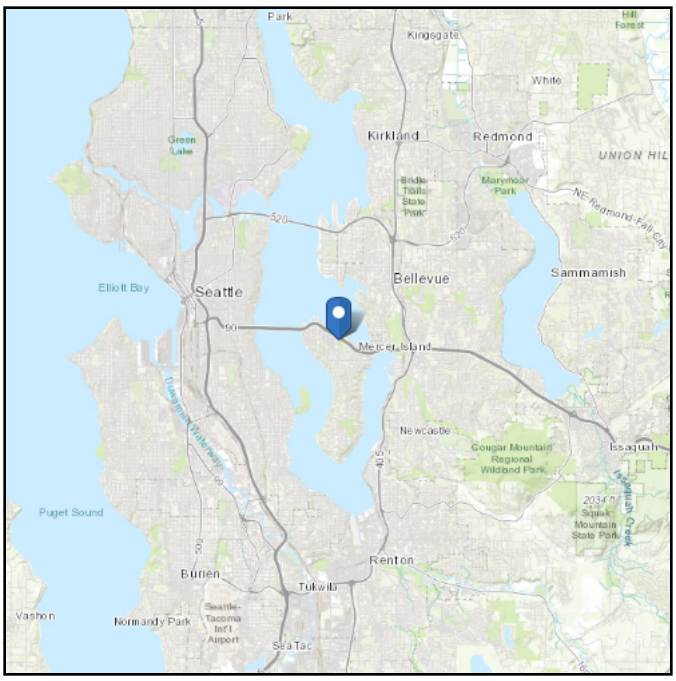
ASCE 7 Hazards Report

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.

Seismic

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_M :	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.

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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

SEISMIC WT. CALCULATION (ROOF)

GENERAL NOTES:
- VERIFY IN THE FIELD ALL DIMENSIONS FOR EXISTING CONDITION
- ALL HEADERS TO BE 6X8 DF#2 OR 4X11 DF#2 UNLESS NOTED OTHERWISE.
- ALL LUMBER EXPOSED TO WEATHER TO BE PRESSURE TREATED OR CEDAR
- SKYLIGHTS IN HEATED ENVELOP TO BE INSULATED PER WSEC.
- MIN. 22"X30" ATTIC ACCESS W/ 30" MIN. HEAD ROOM. INSULATE AND WEATHERSTRIP.
- FIRESTOP ALL VOIDS.

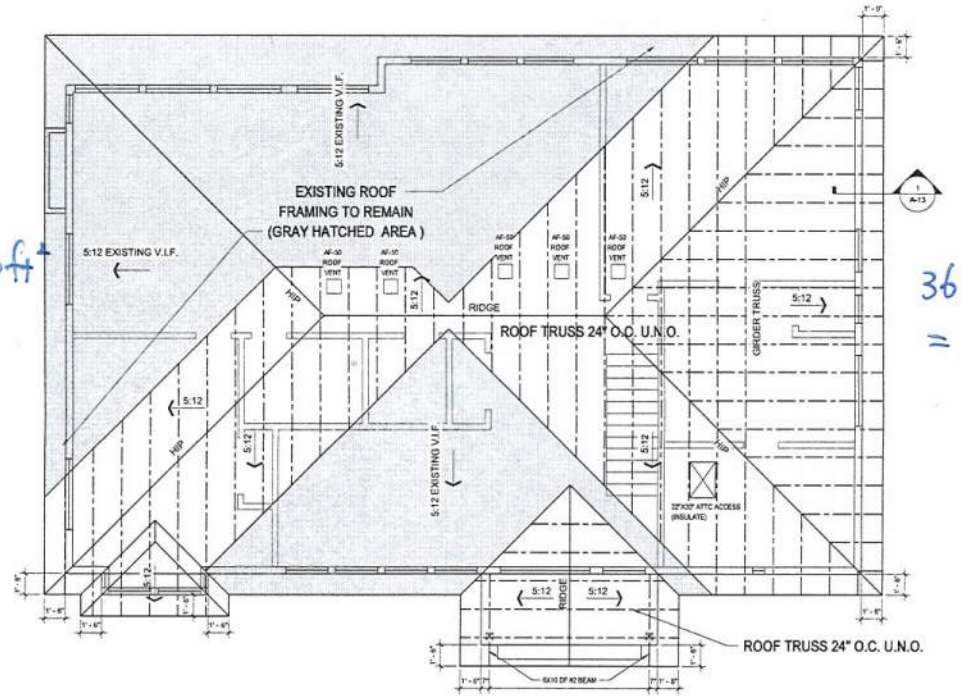
TRUSS NOTES:
- SHALL HAVE MANUFACTURER'S STAMP.
- SHALL BE INSTALLED AND BRACED PER MANUFACTURER'S INSTRUCTIONS.
- WILL NOT BE FIELD ALTERED WITHOUT BUILDING DEPARTMENT APPROVAL OF THE ENGINEERING CALCULATIONS.
- SHALL HAVE DESIGN DETAILS AND DRAWINGS ON SITE.

TRUSS HOLDOWN:
SIMPSON H8 HURRICANE TIE-GW6 GALVANIZED AT EACH TRUSS

ROOF NOTES:
MATERIAL: COMPOSITE ROOFING
PITCH: 5:12
OVERHANG: SEE DIMENSIONS ON PLAN
FASCIA: 1"X8" PRIMED AND PAINTED SPRUCE FASCIA BOARD,
1"X8" PRIMED AND PAINTED SPRUCE FASCIA BOARD AT GABLE

ATTIC VENTILATION:
936 SQ. FT. (NEW ATTIC SPACE) X 144/300 = 302.4 SQ. IN. (REQUIRED NET AREA)
PROVIDE (16) 7.83 SQ. IN. VENT BLOCKS = 125.5 SQ. IN.
PROVIDE (5) AF-50 ROOF JACKS = 250 SQ. IN.
TOTAL 375.5 SQ. IN. PROVIDED
IRC SECTION R806.2

$56.25' + 3' = 59.25'$



$36.5' + 3' = 39.5'$

$DL_{ROOF} = 15$ psf

$AREA_{ROOF} = 60' \times 40' = 2400 ft^2$

$Wt. = (15 \text{ psf})(2400 ft^2)$
$= 36000\#$

$\frac{1}{2}$ WALL $= (\frac{1}{2})(8')(10 \text{ psf})$
$\times 2\,(56.25' + 56.25' + 36.5' + 36.5')$
$= 14840\#$

$\therefore Wt._{ROOF} = 36000\# + 14840\# = 50840\#$

1 ROOF FRAMING PLAN
1/4" = 1'-0"

OWNER:
TAE PARK
8244 SE 30TH ST
MERCER ISLAND WA 98040

ARCHITECT:
STEVE JOO
206-306-8738
steve.joo@hotmail.com

STRUCTURAL ENGINEER:
SUNG CHO
206-235-8886
sung.cho@cs2engineers.com

PARK'S RESIDENCE ADDITION
8244 SE 30TH ST
MERCER ISLAND WA 98040

8419 REGISTERED ARCHITECT
SEKWANG JOO
STATE OF WASHINGTON
EXPIRES 04 / 10 / 2023

ISSUE

MARK	DATE	DESCRIPTION

DRAWN BY: PROJ. ARCH:
PROJ. NO:
DATE: 12/17/2016

DWG.
ROOF FRAMING PLAN

DWG.
A-8

2/27/2022 9:54:38 PM
C:\Users\joo\Documents\Mercer Park 8244_steve joo.rvt

SEISMIC WT. CALCULATION (FLOOR)

DL DECK = (10 psf)[(12'x 22') + (10'x 18')] = 4440#

DL FLOOR = (12 psf)(1914 ft²) = 22968#

½ WALL = [(2 x 56.25') + (2 x 36.5')] (½)(10 psf)(8') = 14840#

GENERAL NOTES
- VERIFY IN THE FIELD ALL DIMENSIONS OF EXISTING CONDITION
- CONSTRUCTION TO COMPLY WITH THE 2018 IRC
- NEW 2X6 EXTERIOR STUD WALLS @ 16" O.C. STACKED FRAMED
- NEW 2X4 INTERIOR STUD WALLS @ 16" O.C. UNLESS NOTED OTHERWISE
- BEARING AND HEADERS TO BE (#) 2X12 AT CR (4X10 #2 OF FURRED-OUT
- FIREBLOCK ALL PLUMBING PENETRATIONS
- PROVIDE SOLID BLOCKING OVER BEAMS & BEARING WALLS
- ALL HANGER TO BE SIMPSON OR EQUAL
- BEDROOMS TO HAVE AT LEAST ONE OPERABLE WINDOW NET CLEAR OPENING OF 5.7 SQ. FT. MIN. WITH A NET CLEAR OPENING HT. OF 24" MIN. AND NET CLEAR OPENING WIDTH OF 20" MIN. AND A FINISHED SILL HEIGHT OF NOT MORE THAN 44" ABOVE FINISH FLOOR.
- ALL LUMBER EXPOSED TO WEATHER OR CONCRETE TO BE PRESSURE TREATED OR CEDAR

NOTE FOR EXISTING CONDITION
THE CONSTRUCTION DOCUMENTS REPRESENTED HEREIN ARE BASED ON NON-INVASIVE SITE OBSERVATION OF THE EXISTING STRUCTURAL CONDITIONS OF THE PROPOSED PROJECT. AS A RESULT, IN CERTAIN INSTANCES, DESIGN ASSUMPTIONS WERE USED TO FORMULATE THE COMPATIBILITY OF THE NEW CONSTRUCTION WITH THE EXISTING STRUCTURAL ELEMENTS. DURING THE COURSE OF CONSTRUCTION, IT IS POSSIBLE THAT CONDITIONS MAY BE ENCOUNTERED THAT DO NOT COINCIDE WITH THE DESIGN ASSUMPTIONS AND MAY REQUIRE FURTHER STRUCTURAL REVIEW TO DETERMINE ADEQUACY. THE BUILDER SHALL BE OBSERVANT OF THESE CONDITIONS AND IMMEDIATELY REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO PROCEEDING FURTHER WITH THE WORK.

PLAN LEGEND
- NEW CONSTRUCTION
- EXISTING WALL TO REMAIN
- EXISTING WALLS AND WINDOWS TO BE REMOVED AND OR MODIFIED
- D-# NEW DOOR
- EXISTING DOOR
- EXISTING DOOR TO BE REMOVED AND OR MODIFIED

SHEAR WALL SCHEDULE

MARK	SHEATHING COMMON	STUDS AT ABUTTING PANEL EDGES*	PANEL EDGE NAILING **/***	RIM JOIST OR BLOCKING ATTACHMENT TO TOP PLATE		2X BOTTOM PLATE ATTACHMENT	SILL PLATE ATTACHMENT	
				SOLID RIM	1-1/2 RIM	BOTTOM PLATE TO RIM JOIST BELOW***	ANCHOR BOLT TO CONCRETE ****	SILL PLATE AT FOUND.
SW1	7/16" OSB ONE SIDE	2X	8d @ 6" O.C.	A35 @ 24" O.C.	16d @ 8" O.C.	16d @ 8" O.C.	5/8" DIA. @ 48" O.C.	2X
SW2	7/16" OSB ONE SIDE	2X	8d @ 4" O.C.	A35 @ 16" O.C.	16d @ 4" O.C.	16d @ 4" O.C.	5/8" DIA. @ 32" O.C.	2X

* INTERMEDIATE FRAMING TO BE 2x STUDS. TWO 2x STUDS MAY BE USED IN PLACE OF 3x STUDS; NAIL TOGETHER WITH BOTTOM PLATE ATTACHMENT NAILING.
** 8d NAILS SHALL BE 0.131"-DIA X 2 1/2" (COMMON). 16d NAILS SHALL BE 0.135" DIA X 3 1/2" (BOX).
*** USE ANCHOR BOLT WITH 7" MIN. EMBED OR EXPANSION BOLTS WITH 4" EMBED. AT ALL ANCHOR BOLTS USE 3"X3"X1/4" PLATE WASHERS (SIMPSON BPS6-3 OR EQUAL)
**** TWO STUDS MINIMUM ARE REQUIRED AT EACH END OF SHEARWALLS. END STUD SHALL RECEIVE PANEL EDGE NAILING.

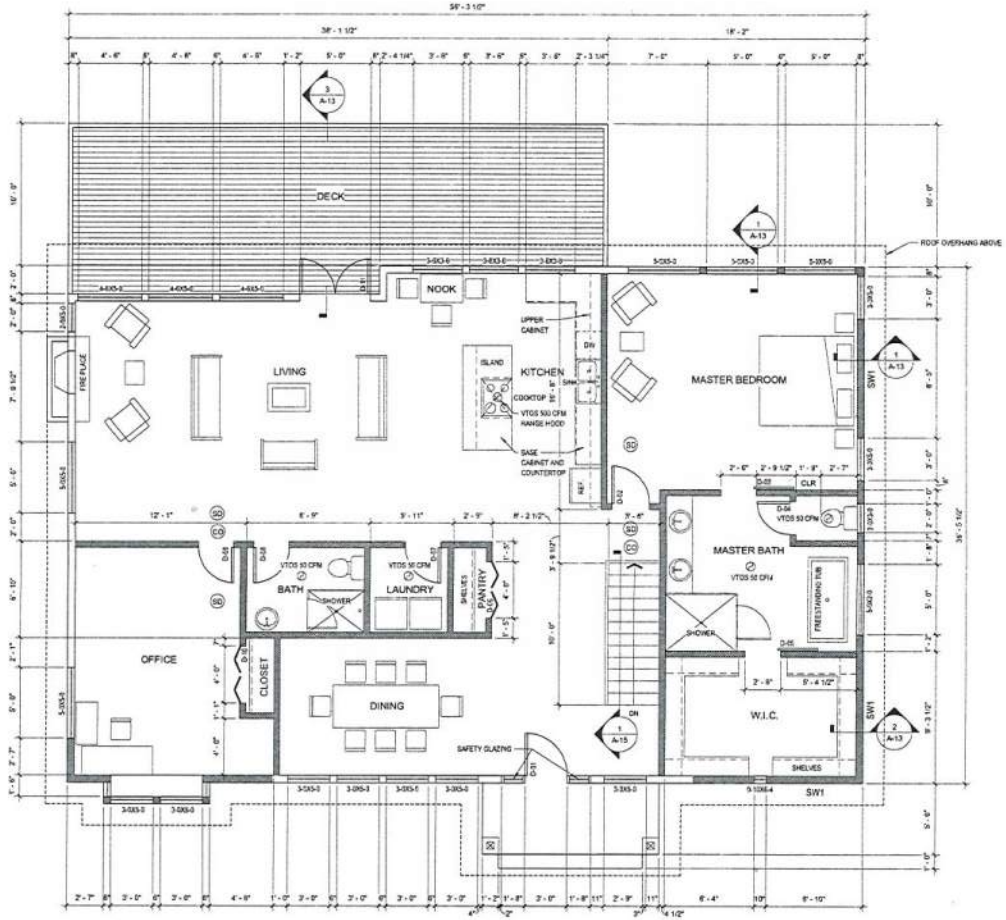
WSEC - ENERGY EFFICIENCY CREDITS

SELECTED OPTIONS	DESCRIPTION	CREDIT
EFFICIENT BUILDING ENVELOPE 1a	VERTICAL PENESTRATION (AF) 2X FLOOR R=38	0.5
HIGH EFFICIENCY HVAC EQUIPMENT 3a	GAS FURNACE W/ MINIMUM AFUE OF 94%	1.5
EFFICIENT WATER HEATING 5a	KITCHEN SINK FAUCET AND SHOWERHEAD AT 1.75 GPM OR LESS	0.5
EFFICIENT WATER HEATING 5c	GAS WATER HEATER W/ MINIMUM EF 0.91	1.5

WHOLE HOUSE FAN

BATHROOM (3)	.25 w.g.	50 CFM
LAUNDRY	.25 w.g.	50 CFM
KITCHEN	.10 w.g.	100 CFM
BEDROOM (4)	.25 w.g.	50 CFM

PROVIDE 150 CFM W.H.F. WITH A 24 HOUR TIMER TO CONTROL EXHAUST FAN.
INTERMITTENT AIR FLOW AT 50% RUN TIME.
VENTILATION PATH THROUGH UNDERCUT DOOR.



∴ Wt. FLOOR = 14840# + 22968# + 4440# + 14840#

= 57088#

1 PROPOSED 1ST FLOOR PLAN
1/4" = 1'-0"

OWNER:
TAE PARK
8244 SE 36TH ST
MERCER ISLAND WA 98040

ARCHITECT:
STEVE JOO
206-306-6736
stevej.joo@hotmail.com

STRUCTURAL ENGINEER:
SUNG CHO
206-235-9986
sung.cho@cs2engineers.com

PARK'S RESIDENCE ADDITION
8244 SE 36TH ST
MERCER ISLAND WA
98040

8419 REGISTERED ARCHITECT
SEKWANG JOO
STATE OF WASHINGTON
EXPIRES 04/10/2023

ISSUE

MARK	DATE	DESCRIPTION

DRAWN BY: PROJ. ARCH.
PROJ. NO.:
DATE: 12/17/2016

DWG.
PROPOSED 1ST FLOOR PLAN

DWG.
A-5

2/27/2022 9:54:35 PM
C:\Users\joo\Documents\Mercer Park 8244_steve.joo.rvt

Calculate Seismic Design Base Shear

Per USGS

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

Seismic Base Shear, $V_S = C_S W$, (kips)	=	0.172	x Weight	$F_{px,\ min}$ =
Seismic Base Shear, $V_S/1.4 = C_S W$, (kips)	=	0.123	x Weight (ASD)	$F_{px,\ max}$ =

Calculate Seismic Force for Components (Per ASCE7-05 Chapter 13)

Component amplification factor, a_p	=	1	(ASCE 7, Table 13.5.1 & 13.6.1)
Component Importance factor, I_p	=	1	(ASCE 7, Section 13.3)
Component operating weight, W_p	=	W_p	(lb)
Component response modification factor, R_p	=	2.5	(ASCE 7, Table 13.5.1 & 13.6.1)
Height of attachment / Mean roof height, z/h	=	1	(z/h need not exceed 1.0)

Seismic Design Force, $F_p = \dfrac{(0.4 a_p S_{DS} W_P)\ (1+2xz/h)}{R_p/I_p}$ = 0.536 W_p (Eq. 13.3-1)

Max. seismic design force, $F_{pmax} = 1.6 S_{DS} I_p W_P$ = 1.786 W_p (Eq. 13.3-2)

Min. seismic design force, $F_{pmin} = 0.3 S_{DS} I_p W_P$ = 0.335 W_p (Eq. 13.3-3)

Seismic Design Force, Fp	=	0.536 W_p
Seismic Design Force, Fp/1.4	=	0.383 W_p

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	50840	854112		65%	8624	0.170	8624
2	8	57088	456704		35%	4612	0.081	13236
1			0		0%	0	0.000	13236
Σ		107928	1310816		100%	13236		

$F_{px,\ min}$ = 8105

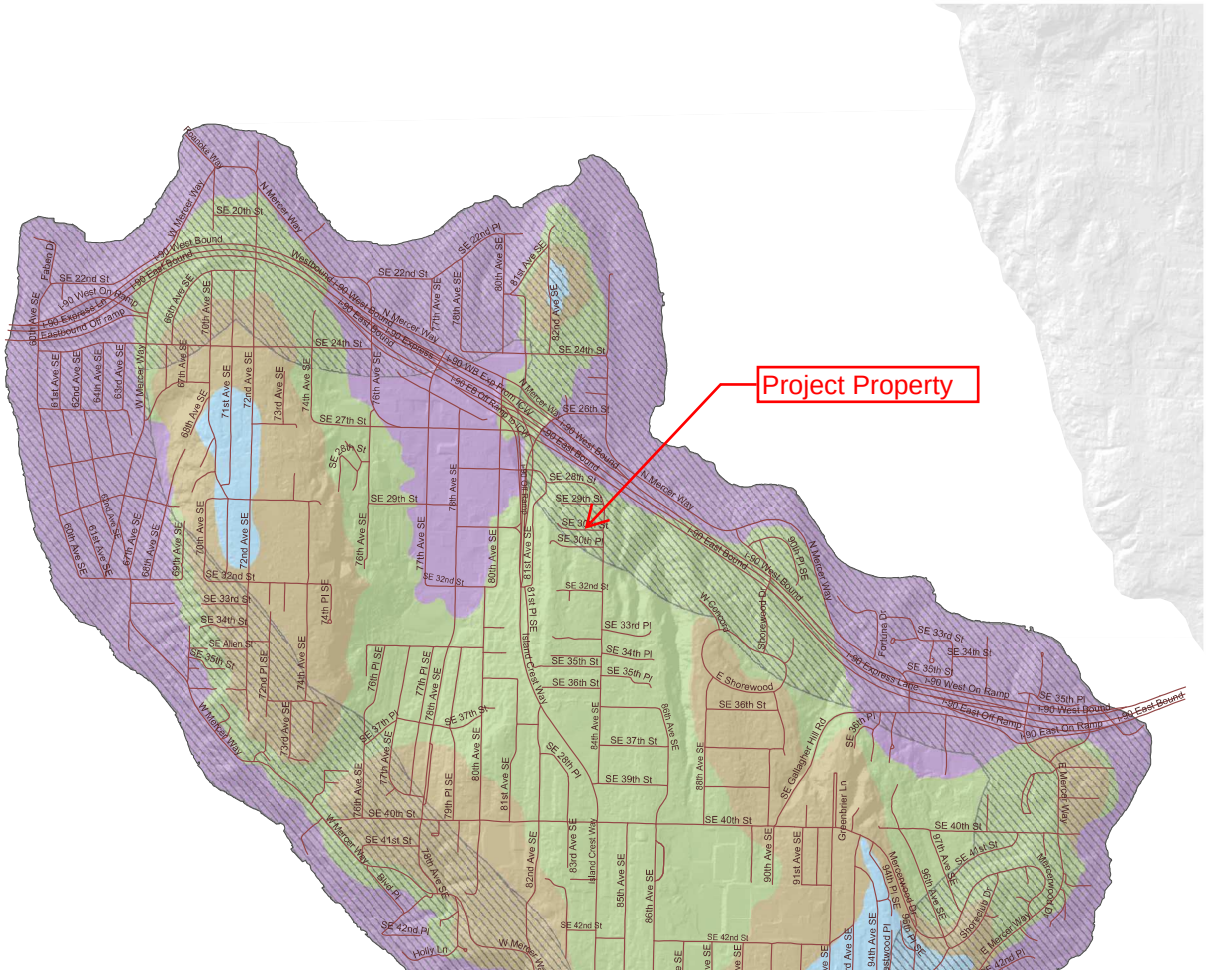
$F_{px,\ max}$ = 16211

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	50840	854112		65%	8624	0.170	8624
2	8	57088	456704		35%	4612	0.081	13236
1			0		0%	0	0.000	13236
Σ		107928	1310816		100%	13236		

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

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



0 0.5 1 Kilometers 1:12,000
0 0.5 1 Miles
TN

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 Kzt factor to be utilized for each specific project. The Kzt 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 Kzt 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

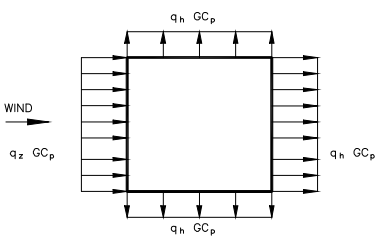
- **K_zt = 1.0**
- **K_zt = 1.3**
- **K_zt = 1.6**
- **K_zt = 1.9**

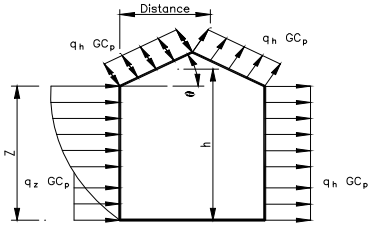
Wind Load Calculation (Method 2 - Analytical)

(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	=	1.0	(IBC Table 1604.5)
Velocity pressure exposure coefficient, K_z	=	See Table	(ASCE 7-16, Table 6-3)
Topographic Factor, K_{zt}	=	1.30	(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^2)	=	$0.00256K_zK_{zt}K_dV^2I_w$	(ASCE 7-16, Eq. 6-15)
	=	27.17 Kz	(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
θ =	22.6	deg
q_h, (lb/ft^2) =	26.69	
L/B =	1.5	
h/L =	0.3	

Internal Pressure Coefficent, C_{pi} = **0.18** → q_hGC_{pi} = **4.08**

$p = qGC_p - q_i(GC_{pi})$ (ASCE 7-16, Eq 6-17)

MWFRS Pressure:

	Height Z, (ft)	K_Z	q_z or q_h	Cp	qGC_p	Net Pressure (**p**), psf (+GCpi)	Net Pressure (**p**), psf (-GCpi)	Total Wind Load
Winward Wall	0-15	0.85	23.06	0.8	15.68	11.60	19.77	35.19
	20	0.90	24.50	0.8	16.66	12.58	20.74	36.17
	25	0.95	25.68	0.8	17.46	13.38	21.55	36.97
	30	0.98	26.69	0.8	18.15	14.06	22.23	37.65
Leeward Wall	All		26.69	-0.5	-11.34	-15.42	-7.26	
Side Wall	All		26.69	-0.7	-15.88	-19.96	-11.80	
Windward Roof	-		26.69	-0.7	-15.88	-19.96	-11.80	-4.54
			26.69	-0.18	-4.08	-8.17	0.00	7.26
Leeward Roof	-		26.69	-0.5	-11.34	-15.42	-7.26	
Horizontal Distance from windward edge								
	0 to h		26.69	-0.9	-20.41	-24.50	-16.33	
	h to 2h		26.69	-0.5	-11.34	-15.42	-7.26	
	> 2h		26.69	-0.3	-6.80	-10.89	-2.72	

(Where h = 21 ft)

Vertical Wall = 36.17 psf
Vertical Roof = 6.49 psf or **-24.50 psf**
Horizontal Roof = 3.26 psf
OR Not less than (16psf)xA_f

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

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

% Assume 7/16" Wood Structural Panel - Structural I with 10d common nails

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

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

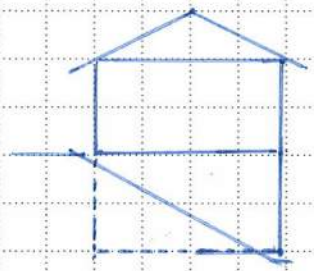
at 6" o.c. = (950#/2) [1-(0.5-0.43)] = 442 plf (SW-1)

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)

SEISMIC LOAD CALC



$\leftarrow F_{ROOF} = 8624^{\#}$ $\quad V_{ROOF} = \frac{8624^{\#}}{2340 ft^2} = 3.69$ psf

$\leftarrow F_{FLOOR} = 4612^{\#}$ $\quad V_{FLOOR} = \frac{4612^{\#}}{2053 ft^2} = 2.25$ psf

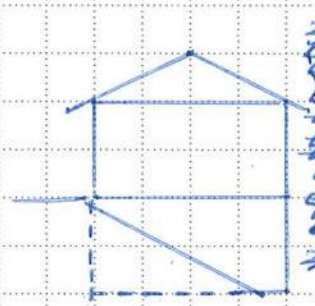
N-S DIRECTION $\quad W_{ROOF} = (3.69 psf)(36.5') = 134.7$ plf

$W_{FLOOR} = (2.25 psf)(36.5') = 82.1$ plf

E-W DIRECTION $\quad W_{ROOF} = (3.69 psf)(56.25') = 208$ plf

$W_{FLOOR} = (2.25 psf)(56.25') = 126.6$ plf

WIND LOAD CALC.

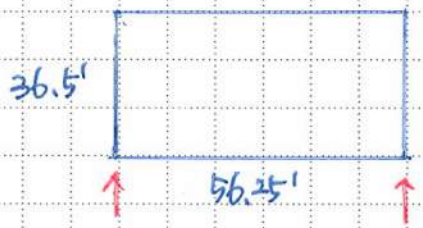


$\leftarrow W_{ROOF} = (36.2 psf)(5' + 8'/2) = 326$ plf

$\leftarrow W_{FLOOR} = (36.0 psf)(8'/2 + 8'/2) = 288$ plf

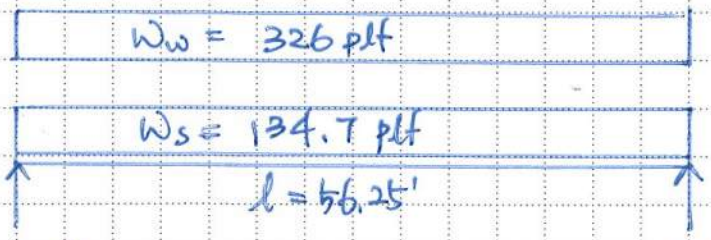
SHEAR WALL DESIGN <ROOF LEVEL>

*N-S DIRECTION



WIND W_{ROOF} = 326 plf

SEISMIC W_{ROOF} = 134.7 plf



*( ) DENOTE SEISMIC FORCE.

√ (#)	9169# (3788#)	9169# (3788#)
SHEAR WALL LENGTH (ft)	11'	10.5' + 8.5' = 19'
UNIT SHEAR (#/ft)	834 plf (344 plf)	483 plf (199 plf)
SHEAR WALL TYPE	SW3	SW2
HOLDOWN	HSTC66B3Z	HSTC28

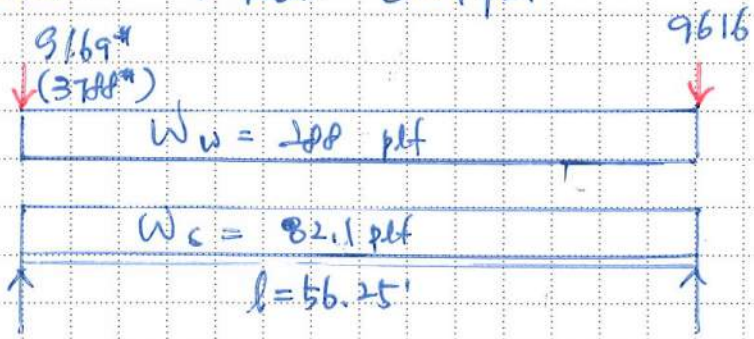
SHEAR WALL DESIGN

< FLOOR LEVEL >

* N-S DIRECTION

WIND $w_{FLOOR} = 288$ plf

SEISMIC $w_{FLOOR} = 82.1$ plf



* ( ) DENOTE SEISMIC FORCE

V (#)	9169 + 8100 = 17269# (3788 + 2309 = 6097#)	17269# 6097#
SHEAR WALL LENGTH (ft)	15'	17.5' + 8.5' = 26'
UNIT SHEAR (#/ft)	1151 plf (406 plf)	664 plf (235 plf)
SHEAR WALL	SW4	SW2
HOLDOWN	HDU11	HTT5

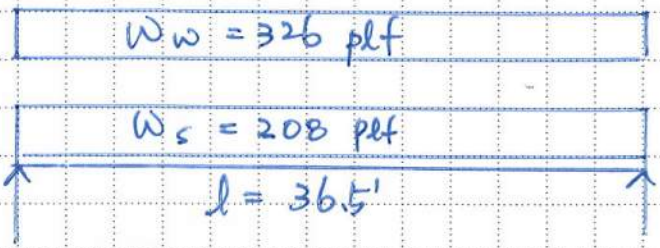
SHEAR WALL DESIGN

<ROOF LEVEL>

* E-W DIRECTION

WIND W_{ROOF} = 326 plf

SEISMIC W_{ROOF} = 208 plf

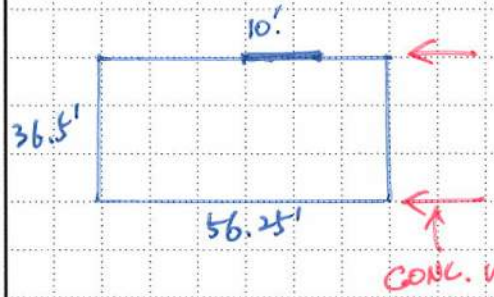


* ( ) DENOTE SEISMIC FORCE

V (#)	5950# (3796#)	5950# (3796#)
WALL LENGTH (ft)	5.5' + 7.5' + 7' = 20'	~~3.75' + 4'~~ NEED MORE WALL LENGTH.
UNIT SHEAR (#/ft)	298 plf (190 plf)	NO GOOD. ~~1587 plf~~ 5950#/8' = 744 plf, 3796#/8' = 475 plf
SHEAR WALL TYPE	SW1	SW3
HOLDOWN	HTT5	MSTC 52

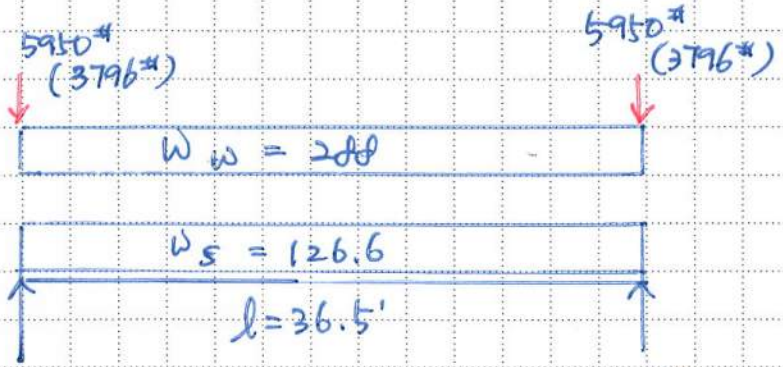
SHEAR WALL DESIGN <FLOOR LEVEL>

* E-W DIRECTION



WIND W_{FLOOR} = 288 plf

SEISMIC W_{FLOOR} = 126.6 plf.



* ( ) DENOTE SEISMIC FORCE.

V (#)	5950+5256 = 11206# (3796+2310 = 6106#)	11206# 6106#
WALL LENGTH	CONC. WALL. 56.25'	10'
UNIT SHEAR (#/ft)	199 plf (109 plf)	1121 plf (611 plf)
SHEAR WALL	CONC. WALL	SW4
HOLDOWN	—	HDU11

Appendix

LTT/HTT

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 holdown application. It features an extruded anchor bolt hole to accommodate ¾", ⅝" and ½" 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 holdown, bearing plate washer and Strong-Drive SD Connector screws.

The HTT5-¾ is designed to use a ¾"-diameter anchor bolt.

When using LTT or HTT tension ties with unreinforced concrete masonry, ¾" post-installed anchor bolts are commonly used.

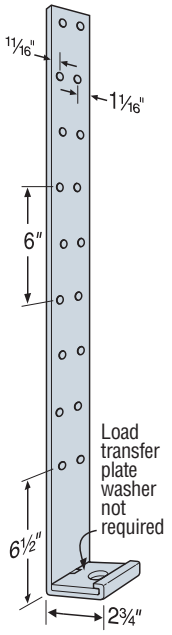
Material: See table

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

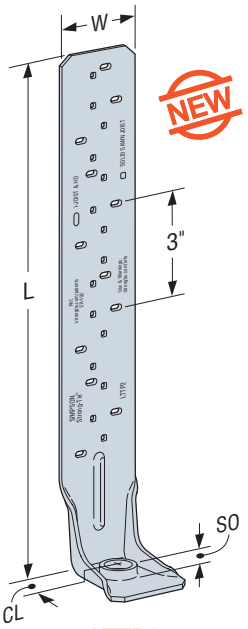
Installation:

- See Holdown and Tension Tie General Notes on pp. 49–50.
- LTTP2 — one standard cut-washer is required when using ½" and ⅝" anchor bolts; and no additional washer is required for ¾" 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 2½"-long fastener minimum.
- For information about marriage strap at panelized roof applications, see **strongtie.com**.
- HTT5-KT requires BP 5/8-2 bearing plate and #10 x 2½" SD Strong-Drive screws (included in kit).

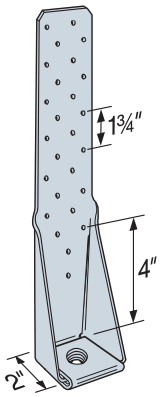
Codes: See p. 11 for Code Reference Key Chart



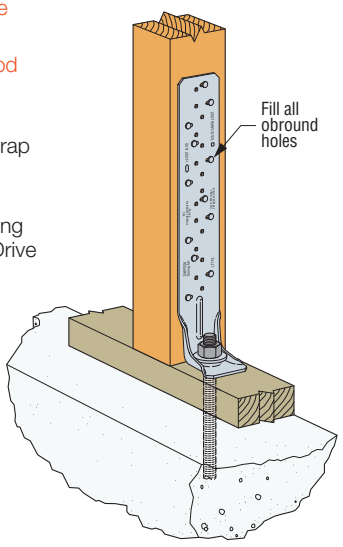
LTTI31



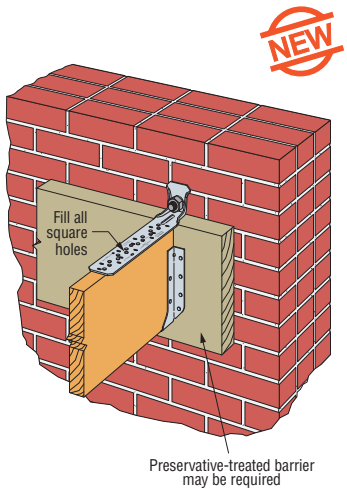
LTTP2
US Patent Pending



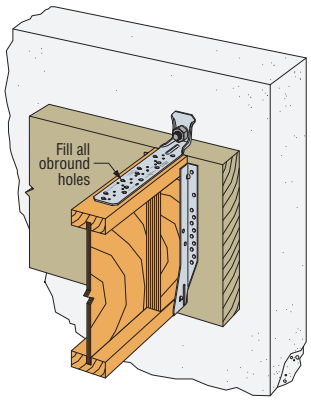
HTT5
(HTT4 similar)



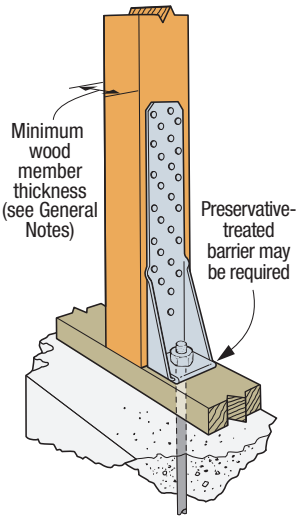
Typical LTTP2 Installation for Holdown Application



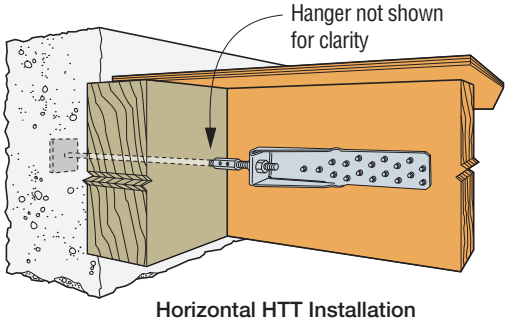
Typical LTTP2 Installation for Solid Sawn Joist



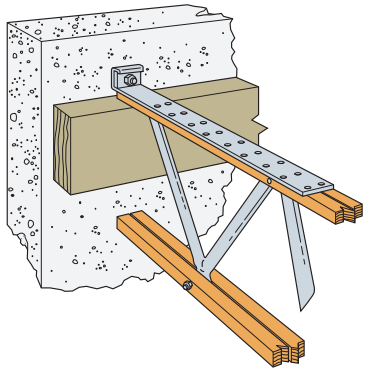
Typical LTTP2 Installation for I-joist



Vertical HTT5 Installation
(HTT4 similar)



Horizontal HTT Installation



Horizontal LTTI31 Installation

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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.) W	L	CL	SO (in.)	Fasteners (in.) Anchor Rod Diameter	Wood Fasteners	Minimum Wood Member Size (in.)	Allowable Tension Loads (160) DF/SP	SPF/HF	Deflection at Highest Allowable Load (in.)	Code Ref.
LTTP2	10	2⁹⁄₁₆	14¹⁵⁄₁₆	1⅛	7⁄16	½, ⅝, ¾	(15) 0.148 x 2½	1½ x 3½ (narrow edge)[4,5]	1,845	1,695	0.104	IBC, FL, LA
						½	(12) 0.148 x 1½	1½ x 3½	1,680[6]	1,545[6]	0.138	
						⅝, ¾			2,135	1,965	0.112	
						½	(12) #9 x 1½" SD	1½ x 3½	2,320	1,970	0.112	
						⅝, ¾			2,570	2,045	0.136	
						½, ⅝, ¾	(12) 0.148 x 2½	3 x 3½	2,275	2,230	0.128	
LTTI31	18	3¾	31	1⅜	¼	⅝	(18) 0.148 x 1½	3 x 3½	1,350	1,160	0.193	
HTT4	11	2½	12⅜	1⁵⁄₁₆	7⁄16	⅝	(18) 0.148 x 1½	1½ x 3½	3,000	2,580	0.090	—
							(18) 0.148 x 1½	3 x 3½	3,610	3,105	0.086	IBC, FL, LA
							(18) 0.162 x 2½	3 x 3½	4,235	3,640	0.123	
							(18) #10 x 1½" SD	1½ x 5½	4,455	3,830	0.112	—
							(18) #10 x 1½" SD	3 x 3½	4,455	3,830	0.112	
HTT5	11	2½	16	1⁷⁄₁₆	7⁄16	⅝	(26) 0.148 x 1½	3 x 3½	4,350	3,740	0.120	IBC, FL, LA
							(26) 0.148 x 3	3 x 3½	4,670	4,015	0.116	
							(26) 0.162 x 2½	3 x 3½	5,090	4,375	0.135	
							(26) #10 x 1½" SD	1½ x 5½	4,555	3,915	0.114	—
HTT5KT	11	2½	16	1⁷⁄₁₆	7⁄16	⅝	(26) #10 x 2½" SD	3 x 3½	5,445	5,360	0.103	
HTT5-3/4	11	2½	16	1⁷⁄₁₆	7⁄16	¾	(26) 0.148 x 1½	1½ x 5½	4,065	3,495	0.103	IBC, FL
							(26) 0.162 x 2½	3 x 3½	5,090	4,375	0.121	
							(26) #10 x 1½" SD	1½ x 7¼	4,830	4,155	0.100	

1. LTTI31 installed flush with concrete or masonry has an allowable load of 2,285 lb.
2. 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.
3. For LTTP2, standard cut washer is required when using ½" and ⅝" anchor rods.
4. For (15) nail installations on narrow edge of 2x4 (minimum) joist, LTTP2 installed flush with concrete or masonry has an allowable load of 2,560 lb. for DF/SP and 2,355 lb. for SPF/HF.
5. LTTP2 installed with (15) #9 x 1½" 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.
6. For (12) nail installations on I-joist or wide face of 2x member, LTTP2 installed flush with concrete or masonry has an allowable load of 1,950 lb. for DF/SP and 1,795 lb. for SPF/HF.
7. **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: Wind and Seismic Design Category A&B: Midwall/Corner	Stemwall: Wind and Seismic Design Category A&B: End Wall	Stemwall: Seismic Design Category C–F: Midwall/Corner	Stemwall: Seismic Design Category C–F: End Wall	Slab on Grade: Wind and Seismic Design Category A&B: Midwall/Corner	Slab on Grade: Wind and Seismic Design Category A&B: Garage Curb	Slab on Grade: Seismic Design Category C–F: Midwall/Corner	Slab on Grade: Seismic Design Category C–F: Garage Curb
HDU2	6	SSTB16		SSTB24		SSTB16		SSTB16	SSTB20* (2,960)
HDU4	6	SB5/8X24		SB5/8X24		SSTB16	SB5/8X24	SSTB20	SB5/8X24
HDU5	6	SB5/8X24		SB5/8X24		SSTB20	SB5/8X24	SSTB24	SB5/8X24
HDU8									
HD08									
HDU11									
HHDQ11									
HDU14									
HHDQ14									
LTTP2									
LTTI31									
HTT4									
HTT5									
HD3B									
HD5B									
HD7B									
HD9B									
HD12									

See foonotes be

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

Holdown on SPF/HF Lumber	Stemwall Width (in.)	Stemwall: Wind and Seismic Design Category A&B: Midwall/Corner	Stemwall: Wind and Seismic Design Category A&B: End Wall	Stemwall: Seismic Design Category C–F: Midwall/Corner	Stemwall: Seismic Design Category C–F: End Wall	Slab on Grade: Wind and Seismic Design Category A&B: Midwall/Corner	Slab on Grade: Wind and Seismic Design Category A&B: Garage Curb	Slab on Grade: Seismic Design Category C–F: Midwall/Corner	Slab on Grade: Seismic Design Category C–F: Garage Curb
HDU2	6	SSTB16		SSTB16		SSTB16		SSTB16	
HDU4	6	SSTB16		SSTB24		SSTB16		SSTB16	SSTB24
HDU5	6	SSTB24* (4,295)		SB5/8X24		SSTB16	SSTB24* (4,295)	SSTB20	SB5/8X24
HDU8	8	SSTB28		SSTB28	SSTB28* (6,395)	SSTB28		SSTB28	SSTB28
HDQ8	8	SSTB28		SSTB28	SSTB28* (6,395)	SSTB28		SSTB28	SSTB28
HDU11	8	SB1X30* (9,505)	PAB8	PAB8	PAB8	SB1x30		SB1x30	
HHDQ11	8	SB1X30	PAB8	PAB8					
HDU14	—	PAB8		PAB8		SB1x30		SB1x30	
HHDQ14	—								
LTTP2	6	SSTB16		SSTB16		SSTB16		SSTB16	
LTTI31	6								
HTT4	6	SSTB20		SB5/8X24		SSTB16	SSTB20	SSTB16* (3,780)	SB5/8X24
HTT5	6	SB5/8X24		SB5/8X24		SSTB20	SB5/8X24	SSTB24	SB5/8X24
HD3B	6	SSTB16		SSTB24		SSTB16		SSTB16	SSTB20* (2,960)

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.

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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 holdown 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 holdown 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

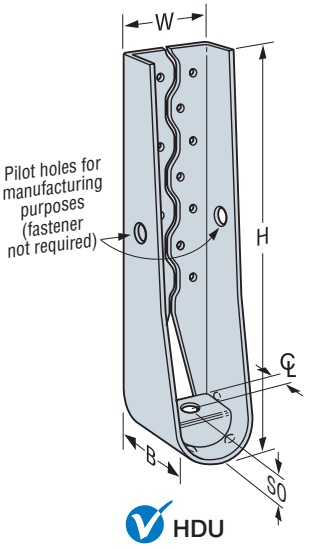
Material: See table

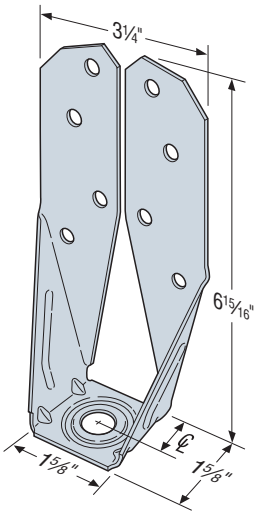
Finish: HDU — galvanized; DTT1Z and DTT2Z — ZMAX® coating; DTT2SS — stainless steel

Installation:

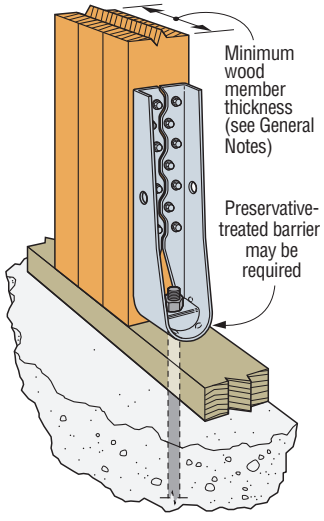
- See Holdown and Tension Tie General Notes on pp. 49–50.
- The HDU requires no additional washer; the DTT requires a standard-cut washer (included) be installed between the nut and the seat.
- Strong-Drive SDS Heavy-Duty Connector screws install best with a low-speed high-torque drill with a ⅜" hex-head 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

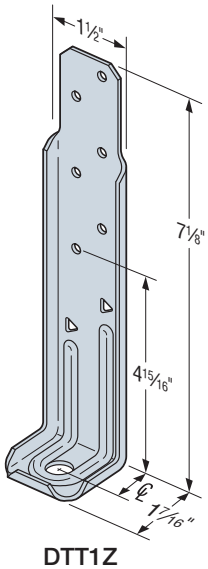




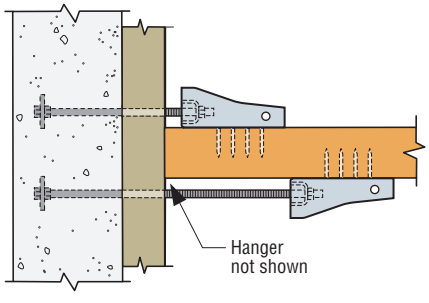
DTT2Z
US Patent
8,555,580



Vertical HDU Installation



DTT1Z
US Patent
10,865,558



Horizontal HDU Offset Installation
(plan view)
See Holdown and Tension Tie General Notes.

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HDU/DTT

Holdowns (cont.)

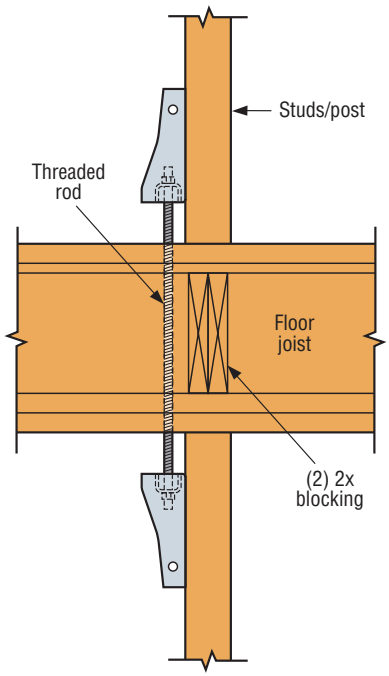
These products are available with additional corrosion protection. For more information, see p. 14.

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

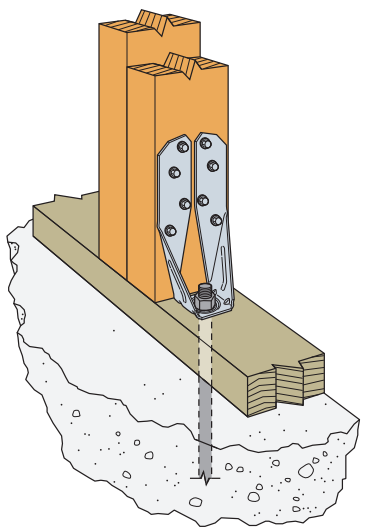
SD Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 348–352 for more information.

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	1½	7⅛	1⅞16	¾	⅜16	⅜	(6) #9 x 1½" SD	1½ x 5½	840	840	0.17	IBC, FL, LA
								(6) 0.148 x 1½		910	640	0.167	
								(8) 0.148 x 1½		910	850	0.167	
SS DTT2Z	14	3¼	6⅝16	1⅝	1¾16	⅜16	½	(8) ¼ x 1½ SDS	1½ x 3½	1,825	1,800	0.105	
								(8) ¼ x 1½ SDS	3 x 3½	2,145	1,835	0.128	
SS DTT2Z-SDS2.5								(8) ¼ x 2½ SDS	3 x 3½	2,145	2,105	0.128	
HDU2-SDS2.5	14	3	8⅛16	3¼	1⅝16	1⅜	⅝	(6) ¼ x 2½ SDS	3 x 3½	3,075	2,215	0.088	
HDU4-SDS2.5	14	3	10⅝16	3¼	1⅝16	1⅜	⅝	(10) ¼ x 2½ SDS	3 x 3½	4,565	3,285	0.114	
HDU5-SDS2.5	14	3	13¾16	3¼	1⅝16	1⅜	⅝	(14) ¼ x 2½ SDS	3 x 3½	5,645	4,340	0.115	
HDU8-SDS2.5	10	3	16⅝	3½	1⅜	1½	⅞	(20) ¼ x 2½ SDS	3 x 3½	6,765	5,820	0.11	
									3½ x 3½	6,970	5,995	0.116	
									3½ x 4½	7,870	6,580	0.113	
HDU11-SDS2.5	10	3	22¼	3½	1⅜	1½	1	(30) ¼ x 2½ SDS	3½ x 5½	9,535	8,030	0.137	
									3½ x 7¼	11,175	9,610	0.137	
HDU14-SDS2.5	7	3	25 11⁄16	3½	1⅞16	1⅞16	1	(36) ¼ x 2½ SDS	3½ x 5½	10,770	9,260	0.122	—
									3½ x 7¼	14,390	12,375	0.177	IBC, FL, LA
									5½ x 5½	14,445	12,425	0.172	

1. HDU14 requires heavy-hex anchor nut to achieve tabulated loads (supplied with holdown).
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

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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

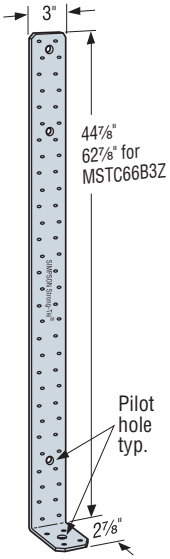
Finish: Galvanized. Some products available in ZMAX® coating; see Corrosion Information, pp. 12–15.

Codes: See p. 11 for Code Reference Key Chart

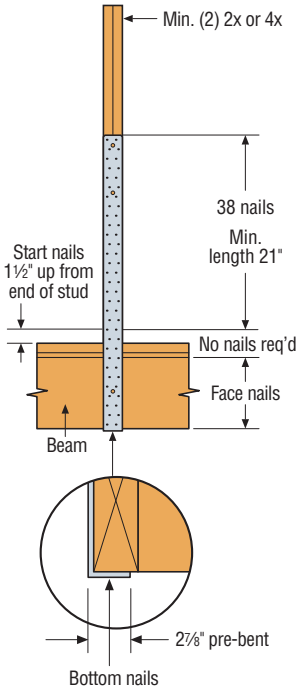
These products are available with additional corrosion protection. For more information, see p. 14.

Model No.	Min. Wood Beam Dimension (in.)		Fasteners (in.)			Allowable Tension Loads		Code Ref.
			Beam		Studs/ Post			
	Width (min.)	Depth (min.)	Face	Bottom		DF/SP (160)	SPF/HF (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	

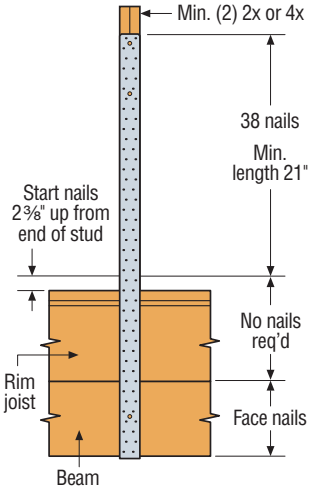
1. Using fewer than 38 nails in the studs/post will reduce the allowable load of the connection. To calculate a reduced allowable load, use 199 lb. per nail for DF/SP or 172 lb. per nail for HF/SPF. Minimum length of extent of reduced nails may not be less than 21" as is shown in graphic.
2. Nails in studs/post shall be installed symmetrically. Nails may be installed over the entire length of the strap in the studs/post.
3. The minimum 3"-wide beam may be made up of two 2x members.
4. MSTC48B3 and MSTC66B3Z installed over wood structural panel sheathing up to ½" thick achieve 0.85 of table loads.
5. PSL beam may be used in lieu of a standard-dimension lumber beam with no load reductions.
6. 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.
7. 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** for load reductions resulting from narrow-face installations.
8. **Fasteners:** Nail dimensions are listed diameter by length. See pp. 21–22 for fastener information.



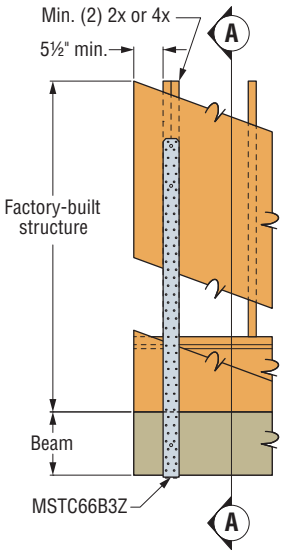
MSTC48B3



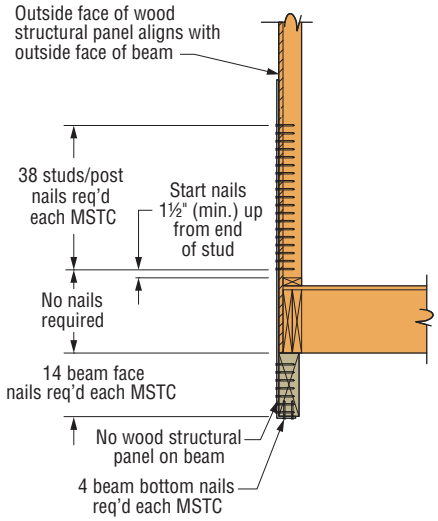
MSTC48B3 Installation with No Rim Board



MSTC66B3Z Installation with Rim Board



MSTC66B3Z Installation



Section A-A

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Strap Ties (cont.)

Codes: See p. 11 for Code Reference Key Chart

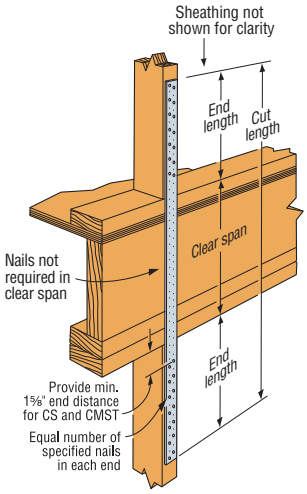
These products are available with additional corrosion protection. For more information, see p. 14.

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

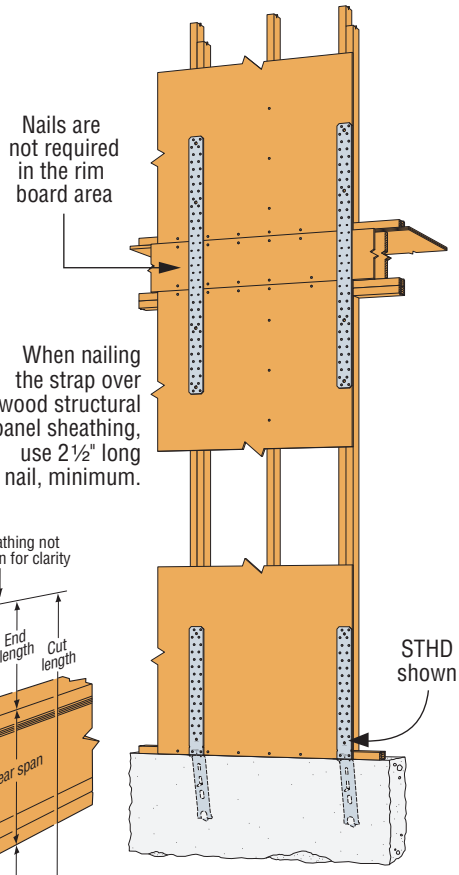
Floor to Floor Span Table

Model No.	Clear Span (in.)	Fasteners (Total) (in.)	Allowable Tension Loads (DF/SP) (160)	Allowable Tension Loads (SPF/HF) (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 3¼	1,150	995
	16	(16) 0.148 x 3¼	1,535	1,330
MSTC40	24	(20) 0.148 x 3¼	1,920	1,660
	18	(28) 0.148 x 3¼	2,690	2,325
	16	(32) 0.148 x 3¼	3,070	2,655
MSTC52	24	(36) 0.148 x 3¼	3,455	2,990
	18	(44) 0.148 x 3¼	4,225	3,650
	16	(48) 0.148 x 3¼	4,610	3,985
MSTC66	30	(48) 0.148 x 3¼	4,775	4,130
	24	(54) 0.148 x 3¼	5,375	4,645
	18	(64) 0.148 x 3¼	5,850	5,505
	16	(68) 0.148 x 3¼	5,850	5,850
MSTC78	30	(64) 0.148 x 3¼	5,850	5,505
	24	(72) 0.148 x 3¼	5,850	5,850
	18	(76) 0.148 x 3¼	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.



Floor-to-Floor Tie Installation Showing a Clear Span



Typical Detail with Strap Installed over Wood Structural Panel Sheathing

Model No.	Ga.	Dimensions (in.) W	Dimensions (in.) L	Fasteners (Total) Nails (in.)	Fasteners (Total) Bolts Qty.	Fasteners (Total) Bolts Dia.	Allowable Tension Loads (DF/SP) Nails (160)	Allowable Tension Loads (DF/SP) Bolts (160)	Allowable Tension Loads (SPF/HF) Nails (160)	Allowable Tension Loads (SPF/HF) Bolts (160)	Code Ref.
MST27	12	2⅛	27	(30) 0.162 x 2½	4	½	3,700	2,165	3,210	2,000	IBC, FL, LA
MST37		2⅛	37½	(42) 0.162 x 2½	6	½	5,070	3,030	4,495	2,800	
MST48		2⅛	48	(50) 0.162 x 2½	8	½	5,310	3,675	5,190	3,395	
MST60	10	2⅛	60	(68) 0.162 x 2½	10	½	6,730	4,490	6,475	4,150	
MST72		2⅛	72	(68) 0.162 x 2½	10	½	6,730	4,490	6,475	4,150	

1. See pp. 266–267 for Straps and Ties General Notes.
2. Install bolts or nails as specified by designer. Bolt and nail values may not be combined.
3. Allowable bolt loads are based on parallel-to-grain loading and minimum member thickness: MST – 2½".
4. 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.
5. **Fasteners:** Nail dimensions are listed diameter by length. See pp. 21–22 for fastener information.

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