LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

Structural Package for:

Maksimchuk Garage

7847 SE 40th St
Mercer Island, WA 98040

Project No: S230918-1

October 20, 2023

MANS R. THURFJELL
STATE OF WASHINGTON
44745
REGISTERED
PROFESSIONAL ENGINEER

STRUCTURAL ENGINEER
L120 ENGINEERING & DESIGN
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KIRKLAND, WA 98034
CONTACT: MANS THURFJELL, PE
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MTHURFJELL@L120ENGINEERING.COM

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DESIGN CRITERIA & STRUCTURAL NARRATIVE

Structural scope of work consists of new enclosed garage over what was previously a carport and existing foundation system.

The lateral design criteria was determined to be governed exclusively by wind loading. The analysis to determine lateral loading to the new garage was taken conservatively such that the existing residence's lateral force resisting system does not need to be altered.

See attached plans that show the design loading diagrams for lateral loading.

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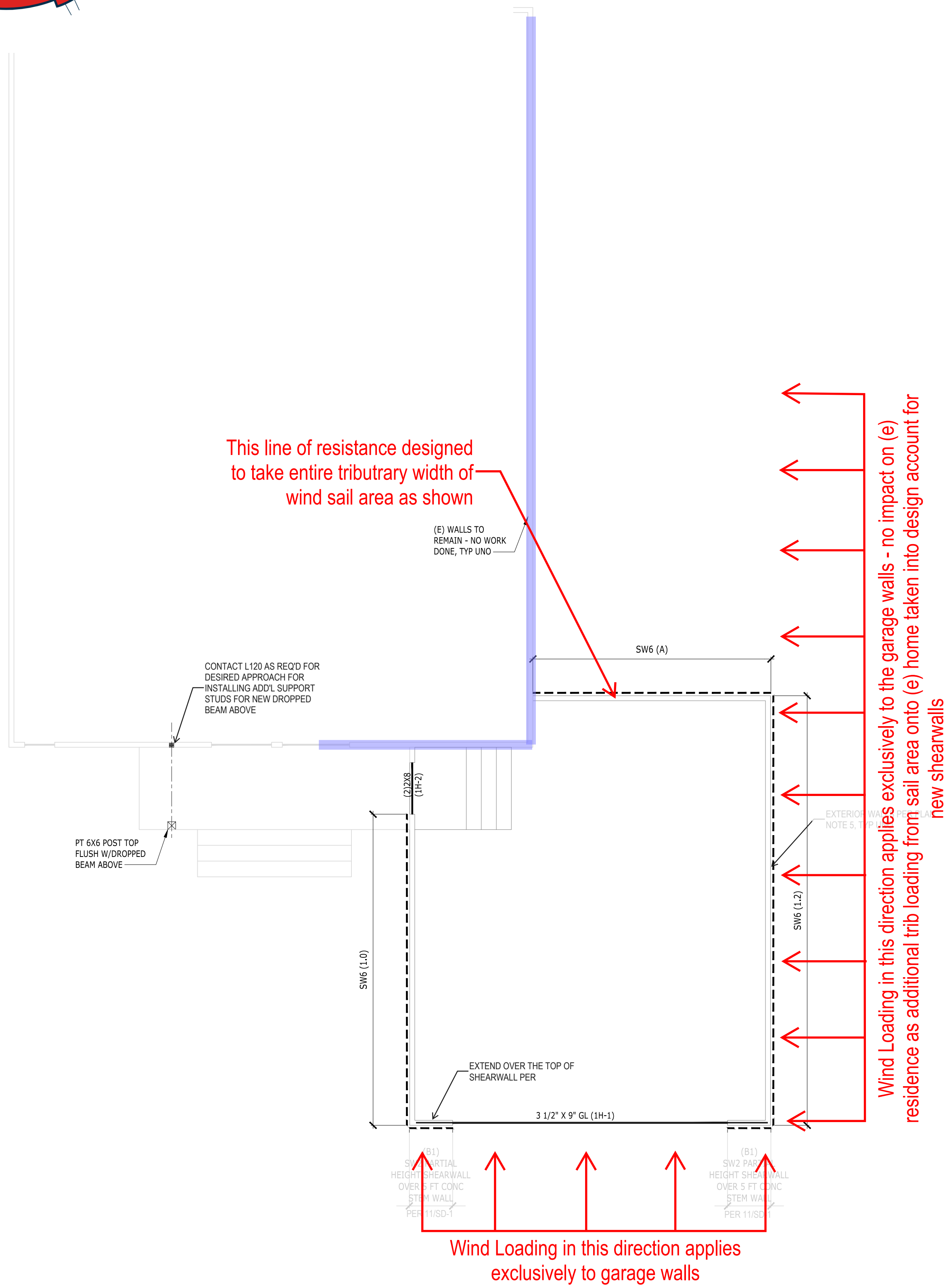
Represents assumed existing shearwall at existing residence



Main Floor Plan

Project Number:	Plan Name:	Sheet Number:
S230918-1	Maksimchuk Addition	DC
Engineer:	Specifics:	Date:
HK	Design Criteria	10/20/2023

Gravity Criteria: **BLUE** = Review and update as required - Typical Input Code: IBC 2018

ROOF SYSTEM		
Live Load:		
Snow	25.0	psf
Dead Load:		
Composite Roofing	2.0	psf
19/32" Plywood Sheathing	2.5	psf
Trusses at 24" o.c.	3.0	psf
Insulation	1.8	psf
(2) Layers 5/8" GWB	4.4	psf
Misc or Tile Roof	**1.3**	psf
Total	**15.0**	**psf**

FLOOR SYSTEM		
Live Load:		
Residential	40.0	psf
Dead Load:		
Flooring	3.0	psf
3/4" T & G Plywood	2.5	psf
Floor Joists at 16" o.c.	2.5	psf
Insulation	0.5	psf
(1) Layers 5/8" GWB	2.2	psf
Misc or Tile Flooring	**1.3**	psf
Total	**12.0**	**psf**

EXTERIOR WALL SYSTEM		
2x6 at 16" o.c.	1.7	psf
Insulation	1.0	psf
1/2" Plywood Sheathing	1.5	psf
(2) layers 5/8" GWB	4.4	psf
Misc or Brick Covered Wall	**3.4**	psf
Total	**12.0**	**psf**

INTERIOR WALL SYSTEM		
2x4 at 16" o.c.	1.1	psf
Insulation	0.5	psf
(2) Layers 5/8" GWB	4.4	psf
Misc	2.0	psf
Total	**8.0**	**psf**

SEISMIC PARAMETERS:

Code Reference:	ASCE 7-16	
R =	**6.5**	Bearing Wall System, Wood Structural Panel Walls
Mapped Spectral Acceleration, Ss =	**1.58**	
Mapped Spectral Acceleration, S1 =	**0.64**	
Soil Site Class =	**D**	

WIND PARAMETERS:

Code Reference:	ASCE 7-16	
Basic Wind Speed (3 second Gust) =	**100**	mph
Exposure :	**B**	
Kzt =	**1.60**	

SOIL PARAMETERS:

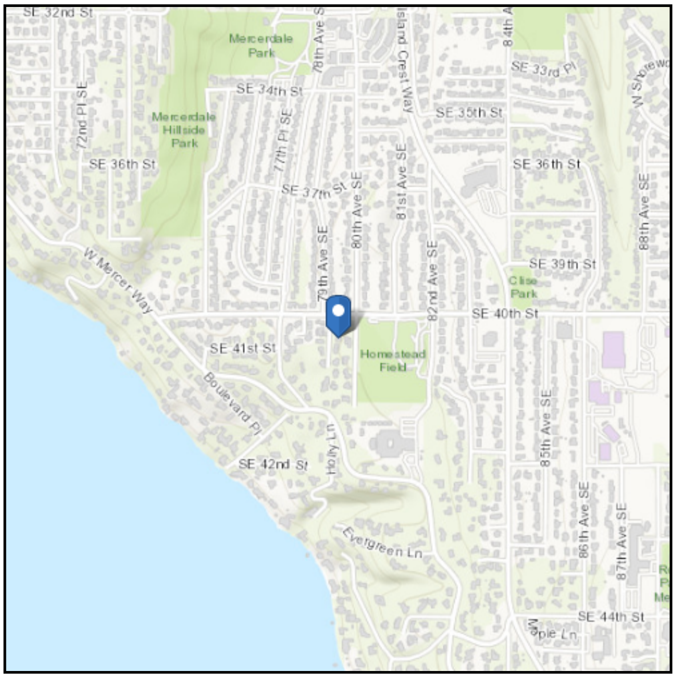
Soil Bearing Pressure =	**1,500**	psf	competent native soil or structural fill
1/3 increase for short-term wind or seismic loading is acceptable			
Frost Depth =	**18**	in	
Lateral Wall Pressures:			
Unrestrained Active Pressure =	**35**	pcf	Cantilevered walls
Restrained Active Pressure =	**50**	pcf	Plate Wall Design/Tank Walls
Passive Pressure =	**250**	pcf	
Soil Friction Coeff. =	**0.35**		

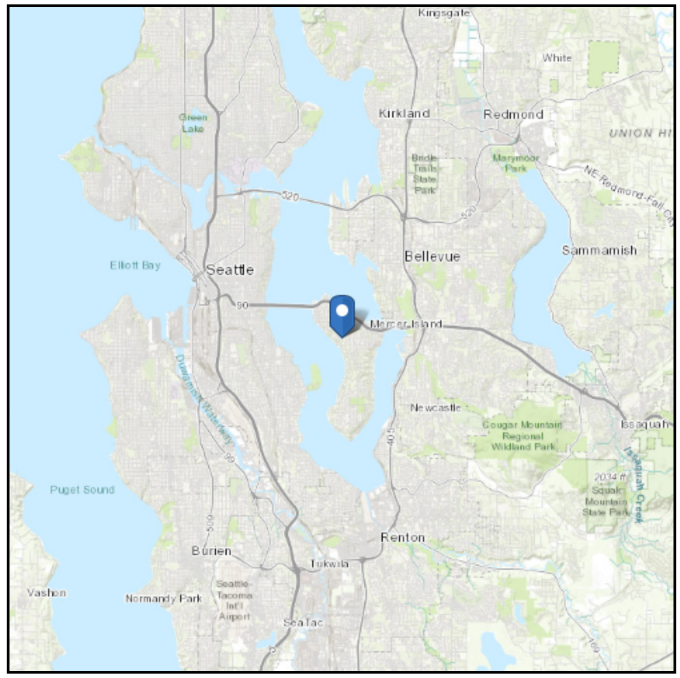
ASCE 7 Hazards Report

Address:
7847 SE 40th St
Mercer Island, Washington
98040

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: Default

Latitude: 47.573977
Longitude: -122.232992
Elevation: 193.89209466583293 ft (NAVD 88)





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
300-year MRI	92 Vmph
700-year MRI	98 Vmph
1,700-year MRI	105 Vmph
3,000-year MRI	109 Vmph
10,000-year MRI	118 Vmph
100,000-year MRI	136 Vmph
1,000,000-year MRI	154 Vmph

Data Source: ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Thu Oct 19 2023

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 7-22 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2.

Seismic   Default

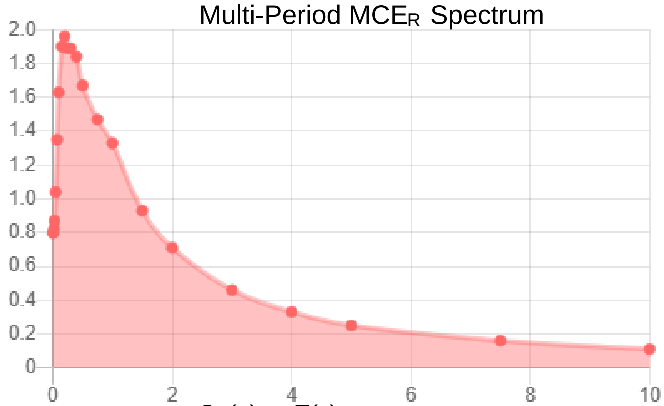
Site Soil Class:

Results:

PGA_M :	0.73	T_L :	6
S_{MS} :	1.76	S_S :	1.58
S_{M1} :	1.33	S_1 :	0.64
S_{DS} :	1.17	V_{S30} :	260
S_{D1} :	0.89		

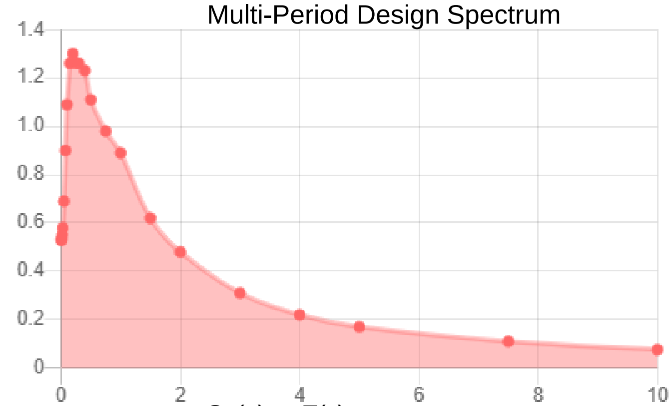
Seismic Design Category: D

Multi-Period MCE_R Spectrum



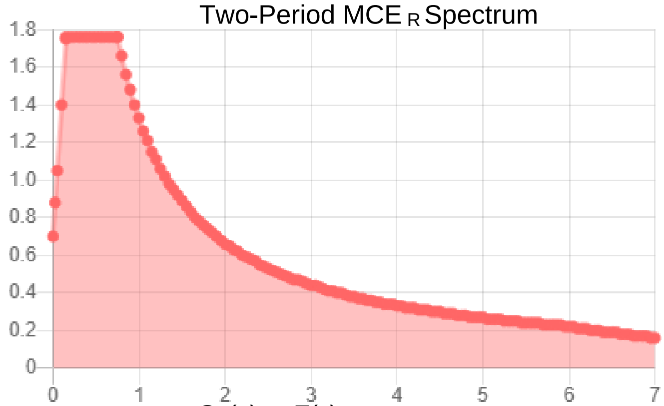
S_a(g) vs T(s)

Multi-Period Design Spectrum



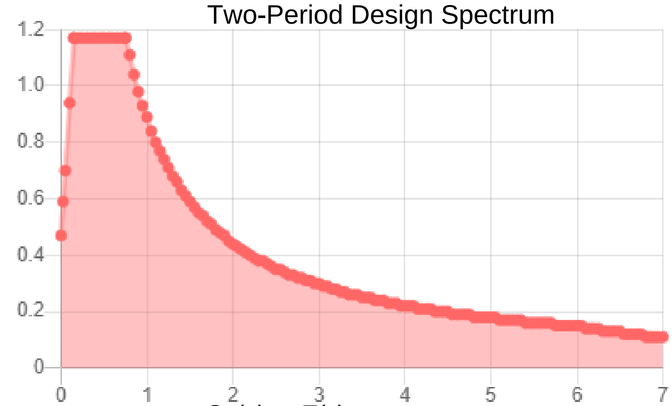
S_a(g) vs T(s)

Two-Period MCE_R Spectrum



S_a(g) vs T(s)

Two-Period Design Spectrum



S_a(g) vs T(s)

MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Thu Oct 19 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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

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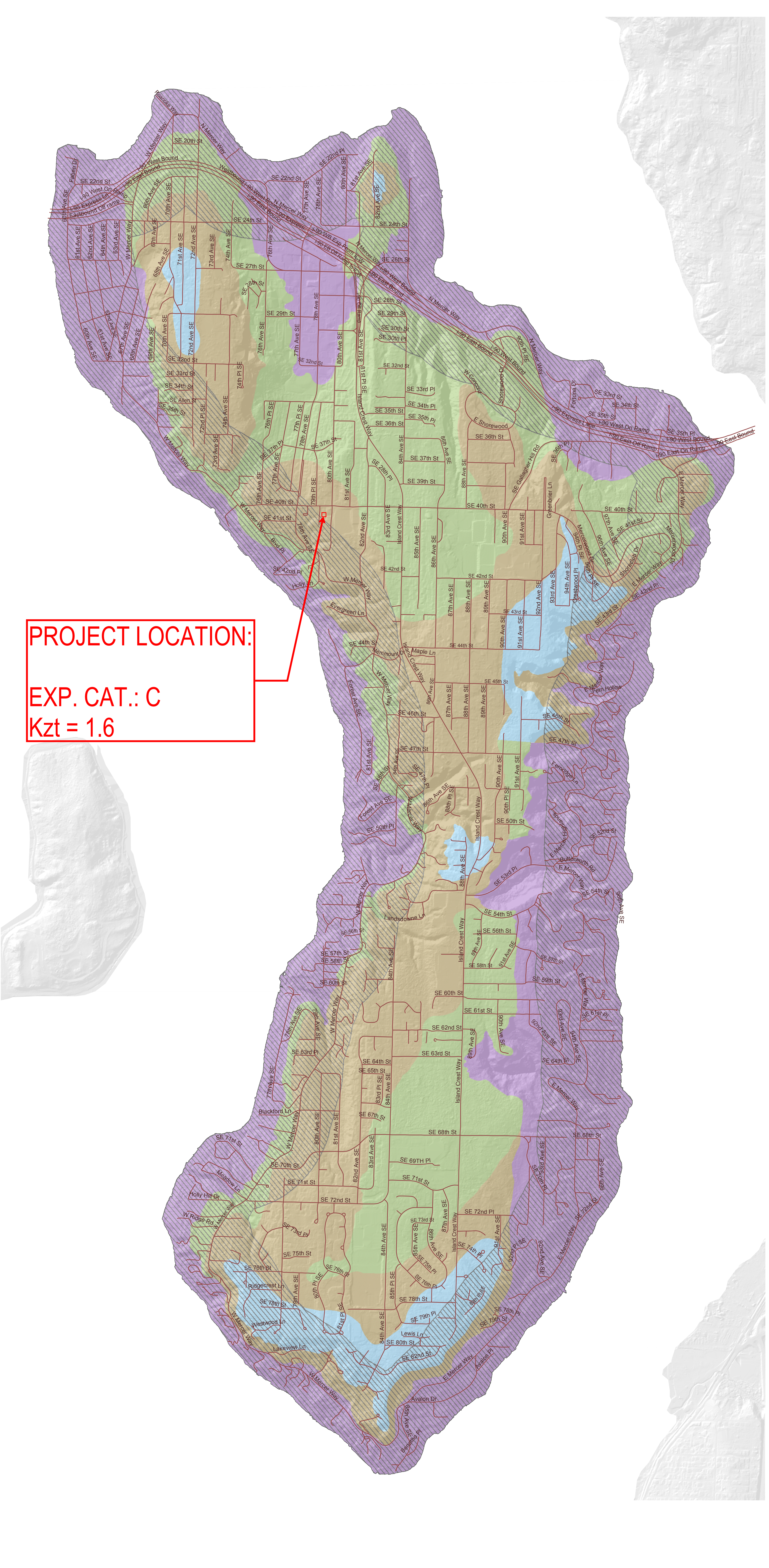
Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

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

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



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	
	$K_zt = 1.0$
	$K_zt = 1.3$
	$K_zt = 1.6$
	$K_zt = 1.9$

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer island. This map shows the minimum wind exposure category and the minimum wind speed-up, "K_zt" factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically indentified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

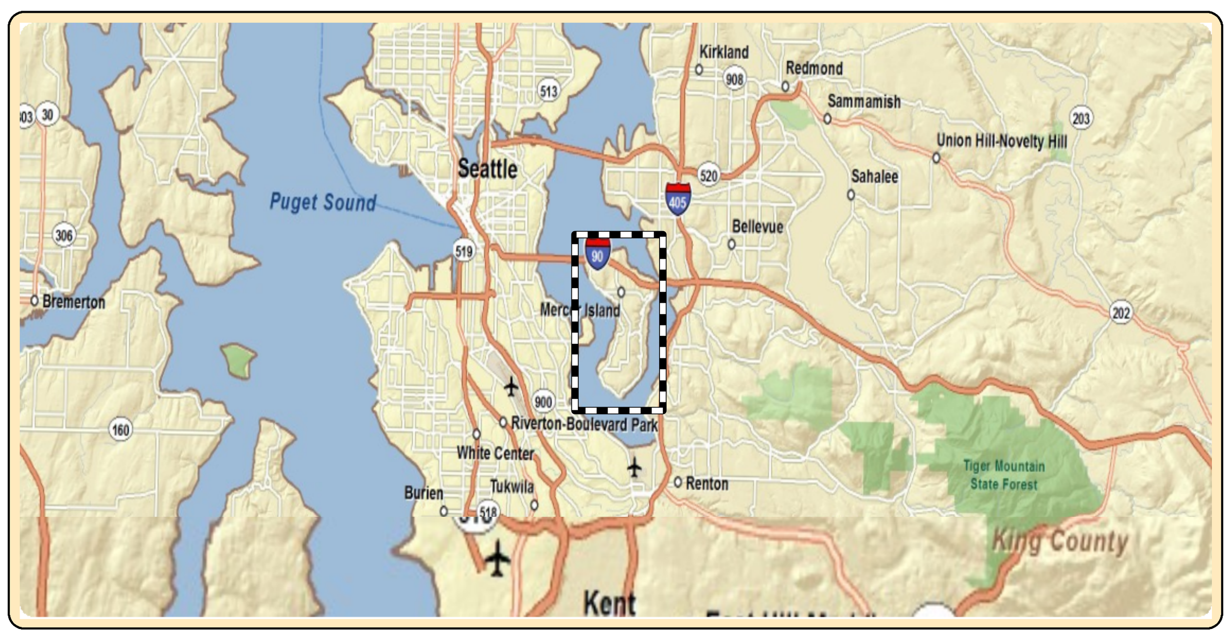
DEFINITIONS:

K_zt factor: The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.

Exposure B: The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.

Exposure C: The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.

Wind Speed: Minimum 85 mph 3-second gust per IRC Figure R301.2(4)



FRAMING CALCULATIONS

BEAM REFERENCE PER PLAN

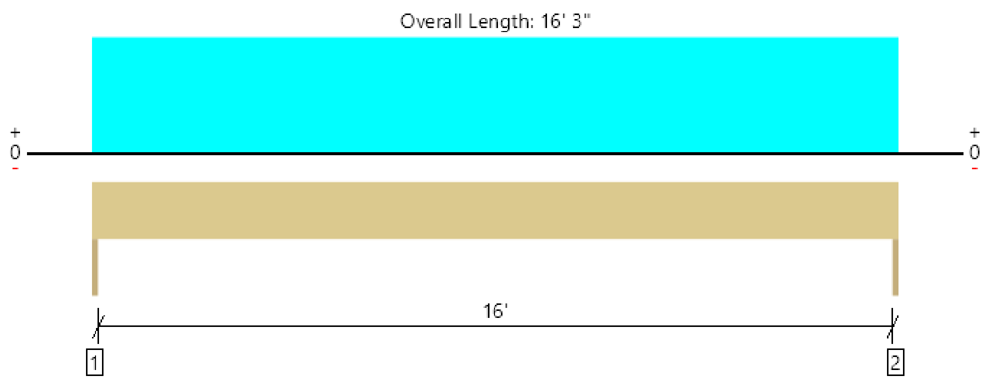
(425) 636 3313
L120Engineering.com

Maksimchuk Remodel

Roof and 1st Floor			
Member Name	Results	Current Solution	Comments
1H-1 (Garage Header)	Passed	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam	
RB-1 (Dropped Beam)	Passed	1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam	
1H-2	Passed	2 piece(s) 2 x 8 DF No.2	

Roof and 1st Floor, 1H-1 (Garage Header)

1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



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)	1048 @ 0	3413 (1.50")	Passed (31%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	936 @ 10 1/2"	6400	Passed (15%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	4259 @ 8' 1 1/2"	10125	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.307 @ 8' 1 1/2"	0.542	Passed (L/634)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.529 @ 8' 1 1/2"	0.813	Passed (L/369)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- A 6.8% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 16' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	439	609	1048	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	439	609	1048	None

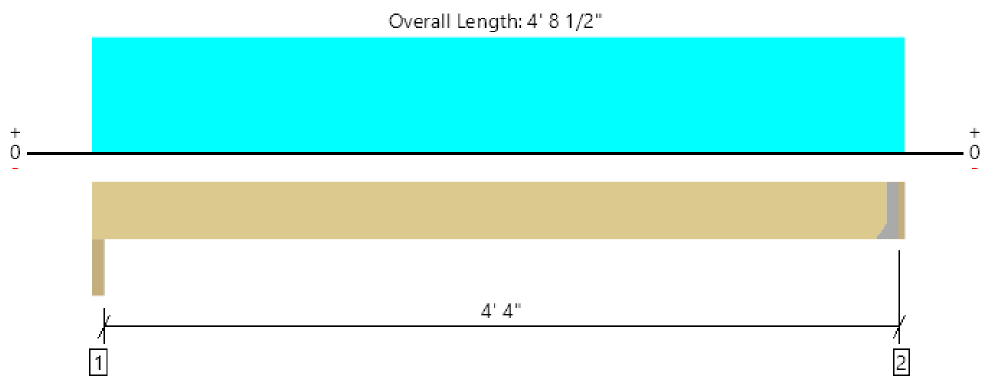
Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 16' 3"	N/A	7.7	--	
1 - Uniform (PSF)	0 to 16' 3"	3'	15.5	25.0	Roof Load

ForteWEB Software Operator	Job Notes
Harrison Kliegl L120 Engineering (425) 636-3313 hkliegl@l120engineering.com	

Roof and 1st Floor, RB-1 (Dropped Beam)

1 piece(s) 5 1/2" x 7 1/2" 24F-V4 DF Glulam



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)	1586 @ 4' 7"	5363 (1.50")	Passed (30%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1141 @ 3' 11 1/2"	8381	Passed (14%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	1767 @ 2' 4 1/4"	11818	Passed (15%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.011 @ 2' 4 1/4"	0.149	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.018 @ 2' 4 1/4"	0.223	Passed (L/999+)	--	1.0 D + 1.0 S (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).
- A 0.3% decrease in the moment capacity has been added to account for lateral stability.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 4' 5 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Column - HF	3.00"	3.00"	1.50"	674	1001	1674	None
2 - Hanger on 7 1/2" HF Ledger	1.50"	Hanger[1]	1.50"	673	1001	1673	See note [1]

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

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

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

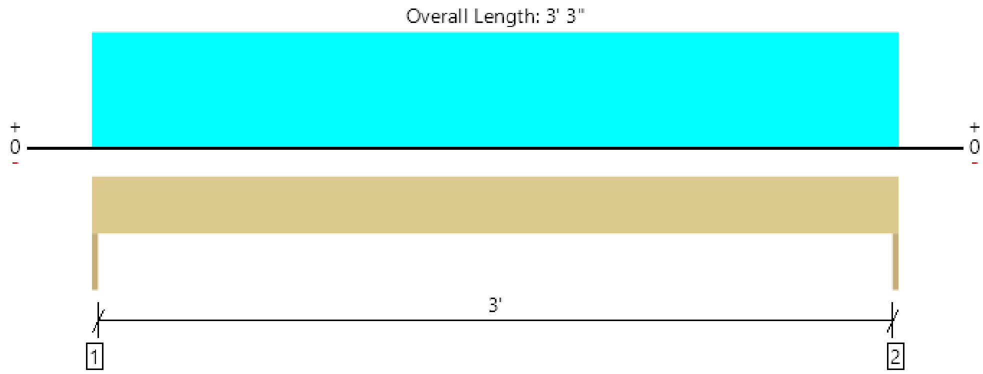
Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 4' 7"	N/A	10.0	--	
1 - Uniform (PSF)	0 to 4' 8 1/2" (Front)	17'	16.2	25.0	Roof Load

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Harrison Kliegl L120 Engineering (425) 636-3313 hkliegl@l120engineering.com	

Roof and 1st Floor, 1H-2

2 piece(s) 2 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)	1127 @ 0	2813 (1.50")	Passed (40%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	621 @ 8 3/4"	3002	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	915 @ 1' 7 1/2"	2667	Passed (34%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.007 @ 1' 7 1/2"	0.108	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.011 @ 1' 7 1/2"	0.162	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

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

- Deflection criteria: LL (L/360) and TL (L/240).
- A 2% decrease in the moment capacity has been added to account for lateral stability.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Trimmer - HF	1.50"	1.50"	1.50"	436	691	1127	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	436	691	1127	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	End Bearing Points	
Bottom Edge (Lu)	End Bearing Points	

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 3"	N/A	5.5	--	
1 - Uniform (PSF)	0 to 3' 3"	17'	15.5	25.0	Roof Load

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Harrison Kliegl L120 Engineering (425) 636-3313 hkliegl@l120engineering.com	

Weyerhaeuser

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

LATERAL CALCULATIONS

Lateral analysis determined to be governed by wind loading. Wind sail areas taken conservatively to load the garage walls as heavily as possible to prove adequacy and isolation of existing lateral system at main house.

Project Number:	Plan Name:	Sheet Number:
S230918-1	Maksimchuk Addition	DC
Engineer: HK	Specifics: Design Criteria	Date: 10/20/2023

Gravity Criteria: BLUE = Review and update as required - Typical Input   Code: IBC 2018

ROOF SYSTEM		
Live Load:		
Snow	25.0	psf
Dead Load:		
Composite Roofing	2.0	psf
19/32" Plywood Sheathing	2.5	psf
Trusses at 24" o.c.	3.0	psf
Insulation	1.8	psf
(2) Layers 5/8" GWB	4.4	psf
Misc or Tile Roof	1.3	psf
Total	**15.0**	**psf**

FLOOR SYSTEM		
Live Load:		
Residential	40.0	psf
Dead Load:		
Flooring	3.0	psf
3/4" T & G Plywood	2.5	psf
Floor Joists at 16" o.c.	2.5	psf
Insulation	0.5	psf
(1) Layers 5/8" GWB	2.2	psf
Misc or Tile Flooring	1.3	psf
Total	**12.0**	**psf**

EXTERIOR WALL SYSTEM		
2x6 at 16" o.c.	1.7	psf
Insulation	1.0	psf
1/2" Plywood Sheathing	1.5	psf
(2) layers 5/8" GWB	4.4	psf
Misc or Brick Covered Wall	3.4	psf
Total	**12.0**	**psf**

INTERIOR WALL SYSTEM		
2x4 at 16" o.c.	1.1	psf
Insulation	0.5	psf
(2) Layers 5/8" GWB	4.4	psf
Misc	2.0	psf
Total	**8.0**	**psf**

SEISMIC PARAMETERS:

Code Reference: ASCE 7-16
R = **6.5** Bearing Wall System, Wood Structural Panel Walls
Mapped Spectral Acceleration, Ss = **1.58**
Mapped Spectral Acceleration, S1 = **0.64**
Soil Site Class = **D**

WIND PARAMETERS:

Code Reference: ASCE 7-16
Basic Wind Speed (3 second Gust) = **100** mph
Exposure : **B**
Kzt = **1.60**

SOIL PARAMETERS:

Soil Bearing Pressure = **1,500** psf competent native soil or structural fill
1/3 increase for short-term wind or seismic loading is acceptable
Frost Depth = **18** in

Lateral Wall Pressures:
Unrestrained Active Pressure = **35** pcf Cantilevered walls
Restrained Active Pressure = **50** pcf Plate Wall Design/Tank Walls
Passive Pressure = **250** pcf
Soil Friction Coeff. = **0.35**

Project Number:	Plan:	Sheet Number:
S230918-1	**Maksimchuk Addition**	**L1**
Engineer:	Specifics:	Date
HK	**WIND FORCES**	**10/20/2023**

IBC 2018 Section 1609 → ASCE 7-16 Section 28.5 - Simplified Procedure → Main Wind-Force Resisting System

WIND DESIGN CRITERIA:

Basic Wind Speed, V_s =	100 mph		(ASCE 7-16, Section 26.5)
Exposure =	B		(ASCE 7-16, Section 26.7)

BUILDING DIMENSIONS:

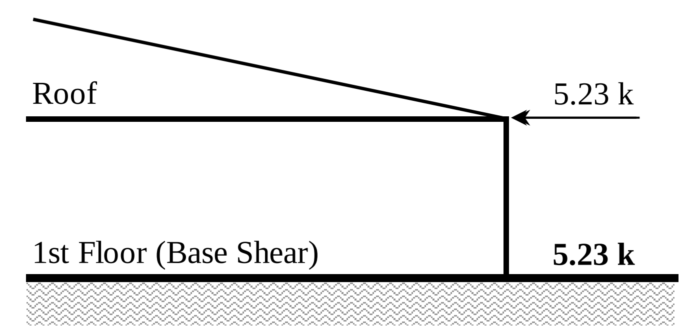
Roof Slope =	5.00 :12	= 22.62 degrees	
Loads From Front/Back - Width (ft)=	21.00 ft	Roof: Gable	
Loads From Side - Width (ft) =	25.00 ft	Roof: Hip	
Average Eave Height =	11.00 ft		
Mean Roof Ht. , h =	15.00 ft		(ASCE 7-16, Figure 27.5-2)
Edge Strip Width, a =	3 ft		(ASCE 7-16, Figure 28.5-1)
End Zone Width, 2a =	6.00 ft		(ASCE 7-16, Figure 28.5-1)

TOPOGRAPHIC DESIGN CONSIDERATIONS:

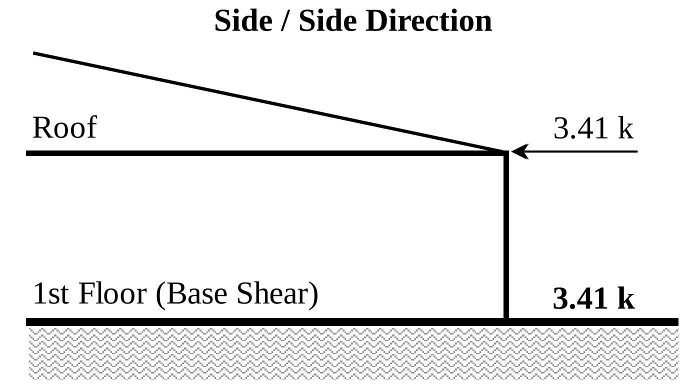
Topographic Factor , Kzt =	**1.60**	(ASCE 7-16, Section 26.8)
Adjustment Factor, λ =	1.00	(ASCE 7-16, Figure 28.5-1)

WIND LOAD SUMMARY:

Front / Back Direction



Side / Side Direction

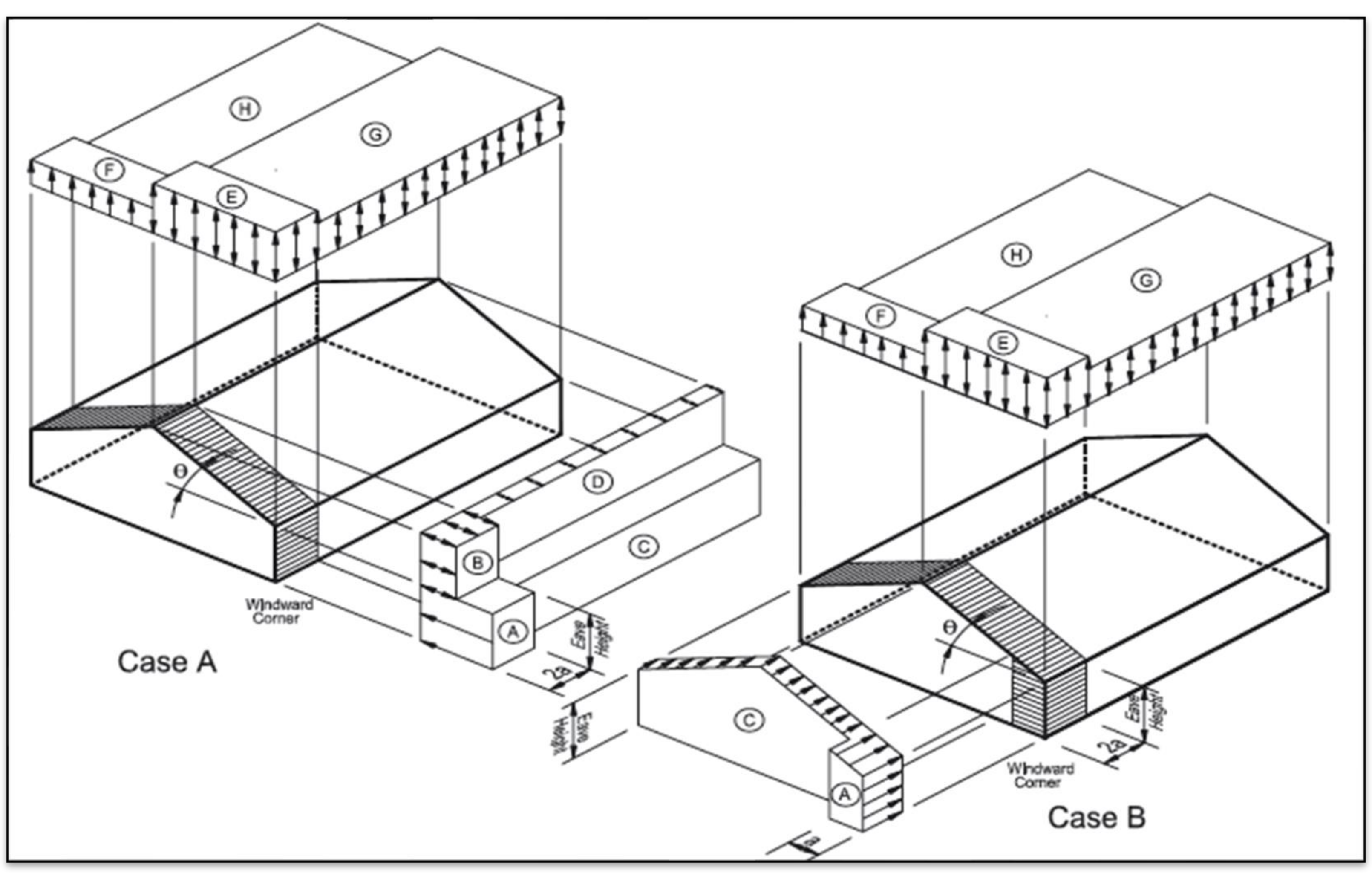


SIMPLIFIED DESIGN WIND PRESSURE, P_{S30} (psf)

(Exposure B at h = 30ft.)

Basic Wind Speed, Vs (mph)	Roof Angle (Degrees)	Load Case	ZONES*									
			Horizontal Pressure				Vertical Presssure				Overhang	
			A	B	C	D	E	F	G	H	E_{OH}	G_{OH}
100	22.62	A	19.90	3.20	14.40	3.30	-8.80	-12.00	-6.40	-9.70	-16.50	-14.00

* *Values Interpolated from Figure 28.5-1 ASCE 7-16*



Project Number:	Plan:	Sheet Number:
S230918-1	**Maksimchuk Addition**	**L1**
Engineer:	Specifics:	Date
HK	**WIND FORCES**	**10/20/2023**

IBC 2018 Section 1609 → ASCE 7-16 Section 28.5 - Simplified Procedure → Main Wind-Force Resisting System

HORIZONTAL LOADS (psf) $p_s = \lambda * Kzt * Ps30$				**MIN. LOADS (psf)** Per ASCE 7-16, 28.5	
End zone		Interior zone		Roof	Wall
A (Wall)	B (Roof)	C (Wall)	D (Roof)		
31.84	5.12	23.04	5.28	8.0	16.0

ASD WIND FORCES: FRONT / BACK LOADING DIRECTION

	Location	Width (ft)	Height (ft)	Plane	End Zone Length (ft)	End Zone Pressure (W) (psf)	Interior zone Length (ft)	Interior zone Pressure (W) (psf)	Force 0.6 ω*W (kips)	Min Force 0.6 ω*W (kips)
ROOF	"Height" of Roof to Plate (see note)	21.0	7.00	(roof)	6.0	31.84	15.0	23.04	2.93	0.92
	Plate to Mid 1st LVL	21.0	5.50	(wall)	6.0	31.84	15.0	23.04	2.30	1.44
								Σ =	5.23	2.36
								Total Wind Base Shear (kips)	5.23	2.36

ASD WIND FORCES: SIDE / SIDE LOADING DIRECTION

	Location	Width (ft)	Height (ft)	Plane	End Zone Length (ft)	End Zone Pressure (W) (psf)	Interior zone Length (ft)	Interior zone Pressure (W) (psf)	Force 0.6 ω*W kips	Min Force 0.6 ω*W kips
ROOF	"Height" of Roof to Plate (see note)	25.0	7.00	(roof)	6.0	5.12	19.0	5.28	0.72	1.09
	Plate to Mid 1st LVL	25.0	5.50	(wall)	6.0	31.84	19.0	23.04	2.70	1.72
								Σ =	3.41	2.81
								Total Wind Base Shear (kips)	3.41	2.81

Project Number:	Plan Name:	Sheet Number:
S230918-1	**Maksimchuk Addition**	**L2**
Engineer:	Specifics:	Date:
HK	**SEISMIC WEIGHTS**	**10/20/2023**

Unit Weights (psf)		
Roof:	15	psf
Floor:	12	psf
Exterior Wall:	12	psf
Interior Wall:	8	psf

Seismic Weights include: (REF §12.7)

25% of storage Live loads

Actual partition weight or 10 psf min if applicable

Operating weight of permenant equipment

20% of uniform design snow loads for areas where Pf > 30 psf

LEVEL	**ITEM**	**AREA / LENGTH**	**HEIGHT (ft)**	**UNIT WEIGHT (psf)**		**Item Total Weight. (lbs)**	**Level Sub-Total (kips)**	**Average Pressure (psf)**
ROOF								
	Roof	740	1.09	15	=	12,070		
	Ext. Wall Below	82	5.50	12	=	5,412		
	Corridor Wall Below	0	5.00	8	=	0		
							17	**24**

STRUCTURE WEIGHT FOR SEISMIC BASE SHEAR: **17** **kips**

TOTAL WEIGHT OF STRUCTURE: **17** **kips**
(Includes Basement Dead Load)

Project Number: S230918-1	Plan Name: **Maksimchuk Addition**	Sheet Number: L3
Engineer: **HK**	Specifics: **SEISMIC FORCES**	Date: **10/20/2023**

Equivelant Lateral Force Analysis per IBC 2018 1613.1 →ASCE 7-16 Table 12.6-1 →Sec 12.8

Data generated by: Seismic Design Values for Buildings **"Java Ground Motion Parameter Calculation"**

S_1 =	0.64		Maps
S_{DS} =	1.17		(ASCE 7 EQ 11.4.-3)
S_{D1} =	0.89		(ASCE 7 EQ 11.4.-4)
Seismic Importance Factor =	1.00		(ASCE 7 Table 11.5-1)
Seismic Design Category =	D		(ASCE 7 Table 11.6-1 & 11.6.2)
Response Modification Factor, R =	6.5		(ASCE 7 Table 12.2-1)
Seismic Force-Resisting System Description =	A.13 - light framed walls		
Building Height, h_n =	15.0	ft	
Building Period Coefficient, C_T =	0.020		(ASCE 7 Table 12.8.-2)
Approx. Fundamental Period, T_a =	0.152	$(C_{T*}(h_n{}^{0.75})$	(ASCE 7 EQ 12.8.-7)
Approx. Fundamental Period, T_L =	6.0	sec	(ASCE 7 11.4.5)

Seismic Response Coefficient

$C_s = S_{DS}/(R/I)$	C_s =	0.180		(ASCE 7 EQ 12.8.-2)

Seismic Response Coefficient, Maximum

$C_{s,\ MAX} = S_{D1}/(T{*}R/I)$	$C_{s,\ MAX}$ =	0.898	$T \le T_L$	(ASCE 7 EQ 12.8.-3)
$C_{s,\ MAX} = S_{D1}\ T_L/(T^2{*}R/$	$C_{s,\ MAX}$ =	NA	$T > T_L$	(ASCE 7 EQ 12.8.-4)

Seismic Response Coefficient, Minimum

$C_{s,\ MIN} = 0.01$	$C_{s,\ MIN}$ =	0.010		(ASCE 7 EQ 12.8.-5)
$C_{s,\ MIN} = 0.5\ S_1 / (R/I)$	$C_{s,\ MIN}$ =	0.049	if S1 > 0.6	(ASCE 7 EQ 12.8.-6)

C_s =	**0.180**		
Dead Load W =	17	kips	
V = Cs W =	3.1	kips	(ASCE 7 EQ 12.8.-1)
Q_E = V =	3.1	kips	(ASCE 7 EQ 12.4-3)
ρ =	1.0		(ASCE 7 12.3.4.2)
$E_H = \rho\ Q_E$ =	3.1	kips	(ASCE 7 EQ 12.4-3)
Ev = .2 S_{DS} D =	0.23	x D kips	

Factor for Alternate Basic Load conbinations - 2018 IBC

E_H/1.4 =	**2.2**	**kips**	IBC 2018 1605.3.2
k =	1		(ASCE 7 12.8.3)

VERTICAL DISTRIBUTION (Per ASCE 7 - 12.8.3)

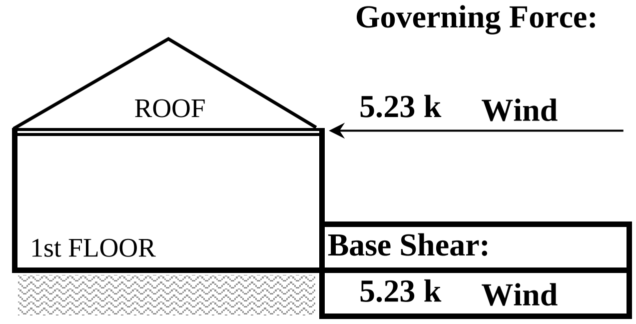
Floor	Area (ft^2)	Story Height H (ft)	Total Height h_x (ft)	Story Weight w_x (kips)	$w_x h_x{}^{\kappa}$ (k-ft)	Vert Dist Factor Cvx	Story Force Fx (kips)	Factored Story Force (ASD) Fx ρ/1.4 = E_H/1.4 (kips)
Roof	740	11.00	11.00	17	192	1.00	3.1	**2.2**
				Sum =	192	1.000	3.1	**2.2**

Project Number:	Plan Name:	Sheet Number:
S230918-1	**Maksimchuk Addition**	**L4**
Engineer:	**Specifics:**	**Date:**
HK	**DESIGN LOADS**	**10/20/2023**

FRONT / BACK APPLIED FORCES

Wind Force $0.6\ \omega * W_S$ (kips)		Seismic Force $E/1.4$ (kips)	
Per Level	Sum	Per Level	Sum
5.23		2.25	
	5.23		2.25
	5.23		2.25

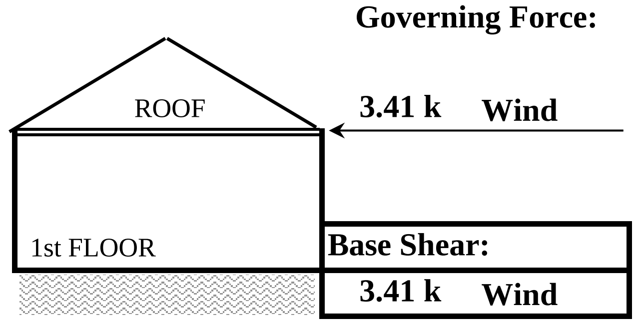
Governing Force:



SIDE / SIDE APPLIED FORCES

Wind Force $0.6\ \omega * W_S$ (kips)		Seismic Force $E/1.4$ (kips)	
Per Level	Sum	Per Level	Sum
3.41		2.25	
	3.41		2.25
	3.41		2.25

Governing Force:



Project Number:	Plan Name:	Sheet Number:
S230918-1	Maksimchuk Addition	L5
Engineer:	Specifics:	Date:
HK	Shear walls	10/20/2023

Notes:

* All walls designed with Force-Transfer should meet a minimum height to width ratio of 2:1 at Pier (SDPWS 2018, Table 4.3.4)

* Maximum allowed height to width ratio 3.5:1 for walls w/o openings (increased shear design values per SDPWS 2018, Table 4.3.4)

* Shear panel height is height to underside or roof or floor framing.

RED = Update Formula as required - Important
BLUE = Review and update as required - Typical Input

2nd Story Walls (Front - Back Direction)

Stud Species HF

"Adjusted" Story shear(kips) = **5.23**
Story height (ft) = 11.00
Shear Panel height (ft) = 11.00
Total Diaphragm width (ft) = **21.00**

Governing Force (F/B Direction) = **Wind**
Dead load factor (F/B Direction) = **0.67** IBC 2018 Equation 16-18

load balance check = OK

2nd Story Walls (Front - Back Direction)
Hold downs and window straps

Story	**Wall Mark**	Wall L(ft)	Opening Width (ft)	Opening Height (ft)	Opening (max) to Edge (ft)	Plate to Opening (ft)	**Effective Length (ft)**	Trib. Width (ft)	Percent Sharing (%)	**Effective Trib. Width**	Story V(kips)	**Sum V(kips)**	Panel Shear (plf)	Height/Width Reduction (%) R = 2*L/H	**Design Panel Shear (plf)**	**Wall Type**	**Roof Trib (ft)**	Story DL(klf)	Sum DL(klf)	OTM (k-ft)	RM (k-ft)	Resultant HD(kips)	HD TYPE	HD/Strap to DF or HF?	HD location Edge/Interior?	**Resultant HD**	Force at Window (Kips)	Window Strap
1	**1.0**	17.00					17.00	10.50	1.00	10.50	2.62	**2.62**	154	1.00	**154**	**SW6**	10.00	0.28	0.28	28.8	27.3	0.09	flr-conc	HF	Edge	**No HD**	0.00	**No strap**
1	**2.0**	25.00					25.00	10.50	1.00	10.50	2.62	**2.62**	105	1.00	**105**	**SW6**	10.00	0.28	0.28	28.8	59.0	-1.24	flr-conc	HF	Edge	**No HD**	0.00	**No strap**
	S =	42.00				Total OSB wall length = (feet)	42.00		S =	21.00	5.23	**5.23**	**OK**	Total OSB Capacity (kips)	5.23													

Project Number:	Plan Name:	Sheet Number:
S230918-1	**Maksimchuk Addition**	**L6**
Engineer:	Specifics:	Date:
HK	**Shear walls**	**10/20/2023**

Notes:

* All walls designed with Force-Transfer should meet a minimum height to width ratio of 2:1 at Pier (SDPWS 2018, Table 4.3.4)
* Maximum allowed height to width ratio 3.5:1 for walls w/o openings (increased shear design values per SDPWS 2018, Table 4.3.4)
* Shear panel height is height to underside or roof or floor framing.

RED = Update Formula as required - Important
BLUE = Review and update as required - Typical Input

2nd Story Walls (Side / Side Direction)

Stud Species HF

2nd Story Walls (Side / Side Direction)
Hold downs and window straps

"Adjusted" Story shear(kips) =	**3.41**
Story height (ft) =	11.00
Shear Panel height (ft) =	11.00
Total Diaphragm width (ft) =	**25.00**

100% story shear
YES

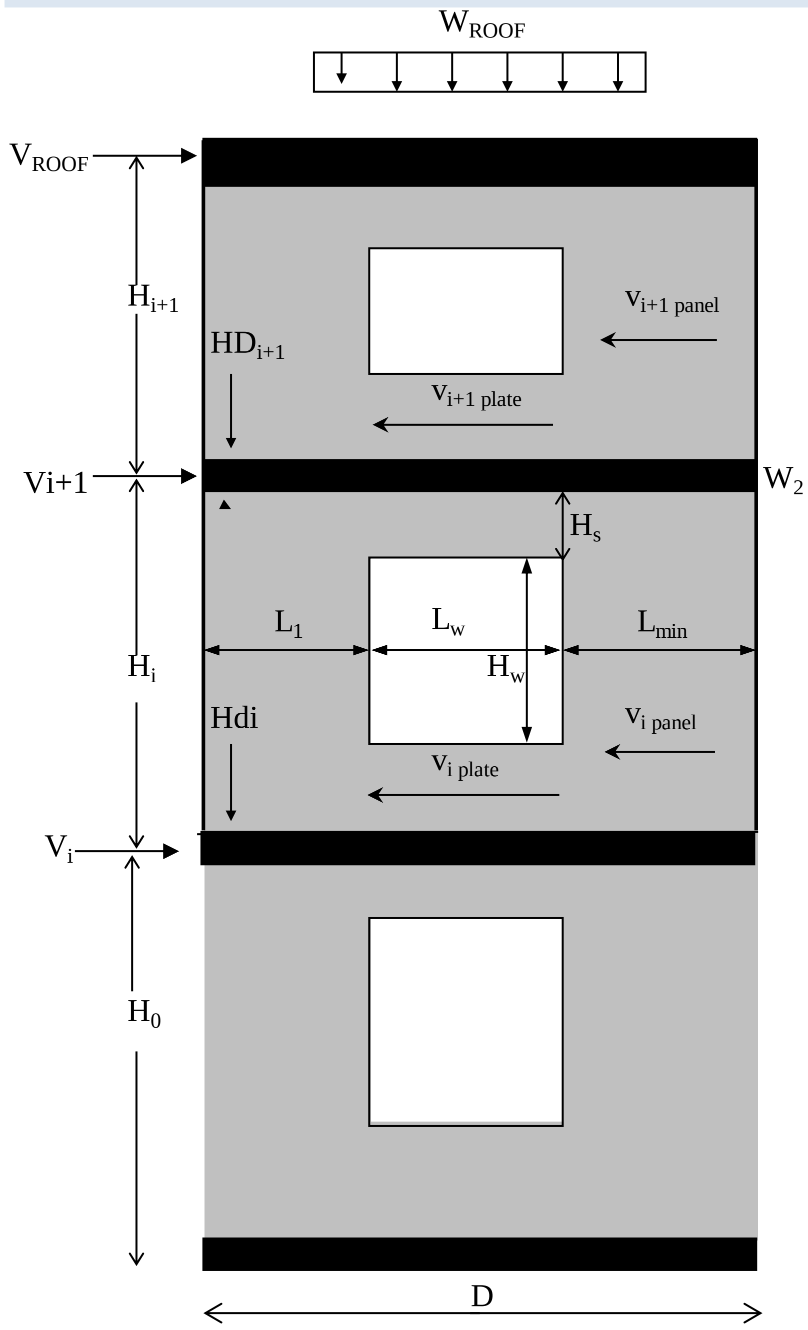
Governing Force (F/B Direction) =	**Wind**	
Dead load factor (F/B Direction) =	**0.67**	IBC 2018 Equation 16-18

load balance check = Warning-Wall loads do not match story shear

Story	**Wall Mark**	Wall L(ft)	Opening Width (ft)	Opening Height (ft)	Opening (max) to Edge (ft)	Plate to Opening (ft)	**Effective Length (ft)**	Trib. Width (ft)	Percent Sharing (%)	**Effective Trib. Width**	Story V(kips)	**Sum V(kips)**	Panel Shear (plf)	Height/Width Reduction (%) R = 2*L/H	**Design Panel Shear (plf)**	**Wall Type**	**Roof Trib (ft)**	Story DL(klf)	Sum DL(klf)	OTM (k-ft)	RM (k-ft)	Resultant HD(kips)	HD/Strap to DF or HF?	HD location Edge/Interior?	HD TYPE	**Resultant HD**	Force at Window (Kips)	Window Strap
1	**A1**	13.75					13.75	20.00	1.00	20.00	2.73	**2.73**	199	1.00	**199**	**SW6**	2.00	0.16	0.16	30.0	10.3	1.49	HF	Edge	flr-conc	**STHD14**	0.00	**No strap**
1	**B1**	2.50					2.50	12.50	0.50	6.25	0.85	**0.85**	341	N/A		HALF-HEIGHT CONCRETE WALL								HALF-HEIGHT CONCRETE WALL				
1	**B2**	2.50					2.50	12.50	0.50	6.25	0.85	**0.85**	341	N/A		HALK-HEIGHT CONCRETE WALL								HALK-HEIGHT CONCRETE WALL				
	S =	18.75				Total OSB wall length = (feet)	18.75		S =	32.50	4.44	**4.44**	**Warning-W**	Total OSB Capacity (kips)	**3.41**													

Project	sheet number:
Maksimchuk Addition	**L7**
Subject	Date
SHEAR WALL EQUATION DIAGRAM	**10/20/2023**

SHEAR WALL WITH WINDOW BASED ON SHEAR TRANSFER:



Where:

- V_i = Story Shear
- W_i = Story Dead Load
- HD_i = Story Holdown
- M_{OTi} = Story Over Turning Moment
- M_{Ri} = Story Resisting Moment

$M_{OT\ ROOF} = V_{ROOF} \text{ x } H_{1+1}$

$M_{OTi} = [(V_{i+1} + V_{ROOF}) \text{ x } H_i] + M_{OT\ ROOF}$

$M_{R\ ROOF} = 0.6 \text{ x } W_{ROOF} \text{ x } D^2/2$

$M_{Ri} = 0.6 \text{ x } (W_{i+1} + W_{ROOF}) \text{ x } D^2/2$

$HD_{i+1} = (M_{OT\ ROOF} - M_{R\ ROOF})/(D - 6")$

$HD_i = (M_{OTi} - M_{R1i})/(D - 6")$

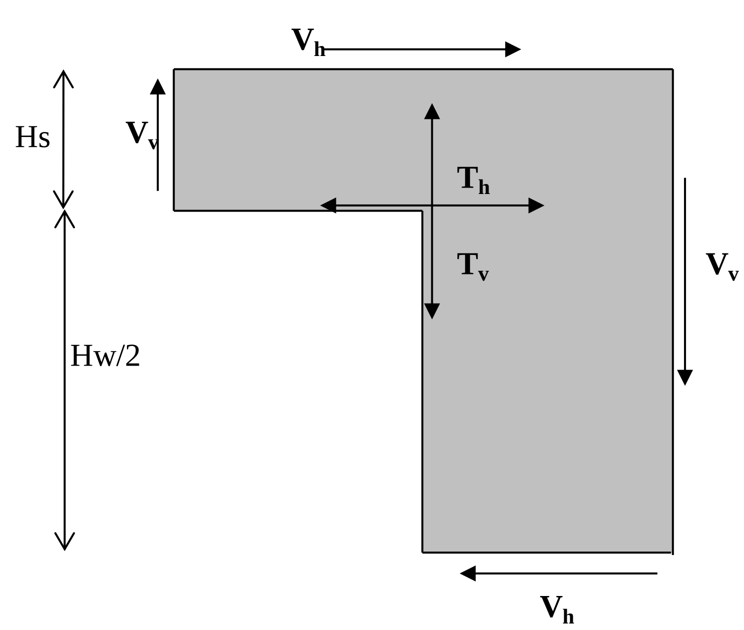
$V_{i+1\ panel} = V_{ROOF} / (L_1 + L_{max})$

$V_{i\ panel} = (V_{ROOF} + V_{i+1}) / (L_1 + L_{max})$

$V_{i+1\ plate} = V_{ROOF} / D$

$V_{i\ plate} = (V_{ROOF} + V_{i+1}) / D$

FORCE TRANSFER AROUND WINDOW CALCULATION (CANTILEVER PIER METHOD)



$V_h = v_{i\ panel} \text{ x } L_{max}$

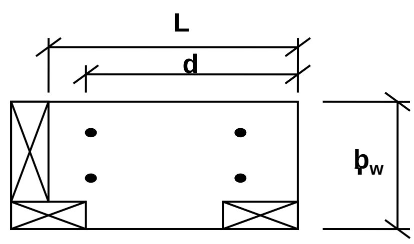
$V_v = HD_i$

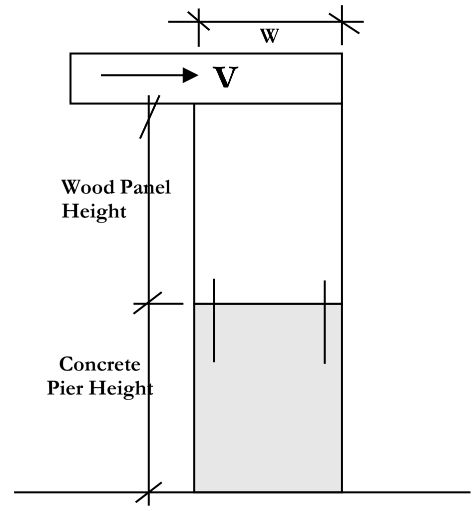
$T_h = V_h (H_w / 2 + H_s) / H_s$

T_v = Is resisted by the continuous stud adjacent to the window.

Project Number: S230918-1	Plan Name: Maksimchuk Addition	Sheet Number: L9
Engineer: HK	Specifics: 1/2 Height concrete wall	Date: 10/20/2023

W	=	30	in
H	=	11	ft
L	=	29	in
b_w	=	8	in
f'_c	=	2500	psi
DL	=	200	plf
Force	=	Wind	
Load Factor	=	0.67	
Conc. Height	=	5	ft
Wood Height	=	6	ft
F_y	=	40	ksi





Rebar Design:

Bar Size	=	4		Diameter	=	1	jn
Number of Bars	=	2	(Each Side)	A_s	=	0	jn^2
Cover	=	2	in	d	=	27	in

Concrete Design:

$\phi V_c = \phi\, 2\, f'_c\, b_w\, d$	=	18.2	k	where:	f	=	0.85	
$\phi M_N = \phi A_s F_y (d - a/2)$	=	29.8	k-lbs		$a = \dfrac{A_s F_y}{0.85\, f'_c\, b_w}$	=	0.94	in

For ASD Loads:

fV_c	=	13.0	k
fM_N	=	21.3	k-lbs

Wood Design:

Panel Shear: (Single sided shearwall with 7/16" sheathing and 2" O.C. nailing ansd (2) 5/8" A.B.)

$V = (595)W$ 1488 lb

* 595 = Capacity for shearwall (plf)

Controlling Shear Load

1488 lbs

Use:

Holdown Design:

STHD14 = 4165 lbs (Max Capacity)

$R_m = \phi\, DL\, W^2/2$	=	5025	in-lbs
$V = \dfrac{5025(W - 6.5) + R_m}{h}$	=	1710	lbs

(2) 5/8 in A.B.
(2) STHD14 Holdowns
7/16" Ply Single Side
Nailing at 2" O.C.

Load Summary

Concrete	fV_c	=	12993	lbs
	fM_N	=	1934	lbs
Wood	Panel	=	1488	lbs
	Holdown	=	1710	lbs

LONGITUDE
ONE TWENTY°
ENGINEERING & DESIGN

FOUNDATION CALCULATIONS

FOOTING REFERENCE PER PLAN

(425) 636 3313
L120Engineering.com

Project: Foundation calculations - 1500 psf

Location: 16" continous footing (max loading) - bearing Footing

StruCalc 9.0

page / of

Footing Size: 16.0 IN Wide x 8.0 IN Deep Continuous Footing With 8.0 IN Thick x 18.0 IN Tall Stemwall
LongitudinalReinforcement: (2) Continuous #4 Bars
TransverseReinforcement: #4 Bars @ 12.00 IN. O.C. (unnecessary)
Section Footing Design Adequate

FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs =	1500	psf
Concrete Compressive Strength:	F'c =	2500	psi
Reinforcing Steel Yield Strength:	Fy =	40000	psi
Concrete Reinforcement Cover:	c =	3	in

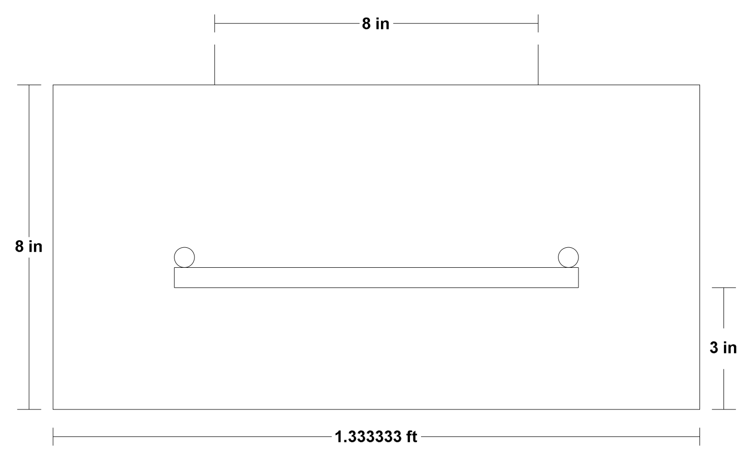
FOOTING SIZE

Width:	W =	16	in
Depth:	Depth =	8	in
Effective Depth to Top Layer of Steel:	d =	4.25	in

STEMWALL SIZE

Stemwall Width:	8	in
Stemwall Height:	18	in
Stemwall Weight:	150	pcf

LOADING DIAGRAM



FOOTING LOADING

Live Load:	PL =	1000	plf
Dead Load:	PD =	700	plf
Total Load:	PT =	1850	plf
Ultimate Factored Load:	Pu =	2620	plf

FOOTING CALCULATIONS

Bearing Calculations:

Ultimate Bearing Pressure:	Qu =	1388	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1400	psf
Width Required:	Wreq =	1.32	ft

Beam Shear Calculations (One Way Shear):

Beam Shear:	Vu1 =	0	lb
Allowable Beam Shear:	Vc1 =	3825	lb

Transverse Direction:

Bending Calculations:

Factored Moment:	Mu =	1310	in-lb
Nominal Moment Strength:	Mn =	0	in-lb

Reinforcement Calculations:

Concrete Compressive Block Depth:	a =	0.30	in
Steel Required Based on Moment:	As(1) =	0.01	in2
Min. Code Req'd Reinf. Shrink./Temp. (ACI-10.5.4)	As(2) =	0.19	in2
Controlling Reinforcing Steel:	As-reqd =	0.19	in2
Selected Reinforcement:	Trans: #4's @ 12.0 in. o.c.		
Reinforcement Area Provided:	As =	0.19	in2

Development Length Calculations:

Development Length Required:	Ld =	15	in
Development Length Supplied:	Ld-sup =	1	in

Longitudinal Direction:

Reinforcement Calculations:

Min. Code Req'd Reinf. Shrink./Temp. (ACI-10.5.4):	As(2) =	0.26	in2
Controlling Reinforcing Steel:	As-reqd =	0.26	in2
Selected Reinforcement:	Longitudinal: (2) Cont. #4 Bars		
Reinforcement Area Provided:	As =	0.39	in2

Loading Demand on Existing Footing:

Roof = (15 psf * 12ft)D + (25 psf * 12 ft)S

Wall Load = 100 plf D

$W_{TOT\ (ASD)}$ = (280 PLF)D + (300 PLF)S
$W_{TOT\ (LRFD)}$ = 1.2(280) + 1.6(300)S = 816 PLF < 2620 PLF

DCR = 0.31, THEREFORE EXISTING FOOTING DESIGN OK ASSUMING 16"W X 8" DP

General Footing

DESCRIPTION: 16" (non retaining) stemwall footing - max point load (1500psf)

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	=	2.5 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	=	1.0 ft
Allow press. increase per foot of depth	=	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

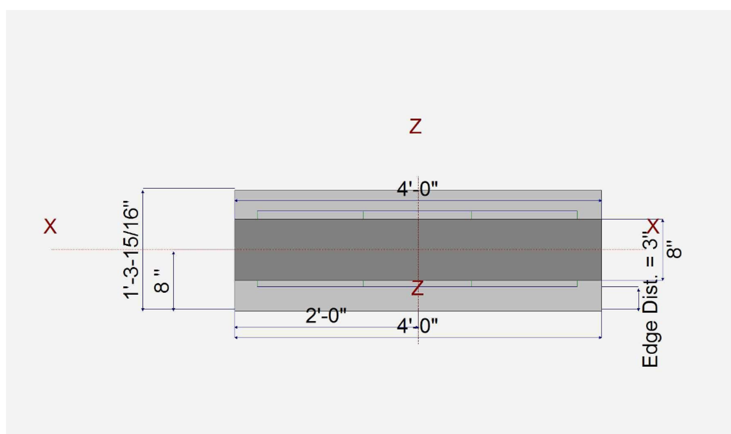
Width parallel to X-X Axis	=	4.0 ft
Length parallel to Z-Z Axis	=	1.330 ft
Footing Thickness	=	8.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	48.0 in
pz : parallel to Z-Z Axis	=	8.0 in
Height	=	18.0 in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0 in



Reinforcing

Bars parallel to X-X Axis

Number of Bars	=	2.0
Reinforcing Bar Size	=	# 4

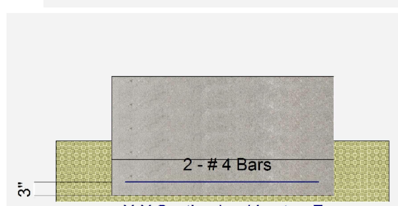
Bars parallel to Z-Z Axis

Number of Bars	=	4.0
Reinforcing Bar Size	=	# 4

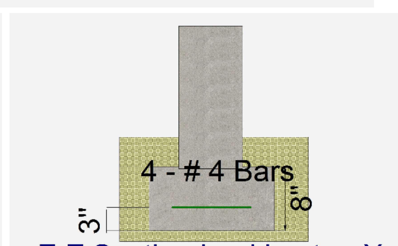
Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	Bars along Z-Z Axis
# Bars required within zone	49.9 %
# Bars required on each side of zone	50.1 %



X-X Section Looking to +Z



Z-Z Section Looking to +X

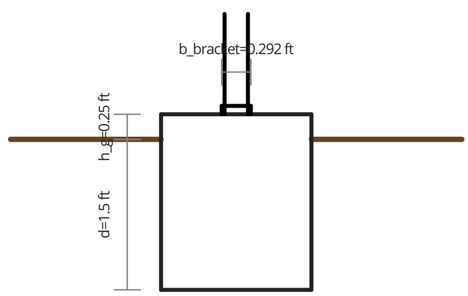
Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.0		4.30					k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

Client:		**Date:**	Jun 3, 2022
Author:	Harrison Kliegl	**Job #:**	
Project:	Footing Checks	**Subject:**	**18" Sonotube (1500 psf)** PASS
References:	IBC 2021, ACI 318-19		

Summary

Utilization	Item	Value	Reference
	Lateral Soil Stress at 1/3 of Embedment Depth	$S_1' = 0\ \mathrm{psf}$	IBC 2021, Cl 1807.3.2.1
0%	Allowable Lateral Soil Stress	$S_a = 50\ \mathrm{psf}$	
	Gross Vertical Bearing Pressure	$q_s = 1500\ \mathrm{psf}$	
100%	Allowable Vertical Bearing Pressure	$q_a = 1500\ \mathrm{psf}$	
1%	Pier Compression and Bending Capacity	$\mathrm{Int} = 0.0135$	ACI 318-19, Cl 14.5.4.1
	Shear Demand	$V_u = 0\ \mathrm{lb}$	
0%	Pier Shear Strength	$\phi V_n = 11\,500\ \mathrm{lb}$	ACI 318-19, Cl 14.5.5
	Ultimate Bearing Load	$P_u = 3090\ \mathrm{lb}$	
10%	Pier Bearing Capacity	$\phi B_n = 31\,200\ \mathrm{lb}$	



Pier Properties

Pier Diameter	$b = 18\ \mathrm{in}$	
Embedment Depth	$d = 1.5\ \mathrm{ft}$	
Height of Pier Above Ground	$h_g = 0.25\ \mathrm{ft}$	
Total Pier Length	$L_{pier} = 1\ \mathrm{ft},\ 9\ \mathrm{in}$	
Lateral Constraint at Ground Surface	Nonconstrained	IBC 2021, Cl 1807.3.2

Concrete Properties

Concrete Strength	$f_c' = 2500\ \mathrm{psi}$	ACI 318-19 Table 19.2.1.1
Concrete Weight Classification	Normalweight	ACI 318-19, Cl 19.2.4.2 and Cl 19.2.4.3

Post Properties

Post and Connection Type	Post + Bracket / Bearing Plate

Bracket Bearing Width	$b_{\text{bracket}} = 3.5 \text{ in}$	
Bracket Bearing Length	$\ell_{\text{bracket}} = 3.5 \text{ in}$	
Bearing Area Diagonal Length	$\ell_{\text{diag}} = 4.95 \text{ in}$	

Soil Properties

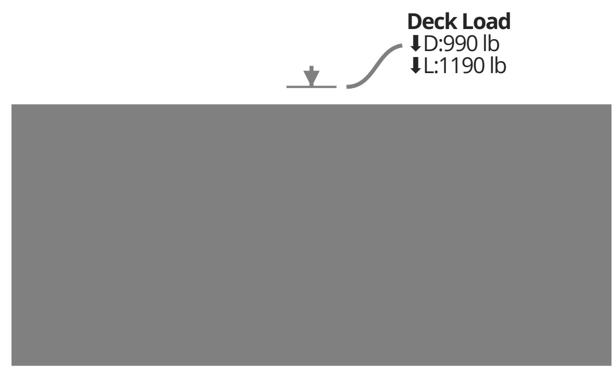
Allowable Soil Gross Bearing Capacity	$q_a = 1500 \text{ psf}$	IBC 2021, Cl 1806.2
Allowable Lateral Pressure per Unit Depth	$S = 100 \text{ psf/ft}$	IBC 2021, Cl 1806.1 and 1806.2

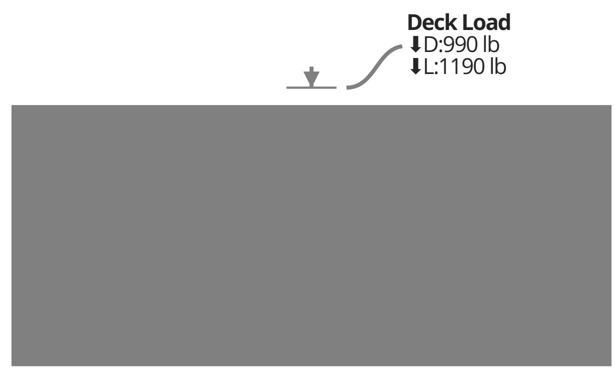
Applied Loads

Height Above Ground of Lateral Load Application $h = 0.25 \text{ ft}$

Axial, Shear, & Moment Loads about X-axis $V, P, M =$

Label	Location z (ft)	Axial Eccentricity y (ft)	Load Magnitudes V, P, M
Deck Load	0	0	D: 0 lb, 990 lb, 0 lb ft, L: 0 lb, 1190 lb, 0 lb ft





Use Reduced Companion Live Load?	No	ASCE 7-16 2.3.1.1
Consider Self Weight?	Yes	

Design Criteria

Design Code for Load Combinations	International Building Code (IBC) 2018
Design Standard Edition Note	Note that this calculation is using a newer edition of the concrete design standard (ACI 318-19, while the code only requires an older edition)

Total Unfactored Loads

Unfactored Loads $Loads =$

Load Type	Axial Load P (lb)	Lateral Load V (lb)	Moment Load M (lb · ft)
D	990	0	0
L	1190	0	0

ASD Load Combinations (ASCE 7-16, Ch. 2)

Service (ASD) Load Combinations $LC_{ASD} =$ IBC 2021, Cl 1605.2

Load Combination	Axial Load P (lb)	Lateral Load V (lb)	Pure Moment Load M (lb · ft)
D+F	1450	0	0
D+H+F + L	2640	0	0
D+H+F + L_r	1450	0	0
D+H+F + S	1450	0	0
D+H+F + R	1450	0	0
D+H+F + 0.75L + 0.75 L_r	2350	0	0
D+H+F + 0.75L + 0.75 S	2350	0	0
D+H+F + 0.75L + 0.75 R	2350	0	0
D+H+F + 0.6W,dn	1450	0	0
D+H+F + 0.7E	1450	0	0
D+H+F + 0.45W_dn + 0.75L + 0.75L_r	2350	0	0
D+H+F + 0.45W_dn + 0.75L + 0.75S	2350	0	0
D+H+F + 0.45W_dn + 0.75L + 0.75R	2350	0	0
D+H+F + 0.525E + 0.75L + 0.75S	2350	0	0
0.6D + 0.6W,up + H	872	0	0
0.6(D+F) - 0.7Ev + 0.7Eh + H	872	0	0

Governing ASD Axial Load $P_s = 2640\ \mathrm{lb}$

LRFD Load Combinations (ASCE 7-16, Ch. 2 and ACI 318-19, Ch. 13)

Strength Load Combinations $LC_{str} =$

Load Combination	Factored Axial Load P_u (lb)	Ultimate Shear V_u (lb)	Ultimate Moment M_u (lb · ft)
1.4(D+F)	1390	0	0
1.2(D+F) + 1.6(L+H) + 0.5L_r	3090	0	0
1.2(D+F) + 1.6(L+H) + 0.5S	3090	0	0
1.2(D+F) + 1.6(L+H) + 0.5R	3090	0	0
1.2(D+F) + 1.6L_r + 1.6H + f_1L	2380	0	0
1.2(D+F) + 1.6L_r + 1.6H + 0.5W_dn	1190	0	0
1.2(D+F) + 1.6S + 1.6H + f_1L	2380	0	0
1.2(D+F) + 1.6S + 1.6H + 0.5W_dn	1190	0	0
1.2(D+F) + 1.6R + 1.6H + f_1L	2380	0	0
1.2(D+F) + 1.6R + 1.6H + 0.5W_dn	1190	0	0
1.2(D+F) + 1.0W_dn + f_1L + 0.5L_r	2380	0	0
1.2(D+F) + 1.0W_dn + f_1L + 0.5S	2380	0	0
1.2(D+F) + 1.0W_dn + f_1L + 0.5R	2380	0	0
1.2(D+F) + 1.0E_v + 1.0E_h + f_1L + 1.6H + f_2S	2380	0	0
0.9D + 1.0W_up + 1.6H	891	0	0
0.9(D+F) - 1.0E_v + 1.0E_h + 1.6H	891	0	0

Maximum Ultimate Axial Load $P_{umax} = 3090\ \mathrm{lb}$

Maximum Ultimate Shear Load $V_{umax} = 0\ \mathrm{lb}$

Maximum Ultimate Moment Load $M_{umax} = 0\ \mathrm{lb \cdot ft}$

Pier Capacity (ACI 318-19, Ch. 21)

0% Pier Moment Capacity (Tension Face) $\phi M_{n,t} = 7160\ \mathrm{lb \cdot ft}$ ACI 318-19, Cl 14.5.2.1

0% Pier Moment Capacity (Compression Face) $\phi M_{n,c} = 60\,800\ \mathrm{lb \cdot ft}$ ACI 318-19, Cl 14.5.2.1

1% Pier Compression Capacity $\phi P_n = 229\,000\ \mathrm{lb}$ ACI 318-19, Cl 14.5.3.1

Pier Embedment (IBC 2021, Ch. 18)

Solved Minimum Embedment Depth	$d_{\mathrm{min,solved}} = 1\ \mathrm{ft},\ 6\ \mathrm{in}$	IBC 2021, Eq. 18-1 and 18-2
Lateral Soil Stress at Designated Depth	$S' = 0\ \mathrm{psf}$	IBC 2021, Eq. 18-1 and 18-2

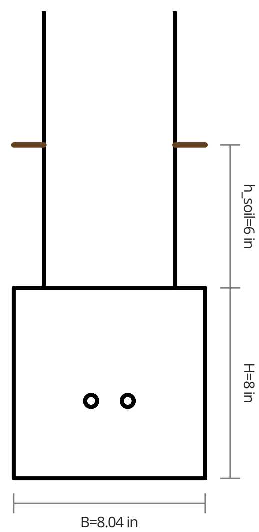
Comments

LONGITUDE ONE TWENTY° ENGINEERING & DESIGN

Client:		**Date:**	Jun 3, 2022
Author:	Harrison Kliegl	**Job #:**	
Project:	Footing Checks	**Subject:**	**Thickened Slab Edge Check** PASS
References:	ACI 318-19		

Summary

	Service Soil Bearing Stress	$q_s =$	981 psf	
65%	Allowable Gross Soil Bearing Stress	$q_a =$	1500 psf	ACI318-19, Cl 13.3.1.1
	Moment Demand	$M_u =$	6.82 lb · ft/ft	ACI 318-19, Cl 13.2.7.1
1%	Factored Moment Capacity	$\phi M_n =$	900 lb · ft/ft	ACI 318-19, 8.5.1.1a
	Shear Demand	$V_u =$	0 plf	ACI 318-19, Cl 7.4.3.2
0%	Factored One-Way Shear Capacity	$\phi V_n =$	2880 plf	ACI 318-19, Cl 7.5.1.1
	Stability	Status $=$	Footing in Total Compression	



Footing Properties

Footing Width	$B =$	0.67 ft	
Footing Thickness	$H =$	8 in	ACI 318-19, Cl 14.3.2.1 IBC 2021, Cl 1809.8 IRC 2021, Cl R403.1.1
Wall Type		Concrete	
Wall Width	$b =$	5.5 in	
Concrete Strength	$f'_c =$	2500 psi	ACI 318-19, Table 19.2.1.1
Concrete Weight Classification		Normalweight	ACI 318-19, Cl 19.2.4.2

Soil Properties

Allowable Soil Gross Bearing Capacity	$q_a =$	1500 psf	IBC 2021, Cl 1806.2
Depth of Soil Over Footing	$h_{soil} =$	0.5 ft	IBC 2021, Cl 1809.5
Unit Weight of Soil	$\gamma_s =$	100 pcf	
Lateral Sliding Coefficient of Friction	$\mu =$	0.3	

Bottom Reinforcement

Include Transverse Reinforcement?	No

Concrete Cover	$\text{cover} = 3\ \text{in}$	ACI 318-19, Table 20.5.1.3.1
Reinforcement Yield Strength	$f_y = 60\,000\ \text{psi}$	ACI 318-19, Table 20.2.2.4a

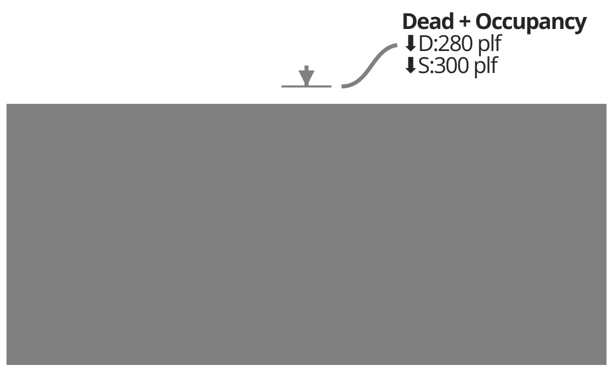
Longitudinal Reinforcement

Include Longitudinal Reinforcement?	Yes	ACI 318-19, Cl 14.1.4
Shrinkage/Temperature Reinforcement Size	#4	
Number of Shrinkage/Temperature Bars	$n_\ell = 2$	ACI 318-19, Cl 7.7.2.3
Required Number of Shrinkage/ Temperature Bars	$n_{\ell,reqd} = 2$	ACI 318-19, Cl 7.7.2.3

Applied Loads

Axial, Shear, & Moment Loads about X-axis $V, P, M =$

Label	Location z (ft)	Axial Eccentricity y (ft)	Load Magnitudes V, P, M
Dead + Occupancy	0	0	D: 0 plf, 280 plf, 0 (lb ft) / ft, S: 0 plf, 300 plf, 0 (lb ft) / ft



Use Reduced Companion Live Load?	No	ASCE 7-16 2.3.1.1
Self Weight of Concrete Footing	$SW = 67\ \text{plf}$	
Weight of Soil above Footing	$W_{soil} = 10.6\ \text{plf}$	

Design Criteria

Design Code for Load Combinations	International Building Code (IBC) 2018
Design Standard Edition Note	Note that this calculation is using a newer edition of the concrete design standard (ACI 318-19, while the code only requires an older edition)
Sliding and Overturning Minimum Factor of Safety	$FS_{\min} = 1.5$

Total Loads

Unfactored Loads $Loads =$

Load Type	Vertical Load P (plf)	Lateral Shear V_x (plf)	Moment M_x (lb · ft/ft)
D	280	0	0
S	300	0	0

ASD Load Combinations and Stress Distribution (ASCE 7-16, Ch. 2)

ASD Load Combinations $LC_{str,ASD} =$

Load Combination	Axial Load P (plf)	Lateral Load V (plf)	Moment Load M (lb · ft/ft)	Foundation Weight W_f (plf)	Eccentricity e (ft)
D+F	280	0	0	77.6	0
D+H+F + L	280	0	0	77.6	0
D+H+F + L_r	280	0	0	77.6	0
D+H+F + S	580	0	0	77.6	0
D+H+F + R	280	0	0	77.6	0
D+H+F + 0.75L + 0.75 L_r	280	0	0	77.6	0
D+H+F + 0.75L + 0.75 S	505	0	0	77.6	0
D+H+F + 0.75L + 0.75 R	280	0	0	77.6	0
D+H+F + 0.6W,dn	280	0	0	77.6	0
D+H+F + 0.7E	280	0	0	77.6	0
D+H+F + 0.45W_dn + 0.75L + 0.75L_r	280	0	0	77.6	0
D+H+F + 0.45W_dn + 0.75L + 0.75S	505	0	0	77.6	0
D+H+F + 0.45W_dn + 0.75L + 0.75R	280	0	0	77.6	0
D+H+F + 0.525E + 0.75L + 0.75S	505	0	0	77.6	0
0.6D + 0.6W,up + H	168	0	0	46.6	0
0.6(D+F) - 0.7Ev + 0.7Eh + H	168	0	0	46.6	0

Bearing Pressure $\mathbf{BP} =$

Combination	Eccentricity e (ft)	Maximum Bearing Pressure q_{max} (psf)	Sliding Factor of Safety FS_s	Overturning Factor of Safety FS_o
D+F	0	534	99	
D+H+F + L	0	534	99	
D+H+F + L_r	0	534	99	
D+H+F + S	0	981	99	
D+H+F + R	0	534	99	
D+H+F + 0.75L + 0.75 L_r	0	534	99	
D+H+F + 0.75L + 0.75 S	0	870	99	
D+H+F + 0.75L + 0.75 R	0	534	99	
D+H+F + 0.6W,dn	0	534	99	
D+H+F + 0.7E	0	534	99	
D+H+F + 0.45W_dn + 0.75L + 0.75L_r	0	534	99	
D+H+F + 0.45W_dn + 0.75L + 0.75S	0	870	99	
D+H+F + 0.45W_dn + 0.75L + 0.75R	0	534	99	
D+H+F + 0.525E + 0.75L + 0.75S	0	870	99	
0.6D + 0.6W,up + H	0	320	99	
0.6(D+F) - 0.7Ev + 0.7Eh + H	0	320	99	

Governing ASD Axial Load $P_s = 658$ plf

LRFD Load Combinations and Footing Loads (ASCE 7-16, Ch. 2 and ACI 318-19, Ch. 13)

LRFD Strength Load Combinations $LC_{str,LRFD} =$

Load Combination	Factored Axial Load P_u (plf)	Factored Moment Load M_u (lb · ft/ft)	Factored Foundation Weight W_{uf} (plf)	Eccentricity e (ft)
1.4(D+F)	392	0	109	0
1.2(D+F) + 1.6(L+H) + 0.5L_r	336	0	93.1	0
1.2(D+F) + 1.6(L+H) + 0.5S	486	0	93.1	0
1.2(D+F) + 1.6(L+H) + 0.5R	336	0	93.1	0
1.2(D+F) + 1.6L_r + 1.6H + f_1L	336	0	93.1	0
1.2(D+F) + 1.6L_r + 1.6H + 0.5W_dn	336	0	93.1	0
1.2(D+F) + 1.6S + 1.6H + f_1L	816	0	93.1	0
1.2(D+F) + 1.6S + 1.6H + 0.5W_dn	816	0	93.1	0
1.2(D+F) + 1.6R + 1.6H + f_1L	336	0	93.1	0
1.2(D+F) + 1.6R + 1.6H + 0.5W_dn	336	0	93.1	0
1.2(D+F) + 1.0W_dn + f_1L + 0.5L_r	336	0	93.1	0
1.2(D+F) + 1.0W_dn + f_1L + 0.5S	486	0	93.1	0
1.2(D+F) + 1.0W_dn + f_1L + 0.5R	336	0	93.1	0
1.2(D+F) + 1.0E_v + 1.0E_h + f_1L + 1.6H + f_2S	396	0	93.1	0
0.9D + 1.0W_up + 1.6H	252	0	69.8	0
0.9(D+F) - 1.0E_v + 1.0E_h + 1.6H	252	0	69.8	0

LRFD Footing Loads (Shear) $\mathbf{FL} =$

Combination	Eccentricity e (ft)	Max Bearing Pressure q_{umax} (psf)	Bearing Pressure at Column Face q_{uCol} (psf)	Bearing Pressure at Critical Shear Section q_{uV} (psf)	Ultimate Shear at Critical Section V_u (plf)
1.4(D+F)	0	747	747	1040	439
1.2(D+F) + 1.6(L+H) + 0.5L_r	0	640	640	892	377
1.2(D+F) + 1.6(L+H) + 0.5S	0	864	864	1200	489
1.2(D+F) + 1.6(L+H) + 0.5R	0	640	640	892	377
1.2(D+F) + 1.6L_r + 1.6H + f_1L	0	640	640	892	377
1.2(D+F) + 1.6L_r + 1.6H + 0.5W_dn	0	640	640	892	377
1.2(D+F) + 1.6S + 1.6H + f_1L	0	1360	1360	1890	737
1.2(D+F) + 1.6S + 1.6H + 0.5W_dn	0	1360	1360	1890	737
1.2(D+F) + 1.6R + 1.6H + f_1L	0	640	640	892	377
1.2(D+F) + 1.6R + 1.6H + 0.5W_dn	0	640	640	892	377
1.2(D+F) + 1.0W_dn + f_1L + 0.5L_r	0	640	640	892	377
1.2(D+F) + 1.0W_dn + f_1L + 0.5S	0	864	864	1200	489
1.2(D+F) + 1.0W_dn + f_1L + 0.5R	0	640	640	892	377
1.2(D+F) + 1.0E_v + 1.0E_h + f_1L + 1.6H + f_2S	0	730	730	1020	422
0.9D + 1.0W_up + 1.6H	0	480	480	669	282
0.9(D+F) - 1.0E_v + 1.0E_h + 1.6H	0	480	480	669	282

LRFD Footing Loads (Moment) $\mathbf{FL}_m =$

Combination	Eccentricity e (ft)	Max Bearing Pressure q_{umax} (psf)	Bearing Pressure at Column Face q_{uCol} (psf)	Ultimate Moment at Column Face M_u (lb · ft/ft)
1.4(D+F)	0	747	747	3.28
1.2(D+F) + 1.6(L+H) + 0.5L_r	0	640	640	2.81
1.2(D+F) + 1.6(L+H) + 0.5S	0	864	864	4.06
1.2(D+F) + 1.6(L+H) + 0.5R	0	640	640	2.81
1.2(D+F) + 1.6L_r + 1.6H + f_1L	0	640	640	2.81
1.2(D+F) + 1.6L_r + 1.6H + 0.5W_dn	0	640	640	2.81
1.2(D+F) + 1.6S + 1.6H + f_1L	0	1360	1360	6.82
1.2(D+F) + 1.6S + 1.6H + 0.5W_dn	0	1360	1360	6.82
1.2(D+F) + 1.6R + 1.6H + f_1L	0	640	640	2.81
1.2(D+F) + 1.6R + 1.6H + 0.5W_dn	0	640	640	2.81
1.2(D+F) + 1.0W_dn + f_1L + 0.5L_r	0	640	640	2.81
1.2(D+F) + 1.0W_dn + f_1L + 0.5S	0	864	864	4.06
1.2(D+F) + 1.0W_dn + f_1L + 0.5R	0	640	640	2.81
1.2(D+F) + 1.0E_v + 1.0E_h + f_1L + 1.6H + f_2S	0	730	730	3.31
0.9D + 1.0W_up + 1.6H	0	480	480	2.11
0.9(D+F) - 1.0E_v + 1.0E_h + 1.6H	0	480	480	2.11

Governing Axial Load $P_u = 816 \text{ plf}$

Maximum Ultimate Net Bearing Pressure $q_{nu} = 1220 \text{ psf}$

Flexural Analysis (ACI 318-19, Cl 22.2)

Resistance Factor in Bending $\phi_b = 0.6$ ACI 318-19, Table 21.2.2

Moment Capacity $M_n = 1500 \text{ lb} \cdot \text{ft/ft}$ ACI 318-19, Cl 22.3.1.1 and 14.5.2.1 (plain concrete)

Factored Moment Capacity $\phi M_n = 900 \text{ lb} \cdot \text{ft/ft}$ ACI 318-19, Cl 8.5.1.1(a)

Ultimate Moment at Critical Section $M_u = 6.82 \text{ lb} \cdot \text{ft/ft}$ ACI 318-19, Cl 13.2.7.1

One-Way Shear (ACI 318-19, Cl 22.5)

Resistance Factor in Shear $\phi_v = 0.6$ ACI 318-19, Table 21.2.1

Concrete Shear Strength $V_c = 4800 \text{ plf}$ ACI 318-19, Cl 22.5.5.1 and 14.5.5.1 (plain concrete)

Factored One-Way Shear Capacity $\phi V_n = 2880 \text{ plf}$ ACI 318-19, Cl 7.5.1.1

Ultimate Shear at Critical Section $V_u = 0 \text{ plf}$ ACI 318-19, Cl 7.4.3.2 and Cl 22.5.1.2 for crushing strength

Comments

General Footing

DESCRIPTION: 16" (non retaining) stemwall footing - max point load (1500psf)

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9913	Soil Bearing	1.487 ksf	1.50 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	0.0	Z Flexure (+X)	0.0 k-ft/ft	0.0 k-ft/ft	No Moment
PASS	0.0	Z Flexure (-X)	0.0 k-ft/ft	0.0 k-ft/ft	No Moment
PASS	0.02530	X Flexure (+Z)	0.1071 k-ft/ft	4.235 k-ft/ft	+1.20D+1.60L
PASS	0.02530	X Flexure (-Z)	0.1071 k-ft/ft	4.235 k-ft/ft	+1.20D+1.60L
PASS	n/a	1-way Shear (+X)	0.0 psi	67.082 psi	n/a
PASS	n/a	1-way Shear (-X)	0.0 psi	67.082 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	67.082 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	67.082 psi	n/a
PASS	n/a	2-way Punching	0.0 psi	67.082 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc	Actual Soil Bearing Stress @ Location: Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.50	n/a	0.0	0.6789	0.6789	n/a	n/a	0.453
X-X, +D+L	1.50	n/a	0.0	1.487	1.487	n/a	n/a	0.991
X-X, +D+0.750L	1.50	n/a	0.0	1.285	1.285	n/a	n/a	0.857
X-X, +0.60D	1.50	n/a	0.0	0.4073	0.4073	n/a	n/a	0.272
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.6789	0.6789	0.453
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.487	1.487	0.991
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	1.285	1.285	0.857
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.4073	0.4073	0.272

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	0.04201	+Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +1.40D	0.04201	-Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +1.20D+1.60L	0.1071	+Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +1.20D+1.60L	0.1071	-Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +1.20D+0.50L	0.05823	+Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +1.20D+0.50L	0.05823	-Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +1.20D	0.03601	+Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +1.20D	0.03601	-Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +0.90D	0.0270	+Z	Bottom	0.1728	AsMin	0.20	4.235	OK
X-X, +0.90D	0.0270	-Z	Bottom	0.1728	AsMin	0.20	4.235	OK
Z-Z, +1.40D	0.0	-X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +1.40D	0.0	+X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +1.20D+1.60L	0.0	-X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +1.20D+1.60L	0.0	+X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +1.20D+0.50L	0.0	-X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +1.20D+0.50L	0.0	+X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +1.20D	0.0	-X	Top	0.1728	AsMin	0.3008	6.168	OK

General Footing

DESCRIPTION: 16" (non retaining) stemwall footing - max point load (1500psf)

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	0.0	+X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +0.90D	0.0	-X	Top	0.1728	AsMin	0.3008	6.168	OK
Z-Z, +0.90D	0.0	+X	Top	0.1728	AsMin	0.3008	6.168	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	67.08 psi	0.00	OK
+1.20D+1.60L	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	67.08 psi	0.00	OK
+1.20D+0.50L	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	67.08 psi	0.00	OK
+1.20D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	67.08 psi	0.00	OK
+0.90D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	67.08 psi	0.00	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	89.44 psi	0	OK
+1.20D+1.60L	0.00 psi	89.44 psi	0	OK
+1.20D+0.50L	0.00 psi	89.44 psi	0	OK
+1.20D	0.00 psi	89.44 psi	0	OK
+0.90D	0.00 psi	89.44 psi	0	OK

SUPPLEMENTAL CALCULATIONS

Post Installed Hold-Down Anchors

Ledger Calculations

(425) 636 3313
L120Engineering.com

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 10.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 11.38
c_{ac} (inch): 22.57
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 18.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 5/8"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

Post Installed HDU 5 Uplift Capacity
(Wind Controlled)

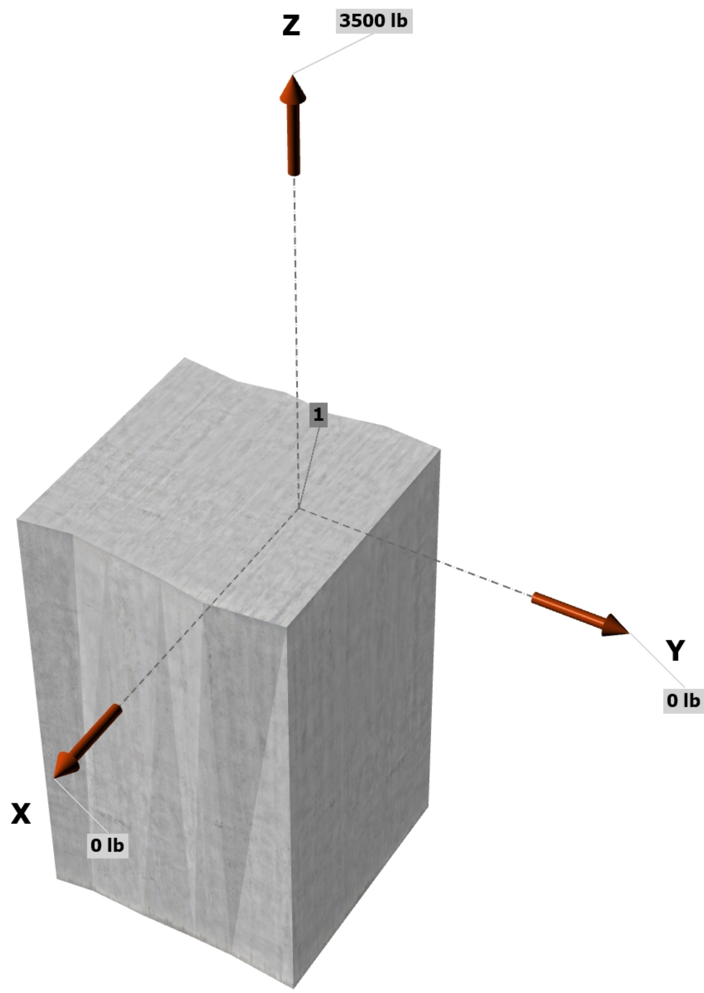
Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: No
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

Strength level loads:

N_{ua} [lb]: 3500
V_{uax} [lb]: 0
V_{uay} [lb]: 0

<Figure 1>

Post Installed HDU 5 Uplift Capacity
(Wind Controlled)



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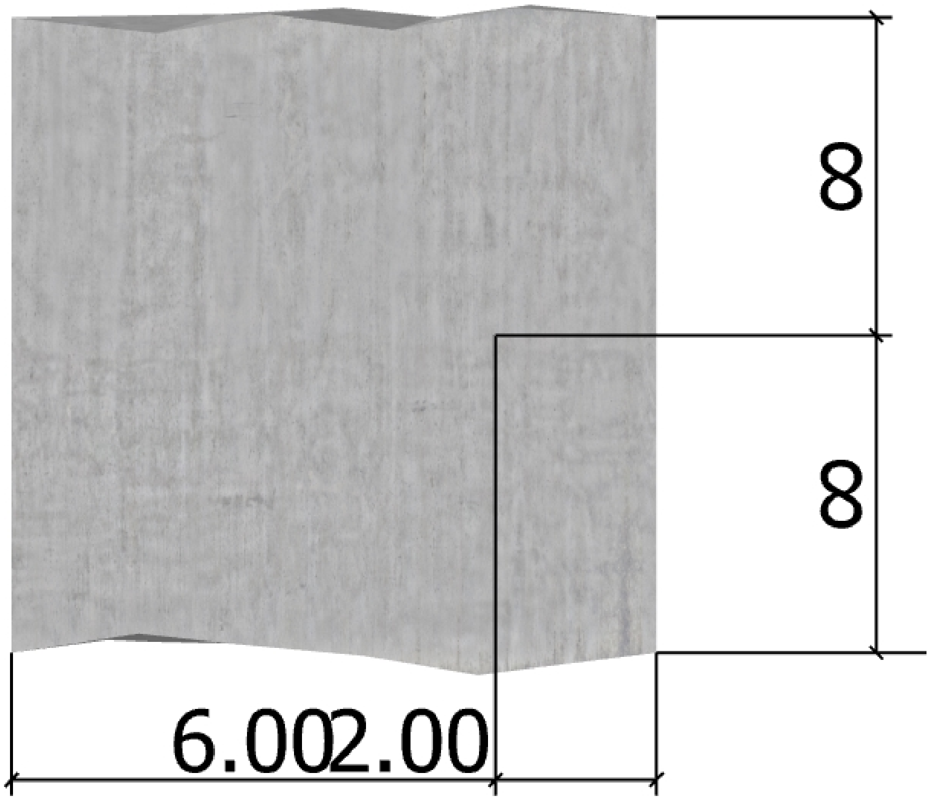


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	3500.0	0.0	0.0	0.0
Sum	3500.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 3500
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
13110	0.75	9833

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	10.000	26879

$\phi N_{cb} = \phi\, (A_{Nc} / A_{Nco})\, \Psi_{ed,N}\, \Psi_{c,N}\, \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cb} (lb)
240.00	900.00	2.00	0.740	1.00	1.000	26879	0.65	3448

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} (f'_c / 2{,}500)^n$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
1356	1.00	1.00	2500	0.24	1356

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	1356	0.63	10.000	26625

$\phi N_a = \phi\, (A_{Na} / A_{Na0})\, \Psi_{ed,Na}\, \Psi_{cp,Na} N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1a)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	ϕ	ϕN_a (lb)
140.19	307.10	8.76	2.00	0.768	1.000	26625	0.65	6071

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Tension	Factored Load, N_{ua} (lb)	Design Strength, $øN_n$ (lb)	Ratio	Status
Steel	3500	9833	0.36	Pass
Concrete breakout	**3500**	**3448**	**1.02**	**Fail (Governs)**
Adhesive	3500	6071	0.58	Pass

FAIL! Selected anchor type and embedment do not meet the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Anchor Designer™
Software
Version 3.0.7947.2

Company:		Date:	9/14/2022
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 1.000
Effective Embedment depth, h_{ef} (inch): 12.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 14.25
c_{ac} (inch): 28.14
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 15.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: A tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 1"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

Post Installed HDU 8 Uplift Capacity
(Wind Controlled)

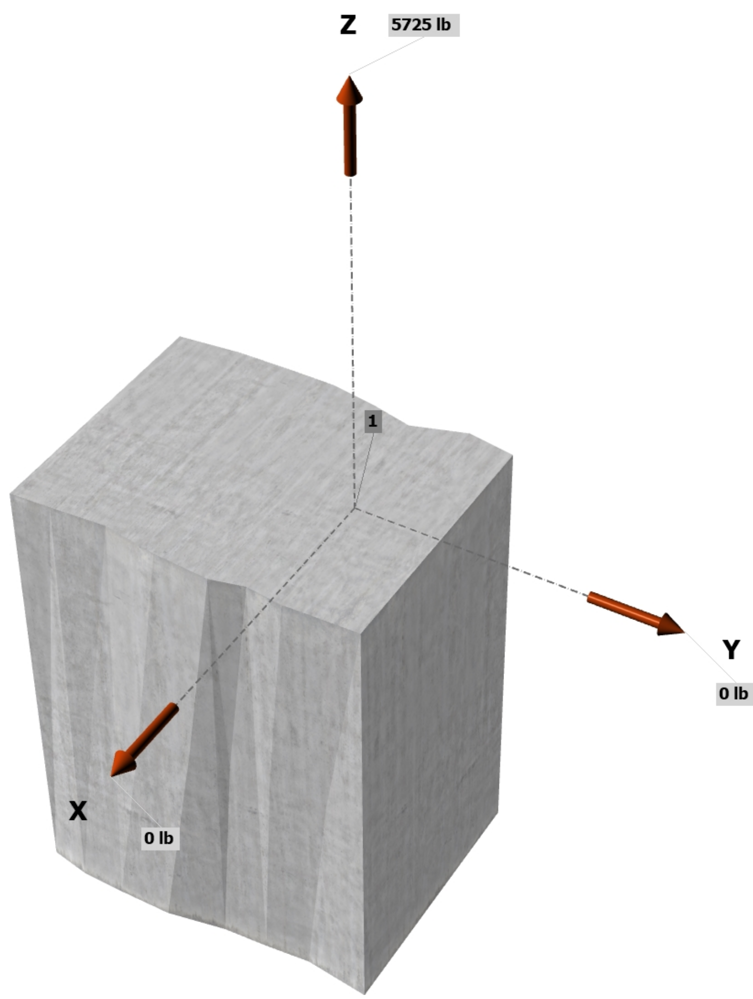
Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: No
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

Strength level loads:

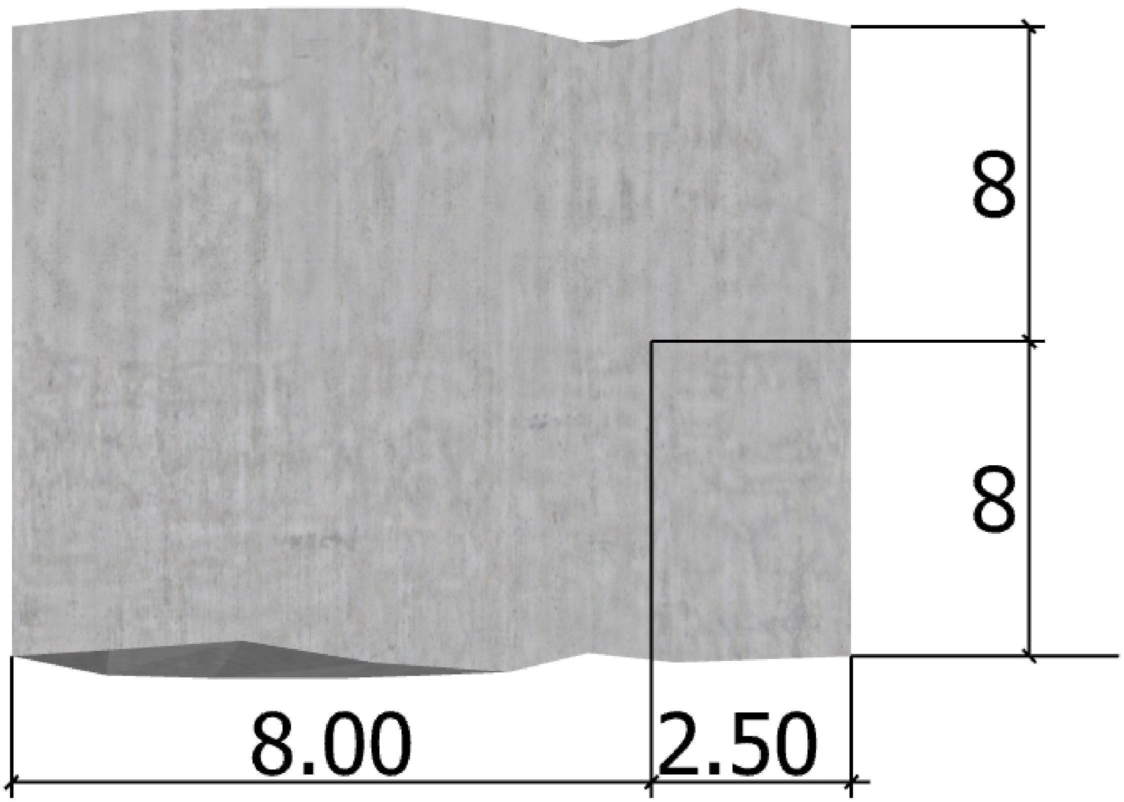
N_{ua} [lb]: 5725
V_{uax} [lb]: 0
V_{uay} [lb]: 0

Post Installed HDU 8 Uplift Capacity
(Wind Controlled)

<Figure 1>



<Figure 2>



3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	5725.0	0.0	0.0	0.0
Sum	5725.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 5725
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
35150	0.75	26363

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	12.000	35334

$\phi N_{cb} = \phi\,(A_{Nc} / A_{Nco})\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cb} (lb)
378.00	1296.00	2.50	0.742	1.00	1.000	35334	0.75	5733

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} (f'_c / 2{,}500)^n$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
1219	1.00	1.00	2500	0.24	1219

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	1219	1.00	12.000	45955

$\phi N_a = \phi\,(A_{Na} / A_{Na0})\,\Psi_{ed,Na}\,\Psi_{cp,Na} N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1a)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	ϕ	ϕN_a (lb)
273.66	679.27	13.03	2.50	0.758	1.000	45955	0.65	9117

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Tension	Factored Load, N_{ua} (lb)	Design Strength, $øN_n$ (lb)	Ratio	Status
Steel	5725	26363	0.22	Pass
Concrete breakout	**5725**	**5733**	**1.00**	**Pass (Governs)**
Adhesive	5725	9117	0.63	Pass

SET-3G w/ 1"Ø F1554 Gr. 36 with hef = 12.000 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

SIMPSON Strong-Tie®

Strong-Drive®
SDWS TIMBER Screw

Structural Wood-to-Wood Connections Including Ledgers, Indoor/Outdoor Projects

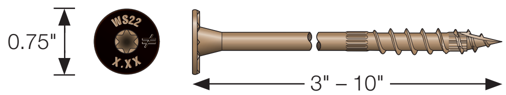
Designed to provide an easy-to-install, high-strength alternative to through-bolting and traditional lag screws. The Strong-Drive SDWS Timber screws are ideal for the contractor and do-it-yourselfer alike.

Double-barrier coating provides corrosion resistance equivalent to hot-dip galvanization, making it suitable for certain exterior and preservative-treated wood applications, as described in the evaluation report.

Codes/Standards: IAPMO-UES ER-192, State of Florida FL13975

US Patent 9,523,383

For more information, see p. 53, C-F-2019 Fastening Systems Catalog



SDWS Timber Screw — Allowable Shear Loads — Douglas Fir–Larch and Southern Pine Lumber

Size Dia.x L (in.)	Model No.	Thread Length (in.)	Reference DFL/SP Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2	2.5	3	3.5	4	4.5	6	8
0.22 x 3	SDWS22300DB	1½	255	—	—	—	—	—	—	—	—
0.22 x 4	SDWS22400DB	2⅜	405	405	305	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2¾	405	405	360	360	325	—	—	—	—
0.22 x 6	SDWS22600DB	2¾	405	405	405	405	365	365	355	—	—
0.22 x 8	SDWS22800DB	2¾	405	405	405	405	395	395	395	395	—
0.22 x 10	SDWS221000DB	2¾	405	405	405	405	395	395	395	395	395

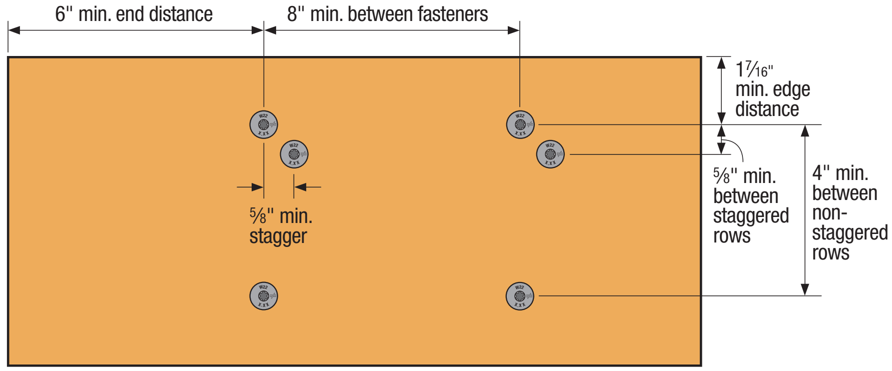
See footnotes below.

SDWS Timber Screw — Allowable Shear Loads — Spruce-Pine-Fir and Hem-Fir Lumber

Size Dia.x L (in.)	Model No.	Thread Length (in.)	Reference SPF/HF Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2	2.5	3	3.5	4	4.5	6	8
0.22 x 3	SDWS22300DB	1½	190	—	—	—	—	—	—	—	—
0.22 x 4	SDWS22400DB	2⅜	385	285	215	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2¾	405	290	290	290	195	—	—	—	—
0.22 x 6	SDWS22600DB	2¾	405	365	365	365	310	310	210	—	—
0.22 x 8	SDWS22800DB	2¾	405	365	365	365	310	310	280	280	—
0.22 x 10	SDWS221000DB	2¾	405	365	365	365	310	310	280	280	280

1. All applications are based on full penetration into the main member. Full penetration is the screw length minus the side member thickness.
2. Allowable loads are shown at the wood load duration factor of $C_D = 1.0$. Loads may be increased for load duration per the building code up to a $C_D = 1.6$. Tabulated values must be multiplied by all applicable adjustment factors per the NDS.
3. Minimum fastener spacing requirements to achieve table loads: 6" end distance, 1 7/16" edge distance, ⅝" between staggered rows of fasteners, 4" between non-staggered rows of fasteners and 8" between fasteners in a row.
4. For in-service moisture content greater than 19%, use $C_M = 0.7$.
5. Loads are based on installation into the side grain of the wood with the screw axis perpendicular to the face of the member.

Strong-Drive®
SDWS TIMBER Screw (cont.)



SDWS Timber Screw Spacing Requirements

SDWS Timber Screw — Allowable Withdrawal Loads — Douglas Fir–Larch, Southern Pine, Spruce-Pine-Fir and Hem-Fir Lumber

Model No.	Fastener Length (in.)	Thread Length (in.)	Reference Withdrawal Design Value, W (lb./in.)		Max. Reference Withdrawal Design Value, W_{max} (lb.)	
			DFL and SP Main Member	HF and SPF Main Member	DFL and SP Main Member	HF and SPF Main Member
SDWS22300DB	3	1½	164	151	245	225
SDWS22400DB	4	2⅜	179	160	425	380
SDWS22500DB	5	2¾	214	187	590	495
SDWS22600DB	6	2¾	214	187	590	495
SDWS22800DB	8	2¾	214	187	590	495
SDWS221000DB	10	2¾	214	187	590	495

1. The tabulated reference withdrawal design value, W, is in pounds per inch of the thread penetration into the side grain of the main member.
2. The tabulated reference withdrawal design value, W_{Max}, is in pounds where the entire thread length must penetrate into the side grain of the main member.
3. Tabulated reference withdrawal design values, W and W_{Max}, are shown at a C_D = 1.0. Loads may be increased for load duration per the building code up to a C_D = 1.6. Tabulated values must be multiplied by all applicable adjustment factors from the NDS as referenced in the IBC or IRC.
4. Embedded thread length is that portion held in the main member including the screw tip.
5. Values are based on the lesser of withdrawal from the main member or pull-through of a 1½" side member.
6. For in-service moisture content greater than 19%, use C_M = 0.7.

Strong-Drive®
SDWS TIMBER Screw with Gypsum Board Interlayer(s)

The Strong-Drive SDWS Timber screw may be installed with one or two layers of ⅝" gypsum board. This layer of gypsum is to be located between the side member and main member for a standard connection. See the tables below for the required screw lengths and allowable loads for these applications. Loads are derived from assembly testing based on ICC-ES AC233.

SDWS Timber Screw — Douglas Fir–Larch and Southern Pine Lumber Allowable Single Shear Loads with One Layer of ⅝" Gypsum Board

Size (in.)	Model No.	Thread Length (in.)	Reference DFL/SP Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2.0	2.5	3.0	3.5	4.0	4.5	6.0	8.0
0.22 x 4	SDWS22400DB	2.375	265	—	—	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2.75	265	265	235	—	—	—	—	—	—
0.22 x 6	SDWS22600DB	2.75	265	265	265	265	235	—	—	—	—
0.22 x 8	SDWS22800DB	2.75	265	265	265	265	255	255	255	—	—
0.22 x 10	SDWS221000DB	2.75	265	265	265	265	255	255	255	255	—

See footnotes on next page.

SDWS Timber Screw — Douglas Fir–Larch and Southern Pine Lumber Allowable Single Shear Loads with Two Layers of ⅝" Gypsum Board

Size (in.)	Model No.	Thread Length (in.)	Reference DFL/SP Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2.0	2.5	3.0	3.5	4.0	4.5	6.0	8.0
0.22 x 4	SDWS22400DB	2.375	—	—	—	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2.75	265	265	—	—	—	—	—	—	—
0.22 x 6	SDWS22600DB	2.75	265	265	265	265	—	—	—	—	—
0.22 x 8	SDWS22800DB	2.75	265	265	265	265	255	255	255	—	—
0.22 x 10	SDWS221000DB	2.75	265	265	265	265	255	255	255	255	—

See footnotes on next page.

SIMPSON Strong-Tie®

Strong-Drive® SDWS TIMBER Screw with Gypsum Board Interlayer(s) (cont.)

SDWS Timber Screw — Spruce-Pine-Fir and Hem-Fir Lumber Allowable Single Shear Loads with One Layer of ⅝" Gypsum Board

Size (in.)	Model No.	Thread Length (in.)	Reference SPF/HF Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2.0	2.5	3.0	3.5	4.0	4.5	6.0	8.0
0.22 x 4	SDWS22400DB	2.375	250	—	—	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2.75	260	190	190	—	—	—	—	—	—
0.22 x 6	SDWS22600DB	2.75	260	235	235	235	200	—	—	—	—
0.22 x 8	SDWS22800DB	2.75	260	235	235	235	200	200	180	—	—
0.22 x 10	SDWS221000DB	2.75	260	235	235	235	200	200	180	180	—

See notes below.

SDWS Timber Screw — Spruce-Pine-Fir and Hem-Fir Lumber Allowable Single Shear Loads with Two Layers of ⅝" Gypsum Board

Size (in.)	Model No.	Thread Length (in.)	Reference SPF/HF Allowable Shear Loads (lb.)								
			Wood Side Member Thickness (in.)								
			1.5	2.0	2.5	3.0	3.5	4.0	4.5	6.0	8.0
0.22 x 4	SDWS22400DB	2.375	—	—	—	—	—	—	—	—	—
0.22 x 5	SDWS22500DB	2.75	260	190	—	—	—	—	—	—	—
0.22 x 6	SDWS22600DB	2.75	260	235	235	235	—	—	—	—	—
0.22 x 8	SDWS22800DB	2.75	260	235	235	235	200	200	180	—	—
0.22 x 10	SDWS221000DB	2.75	260	235	235	235	200	200	180	180	—

1. All applications are based on full penetration which equals fastener length minus side member thickness.
2. Allowable loads are shown at the wood load duration factor of C_D =1.0. Loads may be increased for load duration per the building code up to a C_D =1.6. Tabulated values must be multiplied by all applicable adjustment factors per the NDS.
3. Minimum fastener spacing requirements: 6" end distance, 1 7⁄16" edge distance, ⅝" between staggered rows of fasteners, 4" between non-staggered rows of fasteners and 8" between fasteners in a row. Refer to SDWS Spacing Requirements figure on p. 23.
4. For in-service moisture content greater than 19% use C_M = 0.7.
5. Gypsum board must be attached as required per the building code.

Strong-Drive® SDWS TIMBER Screw in Ledger-to-Stud Applications

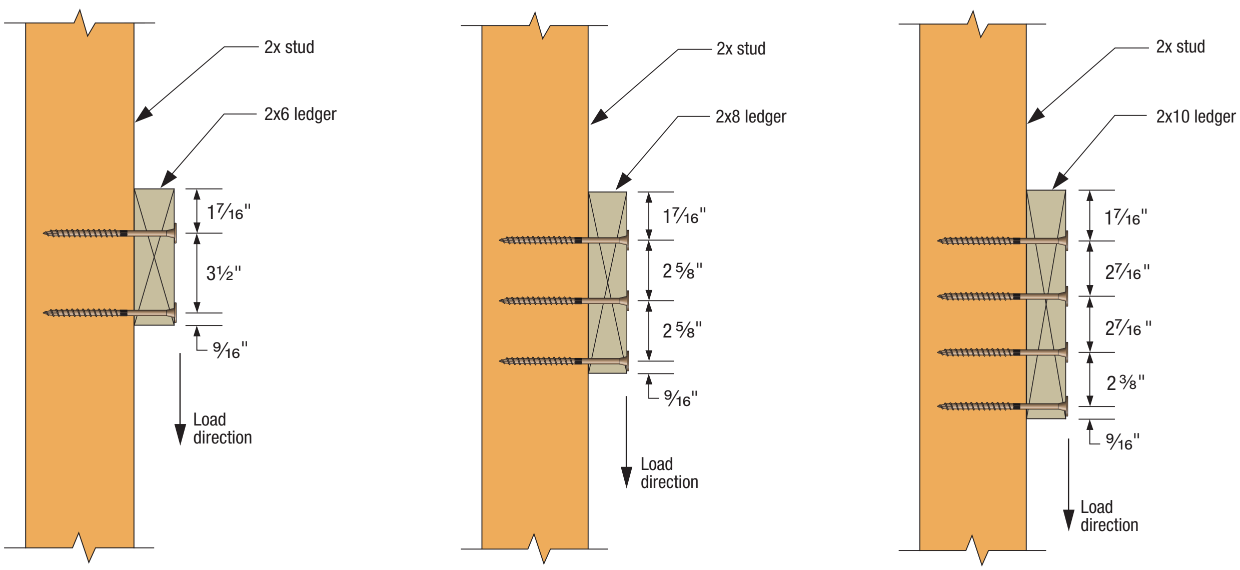
Strong-Drive SDWS Timber screws may be used to attach a ledger to the narrow face of nominal 2x lumber studs according to the following table. Tests and analyses were performed in accordance with ICC-ES Acceptance Criteria AC233.

For more information, see p. 53, C-F-2019 Fastening Systems Catalog

SDWS Timber Screw — Allowable Shear Loads for Ledger to Studs

Size (in.)	Model No.	Ledger Nominal Size (in.)	Number of Screws per Stud	Reference Allowable Shear Load (lb.)		
				SP	DFL	SPF/HF
0.22 x 4	SDWS22400DB	2x6	2	785	630	565
		2x8	3	1,060	890	855
		2x10	4	—	1,040	1,040

1. Allowable loads shall be limited to parallel-to-grain loaded solid sawn main members (minimum 2" nominal). Wood side members shall be loaded perpendicular to grain.
2. Allowable loads are based on DFL, SPF/HF, and SP wood members having a minimum specific gravity of 0.50, 0.42, and 0.55, respectively. Where the side and main members have different specific gravities, the lower values shall be used.
3. Allowable loads are shown at the wood load duration factor of C_D = 1.00. Loads may be increased for load duration as permitted by the building code up to a C_D = 1.60. All adjustment factors shall be applied per the 2012 National Design Specification (NDS). For in-service moisture content greater than 19%, use C_M = 0.70.
4. Fasteners shall be centered in the stud and spaced as shown in the figure. The stud minimum end distance is 6" when loaded toward the end and 2½" when loaded away from the end. The ledger end distance is 6" for full values. For ledger end distances between 2" and 6" use 50% of the table loads. For end distances between 2" and 4", predrill using a 5⁄32" bit for SDWS.
5. Screws may be installed with an intermediate layer of wood structural panel between the side and main member provided the wood structural panel is fastened to the main member per code and the minimum screw penetration of 2½" into the main member (excluding the wood structural panel) is met. Longer lengths of the screw series may be used.
6. For LRFD values, the reference connection design values shall be adjusted in accordance with the NDS-2018, section 11.3.
7. For 2x10 SP ledgers, use the number of screws and allowable loads of the 2x8 SP ledger.
8. For 2x8 ledgers with two screws, use 2x6 values. For 2x10 ledgers with three screws, use 2x8 values. Spacings and edge distances shown in the figure are minimum dimensions.
9. For loads in the opposite direction from that shown in the figure, use the table values multiplied by: 0.50 for two-screw connections, 0.67 for three-screw connections, and 0.75 for four-screw connections.

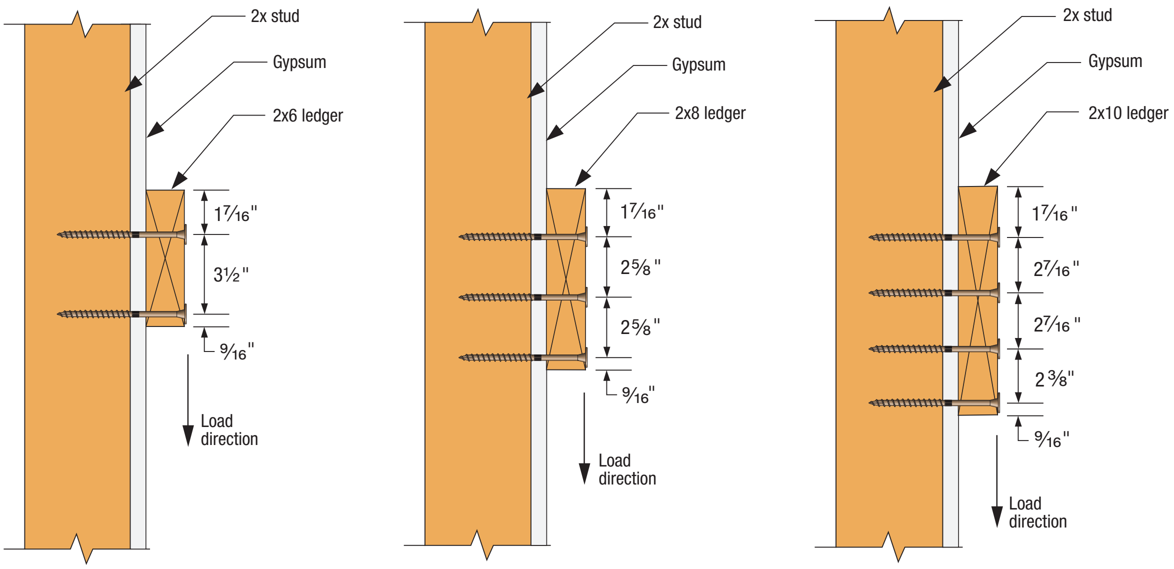


Strong-Drive®
SDWS TIMBER Screw with Gypsum Board Interlayer(s) (cont.)

SDWS Timber Screw — Allowable Shear Loads for Ledger Attachment to Studs with One or Two Layers of Gypsum Board

Size (in.)	Model No.	Ledger Size	Number of Screws per Stud	Reference Allowable Shear Load (lb.)		
				SP	DFL	SPF/HF
0.22 x 6	SDWS22600DB	2x6	2	510	410	365
		2x8	3	690	580	555
		2x10	4	—	675	675

1. Allowable loads shall be limited to parallel-to-grain loaded solid sawn main members (minimum 2" nominal). Wood side members shall be loaded perpendicular to grain.
2. Allowable loads are based on DFL, SPF/HF, and SP wood members having a minimum specific gravity of 0.50, 0.42, and 0.55, respectively. Where the side and main members have different specific gravities, the lower values shall be used.
3. Allowable loads are shown at the wood load duration factor of C_D = 1.00. Loads may be increased for load duration as permitted by the building code up to a C_D = 1.60. All adjustment factors shall be applied per the National Design Specification (NDS). For in-service moisture content greater than 19%, use C_M = 0.70.
4. Fasteners shall be centered in the stud and spaced as shown in the figure. The ledger minimum end distance is 6". The stud minimum end distance is 6" when the load is toward the end and 2½" when the load is away from the end.
5. Screws may be installed with an interlayer of wood structural panel (WSP) between the framing and the gypsum panel(s). When a WSP is present, it shall be a maximum of ½" thick, adjacent to the framing and fastened directly to the framing per code. Minimum screw penetration into the framing of 2½" shall be required; longer screw lengths shall be used to achieve the required penetration.
6. For LRFD values, the reference connection design values shall be adjusted in accordance with NDS-18, section 11.3.
7. For 2x10 SP ledgers, use the number of screws and allowable loads of the 2x8 SP ledger.
8. For 2x8 ledgers with two screws, use 2x6 values. For 2x10 ledgers with three screws, use 2x8 values. Spacings and edge distances shown in the figure are minimum dimensions.
9. For loads in the opposite direction from that shown in the figure, use the table values multiplied by: 0.50 for two-screw connections, 0.67 for three-screw connections, and 0.75 for four-screw connections.
10. Gypsum board must be attached as required per the building code.
11. For ledger end distances between 2" and 6", use 50% of load and predrill with 5⁄32" drill bit.



Note: Minimum stud dimension is nominal 2 x 6.

Notes to Installer Regarding the Attachment of Ledgers to Studs:

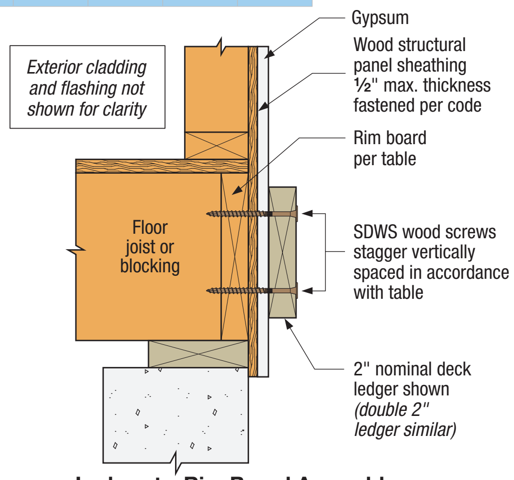
The screws must be installed into the middle of the stud with a tolerance of 3⁄16" either side of center. Various methods can be used to ensure proper placement of the screws in the stud including snapping a chalk line, using a stud finder or prerocking (attaching only a strip of gypsum at the ledger location until the ledger is fastened to the studs). If proper screw placement into the stud cannot be achieved in the field, blocking should be installed between studs to receive and support the ledger screws.

Strong-Drive®
SDWS **TIMBER** Screw with Gypsum Board Interlayer(s) (cont.)

SDWS Timber Screw — 2015 and 2018 IRC Compliant Spacing for a Sawn Lumber Ledger to Rim Board with One or Two Layers of ⅝" Gypsum Board

Loading Condition	Nominal Ledger Thickness (in.)	Model No.	Rim Board Material and Minimum Size	Maximum Deck Joist Span						
				Up to 6 ft.	Up to 8 ft.	Up to 10 ft.	Up to 12 ft.	Up to 14 ft.	Up to 16 ft.	Up to 18 ft.
				Maximum On-Center Spacing of Fasteners (in.)						
40 psf Live 10 psf Dead	2x	For one layer of gypsum board use: SDWS22400DB For two layers of gypsum board use: SDWS22500DB	1" OSB 1" LVL	13	10	8	6	6	5	4
			1⅛" OSB 1 5/16" LVL 1¼" LSL	15	11	9	8	7	6	5
			2x SP, DFL 2x SPF, HF	20	15	12	10	9	8	7
100 psf Live 10 psf Dead	2x	For one layer of gypsum board use: SDWS22400DB For two layers of gypsum board use: SDWS22500DB	1" OSB 1" LVL	6	4	4	—	—	—	—
			1⅛" OSB 1 5/16" LVL 1¼" LSL	8	6	5	4	—	—	—
			2x SP, DFL 2x SPF, HF	9	7	5	5	4	—	—
100 psf Live 10 psf Dead	(2) 2x	For one layer of gypsum board use: SDWS22600DB	1" OSB 1" LVL	7	5	4	—	—	—	—
			1⅛" OSB 1 5/16" LVL 1¼" LSL	7	5	4	—	—	—	—
			2x SP, DFL 2x SPF, HF	7	5	4	—	—	—	—
60 psf Live 10 psf Dead	2x	For one layer of gypsum board use: SDWS22400DB For two layers of gypsum board use: SDWS22500DB	1" OSB 1" LVL	9	7	6	5	4	—	—
			1⅛" OSB 1 5/16" LVL 1¼" LSL	11	8	7	5	5	4	4
			2x SP, DFL 2x SPF, HF	14	11	9	7	6	5	5
40 psf Live 10 psf Dead	(2) 2x	For one layer of gypsum board use: SDWS22600DB	1" OSB 1" LVL	14	11	9	7	6	5	5
			1⅛" OSB 1 5/16" LVL 1¼" LSL	15	11	9	8	7	6	5
			2x SP, DFL 2x SPF, HF	15	11	9	8	7	6	5
60 psf Live 10 psf Dead	(2) 2x	For one layer of gypsum board use: SDWS22600DB	1" OSB 1" LVL	10	8	6	5	5	4	—
			1⅛" OSB 1 5/16" LVL 1¼" LSL	11	8	6	5	5	4	4
			2x SP, DFL 2x SPF, HF	11	8	6	5	5	4	4

1. Sawn rim board shall be spruce-pine-fir, hem-fir, Douglas fir–larch, or southern pine species. Ledger shall be hem-fir, Douglas fir–larch, or southern pine species.
2. Fastener spacings are based on the lesser of single fastener ICC-ES AC233 testing of the Strong-Drive® SDWS screw with a safety factor of 5.0 or ledger assembly testing based on ICC-ES AC13 with a factor of safety of 3.0. Spacing does NOT include NDS wet service factor adjustment.
3. Multiple ledger plies shall be fastened together per code independent of the SDWS screws.
4. SDWS screw spacing values are equivalent to 2018 IRC Table R507.9.1.3(1) and 2012/2015 IRC Table R507.2. The table also provides SDWS screw spacing for a wider range of materials commonly used for rim boards, and an alternate loading condition as required by some jurisdictions.
5. Rows of screws shall be vertically offset and evenly staggered. Screws shall be placed 1½" to 2" from the top and bottom of the ledger or rim board with 3" minimum and 6" maximum between rows and spaced per the table. End screws shall be located 6" from the end and at 1½" to 2" from the bottom of the ledger. For screws located at least 2" but less than 6" from the end, use 50% of the load per screw and 50% of the table spacing between the end screw and the adjacent screw, and for screws located between 2" and 4" from the end, predrill using a 5/32" drill.
6. The design installation permits a wood structural panel (WSP) interlayer in addition to one or two layers of gypsum board. If present, the WSP shall be a maximum of ½" thick, adjacent to the framing and fastened directly to the framing per the code.
7. Gypsum board must be attached as required by the building code.

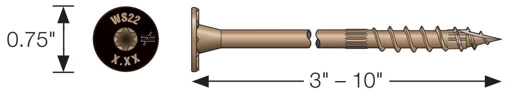


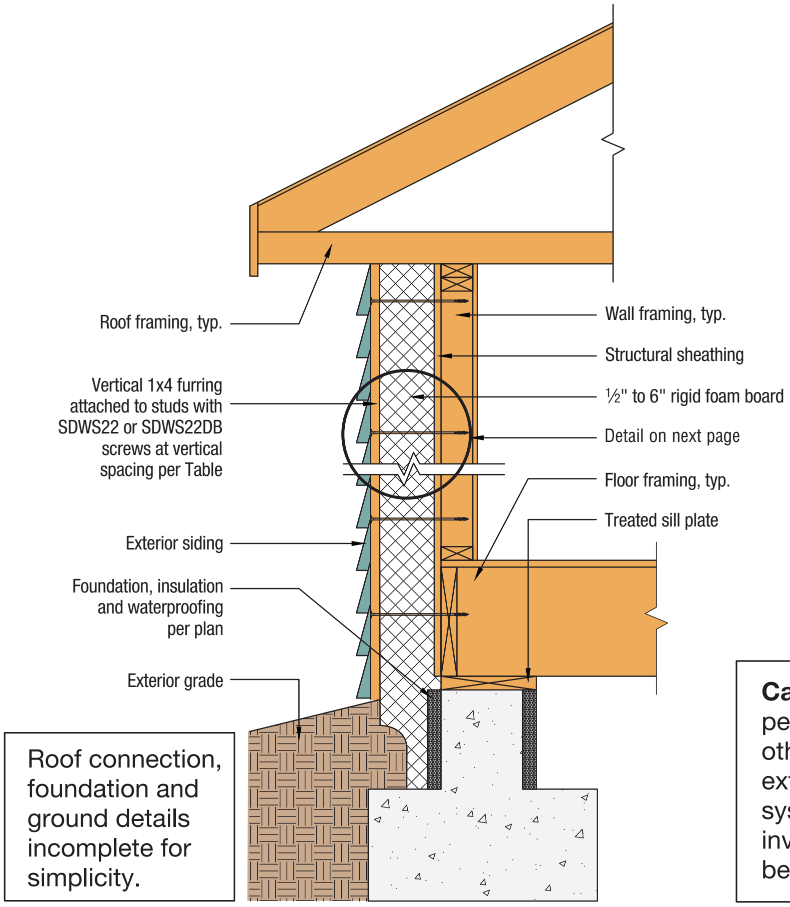
Ledger-to-Rim Board Assembly
(wood-framed lower floor acceptable, concrete wall shown for illustration purposes)

Strong-Drive®
SDWS **TIMBER** Screw for Attaching Exterior Foam Insulation

Simpson Strong-Tie® Strong-Drive SDWS Timber screws may be used for installing exterior rigid-foam board insulation over wood structural panel (WSP) sheathing. Each fastener installs through furring strips, rigid-foam board and WSP sheathing into the wood wall stud framing. The fasteners do not typically require predrilling. Preservative-treated wood suitable for dry-service (AWPA UC1, UC2, UC3A) and untreated wood may be used depending on the protection needs of the construction. The SDWS products with "DB" in the model number have a double-barrier coating that provides corrosion resistance equivalent to hot-dip galvanization, while the products without "DB" in the model number can only be used in conditions with dry-service and no wood treatment chemicals. The table on p. 53 provides recommended spacing for fastening to vertical furring strips through ½" to 6" of rigid foam insulation board into each wall stud. The SDWS22DB and SDWS22 screws were evaluated as alternate threaded fasteners using ICC-ES AC233 and are the subject of IAPMO-UES ER-192. The Strong-Drive SDWS22DB Structural Wood screws were evaluated for corrosion resistance using ICC-ES AC257.

For more information, see p. 53, C-F-2019 Fastening Systems Catalog

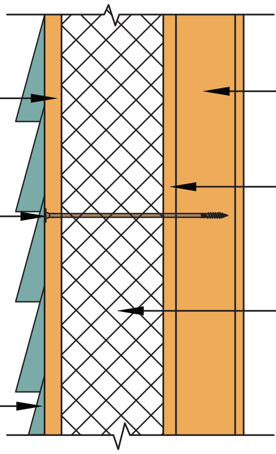




Wall Cross-Section

Caution: Fasteners can penetrate wiring, plumbing and other mechanical systems in exterior walls. All mechanical systems in the exterior wall involved with the fastening shall be mapped before driving screws.

Strong-Drive® SDWS TIMBER Screw for Attaching Exterior Foam Insulation (cont.)



Furring and Rigid Foam Attachment Detail

Recommended Vertical Fastener Spacing

<table>
<tr><th rowspan="2">Size (in.)</th><th rowspan="2">Model No.</th><th rowspan="2">Foam Thickness (in.)</th><th rowspan="2">Stud Spacing (in.)</th><th colspan="3">Maximum Allowable Cladding Weight to be Supported (psf)</th></tr>
<tr><th>≤ 20</th><th>25</th><th>30</th></tr>
<tr><td rowspan="2">0.220 x 4</td><td rowspan="2">SDWS22400DB</td><td rowspan="2">½</td><td>16</td><td rowspan="10">24" o.c.</td><td rowspan="9">24" o.c.</td><td rowspan="9">24" o.c.</td></tr>
<tr><td>24</td></tr>
<tr><td rowspan="2">0.220 x 5</td><td rowspan="2">SDWS22500DB</td><td rowspan="2">1 to 1½</td><td>16</td></tr>
<tr><td>24</td></tr>
<tr><td rowspan="2">0.220 x 6</td><td rowspan="2">SDWS22600DB</td><td rowspan="2">2</td><td>16</td></tr>
<tr><td>24</td></tr>
<tr><td rowspan="2">0.220 x 8</td><td rowspan="2">SDWS22800DB
SDWS22800</td><td rowspan="2">4</td><td>16</td></tr>
<tr><td>24</td></tr>
<tr><td rowspan="2">0.220 x 10</td><td rowspan="2">SDWS221000DB
SDWS221000</td><td rowspan="2">6</td><td>16</td></tr>
<tr><td>24</td><td>18" o.c.</td><td>18" o.c.</td></tr>
</table>

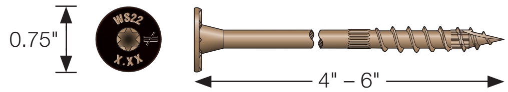
1. Caution: Fasteners can penetrate wiring, plumbing and other mechanical systems in exterior walls. All mechanical systems in the exterior wall involved with the fastening shall be mapped before driving screws.
2. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.
3. Wood wall framing (studs) shall be a minimum of 2" nominal thickness. Wood framing and furring shall be a minimum spruce-pine-fir species with specific gravity of 0.42 or greater. Table assumes furring strip thickness of ¾" and full thread embedment in the framing member.
4. Wood framing, furring and WSP sheathing shall meet the design requirements in accordance with the applicable building codes. WSP sheathing shall be fastened to the framing as required by the applicable building code.
5. Each fastener is capable of resisting 172 lb. of out-of-`plane wind loading (C_D = 1.60) with no further increase allowed.
6. Spacing recommendations are based on a loading that produced 0.015" of assembly movement with 6"-thick rigid foam board insulation.
7. Maximum allowable cladding weight shall be the additive weight of furring, cladding including foam insulation, environmental effects (i.e. ice) and other supported materials.
8. Metal fasteners conduct heat, and it is recommended that exposed screw heads are covered with foam and sealed.
9. Screws shall be installed such that they close gaps between connected components. Furring and sheathing shall provide the required thickness and performance for siding manufacturer installation instructions.

Sole / Top Plate-to-Rim Fastening

Strong-Drive® SDWS TIMBER Screw

Sole-to-Rim Connections

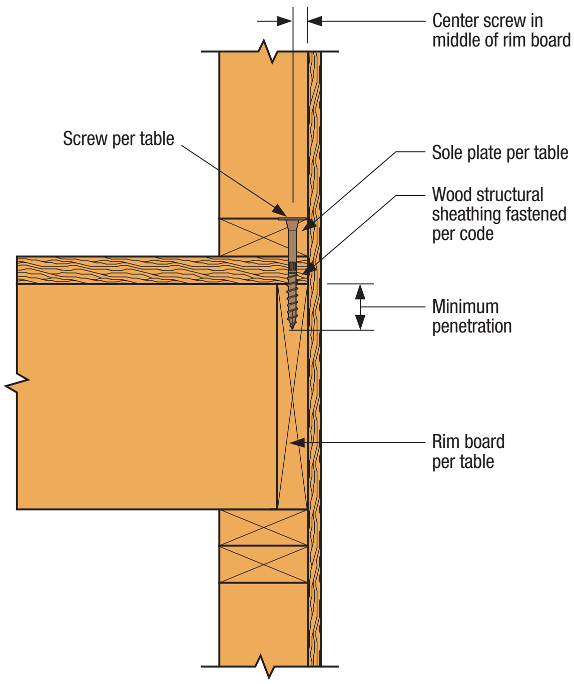
For more information, see p. 53, C-F-2019 Fastening Systems Catalog



SDWS Timber Screw — Allowable Shear Loads for Sole-to-Rim Connections

Size (in.)	Model No.	Sole Plate Nominal Thickness (in.)	Minimum Penetration into Rim Board (in.)	Reference Allowable Loads (lb.) per Screw							
				2x DFL/SP Rim Board		2x SPF/HF Rim Board		1¼" Min. LVL Rim Board		1¼" Min. LSL Rim Board	
				DFL/SP Sole Plate	SPF/HF Sole Plate	DFL/SP Sole Plate	SPF/HF Sole Plate	DFL/SP Sole Plate	SPF/HF Sole Plate	DFL/SP Sole Plate	SPF/HF Sole Plate
0.22 x 4	SDWS22400DB	2x	1.75	345	295	295	295	275	275	275	275
0.22 x 5	SDWS22500DB	2x	2	345	295	295	295	275	275	275	275
0.22 x 6	SDWS22600DB	2x, 3x, (2)-2x	2	345	295	295	295	275	275	275	275

1. Allowable loads are based on testing per ICC-ES AC233 and are limited to parallel-to-grain loading.
2. Allowable loads are shown at the wood load duration factor of C_D = 1.00. Loads may be increased for load duration by the building code up to a C_D = 1.60.
3. Minimum spacing of the SDWS is 6" o.c., minimum end distance is 6", and minimum edge distance is ⅝".
4. Wood structural panel up to 1⅛" thick (23/32" for SDWS22400DB) is permitted between the sole plate and rim board provided it is fastened to the rim board per code and the minimum penetration of the screw into the rim board is met.
5. A double 2x sole plate/top plate is permitted provided it is independently fastened per the code and the minimum screw penetration per the table is met.
6. Minimum rim board height shall be 9¼" when using SDWS screws for sole and top plate fastening.
7. Sole-to-rim loads can be achieved without a wall below.



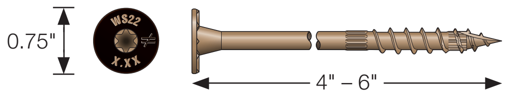
Sole-to-Rim Board Assembly
(Other fasteners not shown for clarity)

Sole/Top Plate-to-Rim Fastening

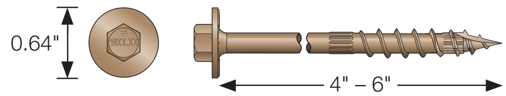
Strong-Drive® SDWS TIMBER Screw and SDWH TIMBER-HEX Screw

Sole Plate/Top Plate to Rim/Blocking Shear Load Transfer with Reduced Fastener Spacing

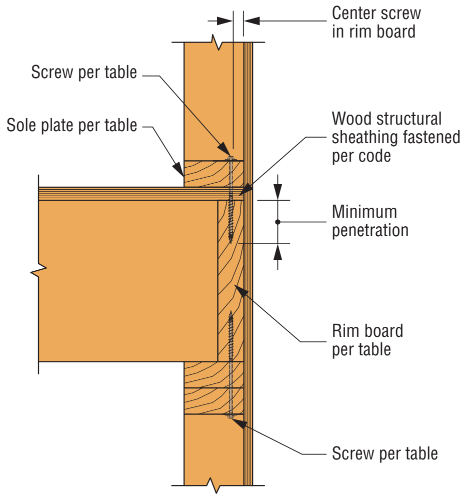
Strong-Drive SDWS Timber and Strong-Drive SDWH Timber-Hex structural screws may be used to attach a sole plate or top plate to a rim board and blocking material according to the following details and loading information. Allowable loads are based on testing per ICC-ES AC233 and are limited to parallel-to-grain or in-plane-shear loading. Each test assembly consisted of multiple fasteners, a sole plate, sheathing and a rim board or blocking material. Please see the following for allowable load tables.



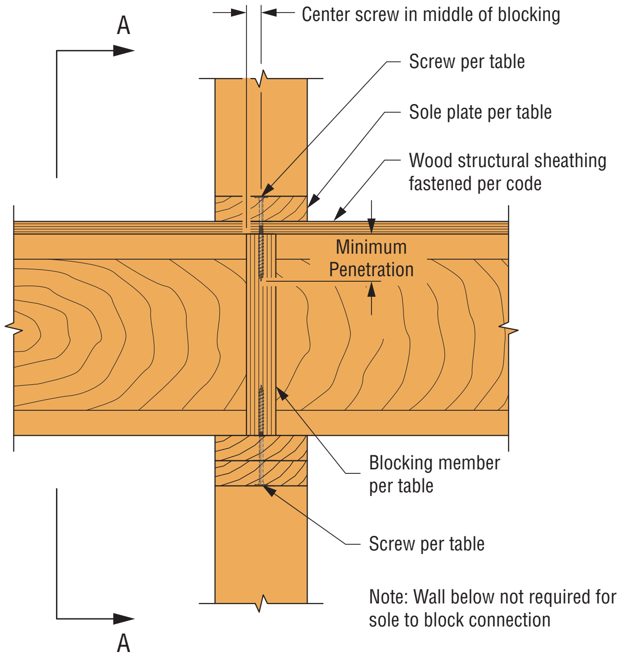
Strong-Drive SDWS TIMBER Screw



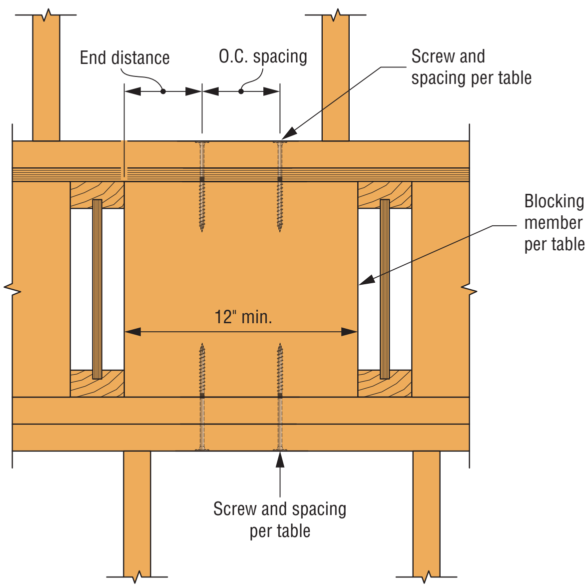
Strong-Drive SDWH TIMBER-HEX Screw



Sole-to-Rim and Top Plate-to-Rim Connection



Sole-to-Block and Top Plate-to-Block Connection



Sole-to-Block and Top Plate-to-Block Connection

Strong-Drive® SDWS TIMBER Screw and SDWH TIMBER-HEX Screw (cont.)

SDWS Timber/SDWH Timber-Hex Single-Fastener, Allowable Loads for Sole-to-Rim (or Blocking) and Top Plate-to-Rim (or Blocking) Connection

Min. Screw Length (in)	Sole Plate or Top Plate Nominal Thickness		Model No.	Min. Penetration into Rim or Block (in.)	Reference Allowable Shear Loads (lb.) per Screw DFL/SP Sole Plate and Top Plate — Rim and Blocking Material					
					2x Min. DFL/SP		1¼" Min. LVL	1¾" Min. LVL	1¼" Min. LSL	1¾" Min. LSL
					6" O.C. 6" End Distance	3" O.C. 3" End Distance	6" O.C. 6" End Distance	4" O.C. 4" End Distance	6" O.C. 6" End Distance	4" O.C. 4" End Distance
4	Sole Plate	2x	SDWH19400DB	1.75	315	220	255	260	275	230
4		2x	SDWS22400DB	1.75	345	240	275	305	275	350
5		2x	SDWS22500DB	2	345	240	275	360	275	345
6		3x	SDWH19600DB	2	315	225	255	260	275	230
6		3x	SDWS22600DB	2	345	240	275	360	275	345
6		(2) 2x	SDWH19600DB	1.75	315	220	255	260	275	230
6		(2) 2x	SDWS22600DB	1.75	345	240	275	305	275	350
8		(2) 2x	SDWH19800DB	2	315	225	255	260	275	230
8		(2) 2x	SDWS22800DB	2	345	240	275	360	275	345
5	Top Plate	(2) 2x	SDWS22500DB	2	345	240	275	360	275	345
6		(2) 2x	SDWH19600DB	2	315	225	255	260	275	230
6		(2) 2x	SDWS22600DB	2	345	240	275	360	275	345

1. Allowable loads are shown at the wood load duration factor of C_D = 1.00. Loads may be increased for load duration by the building code up to a C_D = 1.60.
2. For 2x solid sawn members and 1¼" LVL or LSL members the minimum edge distance is ⅝". For 1¾" LVL or LSL members the minimum edge distance is ⅞".
3. Wood structural panel up to 1⅛" thick (²³⁄₃₂ for 4" fasteners) is permitted between sole plate and rim board provided it is fastened to the rim board per code and the minimum penetration of the screw into the rim/block is met.
4. Double sole plate and top plate fastened minimum per code.
5. Minimum rim height is 9¼" when using fasteners on the top and bottom. Sole to blocking loads can be achieved with or without a wall below.
6. For assemblies using SPF/HF lumber for the sole plate, top plate, or rim/blocking members, multiply table values by 0.86.

Spacing for Multiple Rows of Fasteners

Material	O.C. Spacing/ End Distance Spacing (in.)	Row Offset (in.)	Row Stagger (in.)
Solid Sawn	3	1¼	1¼
	6		
LVL or LSL	4	1¾	1¾
	6	1¼	1¼

1. The material must be wide enough to accommodate minimum edge distance, row offset and row stagger.

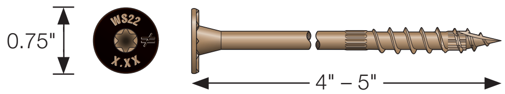
Deck Construction — Ledgers

SIMPSON Strong-Tie®

Deck Applications

Strong-Drive® SDWS TIMBER Screw

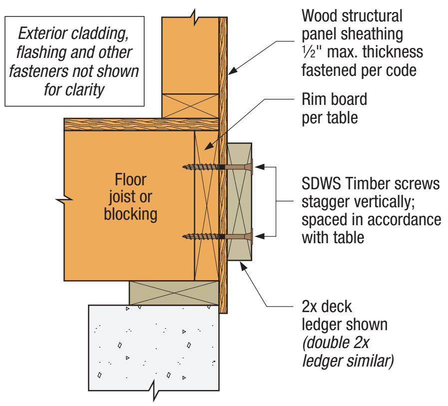
For more information, see p. 53, C-F-2019 Fastening Systems Catalog



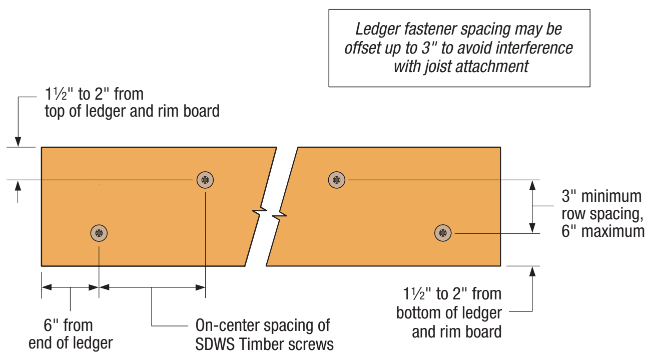
SDWS Timber Screw — 2015 and 2018 IRC Compliant Spacing for a Sawn Lumber Deck Ledger-to-Rim Board

Loading Condition	Nominal Ledger Size (in.)	Size (in.)	Model No.	Rim Board Material and Minimum Size	Maximum Deck Joist Span						
					Up to 6 ft.	Up to 8 ft.	Up to 10 ft.	Up to 12 ft.	Up to 14 ft.	Up to 16 ft.	Up to 18 ft.
					Maximum On-Center Spacing of Fasteners (in.)						
40 psf Live 10 psf Dead	2x	0.22 x 4	SDWS22400DB	1" OSB 1" LVL	14	10	8	7	6	5	5
				1⅛" OSB 1 5/16" LVL 1¼" LSL	16	12	10	8	7	6	5
				2x SP, DFL — 2x SPF, HF	22	16	13	11	9	8	7
60 psf Live 10 psf Dead	2x	0.22 x 4	SDWS22400DB	1" OSB 1" LVL	10	7	6	5	4	4	—
				1⅛" OSB 1 5/16" LVL 1¼" LSL	12	9	7	6	5	4	4
				2x SP, DFL — 2x SPF, HF	15	12	9	8	7	6	5
40 psf Live 10 psf Dead	(2) 2x	0.22 x 5	SDWS22500DB	1" OSB 1" LVL	15	12	9	8	7	6	5
				1⅛" OSB 1 5/16" LVL 1¼" LSL	16	12	10	8	7	6	5
				2x SP, DFL — 2x SPF, HF	16	12	10	8	7	6	5
60 psf Live 10 psf Dead	(2) 2x	0.22 x 5	SDWS22500DB	1" OSB 1" LVL	11	8	7	6	5	4	4
				1⅛" OSB 1 5/16" LVL 1¼" LSL	12	9	7	6	5	4	4
				2x SP, DFL — 2x SPF, HF	12	9	7	6	5	4	4

1. SDWS screw spacing values are equivalent to 2018 IRC Table R507.9.1.3(1) and 2015 IRC Table R507.2. The table above also provides SDWS screw spacing for a wide range of materials commonly used for rim board, and an alternate loading condition as required by some jurisdictions.
2. Sawn lumber rim board shall be spruce-pine-fir, hem-fir, Douglas fir–larch, or southern pine species. Ledger shall be hem-fir, Douglas fir–larch, or southern pine species.
3. Fastener spacings are based on the lesser of single fastener ICC-ES AC233 testing of the Strong-Drive SDWS Timber screw with a safety factor of 5.0 or ICC-ES AC13 assembly testing with a factor of safety of 5.0. Spacing includes NDS wet service factor adjustment.
4. Multiple ledger plies shall be fastened together per code independent of the SDWS screws.
5. Rows of screws shall be vertically offset and evenly staggered. Screws shall be placed 1½" to 2" from the top and bottom of the ledger or rim board with 3" minimum and 6" maximum between rows and spaced per the table. End screws shall be located 6" from the end and at 1½" to 2" from the bottom of the ledger. For screws located at least 2" but less than 6" from the end, use 50% of the load per screw and 50% of the table spacing between the end screw and the adjacent screw, and for screws located between 2" and 4" from the end, predrill using a 5/32" drill.
6. Structural sheathing between the ledger and rim board shall be a maximum of ½" thick and fastened per code.
7. See pp. 109–110 for ledger-to-rim attachment with ½" gap.



Ledger-to-Rim Board Assembly
(wood-framed lower floor acceptable,concrete wall shown for illustration purposes; other fasteners not shown for clarity.)

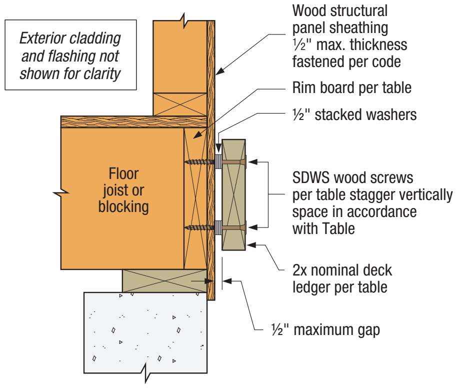


SDWS Timber Screw Spacing Detail for Ledgers

SIMPSON Strong-Tie®

Strong-Drive® SDWH TIMBER-HEX and SDWS TIMBER Screw

2015 and 2018 IRC Compliant Spacing and Allowable Shear Loads for Fastening a Sawn Lumber Deck Ledger-to-Rim Board with ½" Gap



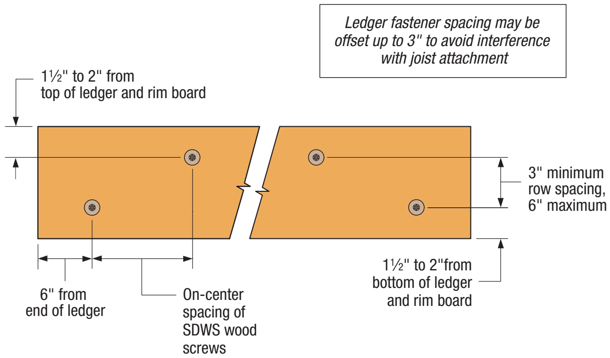


Table below lists the allowable shear loads for SDWS Timber screws and SDWH Timber-Hex screws when attaching a 2x ledger with up to ½" thickness of stacked washers to the listed rim board.

Single-Fastener Allowable Shear Loads for Fastening a Sawn Lumber Deck Ledger-to-Rim Board with ½" Gap

Nominal Ledger Size (in.)	Rim Board	Size (in.)	Model No.	Reference Allowable Load (lb.)
2x	2x SPF, DFL, SP #2	0.220 x 4	SDWS22400DB	270
		0.195 x 4	SDWH19400DB	260
	1⅛" LSL	0.220 x 4	SDWS22400DB	255
		0.195 x 4	SDWH19400DB	245
	1¾" LVL	0.220 x 4	SDWS22400DB	290
		0.195 x 4	SDWH19400DB	255

1. Sawn lumber 2x ledger shall have a minimum specific gravity of 0.42 (HF or SPF) and be grade No. 2 or better.
2. Rim board is to be dry lumber (specific gravity at least 0.42) or EWP rim board product (equivalent specific gravity of at least 0.42 for nails and screws installed in the face orientation).
3. Fastener spacings are based on the lesser of single fastener testing following ICC-ES AC233 or ledger assembly testing following ICC-ES AC13 using a safety factor of 5.0.
4. Screws shall be placed 1½" to 2" from the top and bottom of the ledger board or rim board, 6" from the end of the ledger with 3" minimum and 6" maximum between rows. Minimum on-center spacing is 4".
5. Wood structural panel sheathing between the ledger and rim board shall be a maximum of ½" thick and fastened per code.
6. Screws shall be tightened such that the washer stack is tightly compressed between the ledger and the rim board.
7. Maximum ½" gap created by stacked hot-dip galvanized or stainless-steel 5⁄16" Type A plain washers (N-narrow) with an outside diameter equal to 0.688" and inside diameter equal to 0.344".
8. Allowable loads are shown at the wood load duration factor of C_D = 1.0. Loads may be increased for load duration per the building code up to a C_D = 1.6. Tabulated values must be multiplied by all applicable adjustment factors per the NDS, including wet service factor.

SIMPSON Strong-Tie®

Deck Applications

Strong-Drive®
SDWH TIMBER-HEX and SDWS TIMBER Screw (cont.)

2015 and 2018 IRC Compliant Spacing and Allowable Shear Loads for Fastening a Sawn Lumber Deck Ledger-to-Rim Board with ½" Gap

Strong-Drive® SDWS Timber screws and SDWH Timber-Hex screws are suitable for installing ledgers with up to ½" drainage gap between the ledger and the rim board. These fasteners do not require predrilling and have a double-barrier coating providing corrosion resistance equivalent to hot-dip galvanization. The gap is formed by stacking hot-dip galvanized or stainless-steel 5⁄16" Type A plain washers (0.688" outside diameter, 0.344" inside diameter) on the shank of the screws between the ledger and the rim board. Weather proofing shall be the responsibility of the installer. The table below lists the maximum on-center spacing of SDWS Timber screws and SDWH Timber-Hex screws when attaching a 2x ledger to the listed rim board of various widths with a maximum ½" gap between them.

Loading Condition: 40 PSF Live Load and 10 PSF Dead Load

Ledger Nominal Size (in.)	Rim Board Material (in.)	Size (in.)	Model No.	Maximum Deck Joist Span						
				Up to 6 ft.	Up to 8 ft.	Up to 10 ft.	Up to 12 ft.	Up to 14 ft.	Up to 16 ft.	Up to 18 ft.
				Maximum On-Center Spacing of Fasteners (in.)						
2x	2x DFL, SP, SPF #2	0.220 x 4	SDWS22400DB	15	11	9	7	6	5	5
		0.195 x 4	SDWH19400DB	14	11	8	7	6	5	4
	1.125" LSL	0.220 x 4	SDWS22400DB	14	10	8	7	6	5	4
		0.195 x 4	SDWH19400DB	13	10	8	6	5	5	4
	1.75" LVL	0.220 x 4	SDWS22400DB	16	12	9	8	7	6	5
		0.195 x 4	SDWH19400DB	14	10	8	7	6	5	4

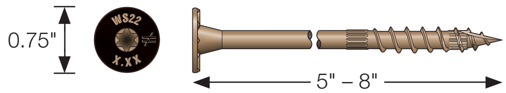
1. Sawn lumber ledger shall have minimum specific gravity of 0.42 (HF or SPF) and shall be grade No. 2 or better. Rim board is to be dry lumber (specific gravity at least 0.42) or EWP rim board product (equivalent specific gravity of at least 0.42 for nails and screws installed in the face orientation).
2. Fastener spacings are based on the lesser of single fastener testing following ICC-ES AC233 or ledger assembly testing following ICC-ES AC13 using a safety factor of 5.0. Spacing includes NDS wet service factor adjustment.
3. Screws shall be placed 1½" to 2" from the top and bottom of the ledger board or rim board, 6" from the end of the ledger with 3" minimum and 6" maximum between rows. End screws shall be located near the bottom of the ledger. See figure on the following page.
4. Wood structural panel sheathing between the ledger and rim board shall be a maximum of ½" thick and fastened per code.
5. Screws shall be tightened such that the washer stacks are tightly compressed between the ledger and the rim board.
6. Maximum ½" gap formed by stacked hot-dip galvanized or stainless-steel 5⁄16" Type A plain washers (N-narrow) with a nominal outside diameter of 0.688" and inside diameter of 0.344".
7. The fastener specifications in this table meet the prescriptive deck ledger attachment solutions and loading requirements per 2018 IRC Table R507.9.1.3(1) and Table R507.2 of the 2012 and 2015 IRC.

Strong-Drive® SDWS TIMBER Screw for Guard Post Installations

For more information, see p. 52, C-F-2019 Fastening Systems Catalog

Framed guard post installations fastened with SDWS Timber screws were tested in accordance with ICC-ES AC273 and met the 600 lb. concentrated ultimate load applied at the top of a single post in an outward direction and the post deflection limit at the 200 lb. design level. For a required uniform load of 150 plf in AC273 for guard and handrail systems, the screw was not tested as excepted for one- and two-family dwellings in IBC 2015 Section 1607.8.1. The following details were tested:

- Detail A: Interior Post on Rim Board
- Detail B: Interior Post at Corner
- Detail C: Interior Post on Rim Joist with Adjacent Joist
- Detail D: Interior Post on Rim Joist between Joists



The SDWS Timber screws are the subject of IAPMO-UES ER-192. The following table lists the SDWS Timber screw information and total quantity of fasteners required for each guard post detail. The guard post details are shown on pp. 116–118.

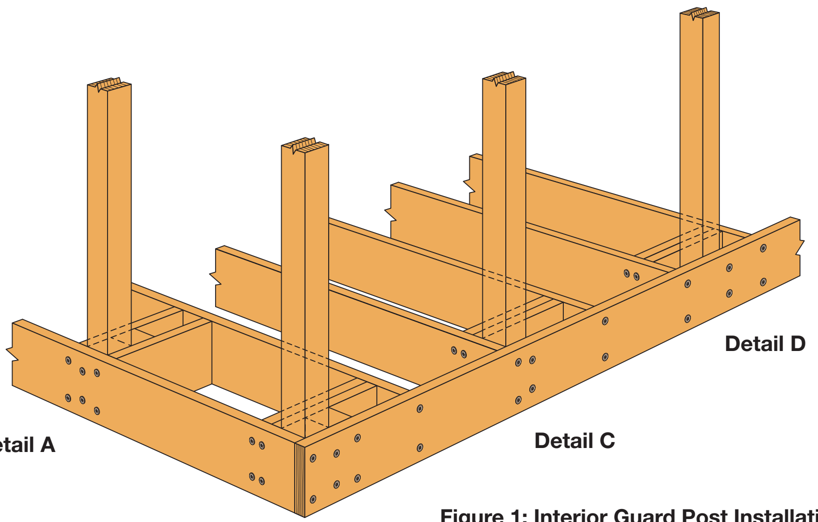


Figure 1: Interior Guard Post Installations Using Strong-Drive SDWS Timber Screws

Code-Compliant Guard Post Connection Details

Installation Scope:

For 36" Guard Post Height
(above deck surface, refer to T-F-GRDPSTRL)

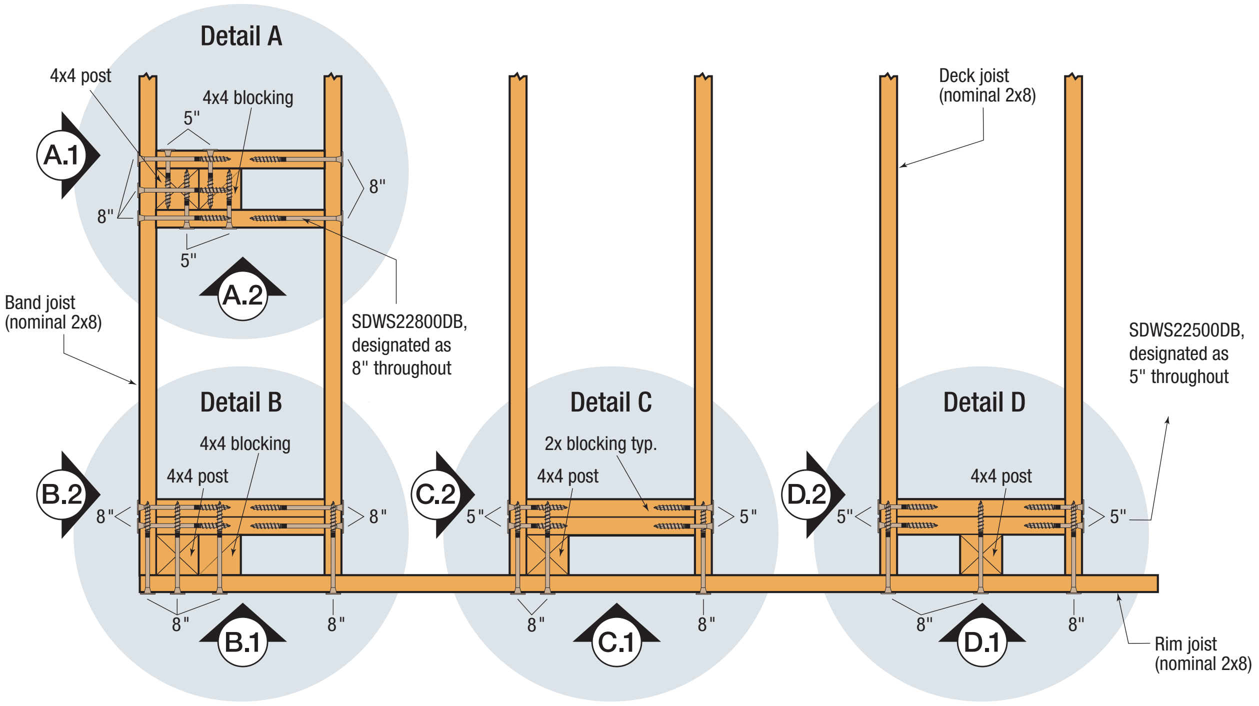
- Use Nominal 4" x 4" guard post
- Use Nominal 2" x 8" rim board/rim joist, 2x blocking and 4x blocking
- Framing lumber should be HF, DFL or SP, pressure treated with chemical retention not greater than UC4A
- Full-depth blocking required
- Interior post installation (post positioned inside the rim board, rim joist)
- Fastener position tolerance: ± 1⁄16"

For 42" Guard Post Height
(above deck surface, refer to L-F-SDWS42GRD)

- Use Nominal 4" x 4" guard post
- Use Nominal 2" x 8" rim board/rim joist, 2x blocking and 4x blocking
- Framing lumber should be DFL (No. 2 grade, minimum) or SP (Construction grade, minimum), pressure treated with chemical retention not greater than UC4A
- Full-depth blocking required
- Interior post installation (post positioned inside the rim board, rim joist)
- Fastener position tolerance: ± 1⁄16"

Deck Applications

Strong-Drive® SDWS TIMBER Screw for Guard Post Installations (cont.)



Plan View Showing Details of Four Guard Post Connections Using Strong-Drive SDWS Timber Screws

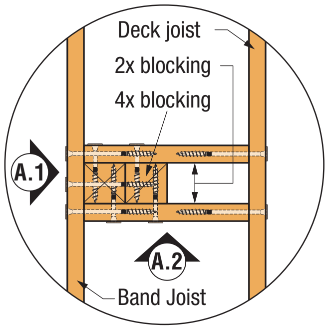
SDWS22DB Screw Information for Guard Post Details

Detail	Size (in.)	Model No.	Quantity Required
A	0.220 x 5	SDWS22500DB	4
	0.220 x 8	SDWS22800DB	10
B	0.220 x 8	SDWS22800DB	16
C	0.220 x 5	SDWS22500DB	8
	0.220 x 8	SDWS22800DB	6
D	0.220 x 5	SDWS22500DB	8
	0.220 x 8	SDWS22800DB	6

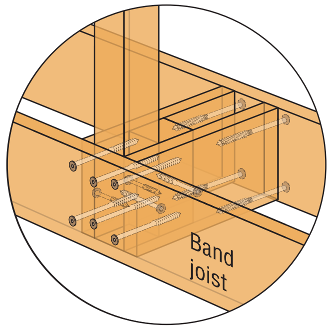
1. SDWS Timber screws install best with a low-speed ½" drill and a T-40 6-lobe bit. The matched bit included with the screws is recommended for best results.
2. Predrilling is typically not required. Where predrilling is necessary, use a 5⁄32" drill bit for Strong-Drive SDWS Timber screws.
3. Screw heads that are countersunk flush to the wood surface are acceptable if the screw has not spun out.
4. Deck joists shall be fastened to rim joist and ledger as required by the code. See p. 118 for rim joist connection.

Strong-Drive® SDWS TIMBER Screw for Guard Post Installations (cont.)

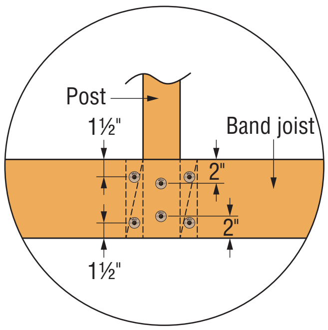
Detail A — Interior Post on Rim Board



Detail A Plan View

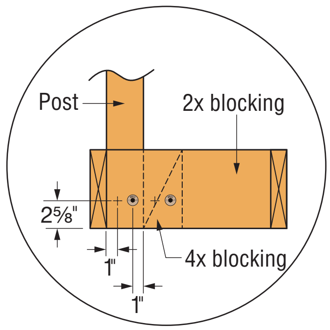


Detail A Isometric View



Detail A.1 Front Elevation

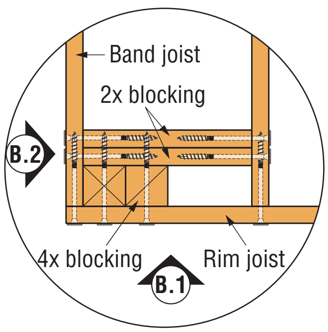
1. Rim board to 2x blocking 1½" from top and bottom edges using 8" SDWS22800DB.
2. Rim board to post and 4x blocking 2" from top and bottom edges using 8" SDWS22800DB.



Detail A.2 Side Elevation

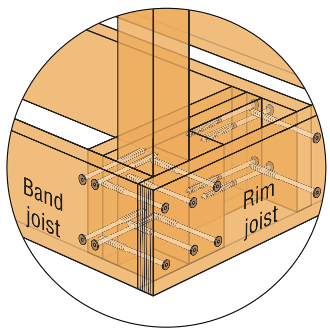
1. 2x blocking to post — opposing screws 1" from outer edges of post, 2⅝" from bottom edge of 2x blocking using 5" SDWS22500DB.
2. 2x blocking to 4x blocking — opposing screws 1" from outer edges of 4x blocking, 2⅝" from bottom edge of 2x blocking using 5" SDWS22500DB.

Detail B — Interior Post on Corner

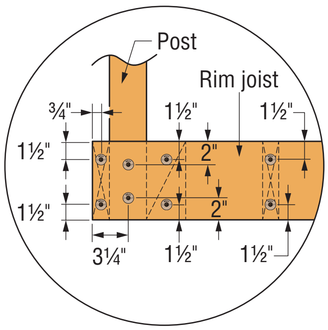


Detail B Plan View

Note: For fastening rim joist to rim board and deck joists, predrilling for the SDWS22800DB screws is recommended using a 5⁄32" drill bit.

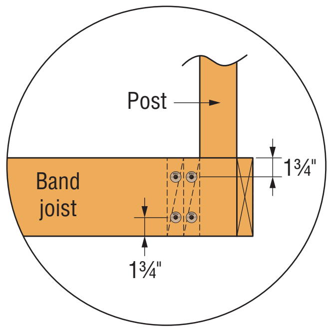


Detail B Isometric View



Detail B.1 Front Elevation

1. Rim joist to rim board or deck joists 1½" from top and bottom edges, ¾" from side edge using 8" SDWS22800DB.
2. Rim joist to post and 2x blocking 2" from top and bottom edges, centered on post using 8" SDWS22800DB.
3. Rim joist to 4x blocking and 2x blocking 1½" from top and bottom edges centered on 4x blocking using 8" SDWS22800DB.



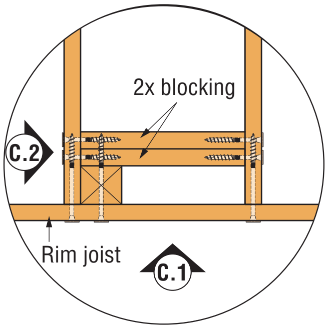
Detail B.2 Side Elevation

1. Rim board to 2x blocking 1¾" from top and bottom edges using 8" SDWS22800DB.

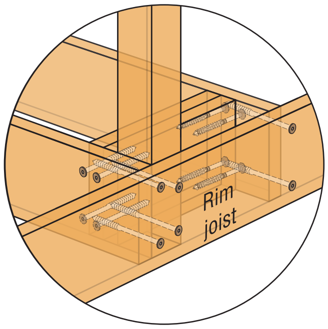
Deck Applications

Strong-Drive® SDWS TIMBER Screw for Guard Post Installations (cont.)

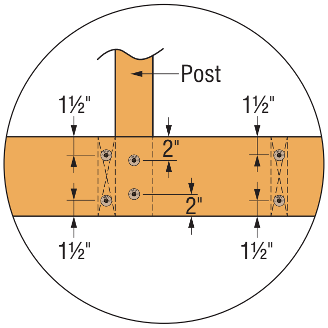
Detail C — Interior Post on Rim Joist with Adjacent Joist



Detail C Plan View

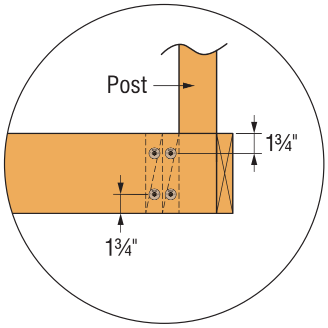


Detail C Isometric View



1. Rim joist to deck joist 1½" from top and bottom edges using 8" SDWS22800DB.
2. Rim joist to post and 2x blocking 2" from top and bottom edges using 8" SDWS22800DB.

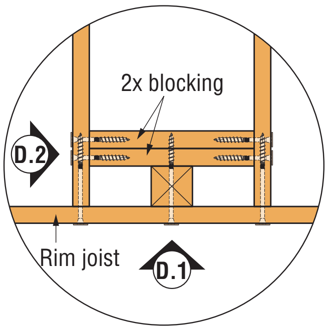
Detail C.1 Front Elevation



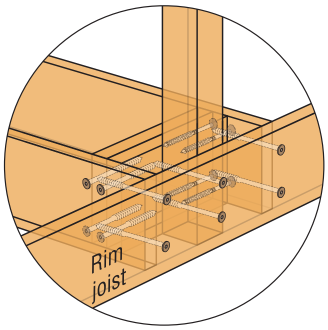
1. Deck joist to 2x blocking 1¾" from top and bottom edges using 5" SDWS22500DB.

Detail C.2 Side Elevation

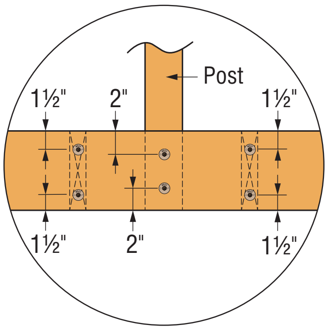
Detail D — Interior Post on Rim Joist Between Joists



Detail D Plan View

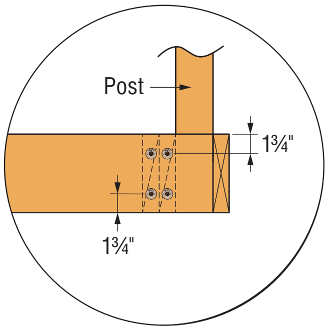


Detail D Isometric View



1. Rim joist to deck joists 1½" from top and bottom edges using 8" SDWS22800DB.
2. Rim joist to post and 2x blocking 2" from top and bottom edges using 8" SDWS22800DB.

Detail D.1 Front Elevation



1. Deck joist to 2x blocking 1¾" from top and bottom edges using 5" SDWS22500DB.

Detail D.2 Side Elevation