HAREZLAK ENGINEERING

STRUCTURAL ENGINEERING CALCULATIONS:

WANG AND YANG ADU

PREPARED BY: PHIL HAREZLAK, PE

DATE: 11/17/2023

HAREZLAK ENGINEERING

JOB _____

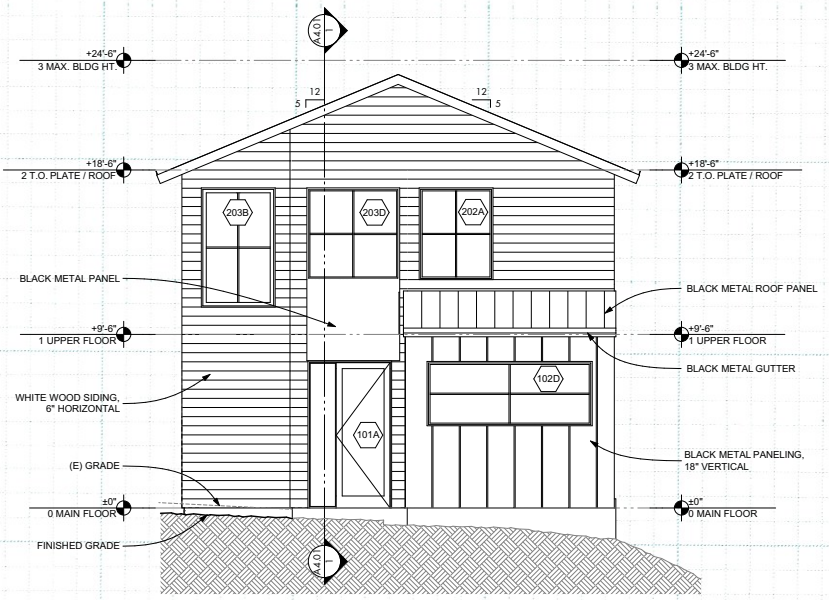
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

PROJECT SCOPE:



NEW DESIGN FOR A 2 STORY ADU. FLOOR FRAMING TO BE PRE-MFR TJI SYSTEM. ROOF FRAMING TO BE PRE-MFR ROOF TRUSSES. ENGINEERED BEAMS SIZED AS REQUIRED.

LATERAL DESIGN WILL BE ACCOMPLISHED BY PLYWOOD SHEATHED WOOD SHEAR WALLS AND DIAPHRAGMS.

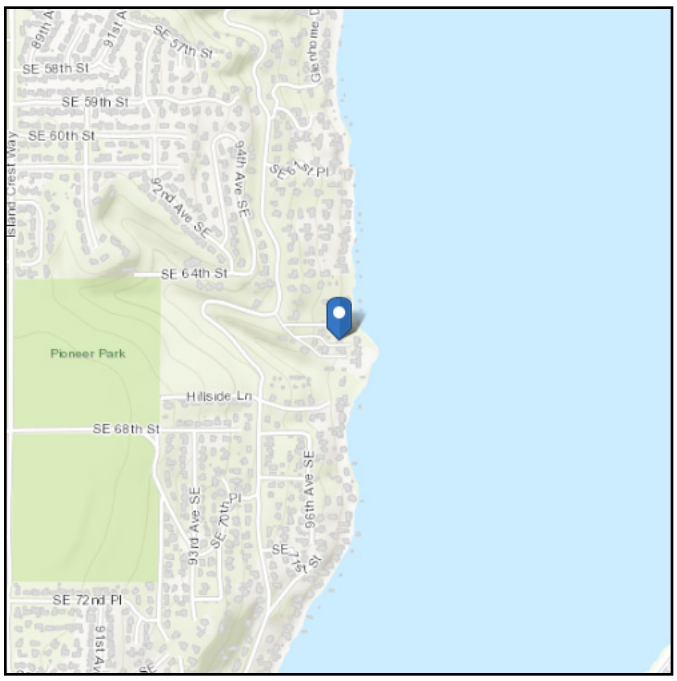
TABLE OF CONTENTS:

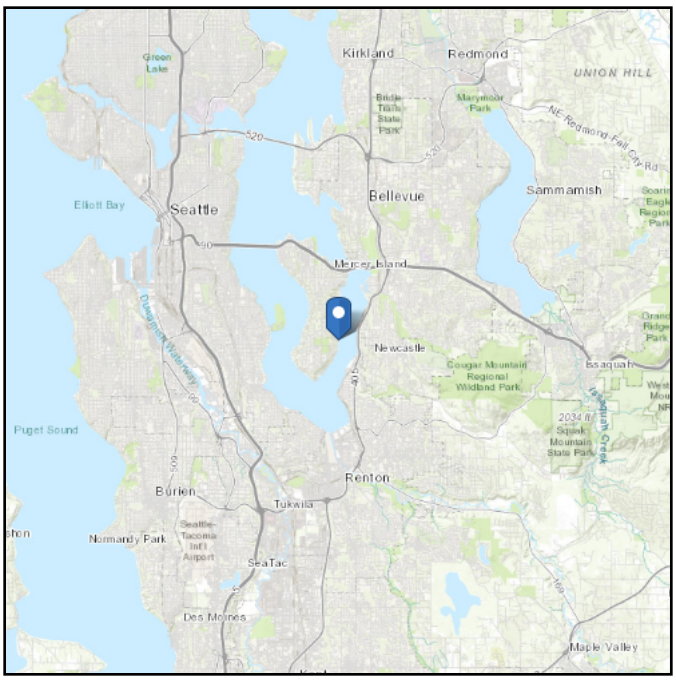
ASCE 7 Hazards Report

Address:
6450 E Mercer Way
Mercer Island, Washington
98040

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

Latitude: 47.544227
Longitude: -122.209992
Elevation: 41.38879395239412 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

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Mon Nov 13 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 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

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

Seismic

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

Results:

S_S :	1.449	S_{D1} :	N/A
S_1 :	0.502	T_L :	6
F_a :	1.2	PGA :	0.62
F_v :	N/A	PGA_M :	0.744
S_{MS} :	1.739	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.159	C_v :	1.39

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

Data Accessed: Mon Nov 13 2023

Date Source: USGS Seismic Design Maps

Snow

Results:

Mapped Elevation:

Data Source:

Date Accessed: Mon Nov 13 2023

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

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

Statutory requirements of the Authority Having Jurisdiction are not included. Site is outside ASCE/SEI 7-16, Table 7.2-5 boundaries. For ground snow loads in this area, see SEAW Snow Load Analysis for Washington, 2nd Ed. (1995), Structural Engineers Association of Washington, Seattle, WA.

Snow load values are mapped to a 0.5 mile resolution. This resolution can create a mismatch between the mapped elevation and the site-specific elevation in topographically complex areas. Engineers should consult the local authority having jurisdiction in locations where the reported ‘elevation’ and ‘mapped elevation’ differ significantly from each other.

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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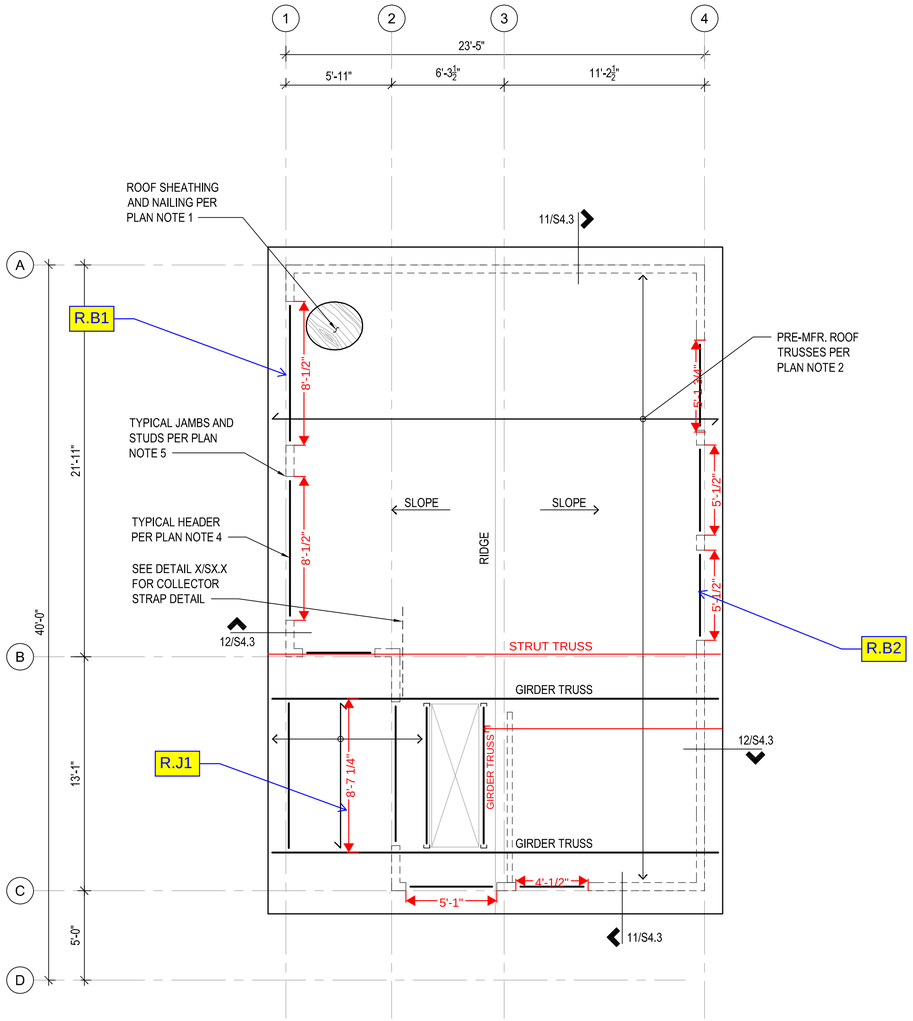
In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

HAREZLAK ENGINEERING

WANG AND YANG ADU--GRAVITY CALCULATIONS



ROOF FRAMING PLAN

SCALE: 1/4" = 1'-0"

HAREZLAK ENGINEERING

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CHECKED BY: MJH
APPROVED BY: PAH

PROJECT INFORMATION:
WANG & YANG ADU

PROJECT ADDRESS:
6450 E MERCER WAY
MERCER ISLAND, WA 98040

REVISIONS:

NO.	DESCRIPTION	DATE

PROJECT NUMBER:
ISSUE DATE:
CURRENT REVISION:

SHEET NAME:
ROOF FRAMING PLAN

SHEET NUMBER:
S2.2

HAREZLAK ENGINEERING

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Wang and Yang ADU.ec6

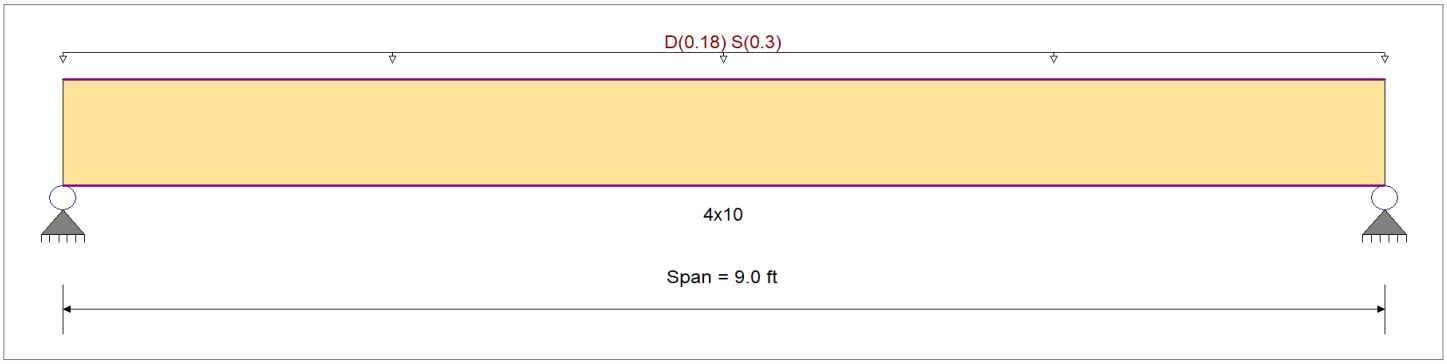
DESCRIPTION: R.B1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	900 psi	Ebend- xx	1600 ksi
		Fc - Prll	1350 psi	Eminbend - xx	580 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625 psi		
Wood Grade :	No.2	Fv	180 psi		
		Ft	575 psi	Density	31.21 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.941 : 1	Maximum Shear Stress Ratio	=	0.402 : 1
Section used for this span		4x10	Section used for this span		4x10
fb: Actual	=	1,168.47 psi	fv: Actual	=	83.28 psi
F'b	=	1,242.00 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	4.500 ft	Location of maximum on span	=	8.245 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.121 in	Ratio =	895 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.193 in	Ratio =	559 >=180	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.451	0.193	0.90	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.82	438.2	972.0	0.67	31.2	162.0
+D+S					1.00	1.00	1.00	1.200	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.941	0.402	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	4.86	1,168.5	1,242.0	1.80	83.3	207.0
+D+0.750S					1.00	1.00	1.00	1.200	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.794	0.339	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	4.10	985.9	1,242.0	1.52	70.3	207.0
+0.60D					1.00	1.00	1.00	1.200	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.152	0.065	1.60	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.09	262.9	1,728.0	0.40	18.7	288.0

Wood Beam

Project File: Wang and Yang ADU.ec6

DESCRIPTION: R.B2

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

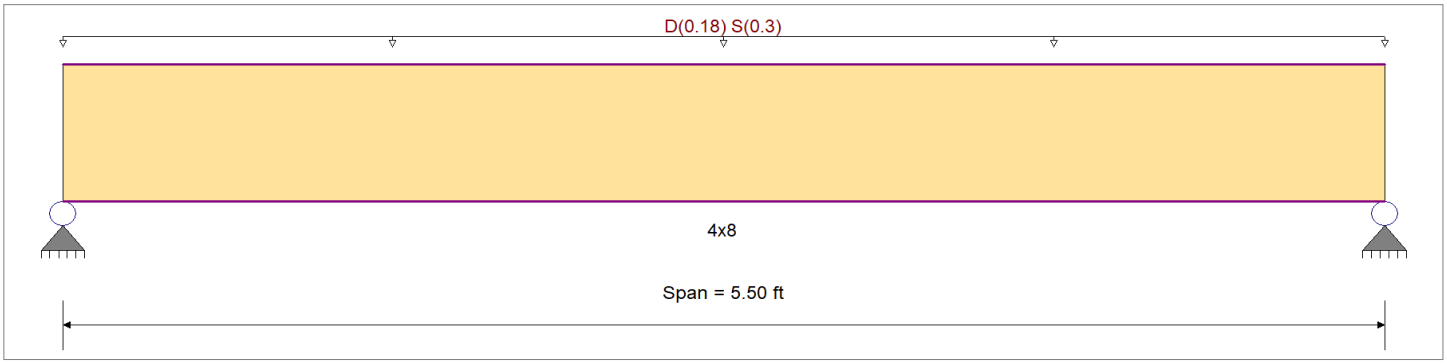
Wood Species : Douglas Fir-Larch
Wood Grade : No.2

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	900.0 psi
Fb -	900.0 psi
Fc - Prll	1,350.0 psi
Fc - Perp	625.0 psi
Fv	180.0 psi
Ft	575.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	580.0 ksi
Density	31.210 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.528 : 1	Maximum Shear Stress Ratio	=	0.294 : 1
Section used for this span		4x8	Section used for this span		4x8
fb: Actual	=	710.34 psi	fv: Actual	=	60.94 psi
F'b	=	1,345.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	2.750 ft	Location of maximum on span	=	4.898 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.035 in	Ratio =	1889 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.056 in	Ratio =	1180 >=180	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 5.50 ft	1	0.253	0.141	0.90	1.00	1.00	1.00	1.300	1.00	1.00	1.00	0.68	266.4	1,053.0	0.39	22.9	162.0
+D+S					1.00	1.00	1.00	1.300	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.50 ft	1	0.528	0.294	1.15	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.82	710.3	1,345.5	1.03	60.9	207.0
+D+0.750S					1.00	1.00	1.00	1.300	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.50 ft	1	0.445	0.248	1.15	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.53	599.3	1,345.5	0.87	51.4	207.0
+0.60D					1.00	1.00	1.00	1.300	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.50 ft	1	0.085	0.048	1.60	1.00	1.00	1.00	1.300	1.00	1.00	1.00	0.41	159.8	1,872.0	0.23	13.7	288.0

HAREZLAK ENGINEERING

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Wang and Yang ADU.ec6

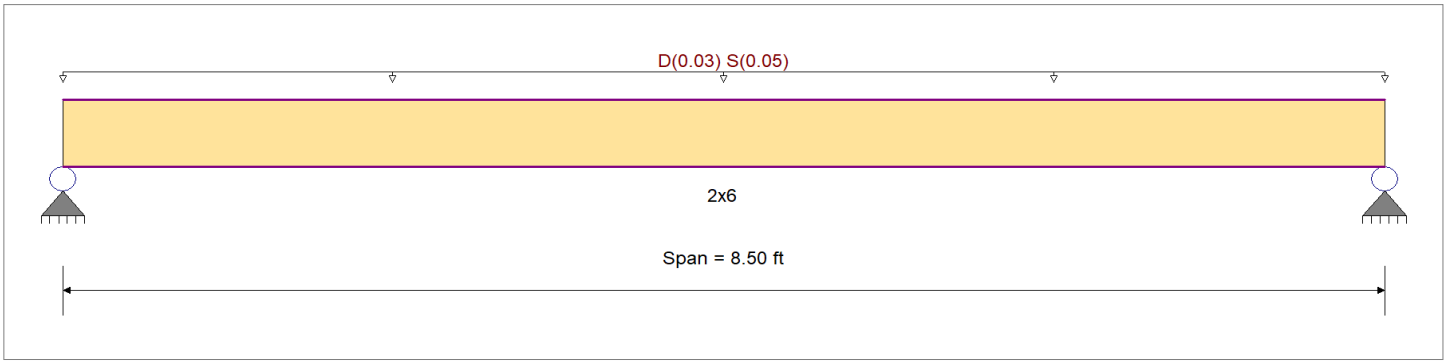
DESCRIPTION: R.J1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	850 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	850 psi	Ebend- xx	1300 ksi
		Fc - Prll	1300 psi	Eminbend - xx	470 ksi
Wood Species :	Hem-Fir	Fc - Perp	405 psi		
Wood Grade :	No.2	Fv	150 psi		
		Ft	525 psi	Density	26.84 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling			Repetitive Member Stress Increase	



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

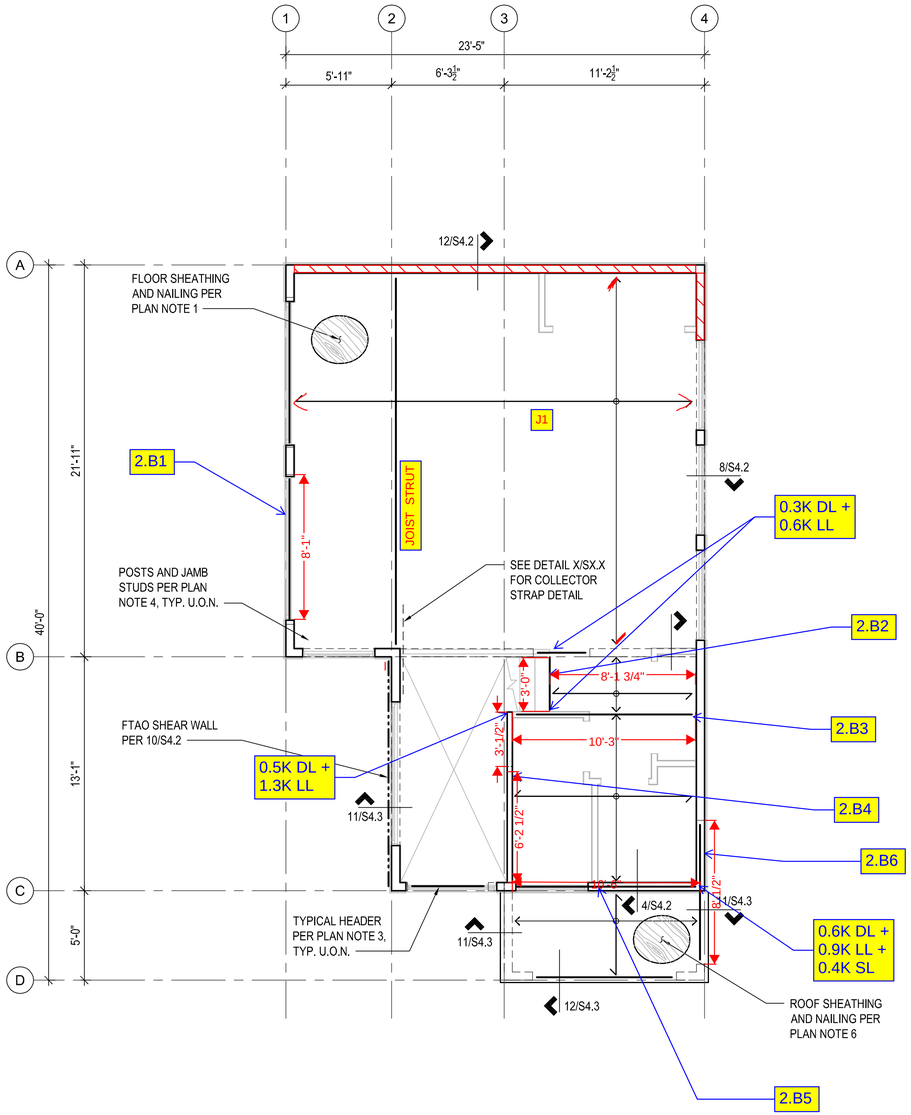
Maximum Bending Stress Ratio	=	0.785 : 1		Maximum Shear Stress Ratio	=	0.322 : 1	
Section used for this span		2x6		Section used for this span		2x6	
fb: Actual	=	1,146.45 psi		fv: Actual	=	55.50 psi	
F'b	=	1,461.36 psi		F'v	=	172.50 psi	
Load Combination		+D+S		Load Combination		+D+S	
Location of maximum on span	=	4.250 ft		Location of maximum on span	=	0.000 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.218 in	Ratio =	466 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.350 in	Ratio =	291 >=180	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 8.50 ft	1	0.376	0.154	0.90	1.00	1.00	1.00	1.300	1.00	1.00	1.15	0.27	429.9	1,143.7	0.11	20.8	135.0
+D+S					1.00	1.00	1.00	1.300	1.00	1.00	1.15			0.0	0.00	0.0	0.0
Length = 8.50 ft	1	0.785	0.322	1.15	1.00	1.00	1.00	1.300	1.00	1.00	1.15	0.72	1,146.4	1,461.4	0.31	55.5	172.5
+D+0.750S					1.00	1.00	1.00	1.300	1.00	1.00	1.15			0.0	0.00	0.0	0.0
Length = 8.50 ft	1	0.662	0.271	1.15	1.00	1.00	1.00	1.300	1.00	1.00	1.15	0.61	967.3	1,461.4	0.26	46.8	172.5
+0.60D					1.00	1.00	1.00	1.300	1.00	1.00	1.15			0.0	0.00	0.0	0.0
Length = 8.50 ft	1	0.127	0.052	1.60	1.00	1.00	1.00	1.300	1.00	1.00	1.15	0.16	258.0	2,033.2	0.07	12.5	240.0



UPPER FLOOR FRAMING PLAN

SCALE: 1/4" = 1'-0"

HAREZLAK ENGINEERING

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APPROVED BY: PAH

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PROJECT ADDRESS:
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MERCER ISLAND, WA 98040

REVISIONS:

NO.	DESCRIPTION	DATE

PROJECT NUMBER:
ISSUE DATE:
CURRENT REVISION:

SHEET NAME:
UPPER FLOOR FRAMING PLAN

SHEET NUMBER:
S2.1

Wood Beam

DESCRIPTION: 2.B1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

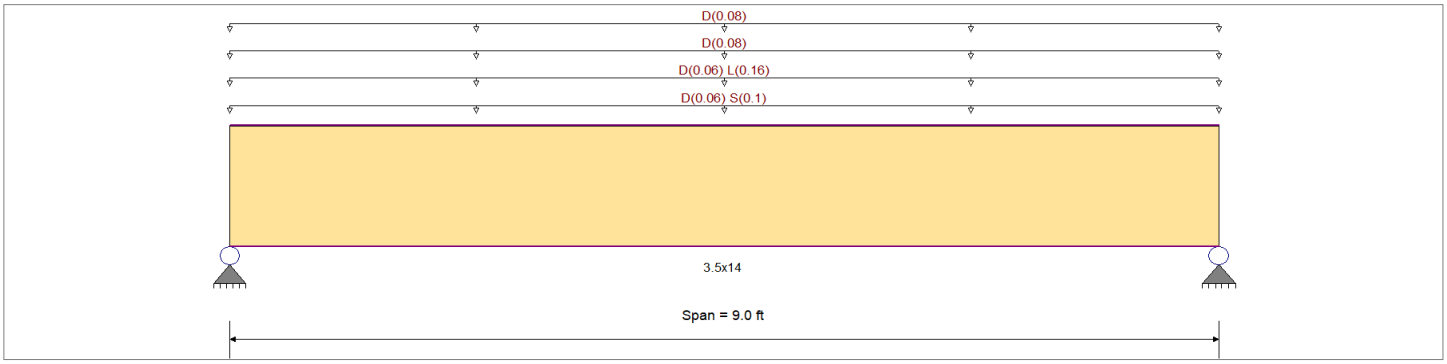
Wood Species : Boise Cascade
Wood Grade : Versa Lam 2800

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2800 psi
Fb -	2800 psi
Fc - Prll	3000 psi
Fc - Perp	750 psi
Fv	285 psi
Ft	2100 psi

E : Modulus of Elasticity

Ebend- xx	2000 ksi
Eminbend - xx	2530120482 ksi
Density	41.76 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 4.0 ft
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 4.0 ft
Uniform Load : D = 0.080 , Tributary Width = 1.0 ft
Uniform Load : D = 0.080 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.170 : 1	Maximum Shear Stress Ratio	=	0.158 : 1
Section used for this span		3.5x14	Section used for this span		3.5x14
fb: Actual	=	467.58 psi	fv: Actual	=	45.13 psi
F'b	=	2,752.45 psi	F'v	=	285.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.500 ft	Location of maximum on span	=	7.850 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.015 in	Ratio =	7276	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.044 in	Ratio =	2451	>=180	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.120	0.112	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	2.84	297.6	2,477.2	0.94	28.7	256.5
+D+L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.170	0.158	1.00	1.00	1.00	1.00	0.983	1.00	1.00	1.00	4.46	467.6	2,752.5	1.47	45.1	285.0
+D+S					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.128	0.119	1.15	1.00	1.00	1.00	0.983	1.00	1.00	1.00	3.85	403.8	3,165.3	1.27	39.0	327.8
+D+0.750L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.124	0.115	1.25	1.00	1.00	1.00	0.983	1.00	1.00	1.00	4.05	425.1	3,440.6	1.34	41.0	356.3

Wood Beam

DESCRIPTION: 2.B2

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

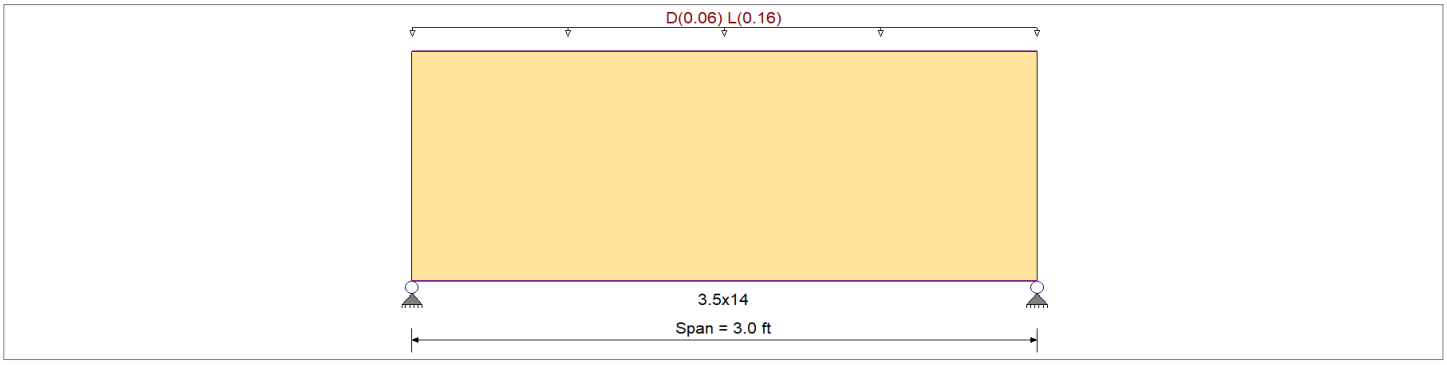
Wood Species : Boise Cascade
Wood Grade : Versa Lam 2800

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,800.0 psi
Fb -	2,800.0 psi
Fc - Prll	3,000.0 psi
Fc - Perp	750.0 psi
Fv	285.0 psi
Ft	2,100.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,036.83 ksi
Density	41.760 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 4.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.009 : 1	Maximum Shear Stress Ratio	=	0.008 : 1
Section used for this span		3.5x14	Section used for this span		3.5x14
fb: Actual	=	25.98 psi	fv: Actual	=	2.29 psi
F'b	=	2,752.45 psi	F'v	=	285.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	1.500 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.000 in	Ratio =	142883 >=180	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 3.0 ft	1	0.003	0.002	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	0.07	7.1	2,477.2	0.02	0.6	256.5
+D+L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 3.0 ft	1	0.009	0.008	1.00	1.00	1.00	1.00	0.983	1.00	1.00	1.00	0.25	26.0	2,752.5	0.07	2.3	285.0
+D+0.750L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 3.0 ft	1	0.006	0.005	1.25	1.00	1.00	1.00	0.983	1.00	1.00	1.00	0.20	21.3	3,440.6	0.06	1.9	356.3
+0.60D					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 3.0 ft	1	0.001	0.001	1.60	1.00	1.00	1.00	0.983	1.00	1.00	1.00	0.04	4.3	4,403.9	0.01	0.4	456.0

Wood Beam

Project File: Wang and Yang ADU.ec6

DESCRIPTION: 2.B3

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

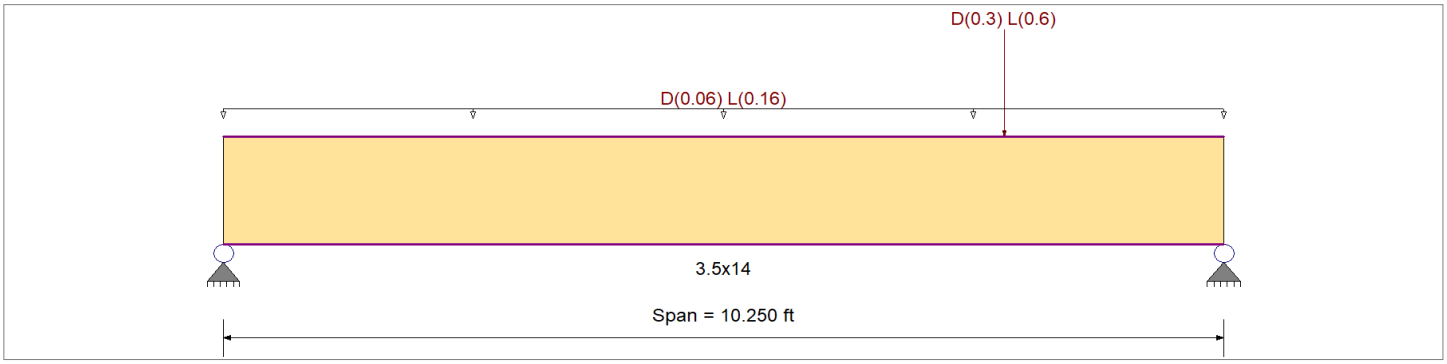
Wood Species : Boise Cascade
Wood Grade : Versa Lam 2800

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,800.0 psi
Fb -	2,800.0 psi
Fc - Prll	3,000.0 psi
Fc - Perp	750.0 psi
Fv	285.0 psi
Ft	2,100.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,036.83 ksi
Density	41.760 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 4.0 ft
Point Load : D = 0.30, L = 0.60 k @ 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.152 1	Maximum Shear Stress Ratio	=	0.169 : 1
Section used for this span		3.5x14	Section used for this span		3.5x14
fb: Actual	=	418.82 psi	fv: Actual	=	48.21 psi
F'b	=	2,752.45 psi	F'v	=	285.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	6.023 ft	Location of maximum on span	=	9.090 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.034 in	Ratio =	3616 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.048 in	Ratio =	2567 >=180	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 10.250 ft	1	0.049	0.056	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	1.16	121.9	2,477.2	0.47	14.5	256.5
+D+L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.250 ft	1	0.152	0.169	1.00	1.00	1.00	1.00	0.983	1.00	1.00	1.00	3.99	418.8	2,752.5	1.57	48.2	285.0
+D+0.750L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.250 ft	1	0.100	0.112	1.25	1.00	1.00	1.00	0.983	1.00	1.00	1.00	3.28	344.6	3,440.6	1.30	39.8	356.3
+0.60D					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.250 ft	1	0.017	0.019	1.60	1.00	1.00	1.00	0.983	1.00	1.00	1.00	0.70	73.2	4,403.9	0.28	8.7	456.0

Wood Beam

DESCRIPTION: 2.B4

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

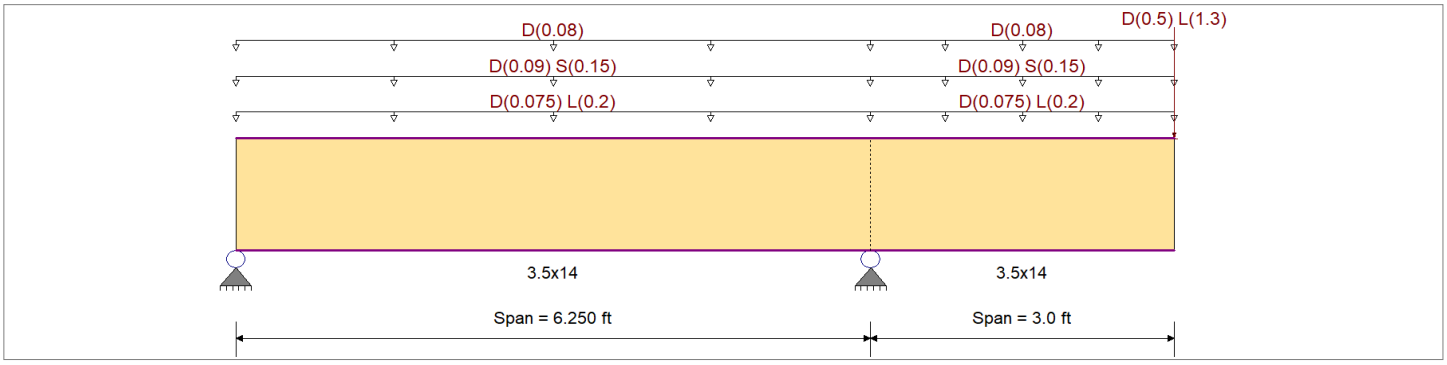
Wood Species : Boise Cascade
Wood Grade : Versa Lam 2800

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,800.0 psi
Fb -	2,800.0 psi
Fc - Prll	3,000.0 psi
Fc - Perp	750.0 psi
Fv	285.0 psi
Ft	2,100.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,036.83 ksi
Density	41.760 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 5.0 ft, (FLOOR)
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 6.0 ft
Uniform Load : D = 0.080 , Tributary Width = 1.0 ft
Load for Span Number 2
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 5.0 ft, (FLOOR)
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 6.0 ft
Uniform Load : D = 0.080 , Tributary Width = 1.0 ft
Point Load : D = 0.50, L = 1.30 k @ 3.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.282** 1	Maximum Shear Stress Ratio	=	**0.281** : 1
Section used for this span		**3.5x14**	Section used for this span		**3.5x14**
fb: Actual	=	776.94 psi	fv: Actual	=	80.22 psi
F'b	=	2,752.45 psi	F'v	=	285.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	6.250 ft	Location of maximum on span	=	6.250 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.041 in	Ratio =	1774	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.009 in	Ratio =	8392	>=360	Span: 2 : S Only
Max Downward Total Deflection	0.058 in	Ratio =	1250	>=240	Span: 2 : +D+L
Max Upward Total Deflection	-0.011 in	Ratio =	6780	>=240	Span: 1 : +D+L

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 6.250 ft	1	0.110	0.114	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	2.60	273.1	2,477.2	0.95	29.1	256.5
Length = 3.0 ft	2	0.110	0.114	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	2.60	273.1	2,477.2	0.95	29.1	256.5

Wood Beam

Project File: Wang and Yang ADU.ec6

DESCRIPTION: 2.B5

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

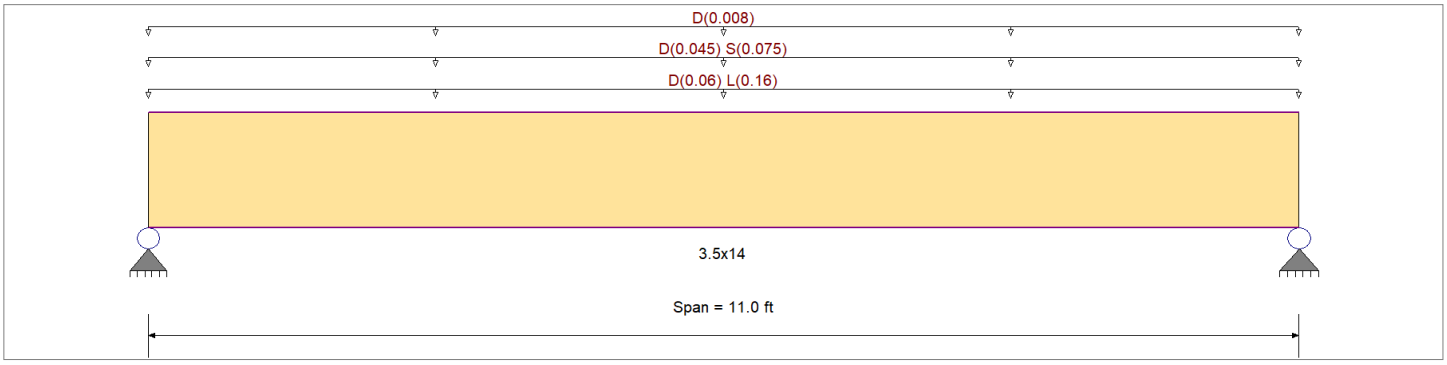
Wood Species : Boise Cascade
Wood Grade : Versa Lam 2800

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,800.0 psi
Fb -	2,800.0 psi
Fc - Prll	3,000.0 psi
Fc - Perp	750.0 psi
Fv	285.0 psi
Ft	2,100.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,036.83 ksi
Density	41.760 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 4.0 ft
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 3.0 ft
Uniform Load : D = 0.0080 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.157 : 1	Maximum Shear Stress Ratio	=	0.127 : 1
Section used for this span		3.5x14	Section used for this span		3.5x14
fb: Actual	=	433.38 psi	fv: Actual	=	36.23 psi
F'b	=	2,752.45 psi	F'v	=	285.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	5.500 ft	Location of maximum on span	=	9.836 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.033 in	Ratio =	3985 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.060 in	Ratio =	2204 >=180	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 11.0 ft	1	0.072	0.058	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	1.71	179.4	2,477.2	0.49	15.0	256.5
+D+L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.0 ft	1	0.157	0.127	1.00	1.00	1.00	1.00	0.983	1.00	1.00	1.00	4.13	433.4	2,752.5	1.18	36.2	285.0
+D+S					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.0 ft	1	0.094	0.076	1.15	1.00	1.00	1.00	0.983	1.00	1.00	1.00	2.84	298.4	3,165.3	0.82	25.0	327.8
+D+0.750L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.0 ft	1	0.108	0.087	1.25	1.00	1.00	1.00	0.983	1.00	1.00	1.00	3.52	369.9	3,440.6	1.01	30.9	356.3
+D+0.750L+0.750S					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

Project File: Wang and Yang ADU.ec6

DESCRIPTION: 2.B6

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

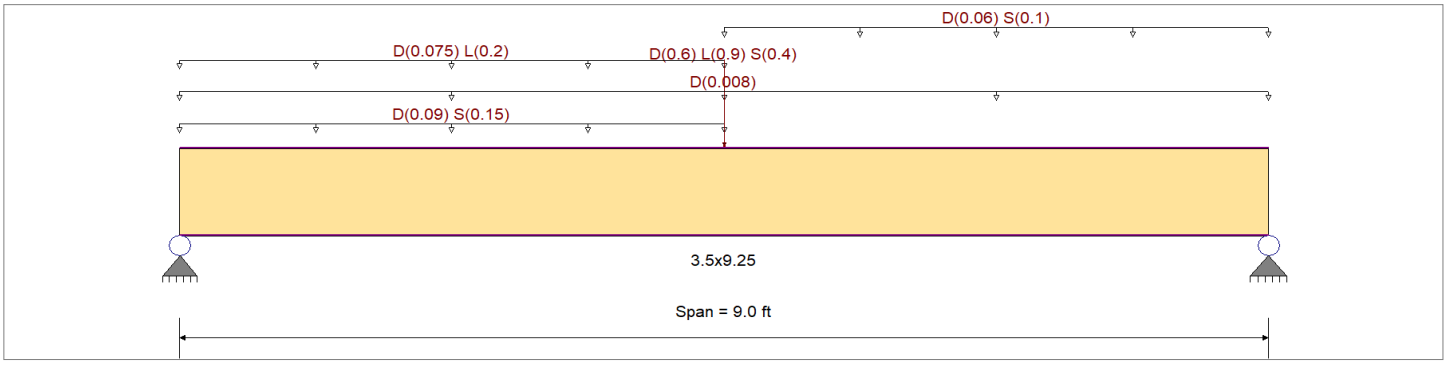
Wood Species : Boise Cascade
Wood Grade : Versa Lam 2800

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,800.0 psi
Fb -	2,800.0 psi
Fc - Prll	3,000.0 psi
Fc - Perp	750.0 psi
Fv	285.0 psi
Ft	2,100.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,036.83 ksi
Density	41.760 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 0.0 -->> 4.50 ft, Tributary Width = 6.0 ft
Uniform Load : D = 0.0080 , Tributary Width = 1.0 ft
Uniform Load : D = 0.0150, L = 0.040 ksf, Extent = 0.0 -->> 4.50 ft, Tributary Width = 5.0 ft
Point Load : D = 0.60, L = 0.90, S = 0.40 k @ 4.50 ft
Uniform Load : D = 0.0150, S = 0.0250 ksf, Extent = 4.50 -->> 9.0 ft, Tributary Width = 4.0 ft

DESIGN SUMMARY

Design OK

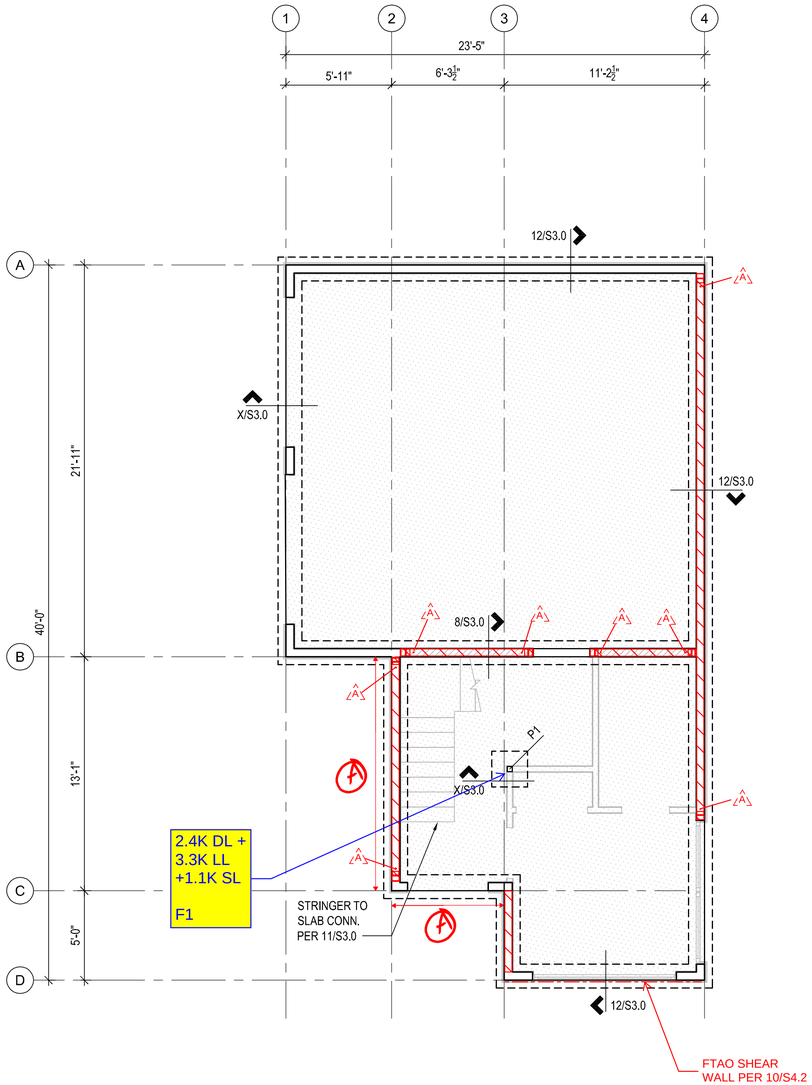
Maximum Bending Stress Ratio	=	0.469 : 1	Maximum Shear Stress Ratio	=	0.295 : 1
Section used for this span		3.5x9.25	Section used for this span		3.5x9.25
fb: Actual	=	1,556.13 psi	fv: Actual	=	96.80 psi
F'b	=	3,314.48 psi	F'v	=	327.75 psi
Load Combination		+D+0.750L+0.750S	Load Combination		+D+0.750L+0.750S
Location of maximum on span	=	4.500 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.084 in	Ratio =	1290 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.183 in	Ratio =	589 >=180	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.238	0.150	0.90	1.00	1.00	1.00	1.029	1.00	1.00	1.00	2.57	617.9	2,593.9	0.83	38.4	256.5
+D+L					1.00	1.00	1.00	1.029	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.468	0.293	1.00	1.00	1.00	1.00	1.029	1.00	1.00	1.00	5.61	1,348.2	2,882.2	1.80	83.6	285.0
+D+S					1.00	1.00	1.00	1.029	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.344	0.217	1.15	1.00	1.00	1.00	1.029	1.00	1.00	1.00	4.74	1,138.6	3,314.5	1.54	71.1	327.8



FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

FOOTING SCHEDULE	
MARK	**SIZE**
F1	18" SQ. x 10" DEEP FOOTING w/ (3) #4 E.W. BOTTOM, TYP.

POST SCHEDULE	
MARK	**SIZE**
P1	P/T 4x4
P2	4x6
P3	4x4

SEISMIC FORCE RESISTING SYSTEM LEGEND

SW-X SHEAR WALL TYPE 'X' PER SCHEDULE 8/S4.0

A HOLDOWN TYPE 'X' PER SCHEDULE 12/S4.0

LEGEND

4" SLAB-ON-GRADE PER PLAN NOTE 5

FOUNDATION & MAIN FLOOR FRAMING PLAN NOTES:

1. TOPS OF ALL EXTERIOR FOOTINGS ON THIS PLAN SHALL BE BURIED BELOW FINISHED GRADE AS SHOWN IN THE DETAILS. FOOTINGS SHALL BEAR ON DENSE NATIVE MATERIAL, OR PREPARED AS SPECIFIED IN THE GEOTECHNICAL REPORT.
2. FINAL SITE GRADES TO BE DETERMINED BY THE CONTRACTOR. CONTRACTOR SHALL COORDINATE UNDERSLAB PIPING REQUIREMENTS AS SHOWN IN 7/S3.0.
3. POSTS AND STUD PACKS SHALL BE CONTINUOUS TO FOUNDATION. TYPICAL STUD WALLS SHALL BE FRAMED USING HEM-FIR #2 2x STUDS @ 16" O.C., U.O.N. POST LOADS FROM ABOVE TO BE BLOCKED PER 7/S4.1.
4. TYPICAL FOOTING TO BE 16"W x 8" DP. CONC. STRIP FTG. w/ (2) #4 CONT. BOTTOM AND #4 @ 16" O.C. TRANS. TYP. STEM WALL TO BE 8" STEM WALL w/ #4 @ 12" O.C. E.W., TYP.
5. SLAB-ON-GRADE SHALL BE 4" THICK w/ WWF 6x6-W2.1xW2.1 MID-DEPTH OR #4 @ 16" O.C. E.W. MID-DEPTH, U.O.N. PROVIDE VAPOR BARRIER BELOW SLAB AS REQUIRED AND PER 2/S3.0. INSTALL CONSTRUCTION AND CONTROL JOINTS PER 2/S3.0.
6. ALL CONNECTIONS AND CONNECTORS IN CONTACT WITH PRESSURE-TREATED LUMBER TO BE HOT DIPPED GALVANIZED OR STAINLESS STEEL, PER GENERAL STRUCTURAL NOTES.
7. ALL EXTERIOR WALLS TO BE SHEATHED AND NAILED PER SW-6, U.O.N.

HAREZLAK ENGINEERING
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11745 87th Ave. S.
Seattle, WA 98178
PH: 360.224.0627
E: phil@harezlakengineering.com

CONSULTANT STAMP:

DRAWN BY: TA
CHECKED BY: MJH
APPROVED BY: PAH

PROJECT INFORMATION:
WANG & YANG ADU

PROJECT ADDRESS:
6450 E MERCER WAY
MERCER ISLAND, WA 98040

REVISIONS:

NO.	DESCRIPTION	DATE

PROJECT NUMBER:
ISSUE DATE:
CURRENT REVISION:

SHEET NAME:
FOUNDATION PLAN

SHEET NUMBER:
S2.0

General Footing

DESCRIPTION: F1

Code References

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

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	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	=	2.50	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	=	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

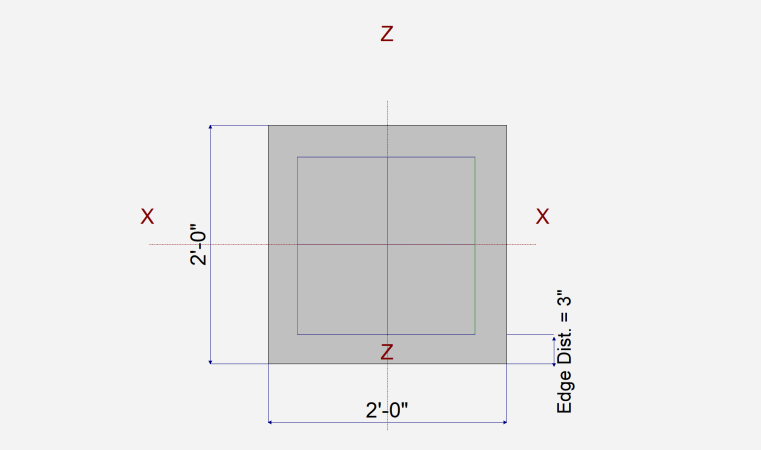
Width parallel to X-X Axis	=	2.0 ft
Length parallel to Z-Z Axis	=	2.0 ft
Footing Thickness	=	10.0 in

Pedestal dimensions...

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

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0 in

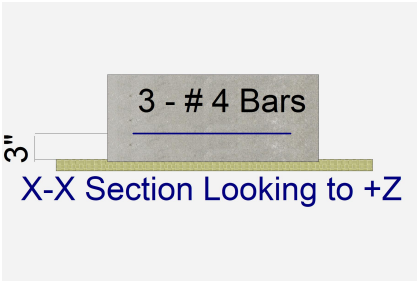


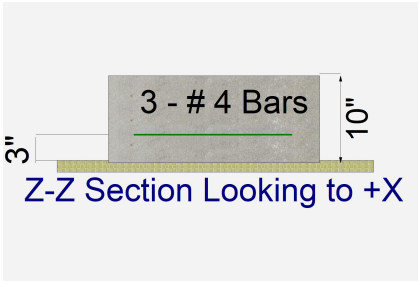
Reinforcing

Bars parallel to X-X Axis			
Number of Bars	=		3
Reinforcing Bar Size	=	#	4
Bars parallel to Z-Z Axis			
Number of Bars	=		3.0
Reinforcing Bar Size	=	#	4

Bandwidth Distribution Check (ACI 15.4.4.2)

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





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	2.40		3.30	1.10				k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

General Footing

DESCRIPTION: F1

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6184	Soil Bearing	1.546 ksf	2.50 ksf	+D+0.750L+0.750S 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	0.1203	Z Flexure (+X)	1.089 k-ft/ft	9.053 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.1203	Z Flexure (-X)	1.089 k-ft/ft	9.053 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.1203	X Flexure (+Z)	1.089 k-ft/ft	9.053 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.1203	X Flexure (-Z)	1.089 k-ft/ft	9.053 k-ft/ft	+1.20D+1.60L+0.50S
PASS	0.1325	1-way Shear (+X)	10.888 psi	82.158 psi	+1.20D+1.60L+0.50S
PASS	0.1325	1-way Shear (-X)	10.888 psi	82.158 psi	+1.20D+1.60L+0.50S
PASS	0.1325	1-way Shear (+Z)	10.888 psi	82.158 psi	+1.20D+1.60L+0.50S
PASS	0.1325	1-way Shear (-Z)	10.888 psi	82.158 psi	+1.20D+1.60L+0.50S
PASS	0.2461	2-way Punching	40.439 psi	164.317 psi	+1.20D+1.60L+0.50S

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	2.50	n/a	0.0	0.7208	0.7208	n/a	n/a	0.288
X-X, +D+L	2.50	n/a	0.0	1.546	1.546	n/a	n/a	0.618
X-X, +D+S	2.50	n/a	0.0	0.9958	0.9958	n/a	n/a	0.398
X-X, +D+0.750L	2.50	n/a	0.0	1.340	1.340	n/a	n/a	0.536
X-X, +D+0.750L+0.750S	2.50	n/a	0.0	1.546	1.546	n/a	n/a	0.618
X-X, +0.60D	2.50	n/a	0.0	0.4325	0.4325	n/a	n/a	0.173
Z-Z, D Only	2.50	0.0	n/a	n/a	n/a	0.7208	0.7208	0.288
Z-Z, +D+L	2.50	0.0	n/a	n/a	n/a	1.546	1.546	0.618
Z-Z, +D+S	2.50	0.0	n/a	n/a	n/a	0.9958	0.9958	0.398
Z-Z, +D+0.750L	2.50	0.0	n/a	n/a	n/a	1.340	1.340	0.536
Z-Z, +D+0.750L+0.750S	2.50	0.0	n/a	n/a	n/a	1.546	1.546	0.618
Z-Z, +0.60D	2.50	0.0	n/a	n/a	n/a	0.4325	0.4325	0.173

Overturning Stability

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

All units k

Sliding Stability

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

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.420	+Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.40D	0.420	-Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+1.60L	1.020	+Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+1.60L	1.020	-Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+1.60L+0.50S	1.089	+Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+1.60L+0.50S	1.089	-Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+L	0.7725	+Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+L	0.7725	-Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D	0.360	+Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D	0.360	-Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+L+1.60S	0.9925	+Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+L+1.60S	0.9925	-Z	Bottom	0.2160	AsMin	0.30	9.053	OK
X-X, +1.20D+1.60S	0.580	+Z	Bottom	0.2160	AsMin	0.30	9.053	OK

Wall Footing

Project File: Wang and Yang ADU.ec6

DESCRIPTION: WORST CASE EXT. WALL FOOTING

Code References

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

General Information

Material Properties

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

Analysis Settings

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

Soil Design Values

Allowable Soil Bearing	=	2.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

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

Increases based on footing Width

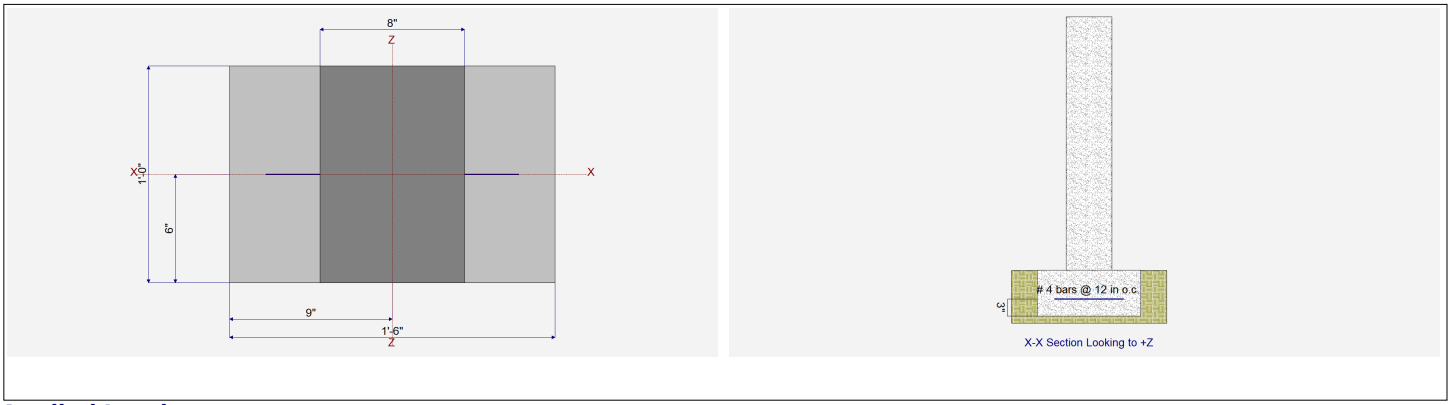
Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

Adjusted Allowable Bearing Pressure = 2.50 ksf

Dimensions

Footing Width	=	1.5 ft	Footing Thickness	=	8.0 in	Bars along X-X Axis	
Wall Thickness	=	8.0 in	Rebar Centerline to Edge of Concrete...			Bar spacing	= 12.00
Wall center offset from center of footing	=	0 in	at Bottom of footing	=	3.0 in	Reinforcing Bar Size	= # 4

Reinforcing



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	0.420		0.640	0.150				k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=								k-ft
Vx applied	=		in above top of footing						

Wall Footing

Project File: Wang and Yang ADU.ec6

DESCRIPTION: WORST CASE EXT. WALL FOOTING

DESIGN SUMMARY

Design OK

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

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.3213	Soil Bearing	0.8033 ksf	2.50 ksf	+D+L
PASS	0.02398	Z Flexure (+X)	0.1028 k-ft	4.288 k-ft	+1.20D+1.60L+0.50S
PASS	0.01819	Z Flexure (-X)	0.07801 k-ft	4.288 k-ft	+1.20D+L+0.20S
PASS	n/a	1-way Shear (+X)	0.0 psi	75.0 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
, D Only	2.50 ksf	0.0 in	0.3767 ksf	0.3767 ksf	0.151
, +D+L	2.50 ksf	0.0 in	0.8033 ksf	0.8033 ksf	0.321
, +D+S	2.50 ksf	0.0 in	0.4767 ksf	0.4767 ksf	0.191
, +D+0.750L	2.50 ksf	0.0 in	0.6967 ksf	0.6967 ksf	0.279
, +D+0.750L+0.750S	2.50 ksf	0.0 in	0.7717 ksf	0.7717 ksf	0.309
, +0.60D	2.50 ksf	0.0 in	0.2260 ksf	0.2260 ksf	0.090

Overturning Stability

Units : k-ft

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

Sliding Stability

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

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	0.04578	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.40D	0.04578	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L	0.0985	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L	0.0985	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L+0.50S	0.1028	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60L+0.50S	0.1028	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L	0.07627	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L	0.07627	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D	0.03924	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D	0.03924	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L+1.60S	0.09016	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L+1.60S	0.09016	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60S	0.05313	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+1.60S	0.05313	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L+0.50S	0.08061	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L+0.50S	0.08061	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +0.90D	0.02943	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +0.90D	0.02943	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L+0.20S	0.07801	-X	Bottom	0.1728	Min Temp %	0.2	4.288	OK
, +1.20D+L+0.20S	0.07801	+X	Bottom	0.1728	Min Temp %	0.2	4.288	OK

One Way Shear

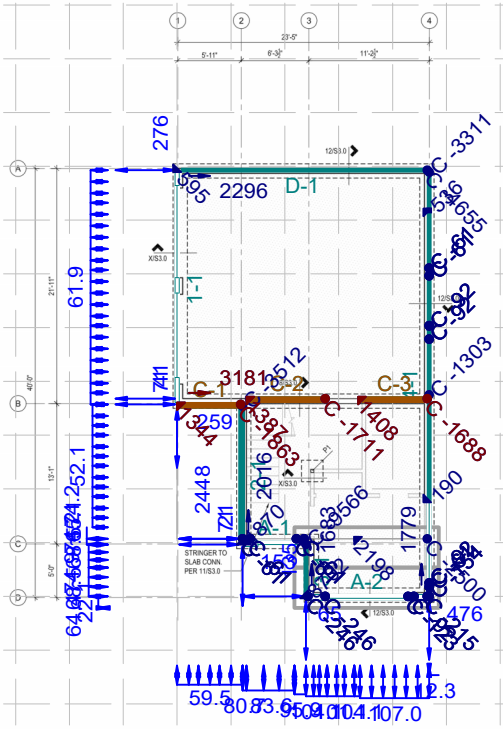
Units : k

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

HAREZLAK ENGINEERING

WANG AND YANG ADU --LATERAL CALCULATIONS

Level 1 of 2



FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

FOOTING SCHEDULE	
MARK	SIZE
F1	18" SQ. x 10" DEEP FOOTING w/ (3) #4 E.W. BOTTOM, TYP.

POST SCHEDULE	
MARK	SIZE
P1	P/T 4x4
P2	4x6
P3	4x4

SEISMIC FORCE RESISTING SYSTEM LEGEND

SW-X SHEAR WALL TYPE 'X' PER SCHEDULE 8/S4.0

HOLDOWN TYPE 'X' PER SCHEDULE 12/S4.0

LEGEND

4" SLAB-ON-GRADE PER PLAN NOTE 5

FOUNDATION & MAIN FLOOR FRAMING PLAN NOTES:

1. TOPS OF ALL EXTERIOR FOOTINGS ON THIS PLAN SHALL BE BURIED BELOW FINISHED GRADE AS SHOWN IN THE DETAILS. FOOTINGS SHALL BEAR ON DENSE NATIVE MATERIAL, OR PREPARED AS SPECIFIED IN THE GEOTECHNICAL REPORT.
2. FINAL SITE GRADES TO BE DETERMINED BY THE CONTRACTOR. CONTRACTOR SHALL COORDINATE UNDERSLAB PIPING REQUIREMENTS AS SHOWN IN 7/S3.0.
3. POSTS AND STUD PACKS SHALL BE CONTINUOUS TO FOUNDATION. TYPICAL STUD WALLS SHALL BE FRAMED USING HEM-FIR #2 2x STUDS @ 16" O.C., U.O.N. POST LOADS FROM ABOVE TO BE BLOCKED PER 7/S4.1.
4. TYPICAL FOOTING TO BE 16"W x 8" DP. CONC. STRIP FTG. w/ (2) #4 CONT. BOTTOM AND #4 @ 16" O.C. TRANS. TYP. STEM WALL TO BE 8" STEM WALL w/ #4 @ 12" O.C. E.W., TYP.
5. SLAB-ON-GRADE SHALL BE 4" THICK w/ WWF 6x6-W2.1xW2.1 MID-DEPTH OR #4 @ 16" O.C. E.W. MID-DEPTH, U.O.N. PROVIDE VAPOR BARRIER BELOW SLAB AS REQUIRED AND PER 2/S3.0. INSTALL CONSTRUCTION AND CONTROL JOINTS PER 2/S3.0.
6. ALL CONNECTIONS AND CONNECTORS IN CONTACT WITH PRESSURE-TREATED LUMBER TO BE HOT DIPPED GALVANIZED OR STAINLESS STEEL, PER GENERAL STRUCTURAL NOTES.
7. ALL EXTERIOR WALLS TO BE SHEATHED AND NAILED PER S/W-6, U.O.N.

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DATE:
APPROVED BY:

PROJECT INFORMATION
WANG & YANG ADU

PROJECT ADDRESS
6450 E MERCER WAY
MERCER ISLAND, WA 98040

REVISIONS:

NO.	DESCRIPTION	DATE

PROJECT NUMBER
ISSUE DATE:
CURRENT REVISION:

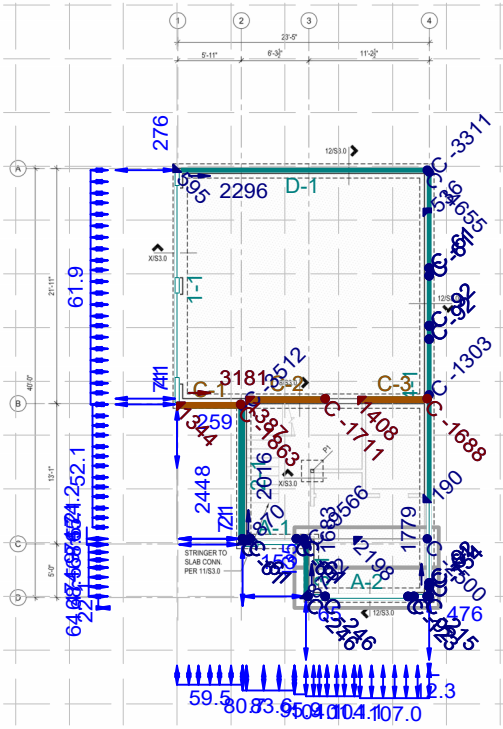
SHEET NAME:
FOUNDATION PLAN

SHEET NUMBER:
S2.0

Factored shearline force (lbs)
Factored hold-down force (lbs)
C Factored compression force (lbs)
Vertical element required
Unfactored applied shear load (plf)
Unfactored dead load (plf,lbs)
Applied point load or discontinuous shearline force (lbs)

Loads: Seismic (Qe); Forces: 0.7E + 0.6D; E = ρQe + 0.2 Sds D; ρ(NS) = 1.0; ρ(EW) = 1.0; Sds = 1.0; Flexible distribution

Level 1 of 2



FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

FOOTING SCHEDULE	
MARK	SIZE
F1	18" SQ. x 10" DEEP FOOTING w/ (3) #4 E.W. BOTTOM, TYP.

POST SCHEDULE	
MARK	SIZE
P1	P/T 4x4
P2	4x6
P3	4x4

SEISMIC FORCE RESISTING SYSTEM LEGEND

SW-X SHEAR WALL TYPE 'X' PER SCHEDULE 8/S4.0

HOLDOWN TYPE 'X' PER SCHEDULE 12/S4.0

LEGEND

4" SLAB-ON-GRADE PER PLAN NOTE 5

FOUNDATION & MAIN FLOOR FRAMING PLAN NOTES:

1. TOPS OF ALL EXTERIOR FOOTINGS ON THIS PLAN SHALL BE BURIED BELOW FINISHED GRADE AS SHOWN IN THE DETAILS. FOOTINGS SHALL BEAR ON DENSE NATIVE MATERIAL, OR PREPARED AS SPECIFIED IN THE GEOTECHNICAL REPORT.
2. FINAL SITE GRADES TO BE DETERMINED BY THE CONTRACTOR. CONTRACTOR SHALL COORDINATE UNDERSLAB PIPING REQUIREMENTS AS SHOWN IN 7/S3.0.
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4. TYPICAL FOOTING TO BE 16"W x 8" DP. CONC. STRIP FTG. w/ (2) #4 CONT. BOTTOM AND #4 @ 16" O.C. TRANS. TYP. STEM WALL TO BE 8" STEM WALL w/ #4 @ 12" O.C. E.W., TYP.
5. SLAB-ON-GRADE SHALL BE 4" THICK w/ WWF 6x6-W2.1xW2.1 MID-DEPTH OR #4 @ 16" O.C. E.W. MID-DEPTH, U.O.N. PROVIDE VAPOR BARRIER BELOW SLAB AS REQUIRED AND PER 2/S3.0. INSTALL CONSTRUCTION AND CONTROL JOINTS PER 2/S3.0.
6. ALL CONNECTIONS AND CONNECTORS IN CONTACT WITH PRESSURE-TREATED LUMBER TO BE HOT DIPPED GALVANIZED OR STAINLESS STEEL, PER GENERAL STRUCTURAL NOTES.
7. ALL EXTERIOR WALLS TO BE SHEATHED AND NAILED PER S/W-6, U.O.N.

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DRAWN BY:
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PROJECT ADDRESS:
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MERCER ISLAND, WA 98040

REVISIONS:

NO.	DESCRIPTION	DATE

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SHEET NAME:
FOUNDATION PLAN

SHEET NUMBER:
S2.0

- Factored shearline force (lbs)
- Factored hold-down force (lbs)
- C Factored compression force (lbs)
- Vertical element required
- Unfactored applied shear load (plf)
- Unfactored dead load (plf,lbs)
- Applied point load or discontinuous shearline force (lbs)

Loads: Seismic (Qe); Forces: 0.7E + 0.6D; E = ρQe + 0.2 Sds D; ρ(NS) = 1.0; ρ(EW) = 1.0; Sds = 1.0; Flexible distribution

WoodWorks® Shearwalls 2023

Wang and Yang ADU.wsw **Nov. 13, 2023 17:02:36**

Project Information

COMPANY AND PROJECT INFORMATION

Company	Project
HAREZLAK ENGINEERING PAH	

DESIGN SETTINGS

Design Code	Wind Standard	Seismic Standard
IBC 2021/AWC SDPWS 2021	ASCE 7-16 Directional (All heights)	ASCE 7-16

Load Combinations

For Design (ASD)	For Deflection (Strength)
0.70 Seismic + 0.60 Dead	1.00 Seismic + 0.90 Dead
0.60 Wind + 0.60 Dead	1.00 Wind + 0.90 Dead

Building Code Capacity Modification

Wind	Seismic
1.00	1.00

Service Conditions and Load Duration

Duration Factor	Temperature Range	Moisture Content	
		Fabrication	Service
1.60	T<=100F	19% (<=19%)	10% (<=19%)

Max Shearwall Offset [ft]

Plan (within story)	Elevation (between stories)
5.00	0.83

Maximum Height-to-width Ratio

Wood panels		Fiberboard	Lumber		Gypsum	
Blocked	Unblocked		Wind	Seismic	Blocked	Unblocked
3.5	2.0	-	-	-	2.0	1.5

Ignore shear resistance contribution of...

Wall segments	Seismic
Side with invalid aspect ratio	Any gypsum, lumber, fiberboard

Forces based on...

Hold-downs	Applied loads
Drag struts	Applied loads

Shearwall relative rigidity: Wall capacity

Non-identical materials and construction on the shearline: Not allowed

Deflection Equation: 3-term from SDPWS 4.3-1

Drift limit for wind design: 1 / 350 story height

FTAO strap: Continuous at top of highest opening and bottom of lowest

SITE INFORMATION

Wind
ASCE 7-16 Directional (All heights)

Design Wind Speed	98 mph
Serviceability Wind Speed	67 mph
Exposure	Exposure B
Enclosure	Partially open
Min Wind Loads: Walls	16 psf
Roofs	8 psf

Topographic Information [ft]

Shape	Height	Length
-	-	-

Site Location: -

Elev: 0ft

Rigid building - Static analysis

Case 2	E-W loads	N-S loads
Eccentricity (%)	15	15
Loaded at	75%	

Seismic
ASCE 7-16 12.8 Equivalent Lateral Force Procedure

Risk Category	Category II - All others
Structure Type	Regular
Building System	Bearing Wall
Design Category	D
Site Class	D

Spectral Response Acceleration

S1: 0.502g **Ss:** 1.449g

Fundamental Period	E-W	N-S
T Used	0.205s	0.205s
Approximate Ta	0.205s	0.205s
Maximum T	0.287s	0.287s
Response Factor R	6.50	6.50

Fa: 1.20 **Fv:** 1.80

Design Summary

SHEARWALL DESIGN

Wind Shear Loads, Flexible Diaphragm
All shearwalls have sufficient design capacity.

Components and Cladding Wind Loads, Out-of-plane Sheathing
All shearwalls have sufficient design capacity.

Components and Cladding Wind Loads, Nail Withdrawal
All shearwalls have sufficient design capacity.

Seismic Loads, Flexible Diaphragm
All shearwalls have sufficient design capacity.

HOLD-DOWN DESIGN

Wind Loads, Flexible Diaphragm
All hold-downs have sufficient design capacity.

Seismic Loads, Flexible Diaphragm
All hold-downs have sufficient design capacity.

COMPRESSION FORCE DESIGN

Wind Loads, Flexible Diaphragm
Bottom plate has sufficient perpendicular-to-grain compressive capacity under all wall end studs.

Seismic Loads, Flexible Diaphragm
Bottom plate has sufficient perpendicular-to-grain compressive capacity under all wall end studs.

This Design Summary does not include failures that occur due to excessive story drift from ASCE 7 CC.2.2 (wind) or 12.12 (seismic). Refer to Story Drift table in this report to verify this design criterion.
Refer to the Deflection table for possible issues regarding fastener slippage (SDPWS Table C4.2.3D).

Flexible Diaphragm Wind Design
ASCE 7 Directional (All Heights) Loads

SHEAR RESULTS

N-S Shearlines	W Gp	For Dir	ASD Shear Force [plf] v	vmax/vft	V [lbs]	Asp-Cub Int	Asp-Cub Ext	Allowable Shear [plf] Int	Ext	Co	C	Cmb	V [lbs]	Resp. Ratio
Line 2														
Level 2														
Ln2, Lev2	-	Both	-	-	622	-	-	0	554	-	A	-	7206	-
Wall 2-1	3	Both	-	-	622	1.0	1.0	0	554	-		-	7206	-
Seg. 1	-	Both	103.6	40.8	311	1.0	1.0	0	554	-		554	1663	0.19
Open. 1	-	Both	-	53.8	377	-	-	0	554	-		554	3880	0.10
Seg. 2	-	Both	103.6	40.8	311	1.0	1.0	0	554	-		554	1663	0.19
Level 1														
Ln2, Lev1	-	Both	-	-	1472	-	-	125	361	-	A	-	6319	-
Wall 2-1	2	Both	113.2	-	1472	1.0	1.0	125	361	-		486	6319	0.23
Line 3														
Level 2														
Ln3, Lev2	-	Both	-	-	788	-	-	125	361	-	A	-	2431	-
Wall 3-1	2	Both	157.7	-	788	1.0	1.0	125	361	-		486	2431	0.32
Level 1														
Ln3, Lev1	-	Both	-	-	1684	-	-	125	554	-	A	-	3397	-
Wall 3-1	3	Both	336.7	-	1684	1.0	1.0	125	554	-		679	3397	0.50
Line 4														
Level 2														
Ln4, Lev2	-	Both	-	-	371	-	-	125	361	-	A	-	6589	-
Wall 4-1	2	Both	-	-	371	1.0	1.0	125	361	-		-	6589	-
Seg. 1	-	Both	0.0	-	0	1.0	1.0	125	361	-		361	-	-
Seg. 2	-	Both	27.3	-	273	1.0	1.0	125	361	-		486	4861	0.06
Seg. 3	-	Both	0.0	-	0	1.0	1.0	125	361	-		361	-	-
Seg. 4	-	Both	0.0	-	0	1.0	1.0	125	361	-		361	-	-
Seg. 5	-	Both	24.3	-	97	.89	.89	111	321	-		432	1728	0.06
Level 1														
Ln4, Lev1	-	Both	-	-	984	-	-	125	361	-	A	-	15069	-
Wall 4-1	2	Both	-	-	984	1.0	1.0	125	361	-		-	15069	-
Seg. 1	-	Both	0.0	-	0	1.0	1.0	125	361	-		361	-	-
Seg. 2	-	Both	31.7	-	984	1.0	1.0	125	361	-		486	15069	0.07

E-W Shearlines	W Gp	For Dir	ASD Shear Force [plf] v	vmax/vft	V [lbs]	Asp-Cub Int	Asp-Cub Ext	Allowable Shear [plf] Int	Ext	Co	C	Cmb	V [lbs]	Resp. Ratio
Line B														
Level 2														
LnB, Lev2	-	Both	-	-	1665	-	-	125	361	-	A	-	3403	-
Wall B-2	2	Both	237.9	-	1665	1.0	1.0	125	361	-		486	3403	0.49
Line C														
Level 1														
LnC, Lev1	-	Both	-	-	4424	-	-	125	361	-	A	-	9722	-
Wall C-1	2	Both	221.2	-	1327	1.0	1.0	125	361	-		486	2917	0.46
Wall C-2	2	Both	221.2	-	1659	1.0	1.0	125	361	-		486	3646	0.46
Wall C-3	2	Both	221.2	-	1438	1.0	1.0	125	361	-		486	3160	0.46
Line D														
Level 2														
LnD, Lev2	2	Both	61.6	-	1447	1.0	1.0	125	361	-	A	486	11423	0.13
Level 1														
LnD, Lev1	2	Both	102.6	-	2412	1.0	1.0	125	361	-	A	486	11423	0.21

Legend:
W Gp - Wall design group defined in Sheathing and Framing Materials tables, where it shows associated Standard Wall. "^" means that this wall is critical for all walls in the Standard Wall group.
For Dir - Direction of wind force along shearline.
v – Design shear force on segment = ASD-factored shear force per unit length of full-height sheathing (FHS)
vmax/vft - Perforated walls: Collector and in-plane anchorage force as per SDPWS eqn. 4.3-9 = V/FHS/Co. FHS is factored for narrow segments as per 4.3.3.4
FTAO walls: Shear force in piers above and below either openings or piers beside opening(s). Aspect ratio factor does not apply to these piers.
V – ASD factored shear force. For shearline: total shearline force. For wall: total of all segments on wall. For segment: force on segment
Asp/Cub – For wall: Unblocked structural wood panel factor Cub from SDPWS 4.3.5.3. For segment or FTAO pier: Aspect ratio factor from SDPWS 4.3.5.5.1. For perforated wall: Either Cub or sum bi / FHS, where bi is segment length adjusted per SDPWS 4.3.3.4.
Int, Ext - Nominal unit shear capacity of interior and exterior sheathing, factored by Table 4.3-1 Note 3 for framing specific gravity and Note 10 for presence of hold-downs. For wall segments, also include unblocked factor Cub and aspect ratio adjustments.
Co - Adjustment factor for perforated walls from SDPWS Equation 4.3-6.
C - Sheathing combination rule, A = Add capacities, S = Strongest side or twice weakest, G = Stiffness-based using Eqns. 4.3-3,-4.

Cmb - Combined interior and exterior unit shear capacity including perforated wall factor Co.
V – Total factored shear capacity of shearline, wall or segment.
Crit Resp – Response ratio = v/Cmb = design shear force/unit shear capacity. "S" indicates that the seismic design criterion was critical in selecting wall.

Notes:
Refer to Elevation View diagrams for individual level for uplift anchorage force t for perforated walls given by SDPWS 4.3.6.4.2,1.

Hold-Down and Compression Design (flexible wind design)

Level 1 Line-Wall	Posit'n	Location [ft] X	Location [ft] Y	Load Case	Tensile Hold-down or Compressive Stud Force [lbs] Shear	Dead	Uplift	Cmb'd	Hold-down	Cap [lbs]	Crit Resp.
Line 2											
2-1	L End	6.00	5.13	Min	1478	616		862	HDU5-SDS	5645	0.15
2-1	L End	6.00	5.13	Min	-1478	1026		2504	Compression	10312	0.24
2-1	R End	6.00	17.87	Min	1478	616		862	HDU5-SDS	5645	0.15
2-1	R End	6.00	17.87	Min	-1478	1026		2504	Compression	10312	0.24
Line 3											
3-1	L End	12.00	0.12	Min	8486	324		8162	HDU14-SDS	^10770	0.76
3-1	L End	12.00	0.12	Min	-8486	540		9026	Compression	10312	0.88
3-1	R End	12.00	4.88	Min	8486	324		8162	HDU14-SDS	^10770	0.76
3-1	R End	12.00	4.88	Min	-8486	540		9026	Compression	10312	0.88
Line 4											
	V Elem	23.50	0.12	1	0	135		135	Compression		
	V Elem	23.50	0.88	1	0	54		54	Compression		
	V Elem	23.50	1.38	1	0	81		81	Compression		
4-1	R Op 1	23.50	9.13	Min	-540	2214		2754	Compression	11601	0.24
	V Elem	23.50	18.88	Min	-252	540		792	Compression		
	V Elem	23.50	24.13	1	0	81		81	Compression		
	V Elem	23.50	25.38	1	0	81		81	Compression		
	V Elem	23.50	30.13	1	0	54		54	Compression		
	V Elem	23.50	30.88	1	0	54		54	Compression		
	V Elem	23.50	36.13	Min	233	130		104	Refer to upper level		
	V Elem	23.50	36.13	Min	-233	216		449	Compression		
4-1	R End	23.50	39.88	Min	-521	1890		2411	Compression	10312	0.23
Line A											
	V Elem	12.13	0.00	1	0	216		216	Compression		
	V Elem	13.88	0.00	1	0	216		216	Compression		
	V Elem	21.63	0.00	1	0	108		108	Compression		
	V Elem	22.13	0.00	1	0	81		81	Compression		
	V Elem	23.38	0.00	1	0	189		189	Compression		
Line B											
	V Elem	6.13	5.50	1	0	54		54	Compression		
	V Elem	6.88	5.50	1	0	54		54	Compression		
	V Elem	11.13	5.50	1	0	54		54	Compression		
	V Elem	11.88	5.50	1	0	54		54	Compression		
	V Elem	16.62	5.50	1	2220	113		2107	Refer to upper level		
	V Elem	16.62	5.50	1	-2220	189		2409	Compression		
	V Elem	23.38	5.50	1	2220	113		2107	Refer to upper level		
	V Elem	23.38	5.50	1	-2220	189		2409	Compression		
Line C											
C-1	L End	0.12	18.00	Min	2077	194		1883	HDU5-SDS	5645	0.33
C-1	L End	0.12	18.00	Min	-2077	324		2401	Compression	10312	0.23
C-1	R End	5.88	18.00	Min	2077	194		1883	HDU5-SDS	5645	0.33
C-1	R End	5.88	18.00	Min	-2077	324		2401	Compression	10312	0.23
C-2	L End	6.63	18.50	Min	2059	122		1938	HDU5-SDS	5645	0.34
C-2	L End	6.63	18.50	Min	-2059	203		2262	Compression	10312	0.22
C-2	R End	13.88	18.50	Min	2059	122		1938	HDU5-SDS	5645	0.34
C-2	R End	13.88	18.50	Min	-2059	203		2262	Compression	10312	0.22
C-3	L End	17.13	18.50	Min	2070	105		1965	HDU5-SDS	5645	0.35
C-3	L End	17.13	18.50	Min	-2070	176		2246	Compression	10312	0.22
C-3	R End	23.38	18.50	Min	2070	105		1965	HDU5-SDS	5645	0.35
C-3	R End	23.38	18.50	Min	-2070	176		2246	Compression	10312	0.22
Line D											
D-1	L End	0.12	40.00	1	1707	1523		184	HDU5-SDS	5645	0.03
D-1	L End	0.12	40.00	1	-1707	2538		4245	Compression	10312	0.41
D-1	R End	23.38	40.00	1	1707	1523		184	HDU5-SDS	5645	0.03
D-1	R End	23.38	40.00	1	-1707	2538		4245	Compression	10312	0.41

Level 2 Line-Wall	Posit'n	Location [ft] X	Location [ft] Y	Load Case	Tensile Hold-down or Compressive Stud Force [lbs] Shear	Dead	Uplift	Cmb'd	Hold-down	Cap [lbs]	Crit Resp.
Line 2											
2-1	L End	6.00	5.13	Min	439	194		244	HDU5-SDS	5645	0.04
2-1	L End	6.00	5.13	Min	-439	324		763	Compression	10312	0.07
2-1	R End	6.00	17.87	Min	439	194		244	HDU5-SDS	5645	0.04
2-1	R End	6.00	17.87	Min	-439	324		763	Compression	11601	0.07
Line 3											
3-1	L End	12.00	0.12	Min	1494	162		1332	HDU5-SDS	5645	0.24
3-1	L End	12.00	0.12	Min	-1493	270		1763	Compression	10312	0.17
3-1	R End	12.00	4.88	Min	1494	162		1332	HDU5-SDS	5645	0.24
3-1	R End	12.00	4.88	Min	-1493	270		1763	Compression	10312	0.17
Line 4											

Hold-Down and Compression Design (flexible wind design, continued)

	V Elem	23.50	0.12	1	0	54	54	Compression		
	V Elem	23.50	0.88	1	0	54	54	Compression		
4-1	R Op 1	23.50	9.13	Min	-252	540	792	Compression	11601	0.07
4-1	L Op 2	23.50	18.88	Min	-252	540	792	Compression	11601	0.07
	V Elem	23.50	24.13	1	0	81	81	Compression		
	V Elem	23.50	25.38	1	0	81	81	Compression		
	V Elem	23.50	30.13	1	0	54	54	Compression		
	V Elem	23.50	30.88	1	0	54	54	Compression		
4-1	R Op 4	23.50	36.13	Min	233	130	104	HDU5-SDS	5645	0.02
4-1	R Op 4	23.50	36.13	Min	-233	216	449	Compression	11601	0.04
4-1	R End	23.50	39.88	Min	233	130	104	HDU5-SDS	5645	0.02
4-1	R End	23.50	39.88	Min	-233	216	449	Compression	10312	0.04
Line A										
	V Elem	12.13	0.00	1	0	108	108	Compression		
	V Elem	13.88	0.00	1	0	108	108	Compression		
	V Elem	22.13	0.00	1	0	81	81	Compression		
	V Elem	23.38	0.00	1	0	81	81	Compression		
Line B										
	V Elem	6.13	5.00	1	0	54	54	Compression		
	V Elem	6.88	5.00	1	0	54	54	Compression		
	V Elem	11.13	5.00	1	0	54	54	Compression		
	V Elem	11.88	5.00	1	0	54	54	Compression		
B-2	L End	16.62	5.50	1	2220	113	2107	HDU5-SDS	5645	0.37
B-2	L End	16.62	5.50	1	-2220	189	2409	Compression	10312	0.23
B-2	R End	23.38	5.50	1	2220	113	2107	HDU5-SDS	5645	0.37
B-2	R End	23.38	5.50	1	-2220	189	2409	Compression	10312	0.23
Line D										
D-1	L End	0.12	40.00	1	773	761	12	HDU5-SDS	5645	0.00
D-1	L End	0.12	40.00	1	-773	1269	2042	Compression	10312	0.20
D-1	R End	23.38	40.00	1	773	761	12	HDU5-SDS	5645	0.00
D-1	R End	23.38	40.00	1	-773	1269	2042	Compression	10312	0.20

Legend:
Line-Wall:
At wall or opening – Shearline and wall number
At vertical element – Shearline
Posit'n – Position of stud pack that hold-down is attached to or which is applying compression force:
V Elem – Vertical element: column or strengthened studs required where not at wall end or opening
L or R End – At left or right wall end
L or R Op n – At left or right side of opening n
t @ Op n – Uplift force t at opening n from offset opening in perforated wall above, from SDPWS 4.3.6.4.2.1
Location – Co-ordinates in Plan View
Load Case – Results are for critical load case:
ASCE 7 All Heights: Case 1 or 2 from Fig. 27.3-8
ASCE 7 Low-rise: Windward corner(s) and Case A or B from Fig. 28.3-1
ASCE 7 Minimum loads (27.1.5 / 28.3.4): "Min"
Tensile Hold-down or Compressive Stud Force – Upwards force on hold-down at one end of the wall or downward force on bottom plate under studs at the other end, for each force direction. Includes forces transferred from upper levels.
Shear – Overturning component = V x h / beff from SDPWS Eqn. 4.3-7; V = force on segment, ASD-factored by 0.60; h = wall height, beff = wall segment length – (tension stud pack width + hold-down anchor bolt offset) – (1/2 compression stud pack width). For perforated walls = V x h / Co sum (bi) from SDPWS Eqn. 4.3-8.
Dead – Dead load resisting component, factored for ASD by 0.60 for tension and 1.0 for compression
Uplift – Uplift wind load component, factored for ASD by 0.60
Cmb'd – Sum of ASD-factored overturning, dead and uplift forces. May also include the uplift force t from perforated walls from SDPWS 4.3.6.4.2.1 when openings are staggered.
Hold-down – Device model number from hold-down database; "Compression" for bearing of end stud pack on bottom plate
Cap – Hold-downs: Allowable ASD tension load from database; Compression: allowable ASD bearing force = Ct CM Cb Fcp A; A = cross sectional area of end studs. Refer to Framing materials table for details
Crit. Resp. – Critical Response = Combined ASD force / Allowable ASD tension load

Notes:
HDU5-SDS2.5 for studs with thickness > 0'-3" and depth > 0'-3.5" : Uses 14 1/4" x 2.5" SDS heavy-duty screws; 5/8" anchor bolt.
HDU14-SDS2.5 for studs with thickness > 0'-5.5" and depth > 0'-3.5" : Uses 36 1/4" x 2.5" SDS heavy-duty screws; 1" anchor bolt.
^WARNING - This hold-down does not have design capacities for the thickness of end studs selected, so additional jack studs or blocking required
Refer to the Shear Line Dimensions table for wall height h, effective segment length beff and perforated wall adjusted sum of bi, to the Story Table for joist depth, and to the Shear Results table for perforated factor Co.
Most severe of wind load cases is used for overturning calculation.
Designer is responsible for design of connection from wall to floor or foundation for shear force shown in Shear Results table. Refer to SDPWS 4.3.6.4.3 for foundation anchor bolt requirements.

COLLECTOR FORCES (flexible wind design)

Level 1 Line-Wall	Position on Wall or Opening	Location [ft] X	Location [ft] Y	Load Case	Drag Strut Force [lbs] --->	Drag Strut Force [lbs] <---	Strap/Blocking Force [lbs] --->	Strap/Blocking Force [lbs] <---
Line 2								
2-1	Right Wall End	6.00	18.00		925	-925		
Line 3								
3-1	Right Wall End	12.00	5.00		1473	-1473		
Line 4								
4-1	Right Opening 1	23.50	9.00		-221	221		
Line C								
C-1	Right Wall End	6.00	18.00		198	-198		
C-2	Left Wall End	6.50	18.50		104	-104		
C-2	Right Wall End	14.00	18.50		351	-351		
C-3	Left Wall End	17.00	18.50		-214	214		

Level 2 Line-Wall	Position on Wall or Opening	Location [ft] X	Location [ft] Y	Load Case	Drag Strut Force [lbs] --->	Drag Strut Force [lbs] <---	Strap/Blocking Force [lbs] --->	Strap/Blocking Force [lbs] <---
Line 2								
2-1	Left Opening 1	6.00	8.00		69	-69		
2-1	Right Opening 1	6.00	15.00		321	-321		
2-1	Right Wall End	6.00	18.00		391	-391		
2-1	Left Opening 1	6.00	8.00				188	188
2-1	Right Opening 1	6.00	15.00				188	188
Line 3								
3-1	Right Wall End	12.00	5.00		690	-690		
Line 4								
4-1	Right Opening 1	23.50	9.00		-83	83		
4-1	Left Opening 2	23.50	19.00		97	-97		
4-1	Right Opening 4	23.50	36.00		-60	60		
Line B								
B-2	Left Wall End	16.50	5.50		-999	999		

Legend:
Line-Wall - Shearline and wall number
Position…- Side of opening or wall end that drag strut is attached to
Location - Co-ordinates in Plan View
Load Case - Results are for critical load case:
ASCE 7 All heights Case 1 or 2
ASCE 7 Low-rise corner; Case A or B
Drag strut Force - Axial force in transfer element at openings, gaps, or changes in design shear along shearline. + : tension; - : compression.
Based on ASD-factored shearline force (vmax from 4.3.6.4.1.1 for perforated walls)
Strap/Blocking Force – For FTAO walls, force transferred from above and below opening to shearwall pier.
-> Due to shearline force in the west-to-east or south-to-north direction
<- Due to shearline force in the east-to-west or north-to-south direction

MWFRS DEFLECTION (flexible wind design)

These deflections are used to determine shearwall stiffness for force distribution

Wall, segment	W Gp	Dir	Srf	v plf	b ft	h ft	Bending A sq.in	Bending Defl in	Ga kips/in	Nail slip Vn lbs	Nail slip en in	Shear Defl in	Hold Defl in	Total Defl in
Level 1														
Line 2														
2-1	2	Both	ExtS	113.2	13.00	9.00	16.5	.002	33.3	181	.009	.031	0.19	0.23
Line 3														
3-1	3	Both	ExtS	336.7	5.00	9.00	16.5	.017	40.6	185	.009	.075	0.71	0.80
Line 4														
4-1,2	2	Both	ExtS	31.7	31.00	9.00	16.5	.000	33.3	181	.009	.009	0.00	0.01
Line C														
C-1	2	Both	ExtS	221.2	6.00	9.00	16.5	.009	33.3	181	.009	.060	0.46	0.53
C-2	2	Both	1S	221.2	7.50	9.00	16.5	.007	33.3	181	.009	.060	0.37	0.43
C-3	2	Both	1S	221.2	6.50	9.00	16.5	.009	33.3	181	.009	.060	0.43	0.49
Line D														
D-1	2	Both	ExtS	102.6	23.50	9.00	16.5	.001	33.3	181	.009	.028	0.10	0.13

Wall, segment	W Gp	Dir	Srf	v plf	b ft	h ft	Bending A sq.in	Bending Defl in	Ga kips/in	Nail slip Vn lbs	Nail slip en in	Shear Defl in	Hold Defl in	Total Defl in
Level 2														
Line 2														
2-1	3	Both	-	-					-	-	-	-		0.62
2-1,1		Both	ExtS	103.6	3.00	6.00	16.5	.005	40.6	185	.009	.015	0.60	0.62
2-1,2		Both	ExtS	103.6	3.00	6.00	16.5	.005	40.6	185	.009	.015	0.60	0.62
Line 3														
3-1	2	Both	ExtS	157.7	5.00	9.00	16.5	.008	33.3	181	.009	.043	0.58	0.63
Line 4														
4-1,2	2	Both	ExtS	27.3	10.00	9.00	16.5	.001	33.3	181	.009	.007	0.00	0.01
4-1,5		Both	ExtS	24.3	4.00	9.00	16.5	.002	33.3	181	.009	.007	0.61	0.62
Line B														
B-2	2	Both	1S	237.9	7.00	9.00	16.5	.009	33.3	181	.009	.064	0.45	0.53
Line D														
D-1	2	Both	ExtS	61.6	23.50	9.00	16.5	.001	33.3	181	.009	.017	0.10	0.12

Legend:

Wall, segment – Wall and segment between openings, e.g. B-3,2 = second segment on Wall 3 on Shearline B.

W Gp – Wall design group, refer to Sheathing and Framing Materials tables.

Dir – Force direction.

Srf – Wall surface = Int(erior) or Ext(erior) for perimeter walls, 1 or 2 for interior partitions; Comb = Combined v and Ga for identical materials on each side; S = Ga from side with stronger shear resistance; W = 2 x Ga of weaker side.

v – ASD shear force per unit distance on wall segment.

Unblocked walls = v / Cub as per SDPWS 4.3.4.3, Cub = Unblocked factor from 4.3.5.3, shown in the Shear Results table.

Perforated walls = vmax from Eqn. 4.3-9, as per 4.3.4.2.

FTAO walls = Unit shear force in pier beside opening(s).

b – Wall or segment length.

Segmented wall or FTAO wall segments = Width of wall segment between openings.

Perforated wall = Sum of FHS segments, modified as in 4.3.3.4 per 4.3.4.2.

FTAO wall = Length of wall including openings.

h – Wall height.

FTAO piers = Distance from bottom of opening to top of wall; for end segments, results using that distance and the wall height are averaged.

Defl – Horizontal shear wall deflection due to given term:

Bending = 8vh^3 / EAb; A = Effective cross sectional area of segment end stud(s), E = stud mod. of elasticity in Framing Materials table

For i studs at one end and j at the other, A = 2 (i^2 j + j^2 i) / (i + j)^2 x area of one stud, based on Ex. C4.3.4-3

Shear = vh / 1000 Ga; Ga = vw / (vw / Gvtv + 0.75 en), from SDPWS Ex. C4.3.4-1.

vw = ASD sheathing capacity.

Gvtv = Shear stiffness from C4.3.4, shown in Sheathing Materials table.

en = Nail slip from Table C4.2.3D of form aVn^b for WSP, constant for other materials.

Vn = Shear force per nail along panel edge at ASD capacity vw.

Hold – Anchorage system (hold-down) = da x h / beff.

da = Vertical hold-down displacement; refer to Hold-down Displacement table for components.

beff = Effective wall segment length = b - (tension stud pack width + hold-down anchor bolt offset) - (1/2 compression stud pack width)

beff is given in the Shear Wall Dimensions table.

For FTAO walls, hold-down device at end of wall is applied to all segments, as per APA T555.

Total Defl – Deflection from bending + shear + hold-down, as per Eqn. 4.3-2.

For FTAO walls, the average of the values for the segments, as per APA T555.

Out-of-plane Wind Design

COMPONENTS AND CLADDING by SHEARLINE

North-South Shearlines			Sheathing [psf]			Fastener Withdrawal [lbs]					Service Cond Factors	
			Force	Cap	Force/	Force		Cap	Force/Cap			
Line	Lev	Grp			Cap	End	Int		End	Int	Temp	Moist
1	1	1	13.9	221.9	0.06	18.5	15.0	126.5	0.15	0.12	1.00	1.00
	2	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
2	1	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
	2	3	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
3	1	3	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
	2	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
4	1	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
	2	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00

East-West Shearlines			Sheathing [psf]			Fastener Withdrawal [lbs]					Service Cond Factors	
			Force	Cap	Force/	Force		Cap	Force/Cap			
Line	Lev	Grp			Cap	End	Int		End	Int	Temp	Moist
A	1	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
		1	13.9	221.9	0.06	18.5	15.0	126.5	0.15	0.12	1.00	1.00
	2	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
B	2	1	13.9	221.9	0.06	18.5	15.0	126.5	0.15	0.12	1.00	1.00
C	1	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
	2	1	13.9	221.9	0.06	18.5	15.0	126.5	0.15	0.12	1.00	1.00
D	1	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00
	2	2	13.9	265.6	0.05	18.5	15.0	95.2	0.19	0.16	1.00	1.00

Legend:
Grp - Wall Design Group (results for all design groups for rigid, flexible design listed for each wall)
Sheathing:
Force - C&C end zone exterior pressures using negative (suction) coefficient in ASCE 7 Figure 30.3-1 added to interior pressure using coefficients from Table 26.13-1
Cap - Out-of-plane capacity of exterior sheathing from SDPWS Tables 3.2.1A/B, divided by 1.6 for short-term ASD loads as per 3.2.1. Assumes continuous over 2 spans (table note 3).
Fastener Withdrawal:
Force - Force tributary to each nail in end zone and interior zone
Cap - Factored withdrawal capacity of individual nail according to NDS 12.2-3

Flexible Diaphragm Seismic Design

SEISMIC INFORMATION

Level	Mass [lbs]	Area [sq.ft]	Story Shear Fx [lbs] E-W	Story Shear Fx [lbs] N-S	Shear Resistance [lbs] E-W	Shear Resistance [lbs] N-S	Diaphragm Force [lbs] E-W Fpx	Diaphragm Force [lbs] E-W Design	Diaphragm Force [lbs] N-S Fpx	Diaphragm Force [lbs] N-S Design
2	22921	802.0	3347	3347	7867	9933	3720	3720	3720	3720
1	27937	802.0	2130	2130	11220	13329	4534	8818	4534	4534
All	**50858**	-	**7824**	**7824**	-	-	-	-	-	-

Legend:
Mass – Sum of all generated and input building masses on level = wx in ASCE 7 Eqn. 12.8-12.
Story Shear – Total ASD-factored shear force induced at level x from Eqn. 12.8-11.
Shear Resistance – Lateral design strength of all shear-resisting elements on story, for use in weak story evaluation (4.1.8).
Diaphragm Force – used by Shearwalls only for drag strut forces, as per Exception to 12.10.2.1.
Fpx - Minimum ASD-factored force for diaphragm design from Eqns. 12.10-1, -2, and -3.
Design = The greater of the story shear and Fpx + transfer forces from discontinuous shearlines, factored by overstrength (omega) as per 12.10.1.1. Omega = 2.5 as per 12.2-1.
Design force for drag struts are determined on a shearline-by-shearline basis, and can use Fx, Fpx, or "Design" depending on the location of transfer forces.

Redundancy Factor p (rho):
E-W 1.00, N-S 1.00
Input by user (overriding calculated value).

Vertical Earthquake Load Ev
Ev = 0.2 Sds D; Sds = 1.00; Ev = 0.200 D unfactored; 0.140 D factored; total dead load factor: 0.6 - 0.140 = 0.460 tension, 1.0 + 0.140 = 1.140 compression.

Weak Story (SDPWS 4.1.8)
The lateral resistance of each story is greater than or equal to that of the story above. This vertical distribution of SFRS is permitted.

SHEAR RESULTS (flexible seismic design)

N-S Shearlines	W Gp	For Dir	ASD Shear Force [plf] v	vmax/vft	V [lbs]	Asp-Cub Int	Asp-Cub Ext	Allowable Shear [plf] Int	Ext	Co	C	Cmb	V [lbs]	Resp. Ratio
Line 2														
Level 2														
Ln2, Lev2	-	Both	-	-	1302	-	-	0	396	-	S	-	5147	-
Wall 2-1	3	Both	-	-	1302	1.0	1.0	0	396	-		-	5147	-
Seg. 1	-	Both	217.1	85.6	651	1.0	1.0	0	396	-		396	1188	0.55
Open. 1	-	Both	-	112.7	789	-	-	0	396	-		396	2772	0.28
Seg. 2	-	Both	217.1	85.6	651	1.0	1.0	0	396	-		396	1188	0.55
Level 1														
Ln2, Lev1	-	Both	-	-	2016	-	-	0	258	-	S	-	3353	-
Wall 2-1	2	Both	155.1	-	2016	1.0	1.0	0	258	-		258	3353	0.60
Line 3														
Level 2														
Ln3, Lev2	-	Both	-	-	1035	-	-	0	258	-	S	-	1290	-
Wall 3-1	2	Both	207.0	-	1035	1.0	1.0	0	258	-		258	1290	0.80
Level 1														
Ln3, Lev1	-	Both	-	-	1683	-	-	0	396	-	S	-	1980	-
Wall 3-1	3^	Both	336.6	-	1683	1.0	1.0	0	396	-		396	1980	0.85
Line 4														
Level 2														
Ln4, Lev2	-	Both	-	-	1010	-	-	0	258	-	S	-	3496	-
Wall 4-1	2	Both	-	-	1010	1.0	1.0	0	258	-		-	3496	-
Seg. 1	-	Both	0.0	-	0	1.0	1.0	0	258	-		258	-	-
Seg. 2	-	Both	74.5	-	745	1.0	1.0	0	258	-		258	2579	0.29
Seg. 3	-	Both	0.0	-	0	1.0	1.0	0	258	-		258	-	-
Seg. 4	-	Both	0.0	-	0	1.0	1.0	0	258	-		258	-	-
Seg. 5	-	Both	66.2	-	265	.89	.89	0	229	-		229	917	0.29
Level 1														
Ln4, Lev1	-	Both	-	-	1779	-	-	0	258	-	S	-	7996	-
Wall 4-1	2	Both	-	-	1779	1.0	1.0	0	258	-		-	7996	-
Seg. 1	-	Both	0.0	-	0	1.0	1.0	0	258	-		258	-	-
Seg. 2	-	Both	57.4	-	1779	1.0	1.0	0	258	-		258	7996	0.22

E-W Shearlines	W Gp	For Dir	ASD Shear Force [plf] v	vmax/vft	V [lbs]	Asp-Cub Int	Asp-Cub Ext	Allowable Shear [plf] Int	Ext	Co	C	Cmb	V [lbs]	Resp. Ratio
Line B														
Level 2														
LnB, Lev2	-	Both	-	-	1714	-	-	0	258	-	S	-	1806	-
Wall B-2	2^	Both	244.8	-	1714	1.0	1.0	0	258	-		258	1806	0.95
Line C														
Level 1														
LnC, Lev1	-	Both	-	-	3181	-	-	0	258	-	S	-	5159	-
Wall C-1	2	Both	159.0	-	954	1.0	1.0	0	258	-		258	1548	0.62
Wall C-2	2	Both	159.0	-	1193	1.0	1.0	0	258	-		258	1934	0.62
Wall C-3	2	Both	159.0	-	1034	1.0	1.0	0	258	-		258	1677	0.62
Line D														
Level 2														
LnD, Lev2	2	Both	69.5	-	1633	1.0	1.0	0	258	-	S	258	6061	0.27
Level 1														
LnD, Lev1	2	Both	97.7	-	2296	1.0	1.0	0	258	-	S	258	6061	0.38

Legend:
W Gp - Wall design group defined in Sheathing and Framing Materials tables, where it shows associated Standard Wall. "^" means that this wall is critical for all walls in the Standard Wall group.
For Dir – Direction of seismic force along shearline.
v – Design shear force on segment = ASD-factored shear force per unit length of full-height sheathing (FHS)
vmax/vft - Perforated walls: Collector and in-plane anchorage force as per SDPWS eqn. 4.3-9 = V/FHS/Co. FHS is factored for narrow segments as per 4.3.3.4
FTAO walls: Shear force in piers above and below either openings or piers beside opening(s). Aspect ratio factor does not apply to these piers.
V – ASD factored shear force. For shearline: total shearline force. For wall: total of all segments on wall. For segment: force on segment
Asp/Cub – For wall: Unblocked structural wood panel factor Cub from SDPWS 4.3.5.3. For segment or FTAO pier: Aspect ratio factor from SDPWS 4.3.5.5.1. For perforated wall: Either Cub or sum bi / FHS, where bi is segment length adjusted per SDPWS 4.3.3.4.
Int, Ext - Nominal unit shear capacity of interior and exterior sheathing, factored by Table 4.3-1 Note 3 for framing specific gravity and Note 10 for presence of hold-downs. For wall segments, also include unblocked factor Cub and aspect ratio adjustments.
Co - Adjustment factor for perforated walls from SDPWS Equation 4.3-6.
C - Sheathing combination rule, A = Add capacities, S = Strongest side or twice weakest, G = Stiffness-based using Eqns. 4.3-3,-4.
Cmb - Combined interior and exterior unit shear capacity including perforated wall factor Co.
V – Total factored shear capacity of shearline, wall or segment.
Crit Resp – Response ratio = v/Cmb = design shear force/unit shear capacity. "W" indicates that the wind design criterion was critical in selecting wall.

Hold-Down and Compression Design (flexible seismic design)

Level 1 Line-Wall	Posit'n	Location [ft] X	Location [ft] Y	Tensile Hold-down or Compressive Stud Force [lbs] Shear	Dead	Ev	Cmb'd	Hold-down	Cap [lbs]	Crit Resp.
Line 2										
2-1	L End	6.00	5.13	2342	616	144	1870	HDU5-SDS	5645	0.33
2-1	L End	6.00	5.13	-2342	1026	144	3512	Compression	10312	0.34
2-1	R End	6.00	17.87	2342	616	144	1870	HDU5-SDS	5645	0.33
2-1	R End	6.00	17.87	-2342	1026	144	3512	Compression	10312	0.34
Line 3										
3-1	L End	12.00	0.12	8950	324	76	8702	HDU14-SDS	^10770	0.81
3-1	L End	12.00	0.12	-8950	540	76	9566	Compression	10312	0.93
3-1	R End	12.00	4.88	8950	324	76	8702	HDU14-SDS	^10770	0.81
3-1	R End	12.00	4.88	-8950	540	76	9566	Compression	10312	0.93
Line 4										
	V Elem	23.50	0.12	0	135	19	154	Compression		
	V Elem	23.50	0.88	0	54	8	61	Compression		
	V Elem	23.50	1.38	0	81	11	92	Compression		
4-1	R Op 1	23.50	9.13	1208	1328	310	190	HDU5-SDS	5645	0.03
4-1	R Op 1	23.50	9.13	-1208	2214	310	3732	Compression	11601	0.32
	V Elem	23.50	18.88	687	324	76	439	Refer to upper level		
	V Elem	23.50	18.88	-687	540	76	1303	Compression		
	V Elem	23.50	24.13	0	81	11	92	Compression		
	V Elem	23.50	25.38	0	81	11	92	Compression		
	V Elem	23.50	30.13	0	54	8	61	Compression		
	V Elem	23.50	30.88	0	54	8	61	Compression		
	V Elem	23.50	36.13	636	130	30	536	Refer to upper level		
	V Elem	23.50	36.13	-635	216	30	882	Compression		
4-1	R End	23.50	39.88	1156	1134	265	287	HDU5-SDS	5645	0.05
4-1	R End	23.50	39.88	-1156	1890	265	3311	Compression	10312	0.32
Line A										
	V Elem	12.13	0.00	0	216	30	246	Compression		
	V Elem	13.88	0.00	0	216	30	246	Compression		
	V Elem	21.63	0.00	0	108	15	123	Compression		
	V Elem	22.13	0.00	0	81	11	92	Compression		
	V Elem	23.38	0.00	0	189	26	215	Compression		
Line B										
	V Elem	6.13	5.50	0	54	8	61	Compression		
	V Elem	6.88	5.50	0	54	8	61	Compression		
	V Elem	11.13	5.50	0	54	8	61	Compression		
	V Elem	11.88	5.50	0	54	8	61	Compression		
	V Elem	16.62	5.50	2285	113	26	2198	Refer to upper level		
	V Elem	16.62	5.50	-2285	189	26	2500	Compression		
	V Elem	23.38	5.50	2285	113	26	2198	Refer to upper level		
	V Elem	23.38	5.50	-2285	189	26	2500	Compression		
Line C										
C-1	L End	0.12	18.00	1493	194	45	1344	HDU5-SDS	5645	0.24
C-1	L End	0.12	18.00	-1493	324	45	1863	Compression	10312	0.18
C-1	R End	5.88	18.00	1493	194	45	1344	HDU5-SDS	5645	0.24
C-1	R End	5.88	18.00	-1493	324	45	1863	Compression	10312	0.18
C-2	L End	6.63	18.50	1481	122	28	1387	HDU5-SDS	5645	0.25
C-2	L End	6.63	18.50	-1481	203	28	1711	Compression	10312	0.17
C-2	R End	13.88	18.50	1481	122	28	1387	HDU5-SDS	5645	0.25
C-2	R End	13.88	18.50	-1481	203	28	1711	Compression	10312	0.17
C-3	L End	17.13	18.50	1489	105	25	1408	HDU5-SDS	5645	0.25
C-3	L End	17.13	18.50	-1488	176	25	1688	Compression	10312	0.16
C-3	R End	23.38	18.50	1489	105	25	1408	HDU5-SDS	5645	0.25
C-3	R End	23.38	18.50	-1488	176	25	1688	Compression	10312	0.16
Line D										
D-1	L End	0.12	40.00	1762	1523	355	595	HDU5-SDS	5645	0.11
D-1	L End	0.12	40.00	-1762	2538	355	4655	Compression	10312	0.45
D-1	R End	23.38	40.00	1762	1523	355	595	HDU5-SDS	5645	0.11
D-1	R End	23.38	40.00	-1762	2538	355	4655	Compression	10312	0.45

Level 2 Line-Wall	Posit'n	Location [ft] X	Location [ft] Y	Tensile Hold-down or Compressive Stud Force [lbs] Shear	Dead	Ev	Cmb'd	Hold-down	Cap [lbs]	Crit Resp.
Line 2										
2-1	L End	6.00	5.13	919	194	45	770	HDU5-SDS	5645	0.14
2-1	L End	6.00	5.13	-919	324	45	1289	Compression	10312	0.12
2-1	R End	6.00	17.87	919	194	45	770	HDU5-SDS	5645	0.14
2-1	R End	6.00	17.87	-919	324	45	1289	Compression	11601	0.11
Line 3										
3-1	L End	12.00	0.12	1961	162	38	1837	HDU5-SDS	5645	0.33
3-1	L End	12.00	0.12	-1961	270	38	2269	Compression	10312	0.22

Hold-Down and Compression Design (flexible seismic design, continued)

3-1	R End	12.00	4.88	1961	162	38	1837	HDU5-SDS	5645	0.33
3-1	R End	12.00	4.88	-1961	270	38	2269	Compression	10312	0.22
Line 4										
	V Elem	23.50	0.12	0	54	8	61	Compression		
	V Elem	23.50	0.88	0	54	8	61	Compression		
4-1	R Op 1	23.50	9.13	687	324	76	439	HDU5-SDS	5645	0.08
4-1	R Op 1	23.50	9.13	-687	540	76	1303	Compression	11601	0.11
4-1	L Op 2	23.50	18.88	687	324	76	439	HDU5-SDS	5645	0.08
4-1	L Op 2	23.50	18.88	-687	540	76	1303	Compression	11601	0.11
	V Elem	23.50	24.13	0	81	11	92	Compression		
	V Elem	23.50	25.38	0	81	11	92	Compression		
	V Elem	23.50	30.13	0	54	8	61	Compression		
	V Elem	23.50	30.88	0	54	8	61	Compression		
4-1	R Op 4	23.50	36.13	636	130	30	536	HDU5-SDS	5645	0.09
4-1	R Op 4	23.50	36.13	-635	216	30	882	Compression	11601	0.08
4-1	R End	23.50	39.88	636	130	30	536	HDU5-SDS	5645	0.09
4-1	R End	23.50	39.88	-635	216	30	882	Compression	10312	0.09
Line A										
	V Elem	12.13	0.00	0	108	15	123	Compression		
	V Elem	13.88	0.00	0	108	15	123	Compression		
	V Elem	22.13	0.00	0	81	11	92	Compression		
	V Elem	23.38	0.00	0	81	11	92	Compression		
Line B										
	V Elem	6.13	5.00	0	54	8	61	Compression		
	V Elem	6.88	5.00	0	54	8	61	Compression		
	V Elem	11.13	5.00	0	54	8	61	Compression		
	V Elem	11.88	5.00	0	54	8	61	Compression		
B-2	L End	16.62	5.50	2285	113	26	2198	HDU5-SDS	5645	0.39
B-2	L End	16.62	5.50	-2285	189	26	2500	Compression	10312	0.24
B-2	R End	23.38	5.50	2285	113	26	2198	HDU5-SDS	5645	0.39
B-2	R End	23.38	5.50	-2285	189	26	2500	Compression	10312	0.24
Line D										
D-1	L End	0.12	40.00	873	761	178	289	HDU5-SDS	5645	0.05
D-1	L End	0.12	40.00	-873	1269	178	2320	Compression	10312	0.22
D-1	R End	23.38	40.00	873	761	178	289	HDU5-SDS	5645	0.05
D-1	R End	23.38	40.00	-873	1269	178	2320	Compression	10312	0.22

Legend:
Line-Wall:
At wall or opening – Shearline and wall number
At vertical element – Shearline
Posit'n – Position of stud pack that hold-down is attached to:
V Elem – Vertical element: column or strengthened studs required where not at wall end or opening
L or R End – At left or right wall end
L or R Op n – At left or right side of opening n
t @ Op n – Uplift force t at opening n from offset opening in perforated wall above, from SDPWS 4.3.6.4.2.1
Location – Co-ordinates in Plan View
Tensile Hold-down or Compressive Stud Force – Upwards force on hold-down at one end of the wall or downward force on bottom plate under studs at the other end, for each force direction. Includes forces transferred from upper levels.
Shear – Overturning component = V x h / beff from SDPWS Eqn. 4.3-7; V = force on segment, ASD-factored by 0.70; h = wall height , beff = wall segment length – (tension stud pack width + hold-down anchor bolt offset) – (1/2 compression stud pack width). For perforated walls = V x h / Co sum (bi) from SDPWS Eqn. 4.3-8.
Dead – Dead load resisting component, factored for ASD by 0.60 for tension and 1.0 for compression
Ev – Vertical seismic load effect from ASCE 7 12.4.2.2 = -0.2 Sds x ASD factor x unfactored D = 0.233 SDS x factored D. Refer to Seismic Information table for more details.
Cmb'd – Sum of ASD-factored overturning, dead and vertical seismic forces. May also include the uplift force t from perforated walls from SDPWS 4.3.6.4.2.1 when openings are staggered.
Hold-down – Device model number from hold-down database; "Compression" for bearing of end stud pack on bottom plate
Cap – Hold-downs: Allowable ASD tension load from database; Compression: Allowable ASD bearing force = Ct CM Cb Fcp A; A = cross sectional area of end studs. Refer to Framing materials table for details.
Crit. Resp. – Critical Response = Combined ASD force/Allowable ASD tension load

Notes:
HDU5-SDS2.5 for studs with thickness > 0'-3" and depth > 0'-3.5" : Uses 14 1/4" x 2.5" SDS heavy-duty screws; 5/8" anchor bolt.
HDU14-SDS2.5 for studs with thickness > 0'-5.5" and depth > 0'-3.5" : Uses 36 1/4" x 2.5" SDS heavy-duty screws; 1" anchor bolt.
^WARNING - This hold-down does not have design capacities for the thickness of end studs selected, so additional jack studs or blocking required
Combined force from ASCE 7 2.4.1 load combination 10 = - (0.6D - 0.7Ev + 0.7Eh); Eh (from 12.4.2.1) = - shear overturning force
Refer to the Shear Line Dimensions table for wall height h, effective segment length beff and perforated wall adjusted sum of bi, to the Story Table for joist depth, and to the Shear Results table for perforated factor Co.
Designer is responsible for design of connection from wall to floor or foundation for shear force shown in Shear Results table. Refer to SDPWS 4.3.6.4.3 for foundation anchor bolt requirements.

COLLECTOR FORCES (flexible seismic design)

Level 1 Line-Wall	Position on Wall or Opening	Location [ft] X	Y	Drag Strut Force [lbs] --->	<---	Strap/Blocking Force [lbs] --->	<---
Line 2							
	Shearline force			3526	3526		
2-1	Right Wall End	6.00	18.00	2216	-2216		
Line 3							
	Shearline force			3017	3017		
3-1	Right Wall End	12.00	5.00	2640	-2640		
Line 4							
	Shearline force			3308	3308		
4-1	Right Opening 1	23.50	9.00	-744	744		
Line C							
	Shearline force			7407	7407		
C-1	Right Wall End	6.00	18.00	331	-331		
C-2	Left Wall End	6.50	18.50	173	-173		
C-2	Right Wall End	14.00	18.50	587	-587		
C-3	Left Wall End	17.00	18.50	-359	359		

Level 2 Line-Wall	Position on Wall or Opening	Location [ft] X	Y	Drag Strut Force [lbs] --->	<---	Strap/Blocking Force [lbs] --->	<---
Line 2							
	Shearline force			1447	1447		
2-1	Left Opening 1	6.00	8.00	161	-161		
2-1	Right Opening 1	6.00	15.00	661	-661		
2-1	Right Wall End	6.00	18.00	822	-822		
2-1	Left Opening 1	6.00	8.00			394	394
2-1	Right Opening 1	6.00	15.00			394	394
Line 3							
	Shearline force			1150	1150		
3-1	Right Wall End	12.00	5.00	1007	-1007		
Line 4							
	Shearline force			1122	1122		
4-1	Right Opening 1	23.50	9.00	-252	252		
4-1	Left Opening 2	23.50	19.00	295	-295		
4-1	Right Opening 4	23.50	36.00	-182	182		
Line B							
	Shearline force			1904	1904		
B-2	Left Wall End	16.50	5.50	-1143	1143		

Legend:
Line-Wall - Shearline and wall number
Position…- Side of opening or wall end that drag strut is attached to
Location - Co-ordinates in Plan View
Drag strut Force - Axial force in transfer element at openings, gaps, or changes in design shear along shearline. + : tension; - : compression.
Based on ASD-factored shearline force shown. For SDC C-F, it is the greater of the design shearline force and the diaphragm force Fpx, added to shearline force from story above and to forces transferred from discontinuous shearlines factored by overstrength (omega) as per 12.10.1.1. Refer to Seismic Information table for diaphragm forces and omega factor.
For SDC D-F, if horizontal torsional irregularities 2, 3, or 4 are input, or vertical irregularity 4 detected or input, 25% increase from 12.3.3.4 applied. For perforated walls, this force is converted to vmax using 4.3.6.4.1.1.
Strap/Blocking Force – For FTAO walls, force transferred from above and below opening to shearwall pier.
-> Due to shearline force in the west-to-east or south-to-north direction
<- Due to shearline force in the east-to-west or north-to-south direction

DEFLECTION (flexible seismic design)

Wall, segment	W Gp	Dir	Srf	v plf	b ft	h ft	Bending A sq.in	Bending Defl in	Ga kips/ in	Nail slip Vn lbs	Nail slip en in	Shear Defl in	Hold Defl in	Total Defl in
Level 1														
Line 2														
2-1	2	Both	ExtS	221.5	13.00	9.00	16.5	.004	33.3	181	.009	.060	0.22	0.29
Line 3														
3-1	3	Both	ExtS	480.8	5.00	9.00	16.5	.024	40.6	185	.009	.107	0.91	1.04
Line 4														
4-1,2	2	Both	ExtS	82.0	31.00	9.00	16.5	.001	33.3	181	.009	.022	0.08	0.10
Line C														
C-1	2	Both	ExtS	227.2	6.00	9.00	16.5	.010	33.3	181	.009	.061	0.46	0.53
C-2	2	Both	1S	227.2	7.50	9.00	16.5	.008	33.3	181	.009	.061	0.37	0.43
C-3	2	Both	1S	227.2	6.50	9.00	16.5	.009	33.3	181	.009	.061	0.43	0.50
Line D														
D-1	2	Both	ExtS	139.6	23.50	9.00	16.5	.001	33.3	181	.009	.038	0.11	0.15

Wall, segment	W Gp	Dir	Srf	v plf	b ft	h ft	Bending A sq.in	Bending Defl in	Ga kips/ in	Nail slip Vn lbs	Nail slip en in	Shear Defl in	Hold Defl in	Total Defl in
Level 2														
Line 2														
2-1	3	Both	-	-					-	-	-	-		0.78
2-1,1		Both	ExtS	310.1	3.00	6.00	16.5	.014	40.6	185	.009	.046	0.72	0.78
2-1,2		Both	ExtS	310.1	3.00	6.00	16.5	.014	40.6	185	.009	.046	0.72	0.78
Line 3														
3-1	2	Both	ExtS	295.8	5.00	9.00	16.5	.015	33.3	181	.009	.080	0.68	0.78
Line 4														
4-1,2	2	Both	ExtS	106.4	10.00	9.00	16.5	.003	33.3	181	.009	.029	0.26	0.29
4-1,5		Both	ExtS	94.6	4.00	9.00	16.5	.006	33.3	181	.009	.026	0.67	0.71
Line B														
B-2	2	Both	1S	349.7	7.00	9.00	16.5	.013	33.3	181	.009	.094	0.51	0.61
Line D														
D-1	2	Both	ExtS	99.3	23.50	9.00	16.5	.001	33.3	181	.009	.027	0.11	0.13

Legend:
Wall, segment – Wall and segment between openings, e.g. B-3,2 = second segment on Wall 3 on Shearline B.
W Gp – Wall design group, refer to Sheathing and Framing Materials tables.
Dir – Force direction.
Srf – Wall surface = Int(erior) or Ext(erior) for perimeter walls, 1 or 2 for interior partitions; Comb = Combined v and Ga for identical materials on each side; S = Ga from side with stronger shear resistance; W = 2 x Ga of weaker side.
v – Unfactored (strength-level) shear force per unit distance on wall segment = ASD force / 0.70, as per ASCE 7 12.8.6,.
Unblocked walls = v / Cub as per SDPWS 4.3.4.3, Cub = Unblocked factor from 4.3.5.3, shown in the Shear Results table.
Perforated walls = vmax from Eqn. 4.3-9, as per 4.3.4.2.
FTAO walls = Unit shear force in pier beside opening(s).
b – Wall or segment length.
Segmented wall or FTAO wall segments = Width of wall segment between openings.
Perforated wall = Sum of FHS segments, modified as in 4.3.3.4 per 4.3.4.2.
FTAO wall = Length of wall including openings.
h – Wall height.
FTAO piers = Distance from bottom of opening to top of wall; for end segments, results using that distance and the wall height are averaged.
Defl – Horizontal shear wall deflection due to given term:
Bending = 8vh^3 / EAb; A = Effective cross sectional area of segment end stud(s), E = stud mod. of elasticity in Framing Materials table
For i studs at one end and j at the other, A = 2 (i^2 j + j^2 i) / (i + j)^2 x area of one stud, based on Ex. C4.3.4-3
Shear = vh / 1000 Ga; Ga = 1.4 vs / (1.4 vs / Gvtv + 0.75 en) from SDPWS Eqn. C4.2.3-3.
vs = ASD sheathing capacity.
Gvtv = Shear stiffness from C4.3.4, shown in Sheathing Materials table.
en = Nail slip from Table C4.2.3D, of form aVn^b for WSP, constant for other materials.
Vn = Strength-level shear force per nail along panel edge at ASD capacity = 1.4 vs.
Hold – Anchorage system (hold-down) = da x h / beff.
da = Vertical hold-down displacement; refer to Hold-down Displacement table for components.
beff = Effective wall segment length = b - (tension stud pack width + hold-down anchor bolt offset) - (1/2 compression stud pack width)
beff is given in the Shear Wall Dimensions table.
For FTAO walls, hold-down device at end of wall is applied to all segments, as per APA T555.
Total Defl – Deflection from bending + shear + hold-down, as per Eqn. 4.3-2.
For FTAO walls, the average of the values for the segments, as per APA T555.

STORY DRIFT (flexible seismic design)

Level	Dir	Wall height ft	Actual Story Drift (in) Max dxe	Line	Max dx	Center of Mass	C of M dxe	C of M dx	Allowable Story Drift hsx ft	Delta a in	Ratio Max	Ratio C of M
1		9.00							9.83	2.95		
	N<->S		1.04	3	2.84	13.28	0.94	2.55			0.96	0.86
	E<->W		0.50	C	0.95	20.33	0.46	0.88			0.32	0.30
2		9.00							9.00	2.70		
	N<->S		0.78	2	1.63	12.14	0.78	1.76			0.60	0.65
	E<->W		0.61	B	1.50	22.11	0.38	0.90			0.56	0.33

ASCE 7 Eqn. 12.8-15: dx = dxe x Cd / Ie
Deflection amplification factor Cd from Table 12.2-1 = (E-W), 4.0 (N-S)
Importance factor Ie = 1.00

Legend:
Max dxe – Largest deflection for any shearline on level in this direction; refer to Deflections table
Line – Shearline with largest deflection on level in this direction
hsx – Story height in ASCE Table 12.12-1 = Height of walls plus joist depth between this level and the one above.
Max dx – Largest amplified deflection on level in this direction using ASCE 7 Eq'n 12.8-15
C of M dxe - Deflection at the center of mass of this level; from interpolating deflections at adjacent shearlines.
C of M dx - Amplified deflection at center of mass using Eq'n 12.8-15. Does not include differences between top and bottom diaphragm deflection.
Delta a = Allowable story drift on this level from ASCE 7 Table 12.12-1
Ratio - Proportion of allowable story drift experienced, on this level in this direction.