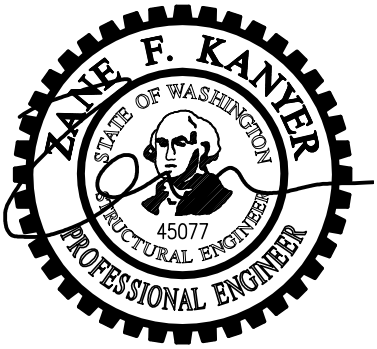
Structural Calculations For:

Prior Residence

Mercer Island, WA



Prepared for: Richartz Studios
8212 SE 64th St
Mercer Island, WA 98040

Job #: 00052-2021-05

Date: 12/17/2021

SSF STRUCTURAL ENGINEERING

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TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 O 253.284.9470
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Criteria Sheet

Codes

Structural	IBC 2018
Loading	ASCE 7-16
Wood:	NDS 2018
Steel:	AISC 360-16
Concrete:	ACI 318-14
Masonry:	TMS 402/602-16

Project Location

Street & Number	8212 SE 64th St		
City:	Mercer Island	State:	WA
ZIP:	98040		
Latitude:	47.5459	N	
Longitude:	-122.2287	W	
Ground Elevation	314	ft	

Occupancy Category

Risk Category: II — ASCE 7 Table 1.5-1

Seismic Load Summary:

Analysis Procedure:	Equivalent Lateral Force Procedure		
Lateral System:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance		
R:	6.50	C_d=	4
Base Shear V =	8 kips	Ω_o=	2.5
S_S=	1.464	S_1=	0.507
S_{DS}=	1.17	S_{D1}=	0.57
C_s=	0.180	I_E=	1.0

Story Information

# Stories Above Grade (Including Mezzanine Levels)	2

Horizontal and Vertical Irregularities:

Is the building a "Regular Structure"? (No horizontal or vertical irregularities): No

Wind Load Summary:

V=	97	K_{ZT}=	1.60
Exposure =	B		

Dead Loads:

Roof			Floor		
Roofing	2.5	psf	Finish Floor	1	psf
1/2" Sheathing	1.8	psf	3/4" Sheathing	2.7	psf
Trusses @ 24" oc	2.5	psf	Joists @ 16" oc	2.2	psf
Misc./Mech.	1.5	psf	Misc./Mech.	2	psf
Ceiling Finish	2.8	psf	Ceiling Finish	2.8	
Solar Panels	4			10.7	psf
	15	psf	Use	12	psf
Use	15	psf			

Live Loads:

Snow	25	psf
Floor	40	psf

Soils:

Soils Report Provided? No — To be approved by the authority having jurisdiction, per 11.8.2 exception.

Allowable Bearing	1500	psf	Active	55/35	pcf (Restrained/Unrestrained)
Sliding, μ	0.3		Seismic Surcharge	8H	
Passive	250	pcf			

STRUCTURAL ENGINEERING

Prior Residence

Criteria

DATE 12/15/2021

PROJ. #

DESIGN AGL

SHEET 1

Seismic Design

ASCE 7-16 Seismic Analysis Equivalent Lateral Force Procedure

Seismic Force Resisting System Per Table 12.2-1		
	System	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D	
Risk Category	II	I, II, or III, or IV per Table 1.5-1
Site Class	D (Default)	Assumed default soil properties, per 11.4.3.
Diaphragm Flexibility	Flexible	

Section 12.8.1.3 Exceptions

Regular Structure	No
≤ 5 Stories above grade	Yes
T ≤ 0.5s	Yes
ρ = 1.0	No
Not Site Class E or F	Yes
Risk Category I or II	Yes

If all exceptions are met, S_{DS} may be taken as 1, but not less than 0.7*(Calculated S_{DS})

S_S	1.464 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.507 g	2% in 50 yr, Latitude & Longitude lookup
R	6.50	
C_d	4.0	
Ω_o	2.5	
I_e	1.00	Table 1.5-2
h_n	18.0 ft	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T_a	0.17 sec	
T	0.17 sec	Eq. 12.8-7
T_0	0.10 sec	
T_S	0.49 sec	
T_L	6.00 sec	
F_a	1.20	Table 11.4-1
F_v	1.70	Table 11.4-2
S_{MS}	1.76 g	Eq. 11.4-1
S_{M1}	0.86 g	Eq. 11.4-2
S_{DS}	1.171 g	Eq. 11.4-3
S_{D1}	0.575 g	Eq. 11.4-4
C_s	***0.180 Controls***	Eq. 12.8-2
	0.506	Eq. 12.8-3 need not exceed, T < T_L
	0.010	Eq. 12.8-5 or 12.8-6 minimum
C_s, design	0.180	Section 11.4.8 Exception 2 Applied
Bldg. Weight	48.0 k	
V = C_SW	8.6 k	Eq. 12.8-1, Strength Level Base Shear
V = C_{Sasd}W	6.1 k	Eq. 12.8-1 ASD Base Shear

Building Period Per Alternate Analysis

T (sec)	

Per Geotech Report

F_a	
F_v	

$$T_a = C_t h_n^x \quad \text{Eq. 12.8.7}$$

$$S_{MS} = F_a S_S \quad \text{Eq. 11.4-1}$$
$$S_{M1} = F_v S_1 \quad \text{Eq. 11.4-2}$$
$$S_{DS} = {}^2/_3\, S_{MS} \quad \text{Eq. 11.4-3}$$
$$S_{D1} = {}^2/_3\, S_{M1} \quad \text{Eq. 11.4-4}$$

$$C_S = \frac{S_{DS}}{(R/I_e)} \quad \text{Eq. 12.8-2}$$
$$C_S = \frac{S_{D1}}{T(R/I_e)} \quad \text{Eq. 12.8-3}$$
$$C_S = \frac{S_{D1}T_L}{T^2(R/I_e)} \quad \text{Eq. 12.8-4}$$
$$C_S \geq 0.044 S_{DS} I_e \quad \text{Eq. 12.8-5}$$
$$C_S \geq 0.01 \quad \text{Eq. 12.8-5}$$
$$C_S > 0.5 \frac{S_1}{(R/I_e)} \quad \text{Eq. 12.8-6}$$

$$C_{VX} = w_x h_x^k / \sum_{i=1}^{n} w_x h_i^k \quad \text{Eq. 12.8-12}$$

$$F_{px} = {}^{\sum_{i=x}^{n} F_i}/_{\sum_{i=x}^{n} w_i}\, w_{px} \quad \text{Eq. 12.10-1}$$
$$F_{px} \geq 0.2 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-2}$$
$$F_{px} \leq 0.4 S_{DS} I_e w_{px} \quad \text{Eq. 12.10-3}$$

Vertical Distribution ASD ρ= 1.3 k= 1.000

Level	h_x (ft)	W_x (k)	h_x^k (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force (ρ not included)				
					C_{vx} (%)	F_x (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	$\gamma=F_{px}/F_x$
3	18.0	22.5	18.0	405	0.614	4.8	**4.8**	3.7	3.7	7.4	**3.7**	0.77
2	10.0	26	10.0	255	0.386	3.0	**7.9**	3.2	4.2	8.4	**4.2**	1.38
Σ		48.0		660		**7.9**						

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Prior Residence

Seismic Criteria

DATE 12/15/2021

PROJ. #

DESIGN AGL

SHEET 2

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	B	
V=	97	mph
K_d=	0.85	Table 26.6-1
K_h=	0.63	Table 26.10-1
K_e=	0.99	Table 26.9-1
G=	0.85	26.9.4

Transverse Wind Pressures

L/B = 0.72 h/L = 0.70

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.87 / -0.18
Leeward Roof	-0.55

Location and Building Dimensions

Calculate Kzt?	No	
Kzt	1.60	
Roof Type	Gable	
Roof Angle - Transverse Dir	14	degrees
Roof Angle - Long Dir	0	degrees
Ground to top of roof	24	ft
Bot of roof to top of roof	6	ft
Mean Roof Height, h	21	ft
Short Plan Dimension	30	ft
Long Plan Dimension	41.5	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	10	ft

Velocity Pressure at Mean Roof Height, q_h =	20.5	psf

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.57	18.46	12.55	8.71	**12.8**
15-20	0.62	20.08	13.65	8.71	**13.4**
20-25	0.66	21.38	14.54	8.71	**13.9**
25-30	0.7	22.67	15.42	8.71	**14.5**
30-40	0.76	24.61	16.74	8.71	**15.3**
41-50	0.81	26.23	17.84	8.71	**15.9**
51-60	0.85	27.53	18.72	8.71	**16.5**
61-70	0.89	28.83	19.60	8.71	**17.0**
71-80	0.93	30.12	20.48	8.71	**17.5**
81-90	0.96	31.09	21.14	8.71	**17.9**
91-100	0.99	32.06	21.80	8.71	**18.3**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-3.1	-15.1	-9.5	**4.80**

Parapet (Unf) ASD

Windward	Leeward	**Total (psf)**
-N/A-	-N/A-	**-N/A-**

Transverse Direction

Base Shear (kips)	**8.2**

Longitudinal Wind Pressures

L/B = 1.38 h/L = 0.51

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.42
Windward Roof	-0.9 / -0.18
Leeward Roof	-0.58

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.57	18.46	12.55	7.37	**11.96**
15-20	0.62	20.08	13.65	7.37	**12.62**
20-25	0.66	21.38	14.54	7.37	**13.15**
25-30	0.7	22.67	15.42	7.37	**13.67**
30-40	0.76	24.61	16.74	7.37	**14.47**
41-50	0.81	26.23	17.84	7.37	**15.13**
51-60	0.85	27.53	18.72	7.37	**15.66**
61-70	0.89	28.83	19.60	7.37	**16.19**
71-80	0.93	30.12	20.48	7.37	**16.71**
81-90	0.96	31.09	21.14	7.37	**17.11**
91-100	0.99	32.06	21.80	7.37	**17.51**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-3.1	-15.8	-10.1	**4.80**

Parapet (Unf) ASD

Windward	Leeward	**Total (psf)**
-N/A-	-N/A-	**-N/A-**

Longitudinal Direction

Base Shear (kips)	**7.4**

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

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

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

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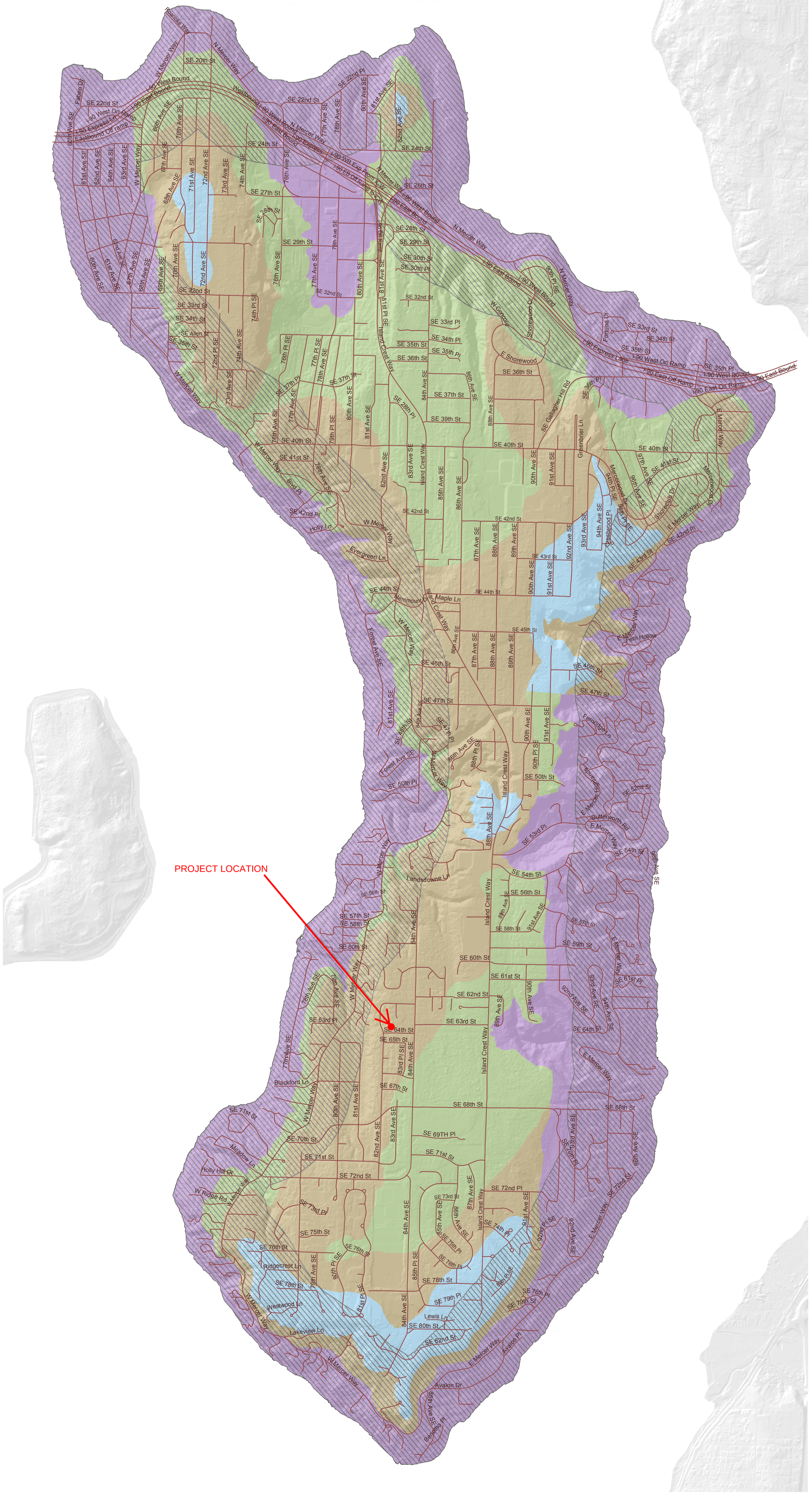


WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS
(ICC Section 1609 & ASCE 7-05 Chapter 6)

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

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

WIND EXPOSURE CATEGORIES:

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

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_zt Factor :

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

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

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

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

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

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

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

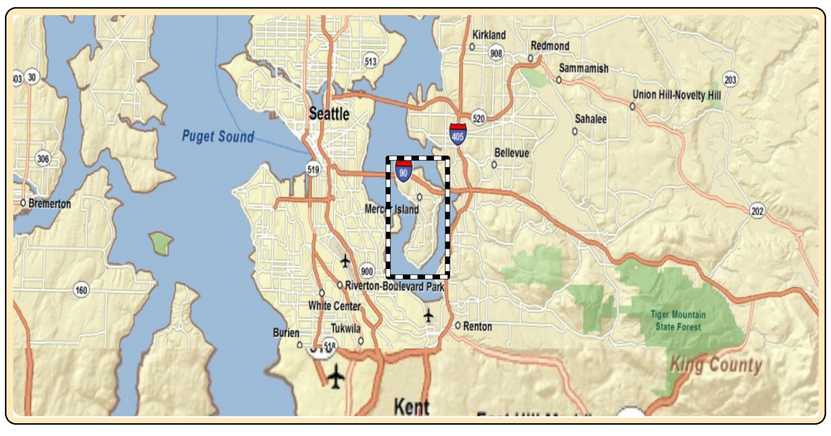
DEFINITIONS:

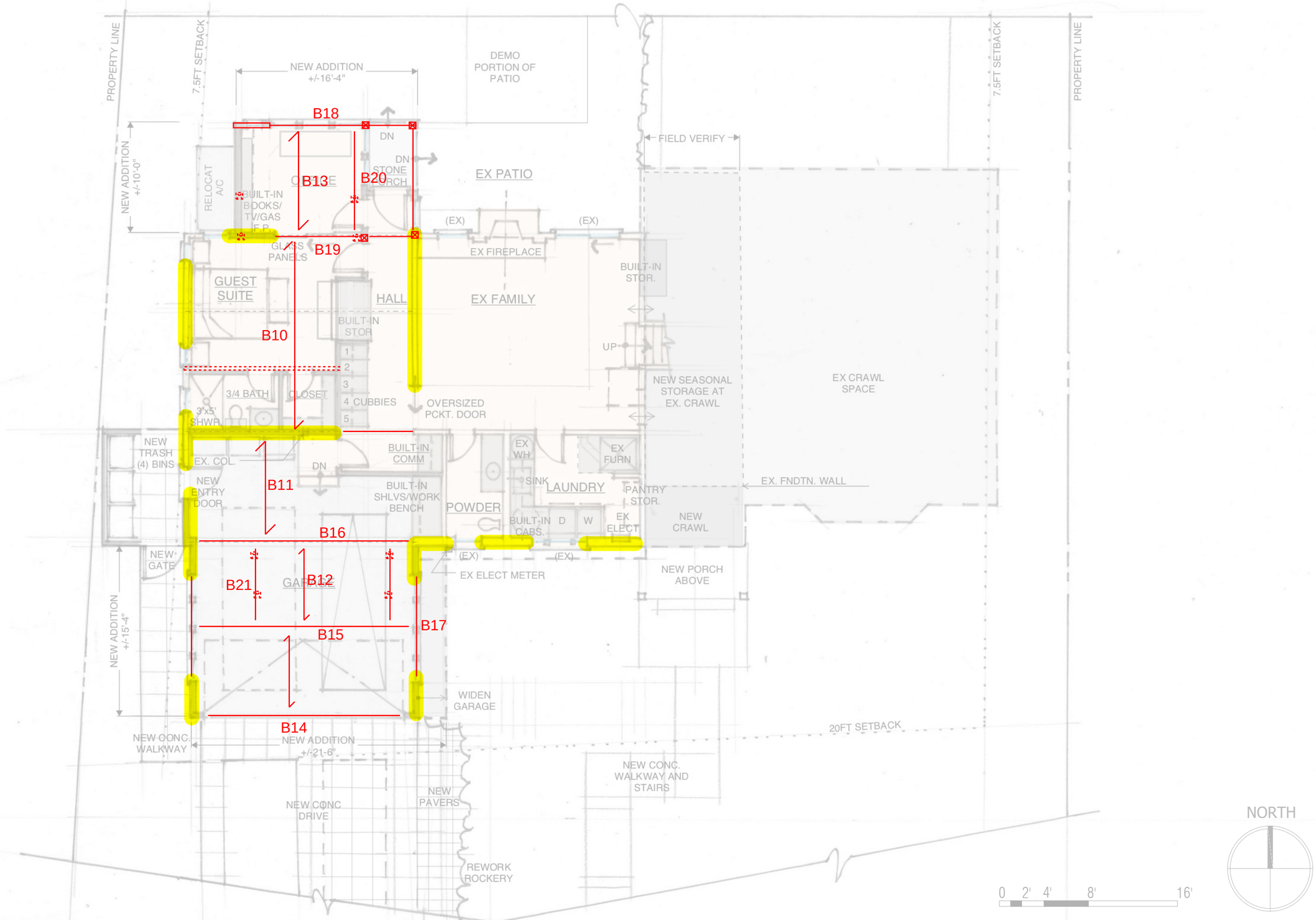
K_zt factor: The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section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

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

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

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





RICHARTZ STUDIOS INC
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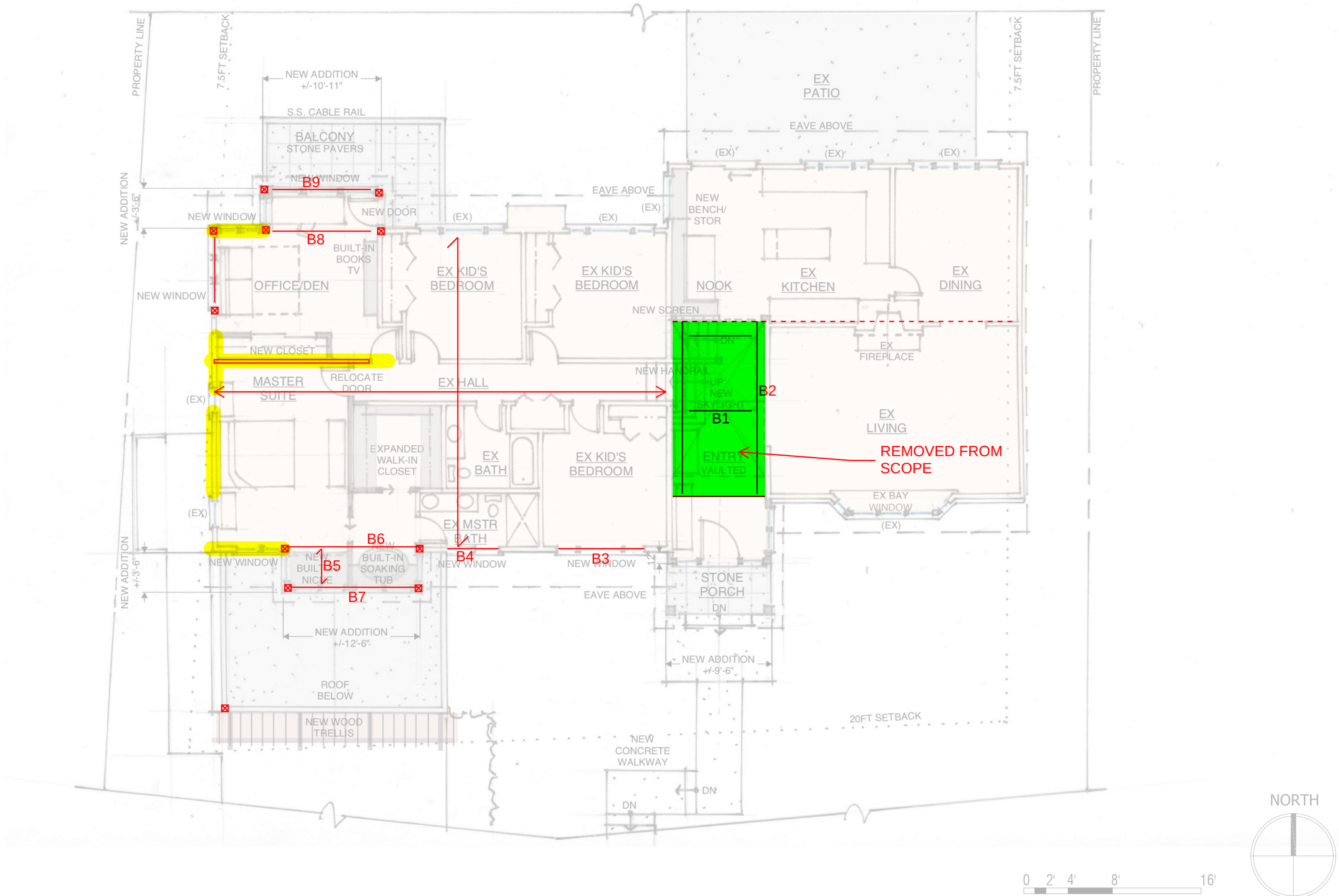
206 784 9652

Kevin Richards
Amy Klet

PRIOR RESIDENCE
Schematic Design Pricing Set
8 Oct 2021

PROPOSED LOWER LEVEL FLOOR PLAN
Scale: 1/8" = 1'-0"



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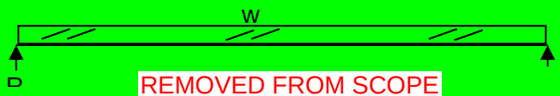
Amy Klet

PRIOR RESIDENCE
Schematic Design Pricing Set
8 Oct 2021

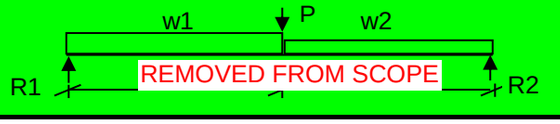
PROPOSED MAIN & UPPER LEVEL FLOOR PLAN
Scale: 1/8" = 1'-0"

Beam	B1			HF	3	x 10	
w=	320	plf		R=	1,120	lbs
L=	7	ft		M=	1,960	ft-lbs
b=	3.00	in		Fb=	550	psi
d=	9.25	in		Fv=	47	psi
E=	1300	ksi		Δ=	0.07	in
Cv=	1.00	≤1.0		l /	1250	



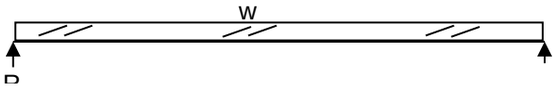
REMOVED FROM SCOPE

Beam	B2			DF-L	3 1/2	x 9 1/4	
w1=	80	plf		R1 =	1,200	lbs
w2=	80	plf		R2 =	1,200	lbs
L1=	8	ft		M =	7,040	lb-ft
L2=	8	ft		Fb =	1,693	psi
X=	8.0	ft		Fv =	53	psi
P=	1,120	lbs		Δ=	0.72	in
b=	3.50	in		l /	266	
d=	9.25	in		Cv=	1.00	
E=	1,700	ksi				

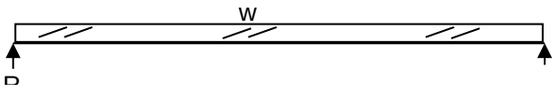


REMOVED FROM SCOPE

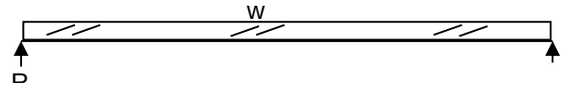
Beam	B3			HF	4	x 10	
w=	600	plf		R=	2,400	lbs
L=	8	ft		M=	4,800	ft-lbs
b=	3.50	in		Fb=	1,154	psi
d=	9.25	in		Fv=	90	psi
E=	1300	ksi		Δ=	0.18	in
Cv=	1.00	≤1.0		l /	521	



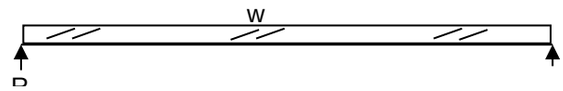
Beam	B4			HF	3	x 6	
w=	600	plf		R=	1,200	lbs
L=	4	ft		M=	1,200	ft-lbs
b=	3.00	in		Fb=	952	psi
d=	5.50	in		Fv=	84	psi
E=	1300	ksi		Δ=	0.06	in
Cv=	1.00	≤1.0		l /	751	



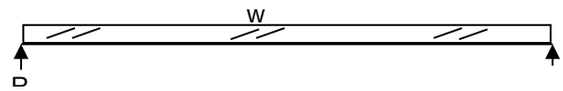
Beam	B5			HF	2	x 6	
w=	80	plf		R=	160	lbs
L=	4	ft		M=	160	ft-lbs
b=	1.50	in		Fb=	254	psi
d=	5.50	in		Fv=	22	psi
E=	1300	ksi		Δ=	0.02	in
Cv=	1.00	≤1.0		l /	2816	



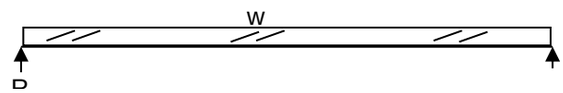
Beam	B6			GL	3 1/8	x 13 1/2	
w=	680	plf		R=	4,420	lbs
L=	13	ft		M=	14,365	ft-lbs
b=	3.13	in		Fb=	1,816	psi
d=	13.50	in		Fv=	130	psi
E=	1800	ksi		Δ=	0.38	in
Cv=	1.00	≤1.0		l /	412	



Beam	B7			HF	3	x 8	
w=	80	plf		R=	520	lbs
L=	13	ft		M=	1,690	ft-lbs
b=	3.00	in		Fb=	772	psi
d=	7.25	in		Fv=	33	psi
E=	1300	ksi		Δ=	0.42	in
Cv=	1.00	≤1.0		l /	376	



Beam	B8			GL	3 1/8	x 12	
w=	680	plf		R=	3,740	lbs
L=	11	ft		M=	10,285	ft-lbs
b=	3.13	in		Fb=	1,646	psi
d=	12.00	in		Fv=	122	psi
E=	1800	ksi		Δ=	0.28	in
Cv=	1.00	≤1.0		l /	477	



STRUCTURAL ENGINEERING

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Project: Prior Residence

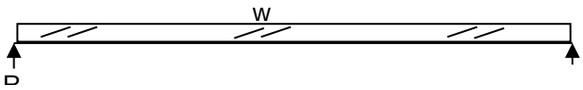
Date: 12/15/21

Project #:

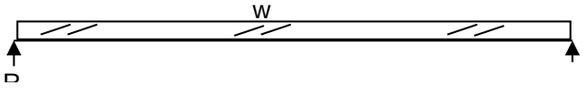
Design: AGL

Sheet:

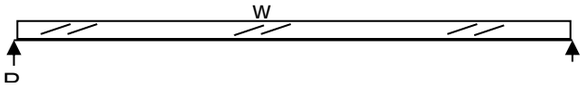
Beam		B9		HF	3	x 8
w=	80	plf		R=	440	lbs
L=	11	ft		M=	1,210	ft-lbs
b=	3.00	in		Fb=	552	psi
d=	7.25	in		Fv=	27	psi
E=	1300	ksi		Δ=	0.21	in
Cv=	1.00	≤1.0		l /	620	



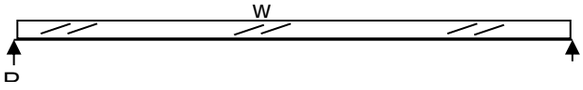
E joists		B10		HF	2	x 12
w=	75	plf		R=	675	lbs
L=	18	ft		M=	3,038	ft-lbs
b=	1.50	in		Fb=	1,152	psi
d=	11.25	in		Fv=	54	psi
E=	1300	ksi		Δ=	0.77	in
Cv=	1.00	≤1.0		l /	282	



Beam		B11		HF	2	x 12
w=	75	plf		R=	375	lbs
L=	10	ft		M=	938	ft-lbs
b=	1.50	in		Fb=	356	psi
d=	11.25	in		Fv=	27	psi
E=	1300	ksi		Δ=	0.07	in
Cv=	1.00	≤1.0		l /	1645	

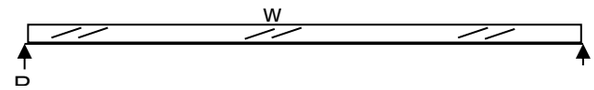


Garage Joist		B12		HF	2	x 8
w=	120	plf		R=	480	lbs
L=	8	ft		M=	960	ft-lbs
b=	1.50	in		Fb=	877	psi
d=	7.25	in		Fv=	56	psi
E=	1300	ksi		Δ=	0.18	in
Cv=	1.00	≤1.0		l /	538	



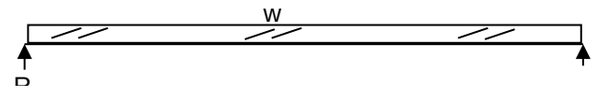
TJI Size	9.50	in		RE 1.75	9.5 TJI 210
EI =	186	in^4		Ma=	3000 lb-ft
Δ =	0.081	in		Va=	1330 lbs
l /	1185			Ra=	1005 lbs

Alt Garage Joist		B12		HF	2	x 12
w=	120	plf		R=	1,200	lbs
L=	20	ft		M=	6,000	ft-lbs
b=	1.50	in		Fb=	2,276	psi
d=	11.25	in		Fv=	97	psi
E=	1300	ksi		Δ=	1.87	in
Cv=	1.00	≤1.0		l /	129	



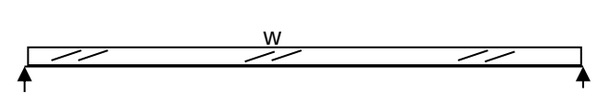
TJI Size	14.00	in		RE 1.75	14 TJI 360
EI =	612	in^4		Ma=	7335 lb-ft
Δ =	0.797	in		Va=	1955 lbs
l /	301			Ra=	1080 lbs

Beam		B13		HF	2	x 12
w=	190	plf		R=	950	lbs
L=	10	ft		M=	2,375	ft-lbs
b=	1.50	in		Fb=	901	psi
d=	11.25	in		Fv=	69	psi
E=	1300	ksi		Δ=	0.18	in
Cv=	1.00	≤1.0		l /	649	



TJI Size	9.50	in		RE 1.75	9.5 TJI 210
EI =	186	in^4		Ma=	3000 lb-ft
Δ =	0.283	in		Va=	1330 lbs
l /	424			Ra=	1005 lbs

Beam		B14		GL	3 1/2	x 12
w=	240	plf		R=	2,400	lbs
L=	20	ft		M=	12,000	ft-lbs
b=	3.50	in		Fb=	1,714	psi
d=	12.00	in		Fv=	77	psi
E=	1800	ksi		Δ=	0.95	in
Cv=	1.00	≤1.0		l /	252	



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Project: Prior Residence

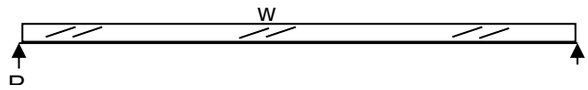
Date: 12/15/21

Project #:

Design: AGL

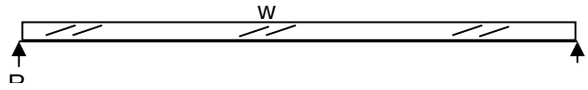
Sheet:

Beam	B15		GL	5 1/8 x 18	
w=	840	plf	R=	8,400	lbs
L=	20	ft	M=	42,000	ft-lbs
b=	5.13	in	Fb=	1,821	psi
d=	18.00	in	Fv=	116	psi
E=	1800	ksi	Δ=	0.67	in
Cv=	0.96	≤1.0	l /	356	



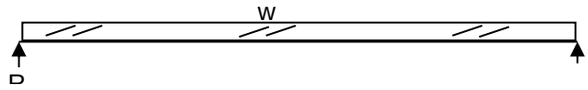
Steel Size				W10X26	
I =	144	in⁴	Fy=	50	ksi
Δ =	0.72	in	Mn/Ω =	78.1	k-ft
l /	331		Vn/Ω =	44.0	kips

E STL	B16		GL	5 1/8 x 19 1/2	
w=	1200	plf	R=	12,000	lbs
L=	20	ft	M=	60,000	ft-lbs
b=	5.13	in	Fb=	2,217	psi
d=	19.50	in	Fv=	151	psi
E=	1800	ksi	Δ=	0.76	in
Cv=	0.96	≤1.0	l /	317	



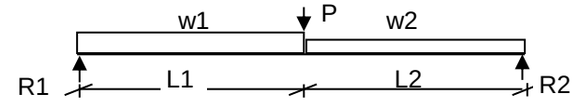
Steel Size				W10X30	
I =	170	in⁴	Fy=	50	ksi
Δ =	0.88	in	Mn/Ω =	91.3	k-ft
l /	274		Vn/Ω =	51.1	kips

E Alt	B16		GL	5 1/2 x 14	
w=	680	plf	R=	6,800	lbs
L=	20	ft	M=	34,000	ft-lbs
b=	5.50	in	Fb=	2,271	psi
d=	14.00	in	Fv=	117	psi
E=	1800	ksi	Δ=	1.08	in
Cv=	0.98	≤1.0	l /	222	



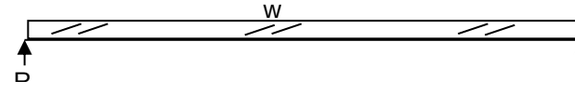
Steel Size				W12X26	
I =	204	in⁴	Fy=	50	ksi
Δ =	0.41	in	Mn/Ω =	92.8	k-ft
l /	580		Vn/Ω =	47.3	kips

Beam	B17		GL	5 1/8 x 12	
w1=	100	plf	R1 =	4,700	lbs
w2=	100	plf	R2 =	4,700	lbs
L1=	5	ft	M =	22,250	lb-ft
L2=	5	ft	Fb =	2,171	psi
X=	5.0	ft	Fv =	112	psi
P=	8,400	lbs	Δ=	0.24	in
b=	5.13	in	l /	491	
d=	12.00	in	Cv=	1.00	
E=	1,800	ksi			



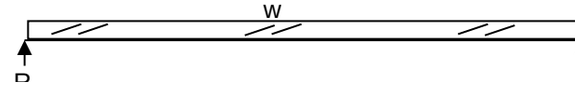
Steel Size				W8X21	
I =	75.3	in⁴	Fy=	50	ksi
Δ =	0.149	in	Mn/Ω =	50.9	k-ft
l /	807		Vn/Ω =	58.5	kips

Alt	B17		GL	3 1/8 x 12	
w=	600	plf	R=	3,000	lbs
L=	10	ft	M=	7,500	ft-lbs
b=	3.13	in	Fb=	1,200	psi
d=	12.00	in	Fv=	96	psi
E=	1800	ksi	Δ=	0.17	in
Cv=	1.00	≤1.0	l /	720	



Steel Size				W8X18	
I =	61.9	in⁴	Fy=	50	ksi
Δ =	0.08	in	Mn/Ω =	42.4	k-ft
l /	1596		Vn/Ω =	30.9	kips

Beam	B18		HF	4 x 8	
w=	375	plf	R=	1,500	lbs
L=	8	ft	M=	3,000	ft-lbs
b=	3.50	in	Fb=	1,174	psi
d=	7.25	in	Fv=	75	psi
E=	1300	ksi	Δ=	0.24	in
Cv=	1.00	≤1.0	l /	401	



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Date: 12/15/21

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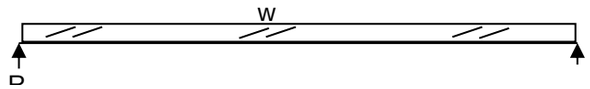
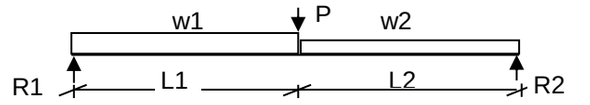
Design: AGL

Sheet:

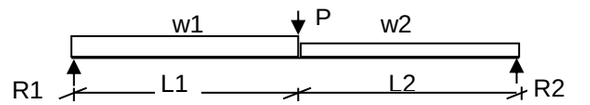
Beam		B19		GL	3 1/8 x 12	
w=	870	plf		R=	4,785	lbs
L=	11	ft		M=	13,159	ft-lbs
b=	3.13	in		Fb=	2,105	psi
d=	12.00	in		Fv=	157	psi
E=	1800	ksi		Δ=	0.35	in
Cv=	1.00	≤1.0		l /	373	



Beam		B20		GL	3 x 9	
w1=	190	plf		R1 =	1,200	lbs
w2=	190	plf		R2 =	1,200	lbs
L1=	5	ft		M =	3,625	lb-ft
L2=	5	ft		Fb =	1,074	psi
X=	5.0	ft		Fv =	59	psi
P=	500	lbs		Δ=	0.19	in
b=	3.00	in		l /	648	
d=	9.00	in		Cv=	1.00	
E=	1,800	ksi				



Beam		B21		LSL	3 1/2 x 11 7/8	
w1=	120	plf		R1 =	2,355	lbs
w2=	120	plf		R2 =	2,355	lbs
L1=	4	ft		M =	8,460	lb-ft
L2=	4	ft		Fb =	1,234	psi
X=	4.0	ft		Fv =	81	psi
P=	3,750	lbs		Δ=	0.11	in
b=	3.50	in		l /	906	
d=	11.88	in		Cv=	1.00	
E=	1,550	ksi				



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Date: 12/15/21

Project #:

Design: AGL

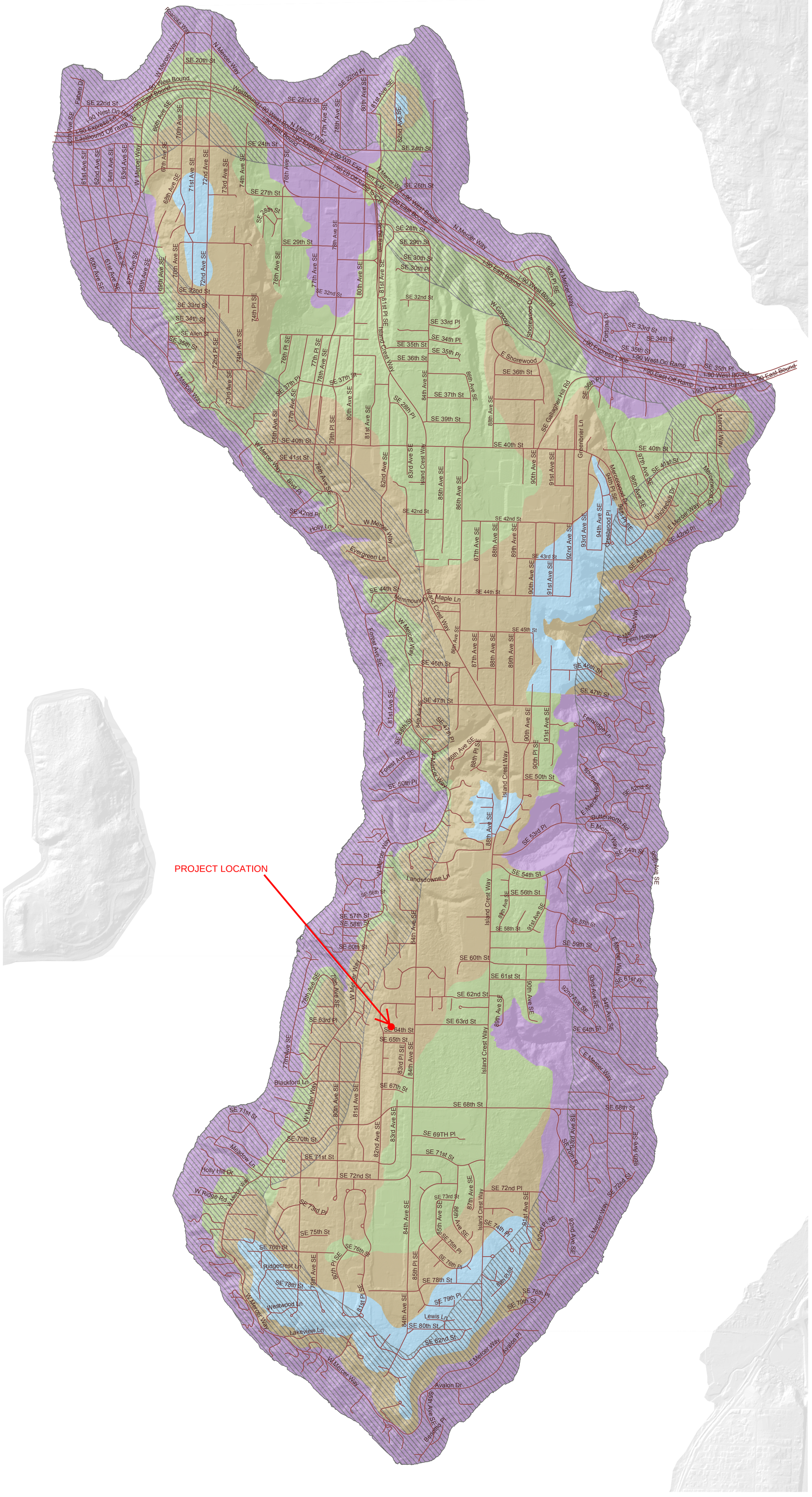
Sheet:

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

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

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

T N



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

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

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

WIND EXPOSURE CATEGORIES:

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

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_zt Factor :

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

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

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

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

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

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

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

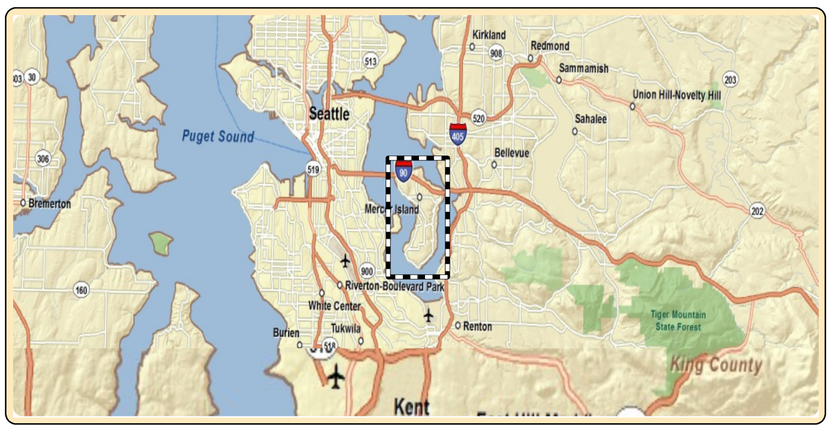
DEFINITIONS:

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

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

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

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



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Project Title:

Date

SSF project no.

Design

Sheet Title:

Drawn

Sheet

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Date

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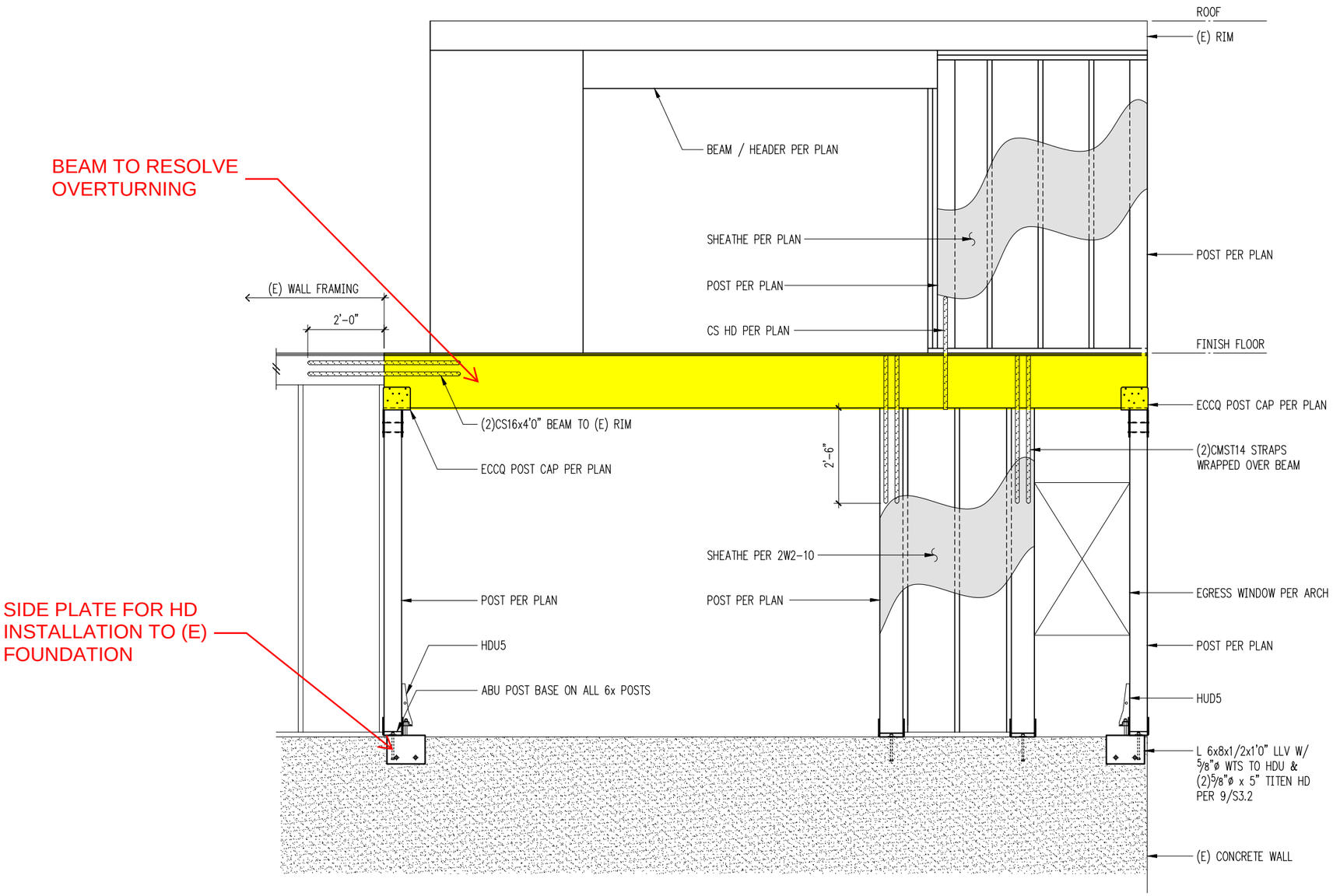
Sheet Title:

Drawn

Sheet



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Project Title:	Date	SSF project no.
Prior Residence North Wall - Overturning Distribution beam	Design	
Sheet Title:	Drawn	Sheet

Beam Analysis

Beam:							
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.090**				0.054	
	w_2	**0.135**				0.081	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1				**1.435**	3.588	
	P_2				**-1.435**	-3.588	**5.50**
	P_3				**9.8**	24.500	**4.00**
	P_4				**-9.8**	-24.500	**8.00**
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**20.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	7.237	**0.00**
R_2	-4.537	**20.00**
R_3	0.000	**20.00**
R_4	0.000	**20.00**
R_5	0.000	**20.00**
R_6	0.000	**20.00**
R_7	0.000	**20.00**
R_8	0.000	**20.00**
R_9	0.000	**20.00**
R_{10}	0.000	**20.00**

Demand Output		
Location, ft		**10.00**
Shear, k	\	5.89
Moment, k-ft	M =	-52.12
Deflection, in	D =	0.85
Δ/Span		L/283

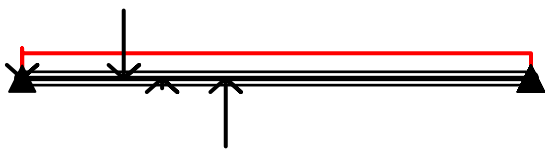
Load Factors	
Dead	**0.60**
Live	**1.00**
Roof Live	**1.00**
Seismic	**2.50**

Stresses @ Input Location	
f_v (psi)	104
f_b (psi)	-2689

Max/Min Stresses	
f_{v_MAX} (psi)	128
f_{v_MIN} (psi)	0
f_{b_MAX} (psi)	697
f_{b_MIN} (psi)	-3313

Beam Properties	
E (ksi)	**1800**
b (in)	**5.125**
d (in)	**16.5**
I (in^4)	1918.5
S (in^3)	232.55
A (in^2)	84.563
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	7.24	4.54	-64.2	13.5	0.095 (↑)	10	L/2526	0	0	L/∞

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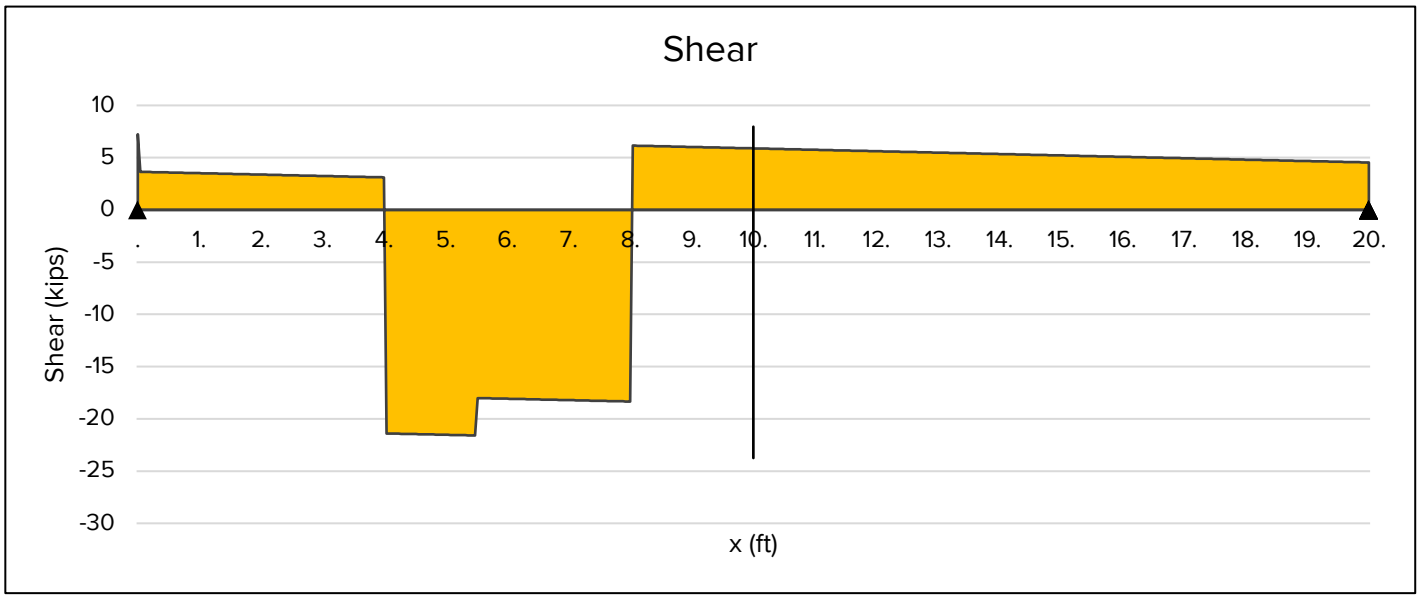
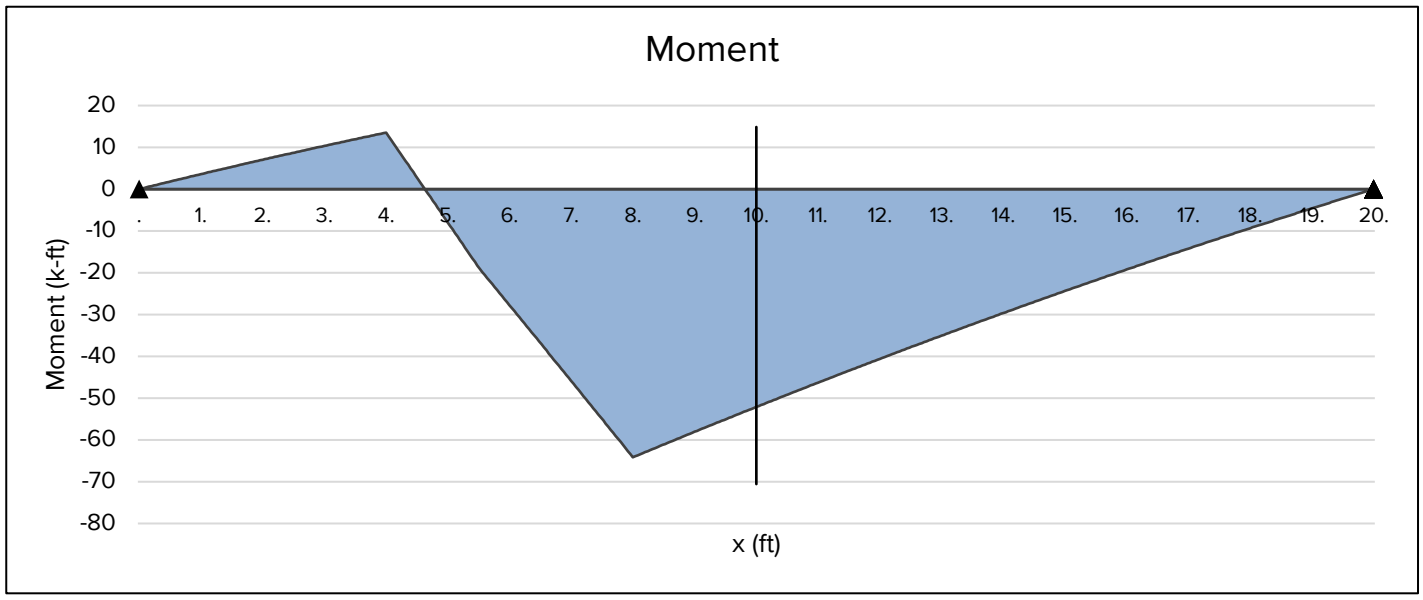
STRUCTURAL ENGINEERING

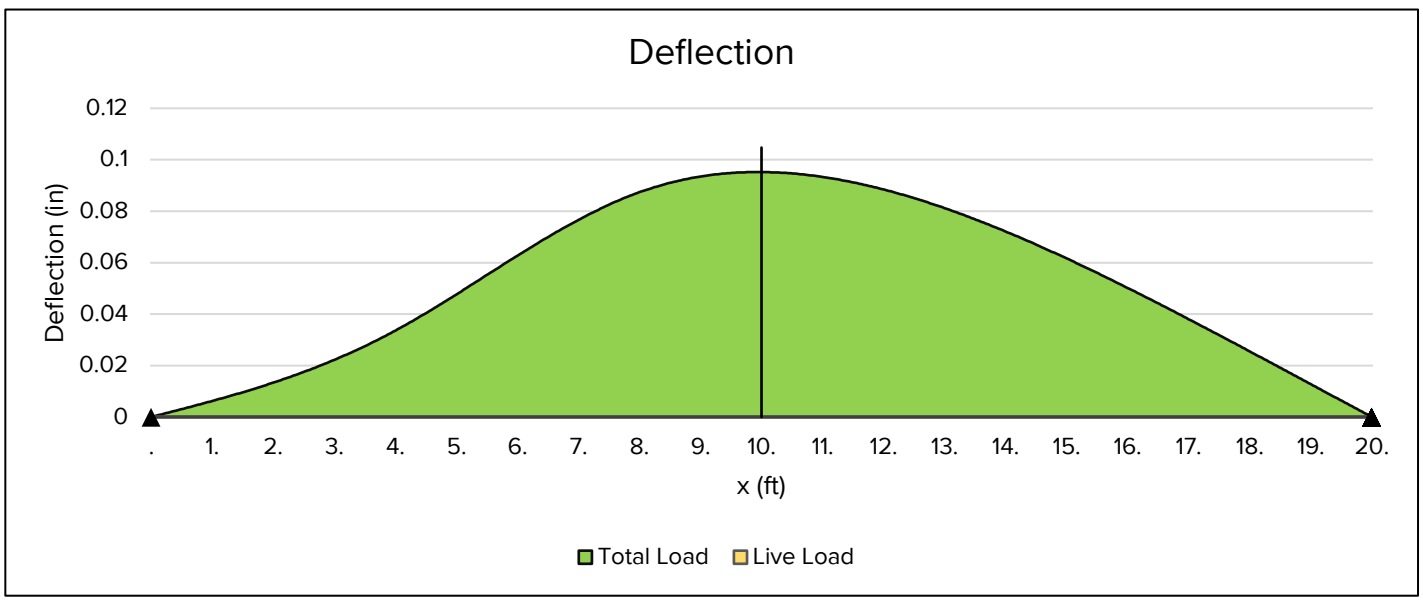
PROJECT Prior Residence
North Wall - Overturning Distribution beam

DATE 12/17/2021
PROJ. #
DESIGN AGL
SHEET 3

Beam Analysis







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TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
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STRUCTURAL ENGINEERING

PROJECT	Prior Residence
	North Wall - Overturning Distribution beam
DATE	12/17/2021
PROJ. #	
DESIGN	AGL
SHEET	4

Beam Analysis

Beam:							
Load		Dead	Live	Roof Live	Seismic	Factored	Location
Distributed (k/ft)	w_1	**0.090**				0.054	
	w_2	**0.135**				0.081	
	w_3					0.000	
	w_4					0.000	
	w_5					0.000	
	w_6					0.000	
	w_7					0.000	
	w_8					0.000	
	w_9					0.000	
	w_{10}					0.000	
Trapezoidal (k/ft/ft)	t_1					0.000	
	t_2					0.000	
	t_3					0.000	
	t_4					0.000	
	t_5					0.000	
	t_6					0.000	
Point (k)	P_1				**1.435**	-3.588	
	P_2				**-1.435**	3.588	**5.50**
	P_3				**9.8**	-24.500	**4.00**
	P_4				**-9.8**	24.500	**8.00**
	P_5					0.000	
	P_6					0.000	
	P_7					0.000	
	P_8					0.000	
	P_9					0.000	
	P_{10}					0.000	

Steel Beam Section	NONE

Support Locations and Reactions		
# of Supports		2
Total Beam Length		**20.00**
Left End Condition		**Pinned**
Right End Condition		**Pinned**
R_1	-4.537	**0.00**
R_2	7.237	**20.00**
R_3	0.000	**20.00**
R_4	0.000	**20.00**
R_5	0.000	**20.00**
R_6	0.000	**20.00**
R_7	0.000	**20.00**
R_8	0.000	**20.00**
R_9	0.000	**20.00**
R_{10}	0.000	**20.00**

Demand Output		
Location, ft		**10.00**
Shear, k	\	-5.89
Moment, k-ft	M =	65.62
Deflection, in	D =	-1.13
Δ/Span		L/212

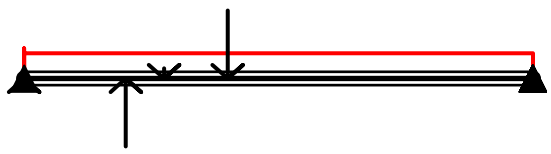
Load Factors	
Dead	**0.60**
Live	**1.00**
Roof Live	**1.00**
Seismic	**-2.50**

Stresses @ Input Location	
f_v (psi)	-104
f_b (psi)	3386

Max/Min Stresses	
f_{v_MAX} (psi)	0
f_{v_MIN} (psi)	-128
f_{b_MAX} (psi)	3979
f_{b_MIN} (psi)	-252

Beam Properties	
E (ksi)	**1800**
b (in)	**5.125**
d (in)	**16.5**
I (in^4)	1918.5
S (in^3)	232.55
A (in^2)	84.563
I (Override)	
S (Override)	
A (Override)	

Beam Loading Diagram



Span	V_L (kips)	V_R (kips)	M(-) (k-ft)	M(+) (k-ft)	Δ_{TL} (in)	@ x =	L/	Δ_{LL} (in)	@ x =	L/
Span 1	-4.54	-7.24	-4.88	77.1	0.162 (↑)	10	L/1481	0	0	L/∞

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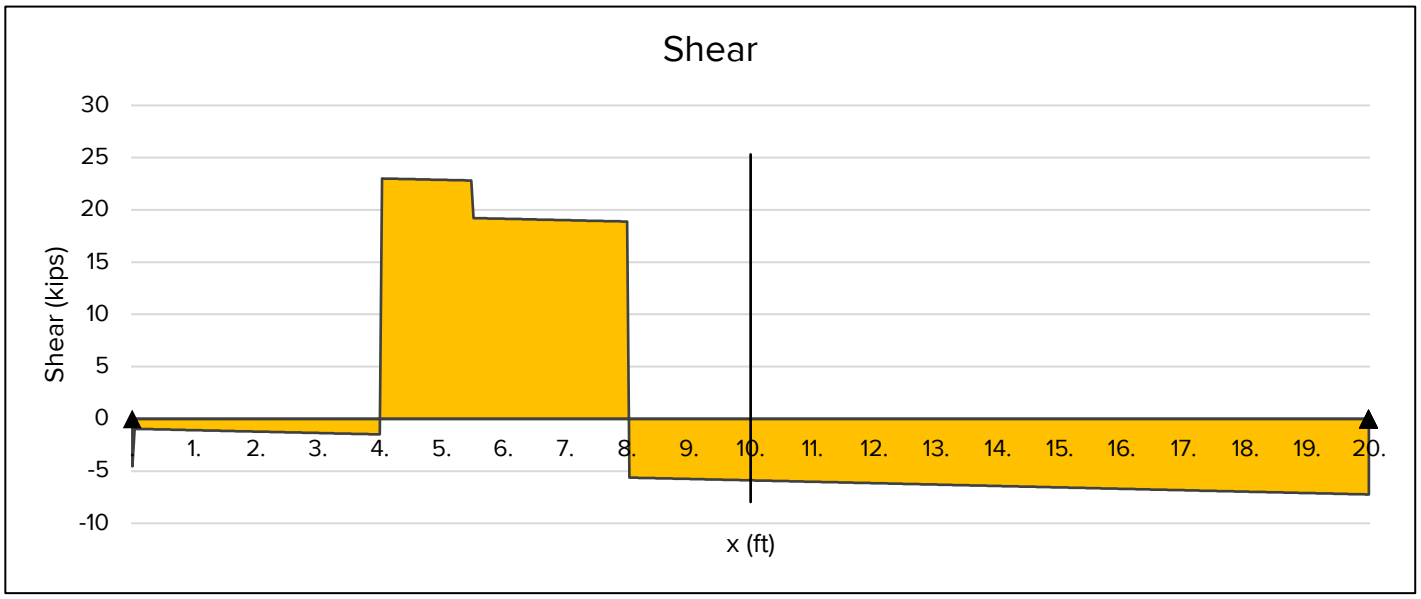
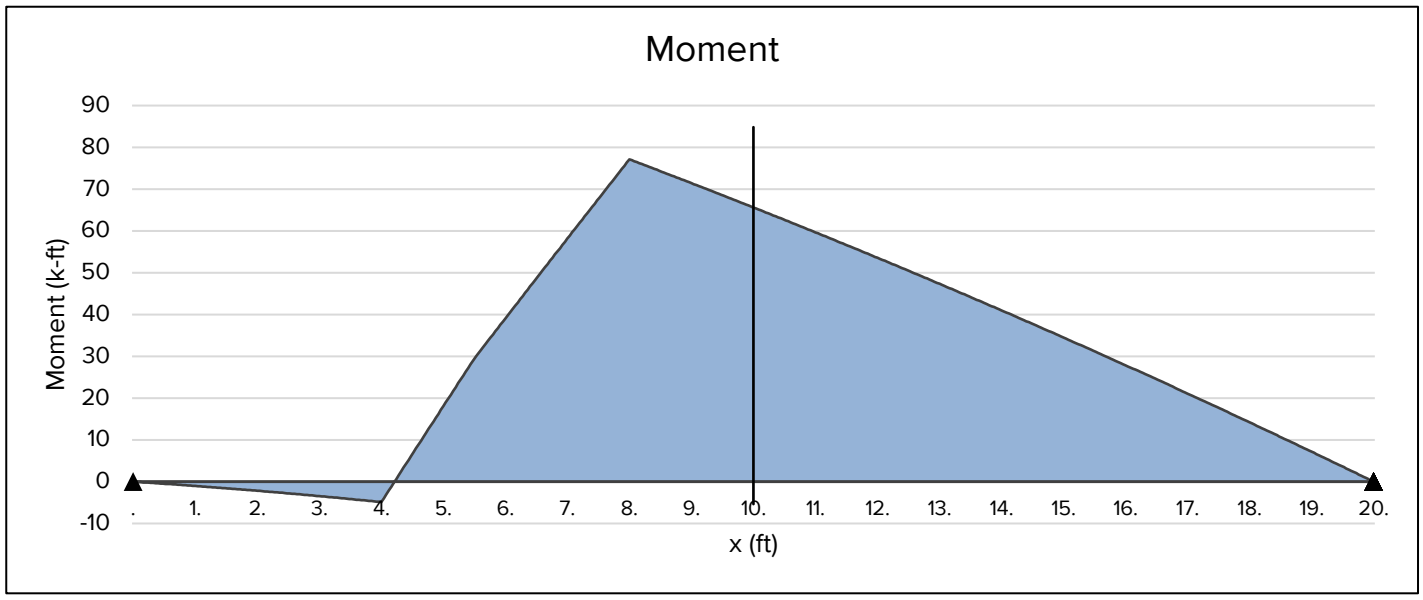
SWENSON SAY FAGÉT

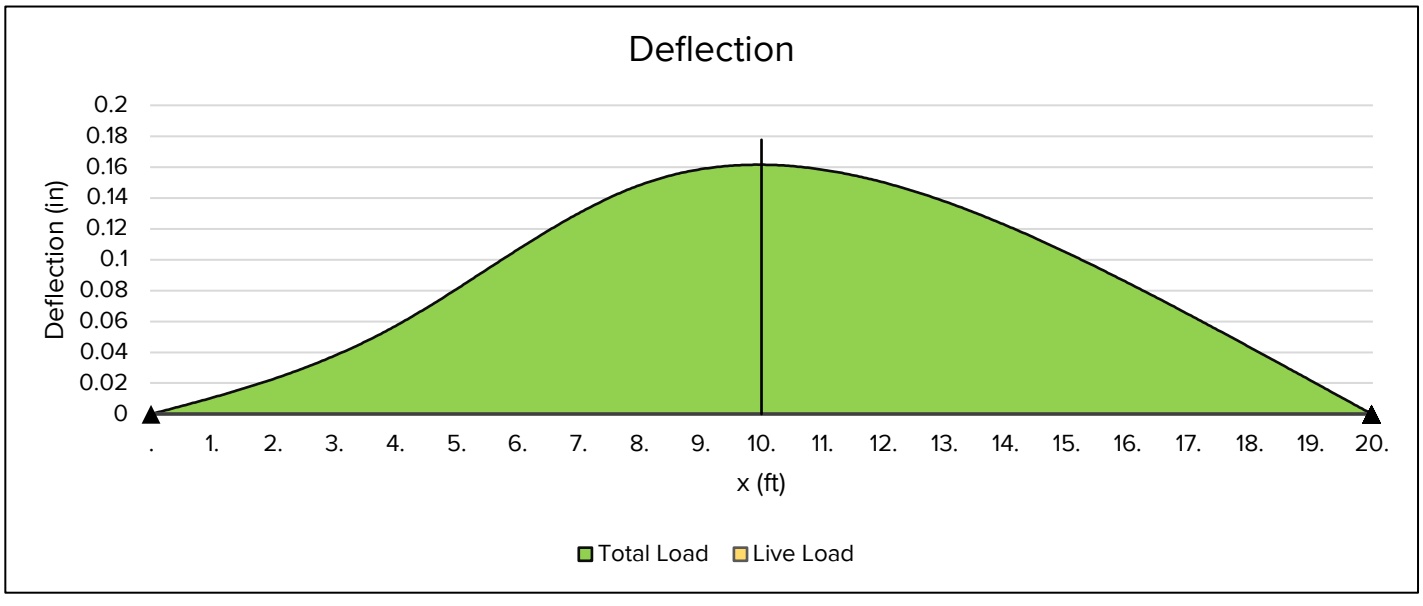
PROJECT Prior Residence
North Wall - Overturning Distribution beam

DATE 12/17/2021
PROJ. #
DESIGN AGL
SHEET 3

Beam Analysis







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STRUCTURAL ENGINEERING

PROJECT	Prior Residence
	North Wall - Overturning Distribution beam
DATE	12/17/2021
PROJ. #	
DESIGN	AGL
SHEET	4

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.0.7947.0

Company:	SSF	Date:	11/22/2021
Engineer:	AGL	Page:	1/5
Project:	Prior Residence		
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment: Direct anchorage of HD is not possible in (E) stem wall.
Provide alternate side plate anchorage

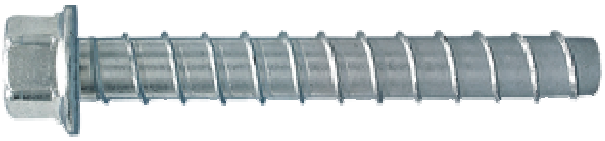
Project description:
Location: West Elevation
Fastening description: HD in (E) Concrete

2. Input Data & Anchor Parameters

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

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 5.000
Effective Embedment depth, h_{ef} (inch): 3.820
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 7.67
c_{ac} (inch): 5.75
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Recommended Anchor
Anchor Name: Titen HD® - 5/8"Ø Titen HD, hnom:5" (127mm)
Code Report: ICC-ES ESR-2713



Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 8.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

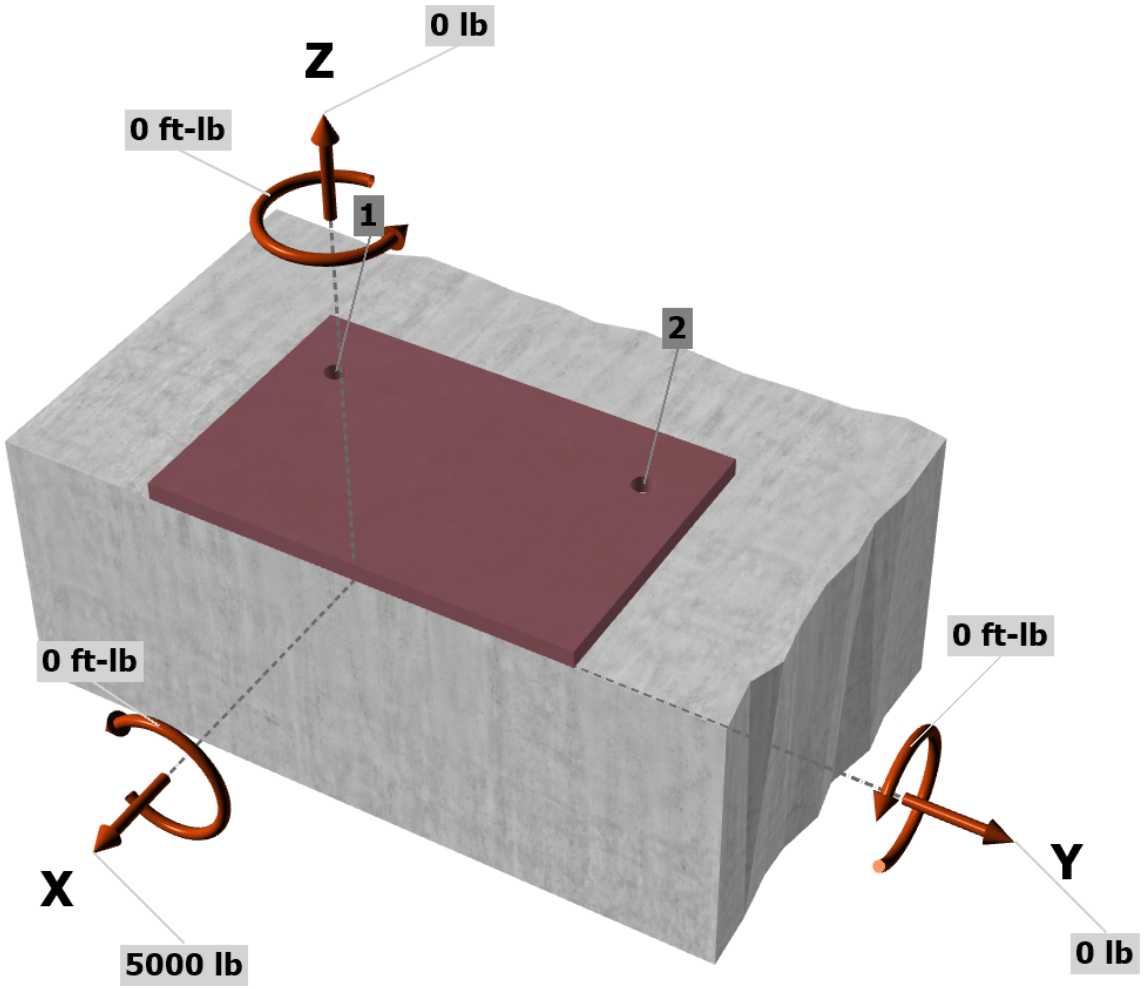
Base Plate
Length x Width x Thickness (inch): 8.00 x 12.00 x 0.50

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

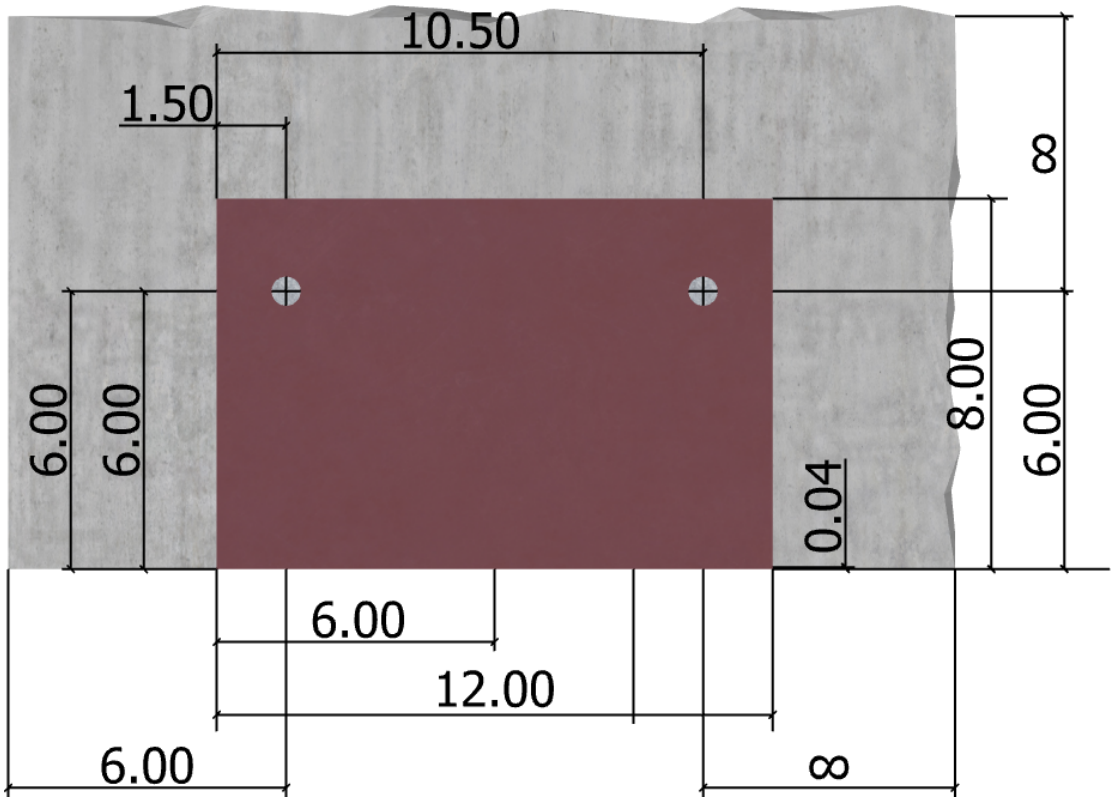
Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 5000
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

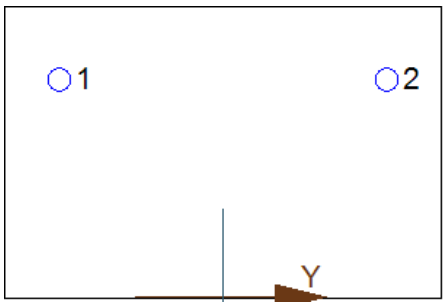


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	2500.0	0.0	2500.0
2	0.0	2500.0	0.0	2500.0
Sum	0.0	5000.0	0.0	5000.0

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

<Figure 3>



8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
8000	1.0	0.60	4800

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.82	0.625	1.00	3000	6.00	6398

$\phi V_{cbgx} = \phi\,(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. 17.3.1 & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
192.00	162.00	1.000	0.900	1.000	1.061	6398	0.70	5067

Shear parallel to edge in y-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.82	0.625	1.00	3000	6.00	6398

$\phi V_{cby} = \phi\,(2)(A_{Vc} / A_{Vco})\,\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1a)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cby} (lb)
120.00	162.00	1.000	1.000	1.061	6398	0.70	7038

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	234.47	131.33	1.000	1.000	1.000	1.000	6952	0.70	17376

11. Results

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

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	2500	4800	0.52	Pass
T Concrete breakout x+	**5000**	**5067**	**0.99**	**Pass (Governs)**
|| Concrete breakout y-	**2500**	**7038**	**0.36**	**Pass (Governs)**
Pryout	5000	17376	0.29	Pass

5/8"Ø Titen HD, hnom:5" (127mm) meets the selected design criteria.

12. Warnings

- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.

- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

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

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