

Structural Calculations

For

Chung Residence Detached Garage

4027 93rd Ave SE Mercer Island, WA 98040 (Parcel # 003100-0095)



Prepared By: Prepared Date: CS2 No.:

Sung U. Cho, P.E. May 18, 2020 2000-G



Project:	4027 93 rd Ave SE (#003100-0095)	Date:	May 18, 2020
Location:	Mercer Island, WA	Prepared By:	S. Cho
CS2 No:	2000-G	Page	

I. Scope of Work

Provide structural design calculations of detached garage addition onto single-family residential house. The house is located on 4027 93rd Ave SE at City of Bellevue. The information in this report summarizes the requirements for construction of structural elements for the gravity loads and lateral loads resisting in conformance with the International Building Code 2015. The engineering of such structural elements and connections are designed to resist the vertical (gravity) loading particular to concrete foundation. Unless noted otherwise, all means and methods used shall be in keeping with good and generally accepted construction practices.

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

II. Loads/Design Criteria: (IBC 2015 & ASCE 7-10)

Please refer to the following calculations

- 1. Dead Load See calculation
- 2. Live Load Roof = 25 psf (snow load)
- 3. Seismic $S_S = 1.398$, $S_1 = 0.537g$, $S_{DS} = 0.932g$, $S_{D1} = 0.537g$ Site Class D, I = 1.0, R = 6.5
- 4. Wind Exposure B, Basic Wind Speed $(V_{3S}) = 85$ mph, I = 1.0
- 5. Concrete compressive strength, f'c = 2,500 psi
- 6. Concrete steel reinforcing strength, fy = 60,000 psi
- 7. Allowable soil bearing pressure = 2,000 psf
- 8. Passive Soil Pressure = 300 pcf

References:

- 1. IBC 2015
- 2. ASCE 7-10
- 3. ACI 318-14
- 4. SPDWS 2015
- 5. NDS 2015

III. Conclusions and Recommendations

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

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Gravity Load Design Calculation



JOB SUMMARY REPORT

2000-G Mercer Island Garage

Level									
Member Name	Results	Current Solution	Comments						
Wall: Header (HDR1a)	Passed	1 piece(s) 4 x 6 Douglas Fir-Larch No. 1							
Wall: Header (HDR1b)	Passed	1 piece(s) 4 x 12 Douglas Fir-Larch No. 1							



5/18/2020 3:17:42 PM UTC ForteWEB v2.4 File Name: 2000-G Mercer Island Garage



MEMBER REPORT

Level, Wall: Header (HDR1a) 1 piece(s) 4 x 6 Douglas Fir-Larch No. 1



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	265 @ 0	3281 (1.50")	Passed (8%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	216 @ 7"	2657	Passed (8%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	414 @ 3' 1 1/2"	2198	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Vert Live Load Defl. (in)	0.021 @ 3' 1 1/2"	0.208	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Vert Total Load Defl. (in)	0.035 @ 3' 1 1/2"	0.313	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Lat Member Reaction (lbs)	167 @ 6' 3"	N/A	Passed (N/A)	1.60	1.0 D + 0.6 W
Lat Shear (lbs)	145 @ 5"	3696	Passed (4%)	1.60	1.0 D + 0.6 W
Lat Moment (Ft-lbs)	262 @ mid-span	2044	Passed (13%)	1.60	1.0 D + 0.6 W
Lat Deflection (in)	0.039 @ mid-span	0.625	Passed (L/999+)		1.0 D + 0.6 W
Bi-Axial Bending	0.23	1.00	Passed (23%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

System : Wall Member Type : Header Building Use : Residential Building Code : IBC 2015 Design Methodology : ASD

PASSED

• Deflection criteria: LL (L/360) and TL (L/240).

Lateral deflection criteria: Wind (L/120)

• Applicable calculations are based on NDS.

	Bearing Length		Ŀ	oads to Sup	oorts (Ibs)			
Supports	Total	Available	Required	Dead	Snow	Wind	Total	Accessories
1 - Trimmer - HF	1.50"	1.50"	1.50"	109	156	86	351	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	109	156	86	351	None
2 - Trimmer - HF	1.50"	1.50"	1.50"	109	156	86	351	None

Lateral Connections

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

			Dead	Snow	Wind	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.15)	(1.60)	Comments
0 - Self Weight (PLF)	0 to 6' 3"	N/A	4.9			
1 - Uniform (PSF)	0 to 6' 3"	2'	15.0	25.0	13.8	Default Load

			Wind	
Lateral Load	Location	Tributary Width	(1.60)	Comments
1 - Uniform (PSF)	Eull Lenath	4'	22.3	

ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (10' 9 5/8"), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (110), Risk Category(II), Effective Wind

Area determined using full member span and trib. width. • IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

Member Notes	
Header (HDR 1a) 6'-0" Max.	

Weyerhaeuser

ForteWEB Software Operator Job Notes Sung Cho CS2 Engineers.com (425) 408-2748 sung.cho@cs2engineers.com



MEMBER REPORT

Level, Wall: Header (HDR1b) 1 piece(s) 4 x 12 Douglas Fir-Larch No. 1



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2397 @ 1 1/2"	6563 (3.00")	Passed (37%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	1855 @ 1' 2 1/4"	5434	Passed (34%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5997 @ 5' 3"	7783	Passed (77%)	1.15	1.0 D + 1.0 S (All Spans)
Vert Live Load Defl. (in)	0.098 @ 5' 3"	0.342	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Vert Total Load Defl. (in)	0.161 @ 5' 3"	0.512	Passed (L/766)		1.0 D + 1.0 S (All Spans)
Lat Member Reaction (lbs)	265 @ 10' 4 1/2"	N/A	Passed (N/A)	1.60	1.0 D + 0.6 W
Lat Shear (lbs)	244 @ 6 1/2"	7560	Passed (3%)	1.60	1.0 D + 0.6 W
Lat Moment (Ft-lbs)	680 @ mid-span	3706	Passed (18%)	1.60	1.0 D + 0.6 W
Lat Deflection (in)	0.132 @ mid-span	1.025	Passed (L/933)		1.0 D + 0.6 W
Bi-Axial Bending	0.73	1.00	Passed (73%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 S

System : Wall Member Type : Header Building Use : Residential Building Code : IBC 2015 Design Methodology : ASD

PASSED

• Deflection criteria: LL (L/360) and TL (L/240).

• Lateral deflection criteria: Wind (L/120)

• Applicable calculations are based on NDS.

	Bearing Length		Ŀ	oads to Sup	oorts (lbs)			
Supports	Total	Available	Required	Dead	Snow	Wind	Total	Accessories
1 - Trimmer - HF	3.00"	3.00"	1.50"	932	1466	808	3206	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	932	1466	808	3206	None

Lateral Connections

Supports	Plate Size	Plate Material	Connector Type/Model		Quantity	Nailing
Left	2X	Hem Fir	Nails	10d x 3" Box (End)	4	
Right	2X	Hem Fir	Nails	10d x 3" Box (End)	4	

			Dead	Snow	Wind	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.15)	(1.60)	Comments
0 - Self Weight (PLF)	0 to 10' 6"	N/A	10.0			
1 - Uniform (PSF)	0 to 10' 6"	11' 2"	15.0	25.0	13.8	Default Load

			Wind	
Lateral Load	Location	Tributary Width	(1.60)	Comments
1 - Uniform (PSF)	Full Length	4'	21.6	

ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (10' 9 5/8"), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (110), Risk Category(II), Effective Wind

Area determined using full member span and trib. width. • IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

Job Notes

Member Notes	
Header (HDR 1a)	

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ForteWEB Software Operator Sung Cho CS2 Engineers.com (425) 408-2748 sung.cho@cs2engineers.com

		Project:	Chung Residence Garage (4027 93rd Ave SE)				
65.	2 ENGINEERS	Client:	Owner	Job No.:	2000-G		
Civil & Structural	By:	S. Cho	Date:	5/18/20			
Challenge & Success		Subject:	Design Calculations	Page:			
tud Wall	(roof supporting wall)						

Stud Wall (roof supporting wall)

Me	ember Data			
Species =	Hem Fir			
Size =	2x4			
Grade =	No. 2			
Width =	1.5 in	Fc =	1300	psi
Depth =	3.5 in	Fb =	850	psi
A =	5.25 in ²	E =	1300000	psi
I =	5.36 in ⁴	Adjustmen	t Factors	
S =	3.06 in ³	C _M	1.00	
Height =	<mark>8</mark> ft	Ct	1.00	
L _{eff. Col.} =	8 ft	C _F (Fb)	1.50	
L _{eff. Beam.} =	<mark>8</mark> ft	C _F (Fc)	1.15	
Spacing =	16" o.c.			

	Loads	
P _{LL} =	0	lb/ft
P _{SNOW} =	279	lb/ft
P _{DL} =	16 8	lb/ft
f _{wind}	15.31	psf

	Case	fc,psi	fb,psi
ſ	1	43	0
	2	113	0
	3	113	320
	4	43	640
	5	78	640

	Factors		
	R _B =	12.2	
	K _{bE} =	1.2	
	F _{bE} =	10446	psi
		F _c '	
Case	Fc*	CP	F _c '
1	1495	0.67	1006
2	1719	0.62	1069
3,4,5	1988	0.57	1126

l₂/d =	27.4	ОК
ĸ K _{cE} =	0.822	
F _{cE} =	1420	psi
	F _b '	
F _b *	CL	F _b '
1275	0.99	1266
1466	0.99	1454
1696	0.99	1680

Wind Deflection = 0.27 L/356

Unity Check				
Case				
1: D+L	=	0.00	OK	
2: D+L+S	=	0.01	OK	
3: D+L+S+W/2	=	0.22	ОК	
4: D+L+W	=	0.39	ОК	
5: D+L+S/2+W	=	0.41	ОК	

Bearing	0.31	OK
Plate:	He	em Fir
Deformation:	yes	0.02" Limit
F _{cperp}	40	05 psi
f _{cperp}	11	3 psi
C _b	1.2	25
F' _{cperp}	37	'0 psi

Use 2x4 Hem Fir No. 2 @ 16" o.c.

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CS2 ENGINEERS P.O. Box 13423 Mill Creek, WA 98082 T. 425-408-2748 F. 425-954-7539 info@cs2engineers.com Project Title: Engineer: Project ID: Project Descr:

> Printed: 18 MAY 2020, 8:29AM File: 2000-G Mercer Island Garage.ec6 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.2.28 CS2 ENGINEERS

Wall Footing

Lic. # : KW-06008270

DESCRIPTION: Garage Wal Footing

Code References

Calculations per ACI 318-14, IBC 2015, CBC 2016, ASCE 7-10 Load Combinations Used : IBC 2015

General Information

Material Properties fc : Concrete 28 day strength fy : Rebar Yield Ec : Concrete Elastic Modulus Concrete Density	= = =	2.50 ksi 60.0 ksi 3,122.0 ksi 145.0 pcf	Soil Design Values Allowable Soil Bearing Increase Bearing By Footing Weight Soil Passive Resistance (for Sliding) Soil/Concrete Friction Coeff.	= = =	1.50 ksf No 250.0 pcf 0.30
φ Values Flexure Shear Analysis Settings Min Steel % Bending Reinf. Min Allow % Temp Reinf.	= = =	0.90 0.750 0.00180	Increases based on footing Depth Reference Depth below Surface Allow. Pressure Increase per foot of depth when base footing is below	= = =	1.50 ft ksf ft
Min. Overturning Safety Factor Min. Sliding Safety Factor AutoCalc Footing Weight as DL	= = :	1.0:1 1.0:1 Yes	Increases based on footing Width Allow. Pressure Increase per foot of width when footing is wider than	= =	ksf ft
Dimensions	1 222	ft Cooling Thi	Adjusted Allowable Bearing Pressure Reinforcing	=	1.50 ksf

Footing Width	=	1.333 ft	Footing Thickness	=	8.0 in	Bars along X-X Axis		
Wall Thickness	=	6.0 in	Rebar Centerline to Ec	dge of Conc	rete	Bar spacing	=	12.00
Wall center offset from center of footing	=	0 in	at Bottom of footing	=	3.0 in	Reinforcing Bar Size	=	# 4





Applied Loads

		D	Lr	L	S	W	E	Н
P : Column Load OB : Overburden	=	0.1675			0.2790	0.1539		k ksf
V-x	=							k
M-zz	=							k-ft
Vx applied	=	in a	bove top of foot	ting				



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Wall Footing

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Lic. # : KW-06008270 DESCRIPTION: Garage Wal Footing

Factor of	Safety Item	beilaaA	Canaaity	0 1 1 10 11 11
PASS n/s		L.L	Capacity	Governing Load Combination
1/200	a Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS n/a	a Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS n/a	a Uplift	0.0 k	0.0 k	No Uplift
Utilization	Ratio Item	Applied	Capacity	Governing Load Combination
PASS 0.28	78 Soil Bearing	0.4316 ksf	1.50 ksf	+D+S
PASS 0.013	333 Z Flexure (+X)	0.05717 k-ft	4.288 k-ft	+1.20D+1.60S+0.50W
PASS 0.004	046 Z Flexure (-X)	0.01735 k-ft	4.288 k-ft	+0.90D
PASS n/a	a 1-way Shear (+X)	0.0 psi	75.0 psi	n/a
DA00) 1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS 0.28 PASS 0.013 PASS 0.004 PASS 0.004 PASS 0.004 PASS 0.004 PASS 0.010	 78 Soil Bearing 333 Z Flexure (+X) 046 Z Flexure (-X) a 1-way Shear (+X) D 1-way Shear (-X) 	0.4316 ksf 0.05717 k-ft 0.01735 k-ft 0.0 psi 0.0 psi	1.50 ksf 4.288 k-ft 4.288 k-ft 75.0 psi 0.0 psi	+D+S +1.20D+1.60S+0.5 +0.90D n/a n/a

Detailed Results

	0			Actual Soil B	earing Stress	Actual / Allo	owable
	Gi	ross Allowable	Xecc	-X	+X	Ratio	
		1.50 ksf 1.50 ksf 1.50 ksf 1.50 ksf 1.50 ksf 1.50 ksf 1.50 ksf 1.50 ksf	0.0 in 0.0 in 0.0 in 0.0 in 0.0 in 0.0 in 0.0 in 0.0 in	0.2223 ksf 0.4316 ksf 0.3793 ksf 0.2916 ksf 0.2743 ksf 0.4313 ksf 0.2027 ksf 0.1334 ksf	0.2223 ksf 0.4316 ksf 0.3793 ksf 0.2916 ksf 0.2743 ksf 0.4313 ksf 0.2027 ksf 0.1334 ksf	((((((Units : k-ft).148).288).253).194).183).288).135).089
	Ove	rturning Moment		Resisting Moment	Stability Ratio	Statu	IS
		Sliding Force		Resisting Force	Sliding SafetyRation	o Statu	IS
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
0.02699 0.02313 0.02313 0.03221 0.03221 0.02814 0.05217 0.05217 0.05717 0.05717 0.05717 0.03314 0.03314 0.04222 0.03584 0.02736 0.02736 0.01735	-X +X -X +X +X +X +X +X +X +X +X +X +X +X +X +X	Bottom Bottom	0.1728 0.1728	Min Temp % Min Temp %	$\begin{array}{c} 0.2 \\$	4.288 4.288	
	Mu k-ft 0.02699 0.02699 0.02313 0.03211 0.03211 0.03211 0.02814 0.02814 0.02814 0.02814 0.02814 0.05217 0.05217 0.0571	Mu Which k-ft Side ? 0.02699 -X 0.02699 -X 0.02699 -X 0.02313 -X 0.02211 -X 0.03221 -X 0.02814 -X 0.05217 -X 0.03314 -X 0.03584 -X 0.01735 -X 0.01735 -X	Gross Allowable 1.50 ksf 1.50 ksf	Gross Allowable Xecc 1.50 ksf 0.0 in 0.02699 X Bottom 0.02699 -X Bottom 0.02699 +X Bottom 0.02213 -X Bottom 0.02214 -X Bottom 0.03221 -X Bottom 0.02814 -X Bottom 0.02814 -X Bottom 0.02814 -X Bottom 0.05217 -X Bottom 0.05217 -X Bottom 0.05717 -X Bottom 0.03314 +X Bottom	Actual Soil B Gross Allowable Xecc -X 1.50 ksf 0.0 in 0.2223 ksf 1.50 ksf 0.0 in 0.3793 ksf 1.50 ksf 0.0 in 0.2916 ksf 1.50 ksf 0.0 in 0.2743 ksf 1.50 ksf 0.0 in 0.2743 ksf 1.50 ksf 0.0 in 0.2743 ksf 1.50 ksf 0.0 in 0.2027 ksf 1.50 ksf 0.0 in 0.1334 ksf 0.02027 ksf 0.0 in 0.1334 ksf 0.02699 -X Bottom 0.1728 Mu Which Tension @ Bot. As Req'd Gvrn. As kft Side ? or Top ? in*2 in*2 0.02699 -X Bottom 0.1728 Min Temp % 0.02313 -X Bottom 0.1728 Min Temp % 0.03221 -X Bottom 0.1728 Min Temp % 0.02313 +X Bottom 0.1728 Min Temp % 0.02211 -X Bottom	Actual Soil Bearing Stress Gross Allowable Xecc -X +X 1.50 ksf 0.0 in 0.2223 ksf 0.2223 ksf 1.50 ksf 0.0 in 0.3793 ksf 0.3793 ksf 1.50 ksf 0.0 in 0.2713 ksf 0.2716 ksf 1.50 ksf 0.0 in 0.2743 ksf 0.2743 ksf 1.50 ksf 0.0 in 0.4313 ksf 0.4313 ksf 1.50 ksf 0.0 in 0.221 ksf 0.2027 ksf 1.50 ksf 0.0 in 0.1334 ksf 0.1334 ksf 1.50 ksf 0.0 in 0.1334 ksf 0.1334 ksf 1.50 ksf 0.0 in 0.1334 ksf 0.1334 ksf 0.02699 -X Bottom 0.1728 Min Temp % 0.2 0.02699 -X Bottom 0.1728 Min Temp % 0.2 0.02699 +X Bottom 0.1728 Min Temp % 0.2 0.02313 +X Bottom 0.1728 Min Temp % 0.2 0.0221 +X Bottom 0.1728 <td>Actual Soil Bearing Stress Actual / Alic 1.50 ksf 0.0 in 0.2223 ksf 0.2223 ksf Actual / Alic 1.50 ksf 0.0 in 0.2223 ksf 0.2223 ksf 0.2223 ksf C 1.50 ksf 0.0 in 0.3793 ksf 0.2213 ksf C C 1.50 ksf 0.0 in 0.27143 ksf 0.27143 ksf C C 1.50 ksf 0.0 in 0.27143 ksf 0.27143 ksf C C 1.50 ksf 0.0 in 0.27143 ksf C C C C 1.50 ksf 0.0 in 0.1334 ksf 0.1334 ksf C C C 1.50 ksf 0.0 in 0.1334 ksf 0.1334 ksf C C C 0verturning Moment Resisting Force Stability Ratio Statu Statu Mu Which Tension @ Bot. As Req'd Gvrn. As Actual As Phi'Mn k-ft Side ? or Top ? in*2 in*2 in*2 Lin*2 Lin*2</td>	Actual Soil Bearing Stress Actual / Alic 1.50 ksf 0.0 in 0.2223 ksf 0.2223 ksf Actual / Alic 1.50 ksf 0.0 in 0.2223 ksf 0.2223 ksf 0.2223 ksf C 1.50 ksf 0.0 in 0.3793 ksf 0.2213 ksf C C 1.50 ksf 0.0 in 0.27143 ksf 0.27143 ksf C C 1.50 ksf 0.0 in 0.27143 ksf 0.27143 ksf C C 1.50 ksf 0.0 in 0.27143 ksf C C C C 1.50 ksf 0.0 in 0.1334 ksf 0.1334 ksf C C C 1.50 ksf 0.0 in 0.1334 ksf 0.1334 ksf C C C 0verturning Moment Resisting Force Stability Ratio Statu Statu Mu Which Tension @ Bot. As Req'd Gvrn. As Actual As Phi'Mn k-ft Side ? or Top ? in*2 in*2 in*2 Lin*2 Lin*2



P.O. Box 13423 CS2 ENGINEERS Mill Creek, WA 98082 T. 425-408-2748 Challenge & Success - Civil & Structural F. 425-954-7539 info@cs2engineers.com Project Title: Engineer: Project ID: Project Descr:

Wall Footing

Lic. # : KW-06008270

DESCRIPTION: Garage Wal Footing

One Way Shear

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File: 2000-G Mercer Island Garage.ec6 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.2.28 CS2 ENGINEERS

One Way Shear								Units :	k
Load Combination	Vu @ -X	Vu @ +	Х	Vu:Max	Phi V	/n	Vu / Phi*Vn		Status
+1.40D +1.20D +1.20D+0.50S +1.20D+0.50W +1.20D+1.60S +1.20D+1.60S+0.50W +1.20D+W +1.20D+W +1.20D+0.50S+W +1.20D+0.70S	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	psi psi psi psi psi psi psi psi psi psi	0 psi 0 psi 0 psi 0 psi 0 psi 0 psi 0 psi 0 psi 0 psi 0 psi	a 0 a 0 a 0 a 0 a 0 a 0 a 0 a 0 a 0 a 0	ISI ISI ISI ISI ISI ISI ISI ISI ISI	75 psi 75 psi 75 psi 75 psi 75 psi 75 psi 75 psi 75 psi 75 psi 75 psi))))))	OK OK OK OK OK OK OK OK OK
+0.90D+W +0.90D	0 0	psi psi	0 psi 0 psi	q 0 q 0	osi osi	75 psi 75 psi	()	OK OK

Project:	4027 93 rd Ave SE (#003100-0095)	Date:	May 18, 2020
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Lateral Load Design Calculation



ASCE 7 Hazards Report

Address: 4027 93rd Ave SE Mercer Island, Washington 98040

Standard:ASCE/SEI 7-10Risk Category:IISoil Class:D - Stiff Soil

 Elevation:
 317.44 ft (NAVD 88)

 Latitude:
 47.57356

 Longitude:
 -122.215157



Wind

Results:

Wind Speed:	110 Vmph
10-year MRI	72 Vmph
25-year MRI	79 Vmph
50-year MRI	85 Vmph
100-year MRI	91 Vmph
Data Source:	ASCE/SEI 7-10, Fig. 26.5-1A and Figs. CC-1–CC-4, incorporating errata of March 12, 2014
Date Accessed:	Mon May 18 2020

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 7-10 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 7-10 Section 26.2.

Mountainous terrain, gorges, ocean promontories, and special wind regions should be examined for unusual wind conditions.



Site Soil Class: Results:	D - Stiff Soil			
S _s :	1.398	S _{DS} :	0.932	
S ₁ :	0.537	S _{D1} :	0.537	
F _a :	1	Τ _L :	6	
F _v :	1.5	PGA :	0.576	
S _{MS} :	1.398	PGA M :	0.576	
S _{M1} :	0.805	F _{PGA} :	1	
			1	

Seismic Design Category D



Data Accessed: Date Source:

Mon May 18 2020

USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.



Results:

Ground Snow Load, p _g :	15 lb/ft ²
Elevation:	317.4 ft
Data Source:	ASCE/SEI 7-10, Fig. 7-1.
Date Accessed:	Mon May 18 2020
	Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow

loads at elevations not covered.

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	Project:	Project: Chung Residence Garage (4027 93rd Ave SE)				
ENGINEERS	Client:	Owner	Job No.:	2000-G		
Civil & Structural	By:	S. Cho	Date:	5/18/20		
challenge & Success	Subject:	Design Calculations	Page:			

Design & Loading Criteria

CS

Roof Dead Load:			
Roofing =	2.8	psf	
Insulation =	0.5	psf	
Roof sheathing =	1.7	psf	
Trusses @ 24" o.c. =	6.0	psf	
5/8" GWB =	2.8	psf	
M & E =	0.5	psf	
Miscellaneous =	0.5	psf	
Roof dead load total =	14.8	psf	
USE =	15.0	psf	
Roof Live Load:	25	psf	
Total Roof Load =	40.0	psf	

Floor Dead Load:		
Floor Cover =	1.0	psf
Insulation =	1.0	psf
Floor sheathing =	2.7	psf
Joists @ 16" o.c. =	2.8	psf
5/8" GWB =	2.8	psf
M&E=	1.0	psf
Miscellaneous =	0.5	psf
Floor dead load total =	11.8	psf
USE =	12.0	psf
Floor Live Load:	40	psf
Total Floor Load =	52.0	psf

Wall Dead Load:			
2x Stud @ 16" o.c. =	2.0	psf	
7/16" Sheathing =	1.8	psf	
Gypsum sheathing =	2.0	psf	
Insulation =	1.0	psf	
Siding =	2.0	psf	
Miscellaneous =	0.5	psf	
Wall dead load total =	9.3	psf	
USE =	10.0	psf	

DESIGN REFERENCES:

ASCE 7-10, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURE.
IBC 2015, INTERNATIONAL BUILDING CODE 2012 W/ SBC 2012.
ACI 318-14, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY.
NDS 2015, NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION WITH COMMENTARY.
AWC SDRWS 2015, SPECIAL DESIGN PROVISIONS FOR WIND AND SEISMIC WITH

·AWC SDPWS-2015, SPECIAL DESIGN PROVISIONS FOR WIND AND SEISMIC WITH COMMENTARY.

·AISC 360-10, SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS: STEEL DESIGN MANUAL

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$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		(Civil & Stru	uctural		By:	S. Cho				Date:	5/18/20
$ \begin{array}{c c} \hline Calculate Seismic Design Base Shear \\ \hline Structure Height, h_{n}, (ft) & = 10.8 & (Mean roof height) & S_{n} = 1.388 \\ S_{0,5} = 2/3 S_{M2} & = 0.932 & (per USGS) & S_{M3} = 0.537 \\ S_{0,7} = 2/3 S_{M1} & = 0.537 & (per USGS) & S_{M3} = 0.537 \\ S_{0,7} = 2/3 S_{M1} & = 0.537 & (per USGS) & S_{M3} = 0.537 \\ Seismic Design Category & Standard-Occupancy Buildings & II & S_{M1} = 0.805 \\ Seismic Design Category & Standard-Occupancy Buildings & II & S_{M1} = 0.805 \\ Seismic Design Category & Standard-Occupancy Buildings & II & S_{M2} = 0.805 \\ Seismic Design Category & Standard-Occupancy Buildings & II & S_{M2} = 0.805 \\ Seismic Design Category & Standard-Occupancy Buildings & II & SCE 7, Table 12.8-1) \\ Response Modification Factor, R & = 6, 5, (ASCE 7, Table 12.8-2) \\ T = C_{N}(h_{0})^{N2} & = 0.119 & (ASCE 7, Eq 12.8-2) \\ Building Period Coefficient, C_{1} & = 0.143 & (ASCE 7, Eq 12.8-2) \\ But need not exceed: & 0.143 & (ASCE 7, Eq 12.8-3) \\ But not less than: & 0.01) & = 0.041 & (ASCE 7, Eq 12.8-3) \\ But not less than: & 0.01) & = 0.041 & (ASCE 7, Eq 12.8-3) \\ But not less than: & 0.010 & = 0.041 & (ASCE 7, Eq 12.8-5) \\ C_{g} = 0.5S_{N}(RN_{L}) & (fS_{1} > or - 0.6g) & = N/A & (ASCE 7, Table 13.5.1 & 13.6.1) \\ Component amplification factor, a_{p} & = 1 & (ASCE 7, Table 13.5.1 & 13.6.1) \\ Component timpofance Sace Narry, V_{g} = C_{W}(k(lps) = 0.102 & x Weight (ASD) & F_{pr, min} = F_{pr, min} = 0.336 g_{M}/W & = 1.4 & (ASCE 7, Table 13.5.1 & 13.6.1) \\ Component timpofance Sace Narry, V_{g} = C_{W}/V_{L} & (M_{P}) & (M_{$		Cr	nallenge & s	Success		Subject:	Design	Calculati	ons		Page:	
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$\begin{split} & \bigcup_{n=1}^{n} \sum_{n=2}^{n} \sum_{n=1}^{n} $		$S_{ro} = 2/3 S_r$	uo				=	0.932	(ner USGS)	S, =	0.537
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$ \begin{array}{rcl} & \text{Response Modification Factor, \mathbf{R}} & = & 6.5 & (ASCE 7, Table 12.2-1) \\ & \text{Bullding Period Coefficient, \mathbf{C}} & = & 0.02 & (ASCE 7, Table 12.2-1) \\ & \text{Bull of transaction} & = & 0.02 & (ASCE 7, Table 12.2-2) \\ & T = C_3, K(h_3)^{3/4} & = & 0.119 & (ASCE 7, Eq. 12.8-2) \\ & \text{T}_1 = \log_p \text{-period transaction} & = & 6 & (ASCE 7, Eq. 12.8-2) \\ & \text{But not less than:} \\ & C_3 = S_{00}(\Pi(R^1 _{D})) & = & 0.693 & (ASCE 7, Eq. 12.8-2) \\ & \text{But not less than:} \\ & C_3 = 0.48_{Spl_2}; (not less than 0.01) & = & 0.041 & (ASCE 7, Eq. 12.8-3) \\ & \text{But not less than:} \\ & C_3 = 0.48_{Spl_2}; (not less than 0.01) & = & 0.041 & (ASCE 7, Eq. 12.8-6) \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Selsmic Base Shear, $V_9^{-1}.2 + C_9W, (klps) = & 0.143 & Weight \\ & & \text{Component amplification factor, \mathbf{a}_p} & = & 1 & (ASCE 7, Table 13.5.1 \& 13.6.1) \\ & & \text{Component amplification factor, \mathbf{a}_p} & = & 1.85_{OS} \ W_p$ = & 1.491 \ W_p$ (Eq. 13.3-1) \\ & \text{Max, seismic design force, $\mathbf{F_{pmx}} = & 1.85_{OS} \ W_p$} & = & 0.240 \ W_p$ (Eq. 13.3-3) \\ \hline & & & & & & & & & & & & & & & & & &$		Occupancy	Importance	Factor, I _E			=	-	(ASCE 7. T	able 11.5.1)		
$\begin{split} & \text{Building Period Coefficient, C_t} & = & 0.02 & (\text{ASCE 7, Table 12.8-2}) \\ T = C_1 x (h_1)^{34} & = & 0.119 & (\text{ASCE 7, Fig 12.8-7}) \\ T_1 = \log_{period transaction} & = & 6 & (\text{ASCE 7, Fig 12.8-7}) \\ C_2 = S_{05}([R/l_2) & = & 0.113 & (\text{ASCE 7, Fig 12.8-2}) \\ & \text{But need not exceed:} \\ C_n = S_{02}([R/l_2)] & = & 0.693 & (\text{ASCE 7, Fig 12.8-3}) \\ & \text{But not less than:} \\ C_2 = 0.443 & (\text{ASCE 7, Fig 12.8-3}) \\ & \text{But not less than:} \\ C_2 = 0.443 & (\text{ASCE 7, Fig 12.8-5}) \\ & (\text{IS 1- } \text{or } \text{or } \text{0.6g}) & = & 0.413 & \text{XWeight} \\ \hline \text{Seismic Base Shear, V_g = C_gW_1(kips) = & 0.143 & \text{XWeight} \\ \hline \text{Seismic Base Shear, V_g = C_gW_1(kips) = & 0.102 & \text{XWeight} \\ \hline \text{Seismic Base Shear, V_g = C_gW_1(kips) = & 0.102 & \text{XWeight} \\ \hline \text{Seismic Base Shear, V_g = C_gW_1(kips) = & 0.102 & \text{XWeight} \\ \hline \text{Seismic Base Shear, V_g = C_gW_1(kips) = & 0.102 & \text{XWeight} \\ \hline \text{Component amplification factor, a_p} & = & 1 & (\text{ASCE 7, Table 13.5.1 & 13.6.1}) \\ \hline \text{Component amplification factor, a_p} & = & 1 & (\text{ASCE 7, Table 13.5.1 & 13.6.1}) \\ \hline \text{Component amplification factor, R_p} & = & 1 & (\text{ASCE 7, Table 13.5.1 & 13.6.1}) \\ \hline \text{Component metoplication factor, R_p} & = & 1 & (\text{ASCE 7, Table 13.5.1 & 13.6.1}) \\ \hline \text{Component amplification factor, R_p} & = & 2.5 & (\text{ASCE 7, Table 13.5.1 & 13.6.1}) \\ \hline \text{Component response modification factor, R_p} & = & 0.447 \text{ W}_p & (\text{Eq. 13.3-1}) \\ \hline \text{Max. seismic design force, F_p = & 0.3S_{04}, \text{W}_p} & = & 0.280 \text{ W}_p & (\text{Eq. 13.3-3}) \\ \hline \hline \text{Min. seismic design force, F_{pmm} = & 0.3S_{04}, \text{W}_p} & = & 0.280 \text{ W}_p & (\text{Eq. 13.3-3}) \\ \hline \hline \text{Min. seismic design force, F_{pmm} = & 0.3S_{04}, \text{W}_p} & = & 0.280 \text{ W}_p \\ \hline \hline \text{Min. Seismic Design Force, F.P = & 0.447 \text{ W}_p \\ \hline \hline \text{Min. Seismic Design Force, F.P = & 0.447 \text{ W}_p \\ \hline \hline \text{Min. Seismic design force, F_{pmm} = & 0.3S_{04}, \text{W}_p & = & 0.280 \text{ W}_p \\ \hline \hline \hline \text{Min. Seismic Design Force, F.P = & 0.447 \text{ W}_p \\ \hline \hline \hline \text{Min. Seismic Design Force, F.P = & 0.447 \text{ W}_p \\ \hline \hline \hline Min. Se$		Response N	/lodification	Factor, R			=	6.5	(ASCE 7. T	able 12.2-1)		
$\begin{split} T &= C_{x} (h_{x})^{34} &= 0.119 (ASCE 7, Eq 12.8.7) \\ T_{x} &= long-period transaction &= 6 (ASCE 7, Eq 12.8.7) \\ T_{x} &= long-period transaction &= 6 (ASCE 7, Eq 12.8.7) \\ C_{x} &= S_{y}(Rl_{x}) &= 0.143 (ASCE 7, Eq 12.8.2) \\ But need not exceed: \\ C_{x} &= S_{y}(T(Rl_{p})) &= 0.693 (ASCE 7, Eq 12.8.3) \\ But noted ses than: \\ C_{y} &= 0.43_{bold}; (not less than 0.01) &= 0.041 (ASCE 7, Eq 12.8.5) \\ C_{y} &= 0.5S_{y}((Rl_{p})) (if S_{1} > or = 0.6g) &= NIA (ASCE 7, Eq 12.8.6) \\ \hline \\ Selsmic Base Shear, V_{y}(1.4 = C_{y}W, (klps) &= 0.143 Weight \\ \hline \\ Selsmic Base Shear, V_{y}(1.4 = C_{y}W, (klps) &= 0.102 x Weight (ASD) \\ \hline \\ F_{\mu\nu, max} &= \\ \hline \\ \hline \\ Calculate Selsmic Force for Components (Per ASCE7.05 Chapter 13) \\ Component amplification factor, a_{p} &= 1 (ASCE 7, Table 13.5.1 & 13.6.1) \\ Component operating weight, W_{p} &= W_{p} (b) \\ Component operating weight, W_{p} &= U_{p} (b) \\ Component operating weight, W_{p} &= 0.447 W_{p} (Eq, 13.3.1) \\ Height of attachment / Mean roof height, zh &= 1 (2/h need not exceed 1.0) \\ \hline \\ Seismic Design Force, F_{p} = (0.43_{BOS} N_{w})(142xz/h) &= 0.447 W_{p} (Eq, 13.3-2) \\ \hline \\ Max. seismic design force, F_{pmax} = 0.3S_{DS} N_{w} = 0.280 W_{p} (Eq, 13.3-3) \\ \hline \\ $		Building Per	riod Coefficio	ent, C t			=	0.02	(ASCE 7, T	able 12.8-2)		
$\begin{split} T_{1} = \log_{p} \text{period transaction} &= 6 & (ASCE 7, Fig 22-15) \\ C_{n} = S_{00}(RM_{0}) &= 0.143 & (ASCE 7, Eq 12.8-2) \\ But need not exceed: \\ C_{3} = S_{00}/(T(R/I_{0})) &= 0.693 & (ASCE 7, Eq 12.8-3) \\ But not less than: \\ C_{n} = 0.448 + S_{00}I_{n}^{-1} (\text{rot less than 0.01}) &= 0.041 & (ASCE 7, Eq 12.8-5) \\ R_{n} = 0.583 & (ASCE 7, Eq 12.8-6) \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Selsmic Base Shear, V_{3} = C_{2}W, (klps) &= 0.143 & x Weight \\ \hline Component amplification factor, a_{p} &= 1 & (ASCE 7, Table 13.5.1 & 13.6.1) \\ Component approxent response modification factor, R_{p} &= 2.5 & (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline Component response modification factor, R_{p} &= 0.447 W_{p} & (Eq, 13.3.1) \\ \hline Component response modification factor, R_{pmn} = 0.3S_{0}d_{0}W_{p} &= 0.280 W_{p} & (Eq, 13.3.2) \\ \hline Max. seismic design force, F_{pmx} = 0.3S_{0}d_{0}W_{p} &= 0.280 W_{p} & (Eq, 13.3.3) \\ \hline \\ \hline Max. seismic design force, F_{pmx} = 0.3S_{0}d_{0}W_{p} &= 0.280 W_{p} & (Eq, 13.3.3) \\ \hline \\ \hline Min. seismic design force, F_{pmx} = 0.3S_{0}d_{0}W_{p} &= 0.200 W_{p} & 0.102 & 912 \\ \hline \\ \hline Mut &= 0.08 & 909 & 96217.2 & 100\% & 912 & 0.102 & 912 \\ \hline \\ \hline \\ \hline \\ Wut &= 0.08 & 8909 & 96217.2 & 100\% & 912 & 0.102 & 912 \\ \hline \\ $		T = C, x (h _n) ^{3/4}				=	0.119	(ASCE 7. E	, Ea 12.8-7)		
$\begin{split} & \begin{array}{rcl} & & & c_{s} = & s_{0.5}([R]_{c}) & = & 0.143 & (\text{ASCE } 7, \text{Eq } 12.8-2) \\ & & & & & & & & \\ & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & & \\ & & & & & & & \\ $		$T_1 = long-pe$, eriod transad	ction			=	6	(ASCE 7. F	ia 22-15)		
$\begin{split} \begin{array}{rcl} & & & & & & & & & & & & & & & & & & &$		$C_{s} = S_{Ds}/(R)$	/I_)				=	0.143	(ASCE 7. E	Eg 12.8-2)		
$\begin{split} & \left(\sum_{s} = S_{0,t} (T(R/I_{2})) \\ & = 0.693 (ASCE 7, Eq 12.8-3) \\ & But not less than: \\ & C_{s} = 0.447 \\ Solsmic Base Shear, V_{s} = C_{s}W, (kips) \\ & = 0.143 x \ Weight \\ \hline Solsmic Base Shear, V_{s} = C_{s}W, (kips) \\ & = 0.143 x \ Weight (ASD) \\ \hline F_{px, max} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}}} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}}} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}}} = \frac{1}{P_{px, max}}} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}}} = \frac{1}{P_{px, max}} = \frac{1}{P_{px, max}}} = \frac$		But need n	ot exceed:						(,		
$\begin{split} & \begin{array}{rcl} & \begin{array}{rcl} & But not less than: \\ & C_{S} = 0.44S_{Osls} (not less than 0.01) & = & 0.041 & (ASCE 7, Eq 12.8-5) \\ & C_{S} = 0.5S_{1}/[R/I_{E}) & (fS_{1} > or = 0.6g) & = & N/A & (ASCE 7, Eq 12.8-6) \\ \hline & Seismic Base Shear, V_{S} = C_{SW} (kips) & = & 0.143 & x \ Weight & F_{pr, min} = \\ \hline & \hline & \hline & \hline & \hline & Seismic Base Shear, V_{S}'1.4 = C_{SW} (kips) & = & 0.143 & x \ Weight & (ASCE 7, Eq 12.8-6) \\ \hline & \hline & \hline & \hline & \hline & Seismic Base Shear, V_{S}'1.4 = C_{SW} (kips) & = & 0.143 & x \ Weight & (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline & \hline$		$C_{S} = S_{D1}/[T($	(R/I _E)]				=	0.693	(ASCE 7, E	Eq 12.8-3)		
$\begin{split} & \begin{array}{rcl} C_{s} = 0.44S_{US}I_{s}: (not less than 0.01) & = & 0.041 & (ASCE 7, Eq 12.8-5) \\ C_{s} = 0.5S_{s}/(R/I_{c}) & (if S_{1} > or = 0.6g) & = & N/A & (ASCE 7, Eq 12.8-6) \\ \hline & Seismic Base Shear, V_{s} = C_{s}W, (kips) & = & 0.143 & x Weight & Sp_{sr,max} = \\ \hline & Seismic Base Shear, V_{s}/1.4 = C_{s}W, (kips) & = & 0.143 & x Weight (ASD) \\ \hline & F_{pr,max} = & \\ \hline & Calculate Seismic Force for Components (Per ASCE7-05 Chapter 13) \\ \hline Component amplification factor, a_{p} & = & 1 & (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline Component importance factor, I_{p} & = & 1 & (ASCE 7, Section 13.3) \\ \hline Component response modification factor, R_{p} & = & 2.5 & (ASCE 7, Table 13.5.1 & 13.6.1) \\ Height of attachment / Mean roof height, Z/h & = & 1 & (Z/h need not exceed 1.0) \\ \hline Seismic Design Force, F_{p} = & (D.4a_{p}SnaW_{p})(1+2xz/h) & = & 0.447 W_{p} & (Eq. 13.3-1) \\ Max. seismic design force, F_{pmax} = & 1.6S_{DS}I_{p}W_{p} & = & 1.491 W_{p} & (Eq. 13.3-2) \\ \hline & \hline & R_{p}/I_{p} & 0.447 W_{p} & (Eq. 13.3-2) \\ \hline & \hline & Nin & seismic design force, F_{pmax} = & 0.3S_{DS}I_{p}W_{p} & = & 0.280 W_{p} & (Eq. 13.3-2) \\ \hline & \hline & \hline & R_{p}/I_{p} & 0.447 W_{p} & (Eq. 13.3-2) \\ \hline & \hline & \hline & R_{p}/I_{p} & 0.447 W_{p} & (Eq. 13.3-2) \\ \hline & \hline & \hline & R_{p}/I_{p} & 0.447 W_{p} & (Eq. 13.3-2) \\ \hline & \hline & \hline & \hline & R_{p}/I_{p} & 0.3S_{DS}I_{p}W_{p} & = & 0.280 W_{p} & (Eq. 13.3-2) \\ \hline & R_{p}/I_{p} & 0.00 & 0 & 0\% & 0 & 0.000 & 912 \\ \hline & R_{p}/I_{p} & 0.00 & 0 & 0\% & 0 & 0.000 & 912 \\ \hline & R_{p}/I_{p} & \hline & \hline & \hline & R_{p}/I_{p} & \hline & $		But not less	s than:							. ,		
$\begin{split} & C_{S} = 0.5S_{F}/(R/I_{E}) (\text{if } S_{1} > \text{or } = 0.6g) & = \text{N/A} (\text{ASCE 7, Eq 12.8-6}) \\ \hline & Seismic Base Shear, V_{S} = C_{S}W, (klps) & = 0.143 x \ \text{Weight} \\ \hline & Seismic Base Shear, V_{g}/1.4 = C_{g}W, (klps) & = 0.102 x \ \text{Weight} (ASD) \\ \hline & F_{px, max} = \begin{array}{c} \\ \hline & Calculate Seismic Force for Components} (Per ASCE7-05 \ Chapter 13) \\ \hline & Component Importance factor, 1_{p} & = 1 \\ \hline & (ASCE 7, Table 13.5.1 \& 13.6.1) \\ \hline & Component Importance factor, 1_{p} & = 1 \\ \hline & (ASCE 7, Table 13.5.1 \& 13.6.1) \\ \hline & Component operating weight, W_{p} & = W_{p} (lb) \\ \hline & Component operating weight, W_{p} & = 2.5 \\ \hline & (ASCE 7, Table 13.5.1 \& 13.6.1) \\ \hline & Component operating weight, Z'_{p} & = 0.447 \ W_{p} (Eq. 13.3-1) \\ \hline & Height of attachment / Mean roof height, z'h & = 1 \\ \hline & (z/h need not exceed 1.0) \\ \hline & Seismic Design Force, F_{p} = (0.4a_{p}Sn_{p}W_{p}) = 1.491 \ W_{p} (Eq. 13.3-1) \\ \hline & Max. seismic design force, F_{pmax} = 1.8Sn_{p}B_{p}W_{p} & = 0.280 \ W_{p} (Eq. 13.3-3) \\ \hline & \hline & & & & & & \\ \hline & & & & & & & \\ \hline & & & &$		$C_{S} = 0.44S_{D}$	_{os} l _E ;(not les	s than 0.01)			=	0.041	(ASCE 7, E	Eq 12.8-5)		
$\begin{split} \hline \textbf{Seismic Base Shear, V_{5} = C_{5}W, (kips) = 0.143 \times Weight}{Seismic Base Shear, V_{5}/1.4 = C_{5}W, (kips) = 0.102 \times Weight (ASD)} \\ F_{px, max} = \\ \hline \textbf{Calculate Seismic Force for Components} (Per ASCE7-05 Chapter 13) \\ \hline \textbf{Component amplification factor, a_{p}} = 1 (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline \textbf{Component Importance factor, l_{p}} = 1 (ASCE 7, Section 13.3) \\ \hline \textbf{Component response modification factor, R_{p}} = 2.5 (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline \textbf{Component response modification factor, R_{p}} = 2.5 (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline \textbf{Height of attachment / Mean roof height, z/h} = 1 (z/h need not exceed 1.0) \\ \hline \textbf{Seismic Design Force, F_{p} = (0.4a_{p}S_{nx}W_{p})(1+2xz/h) \\ \hline \textbf{R}_{p}l_{p} = 0.38_{0}b_{p}W_{p} = 0.280 W_{p} (Eq. 13.3-1) \\ \hline \textbf{Max. seismic design force, F_{pmax} = 1.88_{0}b_{p}W_{p} = 0.280 W_{p} (Eq. 13.3-2) \\ \hline \textbf{Min. seismic design force, F_{pmin} = 0.3S_{0}b_{p}W_{p} = 0.280 W_{p} (Eq. 13.3-3) \\ \hline \textbf{Seismic Design Force, Fp = 0.447 W_{p} \\ \hline Seism$		$C_{S} = 0.5S_{1}/($	(R/I _E)	(if $S_1 > or =$	0.6g)		=	N/A	(ASCE 7, E	Eq 12.8-6)		
$\label{eq:response} \hline \textbf{Seismic Base Shear, V_g/1.4 = C_sW, (kips) = 0.102 x Weight (ASD)} F_{px, max} = \\ \hline \textbf{Calculate Seismic Force for Components} (Per ASCE7-05 Chapter 13) \\ \hline \textbf{Component amplification factor, a_p = 1 (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline \textbf{Component importance factor, I_p = 1 (ASCE 7, Section 13.3) \\ \hline \textbf{Component operating weight, W_p = W_p (b) \\ \hline \textbf{Component operating weight, W_p = 2.5 (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline \textbf{Component response modification factor, R_p = 2.5 (ASCE 7, Table 13.5.1 & 13.6.1) \\ \hline \textbf{Height of attachment / Mean roof height, z/h = 1 (z/h need not exceed 1.0) \\ \hline \textbf{Seismic Design Force, F_p = (0.4a_pSn_sW_p)(1+2xz/h) \\ \hline \textbf{R}_pI_p = 0.447 W_p (Eq. 13.3-1) \\ \hline \textbf{Max. seismic design force, F_pmin = 0.3SD_{0}I_Wp = 0.280 W_p (Eq. 13.3-2) \\ \hline \textbf{Min. seismic design force, F_pmin = 0.3SD_{0}I_Wp = 0.280 W_p (Eq. 13.3-3) \\ \hline \textbf{Min. seismic Design Force, Fp/1.4 = 0.320 W_p \\ \hline \textbf{Min. seismic Design Force, Fp/1.4 = 0.320 W_p \\ \hline \textbf{N}_{0} (1b.7) & (b.7) & (b.8) & (b.7) \\ \hline \textbf{M}_{0} 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & 0 & 0 & 0 \\ \hline \textbf{N}_{0} 0 & 0.000 & 912 \\ \hline \textbf{N}_{1} (1) & \textbf{W}_{0} (bs) & (b.7) & (b.9) & (b.7) \\ \hline \textbf{M}_{1} 0 & 0 & 0 & 0 \\ \hline \textbf{N}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & 0 & 0 & 0 \\ \hline \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{0} 0 & 0.000 & 912 \\ \hline \textbf{M}_{1} 0 & \textbf{M}_{1} 0 & \textbf{M}_{1} 0 & 0.000 & 912 \\ \hline$			Sei	smic Base S	Shear, V _S =	C _S W, (kips)	=	0.143	x Weight		F _{px, min} =	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$			Seismi	ic Base She	ar, V _S /1.4 =	C _s W, (kips)	=	0.102	x Weight (ASD)	F _{px, max} =	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		l										
$\begin{split} & \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	Calo	culate Seism	nic Force fo	r Compone	nts (Per AS	CE7-05 Cha	pter 13)					
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		Component	amplificatio	n factor, a_p			=	1	(ASCE 7, T	able 13.5.1 a	& 13.6.1)	
$\begin{split} & \begin{array}{rcl} & \begin{array}{rcl} & Component operating weight, W_p & = & W_p & (lb) \\ & Component response modification factor, R_p & = & 2.5 & (ASCE 7, Table 13.5.1 & 13.6.1) \\ & \text{Height of attachment / Mean roof height, z/h & = & 1 & (z/h need not exceed 1.0) } \\ & \\ & Seismic Design Force, F_p = & (\underline{0.4a_p}S_{ns}W_p)(\underline{1+2xz/h}) \\ & & R_p/I_p & = & 0.447 W_p & (Eq. 13.3-1) \\ & \text{Max. seismic design force, F_{pmax} = & 1.6S_{Ds}I_pW_p & = & 1.491 W_p & (Eq. 13.3-2) \\ & & \text{Min. seismic design force, F_{pmax} = & 0.3S_{Ds}I_pW_p & = & 0.280 W_p & (Eq. 13.3-3) \\ \hline & & & & \\ \hline & & & & \\ \hline & & & & \\ \hline & & & &$		Component	Importance	factor, I _p			=	1	(ASCE 7, S	Section 13.3)		
$\begin{split} & \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$		Component	operating w	/eight, W _p			=	Wp	(lb)			
$\begin{array}{rcl} \mbox{Height of attachment / Mean roof height, z/h} &= 1 & (z/h need not exceed 1.0) \\ \label{eq:height of attachment / Mean roof height, z/h} &= 1 & (z/h need not exceed 1.0) \\ \mbox{Seismic Design Force, } F_p = & (\underline{0.4a_p}_{Da_p} S_{DS} W_p) &= 0.447 \ W_p & (Eq. 13.3-1) \\ \mbox{Max. seismic design force, } F_{pmax} = & 1.6S_{DS} I_p W_p &= 0.280 \ W_p & (Eq. 13.3-2) \\ \mbox{Min. seismic design force, } F_{pmin} = & 0.3S_{DS} I_p W_p &= 0.280 \ W_p & (Eq. 13.3-3) \\ \hline & \hline & Seismic Design Force, Fp = & 0.447 \ W_p \\ \hline & Seismic Design Force, Fp = & 0.447 \ W_p \\ \hline & Seismic Design Force, Fp = & 0.447 \ W_p \\ \hline & Seismic Design Force, Fp = & 0.447 \ W_p \\ \hline & Seismic Design Force, Fp 1.4 &= & 0.320 \ W_p \\ \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) & 0 & 0.000 \ 912 \\ \hline & \hline & 1 & 0 & 0 & 0 & 0 \\ \hline & & \Sigma & 8909 \ 96217.2 & 100\% \ 912 & 0.102 \ 912 \\ \hline & & \Sigma & 8909 \ 96217.2 & 100\% \ 912 \\ \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) & 0 & 0.000 \ 912 \\ \hline & & \Sigma & 8909 \ 96217.2 & 100\% \ 912 \\ \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & \hline & \hline & N_x(ft) & W_x(lbs) & (lb-ft) \\ \hline & \hline & \hline & \hline & \hline & N_x(ft) & W_x(lbs) & 0 \\ \hline & \hline$		Component	response m	nodification fa	actor, R p		=	2.5	(ASCE 7, T	able 13.5.1	& 13.6.1)	
$\begin{split} & \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$		Height of at	tachment / N	lean roof he	ight, z/h		=	1	(z/h need n	ot exceed 1.	0)	
$\begin{split} \begin{array}{c} \text{Seismic Design Force, } \mathbf{F}_{p} = \underbrace{(0.42n_{D} \ln_{D} \ln_{Q} (1+2\chi 2/n))}{\mathbf{R}_{p}/l_{p}} &= 0.447 \ W_{p} & (\text{Eq. 13.3-1}) \\ \text{Max. seismic design force, } \mathbf{F}_{pmax} = & 1.6\mathbf{S}_{DS}\mathbf{I}_{p}W_{p} &= 0.280 \ W_{p} & (\text{Eq. 13.3-2}) \\ \text{Min. seismic design force, } \mathbf{F}_{pmin} = & 0.3\mathbf{S}_{DS}\mathbf{I}_{p}W_{p} &= 0.280 \ W_{p} & (\text{Eq. 13.3-3}) \\ \hline \\ $				F - (0.4)	• • • • • • • • • • • • • • • • • • •	•						
$\begin{split} & K_{p}^{I_{p}} & (E_{q}, 1, 3, 3, 1) \\ & Max. seismic design force, F_{pmax} = 1.6 S_{DS} I_{p} W_{p} & = 1.491 \ W_{p} & (Eq. 13.3-2) \\ & Min. seismic design force, F_{pmin} = 0.3 S_{DS} I_{p} W_{p} & = 0.280 \ W_{p} & (Eq. 13.3-3) \\ \hline \\ & & & \\ \hline \\ & \\ &$		Seismic Des	sign Force, I	$F_{p} = (0.4a_{r})$	<u>,S_{DS}W_P) (1+</u>	<u>2xz/n)</u>	=	0.447	V W _p		,	
$\begin{split} \label{eq:response} \mbox{Max. seismic design force, F_{pmax} = $1.55 \mbox{bg} \mbox{bg} \mbox{Wp}$ = $1.491 \mbox{Wp}$ (Eq. 13.3-2) \\ \mbox{Min. seismic design force, F_{pmin} = $0.33 \mbox{bg} \mbox{bg} \mbox{Wp}$ = $0.280 \mbox{Wp}$ (Eq. 13.3-3) \\ \hline \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$. .	R _p /I _p			4 404		(Eq. 13.3-1))	
$\begin{split} \label{eq:result} \hline \text{Win. seismic design force, } \mathbf{F}_{pmin} = \mathbf{U.3S}_{DS}_{DS}_{P}\mathbf{W}_{P} = \mathbf{U.280} \ \mathbf{W}_{p} (Eq. 13.3-3) \\ \hline \\ $		Max. seismi	c design for	ce, F _{pmax} =	1.65 ₁	_{DS} I _p VV _P	=	1.491	IVV _p	(Eq. 13.3-2))	
$\frac{\text{Seismic Design Force, Fp} = 0.447 \text{ W}_{p}}{\text{Seismic Design Force, Fp/1.4} = 0.320 \text{ W}_{p}}$ $\frac{\text{Level} \text{Height} \text{Weight} \text{W_xh_x} \text{W_xh_x} \text{W_xh_x} \text{W_xh_x} \text{Height} \text{Height} \text{Height} \text{Weight} \text{W_xh_x} \text{W_xh_x} \text{Height} \text{Height} \text{Height} \text{Height} \text{Weight} \text{W_xh_x} \text{W_xh_x} \text{W_xh_x} \text{Height} \text{Height} \text{Height} \text{Height} \text{Height} \text{Height} \text{Height} \text{Weight} \text{Height} \text{Height}$		win. seismid	c design ford	ce, r _{pmin} =	0.35	_{DS} I _p VV _P	=	0.280	VV _p	(Eq. 13.3-3))	
$\frac{1}{1} = \frac{1}{1} + \frac{1}$				Sei	smic Desig	n Force, Fn	-	0.447	7 W.,]	
$\frac{ \mathbf{F}_{x} ^{2}}{ \mathbf{F}_{x} ^{2}} = \frac{ \mathbf{F}_{x} ^{2}}{ \mathbf{F}_{x} ^{2}} + $				Seismi	c Design F	orce En/1 4	=	0.320) W.,			
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$ \frac{ \mathbf{F}_{px, max} ^2}{\mathbf{F}_{px, max}} = \frac{ \mathbf{F}_{px, max} ^2}{2} + \mathbf{$		nal		h _x (ft)	w _x (lbs)	(lb-ft)			(lbs)	A A	Shear (V _x)	1186
$ \frac{2}{2} = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = $		udi tio	R	10.8	8909	96217.2		100%	912	0.102	912	
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$ \frac{(hallenge 4 Success)}{ $	Civil & Structural		By:	S. Ch	10			Date:	5/18/20		
$\begin{array}{c} \text{Wind Load Calculation (Method 2-Analytical)} \\ \text{(Reference: IBC 2012, Section 1600 & ASCE 7-10, Chapter 27)} \\ \hline \\ \text{Wind Valcotly Pressure:} \\ \hline \\ \text{Basic Wind Speed, Vs., (mph)} = 100 (ASCE 7-10, Figure 6-1) \\ \text{Exposure Category} = 10 (BC Table 1604.5) \\ \text{Wind Lipotaton Factor, I,} = 1.0 (BC Table 1604.5) \\ \text{Wind Lipotaton Factor, I,} = 1.0 (BC Table 1604.5) \\ \text{Wind Directionality Factor, K_a} = 0.85 (ASCE 7-10, Table 6-3.) \\ \text{Topographic Factor, K_a} = 0.85 (ASCE 7-10, Figure 6-4) \\ \text{Wind Directionality Factor, K_a} = 0.85 (ASCE 7-10, Figure 6-4) \\ \text{Wind Directionality Factor, K_a} = 0.85 (ASCE 7-10, Figure 6-4) \\ \text{Wind Directionality Factor, K_a} = 0.85 (ASCE 7-10, Table 6-3.) \\ \text{Topographic Factor, K_a} = 0.85 (ASCE 7-10, Section 65.10) \\ \text{Gust effect factor, G} = 0.85 (ASCE 7-10, Section 65.5) \\ \text{Wintward Walk} \boxed{\frac{1}{PLN}} = \frac{1}{PLN} = 0.81 \\ \text{Winward Walk} \boxed{\frac{1}{PLN}} = 0.00 \\ \text{Motion 1501 - 0.05} \\ \text{Winward Reot} = 1501 \\ \text{Leeward Walk} \boxed{\frac{1}{PLN}} = 1501 \\ \text{Locd} \boxed{\frac{1}{1001}} = 0.3 \\ \text{Winward Reot} \boxed{\frac{1}{PLN}} = 1501 \\ \text{Locd} \boxed{\frac{1}{1001}} = 0.3 \\ \text{Wintward Reot} \boxed{\frac{1}{PLN}} = 1501 \\ \text{Locd} \boxed{\frac{1}{1001}} = 0.3 \\ \text{Wintward Reot} \boxed{\frac{1}{PLN}} = 1501 \\ \text{Locd} \overrightarrow{\frac{1}{1001}} = 0.3 \\ \text{Wintward Reot} \boxed{\frac{1}{PLN}} = 1501 \\ \text{Locd} \overrightarrow{\frac{1}{1001}} = 0.3 \\ \text{Wintward Reot} \overrightarrow{\frac{1}{PLN}} = 1501 \\ $	Cł	nallenge & s	Success		Subject:	Desic	n Calculati	ons		Page:	
Product Calculation (Method 2 - Analytical (Retrow 2 - Relative 1609 & ASCE 7-10, Chapter 27) (Retrow 1609 & ASCE 7-10, Chapter 27) (Retrow 1609 & ASCE 7-10, Chapter 24) (Retrow 1609 & ASCE 7-10, Chapter 24) (Retrow 1609 & ASCE 7-10, Chapter 24, Chapter 24) (Retrow 1600 & ASCE 7-10, Chapter 24, Chapter 24) (Retrow 1600 & ASCE 7-10, Chapter 24, Chapter 24) (Retrow 1600 & ASCE 7-10, Chapter 24, Chap					Casjooa	00012	gir Galoalaa			. ugo:	
Wideschart Reference: IEC 2012, Section 1609 & ASCE 7-10, Chapter 27) Static Wind Speed, V _{an} , (mph) = 10 (ASCE 7-10, Figure 6-1) Building Category = 10 (ASCE 7-10, Table 60-15) Building Category = 1.0 (IBC Table 160-15) Vind Load Importance Factor, N _a = 1.0 (IBC Table 160-15) Topographic Factor, N _a = 0.05 (ASCE 7-10, Table 6-3) Topographic Factor, N _a = 0.00 (ASCE 7-10, Section 6.5.10) Gust effect factor, G = 0.002256K,K _a K _b V _b ^A (ASCE 7-10, Section 6.5.10) Full Importance Factor, K _a = 0.002256K,K _a K _b V _b ^A (ASCE 7-10, Section 6.5.10) Gust effect factor, G = 0.002256K,K _a K _b V _b ^A (ASCE 7-10, Section 6.5.10) Full Importance Factor, K _a = 0.002256K,K _a K _b V _b ^A (ASCE 7-10, Sector 6.5.10) Gust effect factor, G = 0.002 Importance Factor, Fac		Wind Load Calculation (Method 2 - Analytical)									
Vind Velocity PressureBasic Wind Speed, V _{2n} , (mph)=10(ASCE 7-10, Figure 6-1)Exposure Category=8(ASCE 7-10, Section 6.5.6)Wind Load Importance Factor, I _n =0(IEC Table 1604.5)Category=1.0(IEC Table 1604.5)Category=0.0(ASCE 7-10, Table 6-3)Category=0.0(ASCE 7-10, Table 6-4)Velocity Pressure, Q ₂ (Ibff)=0.85Category <td></td> <td></td> <td>(Refere</td> <td>nce: IBC 2</td> <td>012, Section</td> <td>1609</td> <td>& ASCE 7-</td> <td>10, Chapter 2</td> <td>27)</td> <td></td> <td></td>			(Refere	nce: IBC 2	012, Section	1609	& ASCE 7-	10, Chapter 2	27)		
Basic Wind Speed, V_{3s} , (mph) Exposure Category Building Category Wind Load Importance Factor, I_{a} Wind Load Importance Factor, I_{a} Wind Directionality Factor, K_{a} Wind Directionality Factor, K_{a} $K_{a} \in G_{a}$ $K_{a} \in G_{a}$ Wind Load Importance Factor, G_{a} $K_{a} \in G_{a}$ $K_{a} \in G_{a}$	Wind Velocity P	Wind Velocity Pressure:									
Exposure Category Building Category Wind Load Importance Factor, I _n Velocity pressure exposure coefficient, K _n Topographic Factor, K _n Velocity pressure exposure coefficient, K _n Topographic Factor, K _n Velocity Pressure, q _n (lbft ²) Gust effect factor, G $= 0.00256K/K_{n}K_{n}K_{n}^{0}K_{n}^{-1} (ASCE 7-10, Falce 6-4) = 0.055 (ASCE 7-10, Falce 6-4) = 0.055 (ASCE 7-10, Section 6.5.6) = 26.33 Kz (ASCE 7-10, Section 6.5.6) = 0.00256K/K_{n}K_{n}K_{n}^{0}K_{n}^{-1} (ASCE 7-10, Section 6.5.6) = 0.00256K/K_{n}K_{n}K_{n}K_{n}^{0}K_{n}^{-1} (ASCE 7-10, Section 6.5.6) = 0.00256K/K_{n}K_{n}K_{n}K_{n}K_{n}^{0}K_{n}^{-1} (ASCE 7-10, Section 6.5.6) = 0.001256K/K_{n}K_{n}K_{n}K_{n}K_{n}K_{n}K_{n}K_{n}$	Basic Wind	Speed, V _{3c} ,	(mph)			=	110	(ASCE 7-10	. Figure 6-1)	
Building Category = I (IBC Table 1604.5) Wind Load Importance Factor, I _v = I.0 (IBC Table 1604.5) Velocity pressure exposure coefficient, K _x = See Table (ASCE 7-10, Table 6-3) Topographic Factor, K _a = 0.00256F,K _a K _a V ¹ _b (ASCE 7-10, Eq. 6-15) Velocity Pressure, q _x (bff ²) = 0.0256F,K _a K _a V ¹ _b (ASCE 7-10, Eq. 6-15) Cust effect factor, G = 0.85 (ASCE 7-10, Section 65.8) Importance Factor, I _b = 0.85 (ASCE 7-10, Eq. 6-15) See Table (ASCE 7-10, Section 65.8) = 26.33 Kz (ASCE 7-10, Section 65.8) Cust effect factor, G = 0.85 (ASCE 7-10, Eq. 6-15) See Table (ASCE) = 0.85 (ASCE 7-10, Section 65.8) Winth Load Information Pressure Coefficient, C _µ = 0.18 Winth R = 20 ft Minward Wali $\overline{0.15}$ $\overline{0.57}$ $\overline{15.01}$ $\overline{0.60}$ $\overline{0.00}$ $\overline{0.00}$ $\overline{0.00}$ $\overline{0.00}$ $\overline{0.00}$ Vindward Roaf $\overline{1.501}$ $\overline{0.51}$ $\overline{0.50}$ $\overline{0.30}$ $\overline{0.00}$ $\overline{0.00}$ \overline	Exposure C	ategory				=	в	(ASCE 7-10	, Section 6.	, 5.6)	
Wind Load Importance Factor, I_{a} = 1.0 (IBC Table 1604.5) Velocity pressure exposure coefficient, K_{a} = 1.00 (IBC Table 1604.5) Velocity pressure, q_{a} (Ibff ²) = 0.05 (ISC 7-10, Table 6-4) Velocity Pressure, q_{a} (Ibff ²) = 0.05 (ISC 7-10, Table 6-4) Velocity Pressure, q_{a} (Ibff ²) = 0.05 (ISC 7-10, Table 6-4) Gust effect factor, G = 0.05 (ISC 7-10, Table 6-4) Image: the interval pressure q_{a} (Ibff ²) = 0.05 (ISC 7-10, Section 6.5.10) Gust effect factor, G = 0.05 (ISC 7-10, Section 6.5.10) = Image: the interval pressure Coefficient, C_{pi} = 0.18 Windu an orb height = 10.6 ft Internal Pressure Coefficient, C_{pi} = 0.18 Windu Coef IJB = 0.00 0.00 0.00 Vinward Wall $\overline{\frac{1}{2.161}}$ $\overline{\frac{K_{2}}{15.01}}$ $\overline{\frac{Q_{2} \circ q_{0}}{Q_{0}}}$ $\overline{\frac{Cp}{Q_{2} \circ q_{0}}}$	Building Ca	tegory				=	11	(IBC Table	1604.5)		
Velocity pressure exposure coefficient, K_{z} = See Table (ASCE 7-10, Figure 6-4) Wind Directionality Factor, K_{g} = 0.00256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Table 6-3) Gust effect factor, G = 0.00256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Table 6-4) Image: See Table (ASCE 7-10, Table 6-4) = 0.00256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Eq. 6-15) Gust effect factor, G = 0.0256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Section 6.5) Image: Section 6.5.01 = 0.0256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Section 6.5) Image: Section 6.5.01 = 0.0256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Section 6.5) Image: Section 6.5.01 = 0.0256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Section 6.5) Image: Section 6.5.01 = 0.0256K_{x}(K_{u}V_{u}^{1}) (ASCE 7-10, Section 6.5) Image: Section 6.5.01 = 0.18 Height to eave, h_e = 8 ft Height to eave, h_e = 0.18 = 0.16 (BCC_{e}) (ASCE 7-10, Eq 6-17) Image: Section 6.5.01 0.00 0.00 0.00 0.00 0.00 Image: Section 6.5.01 0.00 0.00 0.00 0.00	Wind Load	Importance I	Factor, I_w			=	1.0	(IBC Table [·]	1604.5)		
Topographic Factor, K _n = 1.00 (ASCE 7-10, Figure 6-4) Wind Directionality Factor, K _n = 0.85 (ASCE 7-10, Figure 6-4) Velocity Pressure, q _n (Ib/ft ²) = 0.85 (ASCE 7-10, Figure 6-4) Gust effect factor, G = 0.85 (ASCE 7-10, Figure 6-4) Image: Q _n (Ib/ft ²) = 0.85 (ASCE 7-10, Figure 6-4) Gust effect factor, G = 0.85 (ASCE 7-10, Figure 6-4) Image: Q _n (Ib/ft ²) = 0.85 (ASCE 7-10, Ed, 6-15) = 0.85 (ASCE 7-10, Section 6.5.8) Image: Q _n (Ib/ft ²) = 0.85 (ASCE 7-10, Section 6.5.8) Image: Q _n (Ib/ft ²) = 0.85 (ASCE 7-10, Section 6.5.8) Image: Q _n (Ib/ft ²) = 0.18 Image: Q _n (Ib/ft ²) 15.31 Internal Pressure Coefficent, C _{pi} = 0.18 Image: Q _n (Ib/ft ²) 15.31 Image: Q _n (Ib/ft ²) 15.31 Image: Q _n (Ib/ft ²)	Velocity pre	ssure expos	ure coefficie	ent, K_z		=	See Table	(ASCE 7-10	, Table 6-3)		
Wind Directionality Factor, Kq = 0.85 (ASCE 7-10, Table 6-4). Velocity Pressure, q _k (lbft ²) = 0.00236K/, Kq, V ² , Q, (ASCE 7-10, Section 6.5.10) Gust effect factor, G = 0.85 (ASCE 7-10, Section 6.5.10) Image: A start of the sta	Topographi	c Factor, K_{zt}				=	1.00	(ASCE 7-10	, Figure 6-4)	
Velocity Pressure, q_{z} (Jbft ²) = 0.00256K, K_{x} K_{y} V^{2} L_{y} (ASCE 7-10, Eq. 6-15) Gust effect factor, G = 0.83 (ASCE 7-10, Section 6.5.10) $v = 0$	Wind Direct	ionality Fact	or, K d			=	0.85	(ASCE 7-10	, Table 6-4)	•	
$\begin{array}{c} 26.33 \ \text{Kr} (\text{ASCE } 7-10, \text{Section } 6.5.10) \\ \text{Gust effect factor, G} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	Velocity Pre	essure a . (lt	p/ft^2)			=	0.00256K_I	<u>к</u> .,К.,V ² I	(ASCF 7-10). Fa. 6-15)	
Gust effect factor, G = 0.85 (ASCE 7-10, Section 6.5.8) Image: construction of the sector of the sect		4 2, (,,			=	26.33 Kz	(ASCF 7-10	Section 6	5,10)	
$ \begin{array}{c} \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ \\ & \end{array} \\ \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ \\ \\ & \begin{array}{c} & \end{array} \\ \\ & \end{array} \\ \\ \\ & \begin{array}{c} & \end{array} \\ \\ & \end{array} \\ \\ \\ \\ & \begin{array}{c} & \end{array} \\ \\ \\ & \end{array} \\ \\ \\ \\ \\ & \end{array} \\ \\ \\ \\ \\ \end{array} \\ \\ \\ \\$	Gust effect	factor, G				=	0.85	(ASCE 7-10	, Section 6.	5.8)	
$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} $		q _h GC _p			stance			Width, B =	20	ft	
Height to eave, $h_{e} = 8$ ft Height to ridge, $h_{r} = 13.5$ ft Mean roof height = 10.8 ft $\theta = 22.6$ deg q_{hr} (lbff ²) = 15.01 L/B = 0.7 Internal Pressure Coefficent, $C_{pi} = 0.18$ h/L = 0.7 fr = 0.68 h/L = 0.7 fr = 0.60 fr = 0.000 0.000 0.08 fr = 0.000 0.000 0.000 fr = 0.18 fr = 0.18 fr = 0.8 fr = 0.8 fr = 0.8 fr = 0.8 fr = 0.8 h/L = 0.7 fr = 0.8 fr = 0.18 fr = 0.18			-	qh GCp	SV/ An	GCp		Length, L =	16	ft	
$\begin{array}{c} \underset{a_{2}, \underset{b_{1}, \underset{c_{2}, \underset{c_{3}, \underset{c_{4}, \underset{c_{1}, \underset{1}, \underset{c_{1}, \underset{c_{1}, \atop{1}, \atop_{1}, \atop_{1}, \atop_{1}, \atop_{1}, \atop$				- <u>- +</u>		-	Height f	to eave, h =	8	ft	
$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} $			-			-	Height	to ridge, h _r =	13.5	ft	
$\begin{array}{c cccc} & & & & & & & & & & & & & & & & & $	q _z GC _p		qh GCp №		_	-	Mean	roof height =	10.8	ft	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				gz GC,		9 h G	9C _p	θ =	22.6	deg	
PLAN ELEVATION L/B = 0.8 h/L = 0.7 Internal Pressure Coefficent, C_{pi} = 0.18 μ_{i} GC _p , q_{i} GC _{pi} = 2.30 $p = qGC_{p} - q_{i}$ (GC _{pi}) (ASCE 7-10, Eq 6-17) WIFRS Pressure: Winward Wall Height X/2 qz or qh Cp 0 0.00 0.00 0.88 0 0 0.00 0.00 0.88 0 0 0.00 0.0		qh GCp	¥.					q_{h} , (lb/ft ²) =	15.01		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		PLAN		EI	EVATION		L/B =	• 0.8			
Internal records occurrently, g_{μ}	Internal Pre	ssure Coeffi	cent C .	=	0 18		n/L =	• 0.7 ● 0.GC	=	2 30	
WWFRS Pressure: Winward Wall Height Kz qz or qh Cp Z, (ft)	intornal i ro		oont, op		0.10		$p = qGC_p$ -	• q _i (GC _{pi})	(ASCE 7-10), Eq 6-17)	
Height Kz qz or qh Cp Z, (ft)	MWFRS Pressur	re:				_			•	. ,	
Z, (ft) (+GCpi) (-GCpi) Wind Load Winward Wall 0-15 0.57 15.01 0.8 0.00		Height	Kz	$\mathbf{q}_{\mathbf{Z}} \mathbf{or} \mathbf{q}_{\mathbf{h}}$	Ср		qGC_p	Net Pressu	ure (p), psf	Total	
Winward Wall $0 - 15$ 0.57 15.01 0.8 0 0.00 0.00 0.8 0 0.00 0.00 0.8 0 0.00 0.00 0.8 0 0.00 0.00 0.8 0 0.00 0.00 0.8 0 0.00 0.00 0.00 0.00 0 0.00 0.00 0.00 0.00 0 0.00 0.00 0.00 0.00 0 0.00 0.00 0.00 0.00 0 0.00 0.00 0.00 0.00 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.01 -0.6 -7.65 9.95 -5.36 0 0.01 15.01 -0.3 -7.65 -9.18 $(Where h = 4 ft)$ $4 ft$ -11.48 -13.78		Z, (ft)						(+GCpi)	(-GCpi)	Wind Load	ł
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Winward Wall	0-15	0.57	15.01	0.8		10.21	7.91	12.50	/ 15.31	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		0	0.00	0.00	0.8	_	0.00	0.00	0.00	0.00	
0 0.00 0.00 0.8 Leeward Wall All 15.01 -0.4 Side Wall All 15.01 -0.7 Windward Roof - 15.01 -0.6 Leeward Roof - 15.01 -0.6 Horizontal Distance from windward edge -7.65 9.95 -5.36 Horizontal Distance from windward edge -7.65 -9.95 -5.36 Where h = 4 ft) -4 ft) -4 ft) Vertical Roof = 6.28 psf or Horizontal Roof = 1.68 psf or OR Not less than (10psf)xA _f -10.9 -13.78 psf		0	0.00	0.00	0.8	_	0.00	0.00	0.00	0.00	_
Leeward Wall All 15.01 -0.4 Side Wall All 15.01 -0.7 Windward Roof - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 Horizontal Distance from windward edge -7.65 -9.95 Not best han (10psf)xA _f -0.3 Vertical Wall = 15.31 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf		0	0.00	0.00	0.8	_	0.00	0.00	0.00	0.00	_
Leeward Wall All 15.01 -0.4 Side Wall All 15.01 -0.7 Windward Roof - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 Horizontal Distance from windward edge -7.65 -9.95 Not Phane 15.01 -0.5 > 2h 15.01 -0.3 (Where h = 4 ft.) -4.08 Vertical Wall = 15.31 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f		A 11		45.04	0.4	_	E 40	7.40	/ 0.01		_
Side Wain All 13.01 -0.7 Windward Roof - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.09 - 15.01 -0.6 - 15.01 -0.09 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 - 15.01 -0.6 Horizontal Distance from windward edge -7.65 -9.95 0 to h 15.01 -0.9 h to 2h 15.01 -0.3 (Where h = 4 ft) -4.08 -3.83 -6.12 -1.53 Or -13.78 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f or	Leeward Wall	All		15.01	-0.4	_	-5.10	-7.40	-2.81		-
Vindward root - 10.01 -0.0 Leeward Roof - 15.01 -0.09 - 15.01 -0.6 Horizontal Distance from windward edge 0 to h 15.01 -0.9 h to 2h 15.01 -0.5 > 2h 15.01 -0.3 (Where h = 4 ft) Vertical Wall = 15.31 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f	Windward Roof	All		15.01	-0.7	-	-7.65	-11/23	-0.03	0.00	-
Leeward Roof $-$ 15.01 0.06 Horizontal Distance from windward edge 0 to h 15.01 0.09 h to 2h 15.01 0.03 2h 15.01 0.3 (Where h = 4 ft) Vertical Wall = 15.31 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f	Williaward 1001	-		15.01	-0.0		-1.15	-3 44	-0.00	0.00 ₄ 6.51	-
Horizontal Distance from windward edge 0 to h 15.01 -0.9 h to 2h 15.01 -0.5 $2h$ 15.01 -0.3 (Where h = 4 ft) Vertical Wall = 15.31 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f	Leeward Roof	_		15.01	-0.6	-	-7.65	-9.95	-5.36	0.01	-
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Horizontal [Distance from	n windward	edge						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		0 to h		15.01	-0.9		-11.48	/ -13.78	-9.18	1	
> 2h 15.01 -0.3 -3.83 -6.12 -1.53 (Where h = 4 ft)		h to 2h		15.01	-0.5		-6.38	8.81	-4.08		
(Where h = 4 ft) Vertical Wall = 15.31 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f		> 2h		15.01	-0.3		-3.83	-6.12	-1.53		
Vertical Wall = 15.31 psf Vertical Roof = 6.28 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f		(Where h =	4	ft)			\square				
Vertical Roof = 6.28 psf or -13.78 psf Horizontal Roof = 1.68 psf OR Not less than (10psf)xA _f		Vertical Wa	all =	15.31	psf 🖌	//					
Horizontal Roof = 1.68 psf × OR Not less than (10psf)xA _f		Vertical Ro	of =	6.28	psf 🖌	or	-13.78	psf			
OR Not less than (10psf)xA _f		Horizontal	Roof =	1.68	psf 🖌						
	OR	Not less th	an (10psf)x	A _f							



	Project:	By:	Page:
152 ENGINEERS	5 Location:	Date:	
ivil & Structural Challenge & Succes	SS Client:	Check:	Job No:
Green Design For Our Environment	Subject:	Date:	
LATCRAL LOAD	A SHEAR WALL DESIGN		
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	Page 18 of 21		

	Project:	By: Page:
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Green Design for Our Environmen	Subject:	Date:
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-) ETW PIKEC		
	$W_{W} = 104.1$ plt	
	We= (3.0 psf) (20') =	60 plf
	17.9	
	Ww = 104.1 plt (Ws = 1	60 plf)
	Ø A D-16	
	L = 10	
		017 # C400#)
V (#)	833 (4801)	833 (480)
SHEAR WALL	16.6	7' + 7' = 14'
	•••••	
		1- 11 (24-04)
UNIT SHEAR (PUT)	54 plt (31 plt)	60 plf (34 plf)
SHEAR WALL	(SW 1)	(SW1)
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HULV-DOWN	873 × 0 = 444#	60x 1 x 8 = 5 7 4
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	Page 19 of 21	

Project:	4027 93 rd Ave SE (#003100-0095)	Date:	May 18, 2020
Location:	Mercer Island, WA	Prepared By:	S. Cho
CS2 No:	2000-G	Page	

Appendix

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King County Districts and Development Conditions for parcel 0031000095

Parcel number	0031000095	Drainage Basin	Mercer Island	ЯV	
Address	4027 93RD AVE SE	Watershed	Cedar River / Lake Washington	$\sim T$	5 R
Jurisdiction	Mercer Island	WRIA	Cedar-Sammamish (8)	24	\diamond
Zipcode	98040	PLSS	NE - 18 - 24 - 5		
Kroll Map page	89	Latitude	47.57354	4	
Thomas Guide page	596	Longitude	-122.21543	2	ت کر ج
				Map	Sat

King County Electoral districts

Voting district	M-I 41-0770	Fire district	does not apply
King County Council district	District 6, <u>Claudia Balducci</u>	Water district	does not apply
	(206) 477-1006 == [=]	Sewer district	does not apply
Congressional district	9	Water & Sewer district	does not apply
Legislative district	41	Parks & Recreation district	does not apply
School district	Mercer Island #400	Hospital district	does not apply
Seattle school board district	does not apply (not in Seattle)	Rural library district	Rural King County Library System
District Court electoral district	Northeast	Tribal Lands?	No
Regional fire authority district	does not apply		

King County planning and critical areas designations*

King County zoning	NA, check with	Urban Unincorporated Status	does not apply
	jurisdiction	Rural town?	No
Development conditions	None	Water service planning area	City of Mercer Island
Comprehensive Plan	does not apply	Transportation Concurrency Management	does not apply
Urban Growth Area	Urban	Forest Production district?	No
Community Service Area	does not apply	Agricultural Production district?	No
Community Planning Area	Eastside	Snoqualmie Valley watershed improvement	No
Coal mine hazards?	Check with jurisdiction	district?	
Erosion hazards?	Check with jurisdiction	Critical aquifer recharge area?	None mapped
Landslide hazards?	Check with jurisdiction	Wetlands at this parcel?	Check with jurisdiction
Seismic hazards?	Check with jurisdiction	Within the Tacoma Smelter Plume?	Under 20 ppm
100-year flood plain?	None mapped		Estimated Arsenic Concentration in
· ·			Soil

*Most of these designations apply only to unincorporated areas

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