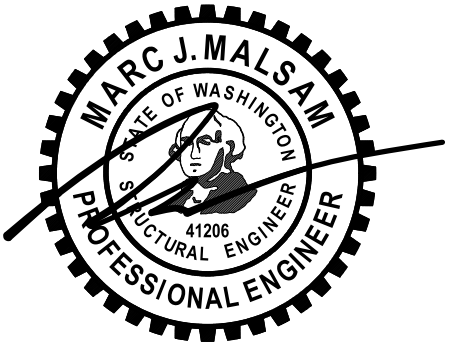
STRUCTURAL CALCULATIONS FOR:

4103 78TH AVE SE

ARCHITECT: 5FT2 STUDIO ARCHITECTS

MARCH 21, 2025



MALSAM TSANG
STRUCTURAL ENGINEERING

122 S JACKSON ST | SUITE 210 | SEATTLE WA 98104 | 206.789.6038 T | 206.789.6042 F

DESIGN CRITERIA IBC 2021

DEAD LOADS

ROOF		ROOF DECK		FLOOR	
Composition	2.5 psf	Composition	2.5 psf	3/4" Plywood	2.4 psf
3/4" Plywood	2.4 psf	3/4" Plywood	2.4 psf	TJI @ 16" o.c.	2.3 psf
Truss @ 24" o.c.	3.0 psf	TJI @ 16" o.c.	2.3 psf	Flooring	1.0 psf
Insulation	1.0 psf	1 1/2" Rigid	2.3 psf	Gyp Board (5/8")	2.8 psf
Gyp Board (5/8")	2.8 psf	Gyp Board (5/8")	2.8 psf	MEP	1.5 psf
MEP	1.5 psf	MEP	1.5 psf		
Solar Panels	5.0 psf	Palletized Deck	5.0 psf		
Total	18.2 psf	Total	18.8 psf	Total	10.0 psf
Use	20.0 psf	Use	20.0 psf	Use	15.0 psf

LIVE LOADS/OCCUPANCY

		ROOF LIVE		FLOOR LIVE		DECK LIVE	
Risk Category	II	Snow =	25 psf	Occupancy =	40 psf	Occupancy =	60 psf
Roof Deck	Yes	Roof Deck =	60 psf	Stair/Corridor =	40 psf		
Common Access	No						

SEISMIC CRITERIA ASCE 7-16 Ch. 11 & Ch. 12

Imp. Factor = 1.00 | Seismic Ht, hn= 34 ft

Site Class = D(Default) | T, Building= 0.3

R Value = 6.5 | Ts= 0.5

Geo. Ground Hazard? **No w/ASCE 11.4.8 Excep's**

S_s =	1.421		F_a =	1.200	Table 11.4-1
S_1 =	0.494		F_v =	NULL	Table 11.4-2
S_{ms} =	1.705	x 2/3 =	S_{ds} =	**1.137**	Eqn. 11.4-3
S_{m1} =	NULL	x 2/3 =	S_{d1} =	**NULL**	Eqn. 11.4-4

C_{SULT} =	**0.175**
C_{SALL} =	**0.123**

T/Ts= 0.538 ≤ 1.5

Okay, Cs Eqn. 12.8-2

SEISMIC WEIGHT ASCE 7-16 12.7.2

Partitions = 15 psf

***Roof weight = 1/2 Partition + Roof DL**

***Floor weight = Full Partition + Floor DL**

ROOF 26.0 psf ROOF DECK 26.5 psf

FLOOR 25.0 psf

SEISMIC DESIGN CATEGORY IBC 1613.2.5

Seismic DC= D

WIND CRITERIA ASCE 7-16 Ch. 27 Directional Procedure

V = 98 mph | K_d = 0.85

Exposure = C | G = 0.85

h = 34 ft | K_{zt} = 1.00 ***See Kzt Worksheet**

Roof Slope = 4 : 12 = 18 °

PRESSURE COEFFICIENTS (Cp)

Windward Wall = 0.8 | Windward Roof = 0.2

Leeward Wall = -0.5 | Leeward Roof = -0.6

PRESSURE (PSF) $q = 0.00256 K_z K_{zt} K_d V^2$

Ht	K_z	q_z	$0.6xq_z$ [1]	q_h	P_{WW}	P_{LW}	P_{WALL}	P_{ROOF}
0-15	0.85	17.8	10.7		7.2	5.4	**12.7**	
15-20	0.90	18.8	11.3		7.7	5.4	**13.1**	
20-25	0.94	19.6	11.8		8.0	5.4	**13.5**	
25-30	0.98	20.5	12.3		8.4	5.4	**13.8**	
30-35	1.02	21.3	12.8	12.8	8.7	5.4	**14.1**	**8.7**
35-40	1.04	21.7	13.0		8.9	5.4	**14.3**	
40-45	1.07	22.4	13.4		9.1	5.4	**14.6**	
45-50	1.09	22.8	13.7		9.3	5.4	**14.7**	

[1] Per ASCE 7-16 2.4.1 Basic Combinations

MALSAM TSANG STRUCTURAL ENGINEERING

122 South Jackson
Suite 210
Seattle, WA 98104
t 206.789.6038
f 206.789.6042

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QTM
Design

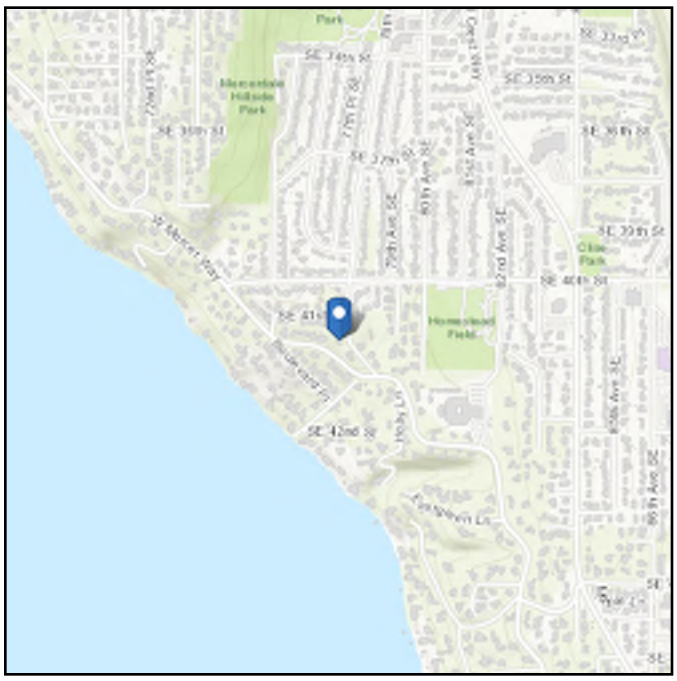
DC1
Sheet

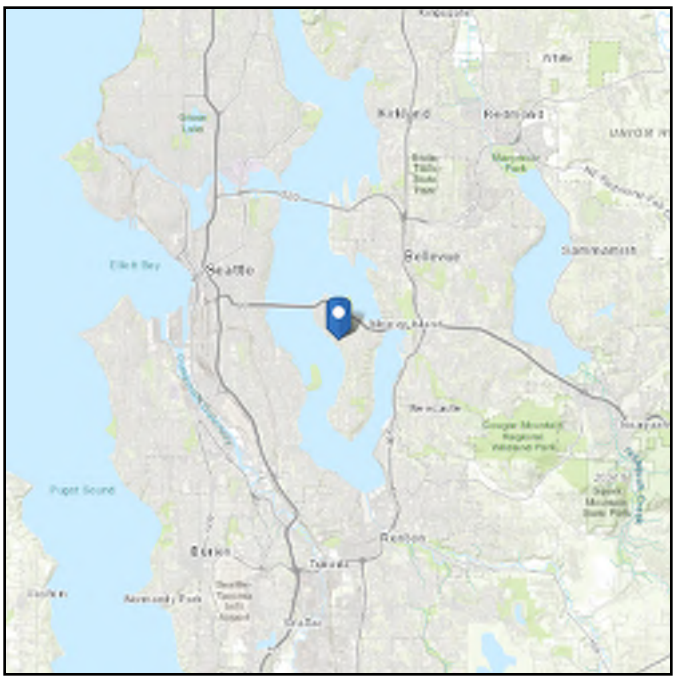
ASCE Hazards Report

Address:
4103 78th Ave SE
Mercer Island, Washington
98040

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

Latitude: 47.573132
Longitude: -122.235406
Elevation: 197.2079027246947 ft (NAVD 88)





Wind

Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	74 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Thu Mar 06 2025

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

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

Seismic

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

Results:

S_S :	1.421	S_{D1} :	N/A
S_1 :	0.494	T_L :	6
F_a :	1.2	PGA :	0.608
F_v :	N/A	PGA_M :	0.73
S_{MS} :	1.705	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.137	C_v :	1.384

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

Data Accessed: Thu Mar 06 2025

Date Source: USGS Seismic Design Maps

Snow

Results:

Mapped Elevation:

Data Source:

Date Accessed: Thu Mar 06 2025

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

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

Statutory requirements of the Authority Having Jurisdiction are not included.

Site is outside ASCE/SEI 7-16, Table 7.2-5 boundaries. For ground snow loads in this area, see SEAW Snow Load Analysis for Washington, 2nd Ed. (1995), Structural Engineers Association of Washington, Seattle, WA.

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

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

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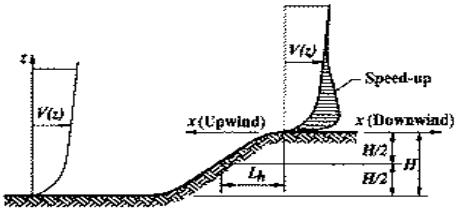
Kzt WORKSHEET

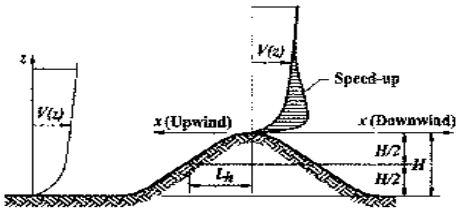
ASCE 7-10 26.8.1

Exposure =	C
Bldg Height =	34 ft
Site Elev =	150 ft

Topographic Factor, K_{zt}
Figure 26.8-1



ESCARPMENT



2-D RIDGE OR 3-D AXISYMMETRICAL HILL

PROFILE 1	PROFILE 2	-- NOT USED --	-- NOT USED --
Shape = 2-D Escarp	**Shape =** 2-D Escarp		
H = 355 **ft**	**H =** 275 **ft**		
H/2 = 178 **ft**	**H/2 =** 138 **ft**		
L_h = 2640 **ft**	**L_h =** 3960 **ft**		
x = 4224 **ft**	**x =** 5016 **ft**		
z = 34 **ft**	**z =** 34 **ft**		
Unobstructed[1] Yes	**Unobstructed[1]** Yes		
Above Terrain[2] Yes	**Above Terrain[2]** Yes		
Upper Half[3] No	**Upper Half[3]** Yes		
Site to Crest Upwind	**Site to Crest** Upwind		
H/Lh[4] 0.134	**H/Lh[4]** 0.069444		
Calc Kzt ? NO	**Calc Kzt ?** NO		
K_1: $(K_1/H/L_h)$	K_1: $(K_1/H/L_h)$		
Coefficient = 0.85	Coefficient = 0.85		
K_1 = N/A	**K_1 = N/A**		
K_2: $(1 - \lvert x\rvert/\mu L_h)$	K_2: $(1 - \lvert x\rvert/\mu L_h)$		
μ = 1.5 (Figure 26.8-1)	μ = 1.5 (Figure 26.8-1)		
K_2 = N/A	**K_2 = N/A**		
K_3: $e^{-\gamma z/Lh}$	K_3: $e^{-\gamma z/Lh}$		
γ = 2.5 (Figure 26.8-1)	γ = 2.5 (Figure 26.8-1)		
K_3 = N/A	**K_3 = N/A**		
$K_{zt} = (1 + K_1 K_2 K_3)^2$	$K_{zt} = (1 + K_1 K_2 K_3)^2$		
K_{zt} = 1.00	**K_{zt} = 1.00**		

1 ***Hill, ridge, or escarpment is isolated and unobstructed upwind by other similar topographic features of comparable height for 100H or 2 miles (whichever is less) ASCE 7-10 26.8.1***

2 ***The hill, ridge, or escarpment protrudes above the height of the upwind terrain features within a 2-mi radlus in any quadrant by a factor of two or more. ASCE 7-10 26.8.1***

3 ***The structure is located as shown in Fig. 26.8-1 in the upper one-half of a hill or ridge or near the crest of an escarpment. ASCE 7-10 26.8.1***

4 ***For $H/L_h > 0.5$, assume $H/L_h = 0.5$ for K_1 and $L_h = 2H$ for K_2 and K_3***

Kzt = 1.00

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f 206.789.6042

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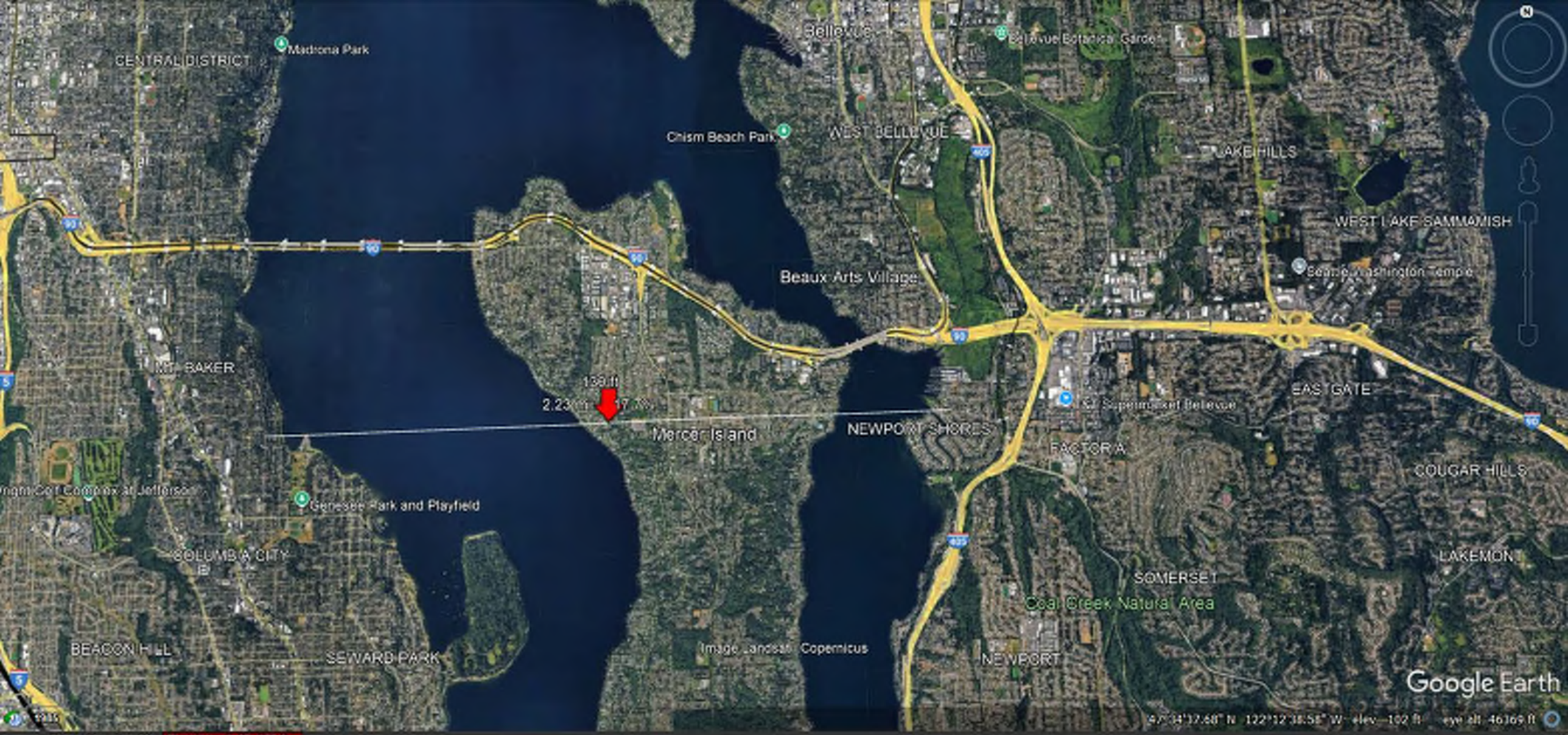
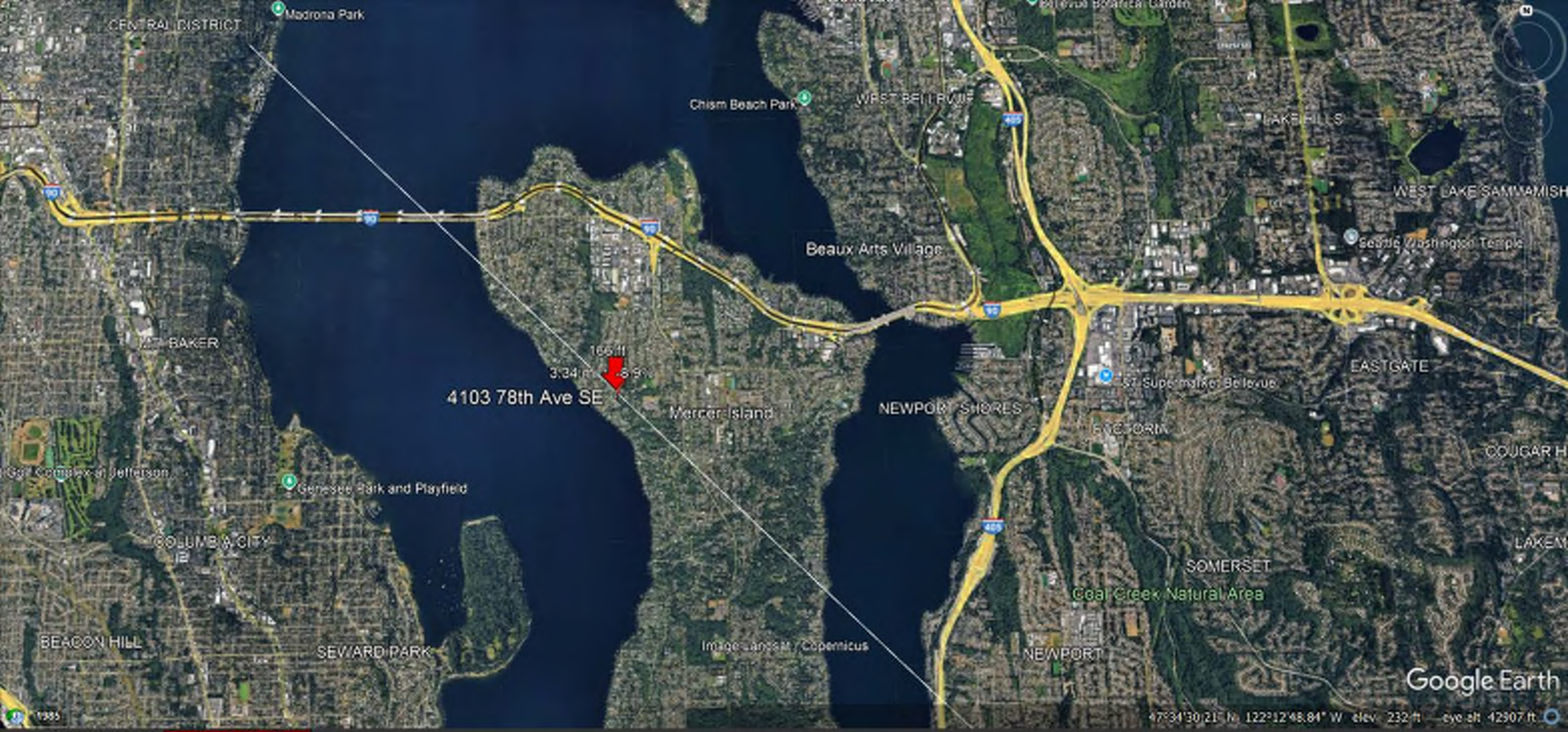
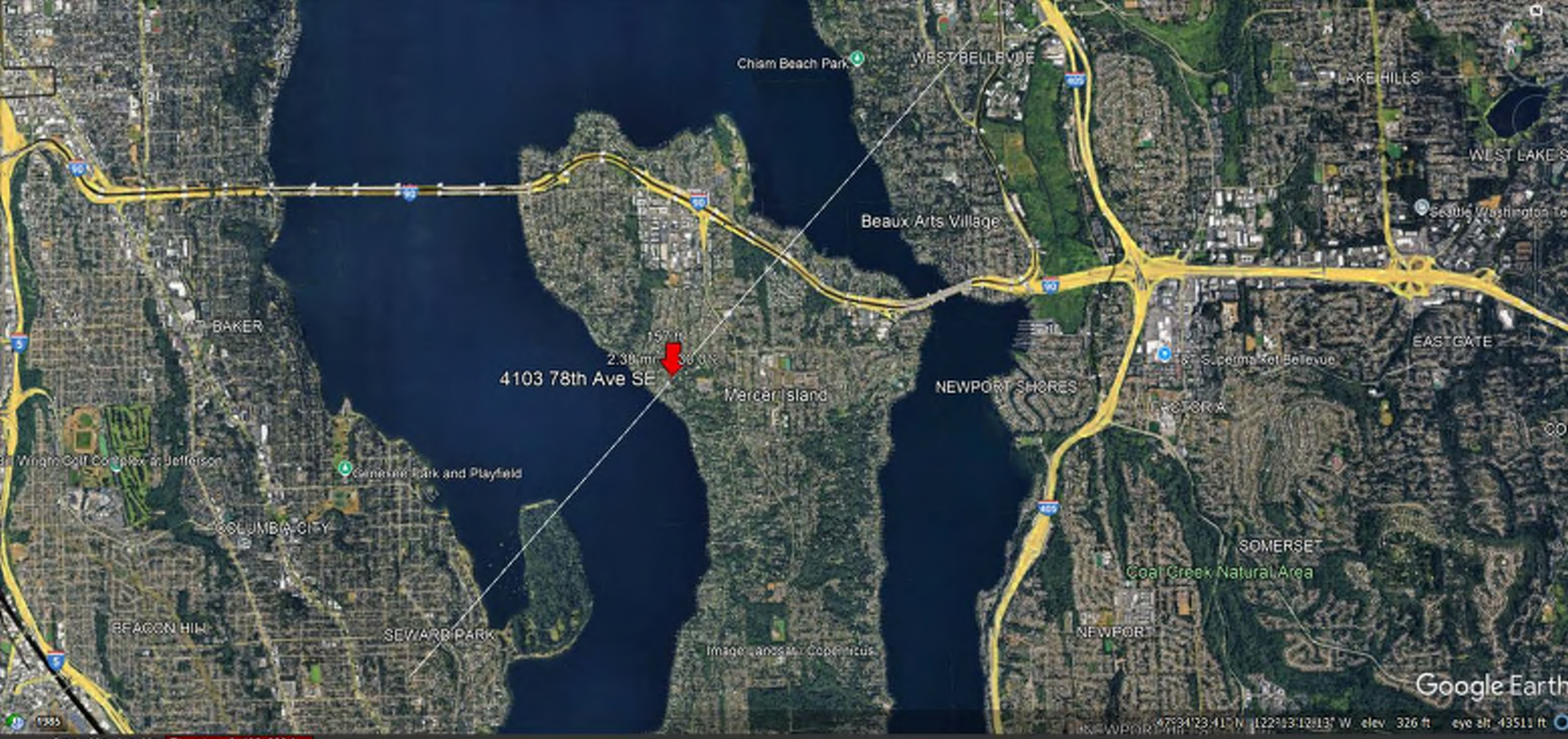

CENTRAL DISTRICT
Madrona Park
Bellevue
Bellevue Botanical Garden
Chism Beach Park
WEST BELLEVUE
LAKE HILLS
WEST LAKE SAMMAMISH
Beaux Arts Village
MT. BAKER
139 ft
2.23 mi
17.7%
Mercer Island
NEWPORT SHORES
EASTGATE
FACTORIA
COUGAR HILLS
Genesee Park and Playfield
SOUTH BELLEVUE
SOMERSET
Coal Creek Natural Area
LAKEMONT
BEACON HILL
SEWARD PARK
Image Landsat / Copernicus
NEWPORT
Google Earth


Graph: Min, Avg, Max Elevation: -0, 95, 355 ft
Range Totals: Distance: 4.46 mi Elev Gain/Loss: 481 ft, -589 ft
Max Slope: 37.0%, -41.0% Avg Slope: 3.0%, -6.0%
355 ft
300 ft
250 ft
200 ft
150 ft
100 ft
50 ft
0 ft
120 ft
17.7%
0.5 mi
1 mi
1.5 mi
2 mi
2.23 mi
2.5 mi
3 mi
3.5 mi
4 mi
4.46 mi


CENTRAL DISTRICT
Madrona Park
Chism Beach Park
WEST BELLEVUE
LAKE HILLS
WEST LAKE SAMMAMISH
Seattle Washington Temple
Beaux Arts Village
BAKER
4103 78th Ave SE
Mercer Island
NEWPORT SHORES
EASTGATE
COUGAR H
Genesee Park and Playfield
COLUMBIA CITY
SOMERSET
Coal Creek Natural Area
BEACON HILL
SEWARD PARK
Image Landsat / Copernicus
NEWPORT
Google Earth
47°34'30.21" N 122°12'48.84" W elev 232 ft eye alt 42507 ft


Graph: Min Avg Max Elevation: -2, 109, 375 ft
Range Totals: Distance: 6.28 mi Elev Gain/Loss: 1659 ft -948 ft Max Slope: 44.1% -38.3% Avg Slope: 4.7% -6.2%
375 ft
300 ft
250 ft
200 ft
150 ft
100 ft
50 ft
-2 ft
166 ft
-8.9%
3.34 mi
0.5 mi
1 mi
1.5 mi
2 mi
2.5 mi
3 mi
4 mi
4.5 mi
5 mi
5.5 mi
6 mi
6.28 mi



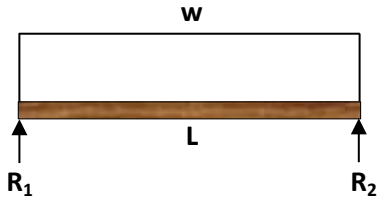
Graph: Min, Avg, Max Elevation: -0, 106, 323 ft

Range Totals: Distance: 5.14 mi Elev Gain/Loss: 870 ft, -1087 ft Max Slope: 46.3%, -55.0% Avg Slope: 6.3%, -6.9%

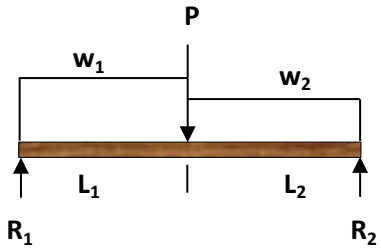
TYPICAL BEAM CASES

***ASSUME CASE 1 FOR ALL BEAMS U.N.O.**

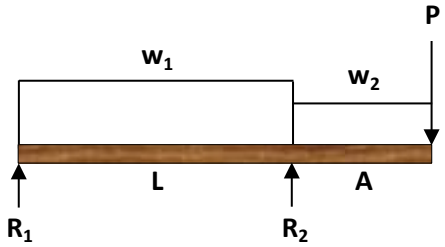
CASE #1: (C1)



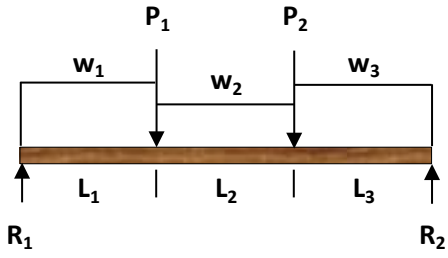
CASE #2: (C2)



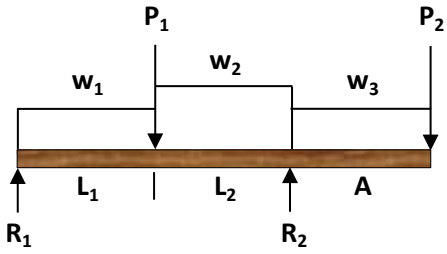
CASE #3: (C3)



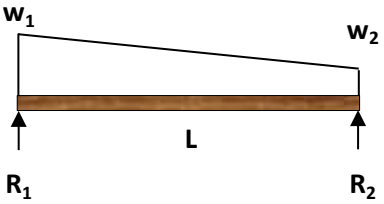
CASE #4: (C4)



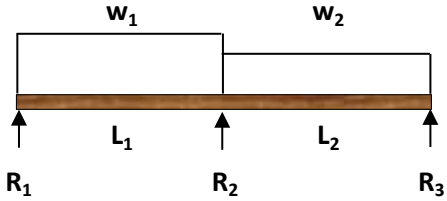
CASE #5: (C5)



CASE #6: (C6)



CASE #7: (C7)



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f 206.789.6042

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QTM	Design
DC6	Sheet

LATERAL ANALYSIS

Seismic:

Level	Area (ft^2)	Unit Wt (psf)	Weight (kips)	Avg Ht (ft)	Wi·Hi (k-ft)	Distrib. (%)	Shear, V (kips)	Uniform (plf)
Roof Deck	2060	27	55.62	34	1891.08	64%	**10.12**	230 / 170
Level 2	1700	25	42.50	18.5	786.25	26%	**4.21**	96 / 71
Level 1	1250	25	31.25	9.5	296.88	10%	**1.59**	36 / 57

Totals: 129.37 k 2974.21 100% **15.92 k**

Base Shear:

$V = C_S \times W$

= 0.175 x 129.37k = 22.64 kips (Ultimate)

= 0.123 x 129.37k = 15.92 kips (Allowable)

Wind:

North-South Exposure

Level	Trib (ft)	Wind Load (#/ft)	Length (ft)	Shear, V (kips)	
Roof Deck	11.5	4' x 14.1 + 5' x 13.8 + 2.5' x 13.5 = 160 plf	44	**7.04**	EQ
Level 2	9	2.5' x 13.5 + 5' x 13.1 + 1.5' x 12.7 = 119 plf	44	**5.24**	
Level 1	9	9' x 12.7 = 115 plf	44	**5.06**	

17.34 k

East-West Exposure

Level	Trib (ft)	Wind Load (#/ft)	Length (ft)	Shear, V (kips)	
Roof Deck	11.5	4' x 14.1 + 5' x 13.8 + 2.5' x 13.5 = 160 plf	59.5	**9.52**	EQ
Level 2	9	2.5' x 13.5 + 5' x 13.1 + 1.5' x 12.7 = 119 plf	59.5	**7.08**	
Level 1	9	9' x 12.7 = 115 plf	28	**3.22**	

19.82 k

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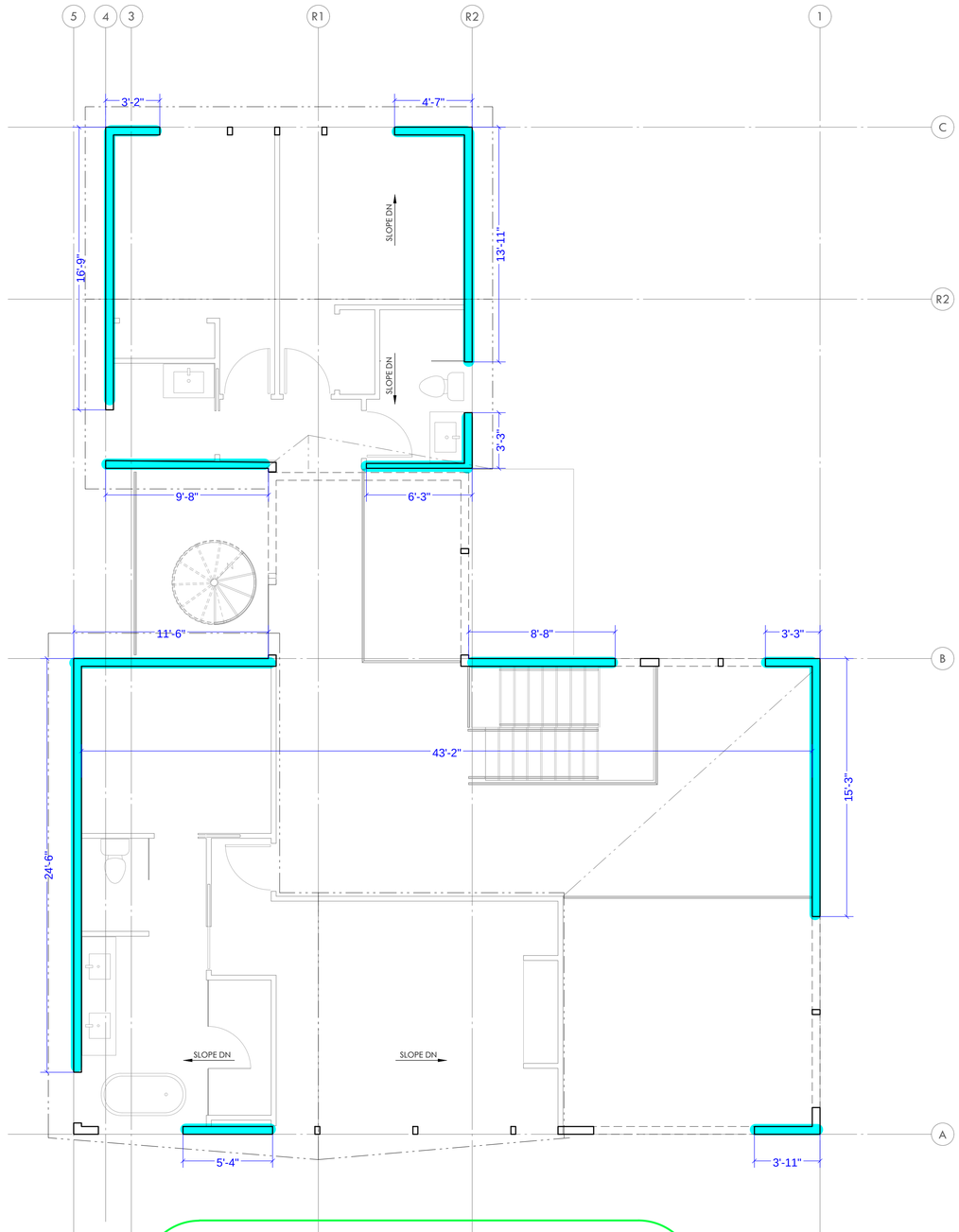


ROOF SHEARWALL KEY PLAN

ROOF FRAMING PLAN

LEVEL 2 WALLS SHOWN SOLID

MALSAM TSANG STRUCTURAL ENGINEERING
122 S JACKSON ST - SUITE 210
SEATTLE, WA 98104 - 206.789.6038

4103 78TH AVE SE
MERCER ISLAND, WA

R.C. J. MALSAM — PRELIMINARY NOT FOR CONSTRUCTION — PROFESSIONAL ENGINEER

PROJECT NO	0496.2025.02.01
PROJECT MANAGER	IHL
DRAWN	RAP
ENGINEER	QUINN MACKENZIE
	206.637.1380
	QUINNM@MALSAM-TSANG.COM

REV	DESCRIPTION	DATE
	PERMIT SET	X.X.XX

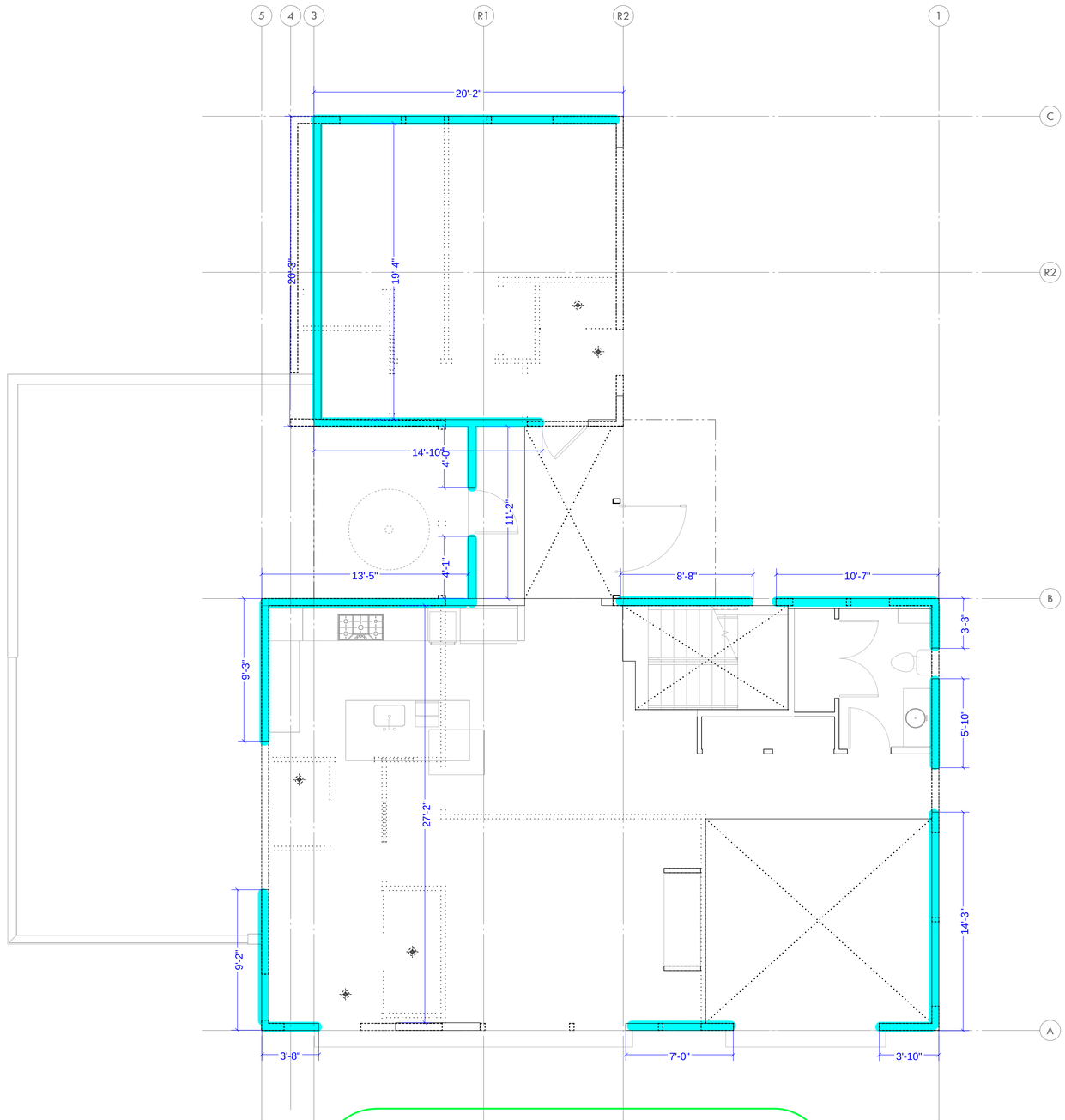
ARCH	5fi2 STUDIO ARCHITECTS
	425.287.1567
CLIENT	ZHANG + HOU

ROOF FRAMING PLAN

S2.3

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

Printed For: Inbip
Printed Date: Feb 27, 2025 - 8:24am



LEVEL 2 SHEARWALL KEY PLAN

(E)HEADER/BEAM

(X) NUMBER OF BUILT UP STUDS

PLUMBING PENETRATION ABOVE

LEVEL 2 FLOOR FRAMING PLAN

LEVEL 2 WALLS SHOWN DASHED
LEVEL 1 WALLS SHOWN SOLID

Plotted By: kelly
Plotted Date: Feb 27, 2025 - 8:24am

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DRAWN	RAP
ENGINEER	QUINN MACKENZIE
	206.637.1380
	QUINNM@MALSAM-TSANG.COM

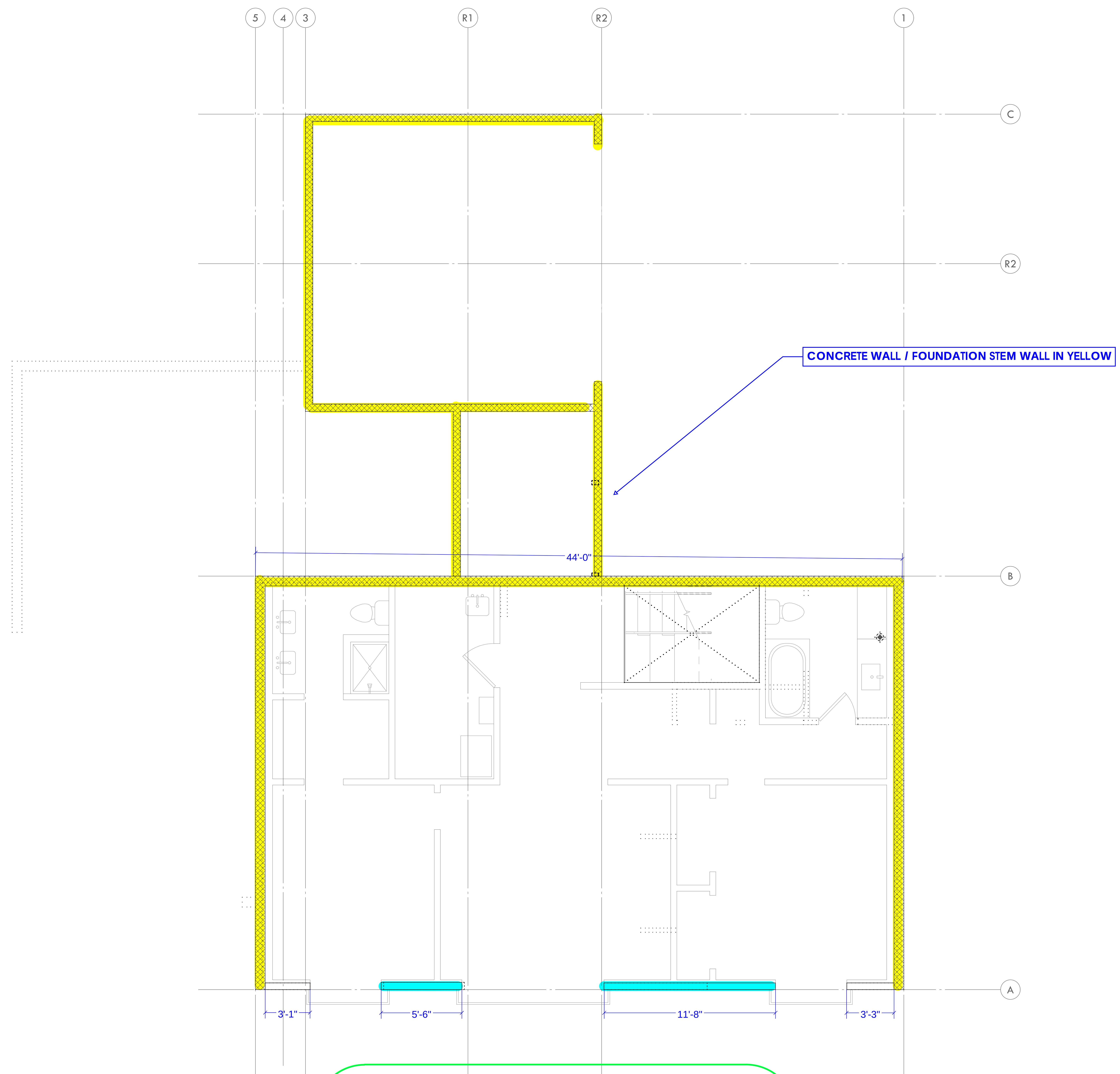
REV	DESCRIPTION	DATE
	PERMIT SET	X.X.XX

ARCH	5fr2 STUDIO ARCHITECTS
	425.287.1567
CLIENT	ZHANG + HOU

LEVEL 2 FLOOR FRAMING PLAN

S2.2

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



LEVEL 1 SHEARWALL KEY PLAN

(E)SPAN AND EXTENTS
HEADER/BEAM BELOW FRAMING - TYP
(E)HEADER/BEAM
(x) NUMBER OF BUILT UP STUDS
PLUMBING PENETRATION ABOVE

LEVEL 1 FLOOR FRAMING PLAN

LEVEL 1 WALLS SHOWN DASHED
BASEMENT WALLS SHOWN SOLID

MALSAM TSANG STRUCTURAL ENGINEERING
122 S JACKSON ST - SUITE 210
SEATTLE, WA 98104 - 206.789.6038

4103 78TH AVE SE
MERCER ISLAND, WA

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT NO	0496.2025.02.01
PROJECT MANAGER	IHL
DRAWN	RAP
ENGINEER	QUINN MACKENZIE 206.637.1380 QUINNM@MALSAM-TSANG.COM

REV	DESCRIPTION	DATE
	PERMIT SET	X.X.XX

ARCH	5ft2 STUDIO ARCHITECTS 425.287.1567
CLIENT	ZHANG + HOU

LEVEL 1 FLOOR FRAMING PLAN

S2.1

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

North-South Exposure — **Roof Deck**

1 W 160
E (230)

West — **East**

Left Offset: 44

Plt Ht: 9	1	2	3	4	5	6	7
Add P:							
R:	3.52 (5.06)	3.52 (5.06)					
PLt Ht:							
L:	41.25	15					
L(min):							
V:	86 (123)	235 (338)					
SW:	SW6	SW4					
OT1:	0.77 (1.11)	2.12 (3.04)					
HD1:	CS16	(2)CS16					
H:W:	-	-					
Dir:	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Left:							
Right:							

North-South Exposure — **Level 2**

2 3.52 (5.06) 3.52 (5.06)

W 119
E (96)

West — **East**

Left Offset: 44

Plt Ht: 9	1	2	3	4	5	6	7
Add P:							
R:	6.14 (7.18)	6.14 (7.18)					
PLt Ht:							
L:	38.5	31					
L(min):		3.25					
V:	160 (187)	199 (232)					
SW:	SW6	SW4					
Stacked:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OT1:	1.44 (1.68)	1.79 (2.09)					
OT2:	2.21 (2.79)	3.91 (5.13)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
HD1:	HDU2	HDU2					
HD2:	HDU4	HDU5					
H:W:	-	350(2)3.25/9 = 253					
Dir:	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Left:							
Right:							

North-South Exposure — **Level 1**

3 6.14 (7.18) 6.14 (7.18)

W 115
E (36)

West — **East**

Left Offset: 44

Plt Ht: 9	1	2	3	4	5	6	7
Add P:							
R:	8.67 (7.98)	8.67 (7.98)					
PLt Ht:							
L:	38.75	23.25					
L(min):		3.25					
V:	224 (206)	373 (344)					
SW:	Conc Wall	Conc Wall					
Stacked:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OT1:							
OT2:			0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
HD1:							
HD2:							
H:W:	-						
Dir:	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Left:							
Right:							

East-West Exposure — **Roof Deck**

1 W 160
E (170) (126) (68) (246)

North — **South**

Left Offset:		20	12	27.5			
Plt Ht:	9	1	2	3	4	5	6	7
Add P:								
R:		1.60 (1.26)	2.56 (1.67)	3.16 (3.80)	2.20 (3.39)			
PLt Ht:								
L:		7.75	15.75	23.25	9.25			
L(min):		3.25		3.25	4			
V:		207 (163)	163 (107)	136 (164)	238 (367)			
SW:		SW4	SW6	SW6	SW3			
OT1:		1.86 (1.47)	1.47 (0.96)	1.22 (1.48)	2.14 (3.30)			
HD1:		CS16	CS16	CS16	(2)CS16			
H:W:		350(2)3.25/9 = 253	-	230(2)3.25/9 = 166	450(2)4/9 = 400			
Dir:		Standard	Standard	Standard	Standard	Standard	Standard	Standard
Left:								
Right:								

East-West Exposure — **Level 2**

2 1.60 (1.26) 2.56 (1.67) 3.16 (3.80) 2.20 (3.39)

W 119
E (71) (48) (54) (94)

North — **South**

Left Offset:		20	12	27.5			
Plt Ht:	9	1	2	3	4	5	6	7
Add P:								
R:		2.79 (1.74)	4.47 (2.48)	5.52 (5.42)	3.84 (4.69)			
PLt Ht:								
L:		20	14.75	32.5	14.25			
L(min):			3.25		3.5			
V:		140 (87)	304 (169)	170 (167)	270 (330)			
SW:		SW6	SW3	SW6	SW3			
Stacked:		Yes	Yes	Yes	Yes	Yes	Yes	Yes
OT1:		1.26 (0.78)	2.74 (1.52)	1.53 (1.50)	2.43 (2.97)			
OT2:		3.12 (2.25)	4.20 (2.48)	2.75 (2.98)	4.57 (6.27)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
HD1:		HDU2	HDU2	HDU2	(2)CS16			
HD2:		HDU2	HDU5	HDU2	(4)CS16			
H:W:		-	450(2)3.25/9 = 325	-	450(2)3.5/9 = 350			
Dir:		Standard	Standard	Standard	Standard	Standard	Standard	Standard
Left:								
Right:								

East-West Exposure — **Level 1**

3 7.26 (4.22) 5.52 (5.42) 3.84 (4.69)

W 115
E (57)

North — **South**

Left Offset:	32			27.5			
Plt Ht:	9	1	2	3	4	5	6	7
Add P:								
R:				7.11 (6.21)	5.43 (5.48)			
PLt Ht:								
L:				44	23.25			
L(min):					3			
V:				162 (142)	234 (236)			
SW:				Conc Wall	SW3			
Stacked:		Yes	Yes	Yes	Yes	Yes	Yes	Yes
OT1:					2.11 (2.12)			
OT2:		0.00 (0.00)	0.00 (0.00)		6.68 (8.40)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
HD1:					HDU2			
HD2:					HDU8			
H:W:				-	450(2)3/9 = 300			
Dir:		Standard	Standard	Standard	Standard	Standard	Standard	Standard
Left:								
Right:								

VERTICAL FRAMING DESIGN

ROOF FRAMING - (C1-UNO)

TYPICAL ROOF DECK JOISTS (15')

L = 15'
w = 0.085 (1.33') = 0.113 klf

R = 0.85 K R_n = 1.0 K
M = 3.18 k' M_n = 3.80 k'
Δ = 0.41" ≈ L/440

11-7/8" TJI 210's @ 16" oc

#301

L = 14'
w = 0.045 (29'/2) = 0.65 klf

R = 4.57 k f_b = 1.56 ksi
M = 15.9 k' f_v = 95 psi
Δ = 0.43" ≈ L/392

GL 5 1/2 x 11 7/8
OR
PSL 5 1/4 x 11-7/8

#302

L = 15'
w = 0.085 (14'/2 + 1.33'/2) = 0.65 klf

R = 4.89 k f_b = 1.78 ksi
M = 18.3 k' f_v = 102 psi
Δ = 0.66" ≈ L/319

GL 5 1/2 x 11 7/8
OR
PSL 5 1/4 x 11 7/8

#303

L = 6'
w = 0.085 (15'/2) = 0.64 klf

R = 1.91 k f_b = 0.67 ksi
M = 2.86 k' f_v = 55 psi
Δ = 0.06" ≈ L/1200

6x8

#304

L = 11'
w = 0.045 (7'/2) = 0.16 klf

R = 0.87 k f_b = 0.57 ksi
M = 2.38 k' f_v = 35 psi
Δ = 0.18" ≈ L/763

4x10

#305 - (C3)

L = 12'
A = 8'
$w_1 = w_2 = 0$
P = 0.87 k ↦ #304

R_1 = -0.44 k f_b = 0.98 ksi
R_2 = 1.83 k f_v = 37 psi
M = 6.5 k' Δ = 0.53" ≈ 2A/272

PSL 5 1/4 x 11 7/8 (9 1/2 MIN)

#306 (C4)

L_1 = 11.5' ; L_2 = 8.5' ; L_3 = 8.5'
w_1 = 0.045 (2') = 0.09 klf
$w_2 = w_3$ = 0.045 (14'/2) + 0.085 (14'/2) = 0.91 klf
P_1 = 1.9 k ; P_2 = 4.6 k ↦ #301

R_1 = 7.95 k
R_2 = 15.1 k
M = 99.2 k'

MIN 5-PLY GT

MALSAM TSANG
STRUCTURAL ENGINEERING
122 SOUTH JACKSON ST
SUITE 210
SEATTLE, WA 98104
T 206.789.8038
MALSAMTSANG.COM

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QTM
DESIGN

V1
SHEET

VERTICAL DESIGN . cont. -(C1-UNO)

LEVEL 2 FRAMING

#201

L = 20'

W = 0.045(2'/2) + 0.055(1.33/2) + 0.015(10') =
= 0.24 klf

R = 0.24k f_b = 0.12 ksi

M = 1.2k' f_v = 5.2 psi

Δ = 0.07" ≈ L/3600

GL 5½ x 11⅞
OR
PSL 5¼ x 11⅞

SEISMIC OK BY INSPECTION ✓

#202 C2

L_1 = 16.5' ; L_2 = 3.5'

$W_1 = W_2$ = 0.045(2'/2) + 0.015(10') + 0.055(14'/2)
= 0.58 klf

P = 4.6k ↦ #301

R_1 = 6.6 k f_b = 1.8 ksi

R_2 = 9.6 k f_v = 96 psi

M = 38. k' Δ = 0.75" ≈ L/322

GL 5½ x 16.½

#203

L = 28'

w = 0.055(28'/2) + 0.1 = 0.87 klf

R = 12.2 k M_n/Ω = 245 k'

M = 85.3k' Δ = 0.77" ≈ L/432

I = 534 in⁴ ; S = 98.5 in³

~~W10x88~~

USE W10x100

#204 (C2)

L_1 = 7' ; L_2 = 13'

W_1 = 0.55(1.33) + 0.1 = 0.17 klf

W_2 = 0.045(9'/2) + 0.055(15'/2) + 0.01(10')
+ 0.17 klf = 1.11 klf

P = 15.1k + 4.9k + 12.2k + 2.11k = 34.4k
↳ #306 ↳ #302 ↳ #203 ↳ #205

R_1 = 28.03k M_n/Ω = 245 k'

R_2 = 21.99k Δ = 0.76" ≈ L/314

M = 192 K' I = 534 in⁴ ; S = 98.5 in³

~~W10x88~~

USE W10x112

#205 (C2)

L_1 = 6' ; L_2 = 10'

W_1 = 0.055(7'/2) = 0.19 klf

W_2 = 0.055(14'/2) = 0.38 klf

P = ∅

R_1 = 2.11 K f_b = 1.02 ksi

R_2 = 2.82k f_v = 47 psi

M = 10.5k' Δ = 0.36" ≈ L/533

6 5½ x 11⅞
OR
PSL 5¼ x 11⅞

#206 (C2)

L_1 = 5' ; L_2 = 5'

W_1 = 0.045(12'/2) + 0.015(10') = 0.42 klf

W_2 = 0.045(20'/2) + 0.015(10') = 0.60 klf

P = 2.95k + 12.2k = 20.15 k
↳ #306 ↳ #203

R_1 = 12.4k f_b = 2.29 ksi

R_2 = 12.85k f_v = 178 psi

M = 56.75k' Δ = 0.18" ≈ L/687

GL 5½ x 18

MALSAM TSANG
STRUCTURAL ENGINEERING
122 SOUTH JACKSON ST
SUITE 210
SEATTLE, WA 98104
T 206 789 5036
MALSAM-TSANG.COM

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SHEET

VERTICAL DESIGN Cont.

FTG CHECK

ASSUME 1500psf BEARING

ASSUME MIN 18" WIDE EXISTING FTG

GRID C CHECK

W = 0.045(26'/2) + (2) 0.015(10') + 0.055(20'/2) + 0.3 = 1.6 klf

FTG REQ'D = 1.6 klf / 1.5 ksf = 1.06' WIDE Ok✓

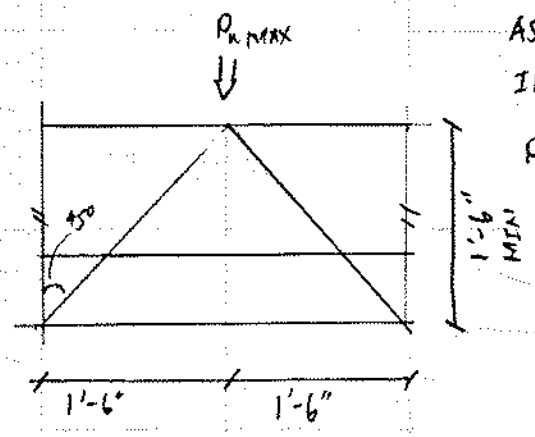
GRID B.2

W = 1.6 klf + 0.055(12'/2) = 1.93

FTG REQ'D = 1.93 klf / 1.5 ksf = 1.28' WIDE Ok✓

GRID D, 1 & 5 ASSUME LARGE FTG FOR CANTILEVER WALL. Ok BY INSPECTION✓

MAX POINT LOAD AT EXISTING FTG



ASSUME POINT LOAD DISTRIBUTES AT 45° IN STEM WALL / FTG

$P_{u\,MAX}$ = 1.5' x (1.5' + 1.5') * 1.5 ksf = 6.75 k

(1.5' → FTG WIDTH; (1.5' + 1.5') → FTG LENGTH)

POINT LOAD AT GRID B, 1 & 5 DISTRIBUTE OVER 10' TALL RETAINING WALL ok BY INSPECTION✓

REACTION FROM #202 & #204 DISTRIBUTE OVER WALL AT GRID A:

FTG LENGTH REQ'D = (9.1 k (#202) + 22.0 k (#204)) / 1.5 ksf / 1.5' = 14' LONG FTG Ok✓

P_u @ #204 AT GRID A.6 = 28.03 k

FTG REQ'D = $\sqrt{28.03\text{ k} / 1.5\text{ ksf}}$ = 4.32' SQ ≈ USE 4.5' SQ

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STRUCTURAL ENGINEERING
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SUITE 210
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T 206.789.6038
MALSAM-TSANG.COM

4103 78TH AVE SE — PROJECT

3/12/25 — DATE

0494-2025.02 — PROJECT NO

QTM — DESIGN

V3 — SHEET

VERTICAL ANALYSIS

(UNIT 1,2,3,4)

Pin Pile Design:

Pile Capacities: 4''Ø = 20k & 3''Ø = 6k

Typical Footing:

fy	=	60 ksi	ØMn	=	68.15 k-ft
F'c	=	2.5 ksi			
As	=	0.59 sq in	ØVc/2	=	9 k
B	=	8 in			
d	=	26.75 in			

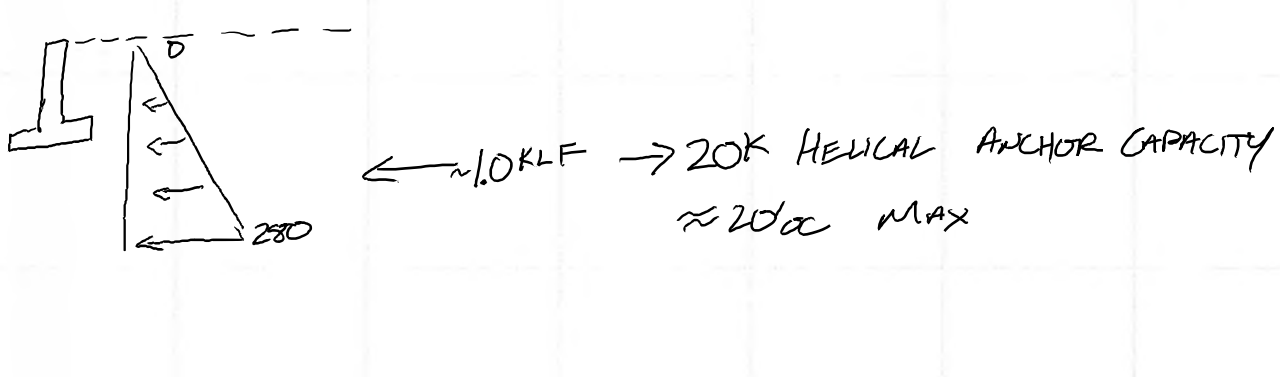
Footing Spans:

N/S Elevation

W = 0.8 LL + 1.18 DL = 1.98 klf
W(ult) = 2.69 klf
Spacing: 4''Ø → 10.1' oc
3''Ø → 3' oc
Design Length: 10.1'
Mu = 34.3 k-ft ≤ ØMn = 68.15 k-ft OK
Vu = 6.86 k ≤ ØVc/2 = 9 k OK

E/W

W = 0.4 LL + 0.74 DL = 1.14 klf
W(ult) = 1.53 klf
Spacing: 4''Ø → 14' oc
3''Ø → 5.2' oc
Design Length: 14' B = 18" d = 14.75"
Mu = 37.36 k-ft ≤ ØMn = 37.87 k-ft OK
Vu = 8.39 k ≤ ØVc/2 = 12.15 k OK



MALSAM TSANG
STRUCTURAL ENGINEERING

122 South Jackson
Suite 210
Seattle, WA 98104
t 206.789.6038
f 206.789.6042

4103 78th Ave SE
Project

6/10/2025
Date

0496.2025.02.01
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QTM
Design

V4
Sheet