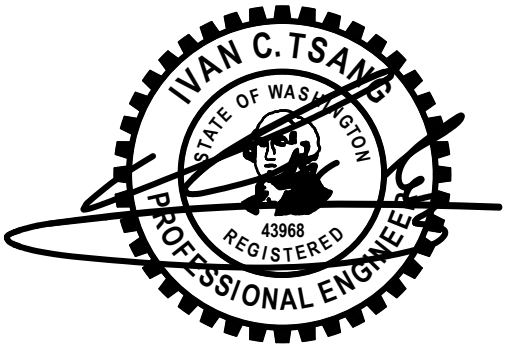
STRUCTURAL CALCULATIONS FOR:

4740 W MECER WAY

MERCER ISLAND, WA

ARCHITECT: GOLDEN DESIGN SERVICES

AUGUST 16, 2024



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		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	2x @ 16" o.c	2.9 psf	Flooring	1.0 psf
Insulation	1.0 psf	2x sleepers	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	1.5" Concrete pavers	18.0 psf		
Total	18.2 psf	Total	32.4 psf	Total	10.0 psf
Use	20.0 psf	Use	35.0 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
Site Class = D(Geo)
R Value = 6.5
Seismic Ht, hn= 18 ft
T, Building= 0.2
Ts= 0.6

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

S_s =	1.44		F_a =	1.000	Table 11.4-1
S_1 =	0.5		F_v =	1.800	Table 11.4-2
S_{ms} =	1.440	x 2/3 =	**S_{ds} =**	**0.960**	Eqn. 11.4-3
S_{m1} =	0.900	x 2/3 =	**S_{d1} =**	**0.600**	Eqn. 11.4-4

C_{SULT} = 0.148
C_{SALL} = 0.104

T/Ts= 0.28 ≤ 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 DECK 40.0 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 = 110 mph
Exposure = C
h = 23 ft
K_d = 0.85
G = 0.85
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	22.4	13.4		9.1	6.3	**15.4**	
15-20	0.90	23.7	14.2		9.7	6.3	**16.0**	
20-25	0.94	24.7	14.8	14.8	10.1	6.3	**16.4**	**10.1**
25-30	0.98	25.8	15.5		10.5	6.3	**16.8**	
30-35	1.02	26.9	16.1		11.0	6.3	**17.3**	
35-40	1.04	27.4	16.4		11.2	6.3	**17.5**	
40-45	1.07	28.2	16.9		11.5	6.3	**17.8**	
45-50	1.09	28.7	17.2		11.7	6.3	**18.0**	

[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

4740 W Mecer Way — Project
Mercer Island, Wa

8/5/2024 — Date
00179-2024-01-01 — Proj. No.
EJJ — Design
DC1 — Sheet

This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Hazards by Location

Search Information

Address: 4740 W Mercer Way, Mercer Island, WA 98040, USA

Coordinates: 47.5608356, -122.2272452

Elevation: 217 ft

Timestamp: 2024-07-16T21:08:09.822Z

Hazard Type: Wind

ASCE 7-16

MRI 10-Year	67 mph
MRI 25-Year	73 mph
MRI 50-Year	78 mph
MRI 100-Year	83 mph
Risk Category I	92 mph
Risk Category II	97 mph
Risk Category III	104 mph
Risk Category IV	108 mph

ASCE 7-10

MRI 10-Year	72 mph
MRI 25-Year	79 mph
MRI 50-Year	85 mph
MRI 100-Year	91 mph
Risk Category I	100 mph
Risk Category II	110 mph
Risk Category III-IV	115 mph

ASCE 7-05

ASCE 7-05 Wind Speed	85 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

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

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

DC2

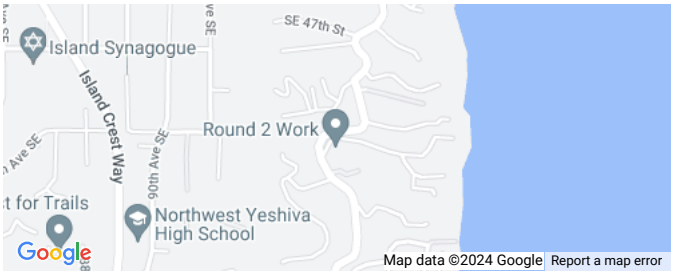
This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Hazards by Location

Search Information

Address:	4740 W Mercer Way, Mercer Island, WA 98040, USA
Coordinates:	47.5608356, -122.2272452
Elevation:	217 ft
Timestamp:	2024-07-16T21:08:54.800Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default



Basic Parameters

Name	Value	Description
S_S	1.44	MCE_R ground motion (period=0.2s)
S_1	0.5	MCE_R ground motion (period=1.0s)
S_{MS}	1.728	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.152	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.902	Coefficient of risk (0.2s)
CR_1	0.898	Coefficient of risk (1.0s)
PGA	0.617	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.74	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	1.44	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.597	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	3.957	Factored deterministic acceleration value (0.2s)
S1RT	0.5	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.557	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.552	Factored deterministic acceleration value (1.0s)
PGAd	1.333	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

DC3

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

DC4

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

ROOF SNOW LOAD[a] (psf)	WIND DESIGN				SEISMIC DESIGN CATEGORY	SUBJECT TO DAMAGE FROM			OUTDOOR DESIGN TEMP (F) - Heat/Cool	ICE BARRIER UNDERLAYMENT REQUIRED	FLOOD HAZARD[e]	AIR FREZING INDEX	MEAN ANNUAL TEMP
	Speed[b] (mph)	Topographic effects[c]	Special wind region	Windborne debris zone		Weathering[d]	Frost line depth	Termite					
25	110	Yes	No	No	D2	Moderate	12"	Slight to Moderate	83/24	No	N.A.	113	53

MANUAL J DESIGN CRITERIA							
Elevation	Latitude	Winter heating	Summer cooling	Altitude correction factor	Indoor design temperature	Design temperature cooling	Heating temperature difference
338 feet	47°34'39''	72°F max	75°F min	0.99	72°F	75°F	48°F
Cooling temperature difference	Wind velocity heating	Wind velocity cooling	Coincident wet bulb	Daily range	Winter humidity	Summer humidity	
8°F	N.A.	N.A.	66	Medium	75%	68%	

a. This is the minimum roof snow load. When using this snow load it will be left to the engineer's judgment whether to consider drift or sliding snow. However, rain on snow surcharge of 5 psf must be considered for roof slopes less than 5 degrees.

b. The 110 mph Ultimate Design Wind Speed (3-second gust) as adopted by the 2018 IRC/ASCE 7-10 (or if using the IBC for structural design, the 98 mph Basic Design Wind Speed as adopted by the 2018 IBC/ASCE 7-16 may be used).

c. Wind exposure category and Topographic effects (Wind Speed-up Kzt factor) shall be determined on a site-specific basis by the Engineer of Record (components and cladding need not consider topographic effects unless otherwise determined by the engineer of record).

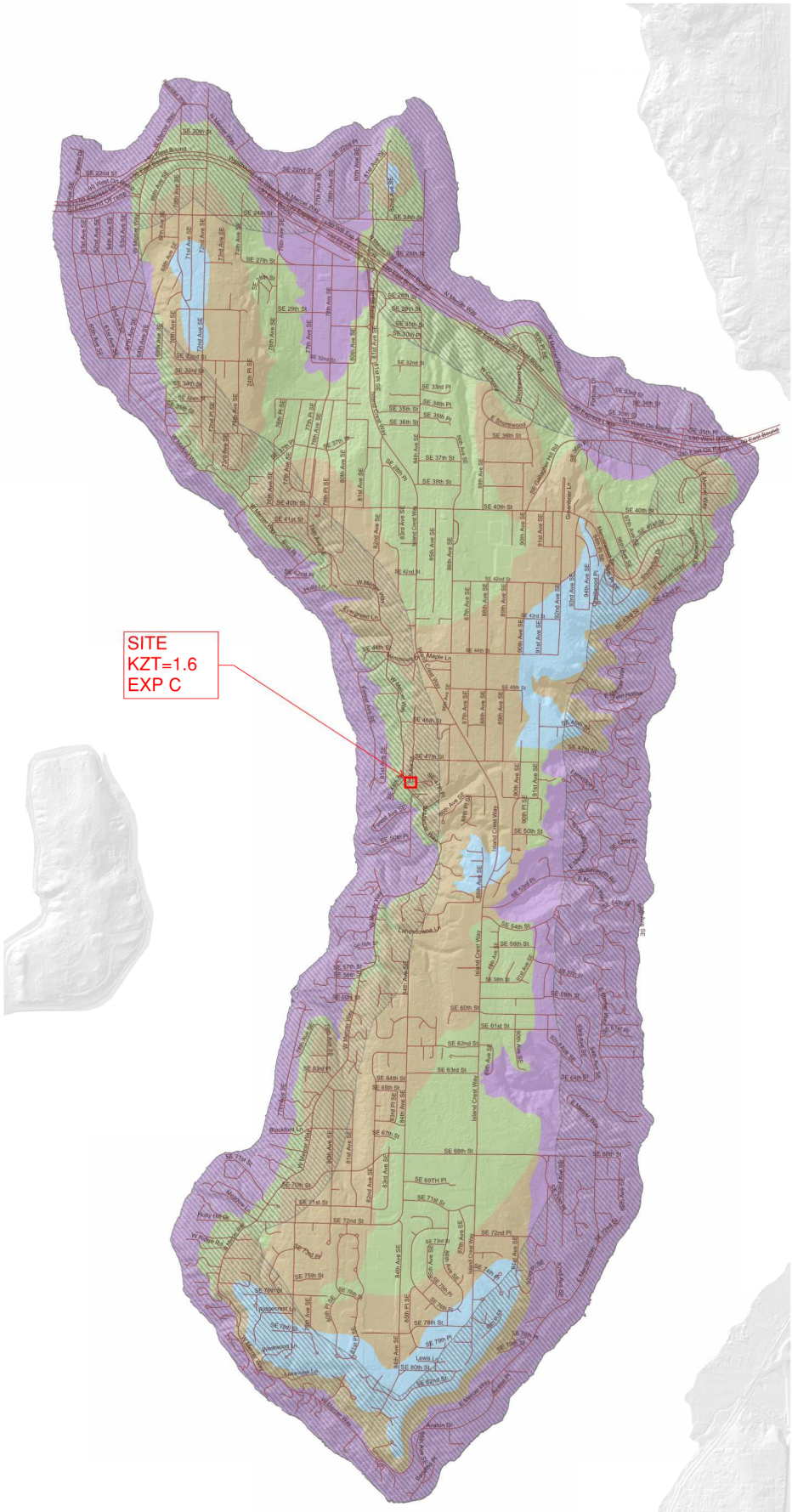
d. Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652.

e. The City of Mercer Island participates in the National Flood Insurance Program (NFIP); Regular Program (No Special Flood Hazard Area). Further NFIP participation information: CID 530083, Initial FHBM Identified 06/28/74, Initial FIRM Identified 05/16/95, Current Effective Map Date (NSFHA), Reg-Emer Date 06/30/97, 53033C0654G effective 8/19/2020.

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

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

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



DC6

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

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

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

WIND EXPOSURE CATEGORIES:

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

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

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

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

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

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

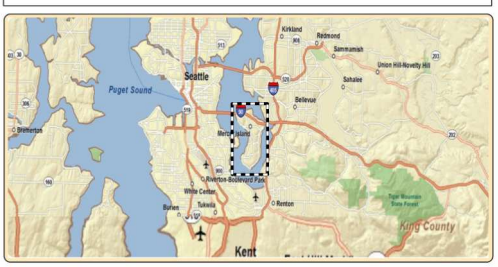
This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically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

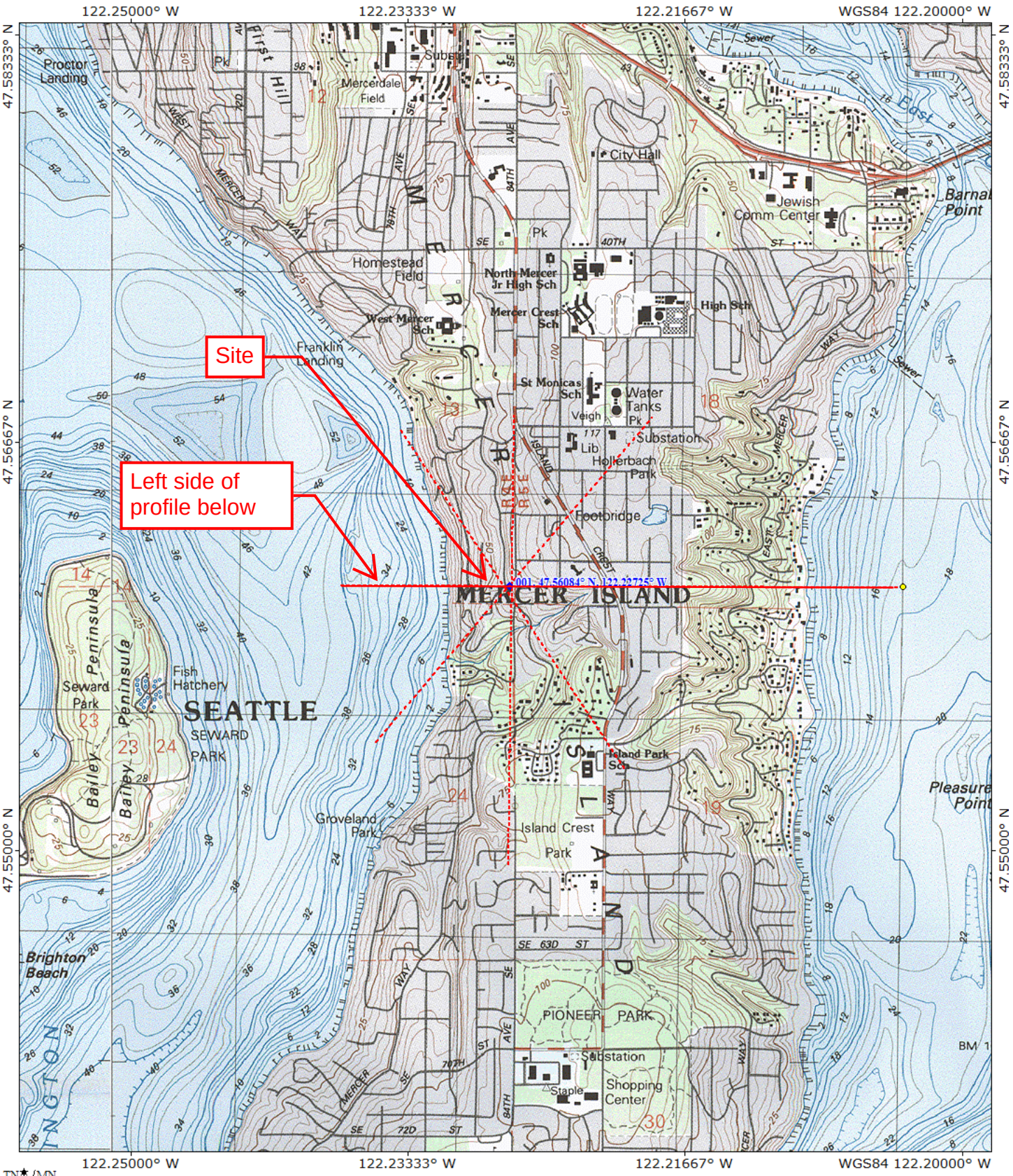
Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island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

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

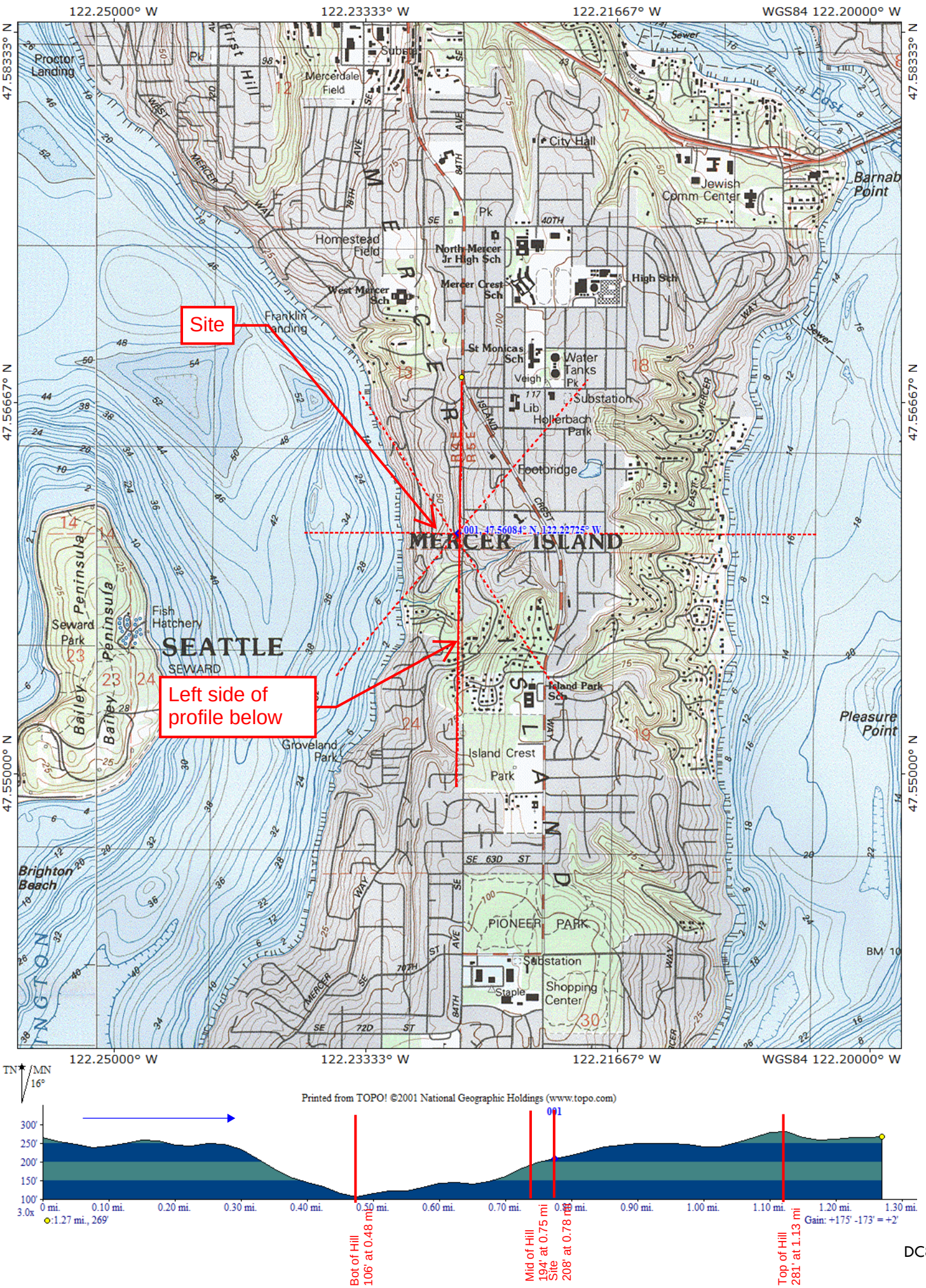
DEFINITIONS:

K_zt factor:	The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.
Exposure B:	The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.
Exposure C:	The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.
Wind Speed:	Minimum 85 mph 3-second gust per IRC Figure R301.2(4)

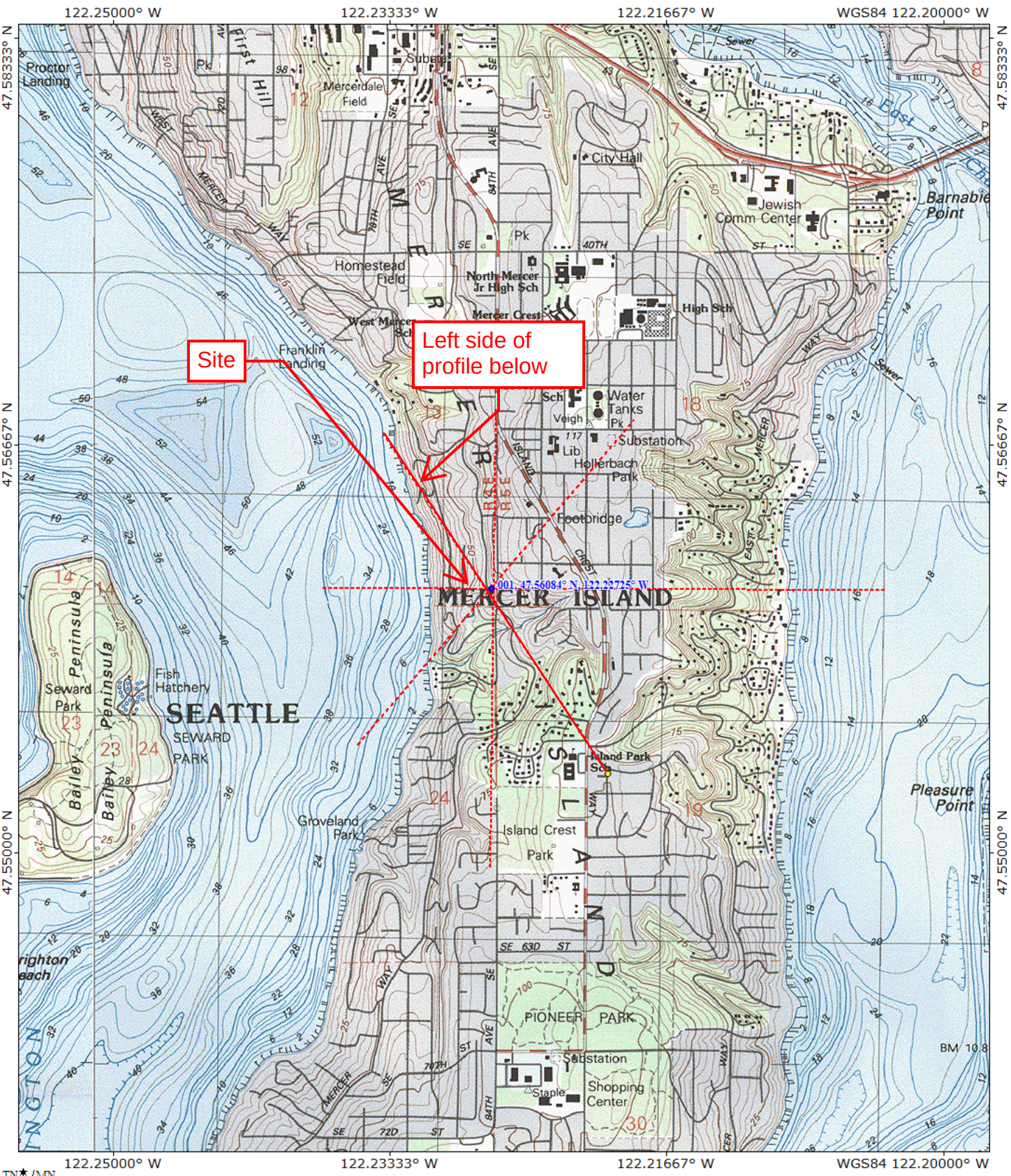


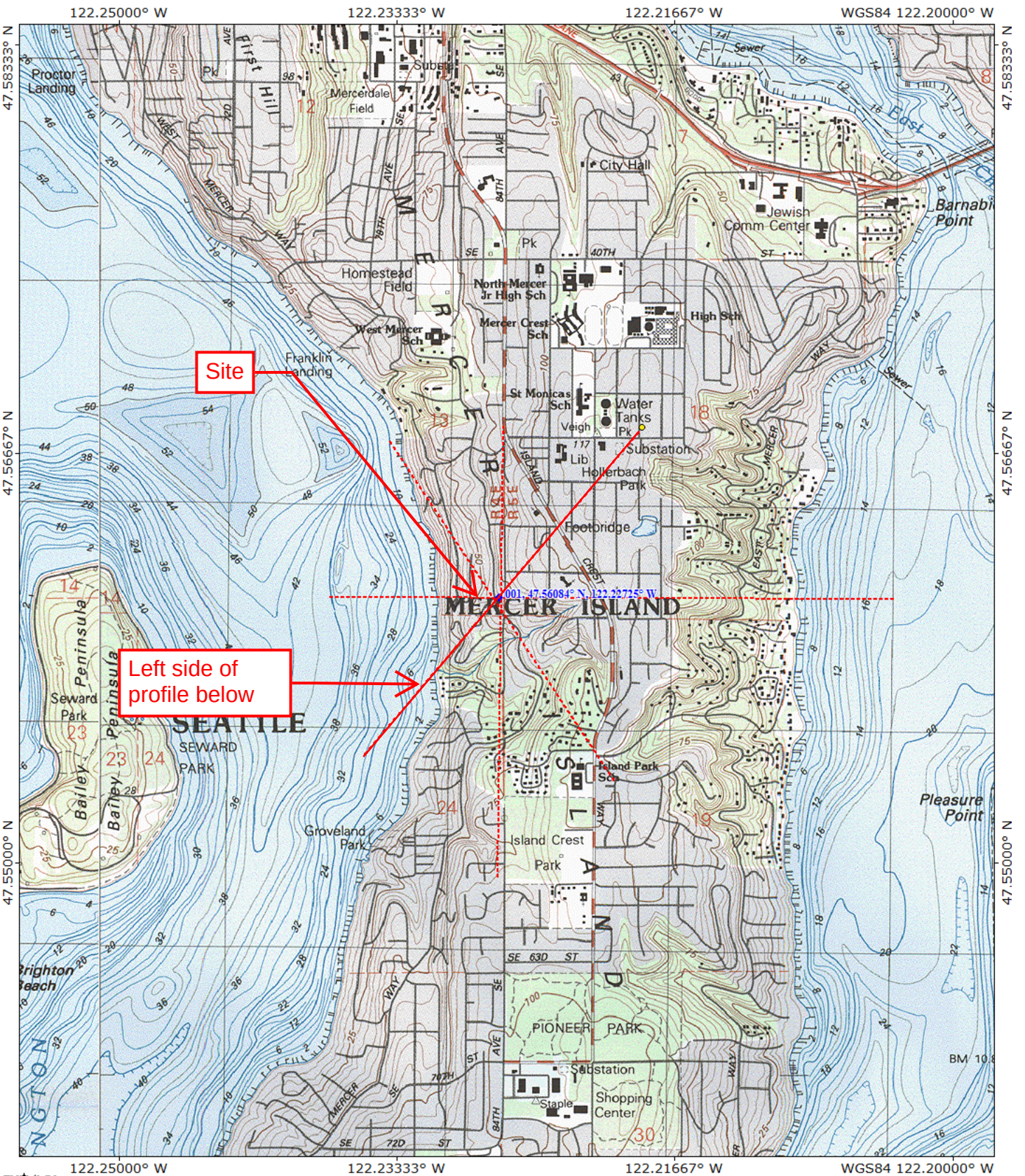

122.25000° W
122.23333° W
122.21667° W
WGS84 122.20000° W
47.58333° N
47.56667° N
47.55000° N
Site
Left side of profile below
001 47.56084° N, 122.22725° W
MERCER ISLAND
SEATTLE
SEWARD PARK
Proctor Landing
Mercerdale Field
Homestead Field
North Mercer Jr High Sch
Mercer Crest Sch
West Mercer Sch
High Sch
City Hall
Jewish Comm Center
Barnard Point
Franklin Landing
St Monicas Sch
Water Tanks
Substation
Lib
Hollerbach Park
Footbridge
Island Park Sch
Island Crest Park
Groveland Park
Pioneer Park
Substation
Staple
Shopping Center
Seward Park
Fish Hatchery
Bailey Peninsula
Brighton Beach
Pleasure Point
BM 1
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)
TN 16° MN
400'
300'
200'
100'
0'
0 mi.
0.10 mi.
0.20 mi.
0.30 mi.
0.40 mi.
0.50 mi.
0.60 mi.
0.70 mi.
0.80 mi.
0.90 mi.
1.00 mi.
1.10 mi.
1.20 mi.
1.30 mi.
1.40 mi.
1.50 mi.
1.60 mi
1.7x
:1.60 mi., 13'
Gain: +354' -354' = +0'
Bot of Hill
13' at 0.27 mi
Mid of Hill
190' at 0.44 mi
Site
208' at 0.48 mi
Top of Hill
357' at 0.91 mi

DC7


122.25000° W
122.23333° W
122.21667° W
WGS84 122.20000° W
47.58333° N
47.56667° N
47.55000° N
Site
Left side of profile below
001 47.56084° N 122.22725° W
MERCER ISLAND
SEATTLE
SEWARD
Proctor Landing
Mercerdale Field
Homestead Field
North Mercer Jr High Sch
West Mercer Sch
Mercer Crest Sch
High Sch
City Hall
Jewish Comm Center
Barnabas Point
Franklin Landing
St Monicas Sch
Water Tanks
Substation
Hollerbach Park
Footbridge
Island Park Sch
Island Crest Park
Groveland Park
Seward Park
Fish Hatchery
Bailey Peninsula
Pleasure Point
Brighton Beach
PIONEER PARK
Substation
Staple
Shopping Center
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)
300'
250'
200'
150'
100'
3.0x
0 mi.
0.10 mi.
0.20 mi.
0.30 mi.
0.40 mi.
0.50 mi.
0.60 mi.
0.70 mi.
0.80 mi.
0.90 mi.
1.00 mi.
1.10 mi.
1.20 mi.
1.30 mi.
:1.27 mi., 269'
Gain: +175' -173' = +2'
Bot of Hill
106' at 0.48 mi
Mid of Hill
194' at 0.75 mi
Site
208' at 0.78 mi
Top of Hill
281' at 1.13 mi

DC8


122.25000° W
122.23333° W
122.21667° W
WGS84 122.20000° W
47.58333° N
47.56667° N
47.55000° N
Site
Left side of profile below
001, 47.56084° N, 122.22725° W
MERCER ISLAND
SEATTLE
SEWARD PARK
Proctor Landing
Mercerdale Field
Homestead Field
North Mercer Jr High Sch
Mercer Crest
West Mercer Sch
Franklin Landing
City Hall
Jewish Comm Center
Barnabie Point
Water Tanks
Substation
Hollerbach Park
Footbridge
Island Park Sch
Island Crest Park
Groveland Park
Pioneer Park
Substation
Staple
Shopping Center
Pleasure Point
Seward Park
Fish Hatchery
Bailey Peninsula
BM 10.8
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)
001
400'
300'
200'
100'
0'
0 mi.
0.10 mi.
0.20 mi.
0.30 mi.
0.40 mi.
0.50 mi.
0.60 mi.
0.70 mi.
0.80 mi.
0.90 mi.
1.00 mi.
1.10 mi.
Gain: +328' -0' = +328'
Bot of Hill
13' at 0.03 mi
Mid of Hill
177' at 0.48 mi
Site
208' at 0.53 mi
Top of Hill
340' at 01.18 mi

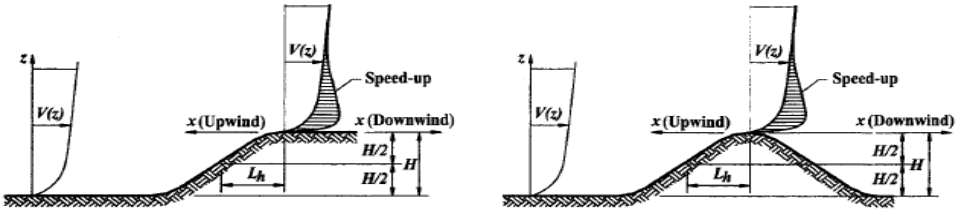

122.25000° W
122.23333° W
122.21667° W
WGS84 122.20000° W
47.58333° N
47.56667° N
47.55000° N
Site
Left side of profile below
001 47.56084° N, 122.22725° W
MERCER ISLAND
SEATTLE
Proctor Landing
Mercerdale Field
City Hall
Jewish Comm Center
Barnabi Point
Homestead Field
North Mercer Jr High Sch
Mercer Crest Sch
High Sch
West Mercer Sch
Franklin Landing
St Monicas Sch
Water Tanks
Substation
Lib
Hollerbach Park
Footbridge
Seward Park
SEWARD PARK
Bailey Peninsula
Island Park Sch
Pleasure Point
Groveland Park
Island Crest Park
PIONEER PARK
Substation
Staple
Shopping Center
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)
TN 16° MN
001
400'
300'
200'
100'
0'
1.5x
0 mi.
0.10 mi.
0.20 mi.
0.30 mi.
0.40 mi.
0.50 mi.
0.60 mi.
0.70 mi.
0.80 mi.
0.90 mi.
1.00 mi.
1.10 mi.
1.20 mi.
1.30 mi.
:1.21 mi., 374'
Gain: +367' -6' = +361'
Bot of Hill
13' at 0.3 mi
Mid of Hill
197' at 0.55 mi
Site
208' at 0.58 mi
Top of Hill
380' at 1.08 mi
DC10

Kzt WORKSHEET

ASCE 7-10 26.8.1

Exposure = C
Bldg Height = 25 ft
Site Elev = 208 ft

Topographic Factor, K_{zt}
Figure 26.8-1



PROFILE 1		PROFILE 2		PROFILE 3		PROFILE 4	
Shape =	3-D Hill	**Shape =**	2-D Escarp	**Shape =**	2-D Escarp	**Shape =**	2-D Escarp
H =	354 **ft**	**H =**	175 **ft**	**H =**	327 **ft**	**H =**	367 **ft**
H/2 =	177 **ft**	**H/2 =**	88 **ft**	**H/2 =**	164 **ft**	**H/2 =**	184 **ft**
L_h =	2482 **ft**	**L_h =**	2006 **ft**	**L_h =**	3590 **ft**	**L_h =**	2798 **ft**
x =	2270 **ft**	**x =**	1848 **ft**	**x =**	3326 **ft**	**x =**	2640 **ft**
z =	25 **ft**	**z =**	25 **ft**	**z =**	25 **ft**	**z =**	25 **ft**
Unobstructed[1]	Yes	**Unobstructed[1]**	Yes	**Unobstructed[1]**	Yes	**Unobstructed[1]**	Yes
Above Terrain[2]	Yes	**Above Terrain[2]**	Yes	**Above Terrain[2]**	Yes	**Above Terrain[2]**	Yes
Upper Half[3]	Yes	**Upper Half[3]**	Yes	**Upper Half[3]**	Yes	**Upper Half[3]**	Yes
Site to Crest	Upwind	**Site to Crest**	Upwind	**Site to Crest**	Upwind	**Site to Crest**	Upwind
H/Lh[4]	0.143	**H/Lh[4]**	0.087221	**H/Lh[4]**	0.091076	**H/Lh[4]**	0.1311464
Calc Kzt ?	NO	**Calc Kzt ?**	NO	**Calc Kzt ?**	NO	**Calc Kzt ?**	NO
K_1:	$(K_1/H/L_h)$	K_1:	$(K_1/H/L_h)$	K_1:	$(K_1/H/L_h)$	K_1:	$(K_1/H/L_h)$
Coefficient =	1.05	Coefficient =	0.85	Coefficient =	0.85	Coefficient =	0.85
K_1 = N/A		**K_1 = N/A**		**K_1 = N/A**		**K_1 = N/A**	
K_2:	$(1 - \lvert x\rvert/\mu L_h)$	K_2:	$(1 - \lvert x\rvert/\mu L_h)$	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)	μ =	1.5 (Figure 26.8-1)	μ =	1.5 (Figure 26.8-1)
K_2 = N/A		**K_2 = N/A**		**K_2 = N/A**		**K_2 = N/A**	
K_3:	$e^{-\gamma z/Lh}$	K_3:	$e^{-\gamma z/Lh}$	K_3:	$e^{-\gamma z/Lh}$	K_3:	$e^{-\gamma z/Lh}$
γ =	4 (Figure 26.8-1)	γ =	2.5 (Figure 26.8-1)	γ =	2.5 (Figure 26.8-1)	γ =	2.5 (Figure 26.8-1)
K_3 = N/A		**K_3 = N/A**		**K_3 = N/A**		**K_3 = N/A**	
$K_{zt} = (1 + K_1 K_2 K_3)^2$		$K_{zt} = (1 + K_1 K_2 K_3)^2$		$K_{zt} = (1 + K_1 K_2 K_3)^2$		$K_{zt} = (1 + K_1 K_2 K_3)^2$	
K_{zt} = 1.00		**K_{zt} = 1.00**		**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

MALSAM TSANG
STRUCTURAL ENGINEERING

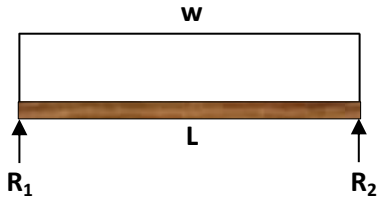
122 South Jackson
Suite 210
Seattle, WA 98104
t 206.789.6038
f 206.789.6042

Project	4740 W Mecer Way
	Mercer Island, Wa
Date	7/17/2024
Proj. No.	00179-2024-01-01
Design	EJJ
Sheet	DC11

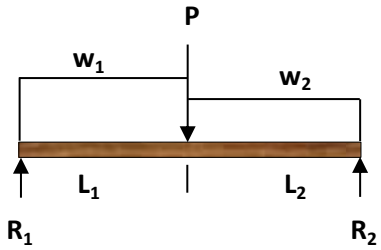
TYPICAL BEAM CASES

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

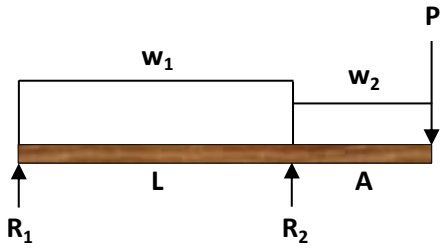
CASE #1: (C1)



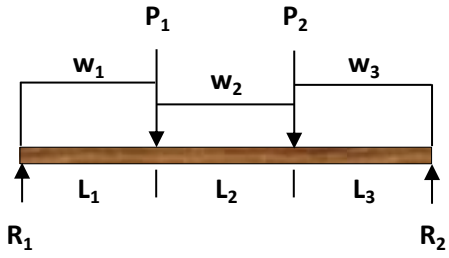
CASE #2: (C2)



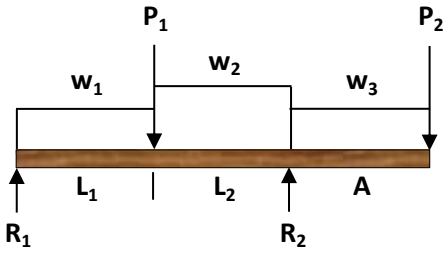
CASE #3: (C3)



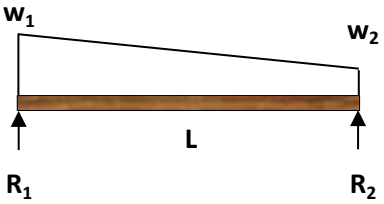
CASE #4: (C4)



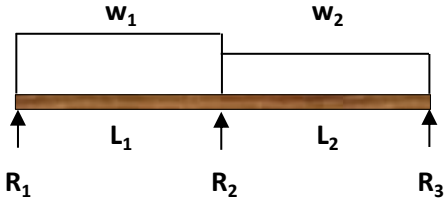
CASE #5: (C5)



CASE #6: (C6)



CASE #7: (C7)



MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way (Project)	7/17/2024 (Date)
Mercer Island, Wa	00179-2024-01-01 (Proj. No.)
	EJJ (Design)
	DC12 (Sheet)

LATERAL ANALYSIS

Units outside Parenthesis() represent Wind Load, units in (Parenthesis) represent Seismic Load

SEISMIC DESIGN VALUES

FLOOR	AREA		W (plf)	W_i (k)	H_i (ft)	W_iH_i	C_{vx}	F_x(k)	N-S EXP plf	E-W EXP plf	Total
ROOF	1075		26	27.95	18	503.1	0.663	3.89	127.4	131.8	3.9
2ND FLOOR	865	*	25	28.45	9	256.0	0.337	1.98	68.21	59.94	5.9
DECK	160		40								
Σ				56.4		759.1	1.0	5.9			

Vs_{ult} = 0.148 x 56.4 k = 8.3

Vs_{all} = 0.104 x 56.4 k = 5.9

WIND DESIGN LOADS

LEVEL	H_{trib}	W (plf)				L (ft)	N-S EXP V(k)	Total (k)	L (ft)	E-W EXP V(k)	Total (k)
ROOF	7	(3)(10.1)+(3)(16)+(1)(15.4)	=	94	plf	30.5	2.9	2.9	29.5	2.8	2.8
2nd FLOOR	9.5	(9.5)(15.4)	=	146	plf	29	4.2	7.1	33	4.8	7.6
Σ							7.1			7.6	

* MIN 9.6 PSF OVERALL CHECK(ASCE 27.1.5)-MINUS ROOF

∑ 13.5 FT * 9.6 PSF = 129.6 PLF < ∑ 210 PLF **OK**

*(new) Thin brick veneer (15 psf max) * 28 SQFT = 420 LB = 0.4 k

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way
Project

Mercer Island, Wa

8/5/2024
Date

00179-2024-01-01
Proj. No.

EJJ
Design

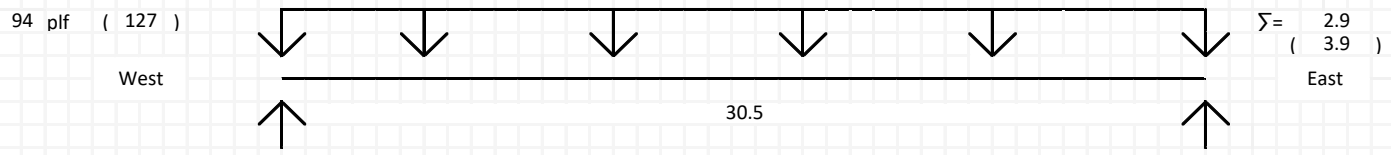
L-1
Sheet

LATERAL ANALYSIS

NORTH-SOUTH EXPOSURE

Units outside Parenthesis() represent Wind Load, units in (Parenthesis) represent Seismic Load

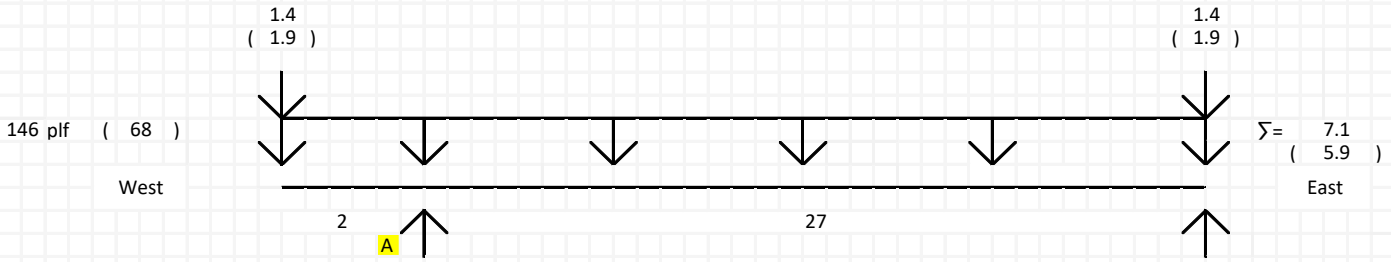
ROOF --- 8.0 ft PL



R (k)	1.4 (1.9)	1.4 (1.9)
L (ft)	(2)2.75 = 4.5	3.5+3.25+2.5+2.25= 11.50
		*Additonal SW1.75 into calc
V (plf)	318 (432)	124 (169)
SW	SW 2 * SEE 'L-5' FOR FTAO	SW 6
OT (k)	0.7 (0.9)	1.0 (1.4)
DL Reduction	-------	-------
OT Stacked (k)	-------	-------
DL Reduction	-------	-------
HD	CS16	CS16
HD Stacked	--------	--------
H:W	-------	

EQ: (2)(3.25)/8= 0.813
(0.813)(230) = 186 > 169
W: (1.4)(2)(3.25)/8= 1.138
(1.138)(230) = 261 > 124

2ND FLOOR --- 9.0 ft PL



R (k)	3.7 (3.0)	3.4 (2.9)
L (ft)	8.25+5+3.5= 17	5.75+4+3.5+3.5+3.5= 20.3
V (plf)	221 (179)	168 (141)
SW	SW 6	SW 6
OT (k)	2.0 (1.6)	1.5 (1.3)
DL Reduction	-------	-------
OT Stacked (k)	-------	2.5 (2.6)
DL Reduction	-------	-------
HD	HDU4 *EPOXY EMBED	HDU4 *EPOXY EMBED
HD Stacked	-------	HDU4 *EPOXY EMBED
H:W	-------	-------

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way
Project

Mercer Island, Wa

8/5/2024
Date

00179-2024-01-01
Proj. No.

EJJ
Design

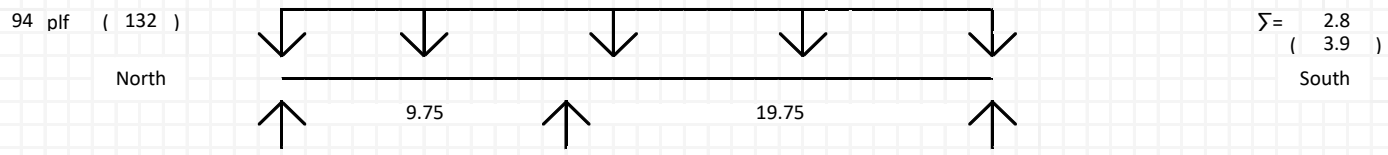
L-2
Sheet

LATERAL ANALYSIS

EAST-WEST EXPOSURE

Units outside Parenthesis() represent Wind Load, units in (Parenthesis) represent Seismic Load

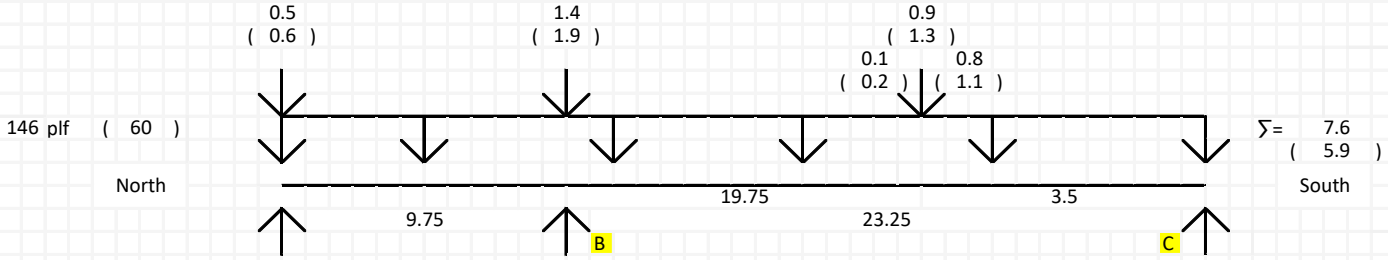
ROOF --- 8.0 ft PL



R (k)	0.5 (0.6)	1.4 (1.9)	0.9 (1.3)
L (ft)	12= 12.0	9= 9.0	6.5+6+3+3= 18.5
V (plf)	38 (54)	154 (216)	50 (70)
SW	SW 6	SW 6	SW 6
OT (k)	0.3 (0.4) (E) OK	1.2 (1.7)	0.4 (0.6)
DL Reduction	-------	-------	-------
OT Stacked (k)	-------	-------	-------
DL Reduction	-------	-------	-------
HD	--------	(2) CS16	--------
HD Stacked	--------	--------	--------
H:W	-------	-------	-------

H:W EQ: (2)(3)/8= 0.750
(0.75)(230) = 172 > 54
W: (1.4)(2)(3)/8= 1.050
(1.05)(230) = 241 > 38

2ND FLOOR --- 9.0 ft PL



R (k)	1.2 (0.9)	3.9 (3.1)	2.5 (1.8) (2.3) w/redundancy
L (ft)	4.75+12.5= 17	4+6.25+3.75= 14	WSWH 24x9 → 24x10
V (plf)	68 (54)	281 (223)	= (1)(5150)=5.1 K
SW	SW 6	SW 4	
OT (k)	0.6 (0.5)	2.5 (2.0)	T24= (5150*108)/17.5= =31.79K
DL Reduction	-------	-------	
OT Stacked (k)	-------	3.8 (3.7)	USE WSWH-AB1HS
DL Reduction	-------	-------	EMBED 16" MIN INTO
HD	-------	HDU4	48"Wx22"DP FOOTING
HD Stacked	-------	HDU5	34.1K CAP
H:W	-------	-------	OK

MALSAM TSANG STRUCTURAL ENGINEERING

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

4740 W Mecer Way — Project

Mercer Island, Wa

8/5/2024 — Date

00179-2024-01-01 — Proj. No.

EJJ — Design

L-3 — Sheet

LATERAL ANALYSIS

Units outside Parenthesis() represent Wind Load, units in (Parenthesis) represent Seismic Load

Supplemental Lateral Calculations

																			LIMIT OF TJI
																			301 plf
A	W:	[	1400	lb	+	(	146	plf	*	(	2.0	))	]	/	17.0 ft		=	100 plf	UNBLOCKED OK	215 plf
	EQ:	[[	1900	lb	+	(	68	plf	*	(	2.0	))	]	/	17.0 ft	] * 1.25	=	120 plf	UNBLOCKED OK	
B	W:	[	100	lb	+	(	146	plf	*	(	23.3 / 2	))	]	/	26.0 ft		=	69.13 plf	UNBLOCKED OK	
	EQ:	[[	200	lb	+	(	60	plf	*	(	23.3 / 2	))	]	/	26.0 ft	] * 1.25	=	43.15 plf	UNBLOCKED OK	
C	W:	[	800	lb	+	(	146	plf	*	(	23.3 / 2	))	]	/	26.0 ft		=	96.05 plf	UNBLOCKED OK	
	EQ:	[[	1100	lb	+	(	60	plf	*	(	23.3 / 2	))	]	/	26.0 ft	] * 1.25	=	86.42 plf	UNBLOCKED OK	

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way
Project

Mercer Island, Wa

8/5/2024
Date

00179-2024-01-01
Proj. No.

EJJ
Design

L-4
Sheet

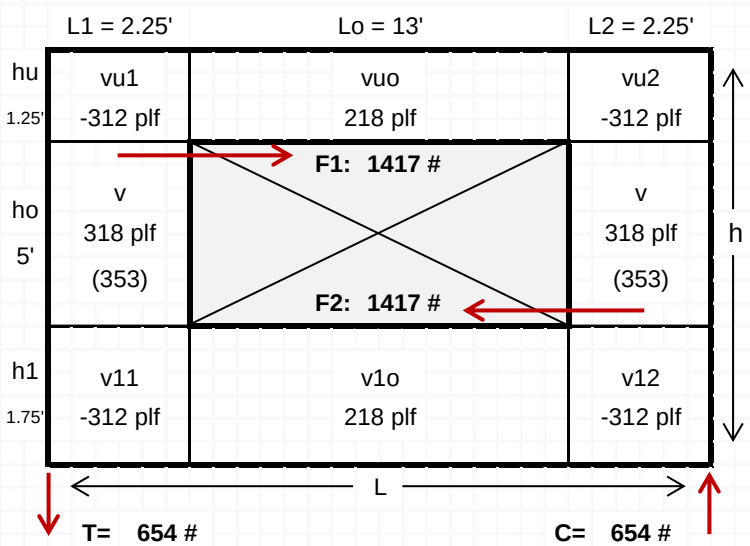
LATERAL ANALYSIS

Shear Transfer Around Openings:

Wall #1: Mark: A

Shear Force (V):	1431 #
Total Length (L):	17.5 ft
Wall1 Length (L1):	2.25 ft
Opening Length (Lo):	13.0 ft
Wall2 Length (L2):	2.25 ft
Wall Height (h):	8.0 ft
Height Above (hu):	1.25 ft
Opening Height (ho):	5.0 ft
Height Below (h1):	1.75 ft

Example Wall Diagram: Wall #1



Calculations:

$$T = V \cdot h / (L1 + Lo + L2) = 654\ \#$$

$$vuo = v1o = T / (hu + h1) = 218\ \text{plf}$$

$$Fo = vuo \cdot Lo = v1o \cdot Lo = 2835\ \#$$

$$F1 = Fo \cdot L1 / (L1 + L2) = 1417\ \#$$

$$F2 = Fo \cdot L2 / (L1 + L2) = 1417\ \#$$

$$v = V / (L1 + L2) = 318\ \text{plf}$$

Side SW: **SW3**

T/B SW: **SW6**

Maximum Strap Demand: **1417 #**

Holdown Demand: **654 #**

Global Unit Shears:

Top:	1431 #
Base:	1431 #
Left:	654 #
Right:	654 #

$$R1 = v \cdot L1 = 716\ \#$$

$$vu1 = v11 = (R1 - F1) / L1 = -312\ \text{plf}$$

$$R2 = v \cdot L2 = 716\ \#$$

$$vu2 = v12 = (R2 - F2) / L2 = -312\ \text{plf}$$

Wall #	Mark	Shear, V (lbs)	Length (ft)			Height (ft)			Side Wall Shears			Top and Bottom Shears				Max Strap Demand (#)	Max Holdown Demand (#)	Unit Shears	
			L1	Lo	L2	hu	ho	h1	v (plf)	H:W	SW	vu1	vu2	vuo	SW			T/B	Side
1	A	1431	2.25	13.0	2.25	1.25	5.0	1.75	**318**	**353**	**SW3**	-312	-312	**218**	**SW6**	**1417**	**654**	1431	654
2	B	1917	2.25	13.0	2.25	1.25	5.0	1.75	**426**	**473**	**SW2**	-418	-418	**292**	**SW4**	**1899**	**876**	1917	876

*Overturning resisting Dead Load moment has not been applied to the tension at the corners of the wall, UNO.
*This method of analysis is one of many options. This method is referred to as the Diekmann Method, by Edward E Diekmann, and correlates well with FEM modeling and test data per M410 of the APA

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way
Project

Mercer Island, Wa

8/5/2024
Date

00179-2024-01-01
Proj. No.

EJJ
Design

L-5
Sheet

VERTICAL ANALYSIS

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi
Units in (Parenthesis) represent Dead Load or 0.6DL (Ωo=2.5)

ROOF FRAMING

Using: pre-mfr trusses @ 24"oc
Using: 2X12's at 16"oc

Typical Loading:
Roof: 20 DL + 25 LL = 45 psf = 0.045 ksf

West HM (C1) #200

L = 16.75 ft
W = (0.045)(5.5/2+1) = 0.17 k/ft

R = 1.4 k
M = 5.9 k-ft

USE: **GT (PLY BY OTHERS)**

SW header (C1) #201

L = 6.0 ft
W = (0.045)(16.75/2) = 0.38 k/ft

R = 1.14 k
M = 1.7 k-ft

Fb = 0.66 KSI
Fv = 53.8 PSI
Δ = 0.06 in
L/ 1,155

USE: **4x8**

South HM (C1) #202

L = 9.5 ft
W = (0.045)(3.5/2+1) = 0.12 k/ft

R = 0.57 k
M = 1.35 k-ft

USE: **GT (PLY BY OTHERS)**

Main NS GT (C2) #203

L1 = 1.00 ft L2 = 15.75 ft
W1 = (0.045)(2) = 0.09 k/ft
W2 = (0.045)(1+11/2) = 0.29 k/ft
P = 0.57 k from #202

R1 = 2.77 k
R2 = 2.45 k
M = 10.4 k-ft

USE: **GT (PLY BY OTHERS)**

Roof Transition GT (C1) #204

L = 9.75 ft
W = (0.045)(1+2.75/2) = 0.11 k/ft

R = 0.53 k
M = 1.3 k-ft

USE: **GT (PLY BY OTHERS)**

Roof Ridge Beam (C1) #205

L = 9.75 ft
W = (0.045)(13.5/2+2.75/2) = 0.37 k/ft

R = 1.8 k
M = 4.4 k-ft

Fb = 0.7 KSI
Fv = 5.5 PSI
Δ = 0.11 in
L/ 1,033

USE: **4x12**

Main EW GT (C4) #206

L = 4.25 ft L2 = 2.75 ft L3 = 11.25 ft
W1 = (0.045)(16.75/2+1) = 0.42 k/ft
W2 = (0.045)(16.75/2+1) = 0.42 k/ft
W3 = (0.045)(9.75/2+1) = 0.26 k/ft
P1 = 1.80 k from #205 P2 = 2.98 k from #203/4

R1 = 6.49 k
R2 = 4.1 k
M = 30.22 k-ft

USE: **GT (PLY BY OTHERS)**

Beam over stairs (C2) #207

L1 = 4.75 ft L2 = 2.75 ft
W1 = (0.045)(2) = 0.09 k/ft
W2 = (0.045)(1+3/2) = 0.11 k/ft
P = 1.8 k from #205

R1 = 1 k
R2 = 1.52 k
M = 3.77 k-ft

Fb = 0.6 KSI
Fv = 54 PSI
Δ = 0.04 in
L/ 1,898

USE: **4X12**

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way — Project
Mercer Island, Wa

8/5/2024 — Date
00179-2024-01-01 — Proj. No.
EJJ — Design
V-1 — Sheet

VERTICAL ANALYSIS

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi
Units in (Parenthesis) represent Dead Load or 0.6DL (Ωo=2.5)

FLOOR FRAMING
Using: Floor: 11-7/8" TJI's at 16"oc
Using: Deck:2X10'S at 16"Oc
Using: Roof: 2X6's at 16"oc

Typical Loading:

Roof:	20	DL +	25	LL =	45	psf	=	0.045 ksf
Wall:	15	DL +	0	LL =	15	psf	=	0.015 ksf
Floor:	15	DL +	40	LL =	55	psf	=	0.055 ksf
Roof Deck:	40	DL +	60	LL =	100	psf	=	0.100 ksf

* additional 20 psf for pavers

Western overhang (C4) #100

L = 1.75 ft L2 = 13.00 ft L3 = 1.75 ft
W1 = (0.045)(5.5/2+2)+(0.015)(8)+(0.055)(2/2) = 0.39 k/ft
W2 = (0.045)(5.5/2+2)+(0.015)(8)+(0.055)(2/2) = 0.39 k/ft
W3 = (0.045)(5.5/2+2)+(0.015)(8)+(0.055)(2/2) = 0.39 k/ft
P1 = 0.00 k P2 = 0 k

Fb = 1.3 KSI
R1 = 3.2 k Fv = 69.7 PSI
R2 = 3.2 k Δ = 0.5 in
M = 13.2 k-ft L/ 392

USE: GL 5-1/2 x 11-7/8 (B3)

CHECK W/ OT

L = 1.75 ft L2 = 13.00 ft L3 = 1.75 ft
W1 = (0.045)(5.5/2+2)+(0.015)(8)+(0.055)(2/2) = 0.39 k/ft
W2 = (0.045)(5.5/2+2)+(0.015)(8)+(0.055)(2/2) = 0.39 k/ft
W3 = (0.045)(5.5/2+2)+(0.015)(8)+(0.055)(2/2) = 0.39 k/ft
P1 = 2.25 k , -2.25 k
P2 = -2.25 k , 2.25 k

Fb = 1.35 KSI
R1 = 5.0 k , 1.4 k Fv = 113 PSI
R2 = 1.4 k , 5.0 k
M = 13.5 k-ft , 13.5 k-ft

USE: **GL 5-1/2 x 11-7/8 (B3)**

SW deck transition beam (C5) #101

CHECK FULL LOAD (C5)

L1= 10.00 ft L2 = 4.50 ft A= 2.0 ft
W1 = (0.045)(16.5/2+2)+(0.015)(8)+(0.055)(1.33/2)+(0.1)(5/2) = 0.87 k/ft
W2 = (0.045)(2/2+2)+(0.015)(8)+(0.055)(1.33/2)+(0.1)(5/2) = 0.54 k/ft
W3 = (0.045)(2/2+2+1)+(0.015)(8)+(0.055)(1.33/2) = 0.34 k/ft
P1 = 1.4 k P2 = 3.2 k
from #100 Fb+ = 1.400 KSI
R1 = 5.7 k Fb- = -0.5 KSI
R2 = 10.3 k Fv = 107 PSI
M+ = 19.30 k-ft Δ_{BS} = 0.33 in
M- = -7.0 k-ft Δ_{C} = 0.120 in
L/ 501

USE: PSL 7x11-7/8 (B4)

CHECK 0.7*DL @ BS ONLY (C5)

L1= 10.00 ft L2 = 4.50 ft A= 2.0 ft
W1 =*((0.020)(16.5/2+2)+(0.015)(8)+(0.015)(1.33/2)+(0.04)(5, = 0.30 k/ft
W2 = 7*((0.020)(2/2+2)+(0.015)(8)+(0.015)(1.33/2)+(0.04)(5/2 = 0.20 k/ft
W3 = (0.045)(2/2+2+1)+(0.015)(8)+(0.055)(1.33/2) = 0.34 k/ft
P1 = 1.4 k P2 = 3.2 k

Fb+ = 0.450 KSI
R1 = 1.9 k Fb- = -0.5 KSI
R2 = 7.1 k Fv = 63.9 PSI
M+ = 6.25 k-ft Δ_{BS} = 0.1 in
M- = -7.1 k-ft Δ_{C} = 0.010 in
L/ 1,643

USE: PSL 7x11-7/8 (B4)

CHECK SIMPLE SPAN (C4)

L = 4.00 ft L2 = 6.00 ft L3 = 4.0 ft
W1 = (0.045)(2/2+2)+(0.015)(8)+(0.055)(1.33/2)+(0.1)(5/2) = 0.54 k/ft
W2 = (0.015)(8)+(0.055)(1.33/2)+(0.1)(5/2) = 0.41 k/ft
W3 = (0.045)(16.5/2+2)+(0.015)(8)+(0.055)(1.33/2)+(0.1)(5/2) = 0.87 k/ft
P1 = 2.50 k P2 = 1.1 k

Fb = 1.43 KSI
R1 = 5.6 k Fv = 93.12 PSI
R2 = 6.0 k Δ = 0.36 in
M = 19.7 k-ft L/ 456

USE: PSL 7x11-7/8 (B4)

CHECK w/ot (C5)

L1= 10.00 ft L2 = 4.50 ft A= 2.0 ft
W1 = (0.045)(16.5/2+2)+(0.015)(8)+(0.055)(1.33/2)+(0.1)(5/2) = 0.87 k/ft
W2 = (0.045)(2/2+2)+(0.015)(8)+(0.055)(1.33/2)+(0.1)(5/2) = 0.54 k/ft
W3 = (0.045)(2/2+2+1)+(0.015)(8)+(0.055)(1.33/2) = 0.34 k/ft
P1 = 1.4 k P2 = 5 k

Fb+ = 1.280 KSI
R1 = 5.5 k Fb- = -0.7 KSI
R2 = 12.4 k Fv = 111 PSI
M+ = 17.60 k-ft
M- = -10.7 k-ft

DESIGN: PSL 7x11-7/8 (B4) USE: **PSL 7x11-7/8 (B4)**

Back deck header (C1) #102

L = 6.0 ft
W = (0.1)(5/2)+(0.015)(4)+(0.045)(2) = 0.40 k/ft

R = 1.2 k Fb = 0.82 KSI
M = 1.8 k-ft Fv = 66 PSI
Δ = 0.09 in
L/ 765

USE: **(2) 2x8 TYP**

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way — Project
Mercer Island, Wa

8/5/2024 — Date
00179-2024-01-01 — Proj. No.
EJJ — Design
V-2 — Sheet

VERTICAL ANALYSIS

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi
Units in (Parenthesis) represent Dead Load or 0.6DL (Ωo=2.5)

FLOOR FRAMING
Using: Floor: 11-7/8" TJI's at 16"oc
Using: Deck:2X10'S at 16"Oc
Using: Roof: 2X6's at 16"oc

Typical Loading:

Roof:	20	DL +	25	LL =	45	psf	=	0.045 ksf
Wall:	15	DL +	0	LL =	15	psf	=	0.015 ksf
Floor:	15	DL +	40	LL =	55	psf	=	0.055 ksf
Roof Deck:	40	DL +	60	LL =	100	psf	=	0.100 ksf

* additional 20 psf for pavers

East roof overhang (C3) #103

CHECK FULL LOAD (C3)

L = 7.50 ft A = 5.50 ft
W1 = (0.045)(2/2) = 0.05 k/ft
W2 = (0.045)(2/2) = 0.05 k/ft

P = 0.10 k
R1 = 0.0 k
R2 = 0.68 k
M+ = 0.00 k-ft
M- = -1.2 k-ft

Fb+ = 0.000 KSI
Fb- = -0.8 KSI
Fv = 25.4 PSI
Δ_{BS} = 0.05 in
Δ_C = 0.500 in
L/ 255

USE: 4X6

CHECK 0.7*DL @ BS ONLY (C3)

L = 7.50 ft A = 5.50 ft
W1 = 0.7*(0.020)(2/2) = 0.01 k/ft
W2 = (0.045)(2/2) = 0.05 k/ft

P = 0.10 k
R1 = -0.1 k
R2 = 0.54 k
M+ = 0.00 k-ft
M- = -1.2 k-ft

Fb+ = 0.000 KSI
Fb- = -0.8 KSI
Fv = 25 PSI
Δ_{BS} = 0.09 in
Δ_C = 0.590 in
L/ 222

*supported by ceiling joists

USE: 4X6

CHECK SIMPLE SPAN (C1)

L = 7.5 ft
W = (0.045)(2/2) = 0.05 k/ft

R = 0.16 k
M = 0.31 k-ft

Fb = 0.2 KSI
Fv = 11.5 KSI
Δ_{BS} = 0.04 in
L/ 2,181

DESIGN: 4X6 USE: **4X6**

SE roof/floor transition beam (C3) #104

CHECK FULL LOAD (C3)

L = 9.75 ft A = 2.00 ft
W1 = (0.045)(4/2+2+5/2)+(0.015)(8) = 0.41 k/ft
W2 = (0.045)(2/2+4/2) = 0.14 k/ft

P = 0.68 k
R1 = 1.8 k
R2 = 3.1 k
M+ = 4.00 k-ft
M- = -1.6 k-ft

Fb+ = 0.590 KSI
Fb- = -0.2 KSI
Fv = 63.56 PSI
Δ_{BS} = 0.08 in
Δ_C = 0.040 in
L/ 1,329

USE: 3-1/2 x 11-7/8 LSL (B2)

CHECK 0.7*DL @ BS ONLY (C3)

L = 9.75 ft A = 2.00 ft
W1 = 0.7*((0.020)(4/2+2+5/2)+(0.015)(8)) = 0.18 k/ft
W2 = (0.045)(2/2+4/2) = 0.14 k/ft

P = 0.68 k
R1 = 0.7 k
R2 = 2 k
M+ = 1.39 k-ft
M- = -1.6 k-ft

Fb+ = 0.200 KSI
Fb- = -0.23 KSI
Fv = 31.31 PSI
Δ_{BS} = 0.02 in
Δ_C = 0.002 in
L/ 4,418

USE: 3-1/2 x 11-7/8 LSL (B2)

CHECK SIMPLE SPAN (C1)

L = 9.75 ft
W = (0.045)(4/2+2+5/2)+(0.015)(8) = 0.41 k/ft

R = 1.99 k
M = 4.87 k-ft

Fb = 0.7 KSI
Fv = 57.4 KSI
Δ_{BS} = 0.11 in
L/ 1,062

DESIGN: 3-1/2 x 11-7/8 LSL (B2) USE: **3-1/2 x 11-7/8 LSL (B2)**

East end of deck beam (C4) #105

L = 1.75 ft L2 = 3.50 ft L3 = 2.3 ft
W1 = (0.045)(4/2) = 0.09 k/ft
W2 = (0.1)(1.33/2)+(0.015)(4)+(0.045)(2/2) = 0.17 k/ft
W3 = (0.1)(1.33/2)+(0.015)(8)+(0.055)(9.5/2) = 0.45 k/ft
P1 = 0.25 k P2 = 1.99 k
from #104

R1 = 1.4 k
R2 = 2.6 k
M = 4.7 k-ft

Fb = 1.6 KSI
Fv = 93.5 PSI
Δ = 0.2 in
L/ 415

USE: 7x16 PSL (B4) * min taper 5-1/2"

Deck transition beam (C2) #106

L1 = 2.50 ft L2 = 9.50 ft
W1 =)(5.75/2)+(0.015)(8)+(0.045)(16.5/2)+(0.055)(1.3 = 0.82 k/ft
W2 = (0.055)(1.33) = 0.07 k/ft
P = 5.37 k from #105 & #203

R1 = 6.36 k
R2 = 1.75 k
M = 13.3 k-ft

Fb = 1.9 KSI
Fv = 200.3 PSI
Δ = 0.35 in
L/ 410

USE: **3-1/2 x 11-7/8 LSL (B2)**

Bay window header (C2) #107

L1 = 1.25 ft L2 = 6.75 ft
W1 = (0.045)(2/2) = 0.05 k/ft
W2 = (0.045)(5.25/2) = 0.12 k/ft
P = 1.75 k from #105

R1 = 1.87 k
R2 = 0.76 k
M = 2.3 k-ft

Fb = 1.05 KSI
Fv = 127 PSI
Δ = 0.2 in
L/ 470

USE: ~~(2)2x8 TYP~~

UPSIZE: **4x8**

MALSAM TSANG STRUCTURAL ENGINEERING
122 South Jackson
Suite 210
Seattle, WA 98104
t 206.789.6038
f 206.789.6042

4740 W Mecer Way — Project
Mercer Island, Wa

8/5/2024 — Date
00179-2024-01-01 — Proj. No.
EJJ — Design
V-3 — Sheet

VERTICAL ANALYSIS

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi
Units in (Parenthesis) represent Dead Load or 0.6DL (Ωo=2.5)

FLOOR FRAMING
Using: Floor: 11-7/8" TJI's at 16"oc
Using: Deck:2X10'S at 16"Oc
Using: Roof: 2X6's at 16"oc

Typical Loading:

Roof:	20	DL +	25	LL =	45	psf	=	0.045 ksf
Wall:	15	DL +	0	LL =	15	psf	=	0.015 ksf
Floor:	15	DL +	40	LL =	55	psf	=	0.055 ksf
Roof Deck:	40	DL +	60	LL =	100	psf	=	0.100 ksf

* additional 20 psf for pavers

East overhang (C2) #108

L1 = 2.25 ft L2 = 8.50 ft
W1 = (0.045)(11/2+2)+(0.015)(8)+(0.055)(2/2) = 0.51 k/ft
W2 = (0.045)(11/2+2)+(0.015)(8)+(0.055)(2/2) = 0.51 k/ft
P = 0 k

Fb = 1 KSI
R1 = 2.7 k Fv = 80.7 PSI
R2 = 2.7 k Δ = 0.2 in
M = 7.3 k-ft L/ 637

USE: 3-1/2 x 11-7/8 LSL (B2)

CHECK W/OT

L1 = 2.25 ft L2 = 8.50 ft
W1 = (0.045)(11/2+2)+(0.015)(8)+(0.055)(2/2) = 0.51 k/ft
W2 = (0.045)(11/2+2)+(0.015)(8)+(0.055)(2/2) = 0.51 k/ft
P = 2.8 k , -2.8 k

Fb = 1.5 KSI , 0.03 KSI
R1 = 4.9 k , 0.5 k Fv = 160.6 PSI , 59.6 PSI
R2 = 3.32 k , 2.1 k
M = 10.85 k-ft , 0.27 k-ft

USE: **3-1/2 x 11-7/8 LSL (B2)**

East cantilever (C5) #109

CHECK FULL LOAD (C3)

L = 11.75 ft A = 2.00 ft
W1 = (0.055)(1.33) = 0.07 k/ft
W2 = (0.055)(1.33/2)+(0.045)(2/2) = 0.08 k/ft

P = 2.70 k from #108

Fb+ = 0.002 KSI
Fb- = -0.8 KSI
R1 = 0.0 k Fv = 100.4 PSI
R2 = 3.7 k Δ_{BS} = 0.07 in
M+ = 0.01 k-ft Δ_{C} = 0.090 in
M- = -5.6 k-ft L/ 512

USE: ~~3-1/2 x 11-7/8 LSL (B2)~~

CHECK 0.7*DL @ BS ONLY (C3)

L = 11.75 ft A = 2.00 ft
W1 = 0.7*(0.015)(1.33) = 0.01 k/ft
W2 = (0.055)(1.33/2)+(0.045)(2/2) = 0.08 k/ft

P = 2.70 k

Fb+ = 1.250 KSI
Fb- = -0.8 KSI
R1 = -0.4 k Fv = 100.3 PSI
R2 = 3.39 k Δ_{BS} = 0.1 in
M+ = 8.50 k-ft Δ_{C} = 0.110 in
M- = -5.6 k-ft L/ 424

USE: ~~3-1/2 x 11-7/8 LSL (B2)~~

CHECK w/ot (C5)

L = 11.75 ft A = 2.00 ft
W1 = (0.055)(1.33) = 0.07 k/ft
W2 = (0.055)(1.33/2)+(0.045)(2/2) = 0.08 k/ft

P = 4.90 k

Fb+ = 0.110 KSI
Fb- = -0.99 KSI
R1 = -0.4 k Fv = 122.7 PSI
R2 = 6.33 k Δ_{BS} = 0.09 in
M+ = 1.20 k-ft Δ_{C} = 0.100 in
M- = -10.0 k-ft L/ 439

DESIGN: GL 5-1/2 x 11-7/8 (B3) USE: **GL 5-1/2 x 11-7/8 (B3)**

Main steel support (C4) #110

L = 5.75 ft L2 = 6.00 ft L3 = 10.75 ft
W1 = (0.1)(1.33) = 0.13 k/ft
W2 = (0.055)(14.25/2+11.5/2) = 0.71 k/ft
W3 = (0.055)(14.25/2+11.5/2) = 0.71 k/ft
P1 = 12.10 k P2 = -0.4 k from #109
from #101 & #106

R1 = 13.8 k
R2 = 10.4 k Δ = 0.5 in
M = 78.5 k-ft L/ 537

USE: W12x58

MALSAM TSANG STRUCTURAL ENGINEERING
122 South Jackson
Suite 210
Seattle, WA 98104
t 206.789.6038
f 206.789.6042

4740 W Mecer Way — Project
Mercer Island, Wa

8/5/2024 — Date
00179-2024-01-01 — Proj. No.
EJJ — Design
V-4 — Sheet

VERTICAL ANALYSIS

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi
Units in (Parenthesis) represent Dead Load or 0.6DL (Ωo=2.5)

FLOOR FRAMING
Using: Floor: 11-7/8" TJI's at 16"oc
Using: Deck:2X10'S at 16"Oc
Using: Roof: 2X6's at 16"oc

Typical Loading:

Roof:	20	DL +	25	LL =	45	psf	=	0.045	ksf
Wall:	15	DL +	0	LL =	15	psf	=	0.015	ksf
Floor:	15	DL +	40	LL =	55	psf	=	0.055	ksf
Roof Deck:	40	DL +	60	LL =	100	psf	=	0.100	ksf

* additional 20 psf for pavers

South beam of opening to above (C2) **#111**

L1 = 5.25 ft L2 = 0.75 ft
W1 = (0.045)(16.5/2)+(0.015)(8)+(0.055)(1.33/2) = 0.53 k/ft
W2 = (0.015)(8)+(0.055)(1.33/2) = 0.16 k/ft
P = 0.52 k

		Fb =	0.25	KSI	
R1 =	1.6 k	Fv =	40	PSI	
R2 =	1.78 k	Δ =	0.01	in	
M =	2.5 k-ft		L/ 5,604		

USE: GL 5-1/2 x 11-7/8 (B3)

CHECK W/OT

L1 = 5.25 ft L2 = 0.75 ft
W1 = (0.045)(16.5/2)+(0.015)(8)+(0.055)(1.33/2) = 0.53 k/ft
W2 = (0.015)(8)+(0.055)(1.33/2) = 0.16 k/ft
P = 4.77 k , -3.73 k

		Fb =	0.44	KSI	,	0.11	KSI
R1 =	2.16 k , 1.1 k	Fv =	131	PSI	,	14.3	PSI
R2 =	5.5 k , -1.9 k						
M =	4.4 k-ft , 1.1 k-ft						

USE: **GL 5-1/2 x 11-7/8 (B3)**

New beam in garage (C2) **#112**

L1 = 9.00 ft L2 = 12.50 ft
W1 = (0.055)(10.75/2+1.33/2) = 0.33 k/ft
W2 = (0.055)(10.75/2+1.33/2) = 0.33 k/ft
P = 3.1 k from (E) BEAM

		Fb =	1.37	KSI	
R1 =	5.29 k	Fv =	64.9	PSI	
R2 =	4.8 k	Δ =	0.5	in	
M =	34.8 k-ft		L/ 471		

USE: **PSL 7x16**

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way — Project
Mercer Island, Wa

8/5/2024 — Date
00179-2024-01-01 — Proj. No.
EJJ — Design
V-5 — Sheet

VERTICAL ANALYSIS

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi
Units in (Parenthesis) represent Dead Load or 0.6DL (Ωo=2.5)

FOUNDATION Allowable Bearing: 2,500 psi

(NEW) EXTERIOR WALL CONTINOUS FOOTING

ROOF:	(0.045)(3.5/2+2)	=	0.17
ECOND FLOOR WALL:	(0.015)(8)	=	0.12
SECOND FLOOR:	(0.055)(13.5/2)	=	0.37
FIRST FLOOR WALL:	(0.015)(9)	=	0.14
FIRST FLOOR:	(0.055)(3.75/2)	=	0.10

Σ 0.90

Check Crushing

= 0.90 / 1.33
= 0.68 k/stud
< 6.3 k/stub (2"x6" @16" o.c)
< 1.97 k/stud (2"x4" @16" o.c.)

FOUNDATION: (0.150)(2.33) = 0.35

Σ = 1.25

1.25 / 2.5 = 0.50 * 12 = 6 "

-- > 18" FOOTING OK

TYPE A-SPREAD FOOTING

P= 10.0 K

√ (10 / 2.5) = 2.00 -> USE: 2' - 0" SQ

TYPE B-SPREAD FOOTING

P= 15.5 K

√ (16 / 2.5) = 2.49 -> USE: 2' - 6" SQ

TYPE C-SPREAD FOOTING

P= 22 K

√ (22 / 2.5) = 2.97 -> USE: 3' - 0" SQ

MALSAM TSANG
STRUCTURAL ENGINEERING

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

4740 W Mecer Way
Project

Mercer Island, Wa

8/5/2024
Date

00179-2024-01-01
Proj. No.

EJJ
Design

V-6
Sheet

Company:	Malsam Tsang	Date:	9/8/2022
Engineer:	JWT	Page:	1/5
Project:	Back-up Calcs		
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 9.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 10.38
c_{ac} (inch): 23.42
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 12.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 3.00 x 3.00 x 0.25

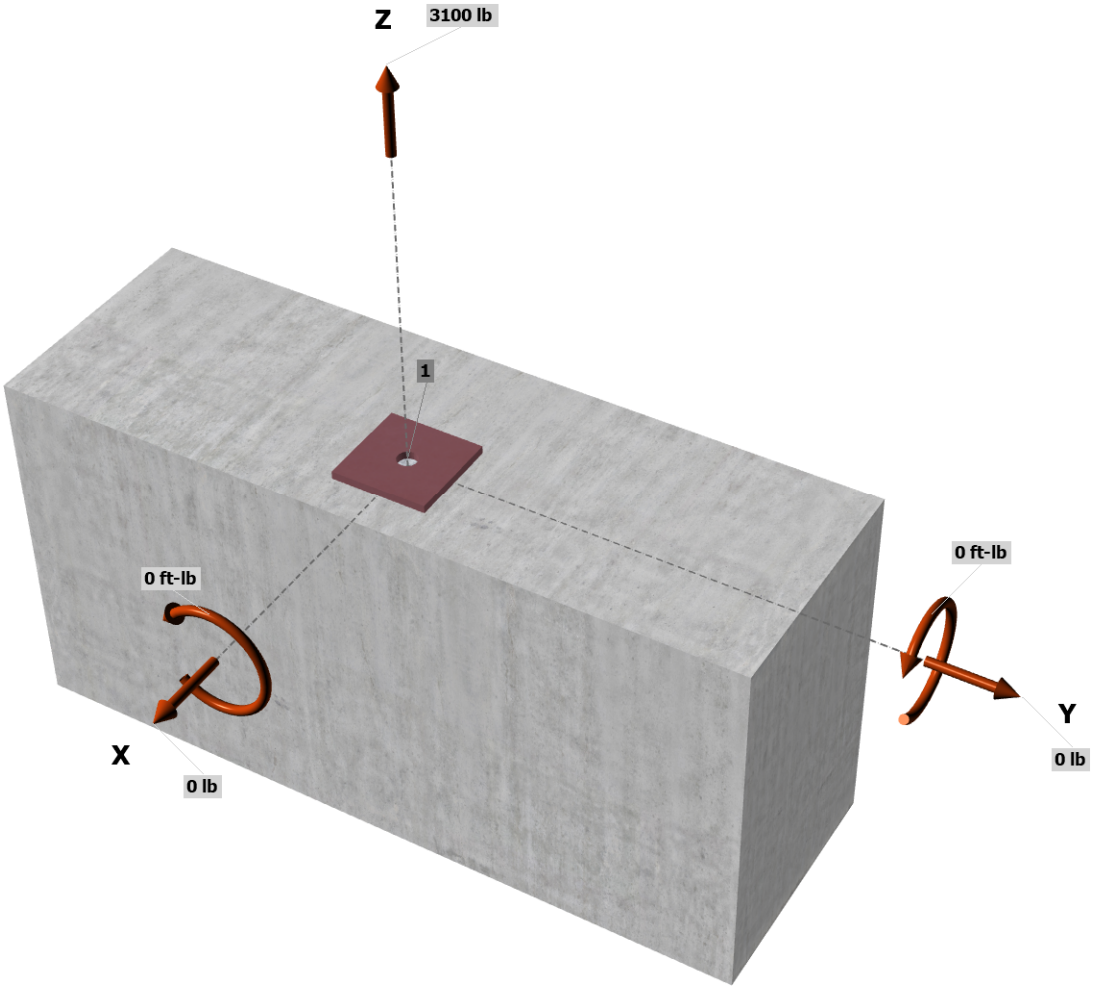
Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 5/8"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

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

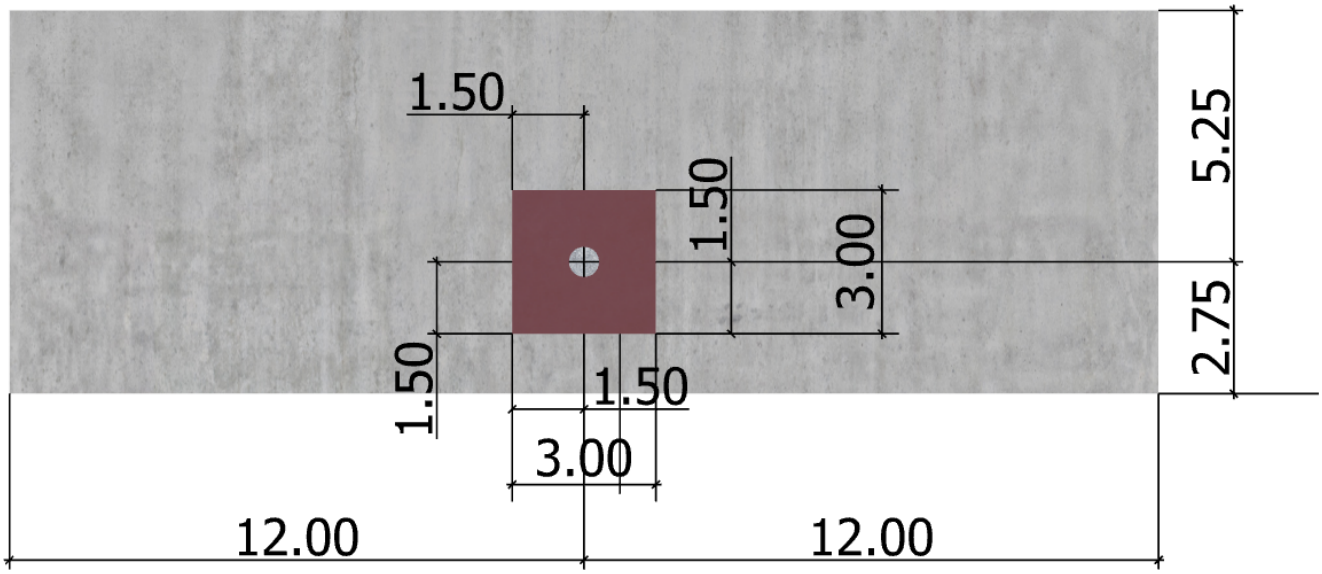
Strength level loads:

N_{ua} [lb]: 3100
V_{uax} [lb]: 0
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0

<Figure 1>



<Figure 2>



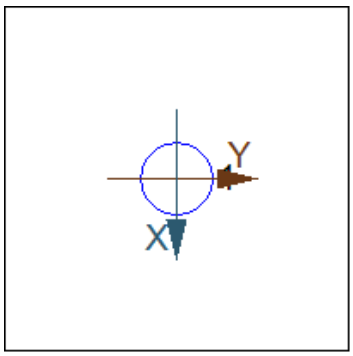
Company:		Date:	9/8/2022
Engineer:		Page:	4/5
Project:			
Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	3100.0	0.0	0.0	0.0
Sum	3100.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 3100
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

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

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	8.000	19233

$\phi N_{cb} = \phi \left(A_{Nc} / A_{Nco}\right) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cb} (lb)
192.00	576.00	2.75	0.769	1.00	1.000	19233	0.65	3204

6. Adhesive Strength of Anchor in Tension (Sec. 17.6.5)

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

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

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.6.5.2.1)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	1356	0.63	9.000	23962

$\phi N_a = \phi \left(A_{Na} / A_{Na0}\right) \Psi_{ed,Na} \Psi_{cp,Na} N_{ba}$ (Sec. 17.5.1.2 & Eq. 17.6.5.1a)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	ϕ	ϕN_a (lb)
140.19	307.10	8.76	2.75	0.794	1.000	23962	0.65	5647

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	3100	9833	0.32	Pass
Concrete breakout	**3100**	**3204**	**0.97**	**Pass (Governs)**
Adhesive	3100	5647	0.55	Pass

SET-3G w/ 5/8"Ø F1554 Gr. 36 with hef = 9.000 inch meets the selected design criteria.

12. Warnings

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

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