Structural Calculations

FOR

McConnell Remodel 2.0

7845 SE 62nd Street

Mercer Island, WA

Prepared for: Dan J. Say SE

Date: December 16, 2021

SSF STRUCTURAL ENGINEERING

SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 O 253.284.9470

ssfengineers.com

McConnell Res 2.0
STRUCTURAL CALCS

DETACHED BUILDING

ROOF DL = 12 PSF
SNOW = 25 PSF
Σ 37 PSF

MAIN FLOOR DL = 20 PSF
LL = 40 PSF
Σ 60 PSF

DECK DL = 15 PSF
LL = 60 PSF
Σ 75 PSF

ROOF FRMG

rafters → L = 12.75' W = 1.33(37) = 50#/'

$M = \frac{1}{8}(50)(12.75)^2 = 12{,}142^{\#}$ "

$F_b = 850 \times 1.15 \times 1.15 \times 1.3 = 1461$ PSI $S_{req'd} = 8.9"^3$

2×6's @ 12" o.c. → $S_{req'd} = 6.6"^3$

or 1 3/4 × 5 1/2 LVLs @ 16" o.c.

$I_{min} = \frac{(5)(50)(12.75)^4 \times 1728}{384 \times 2 \times 10^6 \times .64} = 23.2"^3$ or 2×12's @ 24" o.c.
or 2×8's @ 16" o.c.
1 3/4 × 5 1/2 LVLs @ 16" o.c. or

L = 8'-6" $M = \frac{1}{8}(50)(8.5)^2 = 5419^{\#}$ " $S = 3.7"^3$

2×6's @ 16" o.c. or

or 2×8's @ 24" o.c.

SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com
SWENSON SAY FAGET

OUTER BEAM

$L = 20'$ $\quad W = \left(\frac{8.5}{2} + 137\right) = 157^{\#}/_{'} + 20 = 177^{\#}/_{'}$

$= .177^{K}/_{'}$

$M = \frac{1}{8}(.177)(20)^2 = 8.9^{K'}$

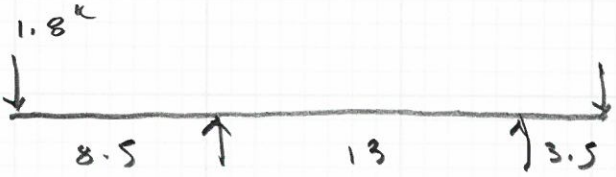
$S = \frac{(8.9)(12)}{.22 KSI} = 4.9^{"3}$

$I_{MIN} = \frac{(5)(.177)(20)^4 (1728)}{384 * 29{,}000 * 1} = 22^{"4}$

$R = 1.8^{K}$ on C7 x 14.75

on HSS 3 x 6 x 1/2

CANT. BEAM



on HSS 4 x 8 x 3/8

$M = 8.5 \times 1.8 = 15.3^{K'}$ $\quad S = \frac{M}{F} \frac{(15.3)(12)}{25} = 7.3^{"3}$

$I_{min} = \frac{(1.8)(8.5)^2(8.5+13)(1728)}{(3)(29{,}000)(.85)} = 65.4^{"4}$

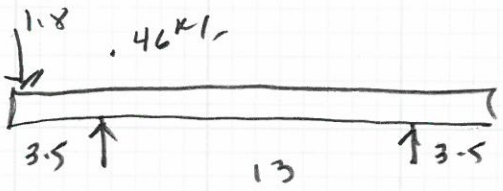
HSS 4 x 8 x 1/2

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STOOP CANT

$w = 11(37) = 407^{\#}/_{'} + 50 = 457^{\#}/_{'}$

$P = 1.8^{K}$



$M = \frac{3.5^2}{2} \times .46 + 3.5 \times 1.8 = 9.1^{K'}$

$M = \frac{1}{8}(.46 \times 13)^2 = 9.8^{K'}$

$I_{req'd} = \frac{(5 \times .46 \times (13)^4 \times 1728}{384 \times 29{,}000 \times .65} = 15.7^{in^4}$

HSS 8x4x1/4

SWENSON SAY FAGÉT
ssfengineers.com
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470

SSF STRUCTURAL ENGINEERING

McConnell Res 2.0
PROJECT

12-6-21
DATE

PROJ. # DJS

DESIGN

F-3
SHEET

MAIN FLOOR

Interior Joists

L = 13' $w = 1.33(60) = 80^{\#}/'$ $M = 20,280^{\#''}$

$F_b = 850 \times 1.15 \times 1.1 = 1075\ psi$ $S_{req'd} = 18.9''^3$

$I_{min.} = \frac{(5)(80)(13)^4 \times 1728}{384 \times 1.3 \times 10^6 \times .43} \approx 92''^4$

USE 2×10's @ 12" O.C.
(STIFF FLOOR)

Deck Joists

Linear = 8' $w = 1.33(75) = 100^{\#}/'$

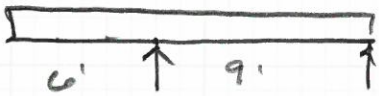
$M = \frac{1}{8}(100)(8)^2 = 800^{\#'} = 9600^{\#''}$

$F_b = 850 \times 1.15 \times 1.1 \times 1.8 = 860\ psi$ $S_{req'd} = 11.2''^3$

USE 2×10's @ 16" O.C.

Propped Cant

$w = 7 \times 75 = 525^{\#}/'$



$M = 6^2/2 \times 525 = 9450^{\#'} = 113,400^{\#''}$

$F_b = 1350 \times .8 = 1080\ psi$ $S_{req'd} = 105''^3$

USE 6×12

MRes 2.0

12-6-21

PROJECT

DATE

PROJ. # 255

DESIGN F-4

SHEET

SSF STRUCTURAL ENGINEERING

SWENSON SAY FAGET
ssfengineers.com
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470

USE PT 4x10 RIMS

$L = 7'$ $\quad w = 8+75 = 600^{\#}/'$

$M = \frac{1}{8}(600)(7)^2 = 44{,}100^{\#}$

$F_b = 1000 \times 1.2 \times .8 = 960 \text{ psi}$ $\quad S = 46''^3$

PT 4x10

Dropped Rims

$L = 13'$ $\quad w = (6.5)(60)+(12)(75)+80 = 620^{\#}/'$

$M = \frac{1}{8}(620)(13)^2 = 13{,}098^{\#}'$

$F_b = 2400 \text{ psi}$ $\quad S_{req'd} = \frac{(13{,}098)(12)}{2400} = 65.5''^3$

$I_{req} = \frac{(5)(620)(13)^4 \times 1728}{384 \times 1.8 \times 10^6 \times .43} = 514''^4$

GL 5 1/2 x 11 1/4

GK

$L = 6'-6''$ $\quad w = 8.5 \times 37 + 80 = 395^{\#}/'$

PT 6x12

Calculate gravity Loads on
Conc-Cols & Diamond Piers

Conc-Cols

$P_{ROOF} = 1.8^K + (10)(.46) = 6.4^K$

$P_{FLOOR} = (4.5)(7)(75) + (5)(3)(75) + (6.5)(6.5)(60)$
$+ (6.5)(80) + (7.5)(3.5)(75) = 8.5^K$

$\Sigma \quad 8.5 + 6.4 = \underline{\underline{14.9^K}}$ ← MUST LOAD COL

℄ DECK → $P = 5.5^K$ → $3'-0" + 3'-0" \times 12'-0"$ w/
(3)#4 LS EW TOP
& BOTT.

℄ OTHER CORNER → $P_R = 6.4^K$

$P_{FLOOR} = (6.5)(6.5)(60) + (6.5)(80)$
$+ (7.5)(3.5)(75)$
$= 5.02^K$

$\Sigma \quad \underline{\underline{11.4^K}}$

Diamond Pier

$P_{RF} = (8)(6.5)(40) + (6.5)(80) = 2600^{\#}$

$P_{roof} = (8)(3.25)(40) + (3.25)(80) + (8)(3)(40) = 2240^{\#}$

DP-50/50" w/ 50" Long Pins $P_V = 3300^{\#}$, $P_H = 600^{\#}$

$P_{UPLIFT} = 1200^{\#}$

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

SSF STRUCTURAL ENGINEERING

PROJECT	M Res 2.0
DATE	12-6-21
PROJ. #	055
DESIGN	F-6
SHEET	

EAST CONC BEAM

$L = 13'-6"$ $\quad d_{MIN} = L/16 = \frac{(13.5)(12)}{16} = 10.2$

$U = 1.2D + 1.6L$ $\quad DL = \frac{(8)(15)}{144} + 150 = 125$

$W_{DL} = (8)(15) = 120 + 125 = 245^{\#}/_{L}$

$W_{LL} = (8)(25) = 200^{\#}/_{L}$

$W_u = 1.2(245) + 1.6(200) = 614^{\#}/_{L}$

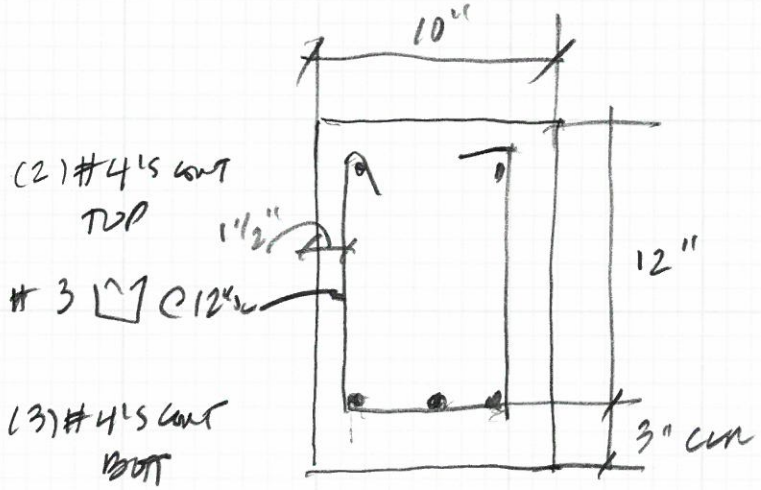
$M = \frac{1}{8}(.614)(13.5)^2 = 14^{K}/_{L}$

$F = \frac{(8)(15-3.5)^2}{1200} = .09$ $\quad K_u = \frac{M_u}{F} = \frac{14}{.09} = 159$

$A_{ST} = (.0035)(8)(13.5) = .38"^2$

USE (2) #5's CONT TOP & BOTT

W/ #3 [] @ 12" o.c. FULL LENGTH



SWENSON SAY FAGÉT
ssfengineers.com
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470

M Res 2.0

PROJECT

12-29-21
DATE

PROJ. # 005

DESIGN F-6A

SHEET

STRUCTURAL ENGINEERING

Garage Revisions

New Roof Frmg

DL = 15
LL = 25
Σ40

LOFT DL = 15
LL = 50
Σ65 PSF

Rafters

L = 14'-6"
L clrwt = 4'

w = 2 × 40 = 80 #/'

M = 25,230 "#

F_b = 850 × 1.15 × 1.15 = 1124 psi

S req'd = 22.5 in³

$I_{req'd} = \frac{(5)(80)(15)^4 + 1728}{384 \times 1.3 \times 10^4 \times .75} = 93.5$ in⁴

OR 2×8's @ 16" OC DF #1

2×12's @ 24" OC

LOFT JOISTS

L = 14'

w = 1.33 × 65 = 87 #/'

$M = \frac{1}{8}(87 \times 14)^2 = 25,378$ #'

F_b = 850 × 1.15 × 1.1 = 1075 psi

S = 20.5 in³

$I_{req'd} = \frac{(5 \times 67)(13)^4 + 1728}{384 \times 1.3 \times 10^4 \times .43} = 77$ in⁴

2×12's @ 16" OC

Ridge Bm

L = 14

$M = \frac{1}{8}(440)(14)^2 = 10,780$ #' = 129,360 #"

w = 11 + 40 = 440 #/'

F_b = 1350 × 1.15 = 1553 psi

S = 83 in³

$I_{req'd} = \frac{(5)(440)(14)^4 + 1728}{384 \times 1.6 \times 10^4 \times .70} = 339$ in⁴

Try 6 + 12

L = 9'-6"

$I_{min} = \frac{(250)(7.5)^3(4(14) + 3(7.5))1728}{(24)(1.6 \times 10^4)(.38)} = 1098$ in⁴

GL 5½ × 13½

I_G = 976 in⁴

M Res 2.0

12-13-21

PROJ. # D55

DESIGN F-7

SHEET

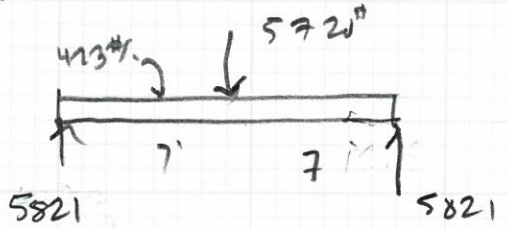
SSF STRUCTURAL ENGINEERING

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

Central Loft Beam

$w = 6 + 5 + 6.5 = 423^{\#}/_{1}$ $\quad P = 13 + 11 + 40 = 5720^{\#}$

$L = 14'-0"$



$M = \frac{1}{8}(423)(14)^2 + \frac{(5720)(14)}{4} = 30,363.5^{\#'} =$

$= 364,602$

$S = 132^{"4}$

$F_b = 2400 + 1.15 = 2760 psi$

$I_{req.} = \frac{(5)(423)(145)^4 + 1728}{384 + 1.8 \times 10^6 + .70} + \frac{(5720)(14)^3 + 1728}{48 + 1.8 \times 10^6 + .70}$

$= 290 + 448 = 738^{"4}$

GL 5 1/2 + 13 1/2

or GLB 3/4 + 12

Garage HDR

$w = (11.5)(40) = 460^{\#}/_{1}$

$L = 9'$

$M = \frac{1}{8}(460)(9)^2 = 4658^{\#'} = 55,896^{\#'}$

USE 6+10 w/ 6+6 POSTS

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

$F_b = 2760^{\#}$ " $S = \cancel{145.6^{in3}}$

$I_{req} = \frac{(5)(460)(17.5)^4 + 1728}{384 + 1.8 + 10^6 \times .88} + \cancel{\frac{(44)(17.5)^2 + 1728}{48 + 1.8 + 10^6 \times .88}}$

$= 613^{"4}$

GL 5½+12

BM @ FACE OF ADDITION

$L = 13'-6"$ $w = 10 + 65 = 650^{\#/'}$ $P = (10)(11)(40) = 4400^{\#}$

$M = \frac{1}{2}(650)(13.5)^2 + \frac{(4400)(13.5)}{4} = 29,658^{\#'}$

$= 355,894^{\#"}$

$S = 129^{"4}$

$I_{req} = \frac{(5)(650)(13.5)^4 + 1728}{384 + 1.8 + 10^6 \times .65} + \frac{(4400)(13.5)^3 + 1728}{48 + 1.8 + 10^6 \times .65}$

$= 397 + 217 = 613^{"4}$

GL 5½+12

WEST HDRS $L = 6'$

$P = (2+3.5)(7)(40) = 1540^{\#}$ $w = 120^{\#/'}$

$M = 2850^{\#'} = 34,200^{\#"}$

(2) 2+10

OTHER E+T. HDRS → 4+8's

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STRUCTURAL ENGINEERING

PROJECT	Mercer 2.0
DATE	12-13-21
PROJ. #	DJS
DESIGN	FG
SHEET	9

Lateral

Seismic

$W_{ROOF} = (25)(20)(15) = 7.5^K$ $\quad H = 14'$

$W_{FLOOR} = (19)(20)(15) = 5.7^K$ $\quad H = 34'$

13.2^K

USE 3 SIDED BOX W/ WOOD SHEAR WALLS (R=6.5) FOR UPPER & CANTILEVER CONC. WALLS FOR LOWER (R=1.5)

$V_U = 1.1^K$, $V_L = 0.2^K \rightarrow \Sigma V = 1.3^K$

$S_S = 1.5$ $\quad S_1 = 0.51$ $\quad S_{DS} = 1.0$ $\quad S_{D1} = 0.57$

W/ R=1.5 $\quad V_U = 6.5/1.5\ (1.1) = 4.8^K$

$V_U = 6.5/1.5\ (0.2) = 0.9^K$

$\Sigma\ 5.7^K$

WIND

$V_U = (14)(7)(14.7) = 1441^\# = 1.4^K$

$V_L = (14)(7)(14.7) = 1441^\# = 1.4^K$

$\Sigma\ 2.8^K$

WIND GOVS UPPER IN BOTH DIRECTIONS $\rightarrow V = 1440^\#$

SEISMIC GOVS BOTT $\rightarrow V = 5700^\#$

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

NORTH / SOUTH

100% INTO EAST WALL → $V = \frac{1440}{13} = 111^{\#}/_{'}$

(W6)

½" PLY OR w/ 8d @ 6" o.c.

USE HDU2 each end

ROTATIONAL COMPONENTS

$T = C = \frac{(1440)(7)}{13} = 775^{\#}/_{'}$

NORTH → $V = \frac{775}{6} = 129^{\#}/_{'}$

SOUTH → $V = \frac{775}{10} = 78^{\#}/_{'}$

(W6)

½" PLY OR w/ 8d @ 6" o.c. w/ HDU2 each end

EAST / WEST

$\frac{1}{2} V = \frac{1440}{2} = 720^{\#}/_{'}$

ROTATIONAL SHEAR controls

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

SSF STRUCTURAL ENGINEERING

PROJECT: McConnell Res

DATE: 12-7-21

PROJ. # 005

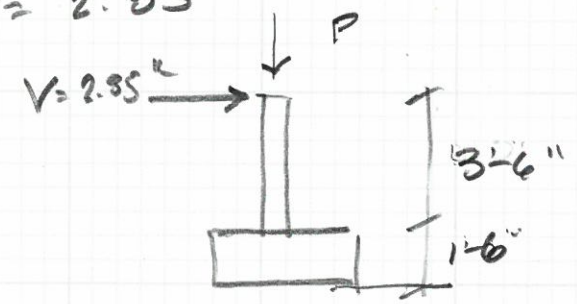
DESIGN

SHEET: L-2

E/W Seismic @ Cant. Cols

$V = 5.7^{K}$ 50% to Ea. Col

$1/2\,V = 2.85^{K}$



$W_{FTG} = 2.4^{K}$

$W_{COL} = 0.4$

$P_{DL} = \left(\frac{22}{2}\right)(9.5)(10) + (10)(6.5)(10) = 1700^{\#} = 1.7^{K}$

Total DL → $2.4 + .4 + 1.7 = 4.5^{K}$

$M_{OVT} = (2.85)(5) = 14.3^{K'}$

$M_{RES} = (2)(4.5) = 9$

Try 5' + 5' + 1'-6" $W_{FTG} = 5.6^{K}$

$P_{TOTAL} = 5.6 + .4 + 1.7 = 7.7^{K}$

$M_{OVT} = 2.85 + 5 = 14.3^{K'}$

$M_{RES} = (2.5)(7.7) = 19.3^{K'}$ FS = 1.4

check soil bldg → $P_{RES} = 7.7^{K}$

$$\frac{(2.85)(5) + 7.7(2.5)}{7.7} = x = 2.5^{K}$$

$\frac{P}{A} = \frac{7.7}{5+5} = .31\ KSF$

SSF STRUCTURAL ENGINEERING

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

PROJECT McConnell Res 2.0

DATE 12-7-21

PROJ. # 005

DESIGN L-3

SHEET

Garage Lateral

Seismic

$W_{ROOF} = 29 + 39 \times 15 \approx 17^{K}$ $\quad H = 13'$

$S_S = 1.47$ $\quad S_1 = 0.51$ $\quad S_{DS} = 1.0$ $\quad S_{D1} = 0.5V$

$C_S = 0.154$ $\quad V_R = 1.4^{K}$

WIND

$\theta = 22°$ $\quad H_{ROOF} = 14'$ $\quad H_{BOTT} = 8'$ $\quad$ 100 mph Exp. "C"

$P_{0-15} = 12.2 PSF$ $\quad P_{ROOF} = 4.80 PSF$

N/S DIRECTION

$V = (5)(37)(4.8) + (4)(34)(12.2) = 2547^{\#}$

E/W DIRECTION

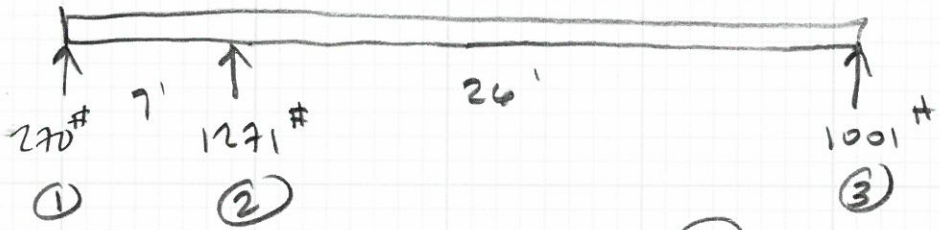
$V = [(6)(22) + (4)(22)]\,12.2 PSF = 2684^{\#}$

WIND GOVERNS BOTH DIRECTIONS

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

N/S DIRECTION

$w = \frac{2547}{33} = 77\#/'$



① $V = \frac{270}{9} = 30\#/'$ — WG — 1/2" PLY OF W/ 8 2C 6" o.c. (NO HD)

② $V = \frac{1271}{14.0} = 90\#/'$ — WG — 1/2" PLY OF W/ 8 2C HDU2 each end

③ $V = \frac{1001}{22} = 46\#/'$ — WG — 1/2" PLY OF W/ 8 2C 6" o.c. (NO HD)

E/W DIRECTION

50% TO NORTH & SOUTH walls

$1/2\,V = \frac{2684}{2} = 1342\#$

NORTH $V = \frac{1342}{8.5} = 158\#/'$ — WG — 1/2" PLY OF W/ 8 2C 6" o.c. HDU2 each end

SOUTH $V = \frac{1342}{33} = 41\#/'$ — WG — 1/2" PLY OF W/ 8 2C 6" o.c. (NO HD)

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

DETACHED BLDG

Criteria Sheet

Codes

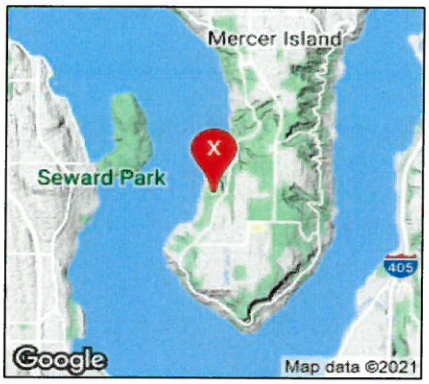
Structural	IBC 2018
Loading	ASCE 7-16
Wood:	NDS 2018
Steel:	AISC 360-16
Concrete:	ACI 318-14
Masonry:	TMS 402/602-16

Project Location

Street & Number	7845 SE 62nd Street
City:	Mercer Island
State:	WA
ZIP:	98040
Latitude:	47.5467 N
Longitude:	-122.2341 W
Ground Elevation	144 ft

Occupancy Category

Risk Category: II — ASCE 7 Table 1.5-1



Seismic Load Summary:

Analysis Procedure: Equivalent Lateral Force Procedure

Lateral System: Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

R:	6.50	C_d=	4
Base Shear V =	2 kips	Ω_o=	2.5
S_s=	1.468	S_1=	0.509
S_{DS}=	1.00	S_{D1}=	0.58
C_s=	0.154	I_E=	1.0

Story Information

Stories Above Grade (Including Mezzanine Levels): 2

Horizontal and Vertical Irregularities:

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

Wind Load Summary:

V= 110 K_{zt}= 1.00

Exposure = C

Dead Loads:

Roof		Floor	
Roofing	2.5 psf	Finish Floor	1 psf
1/2" Sheathing	1.8 psf	3/4" Sheathing	2.7 psf
Trusses @ 24" oc	2.5 psf	Joists @ 16" oc	2.2 psf
Misc./Mech.	1.5 psf	Misc./Mech.	2 psf
Ceiling Finish	2.8 psf	Ceiling Finish	2.8
Solar Panels	4		10.7 psf
	15 psf	Use	20 psf
Use	15 psf		

Live Loads:

Snow	25	psf
Floor	40	psf

Soils:

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

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

SSF STRUCTURAL ENGINEERING

SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com
SWENSON SAY FAGÉT

Project

Criteria

DATE 12/16/2021

PROJ. #

DESIGN ENG

SHEET 1

Seismic Design

ASCE 7-16 Seismic Analysis Equivalent Lateral Force Procedure

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

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

Section 12.8.1.3 Exceptions

Regular Structure	Yes
≤ 5 Stories above grade	Yes
T ≤ 0.5s	Yes
ρ = 1.0	Yes
Not Site Class E or F	Yes
Risk Category I or II	Yes

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

S_S	1.468 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.509 g	2% in 50 yr, Latitude & Longitude lookup
R	6.50	
C_d	4.0	
Ω_o	2.5	
I_e	1.00	Table 1.5-2
h_n	13.0 ft	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T_a	0.14 sec	
T	0.14 sec	Eq. 12.8-7
T_0	0.12 sec	
T_S	0.58 sec	
T_L	6.00 sec	
F_a	1.20	Table 11.4-1
F_v	1.70	Table 11.4-2
S_{MS}	1.76 g	Eq. 11.4-1
S_{M1}	0.87 g	Eq. 11.4-2
S_{DS}	1.000 g	Eq. 11.4-3
S_{D1}	0.577 g	Eq. 11.4-4
C_s	***0.154 Controls***	Eq. 12.8-2
	0.648	Eq. 12.8-3 need not exceed, T < T_L
	0.010	Eq. 12.8-5 or 12.8-6 minimum
C_s, design	0.154	Section 11.4.8 Exception 2 Applied
Bldg. Weight	13.0 k	
V = C_SW	2.0 k	Eq. 12.8-1, Strength Level Base Shear
V = C_{Sasd}W	1.4 k	Eq. 12.8-1 ASD Base Shear

Building Period Per Alternate Analysis

T (sec)	

Per Geotech Report

F_a	
F_v	

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

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

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

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

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

Vertical Distribution ASD ρ= 1 k= 1.000

Level	h_x (ft)	W_x (k)	h_x^k (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force (ρ not included)				
					C_{vx} (%)	F_x (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	$\gamma=F_{px}/F_x$
Roof	13.0	13	13.0	169	1.000	1.4	**1.4**	1.4	1.8	3.6	**1.8**	1.30
Σ		13.0		169		**1.4**						

SWENSON SAY FAGÉT ssfengineers.com SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212 TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	C	
V=	110	mph
K_d=	0.85	Table 26.6-1
K_h=	0.85	Table 26.10-1
K_e=	0.99	Table 26.9-1
G=	0.85	26.9.4

Location and Building Dimensions

Calculate Kzt?	Yes	
Kzt	1.00	
Roof Type	Gable	
Roof Angle - Transverse Dir	22	degrees
Roof Angle - Long Dir	0	degrees
Ground to top of roof	13	ft
Bot of roof to top of roof	5	ft
Mean Roof Height, h	10.5	ft
Short Plan Dimension	23	ft
Long Plan Dimension	33	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	0	ft

Velocity Pressure at Mean Roof Height, q_h =	22.2	psf

Transverse Wind Pressures

L/B = 0.70 h/L = 0.46

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.34 / 0.11
Leeward Roof	-0.60

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	22.26	15.14	9.45	**14.8**
15-20	0.9	23.57	16.03	9.45	**15.3**
20-25	0.94	24.62	16.74	9.45	**15.7**
25-30	0.98	25.67	17.45	9.45	**16.1**
30-40	1.04	27.24	18.52	9.45	**16.8**
41-50	1.09	28.55	19.41	9.45	**17.3**
51-60	1.13	29.60	20.13	9.45	**17.7**
61-70	1.17	30.65	20.84	9.45	**18.2**
71-80	1.21	31.69	21.55	9.45	**18.6**
81-90	1.24	32.48	22.09	9.45	**18.9**
91-100	1.26	33.00	22.44	9.45	**19.1**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
2.0	-6.5	-11.3	**4.80**

Longitudinal Wind Pressures

L/B = 1.43 h/L = 0.32

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.41
Windward Roof	-0.9 / -0.18
Leeward Roof	-0.47

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	22.26	15.14	7.81	**13.77**
15-20	0.9	23.57	16.03	7.81	**14.30**
20-25	0.94	24.62	16.74	7.81	**14.73**
25-30	0.98	25.67	17.45	7.81	**15.16**
30-40	1.04	27.24	18.52	7.81	**15.80**
41-50	1.09	28.55	19.41	7.81	**16.33**
51-60	1.13	29.60	20.13	7.81	**16.76**
61-70	1.17	30.65	20.84	7.81	**17.19**
71-80	1.21	31.69	21.55	7.81	**17.61**
81-90	1.24	32.48	22.09	7.81	**17.94**
91-100	1.26	33.00	22.44	7.81	**18.15**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-3.4	-17.0	-8.9	**4.80**

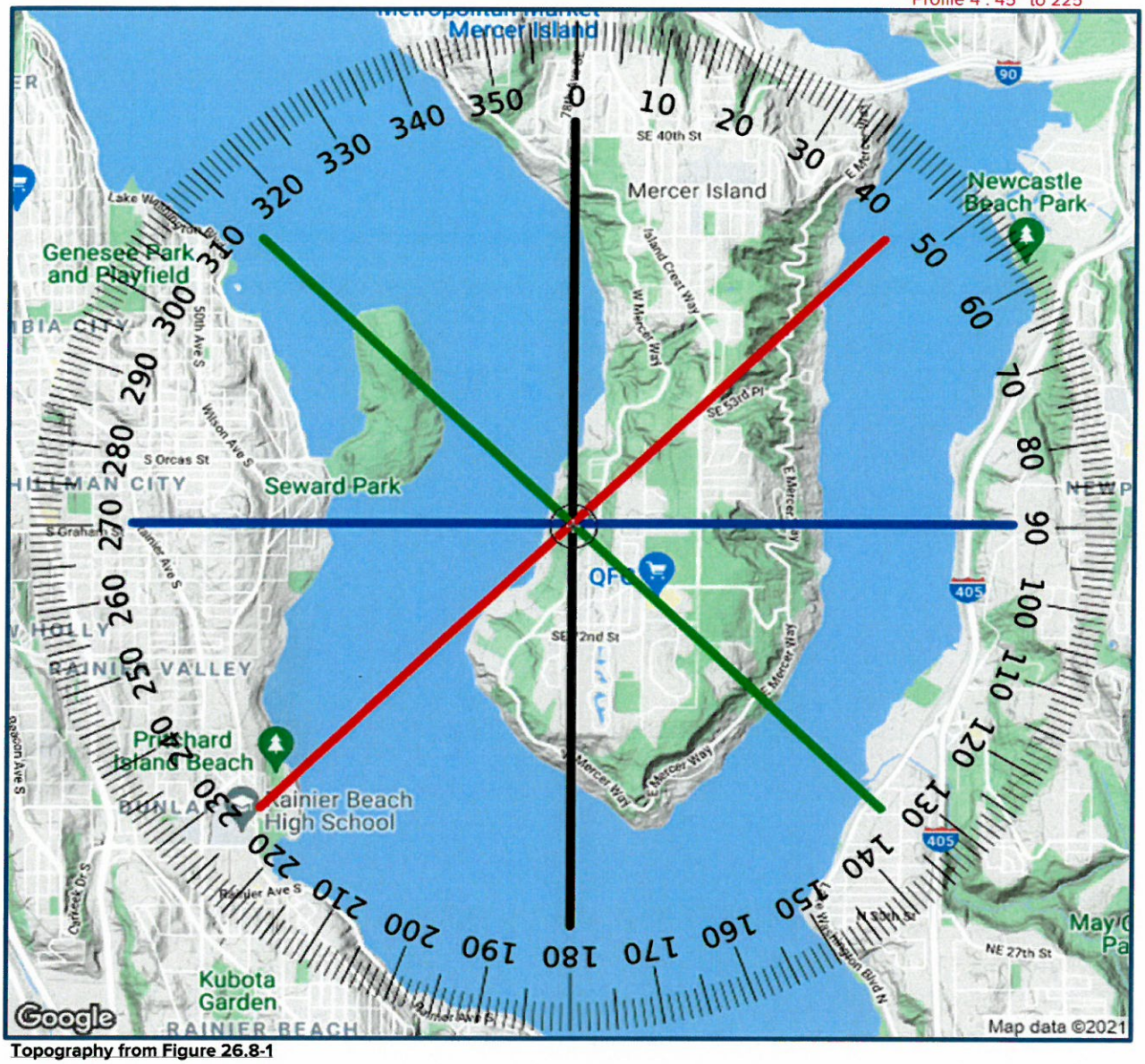
SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

Site Address

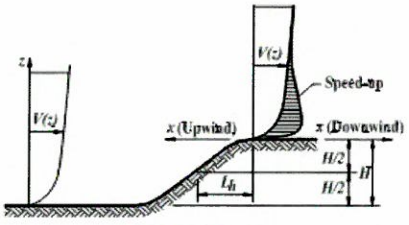
Address	7845 SE 62nd Street		Wind Radius	2.00	Miles
City:	Mercer Islanc State:	WA	Angle	0	°
Lat Long	47.54666 -122.2341		Exposure	C	

Profile 1 : 0 ° to 180 °
Profile 2 : 270 ° to 90 °
Profile 3 : 315 ° to 135 °
Profile 4 : 45 ° to 225 °

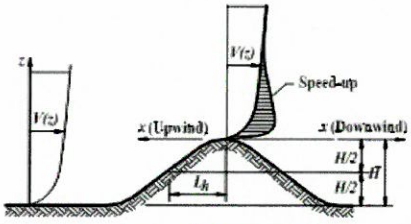
SITE MAP



Topography from Figure 26.8-1



ESCARPMENT



2-D RIDGE OR 3-D AXISYMMETRICAL HILL

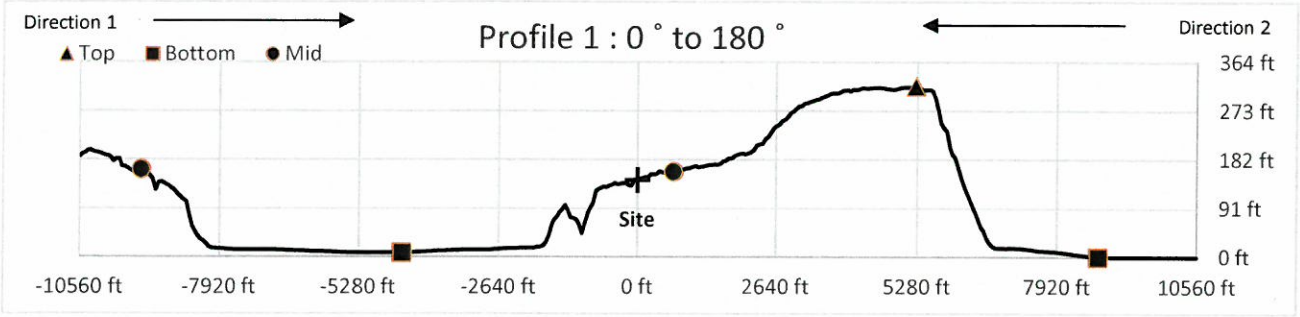
$$K_{zt} = (1 + K_1 K_2 K_3)^2$$
$$K_1 = \text{Per Figure}$$
$$K_2 = (1 - |x|/\mu L_h)$$
$$K_3 = e^{-\gamma z / L_h}$$
$$K_{zt} = 1, \text{ If } H/Lh \le 0.2$$

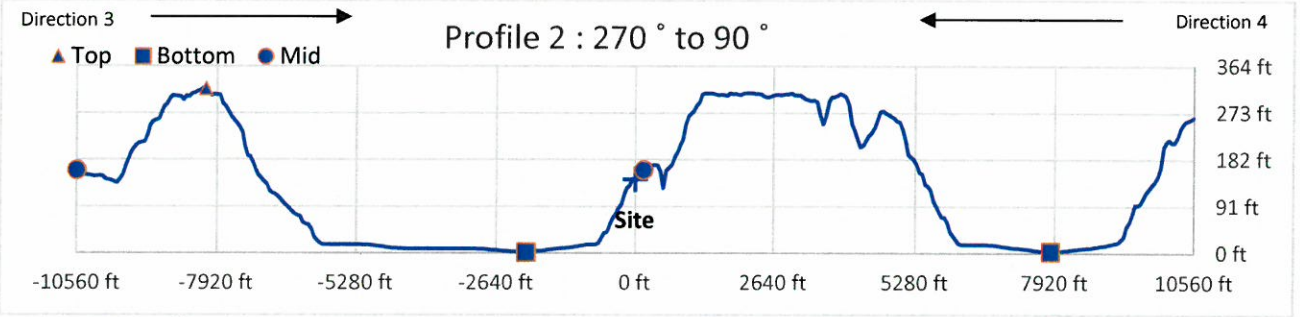
PER FIGURE 26.8-1

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STRUCTURAL ENGINEERING

Project		DATE	12/16/2021
Kzt Calculations		PROJ. #	
		DESIGN	ENG
		SHEET	4





Direction 1 - 0 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	5253
Bott. of Hill Dist.	-4457
L @ H/2	-9393
Site	upwind
Top of Hill Elev.	319
Bott. of Hill Elev.	8
Site Elev.	144.0
Site Dist.	0
H/2	163

Kzt Calculations

H=	310
Lh=	14646
x=	5253
z=	10.5
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.03
K2=	0.76
k3=	1.00
H/Lh =	0.02
Kzt =	1.00

Direction 2 - Site to 180 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	5253
Bott. of Hill Dist.	8703
L @ H/2	690
Site	downwnd
Top of Hill Elev.	319
Bott. of Hill Elev.	0
Site Elev.	144.0
Site Dist.	0
H/2	159

Kzt Calculations

H=	319
Lh=	4563
x=	5253
z=	10.5
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.10
K2=	0.23
k3=	0.99
H/Lh =	0.07
Kzt =	1.00

Direction 3 - 270 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Hill
Top of Hill Dist.	-8119
Bott. of Hill Dist.	-2070
L @ H/2	-10560
Site	downwnd
Top of Hill Elev.	321
Bott. of Hill Elev.	1
Site Elev.	144.0
Site Dist.	0
H/2	161

Kzt Calculations

H=	319
Lh=	2441
x=	8119
z=	10.5
μ=	1.5
γ=	4
K1 value =	1.05
K1=	0.14
K2=	0.00
k3=	0.98
H/Lh =	0.13
Kzt =	1.00

Direction 4 - Site to 90 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

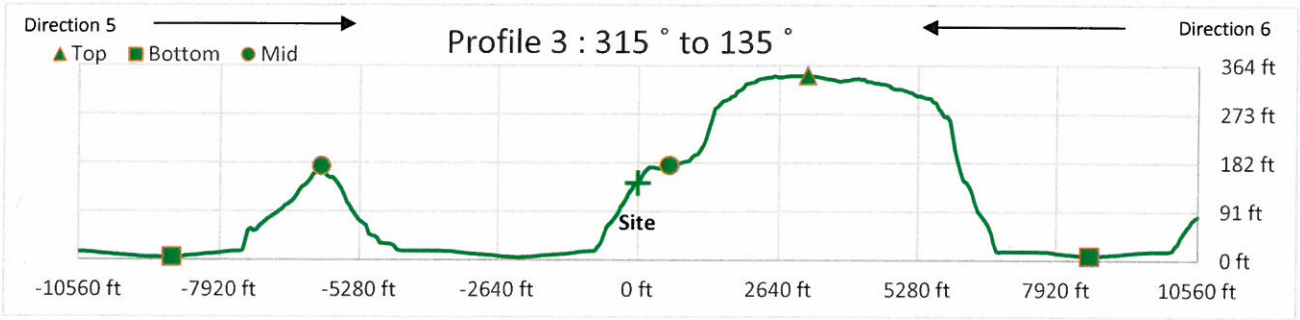
Terrain Data

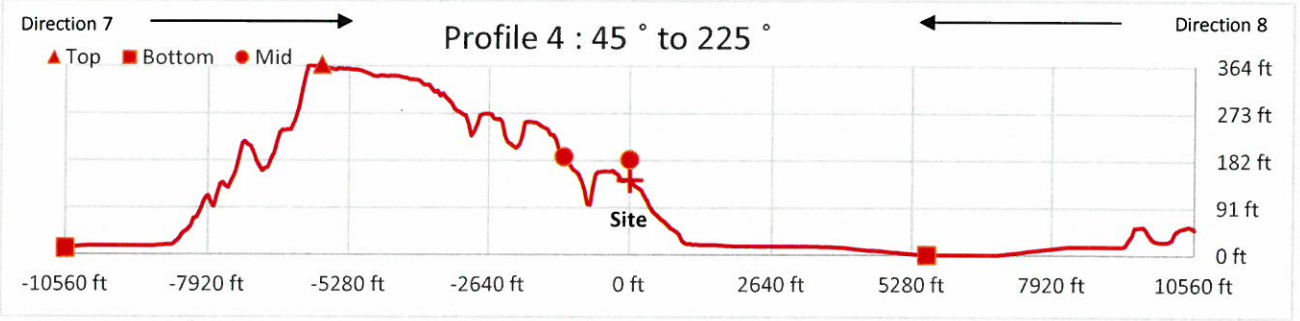
Terrain	Ridge
Top of Hill Dist.	-8119
Bott. of Hill Dist.	7854
L @ H/2	159
Site	upwind
Top of Hill Elev.	321
Bott. of Hill Elev.	3
Site Elev.	144.0
Site Dist.	0
H/2	162

Kzt Calculations

H=	318
Lh=	8278
x=	8119
z=	10.5
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.06
K2=	0.35
k3=	1.00
H/Lh =	0.04
Kzt =	1.00

SWENSON SAY FAGÉT
ssfengineers.com
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470





Direction 5 - 315 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	3184
Bott. of Hill Dist.	-8809
L @ H/2	-5996
Site	upwind
Top of Hill Elev.	346
Bott. of Hill Elev.	4
Site Elev.	144.0
Site Dist.	0
H/2	175

Kzt Calculations

H=	342
Lh=	9180
x=	3184
z=	10.5
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.05
K2=	0.77
k3=	1.00
H/Lh =	0.04
Kzt =	1.00

Direction 6 - Site to 135 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated		
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	3184
Bott. of Hill Dist.	8544
L @ H/2	584
Site	downwnd
Top of Hill Elev.	346
Bott. of Hill Elev.	8
Site Elev.	144.0
Site Dist.	0
H/2	177

Kzt Calculations

H=	339
Lh=	2600
x=	3184
z=	10.5
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.19
K2=	0.18
k3=	0.99
H/Lh =	0.13
Kzt =	1.00

Direction 7 - 45 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	-5784
Bott. of Hill Dist.	-10560
L @ H/2	-1221
Site	downwnd
Top of Hill Elev.	366
Bott. of Hill Elev.	12
Site Elev.	144.0
Site Dist.	0
H/2	189

Kzt Calculations

H=	355
Lh=	4563
x=	5784
z=	10.5
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.11
K2=	0.15
k3=	0.99
H/Lh =	0.08
Kzt =	1.00

Direction 8 - Site to 225 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	-5784
Bott. of Hill Dist.	5572
L @ H/2	0
Site	upwind
Top of Hill Elev.	366
Bott. of Hill Elev.	0
Site Elev.	144.0
Site Dist.	0
H/2	183

Kzt Calculations

H=	366
Lh=	5784
x=	5784
z=	10.5
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.09
K2=	0.33
k3=	0.99
H/Lh =	0.06
Kzt =	1.00

SWENSON SAY FAGÉT
SEATTLE
TACOMA
2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STRUCTURAL ENGINEERING

Project
Kzt Calculations

DATE 12/16/2021
PROJ. #
DESIGN ENG
SHEET 6

Criteria Sheet

GARAGE

Codes

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

Project Location

Street & Number	7845 SE 62nd Street
City:	Mercer Island State: WA
ZIP:	98040
Latitude:	47.5467 N
Longitude:	-122.2341 W
Ground Elevation	144 ft

Occupancy Category

Risk Category: II ASCE 7 Table 1.5-1

Seismic Load Summary:

Analysis Procedure: Equivalent Lateral Force Procedure

Lateral System: Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

R:	7.00	C_d=	4.5
Base Shear V =	2 kips	Ω_o=	2
S_s=	1.468	S_1=	0.509
S_{DS}=	1.00	S_{D1}=	0.58
C_s=	0.143	I_E=	1.0

Story Information

Stories Above Grade (Including Mezzanine Levels): 2

Horizontal and Vertical Irregularities:

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

Wind Load Summary:

V= 110 K_{zt}= 1.00

Exposure = C

Dead Loads:

Roof			Floor		
Roofing	5	psf	Finish Floor	5	psf
1/2" Sheathing	1.8	psf	3/4" Sheathing	2.7	psf
Trusses @ 24" oc	2.5	psf	Joists @ 16" oc	2.2	psf
Misc./Mech.	1.5	psf	Misc./Mech.	2	psf
Ceiling Finish	2.8	psf	Ceiling Finish	2.8	
Solar Panels	3.9			14.7	psf
	17.5	psf	Use	15	psf
Use	18	psf			

Live Loads:

Snow	25	psf
Floor	40	psf

Soils:

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

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

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

Seismic Design

ASCE 7-16 Seismic Analysis Equivalent Lateral Force Procedure

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

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

Section 12.8.1.3 Exceptions

Regular Structure	Yes
≤ 5 Stories above grade	Yes
T ≤ 0.5s	Yes
ρ = 1.0	Yes
Not Site Class E or F	Yes
Risk Category I or II	Yes

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

S_S	1.468 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.509 g	2% in 50 yr, Latitude & Longitude lookup
R	7.00	
C_d	4.5	
Ω_o	2	
I_e	1.00	Table 1.5-2
h_n	14.0 ft	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T_a	0.14 sec	
T	0.14 sec	Eq. 12.8-7
T_0	0.12 sec	
T_S	0.58 sec	
T_L	6.00 sec	
F_a	1.20	Table 11.4-1
F_v	1.70	Table 11.4-2
S_{MS}	1.76 g	Eq. 11.4-1
S_{M1}	0.87 g	Eq. 11.4-2
S_{DS}	1.000 g	Eq. 11.4-3
S_{D1}	0.577 g	Eq. 11.4-4
C_s	***0.143 Controls***	Eq. 12.8-2
	0.569	Eq. 12.8-3 need not exceed, T < T_L
	0.010	Eq. 12.8-5 or 12.8-6 minimum
C_s, design	0.143	Section 11.4.8 Exception 2 Applied
Bldg. Weight	13.2 k	
V = C_SW	1.9 k	Eq. 12.8-1, Strength Level Base Shear
V = C_{Sasd}W	1.3 k	Eq. 12.8-1 ASD Base Shear

Building Period Per Alternate Analysis

T (sec)	

Per Geotech Report

F_a	
F_v	

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

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

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

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

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

Vertical Distribution ASD ρ= 1 k= 1.000

Level	h_x (ft)	W_x (k)	h_x^k (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force (ρ not included)				
					C_{vx} (%)	F_x (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	γ=F_{px}/F_x
Roof	14.0	7.5	14.0	105	0.840	1.1	**1.1**	1.1	1.1	2.1	**1.1**	1.00
Main	3.5	6	3.5	20	0.160	0.2	**1.3**	0.6	0.8	1.6	**0.8**	3.79
Σ		13.2		125		**1.3**						

SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	C	
V=	110	mph
K_d=	0.85	Table 26.6-1
K_h=	0.85	Table 26.10-1
K_e=	0.99	Table 26.9-1
G=	0.85	26.9.4

Location and Building Dimensions

Calculate Kzt?	Yes	
Kzt	1.00	
Roof Type	Monoslope	
Roof Angle - Transverse Dir	0	degrees
Roof Angle - Long Dir	0	degrees
Ground to top of roof	0	ft
Bot of roof to top of roof	0	ft
Mean Roof Height, h	0	ft
Short Plan Dimension	13	ft
Long Plan Dimension	13	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	3	ft

Velocity Pressure at Mean Roof Height, q_h =	22.2	psf

Transverse Wind Pressures

L/B = 1.00 h/L = 0.00

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.9 / -0.18
Leeward Roof	-0.30

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	22.26	15.14	9.45	**14.8**
15-20	0.9	23.57	16.03	9.45	**15.3**
20-25	0.94	24.62	16.74	9.45	**15.7**
25-30	0.98	25.67	17.45	9.45	**16.1**
30-40	1.04	27.24	18.52	9.45	**16.8**
41-50	1.09	28.55	19.41	9.45	**17.3**
51-60	1.13	29.60	20.13	9.45	**17.7**
61-70	1.17	30.65	20.84	9.45	**18.2**
71-80	1.21	31.69	21.55	9.45	**18.6**
81-90	1.24	32.48	22.09	9.45	**18.9**
91-100	1.26	33.00	22.44	9.45	**19.1**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-3.4	-17.0	-5.7	**4.80**

Longitudinal Wind Pressures

L/B = 1.00 h/L = 0.00

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.9 / -0.18
Leeward Roof	-0.30

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.85	22.26	15.14	9.45	**14.75**
15-20	0.9	23.57	16.03	9.45	**15.29**
20-25	0.94	24.62	16.74	9.45	**15.72**
25-30	0.98	25.67	17.45	9.45	**16.14**
30-40	1.04	27.24	18.52	9.45	**16.78**
41-50	1.09	28.55	19.41	9.45	**17.32**
51-60	1.13	29.60	20.13	9.45	**17.75**
61-70	1.17	30.65	20.84	9.45	**18.17**
71-80	1.21	31.69	21.55	9.45	**18.60**
81-90	1.24	32.48	22.09	9.45	**18.92**
91-100	1.26	33.00	22.44	9.45	**19.13**

Roof Pressures (Unfactored) ASD

Windward		Leeward	**Horiz Proj (psf)**
Max	Min		
-3.4	-17.0	-5.7	**4.80**

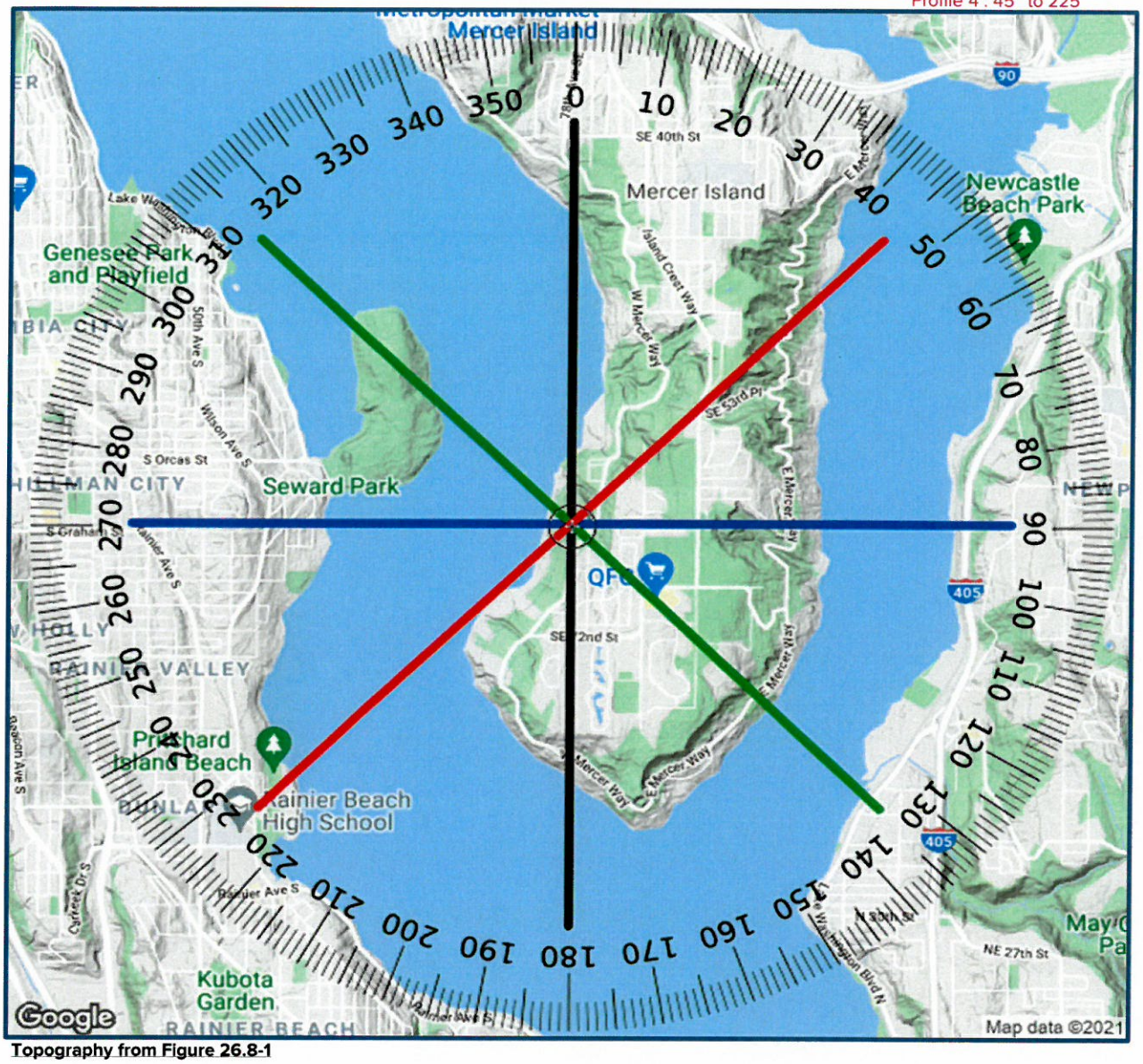
SWENSON SAY FAGET
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

Site Address

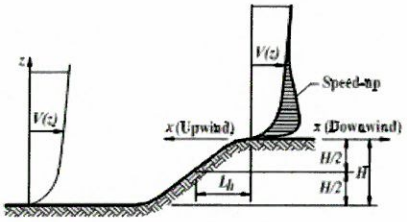
Address	7845 SE 62nd Street		Wind Radius	2.00	Miles
City:	Mercer Islanc State:	WA	Angle	0	°
Lat Long	47.54666 -122.2341		Exposure	C	

Profile 1 : 0 ° to 180 °
Profile 2 : 270 ° to 90 °
Profile 3 : 315 ° to 135 °
Profile 4 : 45 ° to 225 °

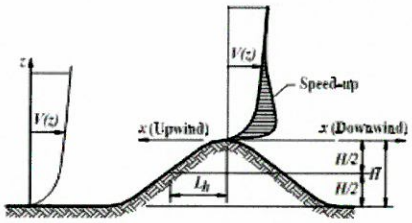
SITE MAP



Topography from Figure 26.8-1



ESCARPMENT



2-D RIDGE OR 3-D AXISYMMETRICAL HILL

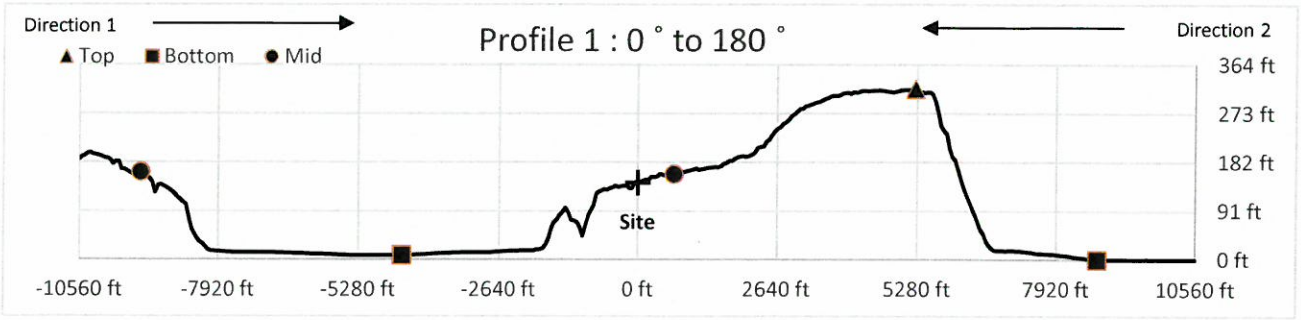
$$K_{zt} = (1 + K_1 K_2 K_3)^2$$
$$K_1 = \text{Per Figure}$$
$$K_2 = (1 - |x|/\mu L_h)$$
$$K_3 = e^{-\gamma z / L_h}$$
$$K_{zt} = 1, \text{ If } H/Lh \le 0.2$$

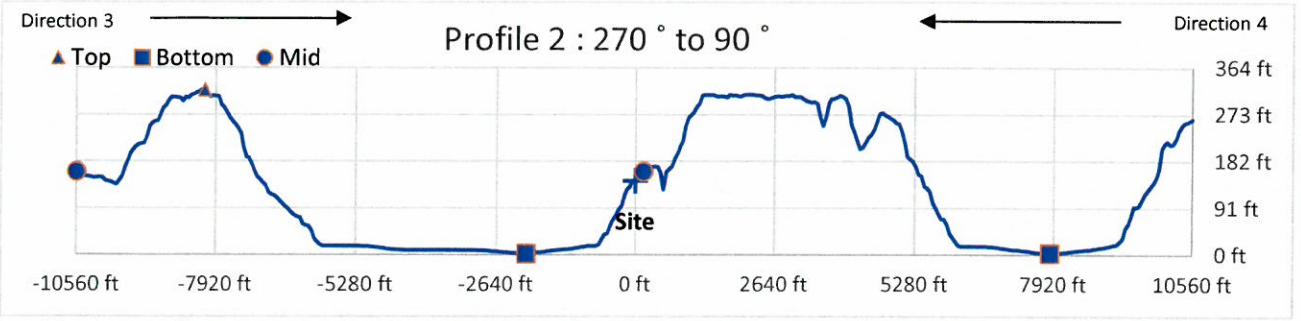
PER FIGURE 26.8-1

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STRUCTURAL ENGINEERING

Project		DATE	12/16/2021
Kzt Calculations		PROJ. #	
		DESIGN	ENG
		SHEET	4





Direction 1 - 0 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	5253
Bott. of Hill Dist.	-4457
L @ H/2	-9393
Site	upwind
Top of Hill Elev.	319
Bott. of Hill Elev.	8
Site Elev.	144.0
Site Dist.	0
H/2	163

Kzt Calculations

H=	310
Lh=	14646
x=	5253
z=	0
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.03
K2=	0.76
k3=	1.00
H/Lh =	0.02
Kzt =	1.00

Direction 2 - Site to 180 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	5253
Bott. of Hill Dist.	8703
L @ H/2	690
Site	downwnd
Top of Hill Elev.	319
Bott. of Hill Elev.	0
Site Elev.	144.0
Site Dist.	0
H/2	159

Kzt Calculations

H=	319
Lh=	4563
x=	5253
z=	0
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.10
K2=	0.23
k3=	1.00
H/Lh =	0.07
Kzt =	1.00

Direction 3 - 270 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Hill
Top of Hill Dist.	-8119
Bott. of Hill Dist.	-2070
L @ H/2	-10560
Site	downwnd
Top of Hill Elev.	321
Bott. of Hill Elev.	1
Site Elev.	144.0
Site Dist.	0
H/2	161

Kzt Calculations

H=	319
Lh=	2441
x=	8119
z=	0
μ=	1.5
γ=	4
K1 value =	1.05
K1=	0.14
K2=	0.00
k3=	1.00
H/Lh =	0.13
Kzt =	1.00

Direction 4 - Site to 90 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	-8119
Bott. of Hill Dist.	7854
L @ H/2	159
Site	upwind
Top of Hill Elev.	321
Bott. of Hill Elev.	3
Site Elev.	144.0
Site Dist.	0
H/2	162

Kzt Calculations

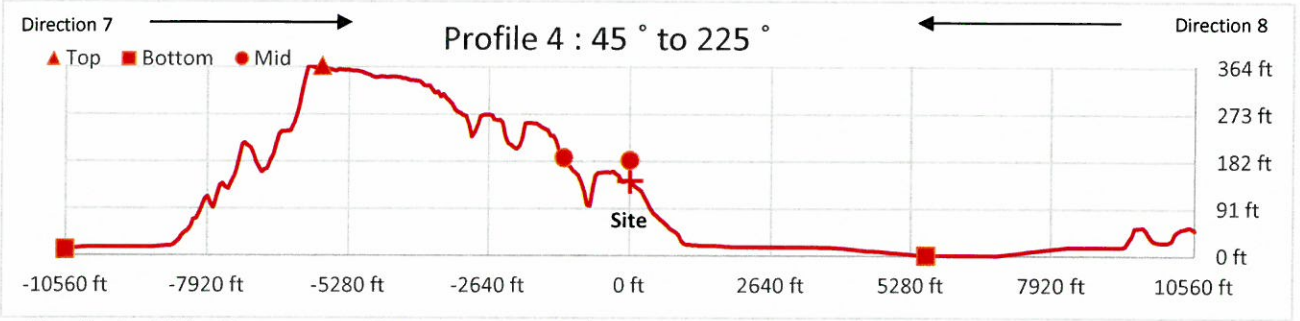
H=	318
Lh=	8278
x=	8119
z=	0
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.06
K2=	0.35
k3=	1.00
H/Lh =	0.04
Kzt =	1.00

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STRUCTURAL ENGINEERING

Project
Kzt Calculations

DATE 12/16/2021
PROJ. #
DESIGN ENG
SHEET 5



Direction 5 - 315 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	3184
Bott. of Hill Dist.	-8809
L @ H/2	-5996
Site	upwind
Top of Hill Elev.	346
Bott. of Hill Elev.	4
Site Elev.	144.0
Site Dist.	0
H/2	175

Kzt Calculations

H=	342
Lh=	9180
x=	3184
z=	0
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.05
K2=	0.77
k3=	1.00
H/Lh =	0.04
Kzt =	1.00

Direction 6 - Site to 135 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated		
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	3184
Bott. of Hill Dist.	8544
L @ H/2	584
Site	downwnd
Top of Hill Elev.	346
Bott. of Hill Elev.	8
Site Elev.	144.0
Site Dist.	0
H/2	177

Kzt Calculations

H=	339
Lh=	2600
x=	3184
z=	0
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.19
K2=	0.18
k3=	1.00
H/Lh =	0.13
Kzt =	1.00

Direction 7 - 45 °to Site

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	-5784
Bott. of Hill Dist.	-10560
L @ H/2	-1221
Site	downwnd
Top of Hill Elev.	366
Bott. of Hill Elev.	12
Site Elev.	144.0
Site Dist.	0
H/2	189

Kzt Calculations

H=	355
Lh=	4563
x=	5784
z=	0
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.11
K2=	0.15
k3=	1.00
H/Lh =	0.08
Kzt =	1.00

Direction 8 - Site to 225 °

Site Conditions (26.8.1)

1. Unubstructed	Yes	
2. Isolated	Yes	
3. Upper Half Hill	No	Kzt=1
4. H/Lh ≥ 0.2	No	Kzt=1
5. H≥ 15'	Yes	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	-5784
Bott. of Hill Dist.	5572
L @ H/2	0
Site	upwind
Top of Hill Elev.	366
Bott. of Hill Elev.	0
Site Elev.	144.0
Site Dist.	0
H/2	183

Kzt Calculations

H=	366
Lh=	5784
x=	5784
z=	0
μ=	1.5
γ=	3
K1 value =	1.45
K1=	0.09
K2=	0.33
k3=	1.00
H/Lh =	0.06
Kzt =	1.00

SWENSON SAY FAGÉT
SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 | O 206.443.6212
TACOMA 934 Broadway, Suite 100, Tacoma, WA 98402 | O 253.284.9470
ssfengineers.com

STRUCTURAL ENGINEERING

Project
Kzt Calculations

DATE 12/16/2021
PROJ. #
DESIGN ENG
SHEET 6