

Criteria Sheet

Codes:

Structural: IBC 2015
 Loading: ASCE 7-10
 Wood: NDS 2015
 Steel: AISC 360-10
 Concrete: ACI 318-14
 Masonry: TMS 402/602-13

Project Location:

Street & Number: 2967 74th Ave SE
 City: Mercer Island State: WA
 ZIP: 98040
 Latitude: 47.5826 N
 Longitude: -122.2407 W

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 $V = 10$ kips $\Omega_o = 2.5$
 $S_s = 1.387$ $S_1 = 0.534$
 $S_{DS} = 0.92$ $S_{D1} = 0.53$
 $C_s = 0.142$ $I_e = 1.0$



Wind Load Summary:

$V = 110$ $K_{Z1} = 1.42$
 Exposure = B

Dead Loads:

Roof

Roofing	2.5 psf
1/2" Sheathing	1.8 psf
Trusses @ 24" oc	2.5 psf
Misc./Mech.	1.5 psf
Ceiling Finish	2.8 psf
Solar Panels	4
	15 psf
Use	15 psf

Floor

Finish Floor	1 psf
3/4" Sheathing	2.7 psf
Joists @ 16" oc	2.2 psf
Misc./Mech.	2 psf
Ceiling Finish	2.8
	10.7 psf
Use	15 psf

Live Loads:

Snow	30 psf
Floor	40 psf

Soils:

Allowable Bearing 1500 psf



**STRUCTURAL
ENGINEERING**

Wisenteiner Residence

Criteria

DATE 1/29/2021

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SHEET 1

Wind Design - MWFRS

ASCE 7-10 Chapter 27 - Directional Procedure

Design Method	ASD
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Wind Coefficients

Exposure	B	
V=	110	mph
K_d =	0.85	Table 26.6-1
K_{zt} =	0.60	Table 27.3-1
G=	0.85	26.9.4

Transverse Wind Pressures

L/B = 0.83 h/L = 0.44

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	-0.46

Location and Building Dimensions

Calculate K_{zt} ?	Yes	
K_{zt}	1.42	
Roof Type	Monoslope	
Roof Angle - Transverse Dir	0	degrees
Roof Angle - Long Dir	0	degrees
Ground to top of roof	17.75	ft
Bot of roof to top of roof	0	ft
Mean Roof Height, h	17.75	ft
Short Plan Dimension	40	ft
Long Plan Dimension	48	ft
Parapet ?	Yes	
Ground to top of parapet	20.5	ft
Average Parapet Height	1.333	ft
Ht of 2nd Level Above Grade	9.25	ft

Velocity Pressure at Mean Roof Height, q_h =	22.5	psf
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Wall Pressures (Unfactored):

Ht	K_z	q_z	$P_{ww \text{ walls}}$	$P_{lw \text{ walls}}$	$P_{\text{walls (psf)}}$
0-15	0.58	21.62	14.70	9.56	14.56
15-20	0.62	23.12	15.72	9.56	15.16
20-25	0.66	24.61	16.73	9.56	15.77
25-30	0.7	26.10	17.75	9.56	16.38
30-40	0.76	28.34	19.27	9.56	17.29
41-50	0.81	30.20	20.54	9.56	18.05
51-60	0.85	31.69	21.55	9.56	18.66
61-70	0.89	33.18	22.56	9.56	19.27
71-80	0.93	34.67	23.58	9.56	19.88
81-90	0.96	35.79	24.34	9.56	20.34
91-100	0.99	36.91	25.10	9.56	20.79

Longitudinal Wind Pressures

L/B = 1.20 h/L = 0.37

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.46
Windward Roof	-0.9 / -0.18
Leeward Roof	-0.46

Wall Pressures (Unfactored):

Ht	K_z	q_z	$P_{ww \text{ walls}}$	$P_{lw \text{ walls}}$	$P_{\text{walls (psf)}}$
0-15	0.58	21.62	14.70	8.79	14.10
15-20	0.62	23.12	15.72	8.79	14.71
20-25	0.66	24.61	16.73	8.79	15.31
25-30	0.7	26.10	17.75	8.79	15.92
30-40	0.76	28.34	19.27	8.79	16.84
41-50	0.81	30.20	20.54	8.79	17.60
51-60	0.85	31.69	21.55	8.79	18.20
61-70	0.89	33.18	22.56	8.79	18.81
71-80	0.93	34.67	23.58	8.79	19.42
81-90	0.96	35.79	24.34	8.79	19.88
91-100	0.99	36.91	25.10	8.79	20.33

Roof Pressures (Unfactored)

Windward		Leeward	Horiz Proj (psf)
Max	Min		
-3.4	-17.2	-8.7	4.80

Parapet (Unf)

Windward	Leeward	Total (psf)
39.1	26.1	39.1

Transverse Direction

Base Shear (kips)	11.8
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Roof Pressures (Unfactored)

Windward		Leeward	Horiz Proj (psf)
Max	Min		
-3.4	-17.2	-8.8	4.80

Parapet (Unf)

Windward	Leeward	Total (psf)
39.1	26.1	39.1

Longitudinal Direction

Base Shear (kips)	12.2
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Wisenteiner Residence

Wind Criteria

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SHEET 3

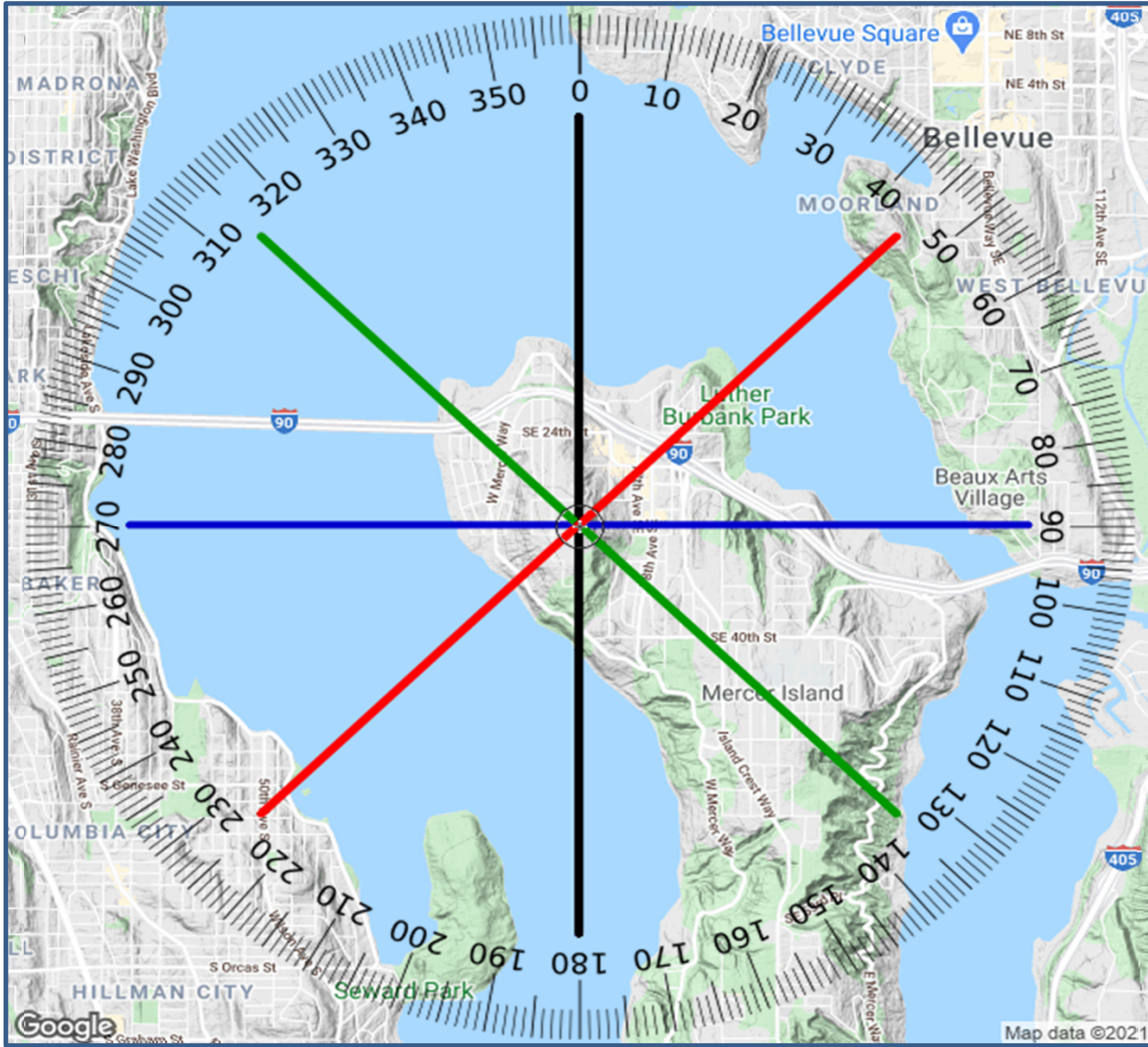
Site Address

Address 2967 74th Ave SE
 City: Mercer Island State: WA
 Lat Long 47.582613 -122.2407

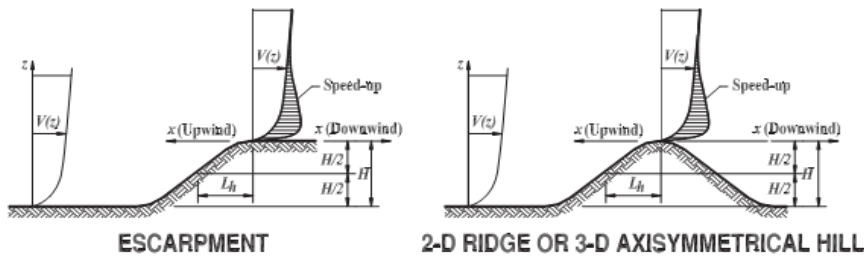
Wind Radius 2.00 Miles
 Angle 0°
 Exposure B

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



$$K_{zt} = (1 + K_1 K_2 K_3)^2$$

$$K_1 = \text{Per Figure}$$

$$K_2 = (1 - |x|/\mu L_h)$$

$$K_3 = e^{-\gamma z/L_h}$$

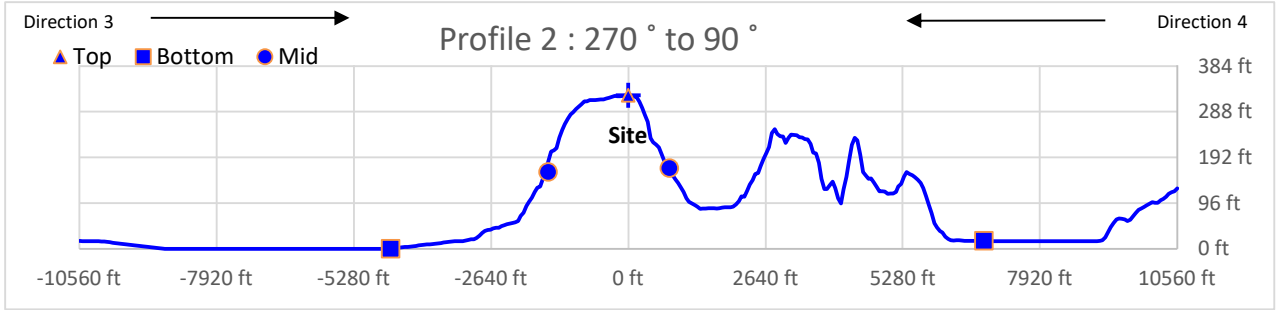
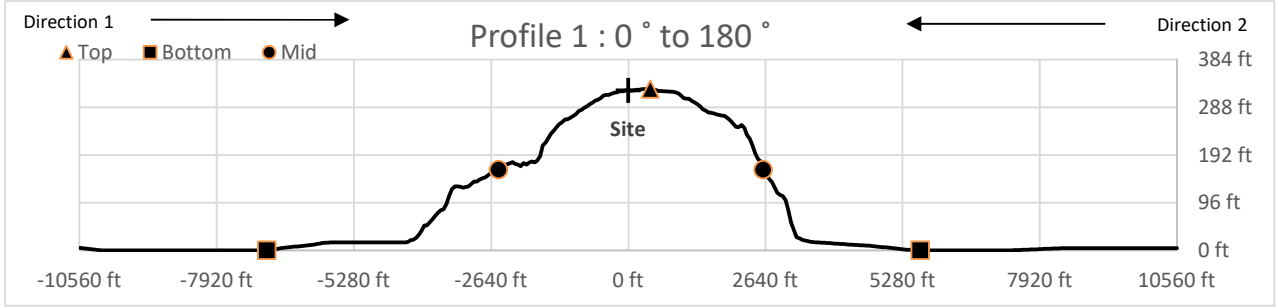
$$K_{zt} = 1, \text{ if } H/L_h \leq 0.2$$

PER FIGURE 26.8-1



Wisenteiner Residence _____
 Kzt Calculations _____

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 SHEET 4



Direction 1 - 0° to Site

Direction 2 - Site to 180°

Direction 3 - 270° to Site

Direction 4 - Site to 90°

Site Conditions (26.8.1)

1. Unobstructed	Yes
2. Isolated	Yes
3. Upper Half Hill	Yes
4. H/Lh ≥ 0.2	No
5. H ≥ 60'	Yes

Kzt=1

Site Conditions (26.8.1)

1. Unobstructed	Yes
2. Isolated	Yes
3. Upper Half Hill	Yes
4. H/Lh ≥ 0.2	No
5. H ≥ 60'	Yes

Kzt=1

Site Conditions (26.8.1)

1. Unobstructed	Yes
2. Isolated	Yes
3. Upper Half Hill	Yes
4. H/Lh ≥ 0.2	Yes
5. H ≥ 60'	Yes

Site Conditions (26.8.1)

1. Unobstructed	Yes
2. Isolated	No
3. Upper Half Hill	
4. H/Lh ≥ 0.2	
5. H ≥ 60'	

Kzt=1

Terrain Data

Terrain	Hill
Top of Hill Dist.	425
Bott. of Hill Dist.	-6952
L @ H/2	-2494
Site	upwind
Top of Hill Elev.	325
Bott. of Hill Elev.	0
Site Elev.	322.3
Site Dist.	0
H/2	162

Terrain Data

Terrain	Hill
Top of Hill Dist.	425
Bott. of Hill Dist.	5625
L @ H/2	2600
Site	downwnd
Top of Hill Elev.	325
Bott. of Hill Elev.	0
Site Elev.	322.3
Site Dist.	0
H/2	162

Terrain Data

Terrain	Hill
Top of Hill Dist.	0
Bott. of Hill Dist.	-4564
L @ H/2	-1539
Site	upwind
Top of Hill Elev.	322
Bott. of Hill Elev.	0
Site Elev.	322.3
Site Dist.	0
H/2	161

Terrain	Hill

Kzt Calculations

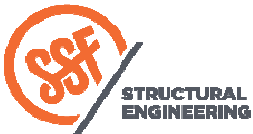
H=	325
Lh=	2919
x=	425
z=	17.75
μ=	1.5
γ=	4
K1 value =	0.95
K1=	0.11
K2=	0.90
k3=	0.98
H/Lh =	0.11
Kzt =	1.00

Kzt Calculations

H=	325
Lh=	2175
x=	425
z=	17.75
μ=	1.5
γ=	4
K1 value =	0.95
K1=	0.14
K2=	0.87
k3=	0.97
H/Lh =	0.15
Kzt =	1.00

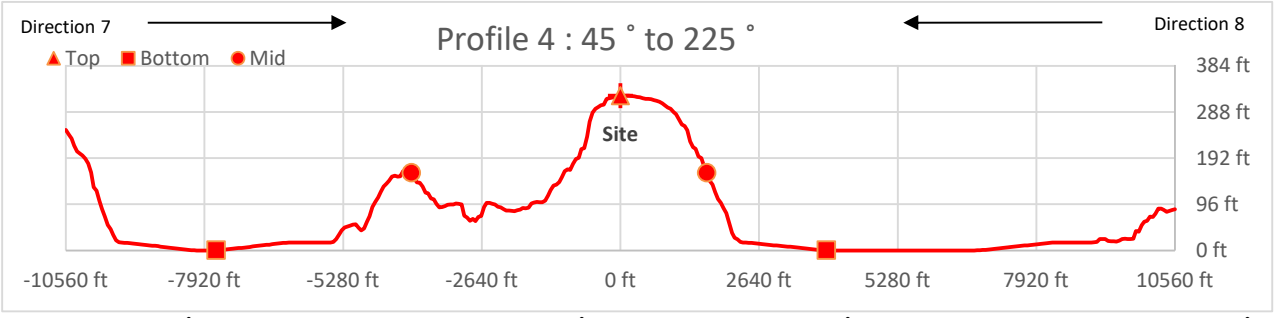
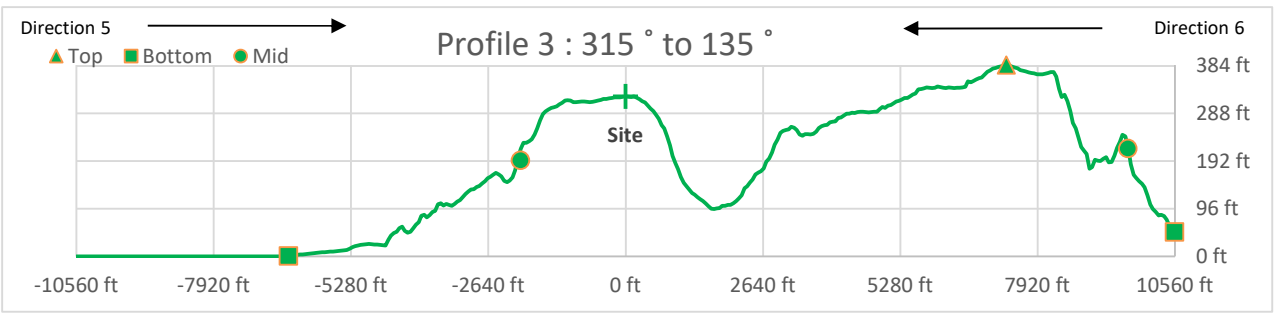
Kzt Calculations

H=	322
Lh=	1539
x=	0
z=	17.75
μ=	1.5
γ=	4
K1 value =	0.95
K1=	0.20
K2=	1.00
k3=	0.95
H/Lh =	0.21
Kzt =	1.42



Wisenteiner Residence
 Kzt Calculations

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 SHEET 5



Direction 5 - 315° to Site

Direction 6 - Site to 135°

Direction 7 - 45° to Site

Direction 8 - Site to 225°

Site Conditions (26.8.1)

1. Unobstructed	Yes
2. Isolated	Yes
3. Upper Half Hill	Yes
4. H/Lh ≥ 0.2	No
5. H ≥ 60'	Yes

Kzt=1

Site Conditions (26.8.1)

1. Unobstructed	No
2. Isolated	
3. Upper Half Hill	
4. H/Lh ≥ 0.2	
5. H ≥ 60'	

Kzt=1

Kzt=1

Site Conditions (26.8.1)

1. Unobstructed	Yes
2. Isolated	Yes
3. Upper Half Hill	Yes
4. H/Lh ≥ 0.2	No
5. H ≥ 60'	Yes

Kzt=1

Site Conditions (26.8.1)

1. Unobstructed	Yes
2. Isolated	Yes
3. Upper Half Hill	Yes
4. H/Lh ≥ 0.2	No
5. H ≥ 60'	Yes

Kzt=1

Terrain Data

Terrain	Ridge
Top of Hill Dist.	7323
Bott. of Hill Dist.	-6474
L @ H/2	-2016
Site	upwind
Top of Hill Elev.	386
Bott. of Hill Elev.	0
Site Elev.	322.3
Site Dist.	0
H/2	193

Terrain	Ridge
Top of Hill Dist.	
Bott. of Hill Dist.	
L @ H/2	
Site	
Top of Hill Elev.	
Bott. of Hill Elev.	
Site Elev.	
Site Dist.	
H/2	

Terrain Data

Terrain	Ridge
Top of Hill Dist.	0
Bott. of Hill Dist.	-7694
L @ H/2	-3980
Site	upwind
Top of Hill Elev.	322
Bott. of Hill Elev.	0
Site Elev.	322.3
Site Dist.	0
H/2	161

Terrain Data

Terrain	Ridge
Top of Hill Dist.	0
Bott. of Hill Dist.	3927
L @ H/2	1645
Site	upwind
Top of Hill Elev.	322
Bott. of Hill Elev.	0
Site Elev.	322.3
Site Dist.	0
H/2	161

Kzt Calculations

H=	386
Lh=	9339
x=	7323
z=	17.75
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.05
K2=	0.48
k3=	0.99
H/Lh =	0.04
Kzt =	1.00

H=	
Lh=	
x=	
z=	
μ=	
γ=	
K1 value =	
K1=	
K2=	
k3=	
H/Lh =	
Kzt =	

Kzt Calculations

H=	322
Lh=	3980
x=	0
z=	17.75
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.11
K2=	1.00
k3=	0.99
H/Lh =	0.08
Kzt =	1.00

Kzt Calculations

H=	322
Lh=	1645
x=	0
z=	17.75
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.25
K2=	1.00
k3=	0.97
H/Lh =	0.20
Kzt =	1.00

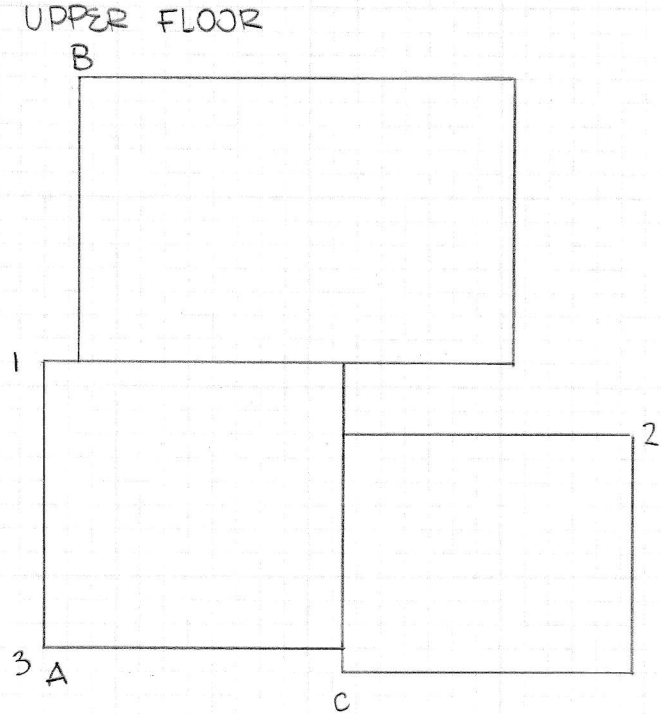
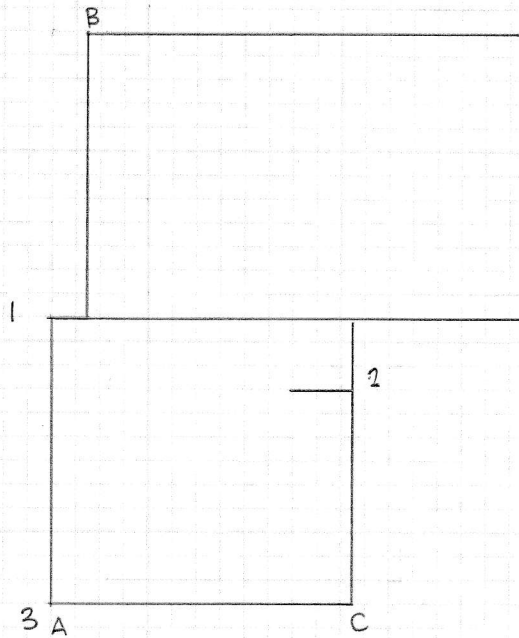
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 Kzt Calculations

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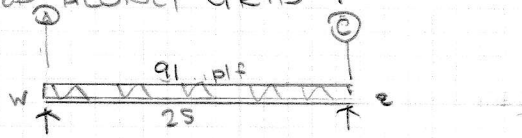
LATERAL DESIGN

PER CRITERIA SHEETS WIND LOADS GOVERN IN BOTH DIRECTIONS

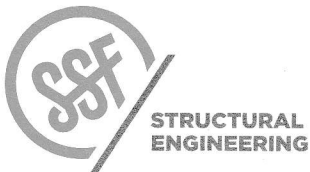


NOTE: ADDITIONAL LATERAL FROM ADDITION TO BE SUPPORTED ALONG LINE 2. NO ADDITIONAL NEW LOAD TO BE SUPPORTED ALONG GRID 1.

NS DIRECTION
ROOF



LOAD	1.14k	1.14k
LENGTH	5.5ft	8+c
SHEAR	207 plf	143 plf
WALL	W6	W6
OT	1.71k	1.14k
HD	CS16	CS16



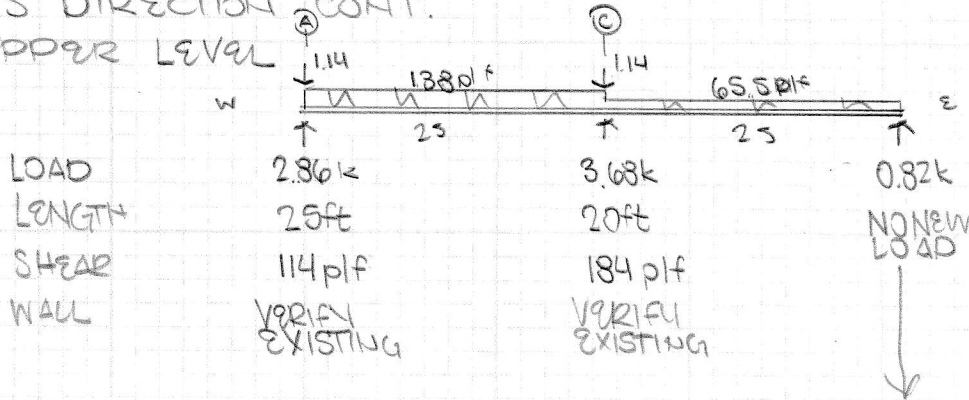
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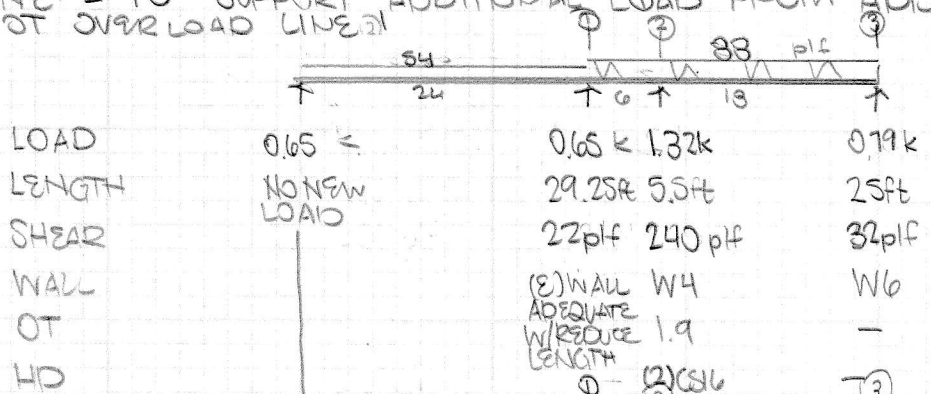
LATERAL DESIGN

NS DIRECTION CONT.
UPPER LEVEL

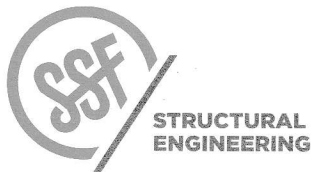
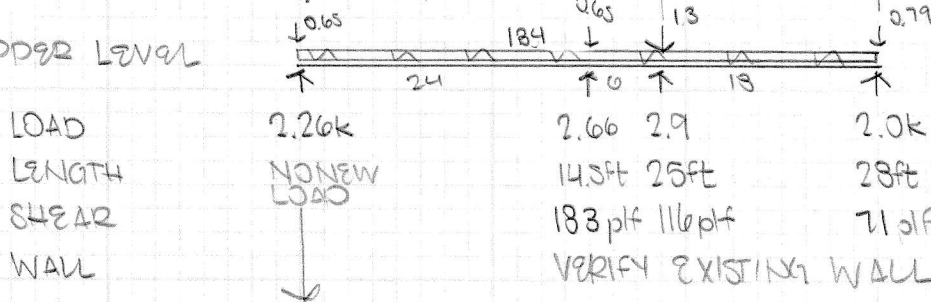


E-W DIRECTION

LINE 2 TO SUPPORT ADDITIONAL LOAD FROM ADDITION SO AS TO NOT OVERLOAD LINE 21



UPPER LEVEL



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L2
SHEET

LATERAL DESIGN

VERIFY ASSUMED EXTERIOR WALL CONSTRUCTION

7/16" (MIN) PLYWOOD NAILED w/ 8d @ 6"oc, NO HORIZONTAL BLOCKING

1/2" φ A. BOLTS @ 60"oc

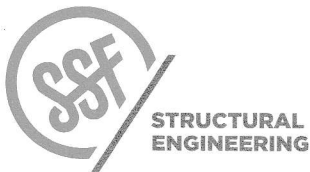
ASD CAPACITY

$$\text{WIND } 0.6 \left(\frac{715 \text{ plf}}{2} \right) = 214 \text{ plf} > 181 \text{ plf OK}$$

$$\text{ANCHOR BOLT } P = \frac{650(1.6)}{5} = 208 \text{ plf} > 181 \text{ plf OK}$$

TOP PLATE (4) 1/2" TO ENAILED @ 24"oc

$$P = \frac{4(103)(1.6)(0.93)}{2} = 273 \text{ plf} > 181 \text{ plf OK}$$



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L3
SHEET

DRAG STRUT

FROM L2 ROOF @ LINE 2

$$V = 1.32k \quad U = 240 \text{ plf}$$

FOR 1 1/2" DLY WOOD w/ 8d @ 4" oc

$$U = 1.6(12 \text{ in} / 4 \text{ in})(64 \text{ k}) = 307.2 \text{ plf} > U = 240 \text{ plf}$$

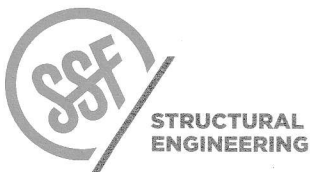
HTTY MIN CAPACITY 2.93k > V = 1.32k OK

(E) DIAPHRAGM CAPACITY

ASSUME MIN 7/16 SHEATHING w/ 8d @ 6" oc UNBLOCKED

$$U_s = \frac{320 \text{ plf}}{2} = 170 \text{ plf}$$

$$\text{MIN DIA. LENGTH} = \frac{V}{U_{\text{DIA}}} = \frac{1.32k}{0.17 \text{ k/plf}} = 7.6 \text{ ft} \Rightarrow \text{DEVELOP SHEAR OVER } 8 \text{ ft}$$



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L4
SHEET

VERTICAL DESIGN

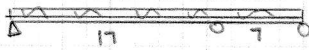
ROOF FRAMING

14" TJ1/360 @ 16" oc



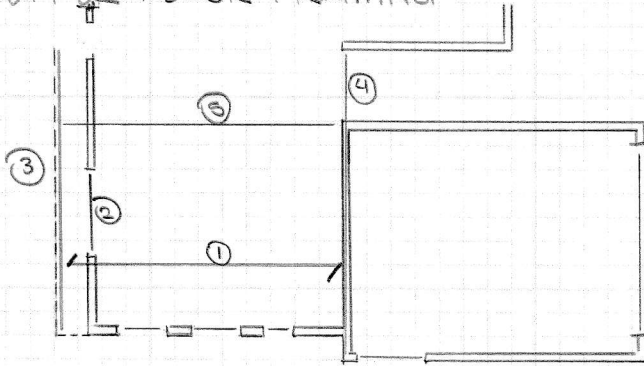
L = 25ft
 W = 60pf
 M = 4.68kft
 R = 0.78k
 $\Delta = 0.86 \text{ in} = L/348$

LSL 3 1/2 x 14 RIM

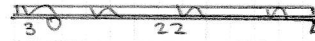


L = 24ft R₁ = 3.89k
 TRIB = 125 R₂ = 9.90k
 W = 565plf R₃ = -0.28k
 M⁺ = 13.41kft f_b = 1.62ksi
 M⁻ = -15.47kft f_v = 174psi
 $\Delta_1 = 0.489 \text{ in} = L/477$
 $\Delta_2 = 0.946 \text{ in} = L/1826$

UPPER FLOOR FRAMING

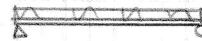


① 14" TJ1/360 @ 16" oc



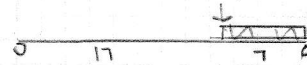
L = 25ft R₁ = 1.04k
 W = 73plf R₂ = 0.79k
 M⁺ = 4.25k $\Delta^+ = 0.69 \text{ in} = L/382$
 M⁻ = 0.33k $\Delta^- = 0.29 \text{ in} = L/249$

② PSL 3 1/2 x 9 1/4 HDR



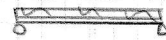
L = 7.75ft R = 3.88k
 TRIB = 14ft f_b = 1.55ksi
 W = 860plf f_v = 123psi
 M = 6.45kft $\Delta = 0.16 \text{ in} = L/615$

③ LSL 3 1/2 x 14 RIM



L = 24ft R₁ = 1.34k
 W = 565plf R₂ = 5.57k
 P = 69/11.8(1.6x2.5) = 2.33 f_v = 147psi
 M = 22.94kft f_b = 2.4ksi
 $\Delta = 1.53 \text{ in} = L/187$
 $\Delta = 0.78 \text{ in} = L/366$
 ← W/O SEISMIC DT.

④ LSL 1 3/4 x 14 RIM

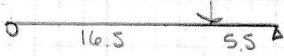


L = 6ft R = 1.81k
 TRIB = 11ft f_b = 571psi
 W = 605plf f_v = 68psi
 M = 2.72kft $\Delta = 0.029 \text{ in} = L/2449$

VERTICAL DESIGN

UPPER FLOOR FRAMING CONT.

⑤ LSL 13/4 x 14



$$L = 22 \text{ ft}$$

$$P = (6.9/22)(19)(2.5) = 2.7$$

$$M = 11.1 \text{ k-ft}$$

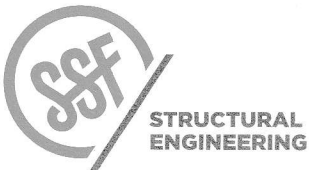
$$R_1 = 0.678 \text{ k}$$

$$R_2 = 2.028 \text{ k}$$

$$f_b = 2.33 \text{ ksi} < F_b = C_b f_b = 3.72 \text{ ksi}$$

$$f_v = 124 \text{ psi}$$

$$\Delta = 1.18 \text{ in} = 4/222$$



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SHEET