Structural Calculations For:

Brenes Remodel

2675 74th Ave SE
Mercer Island, WA

Architect: **Living Shelter Design Architects**
380 Newport Way NW
Issaquah, WA

May 8, 2019

UPDATE 8/3/2019
SHEETS 4 & 13

UPDATE 10/1/19
SHEETS 2-12

Project # 10592-2018-01

Criteria Sheet

Codes:

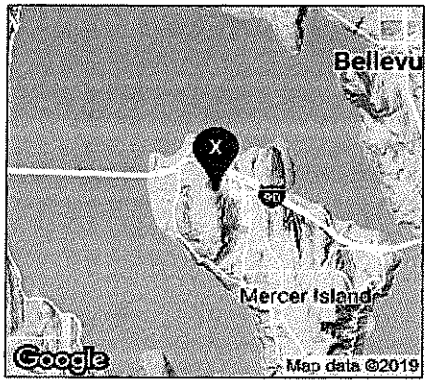
Structural:	IBC 2015
Loading:	ASCE 7-10
Wood:	NDS 2015
Steel:	AISC 360-10
Concrete:	ACI 318-14
Masonry:	TMS 402/602-13

Project Location:

Street & Number:	2675 74th ave se
City:	mercer islanc
State:	WA
ZIP:	98040
Latitude:	47.5870 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 =	0 kips	Ω_o=	3
S_s=	1.377	S_1=	0.53
S_{DS}=	0.92	S_{D1}=	0.53
C_s=	0.141	I_E=	1.0

Wind Load Summary:

V=	110	K_{zt}=	1.25
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	3.9	
	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	12	psf

Live Loads:

Snow	25	psf
Floor	40	psf

RAIN LOAD (62.4/12)2 = 10 PSF
∴ 25+10 = 35PSF

Soils:

Allowable Bearing	2000	psf

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Seismic Design

ASCE 7-10 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	per soils report (D assumed, without soils report)
Diaphragm Flexibility	Semi-Rigid/Rigid	

Ω_o	3	
S_S	1.377 g	2% in 50 yr, Latitude & Longitude lookup
S_1	0.53 g	2% in 50 yr, Latitude & Longitude lookup
h_n	55.0 ft	
R	6.50	
I_e	1.0	Table 1.5-2
C_d	4	
Ct	0.02	Table 12.8-2
x	0.75	Table 12.8-2
T	0.40 sec	Eq. 12.8-7
T_0	0.12 sec	
T_S	0.58 sec	
k	1.000	
Fa	1.00	Table 11.4-1
Fv	1.50	Table 11.4-2
S_{MS}	1.38 g	Eq. 11.4-1
S_{M1}	0.80 g	Eq. 11.4-2
S_{DS}	0.918 g	Eq. 11.4-3
S_{D1}	0.530 g	Eq. 11.4-4
Cs	***0.141 Controls***	Eq. 12.8-2
	0.202	Eq. 12.8-3 need not exceed, $T < T_L$
	0.010	Eq. 12.8-5 or 12.8-6 minimum
Cs, design	0.141	Eq. 12.8-1, Strength Level Base Shear
Cs, ASD	0.099	Eq. 12.8-1 ASD Base Shear

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

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

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

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

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

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Wind Design - MWFRS

ASCE 7-10 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	B	
V=	110	mph
K_d=	0.85	Table 26.6-1
K_h=	0.66	Table 27.3-1
G=	0.85	26.9.4

Transverse Wind Pressures

L/B = 0.89 h/L = 0.50

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	-0.50

Location and Building Dimensions

Calculate Kzt?	Yes	
Kzt	1.25	
Roof Type	Monoslope	
Roof Angle - Transverse Dir	0	degrees
Roof Angle - Long Dir	0	degrees
Ground to top of roof	24	ft
Bot of roof to top of roof	0	ft
Mean Roof Height, h	24	ft
Short Plan Dimension	48	ft
Long Plan Dimension	54	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	10	ft

Velocity Pressure at Mean Roof Height, q_h =	21.7	psf

Wall Pressures (Unfactored): ASD

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	P_{walls} (psf)
0-15	0.58	19.13	13.01	9.21	**13.33**
15-20	0.62	20.45	13.91	9.21	**13.87**
20-25	0.66	21.77	14.80	9.21	**14.41**
25-30	0.7	23.09	15.70	9.21	**14.95**
30-40	0.76	25.07	17.05	9.21	**15.76**
41-50	0.81	26.72	18.17	9.21	**16.43**
51-60	0.85	28.04	19.06	9.21	**16.97**
61-70	0.89	29.36	19.96	9.21	**17.51**
71-80	0.93	30.68	20.86	9.21	**18.04**
81-90	0.96	31.66	21.53	9.21	**18.45**
91-100	0.99	32.65	22.20	9.21	**18.85**

10.6#
11.07
11.5

Roof Pressures (Unfactored) ASD

Windward		Leeward	Horiz Proj (psf)
Max	Min		
-3.3	-16.6	-9.2	**4.80**

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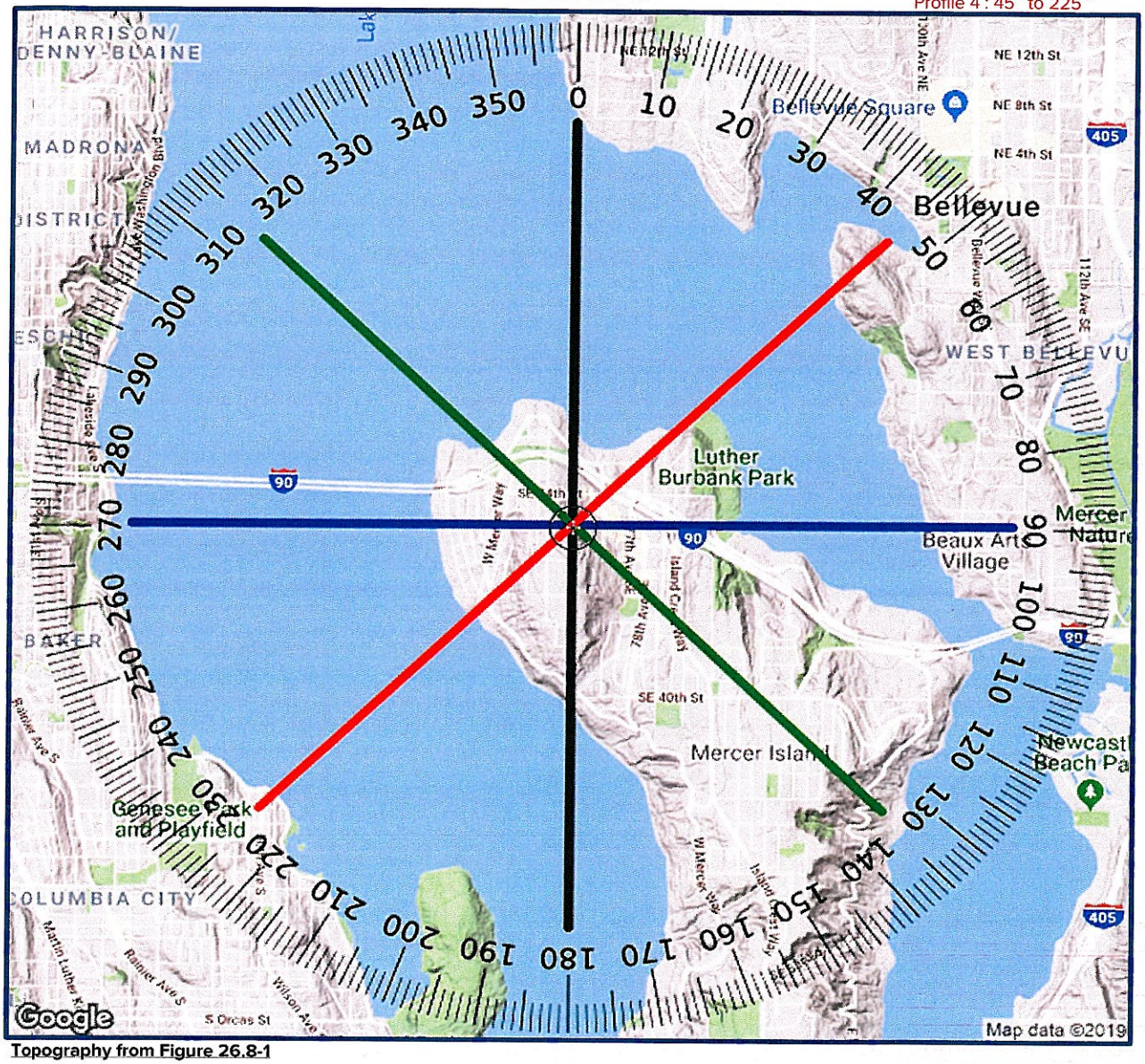
Site Address

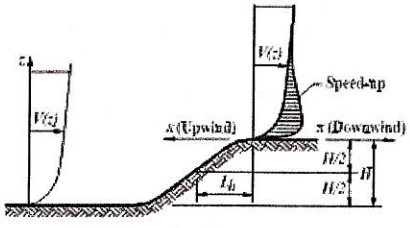
Address	2675 74th ave se			Wind Radius	2.00 Miles
City:	mercer islanc	State:	WA	Angle	0 °
Lat Long	47.58699	-122.2407		Exposure	B

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



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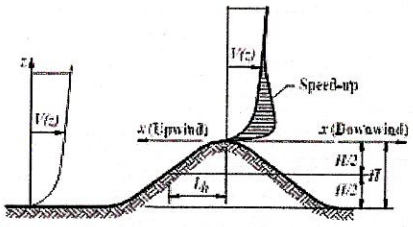

2-D RIDGE OR 3-D AXISYMMETRICAL HILL

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

PER FIGURE 26.8-1

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Brenes Remodel
Kzt Calculations

DATE 10/1/2019
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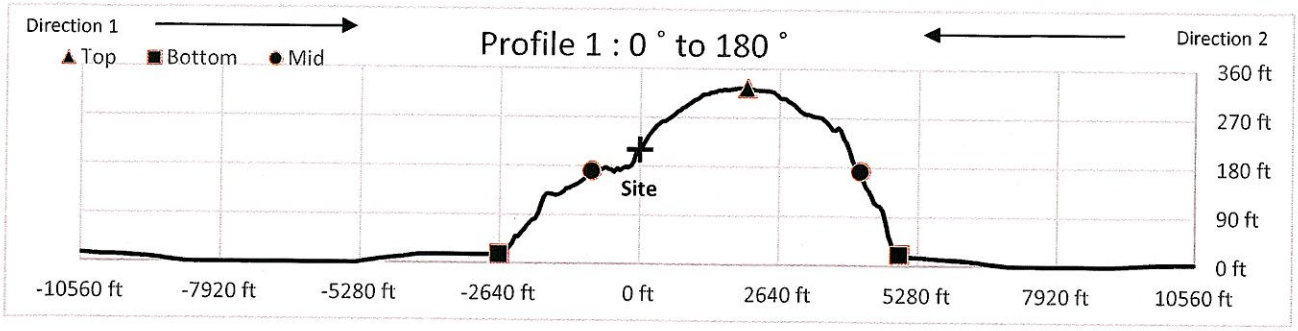

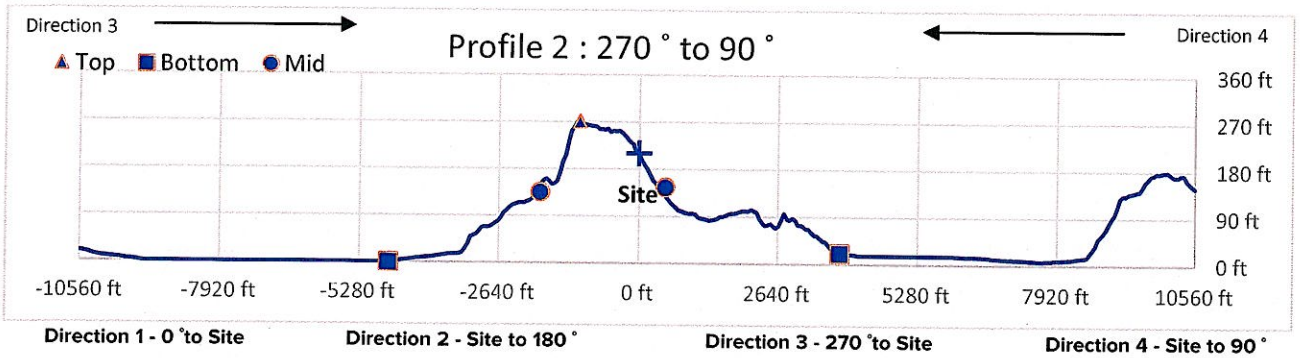

Direction 1 - 0 °to Site

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	Escrpmnt
Top of Hill Dist.	2016
Bott. of Hill Dist.	-2640
L @ H/2	-902
Site	upwind
Top of Hill Elev.	325
Bott. of Hill Elev.	17
Site Elev.	210.5
Site Dist.	0
H/2	171

Kzt Calculations

H=	308
Lh=	2918
x=	2016
z=	24
μ=	1.5
γ=	2.5
K1 value =	0.75
K1=	0.08
K2=	0.54
k3=	0.98
H/Lh =	0.11
Kzt =	1.00

Direction 2 - Site to 180 °

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.	2016
Bott. of Hill Dist.	4935
L @ H/2	4192
Site	downwnd
Top of Hill Elev.	325
Bott. of Hill Elev.	21
Site Elev.	210.5
Site Dist.	0
H/2	173

Kzt Calculations

H=	304
Lh=	2176
x=	2016
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.18
K2=	0.38
k3=	0.97
H/Lh =	0.14
Kzt =	1.00

Direction 3 - 270 °to Site

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

Terrain Data

Terrain	Hill
Top of Hill Dist.	-1114
Bott. of Hill Dist.	-4723
L @ H/2	-1857
Site	downwnd
Top of Hill Elev.	271
Bott. of Hill Elev.	0
Site Elev.	210.5
Site Dist.	0
H/2	135

Kzt Calculations

H=	271
Lh=	743
x=	1114
z=	24
μ=	1.5
γ=	4
K1 value =	0.95
K1=	0.35
K2=	0.00
k3=	0.88
H/Lh =	0.36
Kzt =	1.00

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

Terrain Data

Terrain	Ridge
Top of Hill Dist.	-1114
Bott. of Hill Dist.	3821
L @ H/2	500
Site	upwind
Top of Hill Elev.	271
Bott. of Hill Elev.	20
Site Elev.	210.5
Site Dist.	0
H/2	145

Kzt Calculations

H=	250
Lh=	1614
x=	1114
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.20
K2=	0.54
k3=	0.96
H/Lh =	0.16
Kzt =	1.00

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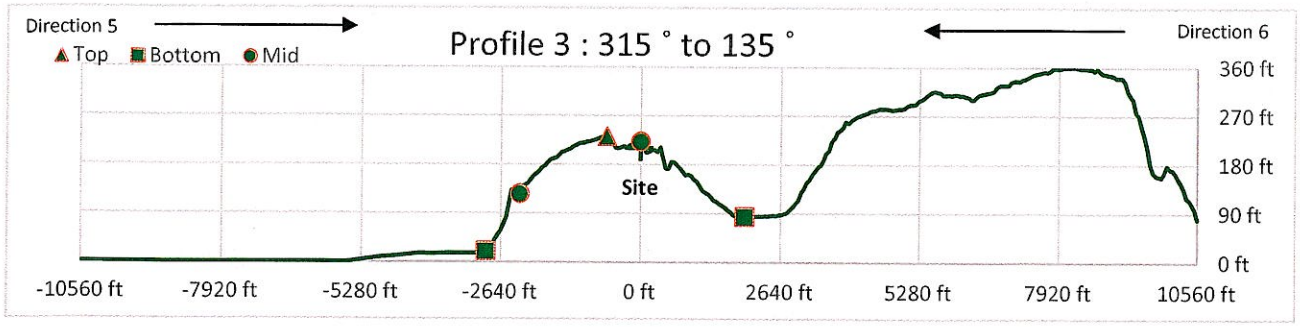

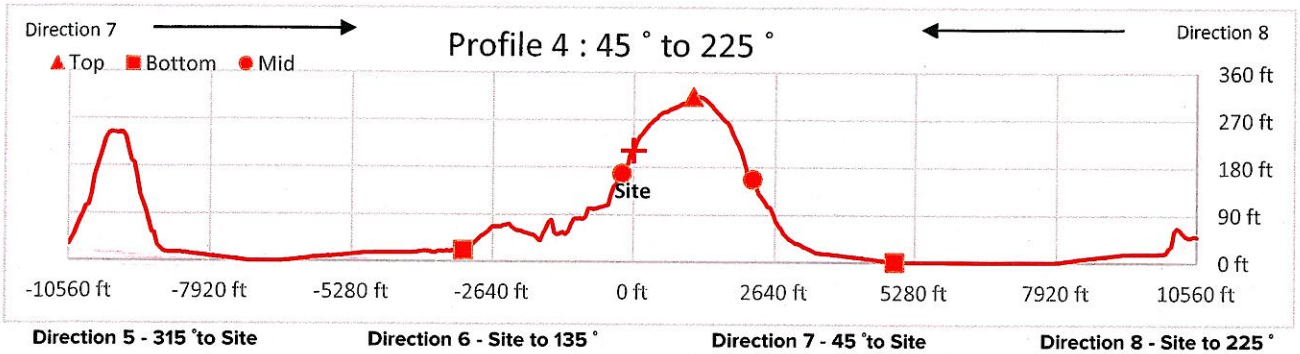

Direction 5 - 315 °to Site

Site Conditions (26.8.1)

1. Unubstructed	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.	-637
Bott. of Hill Dist.	-2919
L @ H/2	-2282
Site	downwnd
Top of Hill Elev.	232
Bott. of Hill Elev.	19
Site Elev.	210.5
Site Dist.	0
H/2	126

Kzt Calculations

H=	213
Lh=	1645
x=	637
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.17
K2=	0.74
k3=	0.96
H/Lh =	0.13
Kzt =	1.00

Direction 6 - Site to 135 °

Site Conditions (26.8.1)

1. Unubstructed	No
2. Isolated	

Kzt=1

Terrain Data

	Ridge

Kzt Calculations

Direction 7 - 45 °to Site

Site Conditions (26.8.1)

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

Terrain Data

Terrain	Ridge
Top of Hill Dist.	1114
Bott. of Hill Dist.	-3184
L @ H/2	-212
Site	upwind
Top of Hill Elev.	313
Bott. of Hill Elev.	21
Site Elev.	210.5
Site Dist.	0
H/2	167

Kzt Calculations

H=	292
Lh=	1326
x=	1114
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.29
K2=	0.44
k3=	0.95
H/Lh =	0.22
Kzt =	1.25

Direction 8 - Site to 225 °

Site Conditions (26.8.1)

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

Terrain Data

Terrain	Ridge
Top of Hill Dist.	1114
Bott. of Hill Dist.	4900
L @ H/2	2229
Site	downwnd
Top of Hill Elev.	313
Bott. of Hill Elev.	1
Site Elev.	210.5
Site Dist.	0
H/2	157

Kzt Calculations

H=	313
Lh=	1115
x=	1114
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.36
K2=	0.33
k3=	0.94
H/Lh =	0.28
Kzt =	1.24

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Brenes Remodel

Kzt Calculations

DATE 10/1/2019

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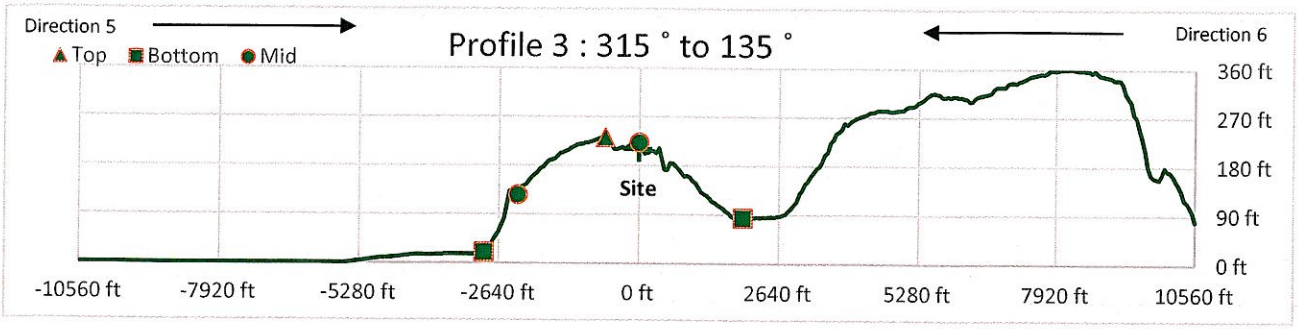
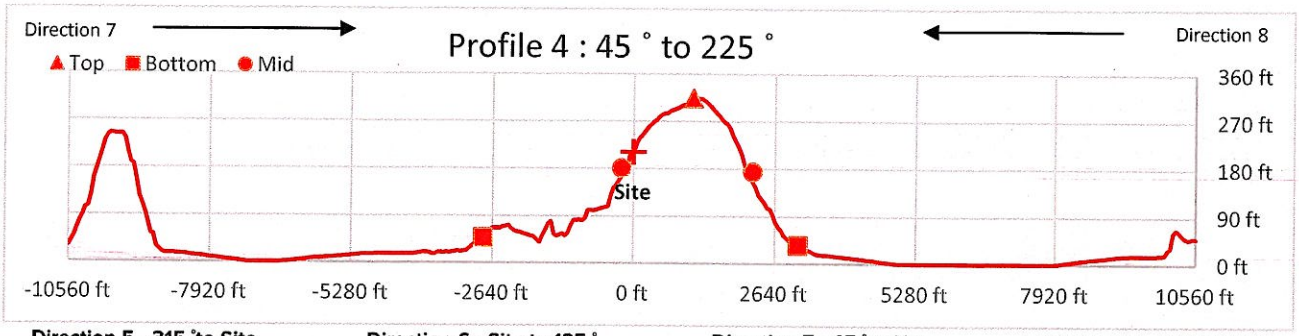
SHEET 7





Direction 5 - 315 ° to Site

Site Conditions (26.8.1)

1. Unubstructed	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.	-637
Bott. of Hill Dist.	-2919
L @ H/2	-2282
Site	downwnd
Top of Hill Elev.	232
Bott. of Hill Elev.	19
Site Elev.	210.5
Site Dist.	0
H/2	126

Kzt Calculations

H=	213
Lh=	1645
x=	637
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.17
K2=	0.74
k3=	0.96
H/Lh =	0.13
Kzt =	1.00

Direction 6 - Site to 135 °

Site Conditions (26.8.1)

1. Unubstructed	No
2. Isolated	

Kzt=1

Terrain Data

	Ridge

Kzt Calculations

Direction 7 - 45 ° to Site

Site Conditions (26.8.1)

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

Terrain Data

Terrain	Ridge
Top of Hill Dist.	1114
Bott. of Hill Dist.	-2812
L @ H/2	-212
Site	upwind
Top of Hill Elev.	313
Bott. of Hill Elev.	48
Site Elev.	210.5
Site Dist.	0
H/2	181

Kzt Calculations

H=	266
Lh=	1326
x=	1114
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.26
K2=	0.44
k3=	0.95
H/Lh =	0.20
Kzt=	1.23

Use 1.25

Direction 8 - Site to 225 °

Site Conditions (26.8.1)

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

Terrain Data

Terrain	Ridge
Top of Hill Dist.	1114
Bott. of Hill Dist.	3078
L @ H/2	2229
Site	downwnd
Top of Hill Elev.	313
Bott. of Hill Elev.	35
Site Elev.	210.5
Site Dist.	0
H/2	174

Kzt Calculations

H=	278
Lh=	1115
x=	1114
z=	24
μ=	1.5
γ=	3
K1 value =	1.3
K1=	0.32
K2=	0.33
k3=	0.94
H/Lh =	0.25
Kzt =	1.21

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STRUCTURAL ENGINEERING

Brenes Remodel

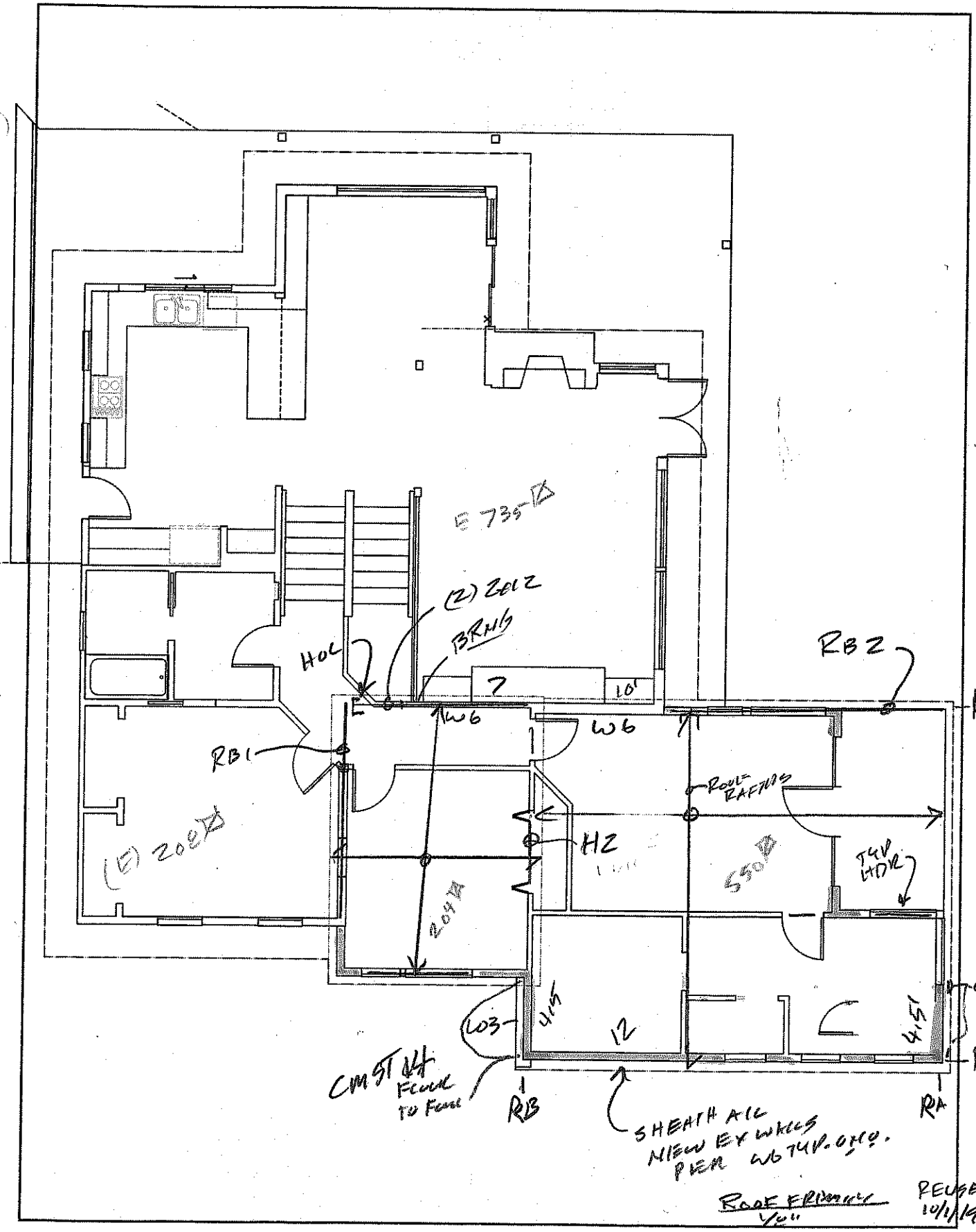
Kzt Calculations

DATE 10/1/2019

PROJ. #

DESIGN KMR

SHEET 7 A



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Brenes Remodel

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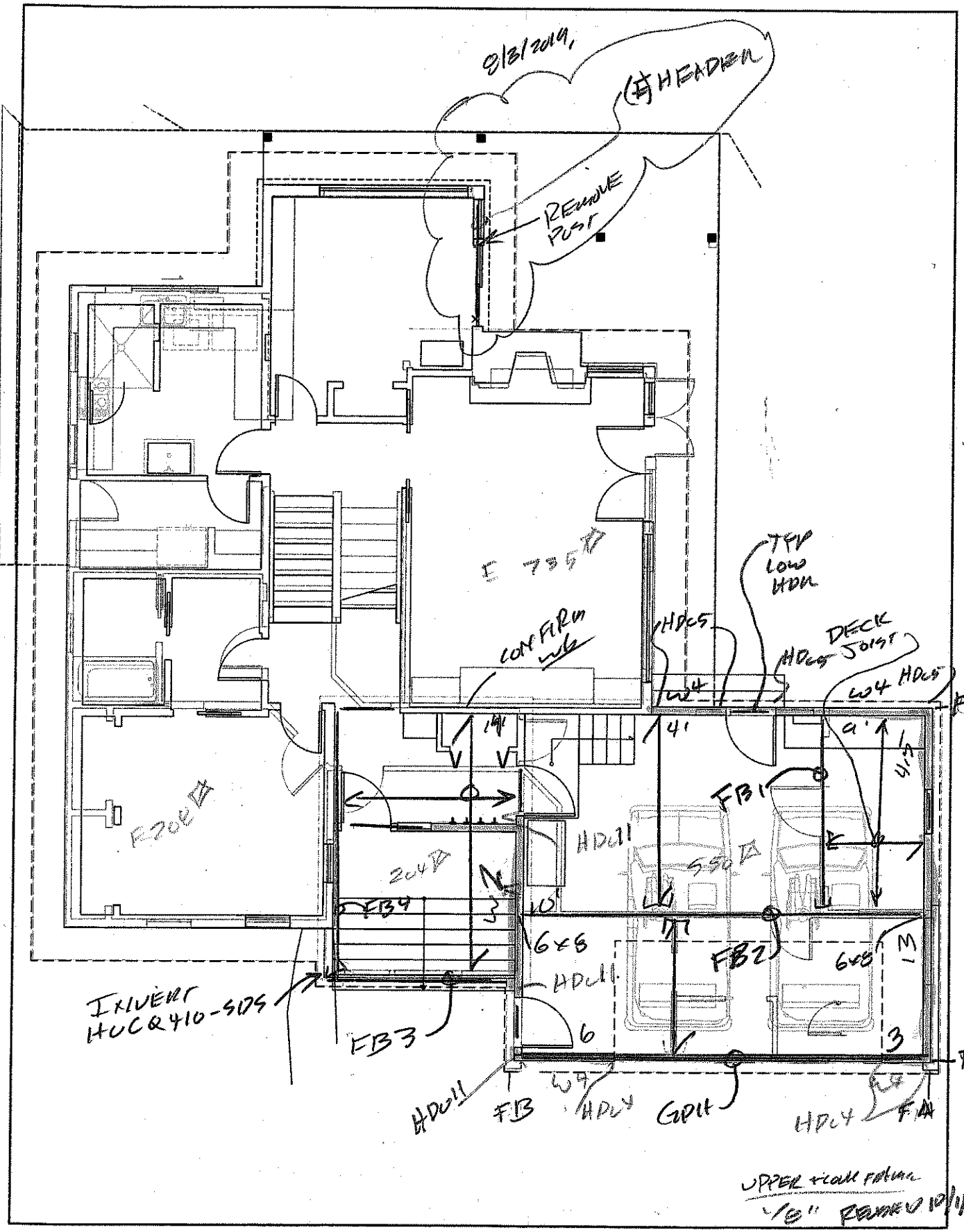
SHEET	8



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STRUCTURAL ENGINEERING

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SHEET	9

LATERAL LOADS @ ADDITION REVISED KZT=1.25

WIND

LINE SHEAR

R1 $V_W = 3.5(6)(14.41) + 5.5(11)13.87 = 1190^{\#}$

R2 $V_W = 3.5(11.5)13.41 + 5.5(21.5)13.87 = 2220^{\#}$

RA $V_W = 5.5(13)(13.87) = 990^{\#}$

RB $V_W = 3.5(12.5)13.41 + 5.5(24)13.87 = 2460^{\#}$

F1 $V_W = 1140^{\#} + 10.5(11)13.33 = 2680^{\#}$

F2 $V_W = 2220^{\#} + 10.5(21.5)13.33 = 5230^{\#}$

FA $V_W = 990 + 10.5(13)13.33 = 2810^{\#}$

FB $V_W = 2460 + 10.5(24)13.33 = 5820^{\#}$

SEISMIC

$WT_{UPPER} = (18+5)(204+735+204+550) = 23(1697) = 39030^{\#}$

$WT_{LOWER} = (12+10)(1697) = 37335^{\#}$

$\Sigma = 76365^{\#}$

$V_S = .1(76365) = 7640^{\#}$

V_S UPPER $= 7640(2(39.1)/2(39)137) = 7640(.68) = 5180^{\#}$

V_S LOWER $= 2460^{\#}$

LINE	SEISMIC SHEAR		WIND SHEAR
R1	$V_S = 5180(377/1697) = 1150^{\#}$	⇐S	$V_W = 1140^{\#}$
R2	$V_S = 5180(745/1697) = 2275^{\#}$	⇐S	$V_W = 2220^{\#}$
RA	$V_S = 5180(275/1697) = 840^{\#}$	⇒W	$V_W = 990^{\#}$
RB	$V_S = 5180(480/1697) = 1465^{\#}$	⇒W	$V_W = 2460^{\#}$
F1	$V_S = 1150 + 2460(377/1697) = 1695^{\#}$	⇒W	$V_W = 2690^{\#}$
F2	$V_S = 2275 + 2460(745/1697) = 3355^{\#}$	⇒W	$V_W = 5230^{\#}$
FA	$V_S = 840 + 2460(275/1697) = 1240^{\#}$	⇒W	$V_W = 2810^{\#}$
FB	$V_S = 1465 + 2460(480/1697) = 2166^{\#}$	⇒W	$V_W = 5820^{\#}$

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PROJECT B Remodel

DATE 5/26/15 REVISED 10/11/19

PROJ # 10552-04-1

DESIGN KMA

SHEET 10

LINE R1

$V_S = 1150^{\#}$

$v_s = 1150/12 = 96^{\#}/FT$ W6 O.T. NOT CRIT.

LINE R2

$V_S = 2275^{\#}$

$v_s = 2275/(10+7) = 134^{\#}/FT$ W6 O.T. NOT CRIT.

LINE RA

$V_W = 990^{\#}$

$v_w = 990/4.5 = 220^{\#}/FT$ W6

$UPLIFT = [220(9.5)4.5 - .6(10(9.5)+16(4))\,4.5^2/2]/4.5 = 1064^{\#}$ CS14

LINE RB

$V_W = 2460$ ← W/MD.

$v_w = 2460/4.5 = 546^{\#}/FT$ W3

$UPLIFT = [546(4.5)(9.5) - .6(167)\,4.5^2/2]/4.5 = 4961^{\#}$ CMST14

LINE F1

$V_W = 2680$

$v = 2680/(6+3) = 294^{\#}/FT$ W4 OKW/ H/W RATIO @ 3' WALL

$UPLIFT = [294(10)3 - .6(10(10)+12(4)+16(9)+18(10))\,3^2/2]/3 = 2563^{\#}$ HDU4

LINE F2

$V_W = 5230^{\#}$

$v = 5230/(14+4+9) = 193^{\#}/FT$ W6

O.T. NOT CRITICAL

CHECK W/ ONLY 9 FT WALL

$v = 5320/(9+4) = 409^{\#}/FT$ ← CONFIRM (E) 14' WALL W6 SHEATH VIEW PELWK

$UPLIFT = [409(10)4 - .6(416)\,4^2/2]/4 = 3588^{\#}$ HDU5

REVISED 6/19.

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PROJECT BREMIC

DATE 5/5/19.

PROJ. # 10592-121

DESIGN KMR

SHEET 11

LINE FA

$V_w = 2810^{\#}$

$w = 2810/(13+4) = 160\ ^{\#}/_{ft}$ W6 OT. HOT CR.,

LINE FB

$V_w = 5820^{\#}$

$w = 5820/10 = 582\ ^{\#}/_{ft}$ W2

$UPLIFT = 4966 + [582(8)(10) - .6(10(8) + 12(4))\frac{10^2}{2}]/10 = 9233^{\#}$ HDU11

VERTICAL

ROOF RAFTERS (PONDING)

$w = (16)(23)2 + 62.4(1/12)2 = 97\ ^{\#}/_{ft}$ @ 24" OC

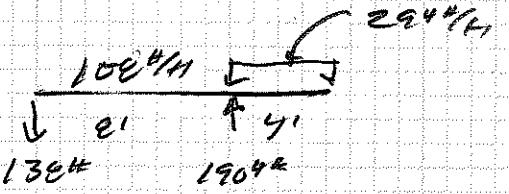
SPAN = 17'

$V = 582^{\#}$
$M = 1746^{\#}$
$\Omega_{DL} = 662^{\#}$
$\Omega_{LL} = 446^{\#}$
$\Delta = .29" = L/736$

2-2X12 @ 24" OC

RB1

$w = 49(6) = 294\ ^{\#}/_{ft}$



@ CANT.

$V = 1176^{\#}$
$M = 2352^{\#ft}$
$\Omega_{DL} = 446^{\#}$
$\Omega_{LL} = 404^{\#}$
$\Delta = .109" = L/1016$

(2) 2X12

RELEASED 5/15/15

SSF STRUCTURAL ENGINEERING

PROJECT BREHE

DATE 5/5/15

PROJ. # 165927.01

DESIGN KMR

SHEET L2

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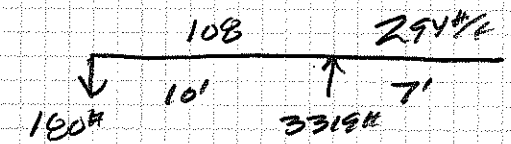
RB2

V= 2060#
m= 7203 ft#
fm= 1170 psi
fc= 625 psi
A = 1.5" = 4341



(2) 1 3/4 x 11 1/4 LVL

TYP HDR

w= 49(11) = 539#/ft
SPAN = 4'

V= 1078#
m= 1078 ft#
fm= 625 psi
fc= 760 psi
A = 1.06" = 4836

(2) 2x6

H2

w= 49(8) = 392#/ft
SPAN = 5'

V= 980#
m= 1225 ft#
fm= 2710 psi
fc= 725 psi
A = 1" = 4560

(2) 2x6

12/31/2019

E HDR

w= 49(9) = 441#/ft
SPAN = 8'

V= 1764#
m= 3528 ft#
fm= 2000 psi
fc= 775 psi
A = 1.64 = 7607

(2) 2x10

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STRUCTURAL ENGINEERING

PROJECT: BREWERY
DATE: 5/15/19
PROJ. #: 10592-127
DESIGN: KMR
SHEET: L3

FLOOR FRAMING

SPAN = 12'

W = (12+40) 16/12 = 69#/ft

SPAN = 13'

V = 414#
m = 1242 ft#
fm = 936 psi
fv = 40 psi
Δ = .25 = L/575

2x10 @ 16" o.c.

DECK JOIST

W = (12+60) 16/12 = 96#/ft

SPAN = 7'

V = 336#
m = 588 ft#
fm = 733 psi
fv = 50 psi
Δ = .12" = L/437

2x SCOPE CUT @ 16" o.c.
MIN DEPTH = 5 1/2"

FB1

W = 72(3.5) + 69 + 49(2) = 420#/ft

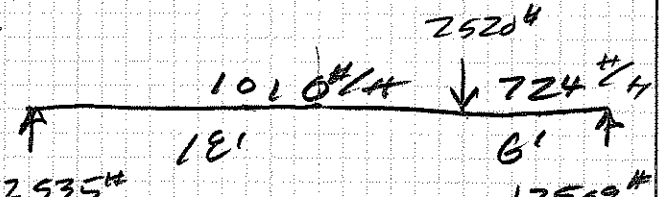
SPAN = 12'

V = 2520#
m = 7560 ft#
fm = 1050 psi
fv = 75 psi
Δ = .22" = L/654

3 1/2 x 12 GLB

BEAM FB2

W = (12+40)10 + 49(10) = 1010#/ft
W2 = (12+40)4.5 + 49(10) = 724#/ft
P = 2520#



V = 12535#
m = 77721 ft#
fm = 1444 psi
fv = 102 psi
Δ = .58" = L/497

6 3/4 x 24 GLB

BEAM

PROJECT

5/5/19

DATE

10592-164

PROJ. #

KMR

DESIGN

14

SHEET

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GDH

W = (52+49) 4.5 = 455#/FT
SPAN = 16.5'
V = 3754#
m = 15464 ft-lb
f_b = 1510 psi
f_v = 81 psi
Δ = .57" = L/346

5 1/2x12 GLB

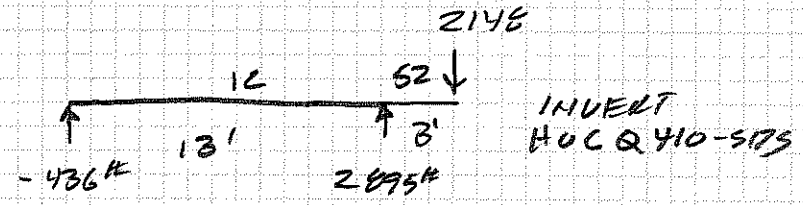
BEAM FB3

W = (12+40) 5 + 49(2) = 356#/ft
SPAN = 12'
V = 2146#
m = 6441 ft-lb
f_b = 1550 psi
f_v = 270 psi
Δ = .30" = L/376

~~3 1/2x5 1/4 LVL~~
→ 3 1/2x11 7/8 LVL

FB4

w_1 = 52#/ft
w_2 = 12#/ft
P = 2148 lb



V = 2304 lb
m = 6676 ft-lb
f_b = 1066 psi
f_v = 165 psi
Δ = .12" = L/816

3 1/2x11 1/4 LVL

2695/340 = (10) 1/4" ø x 6" SDS into Rim w/ Blocking

TYP LOW HDR

W = (52+49) 6 = 606#/ft
SPAN = 3'
V = 909 lb
m = 682 ft-lb
f_b = 3107 psi
f_v = 326 psi
Δ = .09" = L/4037

(2) 2x6

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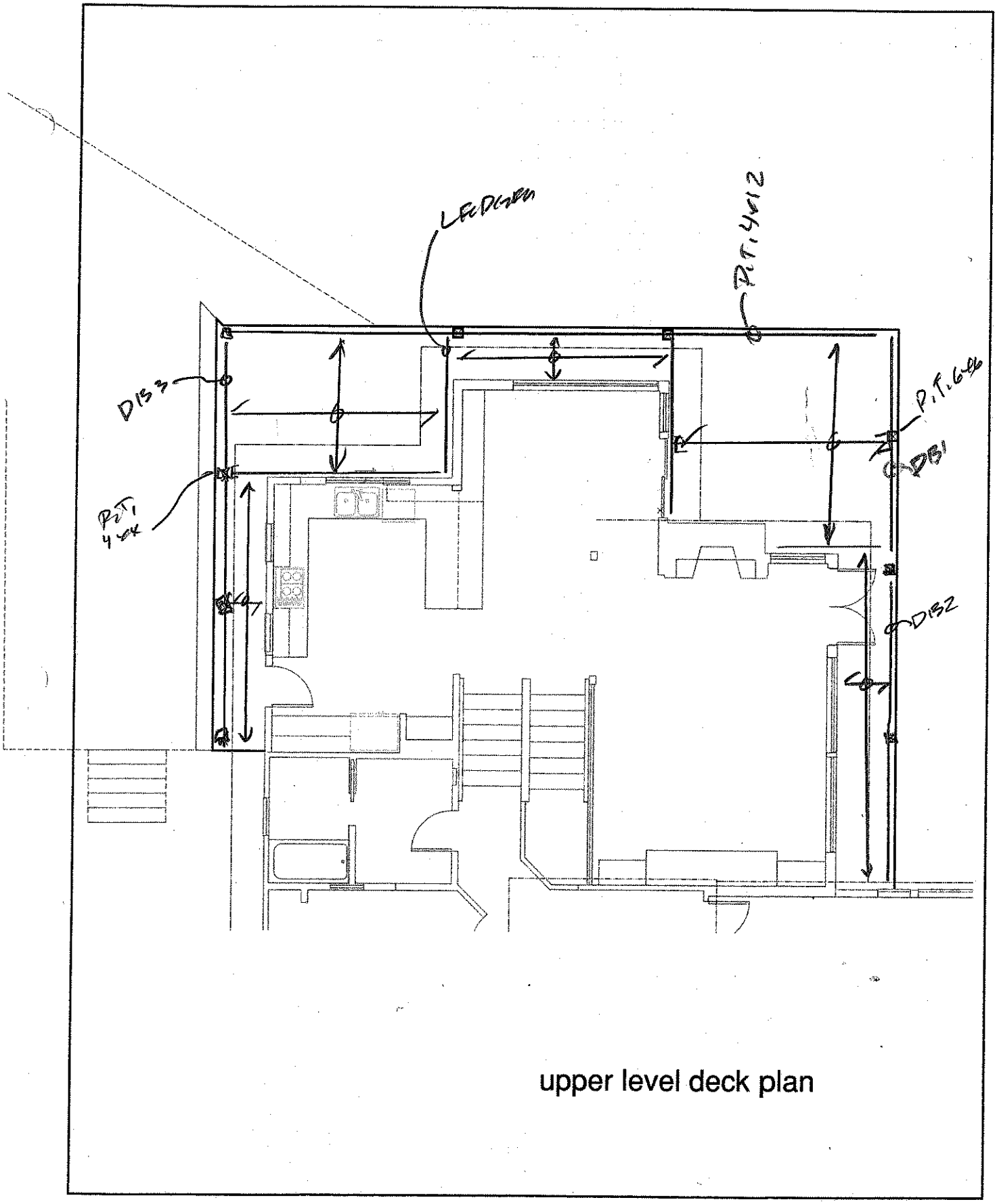
PROJECT: BREMER

DATE: 5/5/17
PROJ #: 1059.21.04
DESIGN: KM
SHEET: 15



upper level deck plan

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STRUCTURAL ENGINEERING

PROJECT	Brenes Remodel
DATE	05/03/2019
PROJ. #	10592-2018-01
DESIGN	KMR
SHEET	16

DECK FRAMING

DECK JOIST

W = (9+6) 16/12 = 91 #/ft

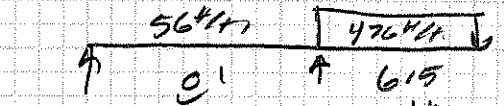
SPAN = 14'

V = 637 lb
m = 2225 in-lb
f_b = 545 psi
f_v = 50 psi
Δ = .133" = 4/424

PIT 2x12 @ 16" o.c.

DB1

W_1 = 68(7) = 476 #/ft
W_2 = 8(7) = 56 #/ft



V = 3054 lb
m = 10055 in-lb
f_b = 995 psi
f_v = 208 psi
Δ = .52" = 4/320

PIT. HF #1 6x12

DB2

W = 68(2) = 136 #/ft
SPAN = 10'

V = 680 lb
m = 1700 in-lb
f_b = 276 psi
f_v = 21 psi
Δ = .06" = 4/2117

PIT. 4x12

DB3

W = (68)(7) = 476 #/ft
SPAN = 9'
V = 2404 #
m = 3605 in-lb
f_b = 620 psi
f_v = 56 psi
Δ = .02" = 4/11C1

PIT 4x12

LEDGER

W = (8+6) 14 = 952 #/ft
SPAN = 3'
V = 1428 lb
m = 1707 in-lb
f_b = 406 psi
f_v = 42 psi
Δ = .00 = 4/4000

2x12 PIT.

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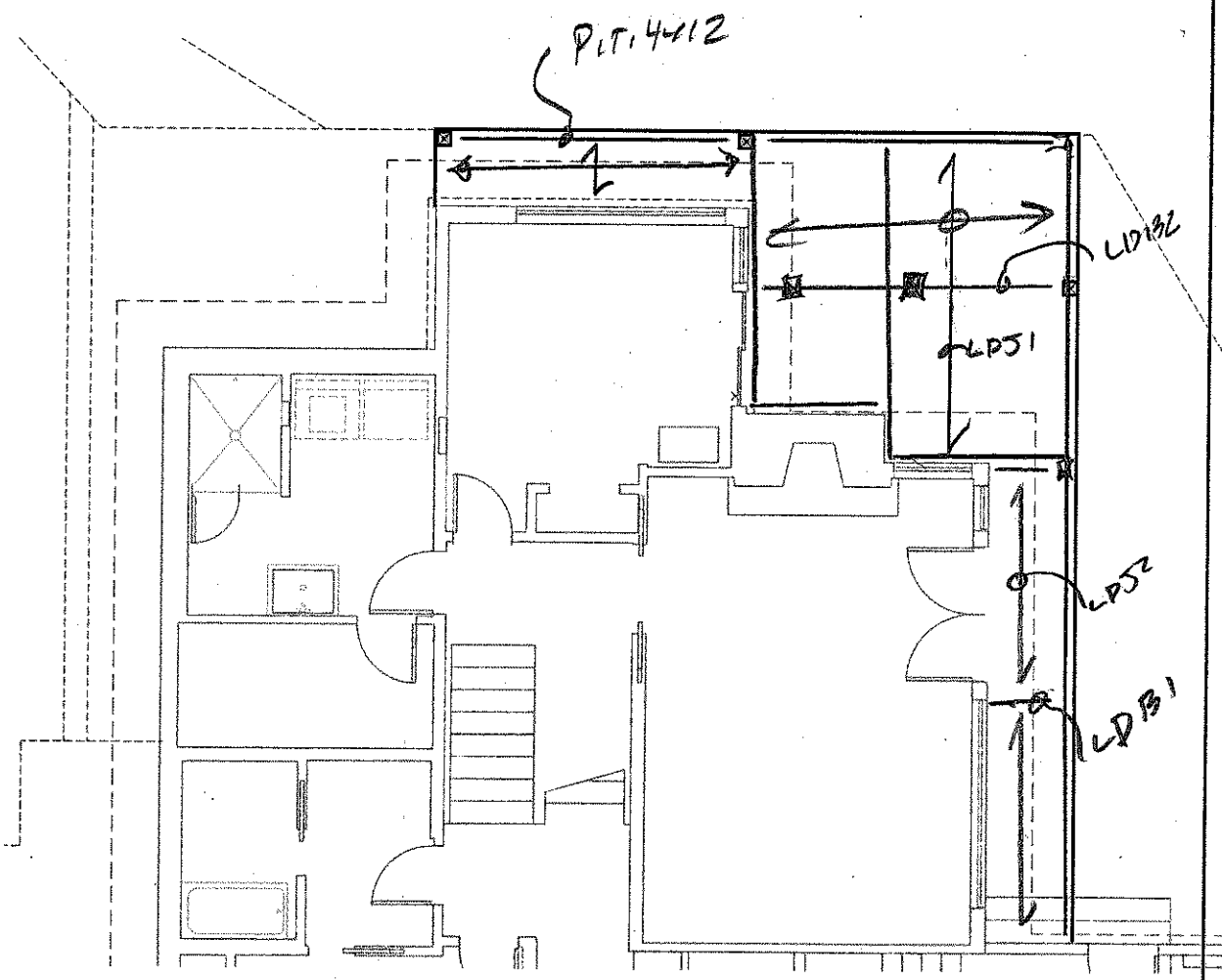
PROJECT: BREMES,

DATE: 5/5/19

PROJ. #: 10592-167

DESIGN: KMC

SHEET: 17



lower level deck plan

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STRUCTURAL ENGINEERING

Brenes Remodel

PROJECT

05/03/2019

DATE

10592-2018-01

PROJ. # KMR

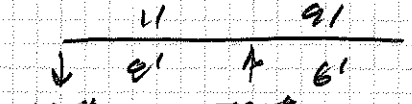
DESIGN 18

SHEET

LDS1

W1 = 8(16/12) = 11#/ft

W2 = (e+60) 16/12 = 91#/ft



V = 546
m = 1638 ik
fb = 621 psi
fv = 41 psi
Δ = .134" = Yes?

P.T. 2x12 @ 16" o.c.

LDS2

W(6E)

SPAN = 10'

V = 340#
m = 850 ik
fb = 774 psi
fv = 41 psi
Δ = .125" = Yes

P.T. 2x6 @ 12" o.c.

LDB1

W = 810(2) = 660#/ft

SPAN = 4'

V = 1320 ik
m = 1320 ik
fb = 5328 psi
fv = 56 psi
Δ = .034" = Yes 1770

P.T. 4x6

LDB2

W = 833#/ft

SPAN = 6'

V = 2500 ik
m = 3750 ik
fb = 601 psi
fv = 66 psi
Δ = .10" = Yes

P.T. 4x10

SSF STRUCTURAL ENGINEERING

PROJECT: BRENNEMAN

DATE: 5/5/09

PROJ #: 0592-12-1

DESIGN: KMK

SHEET: L9

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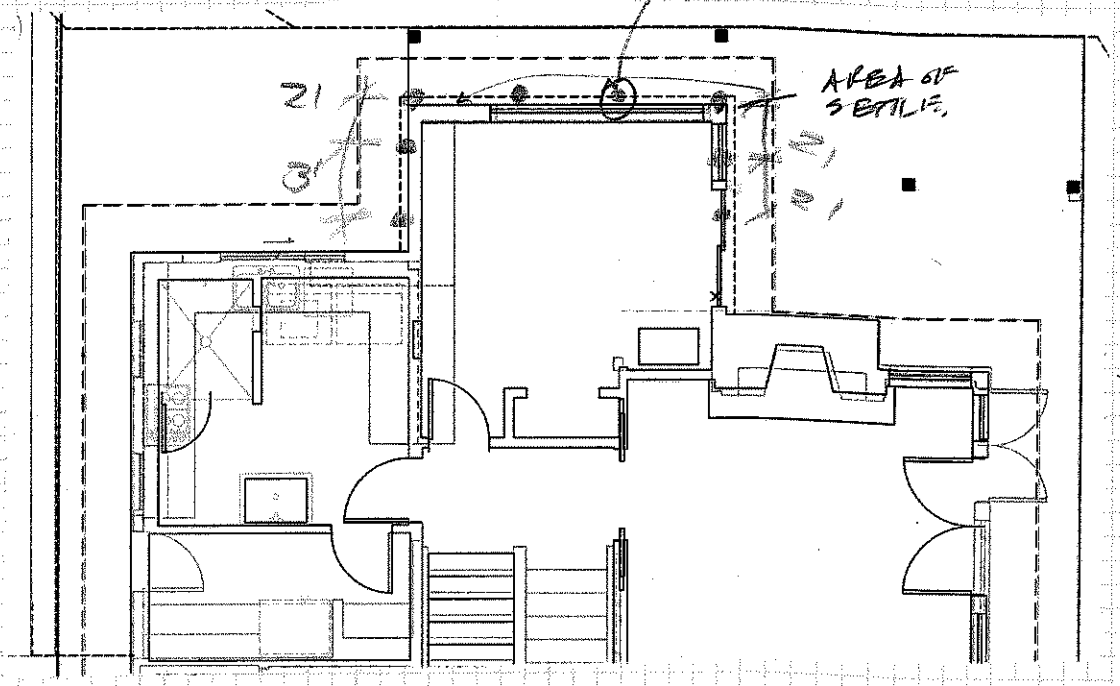
PIN PICES

2½ PIN PICE 6 KIP CAPACITY

2½ PIN PICES



W/LT = (150)(8/12) 8 + 10(16) + (10+14) 2 + (18+25) 2 = 1150#/FT @ MOM BM.

@ BRNG = 900 + (50 + 43) 7 = 1611#/FT

6000/1150 = 5.2' O.C.

6000/1610 = 3.7' O.C.

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STRUCTURAL ENGINEERING

PROJECT BREMES,

DATE 5/6/19,

PROJ. # 10592-121

DESIGN KMH,

SHEET 20

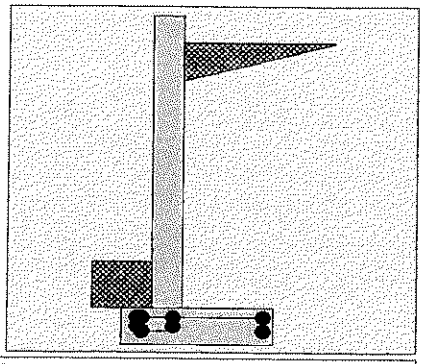
Cantilevered Retaining Wall

Criteria

Retained Height	=	4.75 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	10.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.66 OK
Sliding	=	2.13 OK
Total Bearing Load	=	1,428 lbs
...resultant ecc.	=	8.38 in
Soil Pressure @ Toe	=	1,725 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,415 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	4.8 psi OK
Footing Shear @ Heel	=	12.2 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	660.2 lbs
less 100% Passive Force	= -	656.3 lbs
less 100% Friction Force	= -	749.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	0.0 lbs OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Bar Lap/Emb
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	6.00
Rebar Size =	# 4
Rebar Spacing =	12.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.356**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	812.3
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	1,286.1
Moment.....Allowable =	3,612.6
Service Level psi =	
Strength Level psi =	15.9
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	4.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	75.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0727 in2/ft		
(4/3) * As :	0.0969 in2/ft	Min Stem T&S Reinf Area 0.756 in2	
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in

Footing Dimensions & Strengths

Toe Width	=	0.50 ft
Heel Width	=	2.00
Total Footing Width	=	2.50
Footing Thickness	=	8.00 in
Key Width	=	0.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,415	0 psf
Mu' : Upward	=	272	68 ft-#
Mu' : Downward	=	29	840 ft-#
Mu: Design	=	243	772 ft-#
Actual 1-Way Shear	=	4.76	12.24 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 12.00 in
Heel Reinforcing = # 4 @ 18.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: #4@ 0 in, #5@ 0 in, #6@ 0 in, #7@ 0 in, #8@ 0 in, #9@ 0

Min footing T&S reinf Area 0.43 in2
Min footing T&S reinf Area per foot 0.17 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 13.89 in	#4@ 27.78 in
#5@ 21.53 in	#5@ 43.06 in
#6@ 30.56 in	#6@ 61.11 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	660.2	1.81	1,191.9	Soil Over Heel	= 783.8	1.75	1,371.6
Surcharge over Heel	=				Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	=		
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	=		
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=		
	=				Soil Over Toe	=	0.25	
					Surcharge Over Toe	=		
Total		660.2	**O.T.M.**	1,191.9	Stem Weight(s)	= 393.8	0.75	295.3
	=		=		Earth @ Stem Transitions	=		
					Footing Weight	= 250.0	1.25	312.5
					Key Weight	=		
					Vert. Component	=		
					Total =	1,427.5 lbs	**R.M.=**	1,979.4

Resisting/Overturning Ratio = 1.66
Vertical Loads used for Soil Pressure = 1,427.5 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.101	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

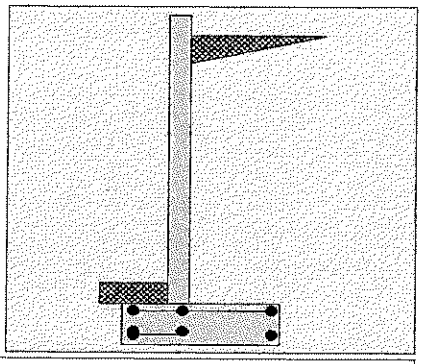
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	6.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.63 OK
Sliding	=	1.55 OK
Total Bearing Load	=	2,480 lbs
...resultant ecc.	=	11.39 in
Soil Pressure @ Toe	=	2,065 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,891 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	7.0 psi OK
Footing Shear @ Heel	=	13.9 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	1,265.6 lbs
less 100% Passive Force	= -	656.3 lbs
less 100% Friction Force	= -	1,302.0 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	0.0 lbs OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

Bottom

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.912**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,521.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	3,295.5
Moment.....Allowable	=	3,612.6
Service Level	psi =	
Strength Level	psi =	29.8
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.25
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	75.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1863 in2/ft	
(4/3) * As :	0.2484 in2/ft	Min Stem T&S Reinf Area 1.008 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1863 in2/ft	#4@ 16.67 in #4@ 33.33 in
Provided Area :	0.2 in2/ft	#5@ 25.83 in #5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in #6@ 73.33 in

Footing Dimensions & Strengths

Toe Width	=	1.00 ft
Heel Width	=	2.50
Total Footing Width	=	3.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,891	0 psf
Mu' : Upward	=	1,245	147 ft-#
Mu' : Downward	=	123	2,076 ft-#
Mu: Design	=	1,122	1,929 ft-#
Actual 1-Way Shear	=	7.00	13.91 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 10.10 in
Heel Reinforcing = # 4 @ 18.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: #4@ 0 in, #5@ 0 in, #6@ 0 in, #7@ 0 in, #8@ 0 in, #9@ 0

Min footing T&S reinf Area 0.91 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	1,265.6	2.50	3,164.1	Soil Over Heel	=	1,430.0	2.50	3,575.0
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=			
	=				Soil Over Toe	=		0.50	
					Surcharge Over Toe	=			
Total		1,265.6	**O.T.M.**	3,164.1	Stem Weight(s)	=	525.0	1.25	656.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	525.0	1.75	918.8
					Key Weight	=			
					Vert. Component	=			
					Total	=	2,480.0 lbs	**R.M.=**	5,150.0

Resisting/Overturning Ratio = 1.63
Vertical Loads used for Soil Pressure = 2,480.0 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.115	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.