Structural Calculations for:

East Mercer Residence – Parcel 3

East Mercer Way, Mercer Island, WA, 98040

Client: Ripple Design Studio Inc.

Code: 2015 International Building Code

Table of Contents

Scope: Single Family Residence
(Formerly Known as Zheng Residence 3)

July 27, 2017
Revised October 6, 2017

Buker Engineering, llc
PO Box 28531
Seattle, WA 98118-8531
Ph: 206.310.3559

Seismic Design Loads (ASCE 7-10)

for a Wood Framed Structure

RISK CATEGORY	II				
OCCUPANCY CAT.	II	Table 1-1			
IMP. FACTOR	1	Table 11.5-1			
SITE CLASS	D	Table 20.3-1	SEISMIC		
R =	6.5	Table 12.2-1	DESIGN CATEGORY	D	11.6.1.1

S_s =	1.461			
S_1 =	0.556			
F_a =	1.00	Table 11.4-1		
F_v =	1.50	Table 11.4-2	Seismic Dead Load:	15 psf Roof
S_{DS}=	0.974			10 psf Floor
S_{D1}=	0.556			20 psf Walls
Cs_{ULT}=	0.150	Eqn. 12.8-2		W_{roof}=15 + 1= 25 psf
Cs_{ASD}=	0.107			W_{floor}=10 + 10 + 10= 30 psf

Vertical Design Loads

Criteria
ASCE 7-10
IBC 2012

Dead Loads

Roof (Composit)	2.5	psf	Flooring	1	psf
1/2" Ply	1.5	psf	Sheathing	2.3	psf
Rafter/Truss	2	psf	Joist	2.6	psf
Insulation	1	psf	5/8" GWB	3.1	psf
5/8" GWB	3.1	psf	Misc. Mech	1	psf
Misc./Mech.	2	psf		10	psf
	12.1	psf			
Use	15	psf	Use	15	psf

Live Loads

	House	
Snow	25	psf
floor	40	psf

Soil Bearing

0 psf

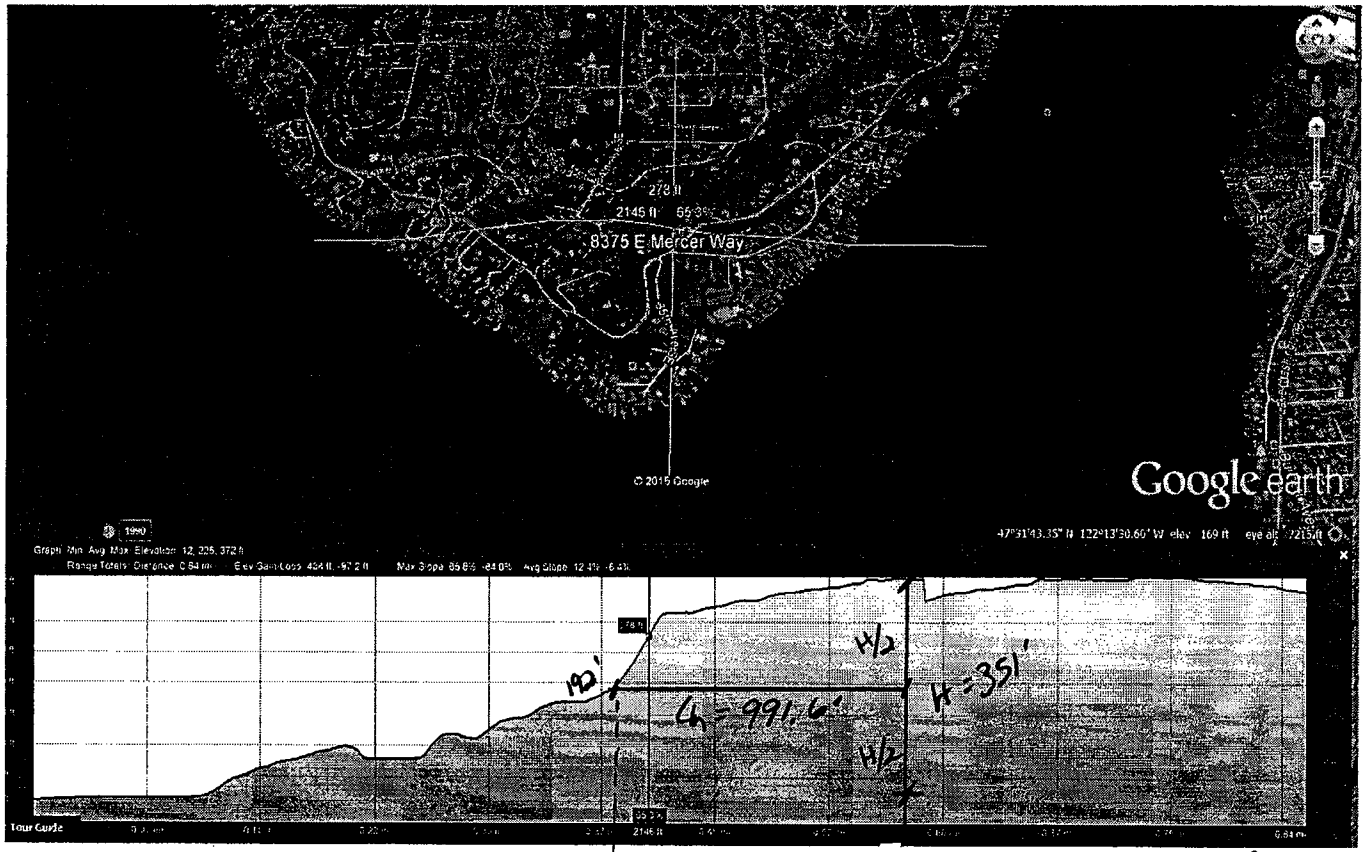
buker ENGINEERING LLC

Project: Zheng Residence 3

Date: 1/15/2016

Design: CRB

C1



$$\frac{H}{L_h} = \frac{351}{991.6} = 0.35 \geq 0.2$$

$$\therefore K_{zt} = (1 + k_1 k_2 k_3)^2 = (1 + (0.455)(0.366)(0.9))^2 = \boxed{1.32 = K_{zt}}$$

$k_1 = 0.455$ Figure 26.8-1

$$k_2 = \left(1 - \frac{|x|}{\mu L_h}\right) = \left(1 - \frac{866.6}{1.5(991.6)}\right) = 0.366$$

$$k_3 = e^{-\gamma z / L_h} = e^{-3(34.5')/991.6'} = 0.90$$

$$\frac{H}{L_h} = \frac{273'}{580.8} = 0.47 > 0.2$$

$$K_{zt} = (1 + K_1 K_2 K_3)^2 = (1 + 0.611(0.697)(0.837))^2 = \boxed{1.84 = K_{zt}}$$

$K_1 = 0.611$

$K_2 = \left(1 - \frac{264}{1.5(580.8)}\right) = 0.697$

$K_3 = e^{-3(34.5)/580.8} = 0.837$

therefor use $\underline{K_{zt} = 1.84}$

Wind Design Loads (ASCE 7-10)

Directional Procedure - Part 1

Exposure	C				
V=	110	mph			
K_d=	0.85		Table 26.6-1		
I=	1				
G=	0.85		26.9		

Roof Angle =	18.43	degrees
Ground to top of roof	35.68	ft
Bottom of roof to top of roof	5	ft
(mean roof height) h=	33.18	ft

K_{zt}= 1.84

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.5
Windward Roof	0.3
Leeward Roof	-0.6

*Note= Cp values are conservative worst case values

Pressures:

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	Ultimate P_{walls} (psf)	**Allowable P_{walls} (psf)**
0-15	0.85	41.18	28.00	21.41	49.42	**29.65**
15-20	0.9	43.60	29.65	21.41	51.06	**30.64**
20-25	0.94	45.54	30.97	21.41	52.38	**31.43**
25-30	0.98	47.48	32.28	21.41	53.70	**32.22**
30-40	1.04	50.38	34.26	21.41	55.67	**33.40**

$P_{ww\ roof}$	$P_{lw\ roof}$	P_{roof} (psf)	**P_{roof} (psf)**
12.85	25.70	38.54	**23.13**

Use 34 **psf** on projected wind surfaces

buker ENGINEERING LLC

Project: Zheng Residence 3

Date: 10/6/2017

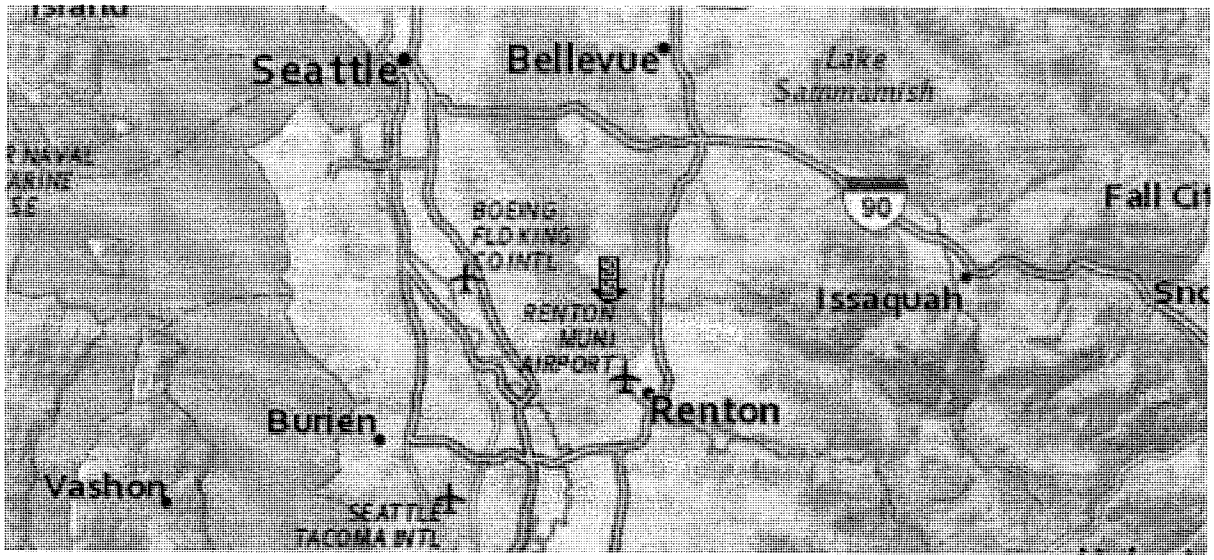
Design: CRB

L3

USGS Design Maps Summary Report

User–Specified Input

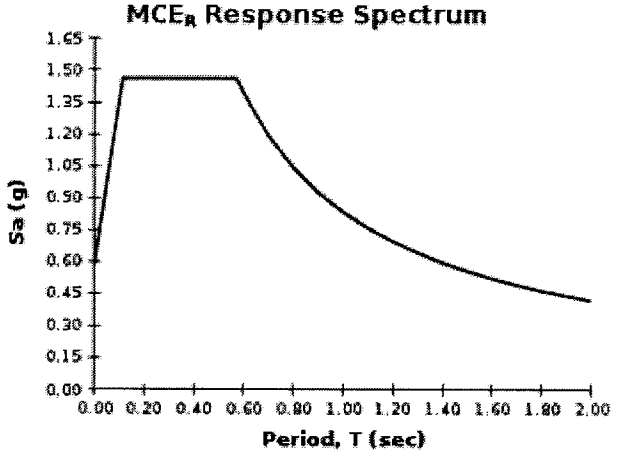
Report Title	Seismic Response Fri January 15, 2016 17:33:13 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	47.52873°N, 122.2253°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

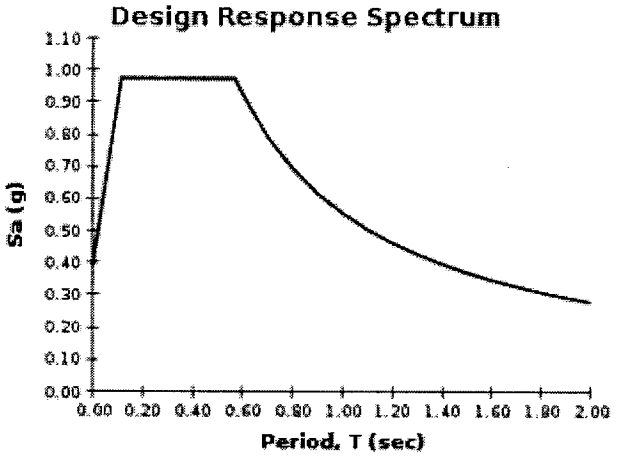


USGS–Provided Output

S_S =	1.462 g	S_{MS} =	1.462 g	S_{DS} =	0.974 g
S_1 =	0.556 g	S_{M1} =	0.833 g	S_{D1} =	0.556 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

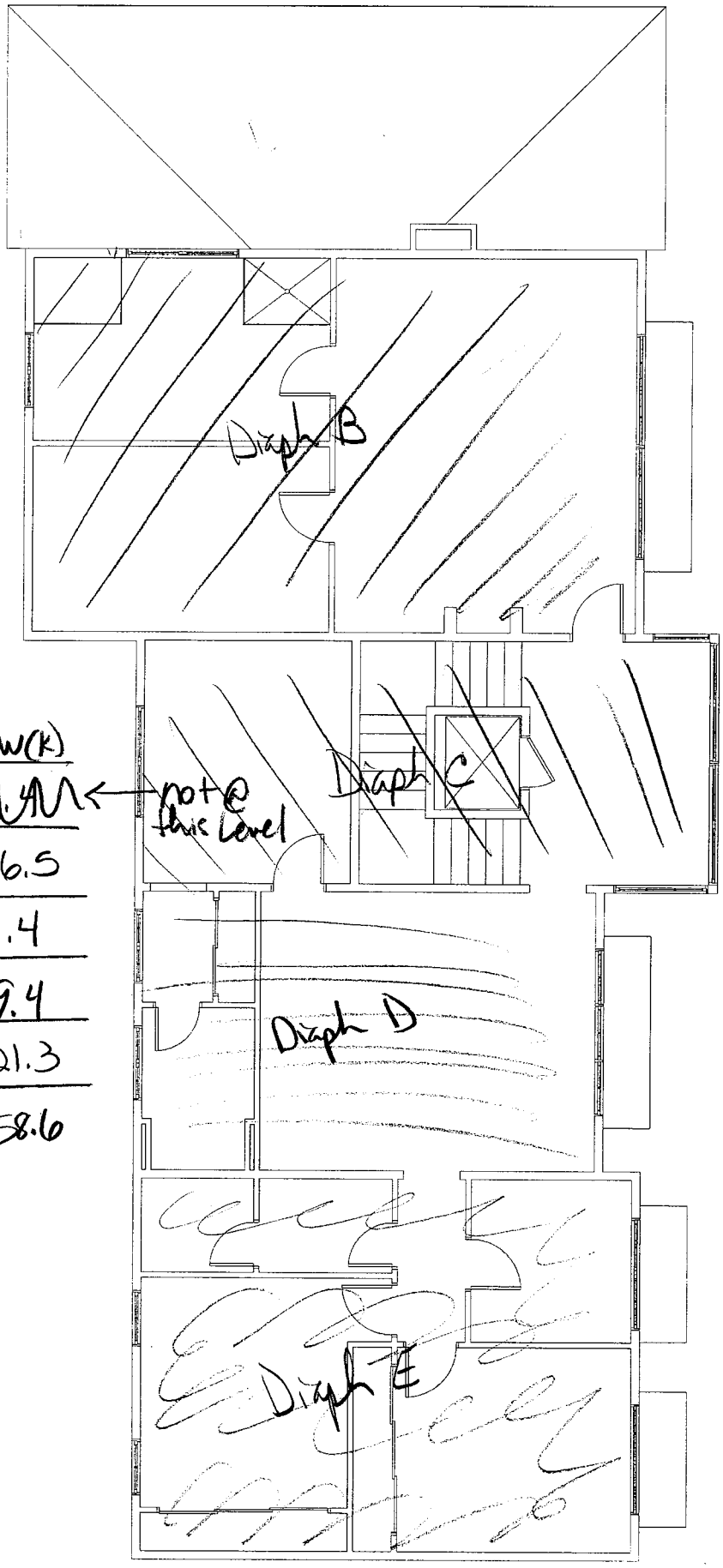




Zheng Residence 3

Seismic Loads

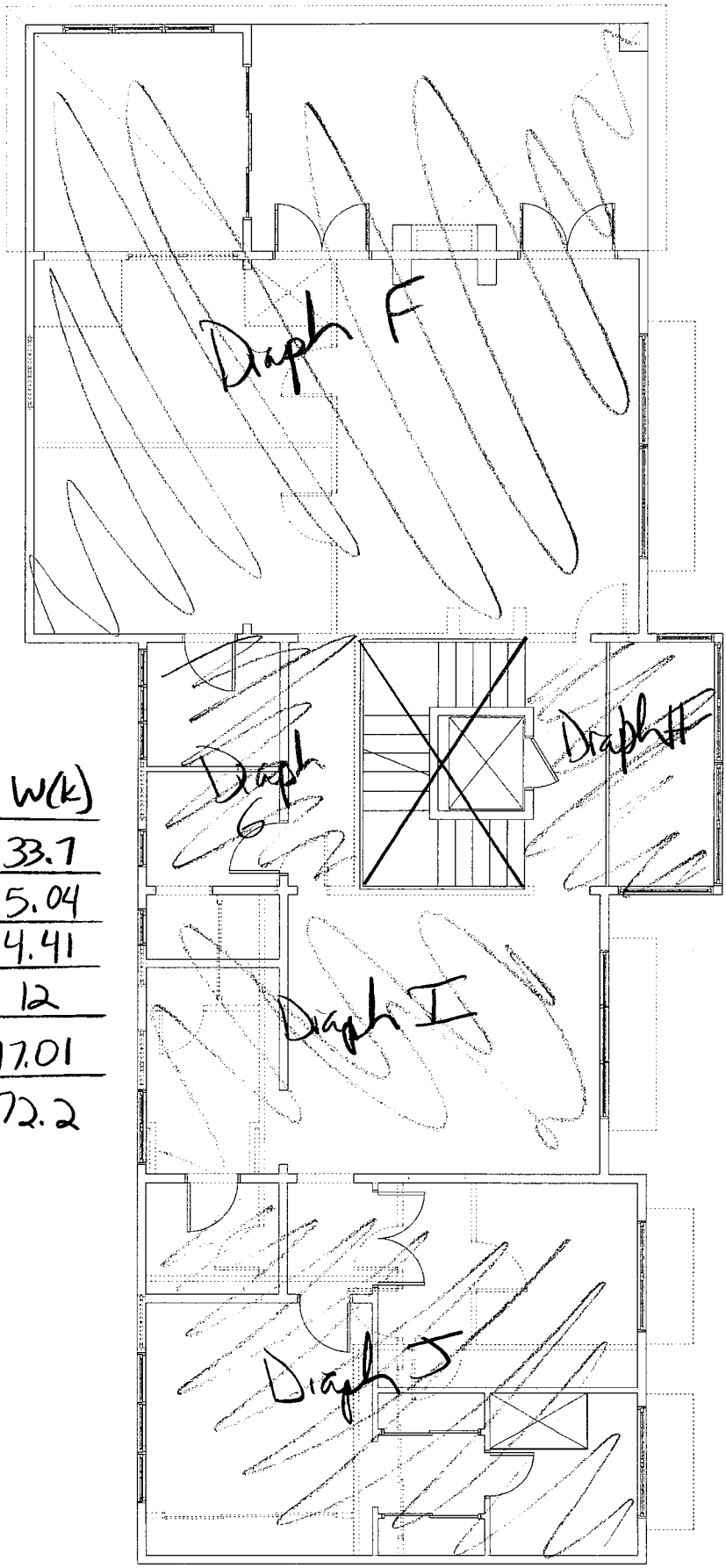
Roof Diaphragm



Diaph	Area(ft²)	W(k)
~~A~~	~~515~~	~~1.4~~ ← not @ this Level
B	660	16.5
C	455	11.4
D	375	9.4
E	850.5	21.3
Σ	2340.5	58.6

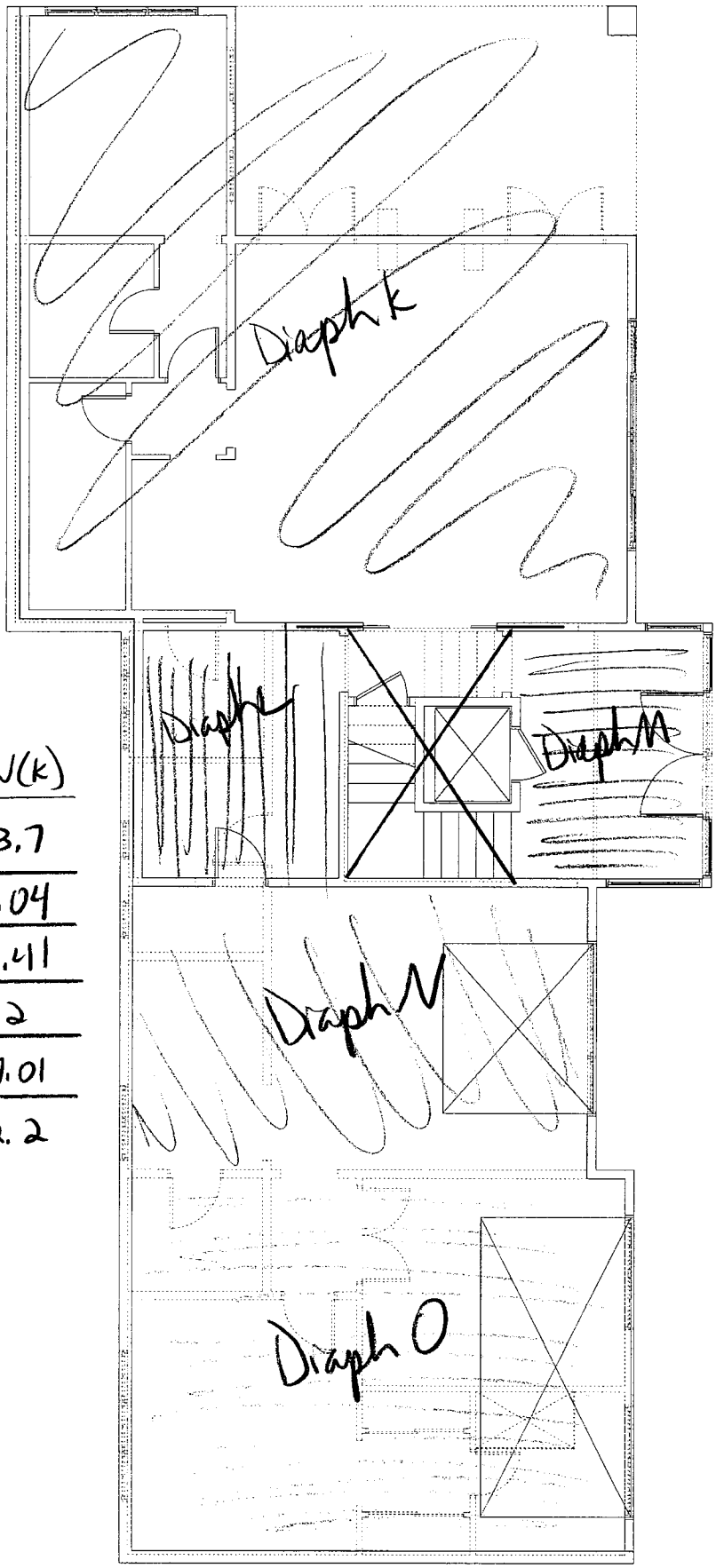
Seismic Loads

2nd Flour Diaphragm



Diaph	Area(ft^2)	W(k)
F	1122	33.7
G	168	5.04
H	147	4.41
I	400	12
J	567	17.01
Σ	2404	72.2

Seismic Load
1st Floor Diaph



Diaph	Area (ft^2)	W(k)
K	1122	33.7
L	168	5.04
M	147	4.41
N	400	12
O	567	17.01
Σ	2404	72.2

Seismic Analysis (ASCE 7-10)

S_s =	1.461	F_a =	1.00	S_{ms} =	1.46	S_{Ds} =	0.97
S_1 =	0.56	F_v =	1.50	S_{m1} =	0.834	S_{D1} =	0.56

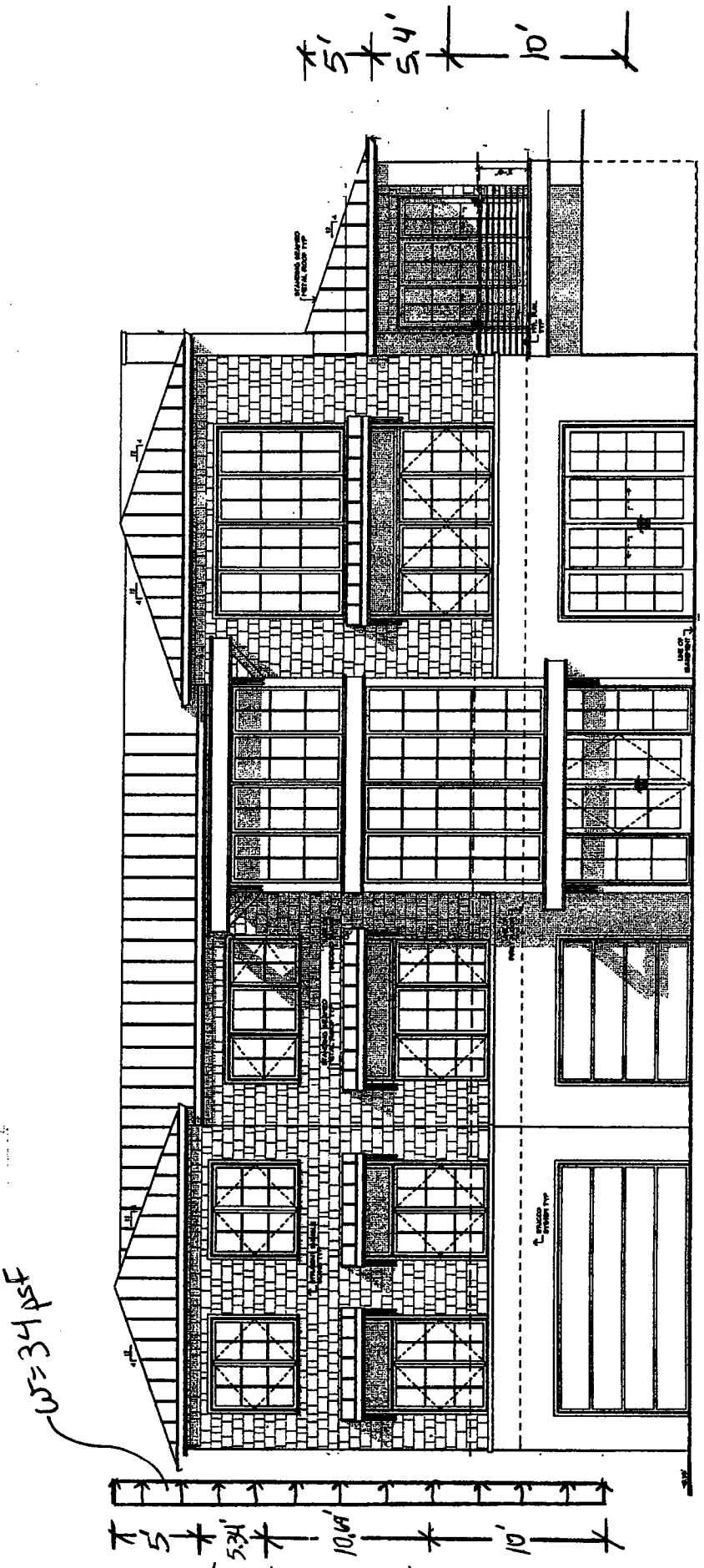
Site Class =	D	
Mean Roof Height =	33.18	ft
T =	0.28	sec
R =	6.5	
I =	1.0	
rho =	1.0	
Cs =	0.150	
W =	203.00	K
Allowable Base Shear V =	21.30	K

House

Level	Wx (K)	hx (ft)	Wxhx	Cvx	Fx (K)
Roof	58.6	30.68	1798	0.46	**9.8**
Second	72.2	20	1444	0.37	**7.9**
First	72.2	9.3	671	0.17	**3.7**
Sum	203		3913	1.0	**21.3**

buker ENGINEERING LLC

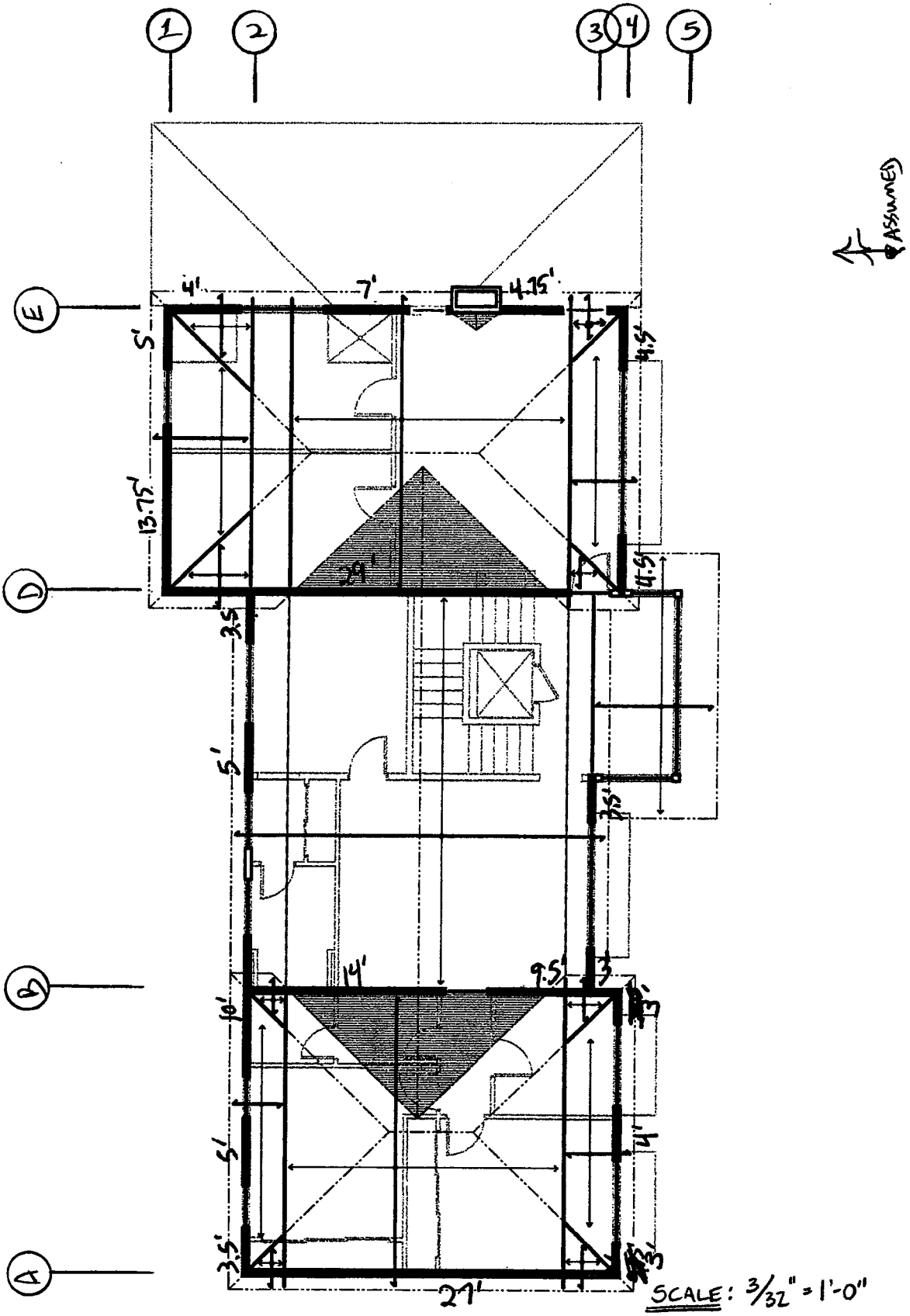
Zhang Residence 3



Zheng Residence 3

Roof Level

Shearwall Key Plan



Zheng Residence 3

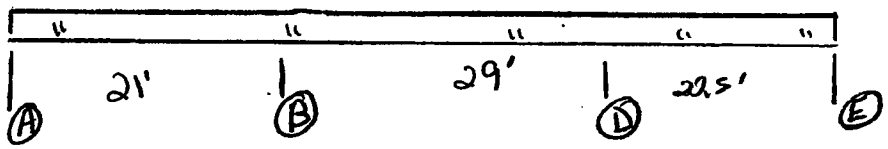
L10

Lateral Analysis: Roof Diaphragm / 2nd Floor walls N/S Direction

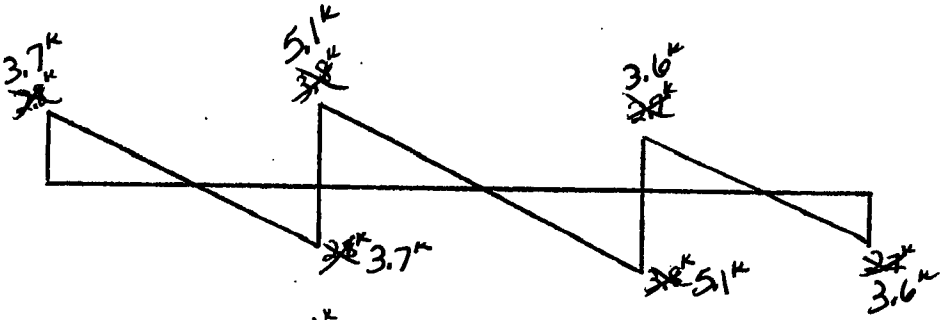
Wind Load: $W = 34psf(5' + 5.34') = 352\ plf$

Seismic Load: $W = 141\ plf$

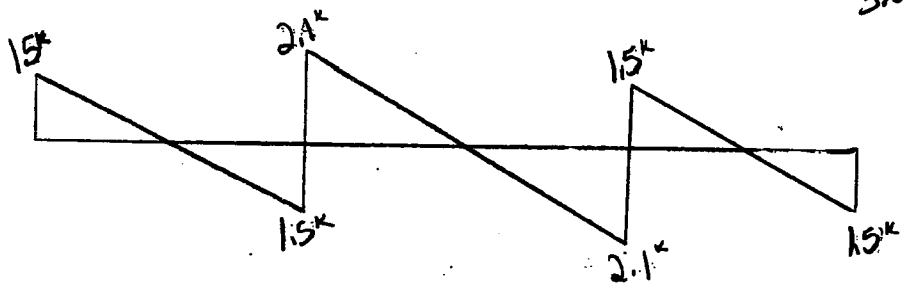
Grid:



Wind:



Seismic:



Grid	A	B	D	E
Vwind (kips)	3.7	8.9	8.7	3.6
Vseismic (kips)	1.5	3.6	3.6	1.5
Length of wall (ft)	27	23.5	29	15.75
v_wind (p/f)	137	379	300	229
v_siesmic (p/l)**	56	153	124	110
h (ft)	9.25	9.25	9.25	9.25
OTF_Wind (lbs)*	1268	3503	2775	2114
OTF_Seismic (lbs)*	514	1417	1148	881
Length of shortest wall pier (ft)	27	9.5	29	4
Apect Ratio Reduction for Seismic Loads	0.34	0.97	0.32	2.31
Siesmic Penalty	1.0	1.0	1.0	0.86
Shearwall	W6	W4	W6	W6
Holdown	CS16	MSTC66	MSTC66	MSTC66

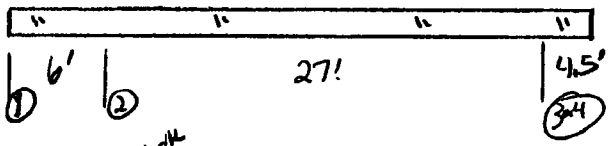
***OTF does not take into account dead load and weight of the wall uno**
****v_siesmic includes penalty**

Lateral Analysis (cont'd) Roof Diaphragm / 2nd Floor walls E/W Direction

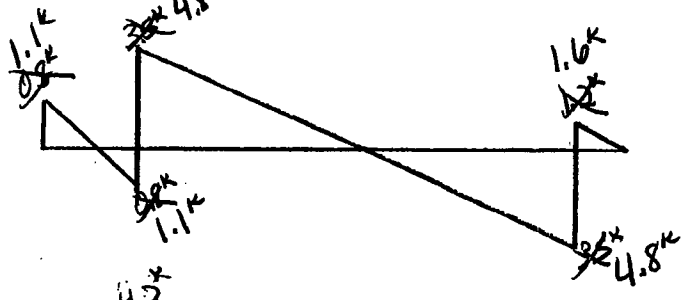
Wind Load: W = 352 plf (see pg L11)

Seismic: V = 9.8^k

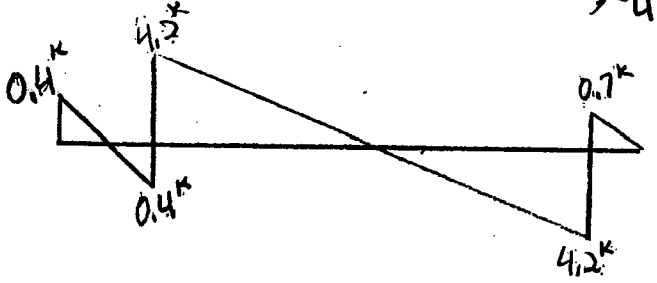
Grid:



Wind:



Seismic:

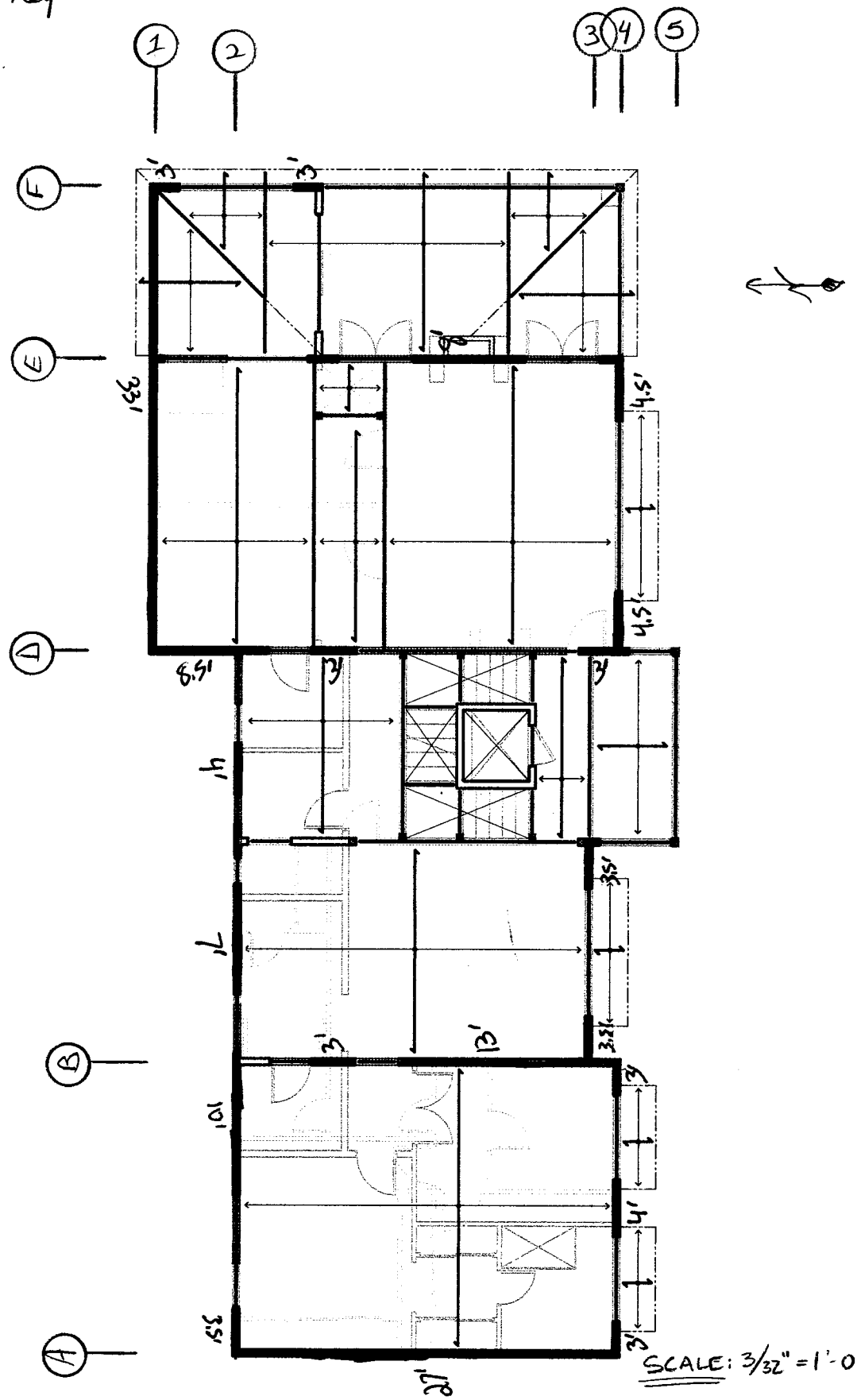


Grid	1	2	3&4
Vwind (kips)	1.1	5.9	6.4
Vseismic (kips)	0.4	4.6	4.9
Length of wall (ft)	18.75	27	25.5
v_wind (p/f)	59	219	251
v_siesmic (p/l)**	21	225	296
h (ft)	9.25	9.25	9.25
OTF_Wind (lbs)*	543	2021	2322
OTF_Seismic (lbs)*	197	1576	1777
Length of shortest wall pier (ft)	5	3.5	3
Apect Ratio Reduction for Seismic Loads	1.85	2.64	3.08
Siesmic Penalty	1.0	0.76	0.65
Shearwall	W6	W6	W4
Holdown	CS16	MSTC66	MSTC66

***OTF does not take into account dead load and weight of the wall uno**

****v_siesmic includes penalty**

Lateral Analysis
Shearwall Key



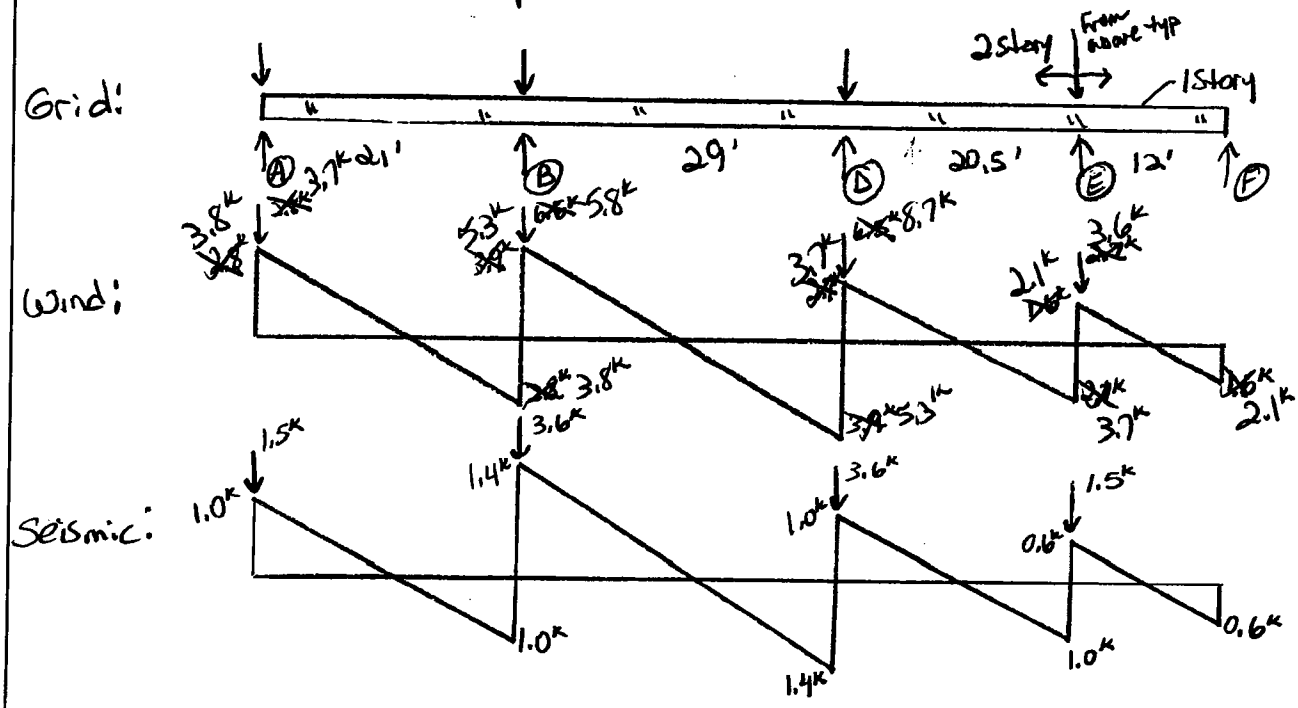
Zheng Residence 3

Lateral analysis (con't) 2nd Floor diaph/First floor walls N/S Direction

Wind Load: 2 story $W = 34psf(10.69') = 364plf$

1 story $W = 34psf(5'+5.4') = 354plf$

Seismic Load: $W = 96plf$



Grid	A	B	D	E	F
Vwind (kips)	7.5	14.9	17.7	9.4	2.1
Vseismic (kips)	2.5	6.0	6.0	3.1	0.6
Length of wall (ft)	27	16	14.5	8	6
v_wind (p/f)	278	931	1221	1175	350
v_siesmic (p/l)**	93	631	697	388	168
h (ft)	10.1	10.1	10.1	10.1	10.1
OTF_Wind (lbs)*	2806	9406	12329	11868	3535
OTF_Seismic (lbs)*	935	3788	4179	3914	1010
Length of shortest wall pier (ft)	27	3	3	8	3
Apect Ratio Reduction for Seismic Loads	0.37	3.37	3.37	1.26	3.37
Siesmic Penalty	1.0	0.59	0.59	1.0	0.59
Shearwall	W6	2W3	2W3	2W3	W6
Holdown	HDU2	(2)MSTC78	(2)MST72	(2)MSTC78	MSTC66

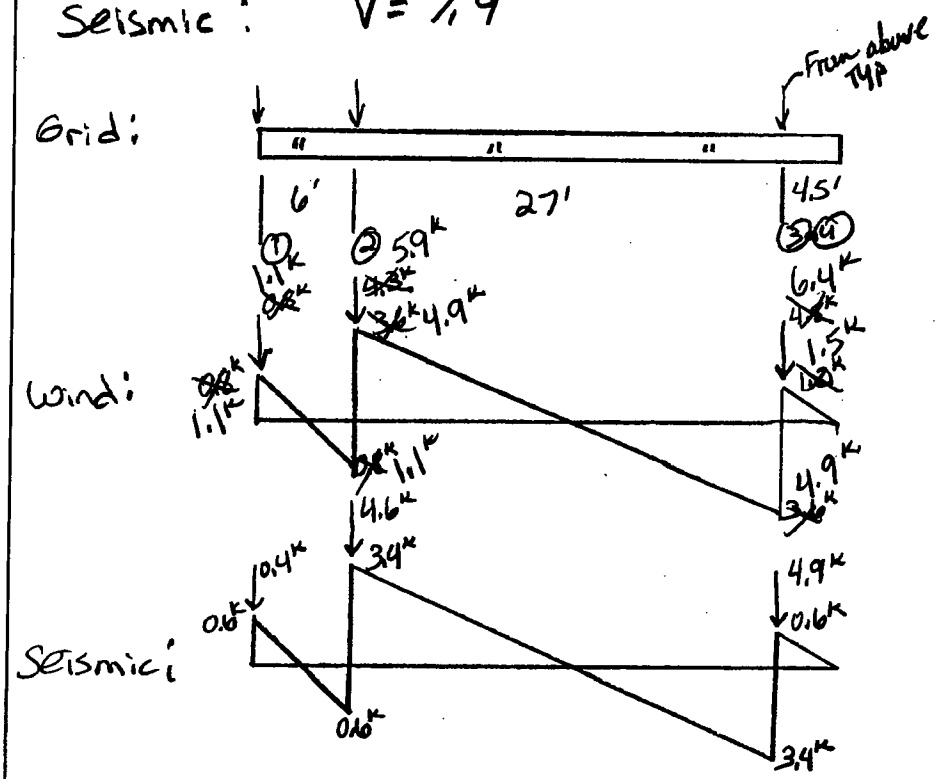
***OTF does not take into account dead load and weight of the wall uno**

****v_siesmic includes penalty**

Lateral Analysis (Cont'd) 2nd Floor diaph/1st Floor walls E/W Direction

Wind Loads: W=364 plf

Seismic: V= 7.9k



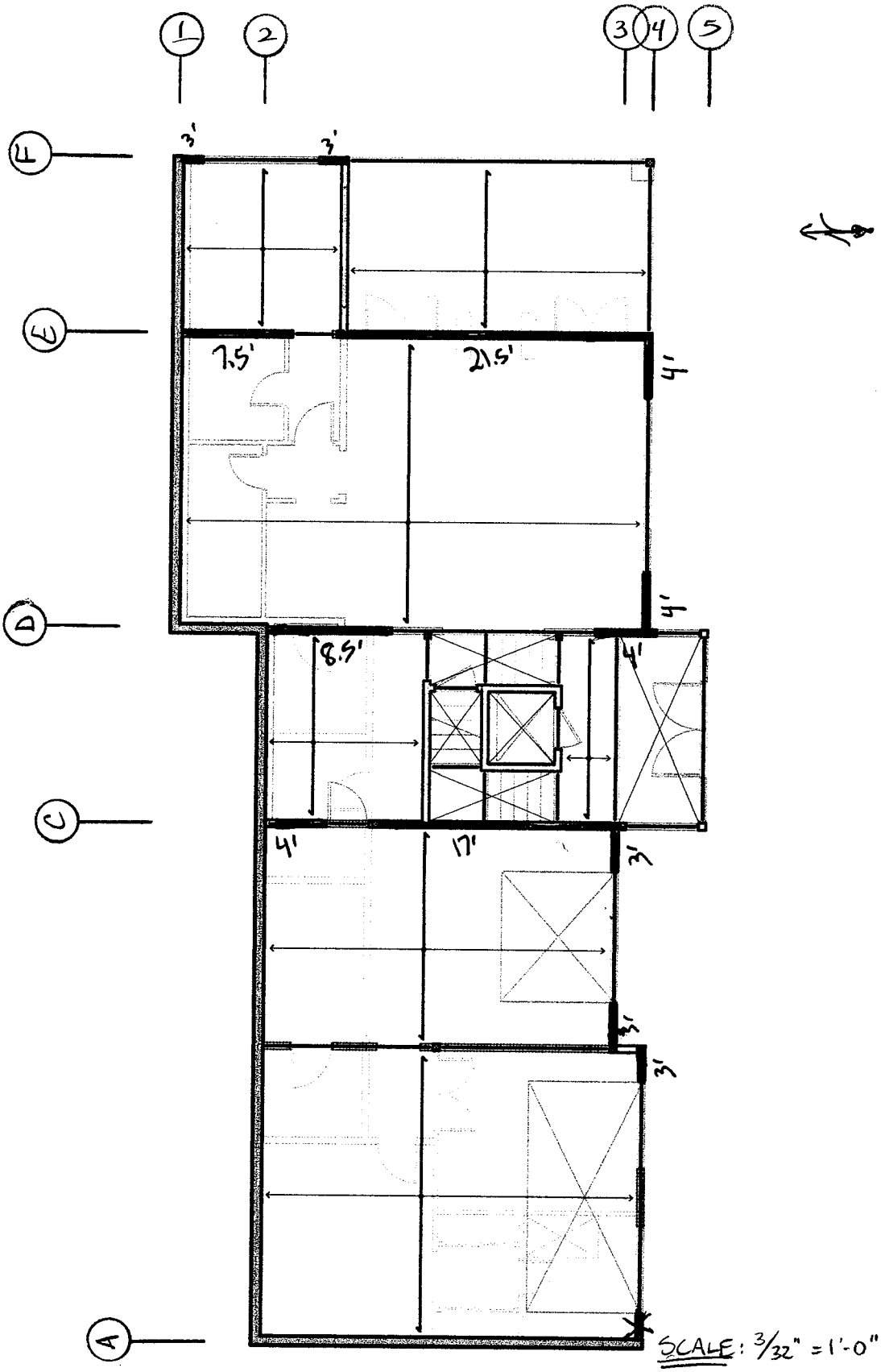
Grid	1	2	3&4
Vwind (kips)	2.2	11.9	12.8
Vseismic (kips)	1.0	8.6	8.9
Length of wall (ft)	33	24.5	26
v_wind (p/f)	67	486	492
v_siesmic (p/l)**	30	506	576
h (ft)	10.1	10.1	10.1
OTF_Wind (lbs)*	673	4906	4972
OTF_Seismic (lbs)*	306	3545	3457
Length of shortest wall pier (ft)	33	3.5	3
Apect Ratio Reduction for Seismic Loads	0.31	2.89	3.37
Siesmic Penalty	1.0	0.69	0.59
Shearwall	W6	W2	W2
Holdown	HDU2	HDU11	(2)MSTC66

***OTF does not take into account dead load and weight of the wall uno**

****v_siesmic includes penalty**

Lateral Analysis

Shearwall key Plan



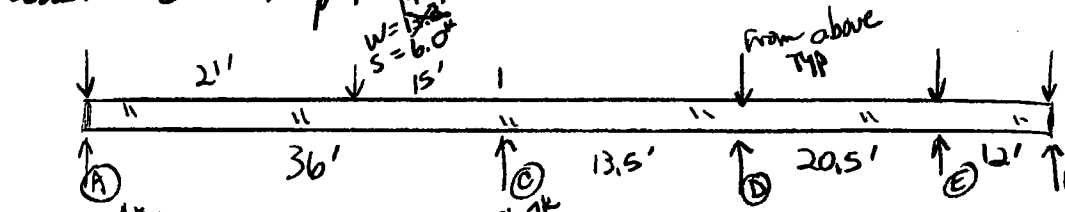
Zheng Residence 3

Lateral analysis (cont'd): First Floor Draph/Basement walls N/S Direction

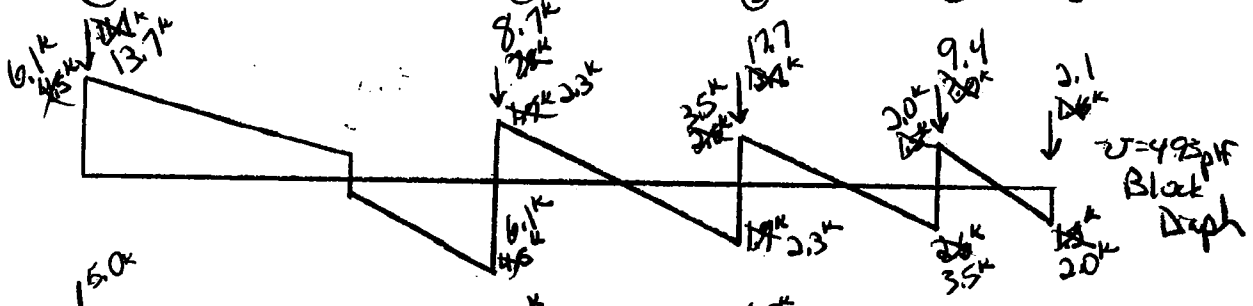
Wind Load: $w = 34\,psf(10') = 340\,plf$

Seismic Load: $w = 45\,plf$

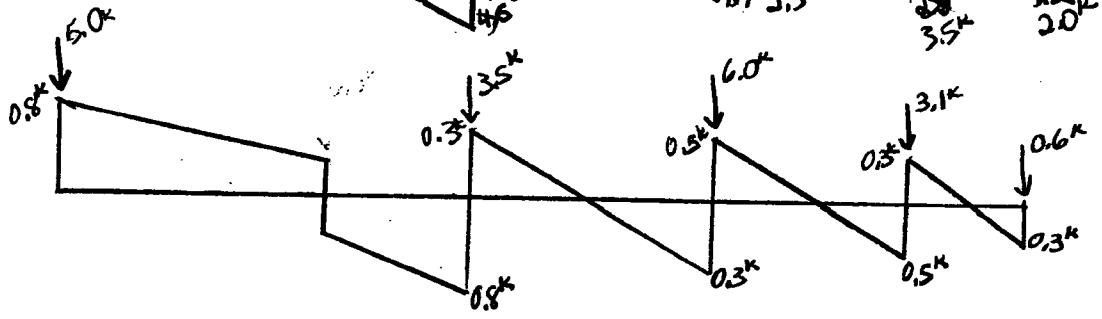
Grid:



Wind:



Seismic:



Grid	A	C	D	E	F
Vwind (kips)	19.8	17.1	23.5	14.9	4.1
Vseismic (kips)	5.8	4.6	6.8	3.9	0.9
Length of wall (ft)	Concrete	21	19	29	6
v_wind (p/f)	Concrete	814	1237	514	683
v_siesmic (p/l)**	Concrete	253	414	134	231
h (ft)	9.25	9.25	9.25	9.25	9.25
OTF_Wind (lbs)*	Concrete	7532	11441	4753	6321
OTF_Seismic (lbs)*	Concrete	2026	3311	1244	1388
Length of shortest wall pier (ft)	Concrete	4	4	7.5	3
Apect Ratio Reduction for Seismic Loads	Concrete	2.31	2.31	1.23	3.08
Siesmic Penalty	Concrete	0.86	0.86	1.0	0.65
Shearwall	Concrete	W2	2W2	2W3	W2
Holdown	Concrete	HDU11	(2) HDU14	HD19	HDU11

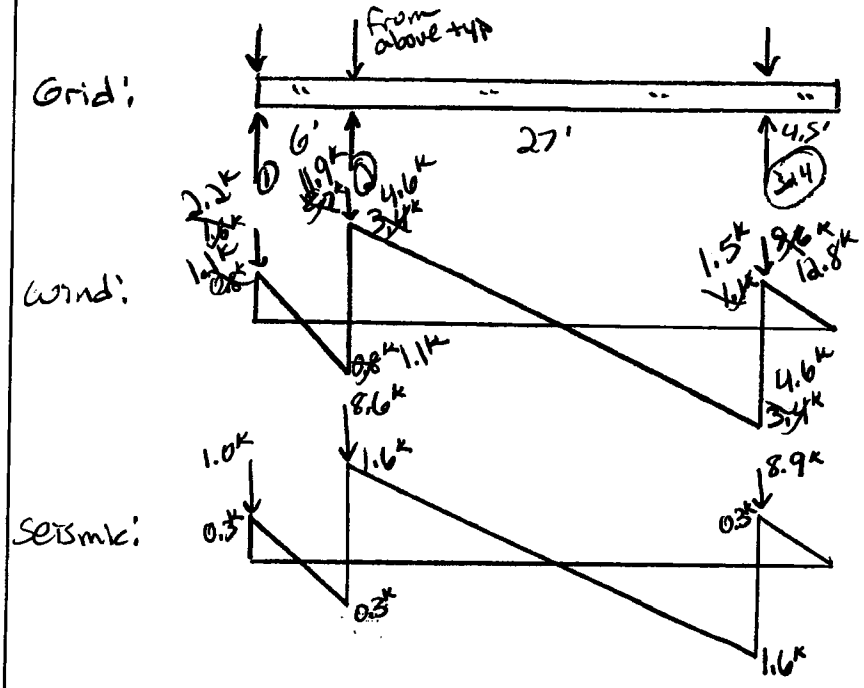
***OTF does not take into account dead load and weight of the wall uno**

****v_siesmic includes penalty**

Lateral Analysis (con't): First Floor diaph / Basement Walls E/W Direction

Wind Load: $w = 340$ plf

Seismic Load: $V = 3.7^k$



Grid	1	2	3&4
Vwind (kips)	3.4	17.6	18.9
Vseismic (kips)	1.3	10.5	10.8
Length of wall (ft)	Concrete	Concrete	17
v_wind (p/f)	Concrete	Concrete	1112
v_siesmic (p/l)**	Concrete	Concrete	979
h (ft)	9.25	9.25	9.25
OTF_Wind (lbs)*	Concrete	Concrete	10284
OTF_Seismic (lbs)*	Concrete	Concrete	5876
Length of shortest wall pier (ft)	Concrete	Concrete	3
Apect Ratio Reduction for Seismic Loads	Concrete	Concrete	3.08
Siesmic Penalty	Concrete	Concrete	0.65
Shearwall	Concrete	Concrete	2W3
Holdown	Concrete	Concrete	HD19

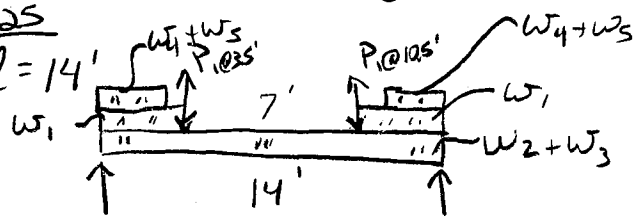
***OTF does not take into account dead load and weight of the wall uno**

****v_siesmic includes penalty**

Lateral (Seismic Beams) $S_{DS} = 0.974$ $\rho = 1.0$ $\Omega_0 = 2.5$

B25

$\ell = 14'$



DL $W_1 = 10psf(10') = 100plf$

DL $W_2 = \frac{20.5'}{2}(15psf) = 154plf$

LL $W_3 = \frac{20.5}{2}(40psf) = 410plf$

DL $W_4 = 13.5/2\,(15psf) = 102plf$

LL $W_5 = 13.5/2\,(40psf) = 270plf$

$P_1 = 4179^{\#}$ (E) $\quad 925^{\#}$ (W)

Load Case 5

$W_1 = (1 + 0.14(0.974))\,100plf = 114plf$

$W_2 = (1 + 0.14(0.974))\,154plf = 175plf$

$W_4 = (1 + 0.14(0.974))\,102plf = 116plf$

$P_1 = 4179^{\#}(2.5)(0.7) = 7314^{\#}$

$M = 11.6^{k\text{-}l} \quad R_1 = 4^{k} \quad R_2 = -176^{\#}$

Load Case 6

$W_1 = (1 + 0.105(0.974))\,100plf = 110plf$

$W_2 = (1 + 0.105(0.974))\,154plf = 170plf$

$W_3 = (0.75)(410) = 308plf$

$W_4 = (1 + 0.105(0.974))\,102 = 112plf$

$W_5 = (0.75)\,270plf = 203plf$

$P_1 = 0.525(2.5)(4179^{\#}) = 5485^{\#}$

$M = 20.0^{k\text{-}l} \quad R_1 = 1780^{\#} \quad R_2 = 7260^{\#}$

Load Case 8

$W_1 = (0.6 - 0.14(0.974))\,100plf = 47plf$

$W_2 = (0.6 - 0.14(0.974))\,154plf = 72plf$

$W_4 = (0.6 - 0.14(0.974))\,102plf = 48plf$

$P_1 = 4179(2.5)(0.7) = 7314^{\#}$

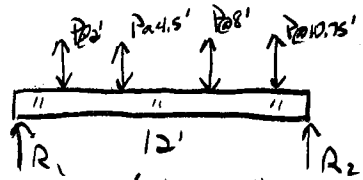
$M = 9.1^{k\text{-}l} \quad R_1 = -1300^{\#} \quad R_2 = 2880^{\#}$

$\therefore$ use 5¼x14 PSL

$M_a = 40.7^{k\text{-}l} \quad V_a = 14.2^{k}$

B26

$\ell = 12'$



$W_{DL} = 10psf(10') + \left(\frac{20}{3} + \frac{15.25}{2}\right)15psf = 365plf$

$W_{LL} = \left(\frac{20}{3} + \frac{15.25}{2}\right)40psf = 705plf$

$P = 3788^{\#}$ (E) $\quad 8396^{\#}$ (W)

Load Case 5

$W_{DL} = (1 + 0.14(0.974))\,365plf = 415plf$

$P = 0.7(2.5)(3788) = 6629^{\#}$

$M = 13.3^{k\text{-}l} \quad R_1 = 5390 \quad R_2 = -411$

Load Case 6

$W_{DL} = (1 + 0.105(0.974))\,365plf = 403plf$

$W_{LL} = (0.75)(705plf) = 529plf$

$P = 0.525(2.5)(3788) = 4972^{\#}$

$M = 18.4^{k\text{-}l} \quad R_1 = 3420^{\#} \quad R_2 = 7770^{\#}$

Load Case 8

$W_{DL} = (0.6 - 0.14(0.974))\,365plf = 170plf$

$P = 0.7(2.5)(4179) = 6629^{\#}$

$M = 6.4^{k\text{-}l} \quad R_1 = -1880^{\#} \quad R_2 = 3920^{\#}$

$\therefore$ use 5¼x14 PSL

$M_a = 40.7^{k\text{-}l} \quad V_a = 14.2^{k}$

Okay

buker ENGINEERING LLC

Project: Zheng Residence 3

Project #: CRB

Designer:

Date:

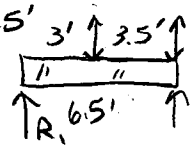
Sheet: L19

Shearwall Capacity Table: Based on Table 4.3A, AWC SDPWS-2008

Shearwall Type	DF (PIF)		Top Plate (PLF)		Base Plate	
	Wind	Seis	TJI (PIF)	2x or LSL	AT WOOD (PLF)	AT CONC. (PLF)
W6	365	260	16d @ 6" OC 242	A35 @ 24" OC 298	16d @ 6" OC 242	5/8" ØAB @ 48" OC 372
W4	532	380	(2) Rows 16d @ 6" OC 484	A35 @ 16" OC 446	(2) Rows 16d @ 6" OC 484	5/8" ØAB @ 32" OC 558
W3	685	490	(2) Rows 16d @ 6" OC 484	A35 @ 12" OC 595	(2) Rows 16d @ 6" OC 484	5/8" ØAB @ 16" OC 1116
W2	895	640	(2) Rows 16d @ 4½" OC 645	A35 @ 9" OC 793	(2) Rows 16d @ 4½" OC 645	5/8" ØAB @ 12" OC 1488
2W3	1370	980	N/A	A35 @ 6" OC 1190	(2) Rows 16d @ 3" OC 968	5/8" ØAB @ 16" OC 1416
2W2	1790	1280	N/A	HGA10TK @ 8" OC 1747	(2) Rows 16d @ 2" OC 1452	5/8" ØAB @ 12" OC 1888

Lateral (seismic Beams)
Rim Joist

$\ell = 6.5'$ 3' 3.5'



$w_{DL} = \left(1.25 + \frac{24.5'}{2}\right)15psf + 10(10) = 303plf$

$w_{LL} = \left(1.25 + \frac{24.5'}{2}\right)40psf = 540plf$

$P = 1576\#$

Load case 5

$w_{DL} = (1 + 0.14(0.974))\,303plf = 345plf$

$P = 0.7(2.5)1576\#) = 2758\#$

$M = 6.3^{k-1}$ $R_1 = 2610\#$ $R_2 = -364\#$

Load Case 6

$w_{DL} = (1 + 0.105(0.974))\,303plf = 334plf$

$w_{LL} = 0.75(540plf) = 405plf$

$P = 0.525(2.5)(1576\#) = 2069\#$

$M = 7.22^{k-1}$ $R_1 = 3520\#$ $R_2 = 1290\#$

Load Case 8

$w_{DL} = (0.6 - 0.14(0.974))\,303plf = 141plf$

$P = 0.7(2.5)(1576) = 2758\#$

$M = 5.2^{k-1}$ $R_1 = 1940\#$ $R_2 = -1030\#$

∴ use 3½x14 LSL
for Rim Joist.

$M_a = 21.8^{k-1}$, $V_a = 10.1^k$

DESIGN PROPERTIES

Allowable Design Properties(1) (100% Load Duration)

Grade	Width	Design Property	Depth 4⅜"	5½"	5½" Plank Orientation	7¼"	8⅝"	9½"	11⅞"	14"	16"	18"
TimberStrand® LSL												
1.3E	3½"	Moment (ft-lbs)	1,735	2,685	1,780	4,550	6,335					
		Shear (lbs)	4,340	5,455	1,925	7,190	8,555					
		Moment of Inertia (in.⁴)	24	49	20	111	187					
		Weight (plf)	4.5	5.6	5.6	7.4	8.8					
1.55E	1¾"	Moment (ft-lbs)						5,210	[illegible]	[illegible]	[illegible]	
		Shear (lbs)						[illegible]	[illegible]	5,165	[illegible]	
		Moment of Inertia (in.⁴)						125	244	400	597	
		Weight (plf)						5.2	6.5	[illegible]	8.8	
	3½"	Moment (ft-lbs)						10,420	15,955	21,840	28,130	
		Shear (lbs)						6,870	8,590	10,125	11,575	
		Moment of Inertia (in.⁴)						250	488	800	1,195	
		Weight (plf)						10.4	13	15.3	17.5	
Microllam® LVL												
2.0E	1¾"	Moment (ft-lbs)		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		Shear (lbs)		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		Moment of Inertia (in.⁴)		24		[illegible]		125	[illegible]	[illegible]	[illegible]	[illegible]
		Weight (plf)		2.8		3.7		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Parallam® PSL												
2.2E	3½"	Moment (ft-lbs)						13,055	19,900	27,160	34,955	43,665
		Shear (lbs)						6,430	8,035	9,475	10,825	12,180
		Moment of Inertia (in.⁴)						250	488	800	1,195	1,701
		Weight (plf)						10.4	13.0	15.3	17.5	19.7
	5¼"	Moment (ft-lbs)						[illegible]	29,855	[illegible]	[illegible]	[illegible]
		Shear (lbs)						9,645	[illegible]	[illegible]	[illegible]	[illegible]
		Moment of Inertia (in.⁴)						[illegible]	733	[illegible]	[illegible]	[illegible]
		Weight (plf)						15.6	19.5	[illegible]	26.3	29.5
	7"	Moment (ft-lbs)						26,115	39,805	54,325	69,905	87,325
		Shear (lbs)						12,855	16,070	18,945	21,655	24,360
		Moment of Inertia (in.⁴)						500	977	1,601	2,389	3,402
		Weight (plf)						20.8	26.0	30.6	35.0	39.4

(1) For product in beam orientation, unless otherwise noted.

ZHENG RESIDENCE 3

F1

PRODUCT STORAGE

Protect product from sun and water

DESIGN PROPERTIES

Design Stresses[1] (100% Load Duration)

Grade	Orientation	G Shear Modulus of Elasticity (psi)	E Modulus of Elasticity (psi)	E_{min} Modulus of Elasticity[2] (psi)	F_b Flexural Stress[3] (psi)	F_v Torsion Stress[4] (psi)	$F_{c\perp}$ Compression Perpendicular to Grain[5] (psi)	F_c Compression Parallel to Grain (psi)	F_w Horizontal Shear Parallel to Grain (psi)	SG Equivalent Specific Gravity
TimberStrand® LSL										
1.3E	Beam/Column	81,250	1.3×10^6	660,750	1,700	1,075	710	1,835	425	0.50[11]
	Plank	81,250	1.3×10^6	660,750	1,550[9]	1,075	625[9]	1,835	425	0.50[11]
1.55E	Beam	96,875	1.55×10^6	787,615	2,325	1,070[6][8]	900	2,170	310[6][8]	0.50[11]
Microllam® LVL										
2.0E	Beam	125,000	2.0×10^6	1,016,535	2,600	1,555	750	2,510	285	0.50
Parallam® PSL										
1.8E	Column	112,500	1.8×10^6	914,880	2,400[6][8]	1,755	425[10]	2,500	190[10]	0.50
2.2E	Beam	137,500	2.2×10^6	1,118,655	2,900	2,025	750	3,015	320	0.50

(1) Unless otherwise noted, adjustment to the design stresses for duration of load are permitted in accordance with the applicable code.

(2) Reference modulus of elasticity for beam and column stability calculations, per NDS®.

(3) For 12" depth. For other depths, multiply F_b by the appropriate factor as follows:
- For TimberStrand® LSL, multiply by $\left[\frac{12}{d}\right]^{0.092}$
- For Microllam® LVL, multiply by $\left[\frac{12}{d}\right]^{0.136}$
- For Parallam® PSL, multiply by $\left[\frac{12}{d}\right]^{0.111}$

(4) F_t has been adjusted to reflect the volume effects for most standard applications.

(5) $F_{c\perp}$ may not be increased for duration of load.

(6) For lateral connection design only.

(7) Specific gravity of 0.58 may be used for bolts installed perpendicular to face and loaded perpendicular to grain.

(8) Values are for thickness up to 3½".

(9) For members less than 1¾" thick and in plank orientation, use $F_{c\perp}$ of 670 psi. NDS® bearing area factor $C_b = 1.0$.

(10) Value accounts for large hole capabilities. See **Allowable Holes** on page 26.

(11) Value shown is for plank orientation.

(12) For column applications, use $F_{c\parallel}$ of 500 psi. Alternatively, refer to ESR-1387, Table 1, footnote 15.

General Assumptions for Trus Joist® Beams

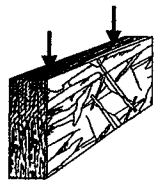
- Lateral support is required at bearing and along the span at 24" on-center, maximum.
- Bearing lengths are based on each product's bearing stress for applicable grade and orientation.
- All members 7¼" and less in depth are restricted to a maximum deflection of 5/16".
- Beams that are 1¾" x 16" and deeper require multiple plies.
- No camber.
- Beams and columns must remain straight to within $5L^2/4608$ (in.) of true alignment. L is the unrestrained length of the member in feet.

For applications not covered in this brochure, contact your Weyerhaeuser representative.

See pages 28 and 29 for multiple-member beam connections.

TimberStrand® LSL, Microllam® LVL and Unreated Parallam® PSL are intended for dry-use applications

Beam Orientation



Column Orientation

Plank Orientation

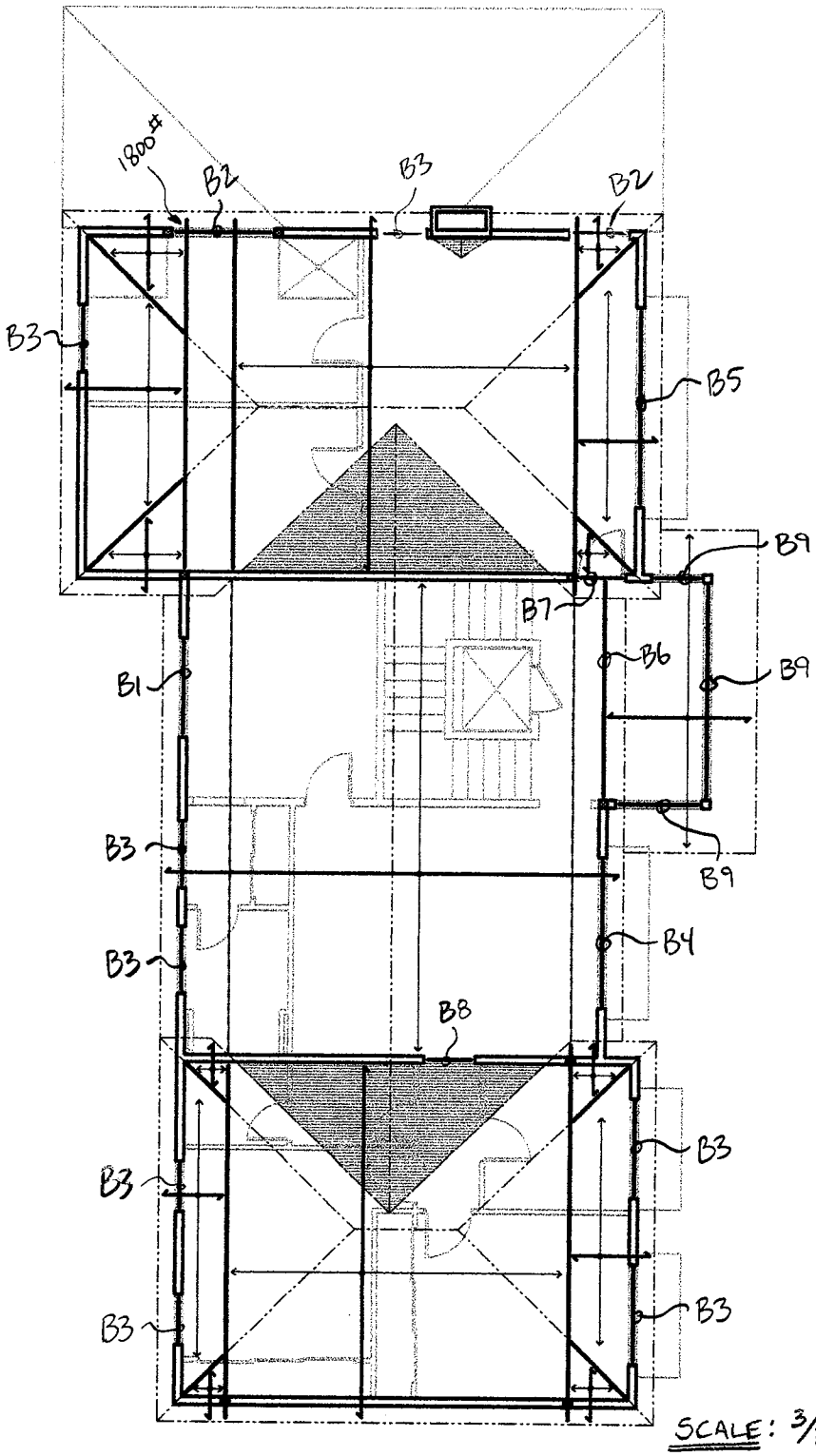
ZHENG RESIDENCE 3

F2

	b (in)	d (in)	Sx (in^3)	Ix (in^4)
2x4	1.5	3.5	3.06	5.36
2x6	1.5	5.5	7.56	20.80
2x8	1.5	7.25	13.14	47.63
2x10	1.5	9.25	21.39	98.93
2x12	1.5	11.25	31.64	177.98
2x14	1.5	13.25	43.89	290.78
3x4	2.5	3.5	5.10	8.93
3x6	2.5	5.5	12.60	34.66
3x8	2.5	7.25	21.90	79.39
3x10	2.5	9.25	35.65	164.89
3x12	2.5	11.25	52.73	296.63
3x14	2.5	13.25	73.15	484.63
4x4	3.5	3.5	7.15	12.51
4x6	3.5	5.5	17.65	48.53
4x8	3.5	7.25	30.66	111.15
4x10	3.5	9.25	49.91	230.84
4x12	3.5	11.25	73.83	415.28
4x14	3.5	13.25	102.41	678.48
6x6	5.5	5.5	27.73	76.26
6x8	5.5	7.5	51.56	193.36
6x10	5.5	9.5	82.73	392.96
6x12	5.5	11.5	121.23	697.07
6x14	5.5	13.5	167.06	1127.67
6x16	5.5	15.5	220.23	1706.78

	Hem-Fir No. 2		
M(#-ft)	Cd=1.0	Cd=1.15	Cd=1.6
(2)2x4	651	748	1,041
(2)2x6	1,393	1,602	2,228
(2)2x8	2,234	2,569	3,574
(2)2x10	3,333	3,833	5,333
(2)2x12	4,482	5,155	7,172
(2)2x14	5,596	6,435	8,954
	DF-L No. 2		
3x4	574	660	919
3x6	1,229	1,413	1,966
3x8	1,971	2,267	3,154
3x10	2,941	3,382	4,706
3x12	3,955	4,548	6,328
3x14	4,938	5,678	7,900
	DF-L No. 2		
4x4	804	924	1,286
4x6	1,720	1,979	2,753
4x8	2,989	3,438	4,783
4x10	4,492	5,166	7,187
4x12	6,091	7,004	9,745
4x14	7,681	8,833	12,289
	DF-L No. 1		
6x6	3,120	3,587	4,991
6x8	5,801	6,671	9,281
6x10	9,307	10,703	14,891
6x12	13,638	15,684	21,821
6x14	18,550	21,333	29,680
6x16	24,081	27,693	38,530

ROOF FRAMING KEYPLAN



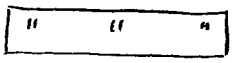
SCALE: 3/32" = 1'-0"

ZHENG RESIDENCE 3

ROOF FRAMING

$D_L = 15psf$, $S_L = 25psf$

B1



L = 6'

$W = \left(\frac{27}{2}\right)(40) = 540plf$

$R = 1920^{\#}$ $M = 2.43k^{-1}$

$f_b = 951psi \leq 1346psi$

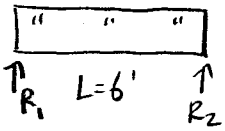
$f_v = 113psi$

$\Delta_{TL} = 0.08" = \ell/900$

USE: 4x8

B2

1800#



R_1 L = 6' R_2

$W = \left(\frac{23}{2}\right)(40) = 460plf$

$R_1 = 2880^{\#}$, $R_2 = 1680^{\#}$

$M = 3.07k^{-1}$

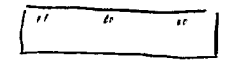
$f_b = 1200psi \leq 1346psi$

$f_v = 170psi \leq 207psi$

$\Delta_{TL} = 0.11" = \ell/655$

USE: 4x8

B3



L = 4'

$W = \left(\frac{27}{2}\right)(40) = 540plf$

$R = 1080^{\#}$ $M = 1.08k^{-1}$

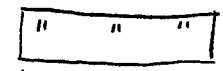
$f_b = 493psi$ $f_v = 75psi$

$\Delta_{TL} = 0.03" = \ell/1600$

USE: (2) 2x8

* BASED ON WORST-CASE LOADING SCENARIO.

B4



L = 9'

$W = \left(\frac{27}{2}\right)(40) = 540plf$

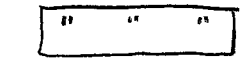
$R = 2430^{\#}$ $M = 5.47k^{-1}$

$f_b = 889psi$ $f_v = 93psi$

$\Delta_{TL} = 0.12" = \ell/900$

USE: 4x12

B5



L = 11.5'

$W = \left(\frac{5}{2}\right)(40) + 40$

$= 140plf$

$R = 805^{\#}$ $M = 2.31k^{-1}$

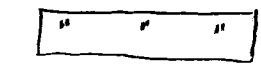
$f_b = 904psi$

$f_v = 48psi$

$\Delta_{TL} = 0.31" = \ell/445$

USE: 4x8

B6



L = 13'

$W = 540plf$

$R = 3510^{\#}$ $M = 11.4k^{-1}$

$f_b = 1128psi$ $f_v = 85psi$

$\Delta_{TL} = 0.31" = \ell/503$

USE: 6x12

---

buker ENGINEERING LLC

ZHENG RESIDENCE 3

Project

Project # CRD

Designer

Date

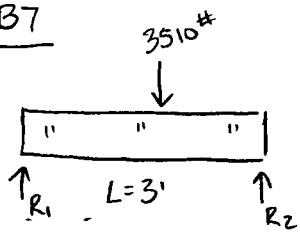
F5

Sheet

ROOF FRAMING, CON'T

$D_L = 15psf$, $S_L = 25psf$

B7



$W = \left(\frac{7}{2}\right)(40) = 140 plf$

$R_1 = 1670\#$ $R_2 = 2260\#$

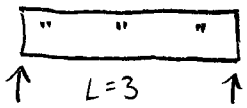
$M = 2.71 k^{-1}$

$f_b = 1060 psi$ $f_v = 133 psi$

$\Delta_{TL} = 0.03" = \ell/1600$

USE: 4x8

B8



$W = \left(\frac{22}{2}\right)(40) = 440 plf$

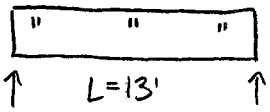
$R = 660\#$ $M = 0.5 k^{-1}$

$f_b = 228 psi$ $f_v = 45 psi$

$\Delta_{TL} = 0.01" = \ell/3600$

USE: (2) 2x8

B9



$W = \left(\frac{12}{2}\right)(40) = 240 plf$

$R = 1560\#$ $M = 5.07 k^{-1}$

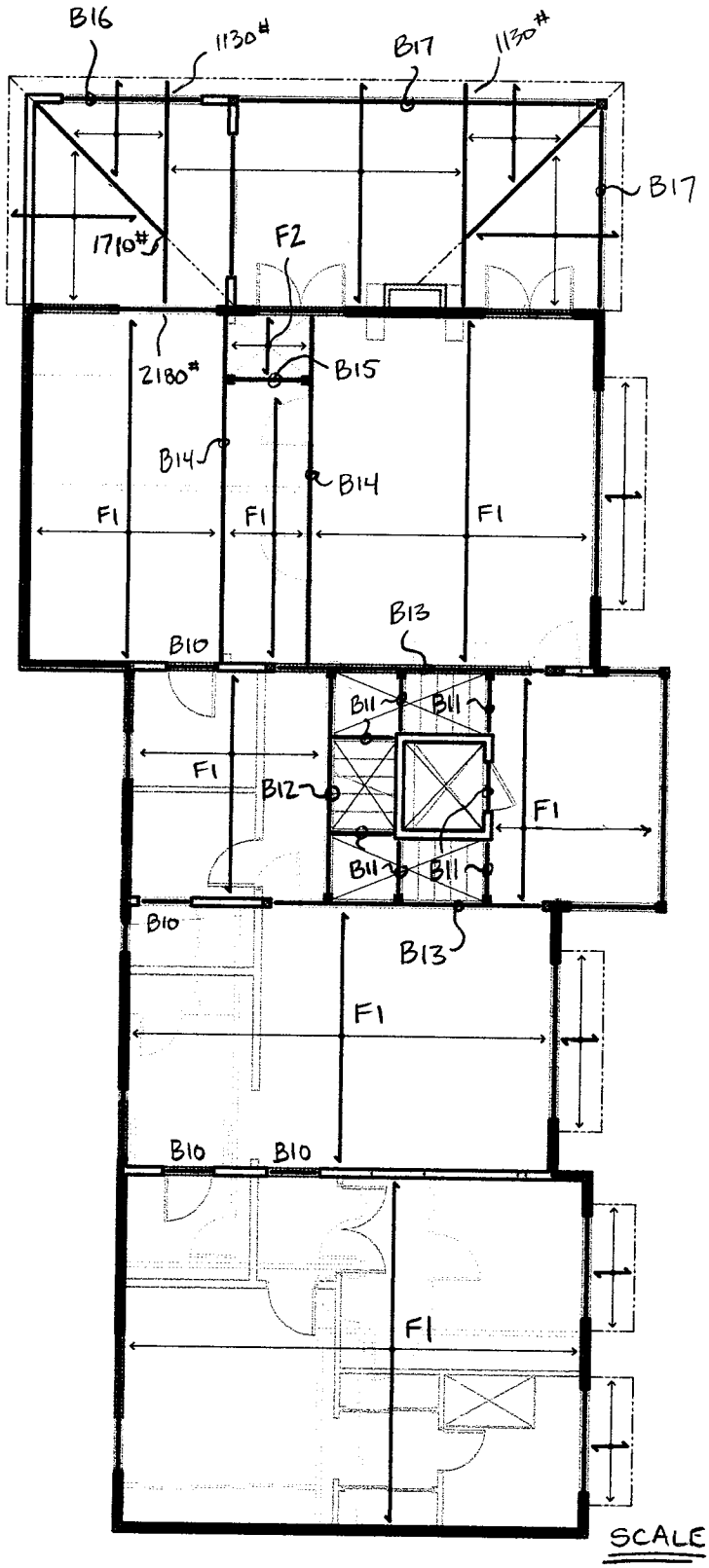
$f_b = 1219 psi \leq 1346 psi$

$f_v = 72 psi \leq 180 psi$

$\Delta_{TL} = 0.41" = \ell/380$

USE: 4x10

SECOND FLOOR FRAMING KEYPLAN

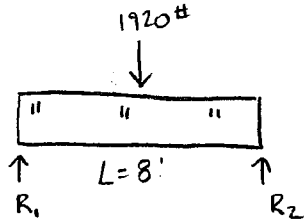


SCALE: 3/32" = 1'-0"

SECOND FLOOR FRAMING

$L_L = 40psf$ $D_L = 15psf$, $S_L = 25psf$

* STRUCTURAL CONTINUOUS RIM JOIST, WORST-CASE LOADING CONDITION:



$W = \left(\frac{27}{2}\right)(40) + \left(\frac{2}{2}\right)(55) + 100$

$= 540 + 55 + 100$

$= 695 plf$

$R_1 = R_2 = 2780\#$

$M = 5.56 k^{-1}$

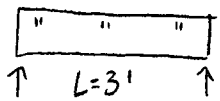
$f_b = 583psi \leq 2325 psi$

$f_v = 85psi \leq 310psi$

$\Delta_{TL} = 0.05" = \ell/1920$

3½" x 14" LSL RIM - OK

B10



$W = \left(\frac{19}{2}\right)(55) + \left(\frac{15}{2}\right)(55)$

$= 523 + 413 + 90$

$= 1026 plf$

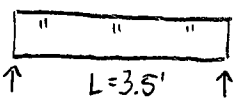
$R = 1539\#$ $M = 1.15 k^{-1}$

$f_b = 525psi$ $f_v = 106psi$

$\Delta_{TL} = 0.02" = \ell/1800$

USE: (2) 2x8

B11



$W = 100 plf$

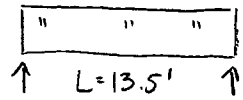
$R = 175\#$ $M = 0.15 k^{-1}$

$f_b = 68psi$ $f_v = 12psi$

$\Delta_{TL} = 0.01" = \ell/4200$

USE: (2) 2x8

B12



$W = 55 + 90 = 145 plf$

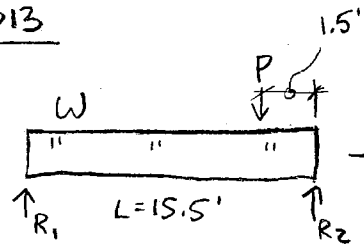
$R = 979\#$ $M = 3.3 k^{-1}$

$f_b = 346 psi$ $f_v = 30 psi$

$\Delta_{TL} = 0.09" = \ell/1800$

USE: 3½" x 14" LSL

B13



$W_D = \left(\frac{34}{2}\right)(15) + \left(\frac{21}{2}\right)(15) + 100 = 513 plf$

$W_L = \left(\frac{34}{2}\right)(40) = 680 plf$

$W_S = \left(\frac{21}{2}\right)(25) = 263 plf$

$P_D = 626\#$

$P_S = 1044\#$

CASE 1: D+L

$W = W_D + W_L = 1193 plf$

$M = 36.1 k^{-1}$

$R_1 = 9290\#$, $R_2 = 9830\#$

$\Delta_{D+L} = 0.593" = \ell/314 \geq \ell/240$

CASE 2: D+S

$W = W_D + W_S = 776 plf$

$M = 24.1 k^{-1}$

$R_1 = 6120\#$, $R_2 = 7580\#$

$\Delta_{D+S} = 0.4" = \ell/465 \geq \ell/240$

CASE 3: $D + \frac{3}{4}(L+S)$

$W = W_D + \frac{3}{4}(W_L + W_S) = 1229 plf$

$M = 37.3 k^{-1}$

$R_1 = 9550\#$, $R_2 = 10800\#$

$\Delta_{TL} = 0.61" = \ell/305 \geq \ell/240$

5¼" x 14" PSL - OK

↑ UPSIZE TO 7" x 14" PSL TO MINIMIZE DEFLECTION

---

buker ENGINEERING LLC

ZHENG RESIDENCE 3

Project

Project # CRD

Designer

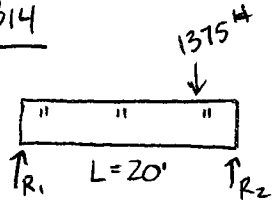
Date

Sheet F8

SECOND FLOOR FRAMING CON'T

$L_L = 40psf$, $D_L = 15psf$, $S_L = 25psf$

B14



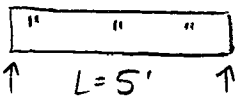
$W = 2(55) = 110plf$ $M = 8.2k^{-1}$

$R_1 = 1340^{\#}$, $R_2 = 2230^{\#}$

$\Delta_{TL} = 0.48" = \ell/500$

USE: 3½" x 14" LSL

B15



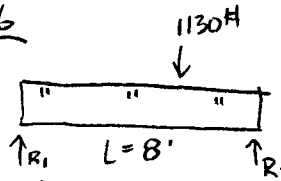
$W = \left(\frac{20}{2}\right)(55) = 550plf$

$M = 1.72k^{-1}$ $R = 1375^{\#}$

$\Delta_{TL} = 0.02" = \ell/3000$

USE: 13/4" x 14" LSL

B16



$W = \left(\frac{13}{2}\right)(40) = 260plf$

$R_1 = 1320^{\#}$ $R_2 = 1890^{\#}$

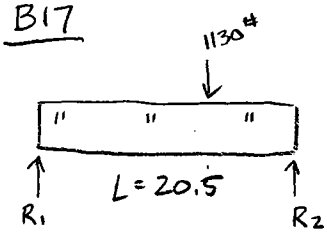
$M = 3.36k^{-1}$

$f_b = 809psi$ $f_v = 88psi$

$\Delta_{TL} = 0.1" = \ell/960$

USE: 4x10

B17



$W = \left(\frac{13}{2}\right)(40) = 260plf$

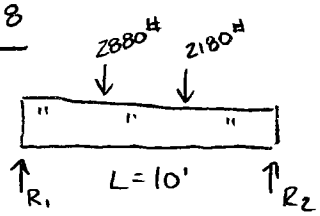
$R_1 = 3080^{\#}$, $R_2 = 3380^{\#}$

$M = 18.2k^{-1}$

$\Delta_{TL} = 0.51" = \ell/482$

USE: 5¼" x 14" PSL

B18



$W = \left(\frac{20}{2}\right)(55) + \left(\frac{13}{2}\right)(40) + 460 + 100$

$= 550 + 260 + 460 + 100$

$= 1370plf$

$R_1 = 9230^{\#}$, $R_2 = 9530^{\#}$

$M = 26.2k^{-1}$

$f_b = 1840psi \leq 2900psi$

$f_v = 195psi \leq 290psi$

$\Delta_{TL} = 0.18" = \ell/667$

* USE 5¼" x 14" PSL

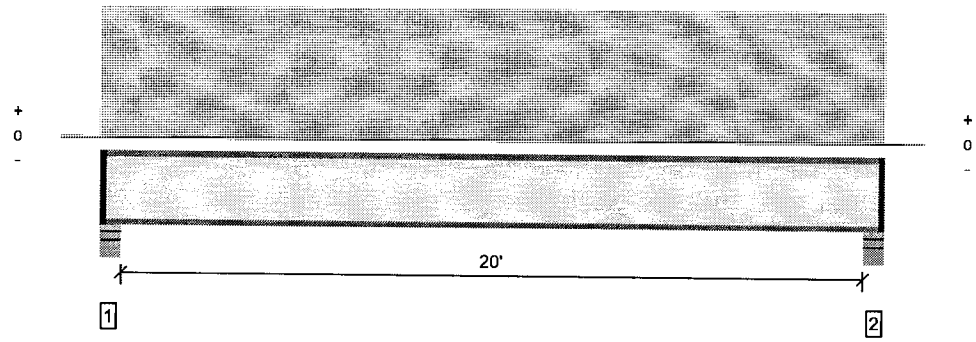
CONTINUOUS ALONG GRID "E".

FORTE® **MEMBER REPORT** *Level, Floor: Joist* **PASSED**

1 piece(s) 14" TJI® 230 @ 16" OC

Overall Length: 20' 11"

F1



All locations are measured from the outside face of left support (or left cantilever end).All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load Combination (Pattern)
Member Reaction (lbs)	756 @ 4 1/2"	1485 (3.50")	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	733 @ 5 1/2"	1945	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3728 @ 10' 5 1/2"	4990	Passed (75%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.366 @ 10' 5 1/2"	0.504	Passed (L/661)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.503 @ 10' 5 1/2"	1.008	Passed (L/481)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	45	45	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Bracing (Lu): All compression edges (top and bottom) must be braced at 4' 2 1/2" o/c unless detailed otherwise. Proper attachment and positioning of lateral bracing is required to achieve member stability.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 1/2" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	5.50"	3.75"	1.75"	209	558	767	1 3/4" Rim Board
2 - Stud wall - DF	5.50"	3.75"	1.75"	209	558	767	1 3/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20' 11"	16"	15.0	40.0	Residential - Living Areas

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Refer to current Weyerhaeuser literature for installation details. (www.woodbywy.com) Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC ES under technical reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports refer to http://www.woodbywy.com/services/s_CodeReports.aspx.

The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

SUSTAINABLE FORESTRY INITIATIVE

F10

Forte Software Operator	Job Notes
Craig Donison Buker Engineering (425) 289-89 craig@bukerengineering.com	ZHENG RESIDENCE 3

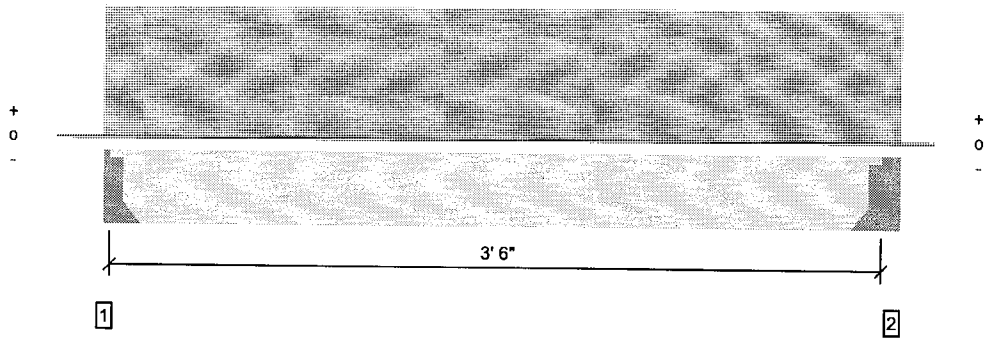
1/26/2016 10:26:06 AM
Forte v5.0, Design Engine: V6.4.0.40

FORTE® **MEMBER REPORT** *Level, Floor: Joist* **PASSED**

1 piece(s) 1 3/4" x 9 1/2" 2.0E Microllam® LVL @ 16" OC

Overall Length: 4' 1"

F2



All locations are measured from the outside face of left support (or left cantilever end).All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load Combination (Pattern)
Member Reaction (lbs)	128 @ 1 3/4"	1969 (1.50")	Passed (7%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	70 @ 11 1/4"	3159	Passed (2%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	112 @ 1' 10 3/4"	6123	Passed (2%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.001 @ 1' 10 3/4"	0.087	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.002 @ 1' 10 3/4"	0.175	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	75	45	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Bracing (Lu): All compression edges (top and bottom) must be braced at 3' 6" o/c unless detailed otherwise. Proper attachment and positioning of lateral bracing is required to achieve member stability.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 1/2" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			
	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Hanger on 9 1/2" LSL beam	1.75"	Hanger[1]	1.50"	38	101	139	See note [1]
2 - Hanger on 9 1/2" PSL beam	5.25"	Hanger[1]	1.50"	44	117	161	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Connector: Simpson Strong-Tie Connectors						
Support	Model	Seat Length	Top Nails	Face Nails	Member Nails	Accessories
1 - Face Mount Hanger	IUS1.81/9.5	2.00"	N/A	8-10d x 1-1/2	2-10d x 1-1/2	
2 - Face Mount Hanger	IUS1.81/9.5	2.00"	N/A	8-10d x 1-1/2	2-10d x 1-1/2	

Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 4' 1"	16"	15.0	40.0	Residential - Living Areas

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Refer to current Weyerhaeuser literature for installation details. (www.woodbywy.com) Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC ES under technical reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports refer to http://www.woodbywy.com/services/s_CodeReports.aspx.

The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

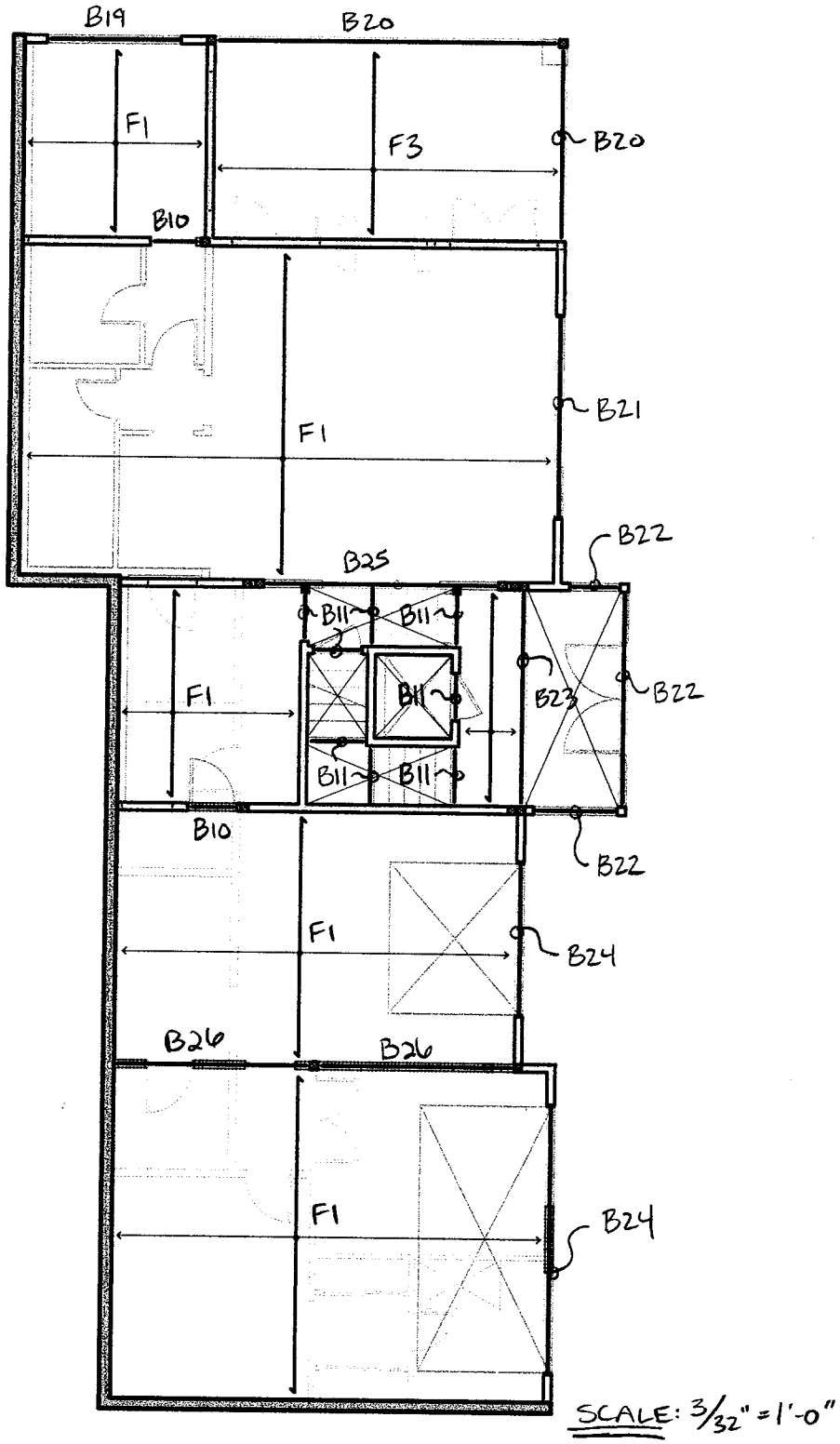
SUSTAINABLE FORESTRY INITIATIVE

F11

Forte Software Operator	Job Notes
Craig Donison Buker Engineering (425) 289-89 craig@bukerengineering.com	ZHENG RESIDENCE 3

1/26/2016 11:26:07 AM
Forte v5.0, Design Engine: V6.4.0.40

FIRST FLOOR FRAMING KEYPLAN

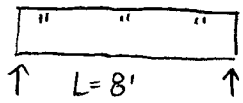


SCALE: 3/32" = 1'-0"

FIRST FLOOR FRAMING

$L_L = 40psf$, $D_L = 15psf$, $L_{L@DECK} = 60psf$

B19



$W = \left(\frac{13}{2}\right)(40) + \left(\frac{12}{6}\right)(55) + 100$

$= 260 + 330 + 100$

$= 690plf$

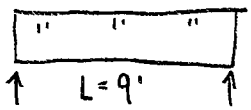
$R = 2760\#$ $M = 5.52k^{-1}$

$f_b = 897psi$ $f_v = 105psi$

$\Delta_{TL} = 0.09"$ $= \ell/1067$

USE: 4x12

B21



$W = \left(\frac{2}{2}\right)(55) + \left(\frac{13}{2}\right)(40) + 100$

$= 55 + 260 + 100$

$= 415plf$

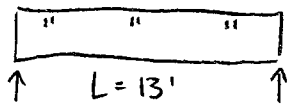
$R = 1868\#$ $M = 4.2k^{-1}$

$f_b = 1010psi$ $f_v = 87psi$

$\Delta_{TL} = 0.17"$ $= \ell/635$

USE: 4x10

B23



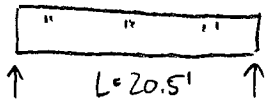
$W = 55plf$

$R = 358\#$ $M = 1.16k^{-1}$

$\Delta_{TL} = 0.03"$ $= \ell/5200$

USE: 3½" x 14" LSL

B20



$W = \left(\frac{12}{2}\right)(75) = 450plf$

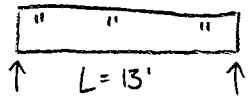
$R = 4613\#$ $M = 23.64k^{-1}$

$\Delta_{TL} = 0.75"$ $= \ell/328$

$f_b = 1650psi$ $f_v = 94psi$

USE: 5¼" x 14 PSL

B22



$W = 100plf$

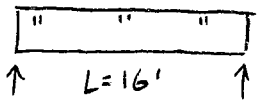
$R = 650\#$ $M = 2.11k^{-1}$

$\Delta_{TL} = 0.02"$ $= \ell/7800$

USE: 5¼" x 14" PSL

* SIZE GOVERNED BY LATERAL

B24



$W = \left(\frac{2}{2}\right)(55) + 100 = 155plf$

$R = 1240\#$ $M = 4.96k^{-1}$

$f_b = 806psi$ $f_v = 47psi$

$\Delta_{TL} = 0.34"$ $= \ell/564$

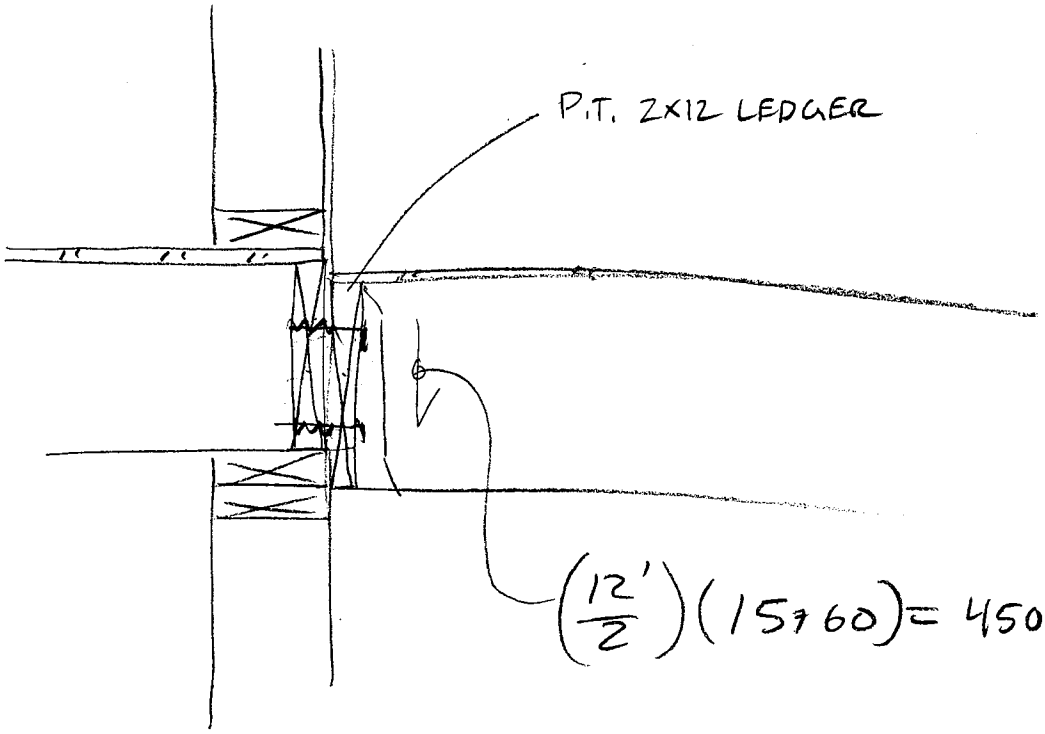
USE: 4x12

F3

Deck Joists

L =	12 ft 0 in		Lumber Type =	DF-L #2	
w_{DL} =	15 psf		F_b =	900 psi	
w_{LL} =	60 psf		F_v =	180 psi	
Spacing =	12 in o.c.		E =	1,600,000 psi	
Joist Size	2x8		C_D =	1	
S =	17.02 in^3		C_r =	1.15	
I =	70.19 in^4		C_F =	1.2	
A =	12.38 in^2		incised	yes	
M =	1350 #-ft				
R1 = R2 =	450 #		E' =	1520000 psi	
f_b =	952 psi		F_b' =	994 psi	**OK**
f_v =	54.5 psi		F_v' =	144 psi	**OK**
Δ_{DL} =	0.066 in	=	L/	2195	
Δ_{LL} =	0.262 in	=	L/	549	
Δ_{TL} =	0.328 in	=	L/	439	

Ledger Connection @ Grid E



$\left(\frac{12'}{2}\right)(150\#) = 450$ plf

use (2) 1/4" ϕ x 4 1/2" SDS @ 12" o.c.

Capacity $= (3)(280)\left(\frac{12}{16}\right) = 630$ #/

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 3' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

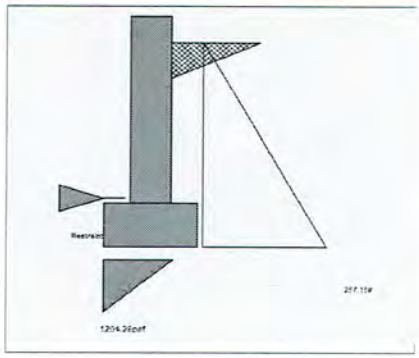
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	3.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
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
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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	=	1.77 OK
Slab Resists All Sliding !		
Total Bearing Load	=	675 lbs
...resultant ecc.	=	4.52 in
Soil Pressure @ Toe	=	1,204 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,445 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	2.5 psi OK
Allowable	=	75.0 psi

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	257.2 lbs

Stem Construction

Top Stem

Design Height Above Ftg	ft =	Stem OK	0.00
Wall Material Above "Ht"	=		Concrete
Thickness	=		8.00
Rebar Size	=		# 4
Rebar Spacing	=		12.00
Rebar Placed at	=		Edge

Design Data

fb/FB + fa/Fa	=	**0.047**
Total Force @ Section	lbs =	252.0
Moment....Actual	ft-# =	252.0
Moment.....Allowable	=	5,412.6
Shear.....Actual	psi =	3.4
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret 1

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	0.42 ft
Heel Width	=	1.08
Total Footing Width	=	1.50
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,445	0 psf
Mu' : Upward	=	110	0 ft-#
Mu' : Downward	=	13	47 ft-#
Mu: Design	=	97	47 ft-#
Actual 1-Way Shear	=	0.00	2.52 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	257.2	1.28	328.6	Soil Over Heel	=	137.4	1.29	177.5
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	=			
					Surcharge Over Toe	=			
Total		257.2	**O.T.M.**	328.6	Stem Weight(s)	=	350.0	0.75	262.6
	=		=		Earth @ Stem Transitions	=			
Resisting/Overturning Ratio		= **1.77**			Footing Weight	=	187.5	0.75	140.6
Vertical Loads used for Soil Pressure	=	674.9 lbs			Key Weight	=			
					Vert. Component	=			
					Total	=	674.9 lbs	**R.M.=**	580.7

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

East Mercer Parcel 3

Ret 2

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

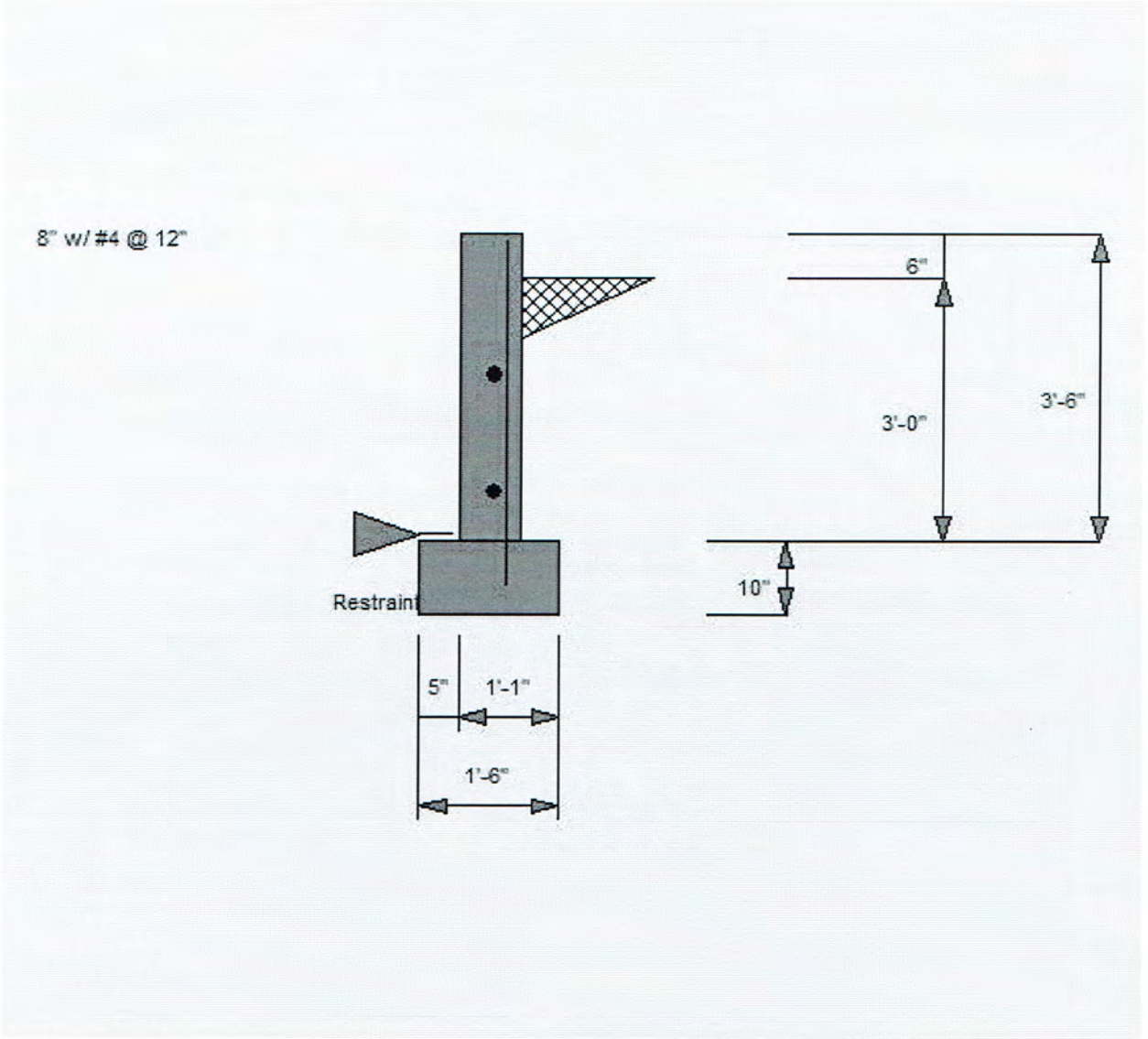
Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3

Ret 3

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11



East Mercer Parcel 3

Ret4

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 4' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

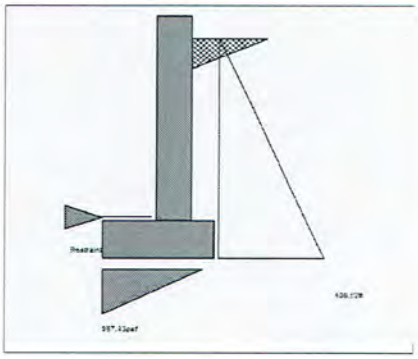
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
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
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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	=	1.84	OK
Slab Resists All Sliding !			
Total Bearing Load	=	894 lbs	
...resultant ecc.	=	5.03 in	
Soil Pressure @ Toe	=	957 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,149 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	5.0 psi	OK
Footing Shear @ Heel	=	3.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	408.8 lbs

Stem Construction

Top Stem

Design Height Above Ftg	ft =	Stem OK 0.00	
Wall Material Above "Ht"	=	Concrete	
Thickness	=	8.00	
Rebar Size	=	# 4	
Rebar Spacing	=	12.00	
Rebar Placed at	=	Edge	
Design Data			
fb/FB + fa/Fa	=	**0.110**	
Total Force @ Section	lbs =	448.0	
Moment....Actual	ft-# =	597.3	
Moment.....Allowable	=	5,412.6	
Shear.....Actual	psi =	6.0	
Shear.....Allowable	psi =	75.0	
Wall Weight	=	100.0	
Rebar Depth 'd'	in =	6.25	
LAP SPLICE IF ABOVE	in =	18.72	
LAP SPLICE IF BELOW	in =		
HOOK EMBED INTO FTG	in =	6.00	

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret 5

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 4' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	1.00 ft
Heel Width	=	1.08
Total Footing Width	=	2.08
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,149	0 psf
Mu' : Upward	=	472	1 ft-#
Mu' : Downward	=	13	59 ft-#
Mu: Design	=	459	58 ft-#
Actual 1-Way Shear	=	5.04	3.00 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings
Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	408.8	1.61	658.7	Soil Over Heel	=	183.2	1.87	343.4
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	=			
					Surcharge Over Toe	=			
Total		408.8	**O.T.M.**	658.7	Stem Weight(s)	=	450.0	1.33	600.0
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	260.4	1.04	271.2
Resisting/Overturning Ratio	=	**1.84**			Key Weight	=			
Vertical Loads used for Soil Pressure =		893.6 lbs			Vert. Component	=			
					Total =		893.6 lbs	**R.M.=**	1,214.6

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

East Mercer Parcel 3

Ret 6

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

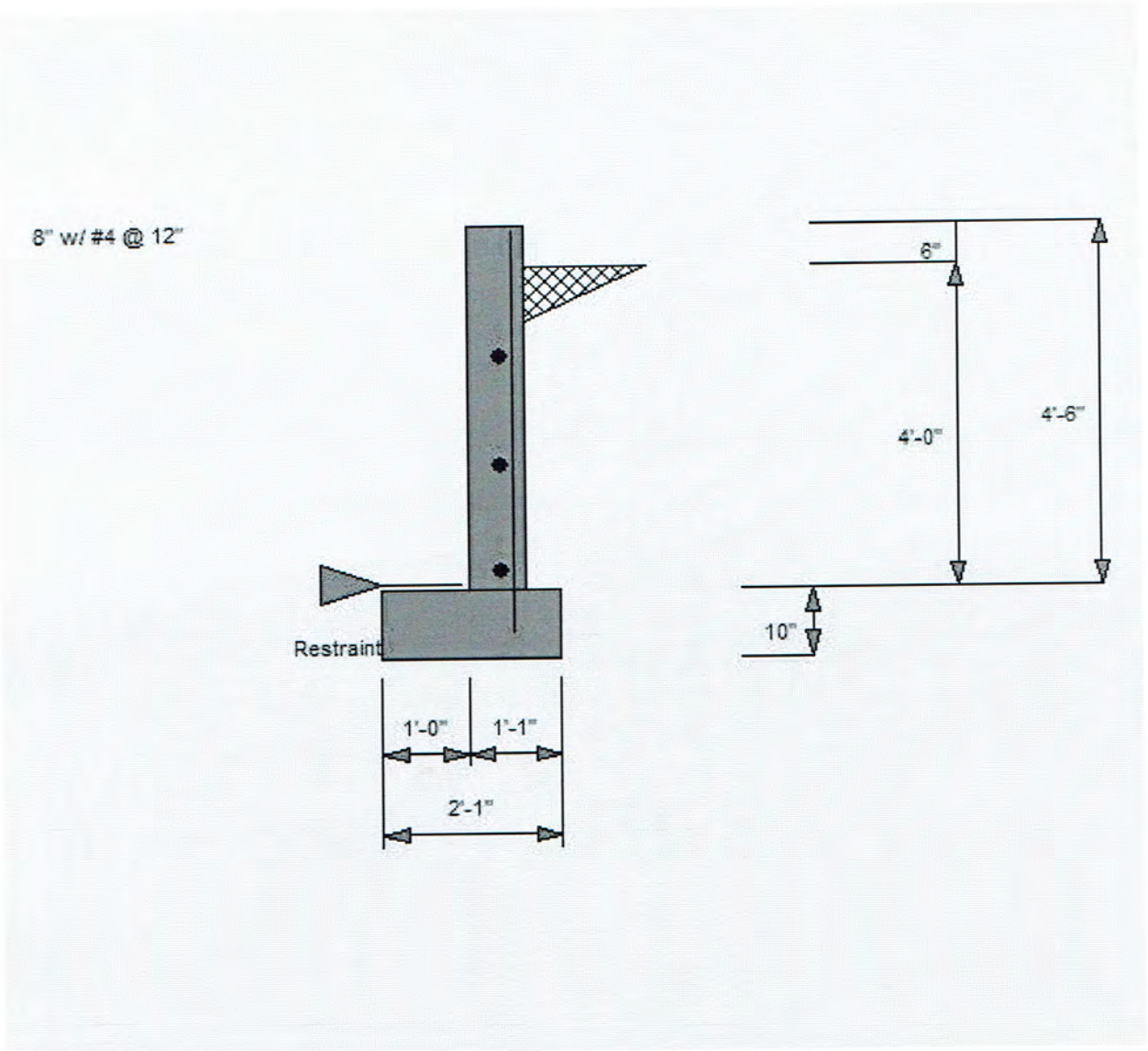
Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3

Ret7

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11



East Mercer Parcel 3

Ret8

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 5' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

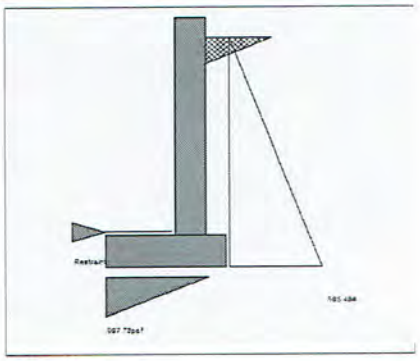
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
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
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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	=	1.70	OK
Slab Resists All Sliding !			
Total Bearing Load	=	1,102 lbs	
...resultant ecc.	=	6.66 in	
Soil Pressure @ Toe	=	998 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,197 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	9.7 psi	OK
Footing Shear @ Heel	=	3.7 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	595.5 lbs

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.216**
Total Force @ Section	lbs =	700.0
Moment....Actual	ft-# =	1,166.7
Moment.....Allowable	=	5,412.6
Shear.....Actual	psi =	9.3
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Masonry Data Hook embedment reduced by stress ratio

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret9

Use menu item Settings > Printing & Title Block to set these five lines of information for your program.

Title 5' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	1.50 ft
Heel Width	=	1.08
Total Footing Width	=	2.58
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,197	0 psf
Mu' : Upward	=	1,042	0 ft-#
Mu' : Downward	=	75	70 ft-#
Mu: Design	=	967	70 ft-#
Actual 1-Way Shear	=	9.68	3.74 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings
Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	595.5	1.94	1,157.9	Soil Over Heel	= 229.0	2.37	543.8
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	=		
					Surcharge Over Toe	=		
Total		595.5	**O.T.M.**	1,157.9	Stem Weight(s)	= 550.0	1.83	1,008.3
	=		=		Earth @ Stem Transitions	=		
Resisting/Overturning Ratio		= **1.70**			Footing Weight	= 322.9	1.29	417.0
Vertical Loads used for Soil Pressure	=	1,101.9 lbs			Key Weight	=		
					Vert. Component	=		
					Total =	1,101.9 lbs	**R.M.=**	1,969.1

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

East Mercer Parcel 3

Ret10

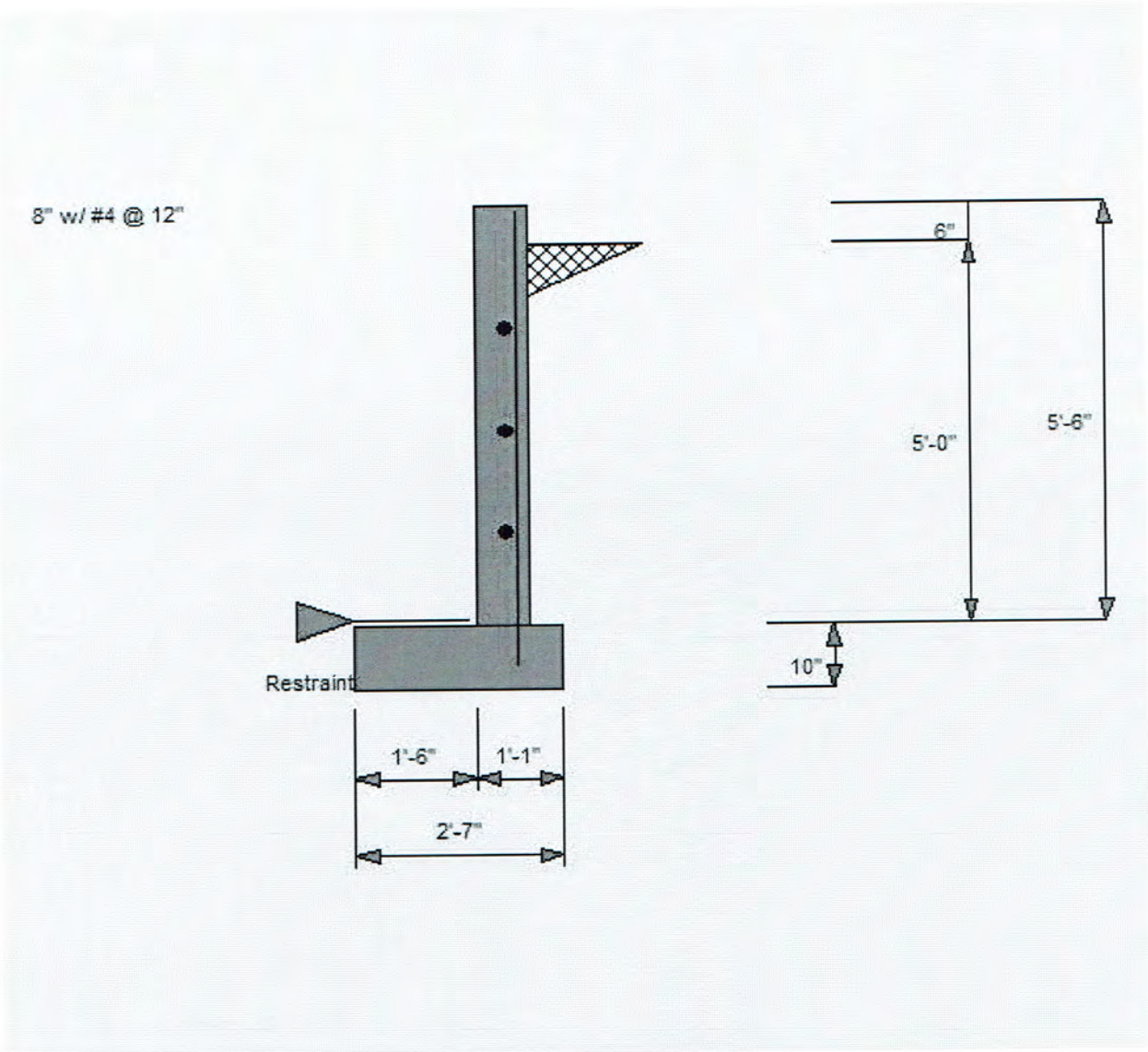
Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3.

Ret11



East Mercer Parcel 3

Ret12

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 6' Cantilever Wall w/Slab on Grade
Job # : Dsgnr: CRB
Description....
Cantilever Retaining Wall w/Slab on Grade

Page: _____
Date: 2 OCT 2014

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

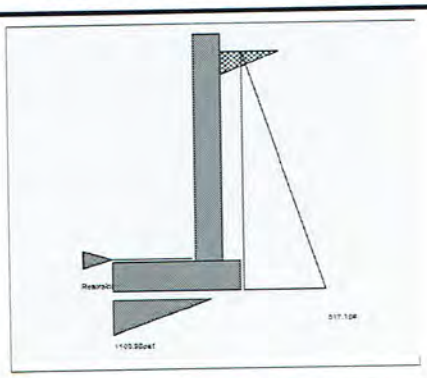
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
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
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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	=	1.56 OK
Slab Resists All Sliding !		
Total Bearing Load	=	1,310 lbs
...resultant ecc.	=	8.98 in
Soil Pressure @ Toe	=	1,101 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,321 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	14.3 psi OK
Footing Shear @ Heel	=	4.4 psi OK
Allowable	=	75.0 psi

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	817.2 lbs

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.372**
Total Force @ Section	lbs =	1,008.0
Moment....Actual	ft-# =	2,016.0
Moment.....Allowable	=	5,412.6
Shear.....Actual	psi =	13.4
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret13

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 6' Cantilever Wall w/Slab on Grade
Job # :
Dsgnr: CRB
Page: _____
Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	2.00 ft
Heel Width	=	1.08
Total Footing Width	=	3.08
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,321	0 psf
Mu' : Upward	=	1,902	0 ft-#
Mu' : Downward	=	175	82 ft-#
Mu: Design	=	1,727	82 ft-#
Actual 1-Way Shear	=	14.33	4.36 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 11.11 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.89 in, #9@ 5
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	817.2	2.28	1,861.3	Soil Over Heel	=	274.8	2.87	789.9
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	=			
					Surcharge Over Toe	=			
					Stem Weight(s)	=	650.0	2.33	1,516.7
					Earth @ Stem Transitions	=			
					Footing Weight	=	385.4	1.54	594.1
					Key Weight	=			
					Vert. Component	=			
Total	=	817.2	O.T.M. =	1,861.3	Total =		1,310.2 lbs	R.M.=	2,900.7

Resisting/Overturning Ratio = 1.56
Vertical Loads used for Soil Pressure = 1,310.2 lbs

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

East Mercer Parcel 3

Ret 14

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

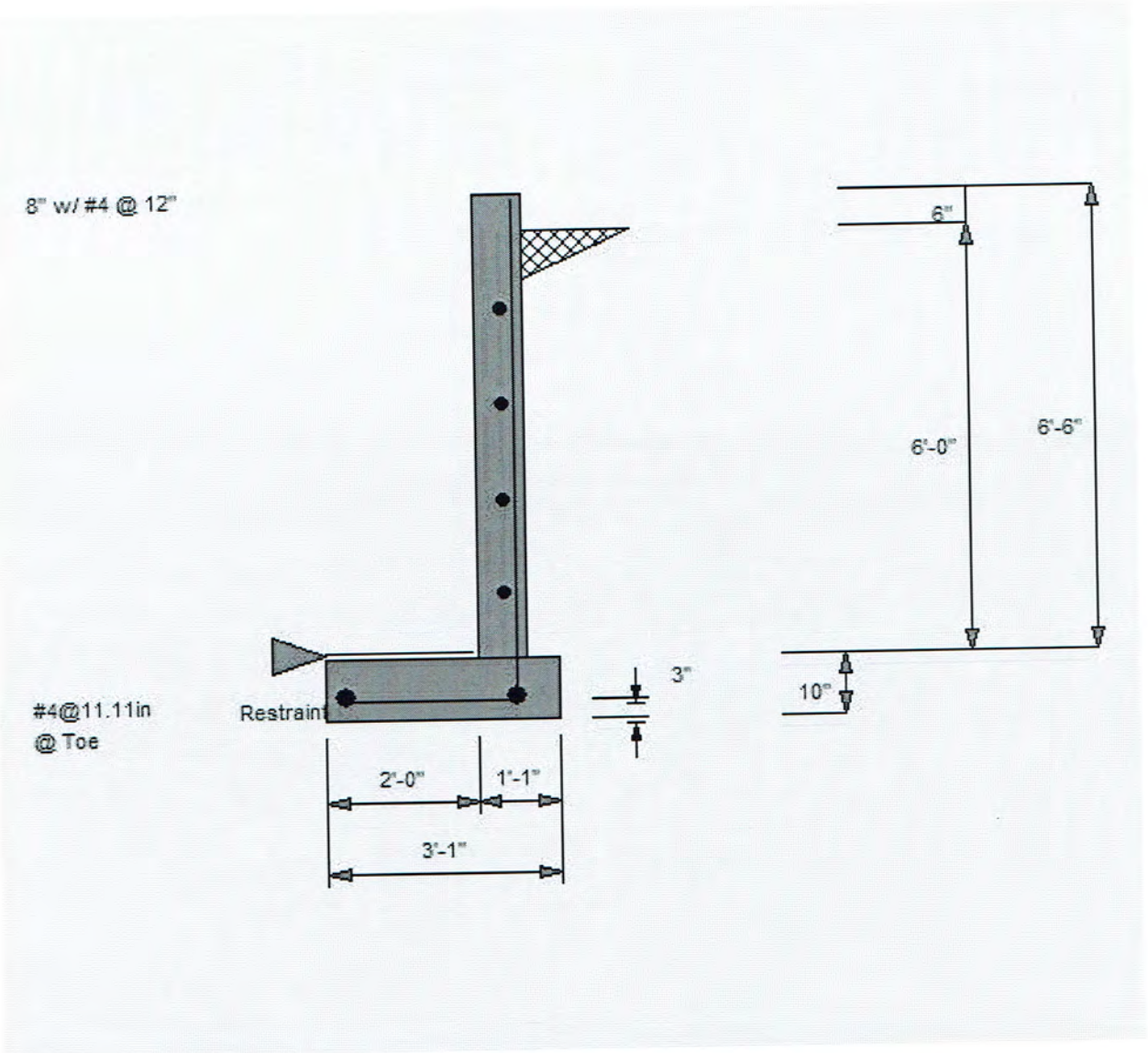
Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3

Ret 15

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11



East Mercer Parcel 3

Ret 16

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 7' Cantilever Wall w/Slab on Grade
Job # :
Dsgnr: CRB
Date: 2 OCT 2014
Page: ____
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

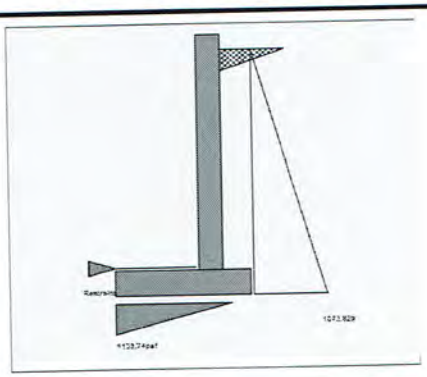
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	1.67	OK
Slab Resists All Sliding !			
Total Bearing Load	=	1,786 lbs	
...resultant ecc.	=	9.40 in	
Soil Pressure @ Toe	=	1,134 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,360 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	18.4 psi	OK
Footing Shear @ Heel	=	8.8 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	1,073.8 lbs

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.591**
Total Force @ Section	lbs =	1,372.0
Moment....Actual	ft-# =	3,201.3
Moment.....Allowable	=	5,412.6
Shear.....Actual	psi =	18.3
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret17

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	2.25 ft
Heel Width	=	1.42
Total Footing Width	=	3.67
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,360	0 psf
Mu' : Upward	=	2,624	1 ft-#
Mu' : Downward	=	126	302 ft-#
Mu: Design	=	2,498	301 ft-#
Actual 1-Way Shear	=	18.43	8.82 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 11.11 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.89 in, #9@ 5
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,073.8	2.61	2,803.9	Soil Over Heel	=	577.8	3.29	1,901.9
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	=			
					Surcharge Over Toe	=			
					Stem Weight(s)	=	750.0	2.58	1,937.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	458.4	1.83	840.4
					Key Weight	=			
					Vert. Component	=			
Total		1,073.8	**O.T.M.**	2,803.9		**Total =**	1,786.1 lbs	**R.M.=**	4,679.8
	=		=						

Resisting/Overturning Ratio = 1.67
Vertical Loads used for Soil Pressure = 1,786.1 lbs

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

East Mercer Parcel 3

Ret 18

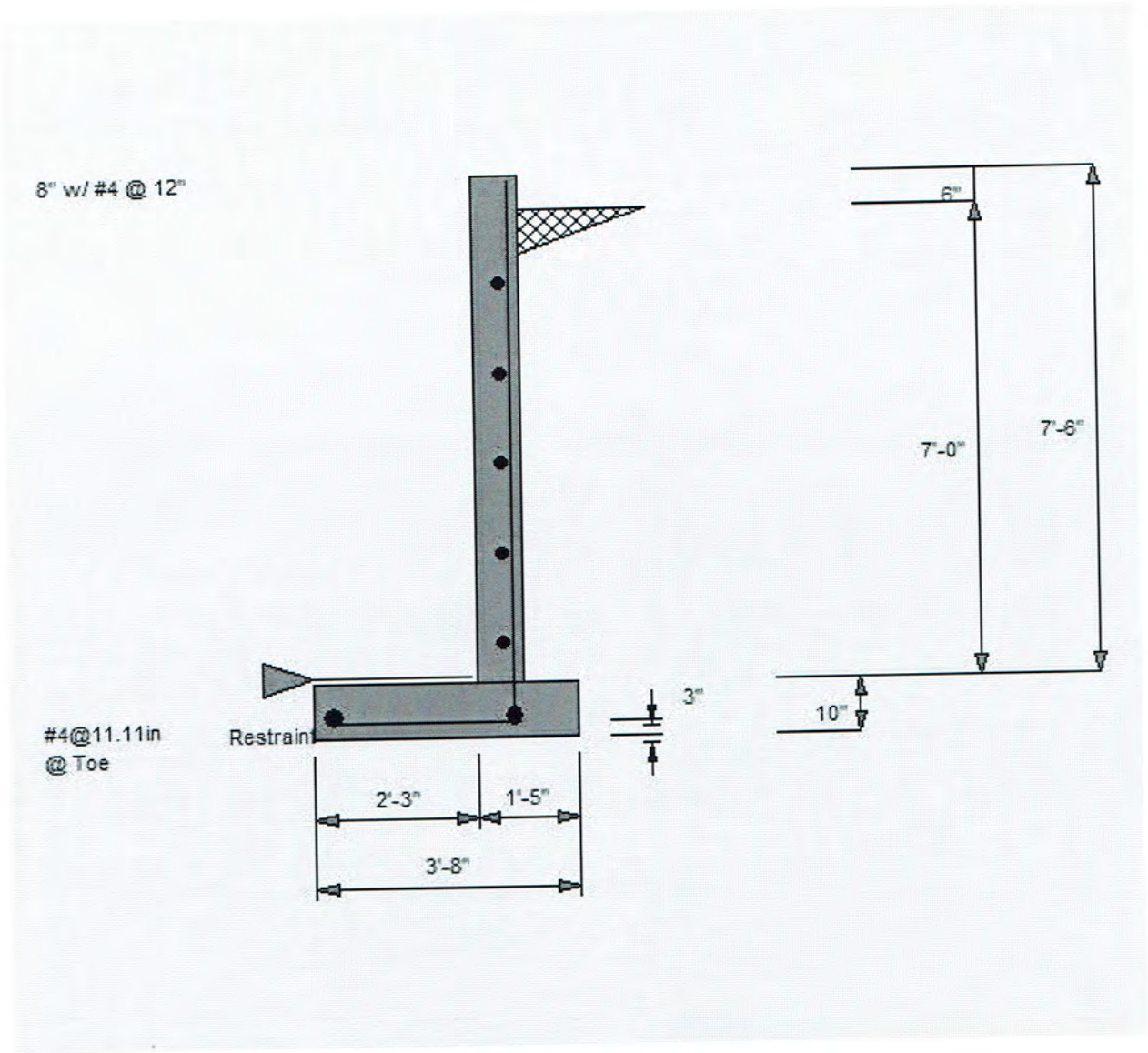
Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3

Ret 19



East Mercer Parcel 3

Ret 20

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 8' Cantilever Wall w/Slab on Grade
Job # :
Description....
Cantilever Retaining Wall w/Slab on Grade

Dsgnr: CRB
Date: 2 OCT 2014
Page: ____

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

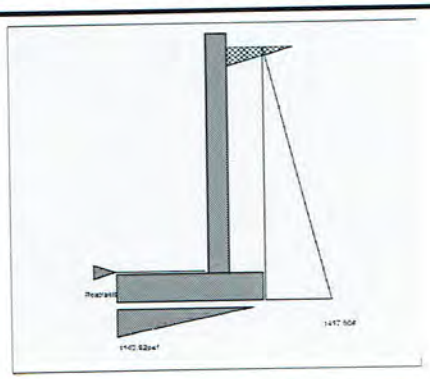
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
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
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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	=	1.77 OK
Slab Resists All Sliding !		
Total Bearing Load	=	2,393 lbs
...resultant ecc.	=	10.06 in
Soil Pressure @ Toe	=	1,164 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,397 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	17.4 psi OK
Footing Shear @ Heel	=	10.1 psi OK
Allowable	=	75.0 psi

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	1,417.5 lbs

Stem Construction

Top Stem

Design Height Above Ftg	ft =	Stem OK 0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.588**
Total Force @ Section	lbs =	1,792.0
Moment....Actual	ft-# =	4,778.7
Moment.....Allowable	=	8,121.3
Shear.....Actual	psi =	24.1
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.19
LAP SPLICE IF ABOVE	in =	23.40
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.02

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret21

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 8' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	2.75 ft
Heel Width	=	1.67
Total Footing Width	=	4.42
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,397	0 psf
Mu' : Upward	=	4,104	19 ft-#
Mu' : Downward	=	185	618 ft-#
Mu: Design	=	3,918	599 ft-#
Actual 1-Way Shear	=	17.41	10.13 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 7 @ 16.00 in
Heel Reinforcing = # 6 @ 16.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,417.5	3.00	4,252.5	Soil Over Heel	= 880.3	3.92	3,448.0
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	=		
					Surcharge Over Toe	=		
					Stem Weight(s)	= 850.0	3.08	2,620.8
					Earth @ Stem Transitions	=		
					Footing Weight	= 662.6	2.21	1,463.2
					Key Weight	=		
					Vert. Component	=		
Total		1,417.5	O.T.M.	4,252.5	Total =	2,392.8 lbs	R.M.=	7,532.0
	=		=					

Resisting/Overturning Ratio = 1.77
Vertical Loads used for Soil Pressure = 2,392.8 lbs

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

East Mercer Parcel 3

Ret 22

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in

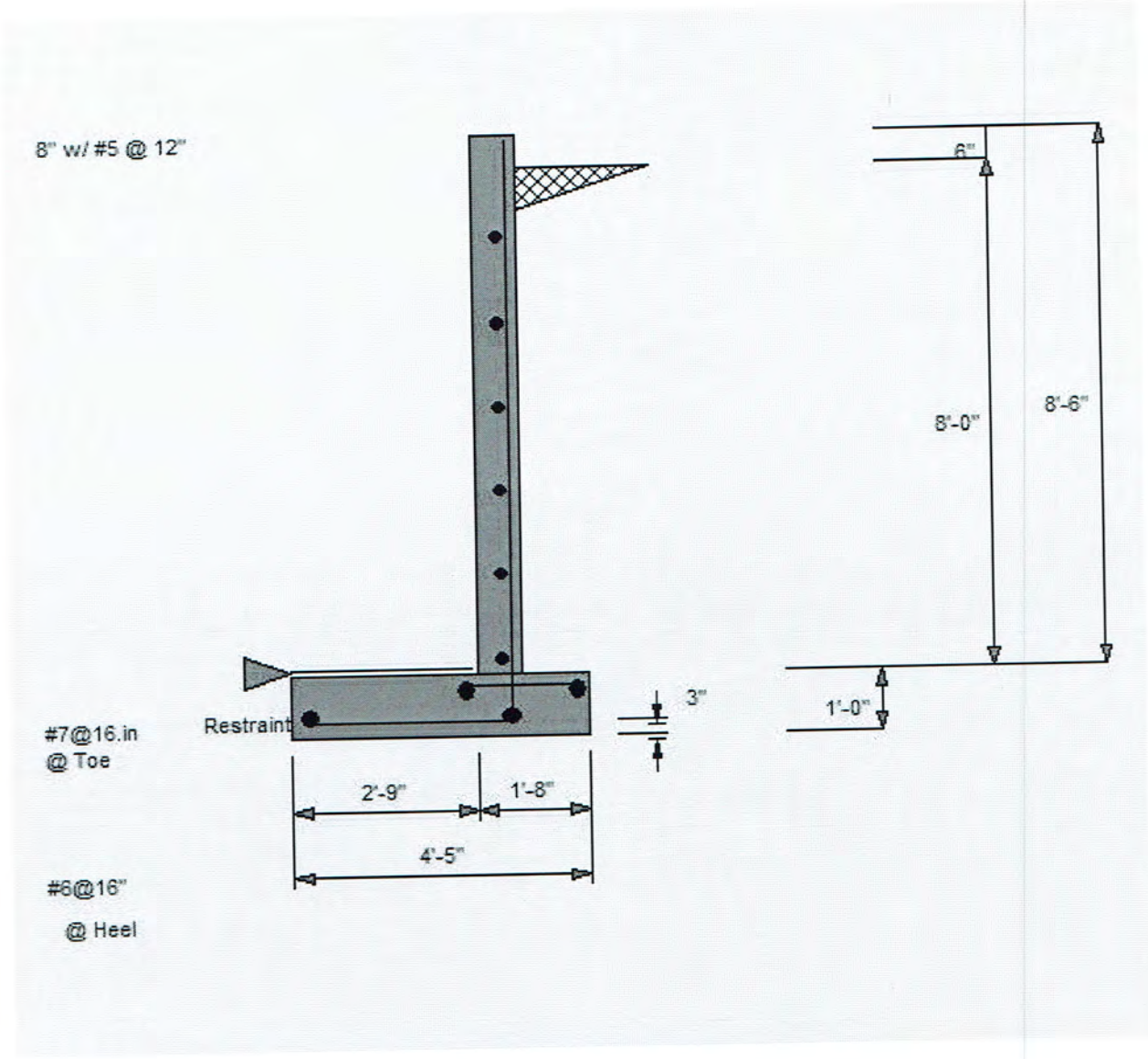
East Mercer Parcel 3

Det 23

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11



East Mercer Parcel 3

Ret 24

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 9' Cantilever Wall w/Slab on Grade
Job # :
Description....
Cantilever Retaining Wall w/Slab on Grade

Dsgnr: CRB
Date: 2 OCT 2014
Page: _____

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

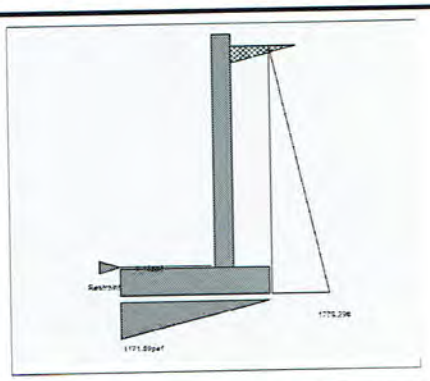
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
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
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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	=	1.87 OK
Slab Resists All Sliding !		
Total Bearing Load	=	3,027 lbs
...resultant ecc.	=	10.33 in
Soil Pressure @ Toe	=	1,172 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,406 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	18.9 psi OK
Footing Shear @ Heel	=	12.0 psi OK
Allowable	=	75.0 psi

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	1,779.3 lbs

Stem Construction

Top Stem

Design Height Above Ftg	ft =	Stem OK 0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	0.838
Total Force @ Section	lbs =	2,268.0
Moment....Actual	ft-# =	6,804.0
Moment.....Allowable	=	8,121.3
Shear.....Actual	psi =	30.5
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.19
LAP SPLICE IF ABOVE	in =	23.40
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	8.70

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret25

Use menu item Settings > Printing & Title Block to set these five lines of information for your program.

Title 9' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	3.25 ft
Heel Width	=	1.92
Total Footing Width	=	5.17
Footing Thickness	=	13.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,406	0 psf
Mu' : Upward	=	5,869	89 ft-#
Mu' : Downward	=	237	1,081 ft-#
Mu: Design	=	5,631	992 ft-#
Actual 1-Way Shear	=	18.90	12.03 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 8.55 in, #5@ 13.25 in, #6@ 18.80 in, #7@ 25.64 in, #8@ 33.76 in, #9@ 42
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,779.3	3.36	5,980.4	Soil Over Heel	=	1,237.8	4.54	5,622.0
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	=			
					Surcharge Over Toe	=			
Total		1,779.3	**O.T.M.**	5,980.4	Stem Weight(s)	=	950.0	3.58	3,404.2
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	839.6	2.58	2,169.2
					Key Weight	=			
					Vert. Component	=			
					Total =		3,027.5 lbs	**R.M.**=	11,195.4

Resisting/Overturning Ratio = **1.87**
Vertical Loads used for Soil Pressure = 3,027.5 lbs

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

East Mercer Parcel 3

Ret26

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in

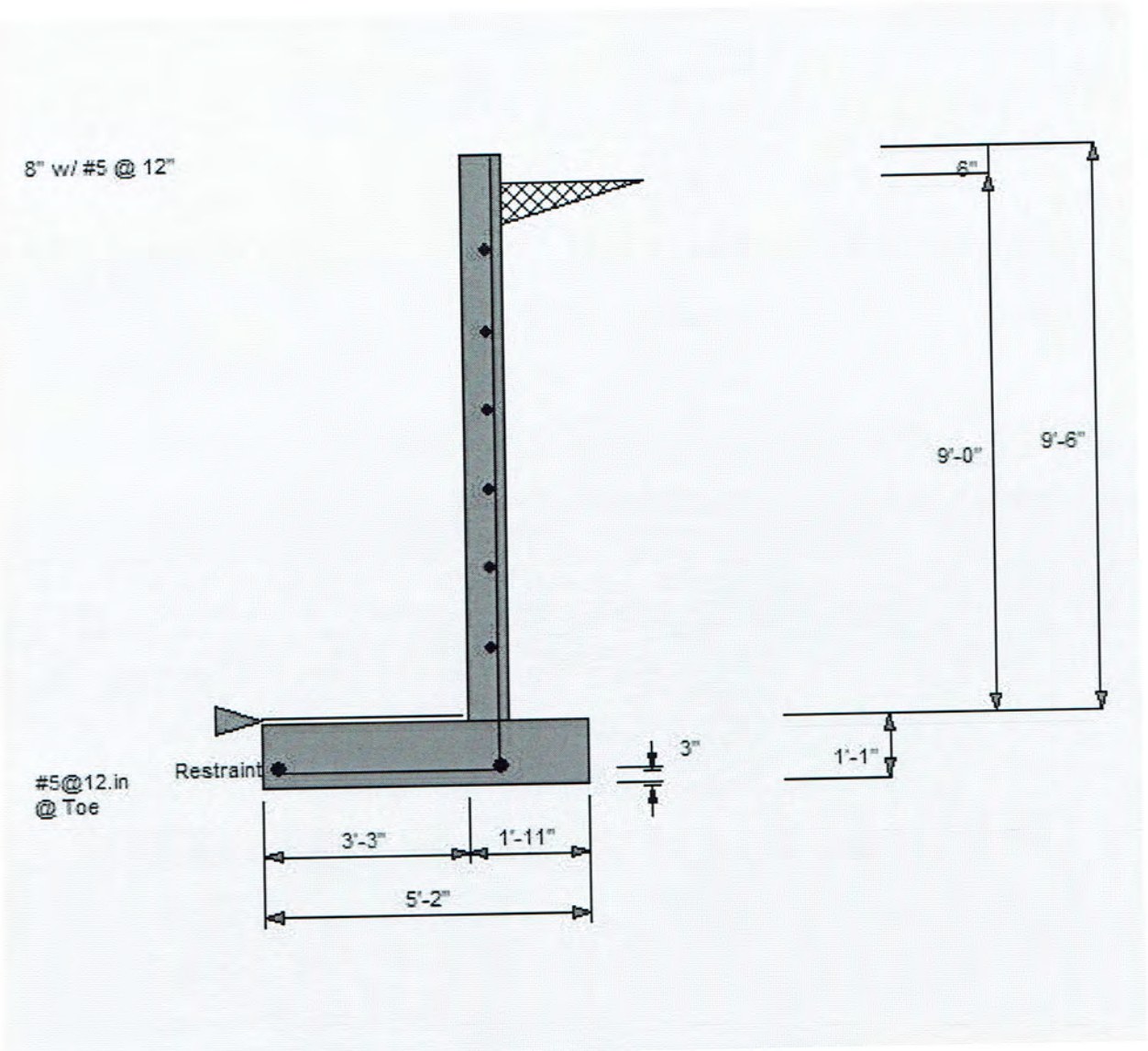
East Mercer Parcel 3.

Ret27

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11



East Mercer Parcel 3

Ret 28

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 10' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

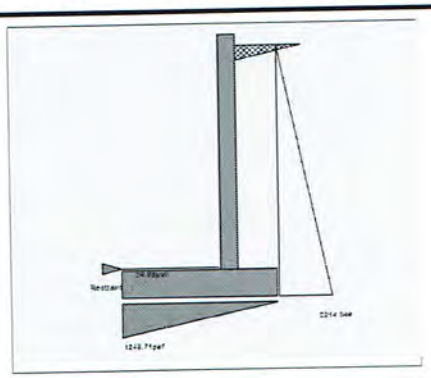
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	10.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
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
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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	=	1.92 OK
Slab Resists All Sliding !		
Total Bearing Load	=	3,784 lbs
...resultant ecc.	=	11.16 in
Soil Pressure @ Toe	=	1,249 psf OK
Soil Pressure @ Heel	=	35 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,498 psf
ACI Factored @ Heel	=	42 psf
Footing Shear @ Toe	=	18.8 psi OK
Footing Shear @ Heel	=	13.0 psi OK
Allowable	=	75.0 psi

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	2,214.8 lbs

Stem Construction

Top Stem

Design Height Above Ftg	ft =	Stem OK 0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 6
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.923**
Total Force @ Section	lbs =	2,800.0
Moment....Actual	ft-# =	9,333.3
Moment.....Allowable	=	10,109.5
Shear.....Actual	psi =	41.5
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	5.63
LAP SPLICE IF ABOVE	in =	28.08
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	11.53

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret29

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 10' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	3.75 ft
Heel Width	=	2.15
Total Footing Width	=	5.90
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,498	42 psf
Mu' : Upward	=	8,365	179 ft-#
Mu' : Downward	=	333	1,693 ft-#
Mu: Design	=	8,032	1,514 ft-#
Actual 1-Way Shear	=	18.79	13.03 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 7 @ 16.00 in
Heel Reinforcing = # 6 @ 16.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.41 in, #5@ 11.48 in, #6@ 16.30 in, #7@ 22.22 in, #8@ 29.26 in, #9@ 37
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,214.8	3.75	8,305.7	Soil Over Heel	=	1,628.4	5.16	8,397.2
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	=			
					Surcharge Over Toe	=			
					Stem Weight(s)	=	1,050.0	4.08	4,287.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	1,105.7	2.95	3,260.1
					Key Weight	=			
					Vert. Component	=			
Total		2,214.8	O.T.M.	8,305.7	Total =		3,784.1 lbs	R.M.=	15,944.8
	=		=						

Resisting/Overturning Ratio = 1.92
Vertical Loads used for Soil Pressure = 3,784.1 lbs

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

East Mercer Parcel 3

Ret30

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

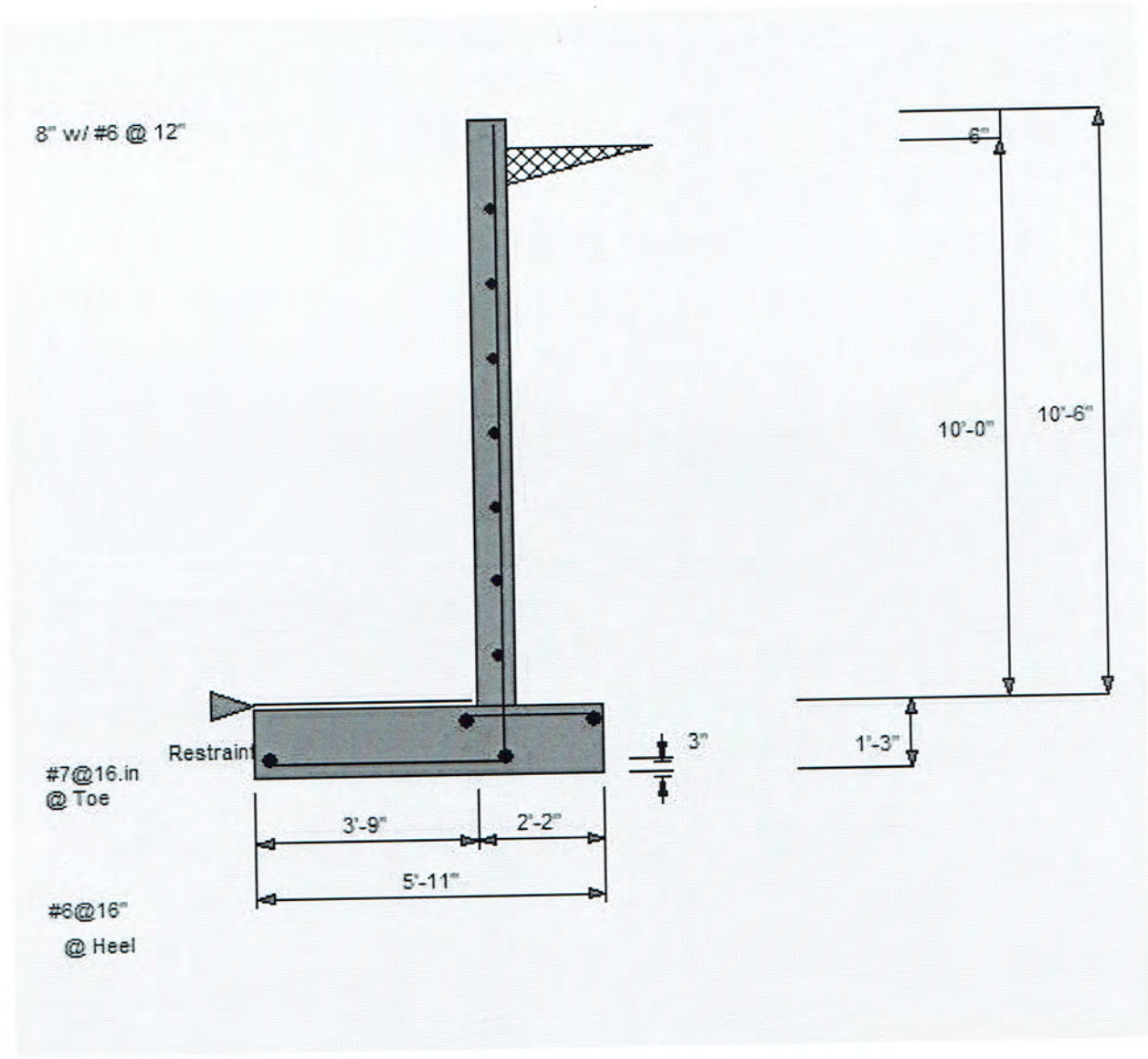
Lap Splice length for #6 bar specified in this stem design segment =	28.08 in
Development length for #6 bar specified in this stem design segment =	21.60 in
Hooked embedment length into footing for #6 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3

Ret 31

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11



East Mercer Parcel 3

Ret32

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 11' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

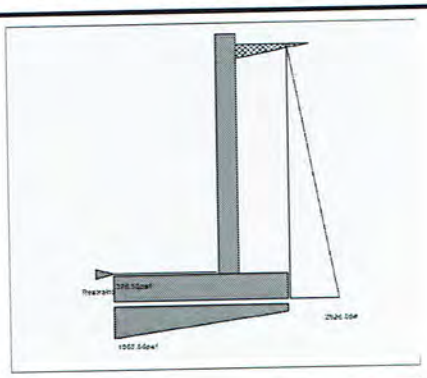
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	11.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	2.44	OK
Slab Resists All Sliding !			
Total Bearing Load	=	5,185 lbs	
...resultant ecc.	=	6.84 in	
Soil Pressure @ Toe	=	1,086 psf	OK
Soil Pressure @ Heel	=	379 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,303 psf	
ACI Factored @ Heel	=	454 psf	
Footing Shear @ Toe	=	21.0 psi	OK
Footing Shear @ Heel	=	14.7 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	2,626.1 lbs

Stem Construction

Top Stem

Design Height Above Ftg	ft =	Stem OK 0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	10.00
Rebar Size	=	# 6
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.883**
Total Force @ Section	lbs =	3,388.0
Moment....Actual	ft-# =	12,422.7
Moment.....Allowable	=	14,069.5
Shear.....Actual	psi =	37.0
Shear.....Allowable	psi =	75.0
Wall Weight	=	125.0
Rebar Depth 'd'	in =	7.63
LAP SPLICE IF ABOVE	in =	28.08
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	11.02

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret33

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	4.25 ft
Heel Width	=	2.83
Total Footing Width	=	7.08
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,303	454 psf
Mu' : Upward	=	10,232	1,068 ft-#
Mu' : Downward	=	120	3,353 ft-#
Mu: Design	=	10,113	2,285 ft-#
Actual 1-Way Shear	=	21.00	14.70 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.41 in, #5@ 11.48 in, #6@ 16.30 in, #7@ 22.22 in, #8@ 29.26 in, #9@ 37
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,626.1	4.08	10,723.2	Soil Over Heel	=	2,419.6	6.08	14,718.8
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	=			
					Surcharge Over Toe	=			
Total		2,626.1	**O.T.M.**	10,723.2	Stem Weight(s)	=	1,437.5	4.67	6,708.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	1,328.1	3.54	4,703.3
					Key Weight	=			
					Vert. Component	=			
					Total =		5,185.2 lbs	**R.M.**=	26,130.5

Resisting/Overturning Ratio = **2.44**
Vertical Loads used for Soil Pressure = 5,185.2 lbs

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

East Mercer Parcel 3

Ret 34

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

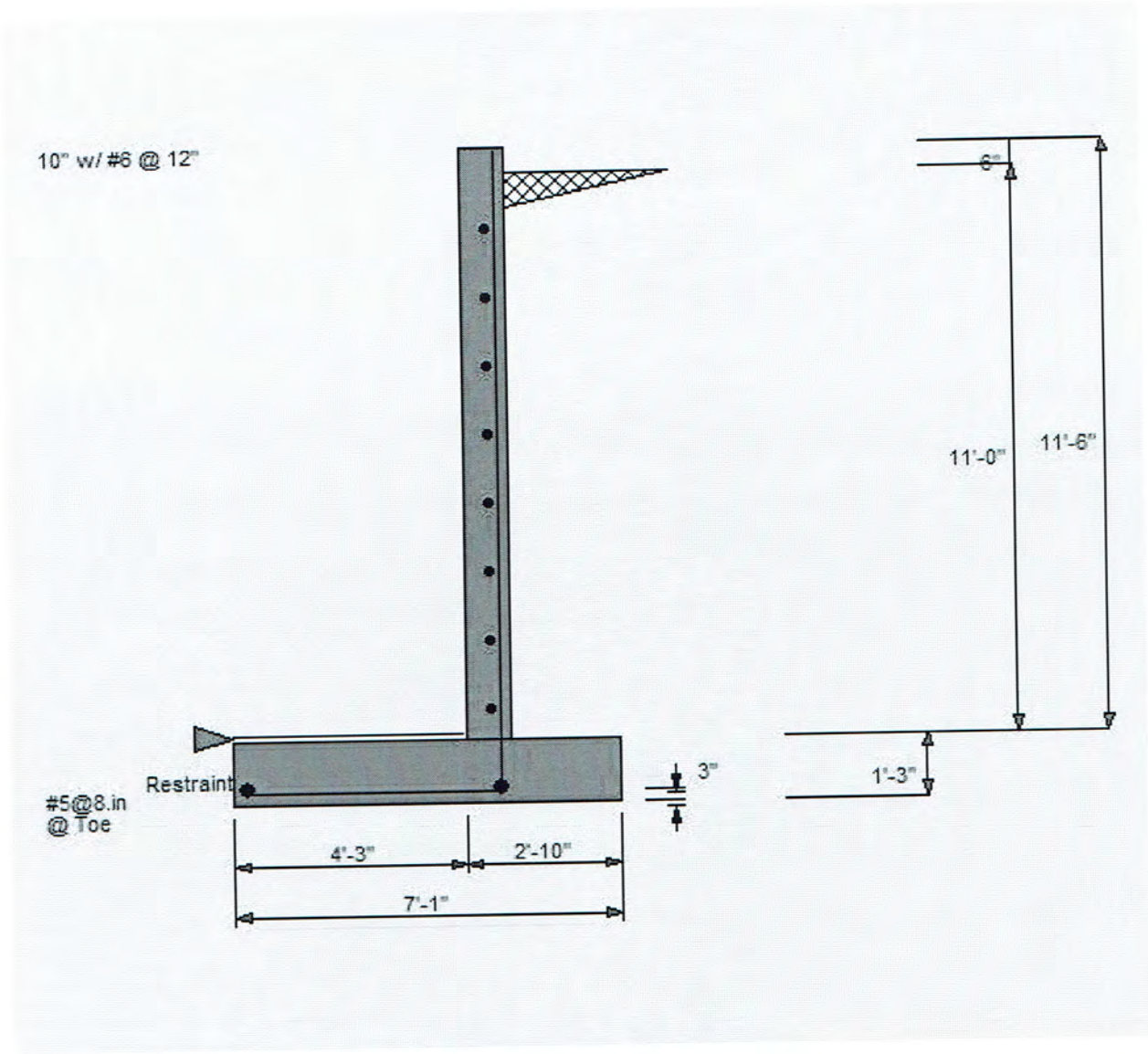
Lap Splice length for #6 bar specified in this stem design segment =	28.08 in
Development length for #6 bar specified in this stem design segment =	21.60 in
Hooked embedment length into footing for #6 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3

Ret35

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11



East Mercer Parcel 3

Ret 36

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 12' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

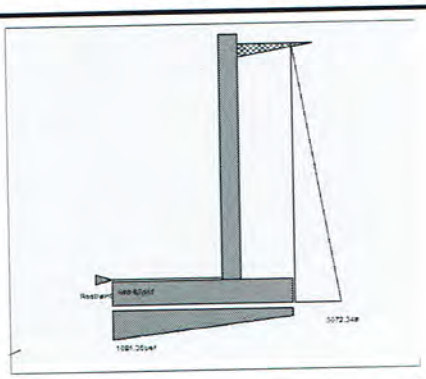
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	12.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.400
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 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	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

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	2.49	OK
Slab Resists All Sliding !			
Total Bearing Load	=	6,001 lbs	
...resultant ecc.	=	6.65 in	
Soil Pressure @ Toe	=	1,091 psf	OK
Soil Pressure @ Heel	=	441 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,310 psf	
ACI Factored @ Heel	=	529 psf	
Footing Shear @ Toe	=	24.6 psi	OK
Footing Shear @ Heel	=	17.5 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	3,072.3 lbs

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	10.00
Rebar Size	=	# 6
Rebar Spacing	=	9.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	0.881
Total Force @ Section	lbs =	4,032.0
Moment....Actual	ft-# =	16,128.0
Moment.....Allowable	=	18,302.4
Shear.....Actual	psi =	44.1
Shear.....Allowable	psi =	75.0
Wall Weight	=	125.0
Rebar Depth 'd'	in =	7.63
LAP SPLICE IF ABOVE	in =	28.08
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	10.96

Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

East Mercer Parcel 3

Ret37

Use menu item Settings > Printing & Title Block
to set these five lines of information
for your program.

Title 12' Cantilever Wall w/Slab on Grade Page: _____
Job # : Dsgnr: CRB Date: 2 OCT 2014
Description....
Cantilever Retaining Wall w/Slab on Grade

This Wall in File: h:\retaining wall calculations\retaining wall - slab on grade\cantilever retainin

RetainPro 10 (c) 1987-2014, Build 10.14.9.29
License : KW-06060889
License To : Buker Engineering, LLC

Cantilevered Retaining Wall Design

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	4.75 ft
Heel Width	=	3.08
Total Footing Width	=	7.83
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 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	=	1,310	529 psf
Mu' : Upward	=	12,994	1,528 ft-#
Mu' : Downward	=	134	4,578 ft-#
Mu: Design	=	12,860	3,050 ft-#
Actual 1-Way Shear	=	24.61	17.52 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.05 in, #5@ 10.93 in, #6@ 15.52 in, #7@ 21.16 in, #8@ 27.86 in, #9@ 35
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	3,072.3	4.42	13,569.5	Soil Over Heel	=	2,969.6	6.71	19,920.3
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	=			
					Surcharge Over Toe	=			
Total		3,072.3	O.T.M.	13,569.5	Stem Weight(s)	=	1,562.5	5.17	8,072.9
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	1,468.7	3.92	5,752.1
					Key Weight	=			
					Vert. Component	=			
					Total =		6,000.7 lbs	R.M.=	33,745.3

Resisting/Overturning Ratio = 2.49
Vertical Loads used for Soil Pressure = 6,000.7 lbs

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

East Mercer Parcel 3

Ret38

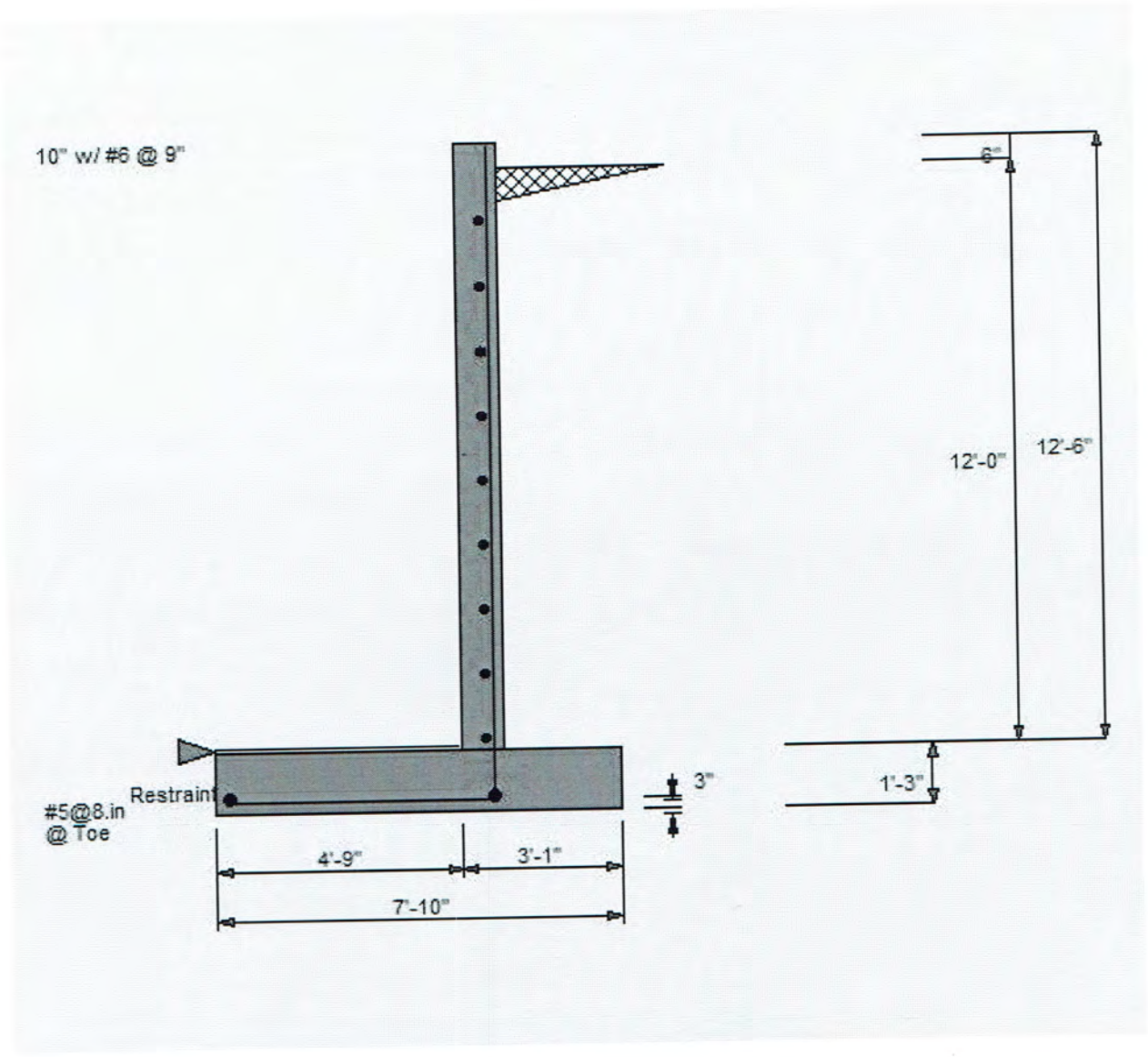
Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #6 bar specified in this stem design segment =	28.08 in
Development length for #6 bar specified in this stem design segment =	21.60 in
Hooked embedment length into footing for #6 bar specified in this stem design segment =	6.00 in

East Mercer Parcel 3

Ret 39



East Mercer Parcel 3

Ret 40