

Structural Calculations for:

Yuan Residence

3611 W Mercer Way Mercer Island, WA 98040



Prepared for: Brandt Design GroupJob #:01519-2019-01-00Date:July 16, 2019







SEATTLE TACOMA

ASCE 7-10 Seisr	mic Analysis	6	Equivalent	Lateral Fo	rce Procedu	ure						
Seismic Force Resisting System: Per Table 12.2-1		System:	Bearing Wall Systems Type: Light-frame (Cold-formed Steel) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance Or Steel Sheets Resistance Or Steel Sheets									
	Туре:											
		1	-	-								
Seismic I	Design Cat.		D									
Risk Category				I, II, OF III, C	or IV per Tai	018 1.5-1 (D assume	ad withou	t soils report)			
Diaphragm Flexibility Fl		vible	per 3013 re	sport	(D assume		t sons report)				
		110	.XIDIC	Bear	ring Wall S	ystems						
Ω₀	2.5		1									
Ss	1.402	g	2% in 50 y	r, Latitude	& Longitude	e lookup						
S ₁	0.54	g	2% in 50 y	r, Latitude	& Longitude	e lookup						
h _n	29.8	ft										
R	6.50		L						_	r		
I _e	1.0		Table 1.5-2	able 1.5-2					$T_a = 0$	$L_t h_n^{\alpha}$	Eq. 12	.8.7
C _d	4		Table 42.0	2								
Ct	0.02		Table 12.8	-2					$S_{MS} =$	$F_a S_S$	Eq. 11	.4-1
x T	0.75	500	Fa 12.8	able 12.8-2					$S_{M1} =$	$F_{v}S_{1}$	Eq. 11	.4-2
T _a	0.20	Sec	Eq. 12.0-7						$S_{DS} =$	$^{2}/_{3}S_{MS}$	Eq. 11	.4-3
Te	0.12	sec	-						$S_{D1} =$	$^{2}/_{3}S_{M1}$	Eg. 11	.4-4
k	1000	360	-						- 01	/ 3 - 1/1	-	
Fa	1.00		Table 11.4-	1					C	S _{DS}	F= 12	0.2
Fv	1.50		Table 11.4-	2					$L_S = \frac{1}{2}$	R/I_e	Eq. 12	.8-2
S _{MS}	1.40	g	Eq. 11.4-1						$C_{\rm c} = -$	S _{D1}	Ea. 12	.8-3
S _{M1}	0.81	g	Eq. 11.4-2						-3 T	$r(R/I_e)$		
			-						$C_S = \frac{1}{T}$	$\frac{3D1^{1}L}{2^{2}(R/L)}$	Eq. 12	.8-4
S _{DS}	0.935	g	Eq. 11.4-3						$C_c > 0$	$0.044S_{\rm DC}$. Fa. 12	.8-5
S _{D1}	0.540	g	Eq. 11.4-4						$C_{2} > 0$	$0.01 \\ 0.01$	Fa 12	8-5
									05 = 0		-9	.0.5
	0.144	Controls	Eq. 12.8-2			-						
Cs	0.325		Eq. 12.8-3	need not e	xceed, I <	I _L	[$C = w h^k / \Sigma^n w h^k$ Eq. 12.8.12				Q_17
	0.010		Eq. 12.8-5	or 12.8-6 m	inimum			$c_{VX} - w_{2}$	$x^n x / \Delta_{i=1}$	$1^{w_x n_i}$	LY. 12.	0-12
0 I I			-					∇^n	E .			
Cs, design	0.144	k	-					$F_{px} = L_{i=1}$	$\left \frac{x^{r_i}}{\sum_{i=1}^{n}}\right $	$W_{w_i}W_{px}$	Eq. 12.	10-1
blug. Weight	214.4	ĸ	-					$F_{max} > 0.2$	2.SpcLawn	~	Fa. 12.	10-2
$V = C_c W$	30.8	k	Ea. 12.8-1.	Strength Le	evel Base S	hear		$F_{px} = 0.125p_{STe} w_{px} \qquad \text{Eq. 12.10.2}$				10-3
$V = C_{Sasd}W$	21.6	k	Eq. 12.8-1	ASD Base S	Shear			$T_{px} \le 0.45 DST_e w_{px}$ Eq. 12.10-5				10 5
			4									
Vertical Distrib	ution	ASD	ρ=	1.3								
			. Kura	k	Story Shear			Diaphragm				
Levél	n _x (ft)	vv _× (K)	n _x " (ft)	w _x h _x "	C (%)	ASD E (1/)	CV//IA	F	F POLC	e (p not incl	uded) F	ν=Ε /⊑
					C _{VX} (%)	г _х (к)	5V (K)	Fpx,calc	Г _{рх,min}	Г _{рх,max}		γ-г _{рх} /г _х
								1		-		-
								1				
			1					1		1		
					ł		1	1		1		
					Ì			1		t		
										1		
						-						
							1					

2124 Third Ave, Suite 100, Seattle, WA 98121 0 206.443.6212 934 Broadway, Suite 100, Tacoma, WA 98402 1 0 253.284.9470 TACOMA

Yuan Residence DATE Seismic Criteria PROJ. # STRUCTURAL ENGINEERING DESIGN SHEET

16.2

11.9

28.1

16.2

28.1

22.2

33.9

0.77

1.43

6/19/2019

SRW

2

12.5

17.0

12.5

13.1

11.1

17.0

84.7 130

214.4

29.8

14.3

2527

1849 4375

0.577

0.423

29.8

14.3

Roof

Main

Σ

Wind Design - MWFRS

ASCE 7-10 Chapter 27 - Directional Procedure

Design Method ASD

Wind Coefficien	its	
Exposure	С	
V=	110	mph
K _d =	0.85	Table 26.6-1
K _h =	1.13	Table 27.3-1
G=	0.85	26.9.4

Transverse Wind Pressures

Wall Pressures (Unfactored):

0-15 15-20

20-25

25-30

30-40

41-50

51-60

61-70

71-80

81-90

91-100

Ht

L/B = 0.52 h/L = 1.57

Pressure Coefficients from Figure 27.4-1:

Bldg Face	Cp
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-1.3 / -0.18
Leeward Roof	-0.70

Kz

0.85

0.9

0.94

0.98

1.04

1.09

1.13

1.17

1.21

1.24

1.26

qz

22.38

23.70

24.75

25.80

27.38

28.70

29.75

30.81

31.86

32.65

33.18

P_{ww walls}

15.22

16.11

16.83

17.55

18.62

19.52

20.23

20.95

21.66

22.20

22.56

Plwwalls

12.60

12.60

12.60

12.60

12.60

12.60

12.60

12.60

12.60

12.60

12.60

Calculate Kzt?	No	
Kzt	1.00	
Roof Type	Monoslo	be
Roof Angle - Transverse Dir	5.9	degrees
Roof Angle - Long Dir	0	degrees
Ground to top of roof	59.83	ft
Bot of roof to top of roof	4.75	ft
Mean Roof Height, h	57.455	ft
Short Plan Dimension	36.5	ft
Long Plan Dimension	70.25	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	14.25	ft

Location and Building Dimensions

Velocity Pressure at Mean	20.7	nof
Roof Height, q _h =	29.7	psi

ASD

P_{walls} (psf)

16.69

17.23

17.66

18.09

18.73

19.27

19.70

20.13

20.56

20.88

21.10

Roof Pressures (Unfactore	ed) ASD	

Horiz Proj	Looward	Windward	
(psf)	Leewalu	Max Min	
4.80	-17.6	-32.8	-4.5

SEATTLE 2124 Third Ave, Suite 100, Seattle, WA 98121 TACOMA 934 Broadwey, Suite 100, Tacoma, WA 98402

| 0 206.443.6212 1 0 253.284.9470

Longitudinal Wind Pressures

L/B = 1.92 h/L = 0.82

Pressure Coefficients from Figur	re 27.4-1:
Bldg Face	Cp
Windward Wall	0.8
Leeward Wall	-0.32
Windward Roof	-1.15 / -0.18
Leeward Roof	-0.70

Wall Pressures ((Unfactored):				ASD
Ht	Kz	qz	P _{ww walls}	P _{lwwalls}	P _{walls} (psf)
0-15	0.85	22.38	15.22	7.94	13.90
15-20	0.9	23.70	16.11	7.94	14.43
20-25	0.94	24.75	16.83	7.94	14.86
25-30	0.98	25.80	17.55	7.94	15.29
30-40	1.04	27.38	18.62	7.94	15.94
41-50	1.09	28.70	19.52	7.94	16.47
51-60	1.13	29.75	20.23	7.94	16.90
61-70	1.17	30.81	20.95	7.94	17.33
71-80	1.21	31.86	21.66	7.94	17.76
81-90	1.24	32.65	22.20	7.94	18.09
91-100	1.26	33.18	22.56	7.94	18.30

Roof Press	ASD		
Windward		Looward	Horiz Proj
Max	Min	Leewaru	(psf)
-4.5	-29.1	-17.6	4.80

CCX /
STRUCTURAL
ENGINEERING

Yuan Residence

Wind Criteria

DATE <u>6/19/2019</u>
PROJ.#
DESIGN <u>SRW</u>
SHEET <u>3</u>

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 Yuan Residence
 4/30/2019

 PROJECT
 DATE

 Wind Criteria
 PROJ.#

 SRW
 DESIGN

SHEET

SEISMIC MASS 206.443.6212 253.284.9470 GARAGE ROOF ARGA = 790 FT = +200 FT = 990 FT = 0 0 W= 35 psf (INCLUDING GREEN ROOF) + 10 psr/2=40 psf WA 98121 . WA 98402 MASS = 790 +72 × 40 pSF = 36340 CB 39.600 LB , Seattle, V Tacoma, 1 ROOF Suite 100, 3 Suite 100, 1 490 F2-2-2255 M2 AREA = 690772+10772 + 110772 + 1450772 + 195772 = 2455772 2124 Third Ave, 9 934 Broadway, S Third Ave, W= 15psr +1955-12 = 20psr MASS = 49100LB 45100LB 0.47 SEATTLE TACOMA (90 MASS, GARAGE = 0+43 TOTAL ROOF : 36340 48 + 4410018 = 854490 LB 90 MIAS, 1/0008 = 0.57 39600 LB 45700 LB = 84700 LB 0.53 ssfengineers.com MAIN FLOOR AREA = 68572 + 1072 + 144572 + 620572 = 2760F72 W= (2"/12)150pc= + 12ps= + 10ps= - 47ps= \oplus MASS = 276072 (47 psp) = 129720 LB SWENSON SAY FAGÉT SETSMIC LOADS (MHIN) 0.53 (16.2K) = 8.6K_ SETSAIR LOADS (GARAGE) $F_{Y, \neq 00r} = 0.43(16.3k) = 17K$ 0.47(16.2k) = 7.6KFx, ROOF = 0.57(16-3K) = 9.37K FR, MAIN = 11.8K 8 6 14/43' = 200 pif 7.6 K/31 = 245 DUF NS N/S VEQ, ROOF = 9.3×143 = 240 PLF VER, RCOF = 7K/31' = 226 PUF VER, MAN = 11.8K/43 1 = 274 put 0.6 K/70 = 123 pur E/W ,714K/25' 304 p.1= VER, ROF= 7+/25'= 280 p.1= Elw VEA, ROOF= 9-34/70 = +33pt= VEQ, MANN = 11.8K/ 70'= 169 DUE YUAN JECT LATERAL DATE PROJ. # STRUCTURAL DESIGN ENGINEERING SHEET

WIND								
TROOF = 418 /ST								
$P_{\rm intrip} d_{\rm tors} = 16.7p_{\rm c}c$		***						
					-			
$15 + 1020^{\circ} - 17.2 \text{psr}$								
20'to 25' = 17.7 psp					-			
ast to 301 = 18.1 psp		· · · · · · · · · · · · · · · · · · ·			**************************************			
		5. <i>a</i>					-	
AT EARAGE								· · · · · · · · · · · · · · · · · · ·
			1	•••				· · · · · · · · · · · · · · · · · · ·
$V_W, ROOF = 16.7 \text{ psf X } 11/2 = 92 \text{ psf}$								
AT MAIN:								
VII DADE: 18.1 DEF X 15/2 = 136 DL	F							
JW, UPPER: 17.7ps= × 15/2+ 17.2ps	$F_{X}IS_{2}=2I$	52.PLF						
			· · · · · · · · · · · · · · · · · · ·					
VIIANI RESI	SENCE					5/8	bora	
PROJECT PROJECT					DATE	/`	1000	Ł
ATEN V								
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PROJECT

Lateral Design

2019-06-14

DATE PROJ. # SRW DESIGN

SHEET

North-South

Level		Roof -	Main		Roof - Ma	in/Garage	Roof - Ma	in/Garage	Roof -	Garage	
Wall Line	1	L	2	2	3		4		5		
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	
V (k)	1.836	2.7			2.924	4.3	2.468	5.275	1.38	3.675	
L (ft)	19	19	8.5	8.5	20	20	18.5	18.5	25	25	
L red (ft)	16.1	16.1	8.5	8.5	16.85	16.85	18.5	18.5	25	25	
V (plf)	114	168	0	0	174	255	133	285	55	147	
SW	W	/6	W	/6	W4		W4		W6		
H (ft)	15	15	0	0	12	12	9	9	9	9	
OT (lb)	1449	2132	0	0	1754	2580	1201	2566	497	1323	
Design OT (lb)	21	32	0		25	2580		2566		1323	
Holdown	HD	U2	N	NA		HDU4		HDU4		HDU2	
	OT-DL										

Level					Up	per				
Wall Line	1		2	2		3	4	1	-	5
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic
V (k)	1.834	1.918	3.537	3.699	3.799	3.973	2.096	2.192		
V above (k)	1.836	2.7	0	0	2.924	4.3	2.468	5.275		
Total V (k)	3.67	4.618	3.537	3.699	6.723	8.273	4.564	7.467		
L (ft)	21.5	21.5	24.5	24.5	38	38	19	19		
L red (ft)	17.7	17.7	24.5	24.5	38	38	19	19		
V (plf)	207	261	144	151	177	218	240	393		
SW	W	/4	W	/6	W6		NA			
H (ft)	13	13	12	12	12	12	12	12		
OT (lb)	2219	2792	1732	1812	2123	2613	2883	4716		
Total OT (lb)	3669	4924	1732	1812	3877	5193	4083	7282		
Design OT (lb)	49	24	18	12	51	93	72	82		
Holdown	HD	U5	HD	U2	HD	U5	NA			
-		Concrete						crete		

Concrete



2019-06-14

PROJ. # SRW DESIGN

Yuan Residence

Lateral Design

SHEET

DATE





PROJECT

Lateral Design

2019-06-14

SRW

PROJ. # DESIGN

SHEET

DATE

East-West

Level	Roof - (Garage		Roof - Main										
Wall Line	A	4	E	3	(0	[)	E		F	F	(ì
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic			Wind	Seismic
V (k)	1.104	3.648	1.224	1.107	3.756	6.0465			3.468	3.1365			2.04	1.845
L (ft)	31.5	31.5	23	23	11	11	7	7	7.5	7.5			20	20
L red (ft)	31.5	31.5	23	23	9.2	9.2	6.35	6.35	7.5	7.5			19.5	19.5
V (plf)	35	116	53	48	408	657	0	0	462	418			105	95
SW	W	/6	W	/6	2V	V3	W	/6	W	3			W	/6
H (ft)	9	9	9	9	9	9	15	15	12	12			15	15
OT (lb)	315	1042	479	433	3073	4947	0	0	5549	5018			1530	1384
Design OT (lb)	10	42	47	79	49	47	()	55	49			15	30
Holdown	N	A	N	A	HD	U5	N	A	HD	U5			CS	16
Level	Upper													
Wall Line	A	A	E	3	(2	0	2	E		F	F	0	i i
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic
Lateral Force V (k)	Wind	Seismic	Wind 2.358	Seismic 1.521	Wind 4.192	Seismic 2.704	Wind 2.751	Seismic 1.7745	Wind 2.358	Seismic 1.521	Wind 3.93	Seismic 2.535	Wind 2.489	Seismic 1.6055
Lateral Force V (k) V above (k)	Wind	Seismic	Wind 2.358 1.224	Seismic 1.521 1.107	Wind 4.192 3.756	Seismic 2.704 6.0465	Wind 2.751 0	Seismic 1.7745 0	Wind 2.358 3.468	Seismic 1.521 3.1365	Wind 3.93 0	Seismic 2.535 0	Wind 2.489 2.04	Seismic 1.6055 1.845
Lateral Force V (k) V above (k) Total V (k)	Wind	Seismic	Wind 2.358 1.224 3.582	Seismic 1.521 1.107 2.628	Wind 4.192 3.756 7.948	Seismic 2.704 6.0465 8.7505	Wind 2.751 0 2.751	Seismic 1.7745 0 1.7745	Wind 2.358 3.468 5.826	Seismic 1.521 3.1365 4.6575	Wind 3.93 0 3.93	Seismic 2.535 0 2.535	Wind 2.489 2.04 4.529	Seismic 1.6055 1.845 3.4505
Lateral Force V (k) V above (k) Total V (k) L (ft)	Wind	Seismic	Wind 2.358 1.224 3.582 24	Seismic 1.521 1.107 2.628 24	Wind 4.192 3.756 7.948 27	Seismic 2.704 6.0465 8.7505 27	Wind 2.751 0 2.751 10	Seismic 1.7745 0 1.7745 10	Wind 2.358 3.468 5.826 10	Seismic 1.521 3.1365 4.6575 10	Wind 3.93 0 3.93 10	Seismic 2.535 0 2.535 10	Wind 2.489 2.04 4.529 20.5	Seismic 1.6055 1.845 3.4505 20.5
Lateral Force V (k) V above (k) Total V (k) L (ft) L red (ft)	Wind	Seismic	Wind 2.358 1.224 3.582 24 24	Seismic 1.521 1.107 2.628 24 24	Wind 4.192 3.756 7.948 27 27	Seismic 2.704 6.0465 8.7505 27 27	Wind 2.751 0 2.751 10 10	Seismic 1.7745 0 1.7745 10 10	Wind 2.358 3.468 5.826 10 10	Seismic 1.521 3.1365 4.6575 10 10	Wind 3.93 0 3.93 10 10	Seismic 2.535 0 2.535 10 10	Wind 2.489 2.04 4.529 20.5 20.5	Seismic 1.6055 1.845 3.4505 20.5 20.5
Lateral Force V (k) V above (k) Total V (k) L (ft) L red (ft) V (plf)	Wind	Seismic	Wind 2.358 1.224 3.582 24 24 24 149	Seismic 1.521 1.107 2.628 24 24 24 110	Wind 4.192 3.756 7.948 27 27 294	Seismic 2.704 6.0465 8.7505 27 27 27 324	Wind 2.751 0 2.751 10 10 275	Seismic 1.7745 0 1.7745 10 10 177	Wind 2.358 3.468 5.826 10 10 583	Seismic 1.521 3.1365 4.6575 10 10 466	Wind 3.93 0 3.93 10 10 393	Seismic 2.535 0 2.535 10 10 254	Wind 2.489 2.04 4.529 20.5 20.5 221	Seismic 1.6055 1.845 3.4505 20.5 20.5 168
Lateral Force V (k) V above (k) Total V (k) L (ft) L red (ft) V (plf) SW	Wind	Seismic	Wind 2.358 1.224 3.582 24 24 24 149 W	Seismic 1.521 1.107 2.628 24 24 110 /6	Wind 4.192 3.756 7.948 27 27 294 W	Seismic 2.704 6.0465 8.7505 27 27 27 324 /4	Wind 2.751 0 2.751 10 10 275 W	Seismic 1.7745 0 1.7745 10 10 10 177 /4	Wind 2.358 3.468 5.826 10 10 583 W	Seismic 1.521 3.1365 4.6575 10 10 466 2	Wind 3.93 0 3.93 10 10 393 W	Seismic 2.535 0 2.535 10 10 254 /4	Wind 2.489 2.04 4.529 20.5 20.5 20.5 221 W	Seismic 1.6055 1.845 3.4505 20.5 20.5 168 /6
Lateral Force V (k) V above (k) Total V (k) L (ft) L red (ft) V (plf) SW H (ft)	Wind	Seismic	Wind 2.358 1.224 3.582 24 24 24 149 W 12	Seismic 1.521 1.107 2.628 24 24 24 110 /6 12	Wind 4.192 3.756 7.948 27 27 27 294 W 12	Seismic 2.704 6.0465 8.7505 27 27 324 /4 /4	Wind 2.751 0 2.751 10 10 275 W 275 W 12	Seismic 1.7745 0 1.7745 10 10 177 /4 12	Wind 2.358 3.468 5.826 10 10 583 W 12	Seismic 1.521 3.1365 4.6575 10 10 466 2 12	Wind 3.93 0 3.93 10 10 393 W 12	Seismic 2.535 0 2.535 10 10 254 /4 /4	Wind 2.489 2.04 4.529 20.5 20.5 221 W 12	Seismic 1.6055 1.845 3.4505 20.5 20.5 168 /6 12
Lateral Force V (k) V above (k) Total V (k) L (ft) L red (ft) V (plf) SW H (ft) OT (lb)	Wind	Seismic	Wind 2.358 1.224 3.582 24 24 149 W 129 1791	Seismic 1.521 1.107 2.628 24 24 110 /6 12 1314	Wind 4.192 3.756 7.948 27 27 294 W 12 3532	Seismic 2.704 6.0465 8.7505 27 27 324 /4 /4 3889	Wind 2.751 0 2.751 10 10 275 W 10 275 W 12 3301	Seismic 1.7745 0 1.7745 10 10 177 /4 12 2129	Wind 2.358 3.468 5.826 10 10 583 W 10 583 W 12 6991	Seismic 1.521 3.1365 4.6575 10 10 466 2 12 5589	Wind 3.93 0 3.93 10 10 393 W 12 4716	Seismic 2.535 0 2.535 10 10 254 /4 /4 /4 /2 3042	Wind 2.489 2.04 4.529 20.5 20.5 221 W 12 2651	Seismic 1.6055 1.845 3.4505 20.5 20.5 168 76 12 2020
Lateral Force V (k) V above (k) Total V (k) L (ft) L red (ft) V (plf) SW H (ft) OT (lb) Total OT (lb)	Wind	Seismic	Wind 2.358 1.224 3.582 24 24 149 W 12 1791 2270	Seismic 1.521 1.107 2.628 24 24 110 /6 12 1314 1747	Wind 4.192 3.756 7.948 27 27 294 W 12 3532 6606	Seismic 2.704 6.0465 8.7505 27 27 324 /4 /4 12 3889 8836	Wind 2.751 0 2.751 10 10 275 W 10 275 W 12 3301 3301	Seismic 1.7745 0 1.7745 10 10 10 177 /4 2129 2129 2129	Wind 2.358 3.468 5.826 10 10 583 W 10 583 W 12 6991 12540	Seismic 1.521 3.1365 4.6575 10 10 466 2 12 5589 10607	Wind 3.93 0 3.93 10 10 393 W 12 4716 4716	Seismic 2.535 0 2.535 10 10 254 /4 /4 3042 3042	Wind 2.489 2.04 4.529 20.5 20.5 221 W 12 2651 4181	Seismic 1.6055 1.845 3.4505 20.5 20.5 168 76 12 2020 3404
Lateral Force V (k) V above (k) Total V (k) L (ft) L red (ft) V (plf) SW H (ft) OT (lb) Total OT (lb) Design OT (lb)	Wind	Seismic	Wind 2.358 1.224 3.582 24 24 149 W 12 1791 2270 22	Seismic 1.521 1.107 2.628 24 24 110 /6 12 1314 1747 70	Wind 4.192 3.756 7.948 27 294 W 12 3532 6606 88	Seismic 2.704 6.0465 8.7505 27 27 324 /4 /4 12 3889 8836 36	Wind 2.751 0 2.751 10 10 275 W 10 3301 3301 3301	Seismic 1.7745 0 1.7745 10 10 10 177 /4 2129 2129 01	Wind 2.358 3.468 5.826 10 10 583 W 10 583 W 12 6991 12540 12540	Seismic 1.521 3.1365 4.6575 10 10 466 2 10 5589 10607 640	Wind 3.93 0 3.93 10 10 393 W 12 4716 4716 4716	Seismic 2.535 0 2.535 10 10 254 /4 /4 12 3042 3042 16	Wind 2.489 2.04 4.529 20.5 20.5 221 W 12 2651 4181 411	Seismic 1.6055 1.845 3.4505 20.5 20.5 168 76 12 2020 3404 81



Yuan	Residence
PROJECT	

Lateral Design

2019-06-14

DATE
PROJ.#
SRW
DESIGN

SHEET



SHEET

Beam		Roof B1		PSL	7 x	11 7/8				
w=	420	plf		R=	3,717	lbs				
L=	17.7	ft		M=	16,448	ft-lbs				
b=	7.00	in		Fb=	1,200	psi				
d=	11.88	in		Fv=	60	psi				
E=	2000	ksi		Δ=	0.47	in				
Cv=	0.99	≤1.0		1/	447					
	Cv= 0.99 ≤1.0 17 447 W Image: Comparison of the second sec									

Beam		Roof B4	HF	4 x	12				
w=	280	plf	R=	1,960	lbs				
L=	14	ft	M=	6,860	ft-lbs				
b=	3.50	in	Fb=	1,115	psi				
d=	11.25	in	Fv=	65	psi				
E=	1300	ksi	Δ=	0.45	in				
Cv=	1.00	≤1.0	1/	375					
Cv= 1.00 ≤ 1.0 1/ 375									

		Roof B3	GL	5 1/8 x	18
w=	530	plf	R=	3,180	lbs
L=	12	ft	M=	9,540	ft-lbs
b=	5.13	in	Fb=	414	psi
d=	18.00	in	Fv=	39	psi
E=	1800	ksi	Δ=	0.055	in
Cv=	1.00	≤1.0	17	2611	

Steel Size	,			HSS12X4X3/	8
=	168	in in i	Fy=	46	ksi
Δ =	0.05	in	$Mn/\Omega =$	84.2	k-ft
17	2837		$Vn/\Omega =$	0.0	kips

Lower be	am 3	Roof B3a		PSL	3 1/2 x	16			
w=	280	plf		R=	1,680	lbs			
L=	12	ft		M=	5,040	ft-lbs			
b=	3.50	in		Fb=	405	psi			
d=	16.00	in		Fv=	35	psi			
E=	2000	ksi		Δ=	0.055	in			
Cv=	1.00	≤1.0		1/	2634				
W									



Steel Size					HSS10X4X1/4		
=	74.7	in⁴		Fy=	46	ksi	
Δ=	0.060	in		$Mn/\Omega =$	43.6	k-ft	
17	2388			Vn/Ω =	0.0	kips	

Steel Size	9	HSS6X6X1/4			
=	28.6	in [.]	Fy=	46	ksi
Δ =	0.29	in	$Mn/\Omega =$	25.7	k-ft
1/	576		$Vn/\Omega =$	0.0	kips

HSS6X6X1/4

Beam		Roof-B5	HF	3 x	8
w=	530	plf	R=	1,590	lbs
L=	6	ft	M=	2,385	ft-lbs
b=	3.00	in	Fb=	1,089	psi
d=	7.25	in	Fv=	88	psi
E=	1300	ksi	Δ=	0.12	in
Cv=	1.00	≤1.0	1/	577	



Beam		Roof-B6		LSL	3 1/2 x	11 7/8		
w=	410	plf		R=	1,333	lbs		
L=	6.5	ft		M=	2,165	ft-lbs		
b=	3.50	in		Fb=	316	psi		
d=	11.88	in		Fv=	33	psi		
E=	1550	ksi		Δ=	0.02	in		
Cv=	1.00	≤1.0		1/	3586			



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Project: Yuan Residence Date: 06/19/19 Roof Beams Project #: Design: haa Sheet: 1

Beam		Roof-B7	LSL	3 1/2 x	11 7/8		Beam		Roof B9	DF-L	4 x	12
w1=	530	plf	R1=	1628	lbs	1	w1=	70	plf	R1=	-1960	lbs
w2=	530	plf	R2=	4,859	lbs		w2=	70	plf	R2=	4,900	lbs
L1=	8	ft	M+=	2,501	lb-ft		L1=	7	ft	M+=	-	lb-ft
L2=	4	ft	M-=	4,386	lb-ft		L2=	7	ft	M-=	15,435	lb-ft
X=	4.09	ft	Fb=	640	psi		X=	3.50	ft	Fb=	2,509	psi
P=	80	lbs	Fv=	79	psi		P=	1,960	lbs	Fv=	91	psi
b=	3.50	in	∆span=	0.028	in		b=	3.50	in	∆span=	(0.110)	in
d=	11.88	in	l span/	3,450			d=	11.25	in	l span/	(761)	
E=	1,550	ksi	∆cant=	0.04	in		E=	1,700	ksi	∆cant=	1.20	in
Cv=	1.00		l cant/	2,445			Cv=	1.00		I cant/	140	
$\begin{array}{c c} w1 & w2 & P \\ \hline R1 & L1 & R2 & L2 \\ \hline \end{array}$						R1	w1	1	w	2 L2	∳ P ∤	

Beam		Roof B8	PSL	PSL 1 3/4 x 5 1/2					HSS6X6X5/8		
w=	140	plf	R=	980	lbs		Δ (in)	1/	Fy=	46	ksi
L=	14	ft	M=	3,430	ft-lbs	span	-0.049	-1726	$Mn/\Omega =$	53.3	k-ft
b=	1.75	in	Fb=	4,665	psi	cant.	0.53	317	Vn/Ω =	0.0	kips
d=	5.50	in	Fv=	143	psi						
E=	2000	ksi	Δ=	2.49	in	Beam		Roof-B10	PSL	5 1/4 x	5 1/
Cv=	1.00	≤1.0	1/	67		w=	100	plf	R=	692	lbs
						L=	13.8333333	ft	M=	2,392	ft-lbs
		w				b=	5.25	in	Fb=	1,084	psi
	/	//		//		d=	5.50	in	Fv=	34	psi
Ť					•	E=	2000	ksi	Δ=	0.57	in
D						Cv=	1 00	<1.0	1/	293	

I	Steel Size		C6X8.2			
	=	13.1	in '	Fy=	36	ksi
	Δ=	0.32	in	$Mn/\Omega =$	9.3	k-ft
	1/	527		$Vn/\Omega =$	13.7	kips

	W		
	//	//	
•			A
			•

Beam		Roof B11		HF	3	Х	10	
w1=	360	plf		R1 =		2,309	lbs	
w2=	360	plf		R2 =		2,309	lbs	
L1=	1.25	ft		M =		2,604	lb-ft	
L2=	1.25	ft		Fb =		731	psi	
X=	1.25	ft		Fv =		110	psi	
P=	3,717	lbs		Δ=		0.01	in	
b=	3.00	in		17		3,206		
d=	9.25	in		Cv=		1.00		
E=	1,300	ksi						
w1 ↓ P w2								
R1 $L1$ $L2$ $R2$ $R2$								

6	st/	Project:	Yuan Residence	Date:	06/19/19
STRUCTURAL ENGINEERING			Roof Beams	Project #:	
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Beam		Roof B15	PSL	3 1/2 x	5 1/2	
w1=	40	plf	R1=	92	lbs	
w2=	100	plf	R2=	543	lbs	
L1=	7.5	ft	M+=	106	lb-ft	
L2=	2	ft	M-=	433	lb-ft	
X=	3.75	ft	Fb=	295	psi	
P=	160	lbs	Fv=	23	psi	
b=	3.50	in	∆span=	0.002	in	
d=	5.50	in	l span/	40,360		
E=	2,000	ksi	∆cant=	0.02	in	
Cv=	1.00		l cant/	2,210		
ſ	w1		w2P			
R1	L1		R2	L2	ł	

Beam		Roof-B13	HF	2 x	8
w=	80	plf	R=	260	lbs
L=	6.5	ft	M=	423	ft-lbs
b=	1.50	in	Fb=	386	psi
d=	7.25	in	Fv=	29	psi
E=	1300	ksi	Δ=	0.05	in
Cv=	1.00	≤1.0	1/	1503	
	/	W			-

Beam		Roof-B14		PSL	5 1/4 x	11 7/8	
w1=	80	plf		R1 =	1,362	lbs	
w2=	80	plf		R2 =	2,091	lbs	
L1=	21	ft		M =	11,105	lb-ft	
L2=	6	ft		Fb =	1,080	psi	
X=	20.5	ft		Fv =	48	psi	
P=	1,333	lbs		Δ=	0.70	in	
b=	5.25	in		1/	456		
d=	11.88	in		Cv=	0.98		
E=	2,000	ksi					
w1 ↓ P w2							
R1 _	L1			L2	2 A	R2	

Beam		Roof B16		PSL	3 1/2 x	5 1/2
w1=	130	plf		R1=	54	lbs
w2=	80	plf		R2=	1,330	lbs
L1=	4	ft		M+=	11	lb-ft
L2=	1	ft		M-=	824	lb-ft
X=	2.00	ft		Fb=	560	psi
P=	783.92	lbs		Fv=	64	psi
b=	3.50	in		∆span=	(0.007)	in
d=	5.50	in		l span/	(6,902)	
E=	2,000	ksi		∆cant=	0.02	in
Cv=	1.00			l cant/	1,317	
w1			w2vP			∳ P
R1	L1			,R2	L2	+

6	SE .	Project:	Yuan Residence	Date:	06/19/19
			Roof Beams	Project #:	
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eam:		Beam					_				
La	oad	Dead	Live	Snow	Factored	Location		Support Lo	ocations and	Reactions	Load Factors
	W_1	0.438	0.000	0.3125	0.750			Number of	f Supports	3	Dead
	W_2				0.000		·	Total Bean	n Length	28.00	Live
5	W ₃				0.000			Left End Co	ondition	Pinned	Snow
1/11	W_4				0.000			Right End (Condition	Pinned	
L CC	W ₅				0.000			R ₁	1.029	0.00	Stresses (
	W ₆				0.000			R ₂	14.335	9.50	Locat
	W ₇				0.000			R ₃	5.636	28.00	f _v (psi)
	w ₈				0.000			R ₄	0.000	28.00	f _b (psi)
	w ₉				0.000			R ₅	0.000	28.00	
	w ₁₀				0.000			R ₆	0.000	28.00	Max/Min
2	t ₁				0.000			R ₇	0.000	28.00	f _{v_MAX} (psi
414	t ₂				0.000			R ₈	0.000	28.00	f _{v_MIN} (psi
	t ₃				0.000			R ₉	0.000	28.00	f _{b_MAX} (psi
5	t ₄				0.000			R ₁₀	0.000	28.00	f _{b_MIN} (psi
	t ₅				0.000						
-	t ₆				0.000			Demand C	output		Beam Pro
	P ₁				0.000			Location, f	t	9.49	E (ksi)
	P ₂				0.000			Shear, k	V =	-6.09	b (in)
	P ₃				0.000			Moment, l	k-ft M =	-24.02	d (in)
-	P ₄				0.000			Deflection	, in Δ =	0.00	l (in⁴)
-	P ₅				0.000			∆/Span		L/401330	S (in ³)
5	P ₆				0.000						A (in ²)
	P ₇				0.000						l (Override)
	P ₈				0.000						S (Override)
	P۹				0.000						A (Override)
	P ₁₀				0.000						
						·					
eel B	Beam Se	ection	NONE					Bear	n Loading	<u>Diagram</u>	
						L					
pan			V _{Left} (kips)	V _{Right} (kips)	M (-) (k-ft)	M (+) (k-ft)	Δ_{TL} (in)	@ x =	L/	∆ _⊔ (in) @	x = L/
pan 1			1.03	-6.10	-24.07	0.71	0.047 (个)	6.38	L/2416	0	- L/∞
pan 2	2		8.24	-5.64	-24.07	21.18	-0.459 (↓)	19.66	L/483	0	- L/∞

DATE	6/19/2019
PROJ. #	
DESIGN	haa
SHEET	
	DATE PROJ. # DESIGN SHEET

STRUCTURAL ENGINEERING

Beam Analysis



SHEET



MEMBER REPORT

Level, Roof: Joist B17 1 piece(s) 11 7/8" TJI ® 560 @ 16" OC

23' 9'



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)	987 @ 4 1/2"	1984 (3.50")	Passed (50%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	950 @ 5 1/2"	2358	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5720 @ 12' 4"	10925	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.423 @ 12' 4"	0.797	Passed (L/679)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	1.014 @ 12' 4"	1.196	Passed (L/283)		1.0 D + 1.0 S (All Spans)

System : Roof Member Type : Joist Building Use : Residential Building Code : IBC 2015 Design Methodology : ASD Member Pitch : 0/12

• Deflection criteria: LL (L/360) and TL (L/240).

• Top Edge Bracing (Lu): Top compression edge must be braced at 7' 4" o/c unless detailed otherwise.

1

0

• Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 24' 8" o/c unless detailed otherwise.

	Bearing Length			Loads t	o Supports		
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Stud wall - HF	5.50"	5.50"	1.75"	576	411	987	Blocking
2 - Stud wall - HF	5.50"	5.50"	1.75"	576	411	987	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

			Dead	Snow	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.15)	Comments
1 - Uniform (PSF)	0 to 24' 8"	16"	35.0	25.0	Default Load

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



SUSTAINABLE FORESTRY INITIATIVE

 ForteWEB Software Operator
 Job Notes

 Holly SSF Engineers (817) 475-3103 hashford@ssfengineers.com
 Image: Comparison of Comparis

6/19/2019 6:56:42 PM UTC ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2 File Name: yuan Page 1 / 1



STRUCTURAL

06/19/19
DATE
PROJ. #
HAA
DESIGN
SHEET



MEMBER REPORT

FLOOR, Floor: Joist B1 1 piece(s) 16" TJI ® 230 @ 16" OC



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)	926 @ 4 1/2"	1485 (3.50")	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	890 @ 5 1/2"	2190	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-Ibs)	3981 @ 9' 2 7/8"	5710	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.172 @ 9' 2 7/8"	0.443	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.326 @ 9' 2 7/8"	0.886	Passed (L/652)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	53	40	Passed		

System : Floor Member Type : Joist Building Use : Residential Building Code : IBC 2015 Design Methodology : ASD

• Deflection criteria: LL (L/480) and TL (L/240).

• Top Edge Bracing (Lu): Top compression edge must be braced at 5' o/c unless detailed otherwise.

• Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 18' 3" o/c unless detailed otherwise.

• A structural analysis of the deck has not been performed.

• Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser EdgeTM Panel (24" Span Rating) that is glued and nailed down.

• Additional considerations for the TJ-Pro[™] Rating include: None.

	Bearing Length			Loads t	o Supports (
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - HF	5.50"	4.25"	1.75"	444	493	937	1 1/4" Rim Board
2 - Stud wall - HF	5.50"	4.25"	1.75"	444	493	937	1 1/4" Rim Board
2 - Stud wall - HF	5.50"	4.25"	1.75"	444	493	937	1 1/4" Rim Board

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

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 18' 5 3/4"	16"	36.0	40.0	Default Load

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



ForteWEB Software Operator	Job Notes
Holly SSF Engineers (817) 475-3103 hashford@ssfengineers.com	

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Beam		Main-B2		PSL	3 1/2 x	16
w=	760	plf		R=	4,674	lbs
L=	12.3	ft		M=	14,373	ft-lbs
b=	3.50	in		Fb=	1,155	psi
d=	16.00	in		Fv=	98	psi
E=	2000	ksi		Δ=	0.16	in
Cv=	1.00	≤1.0		1/	901	
	//	W	/		_//	_

wi=	70	рп		RI=	-3430	ibs
w2=	35	plf		R2=	7,718	lbs
L1=	7	ft		M+=	-	lb-ft
L2=	7	ft		M-=	25,725	lb-ft
X=	4.00	ft		Fb=	1,220	psi
P=	3,553	lbs		Fv=	57	psi
b=	6.75	in		∆span=	(0.040)	in
d=	15.00	in		l span/	(2,110)	
E=	1,800	ksi		∆cant=	0.42	in
Cv=	1.00			I cant/	400	
w1			1	w	12	∳ P
R1	L	.1		PR2	L2	∤

GL

6 3/4 x 15

Main-B6

Beam

Beam		Main-B3	PSL	5 1/4 x	: 16	
w=	1007	plf	R=	7,553	lbs	
L=	15	ft	M=	28,322	ft-lbs	
b=	5.25	in	Fb=	1,517	psi	
d=	16.00	in	Fv=	111	psi	
E=	2000	ksi	Δ=	0.32	! in	
Cv=	1.00	≤1.0	1/	562		
		۱۸/				



Beam		Main-B4		ΗF	2 >	< 12
w=	70	plf		२ =	490	lbs
L=	14	ft	1	Л=	1,715	ft-lbs
b=	1.50	in	F	b=	650	psi
d=	11.25	in	F	v=	38	psi
E=	1300	ksi		Δ=	0.26	3 in
Cv=	1.00	≤1.0		1/	642	2
	//	W			//	

Beam		Main-B5	GL	5 1/8 x	13 1/2
w=	490	plf	R=	3,553	lbs
L=	14.5	ft	M=	12,878	ft-lbs
b=	5.13	in	Fb=	993	psi
d=	13.50	in	Fv=	65	psi
E=	1800	ksi	Δ=	0.26	in
Cv=	1.00	≤1.0	17	675	
↓ ► D	//	W	-	//	-

Beam		Main-B7		GL	6 3/4 x	13 1	/2	
w1=	280	plf		R1 =	2,914	lbs		
w2=	385	plf		R2 =	3,238	lbs		
L=	18.50	ft		M =	14,165	lb-ft		
b=	6.75	in		Fb =	829	psi		
d=	13.50	in		Fv =	43	psi		
E=	1,800	ksi		Δ=	0.35	in		
Cv=	0.97			1/	631			
v	w1 w2							







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Project: Yuan Residence Date: 06/19/19 Floor Beams Project #: Design: haa

Sheet:

1

Beam		Main-B9	GL	6 3/4 x	13 1/2
w=	385	plf	R=	1,781	lbs
L=	9.25	ft	M=	4,118	ft-lbs
b=	6.75	in	Fb=	241	psi
d=	13.50	in	Fv=	22	psi
E=	1800	ksi	Δ=	0.03	in
Cv=	1.00	≤1.0	1/	4360	
	~	W		//	

w1=	722	plf		R1 =	4,071	lbs
w2=	1,007	plf		R2 =	5,126	lbs
L1=	6.25	ft		M =	11,340	lb-ft
L2=	3.25	ft		Fb =	911	psi
X=	6.3	ft		Fv =	101	psi
P=	1,411	lbs		Δ=	0.07	in
b=	3.50	in		17	1,649	
d=	16.00	in		Cv=	1.00	
E=	2,000	ksi				
		/1	∳]	Pw2		
R1 _	L1		٢	L2	≁ F	R2

Main-B11

PSL

3 1/2 x 16

Beam

Beam		Main-B10	PSL	3 1/2 x	16
w1=	101	plf	R1 =	1,293	lbs
w2=	101	plf	R2 =	1,411	lbs
L1=	6.67	ft	M =	6,370	lb-ft
L2=	5.67	ft	Fb =	512	psi
X=	6.7	ft	Fv =	34	psi
P=	1,455	lbs	Δ=	0.06	in
b=	3.50	in	17	2,369	
d=	16.00	in	Cv=	1.00	
E=	2,000	ksi			
	w	<u>'1</u> ↓	P w2		
R1 _	L1		_ L2	₽	R2

Beam		Main-B12	GL	5 1/8 x	22 1/2
w=	1012.5	plf	R=	6,075	lbs
L=	12	ft	M=	18,225	ft-lbs
b=	5.13	in	Fb=	506	psi
d=	22.50	in	Fv=	54	psi
E=	1800	ksi	Δ=	L	in
Cv=	0.99	≤1.0	I/	#VALUE!	
		W			
	~	//		//	<u> </u>
					
D					

Beam		Main-B10a	PSL	3 1/2 x	16
w=	466	plf	R=	1,455	lbs
L=	6.25	ft	M=	2,273	ft-lbs
b=	3.50	in	Fb=	183	psi
d=	16.00	in	Fv=	22	psi
E=	2000	ksi	Δ=	0.01	in
Cv=	1.00	≤1.0	17	11213	
	~	W		//	

Beam		Main-B13	PSL	3 1/2 x	16
w1=	724	plf	R1=	2131	lbs
w2=	663	plf	R2=	6,512	lbs
L1=	8	ft	M+=	3,138	lb-ft
L2=	4	ft	M-=	6,111	lb-ft
X=	4.00	ft	Fb=	491	psi
P=	203	lbs	Fv=	72	psi
b=	3.50	in	∆span=	0.010	in
d=	16.00	in	l span/	9,376	
E=	2,000	ksi	∆cant=	0.02	in
Cv=	1.00		I cant/	4,586	
R1	w1	1	w	2 	+ □ ₽



Beam		Main-B14	PSL	3 1/2 x	16
w=	684	plf	R=	2,223	lbs
L=	6.5	ft	M=	3,612	ft-lbs
b=	3.50	in	Fb=	290	psi
d=	16.00	in	Fv=	35	psi
E=	2000	ksi	Δ=	0.01	in
Cv=	1.00	≤1.0	1/	6784	
↓ P	~	W		//	→

Beam		Main-B15		HF	5 x	12			
w1=	253	plf		R1 =	1,678	lbs			
w2=	466	plf		R2 =	2,439	lbs			
L1=	5	ft		M =	5,222	lb-ft			
L2=	3	ft		Fb =	660	psi			
X=	5.0	ft		Fv =	59	psi			
P=	1,453	lbs		Δ=	0.07	in			
b=	4.50	in		1/	1,304				
d=	11.25	in		Cv=	1.00				
E=	1,300	ksi							
	w1 ♥ w2								
R1 _	L1		1	L2	↓ F	R2			

Dale.	06/19/19
Project #:	
Design:	ENG
Sheet:	3
	Project #: Design: Sheet:

Yuan Residence East wall of driveway



UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Yuan Residence East wall of driveway



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X22: E (ksi)=29000.0, I (in4)/pile=156.0

File: K:\2019\01519-2019-01 Yuan\Shoring\East wall of driveway.sh8

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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report.out SHORING WALL CALCULATION SUMMARY The leading shoring design and calculation software Software Copyright by CivilTech Software www.civiltech.com ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA. The calculation method is based on the following references: 1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015 2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987 3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982 4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000 6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002 5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers. 31 March 1994 7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002 8. Temporary Structures in Construction, Robert T. Ratay (Co-author of Chapter 7: John J. Peirce), McGraw-Hill. 2012 9. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002 UNITS: Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft, Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in Licensed to 4324324234 3424343 Date: 4/22/2019 File: K:\2019\01519-2019-01 Yuan\Shoring\East wall of driveway.sh8 Title: Yuan Residence Subtitle: East wall of driveway Wall Type: 2. Soldier Pile, Drilled wall Height: 6.00 Pile Diameter: 1.50 Pile Spacing: 8.00 Factor of Safety (F.S.): 1.00 Lateral Support Type (Braces): 1. No Top Brace Increase (Multi-Bracing): Add 15%* Embedment Option: 1. Yes Friction at Pile Tip: No **Pile Properties:** Steel Strength, Fy: 50 ksi = 345 MPa Allowable Fb/Fy: 0.66 Elastic Module, E: 29000.00 Moment of Inertia, I: 156.00 User Input Pile: W12X22 * DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) * Z1 top NO. Top Pres. Z2 bottom Bottom Pres. Slope _ _ _ 1 0 0 50 2.250 .045 *eq 2 3 0 .036 6 0.036 n * PASSIVE PRESSURE * No. Z1 top Top Pres. Z2 bottom Bottom Pres. Slope -----6 0 1 50 17.60 .4 ____

Page 1

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* ACTIVE SPACE * NO. Z depth Spacing _____ 1 0.00 8.00 2 6.00 1.50 * PASSIVE SPACE * Z depth NO. Spacing _____ 1 6.00 3.00 *For Tieback: Input1 = Diameter; Input2 = Bond Strength
*For Plate: Input1 = Diameter; Input2 = Allowable Pressure
*For Deadman: Input1 = Horz. Width; Input2 = Passive Pressure;
*For Sheet Pile Anchor: Input1 = Horz. Width; Input2 = Passive Slope; The calculated moment and shear are per pile spacing. Sheet piles are per one foot or meter; Soldier piles are per pile. Top Pressures start at depth = 0.00 D1=0.00D2=6.00== ____ D3=15.61 D1 - TOP DEPTH D2 - EXCAVATION BASE D3 - PILE TIP MOMENT equilibrium AT DEPTH=14.01 WITH EMBEDMENT OF 8.01 FORCE equilibrium AT DEPTH=15.61 WITH EMBEDMENT OF 9.61 The program calculates an embedment for moment equilibrium, then increase the embedment by 1.2 * EMBEDMENT Notes * Based on USS Design Manual, first calculate embedment for moment equilibrium, then increased the embedment to get the design depth. The embedment for moment equilibrium is 8.01 The program calculates an embedment for moment equilibrium, then increase the embedment by 1.2 The total desigh embedment is 9.61 Embedment Information: If 20% increased, the total design embedment is 9.61 If 30% increased, the total design embedment is 10.41 If 40% increased, the total design embedment is 11.21 If 50% increased, the total design embedment is 12.01

Page 2

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* MOMENT IN PILE (per pile spacing)* Pile Spacing: sheet piles are one foot or one meter; soldier piles are one pile. Overall Maximum Moment = 42.21 at 10.18 Maximum Shear = 24.74Moment and Shear are per pile spacing: 8.0 foot or meter * VERTICAL LOADING * Vertical Loading from Braces = 0.00Vertical Loading from External Load = 0.00 Total Vertical Loading = 0.00Overall Maximum Moment = 42.21 at 10.18 The pile selection is based on the magnitude of the moment only. Axial force is neglected. Request Min. Section Modulus = 15.35 in3/pile = 251.50 cm3/pile. Fv= 50 ksi = 345 MPa, Fb/Fy=0.66w12x22 has been found in Soldier Pile list! (English Units): Area= 6.48 in. Depth= 12.3 in. Width= 4.03 in. Height= 12 in. Flange thickness= 0.425 in. Web thickness= 0.26 in. Ix= 156 in4/pile Sx= 25.4 in3/pile Iy = 4.66 in 4/pileSy= 2.31 in3/pile(Metric Units): Ix= 64.93 x100cm4/pile Sx= 416.23 cm3/pile Iy= 1.94 x100cm4/pile Sv= 37.85 cm3/pile The pile selection is based on the magnitude of the moment only. Axial force is neglected. W12X22 is capable to support the shoring! Top deflection = 0.352(in)Max. deflection = 0.352(in)Max. Pressure above base = 0.31Piles are more rigid than timber lagging, due to arching, only portion of pressures are acting to lagging, 30-50% loading is suggested. If 50% loading is used for lagging design, Design Pressure = 0.15 Pile Spacing =8.0, Max. Moment in lagging = 1.22 For 4"x12" Timber, Section Modules S=23.47 in3. The request allowable bending strength, fb=M/S=0.63 For 6"x12" Timber, Section Modules S=57.98 in3. The request allowable bending strength, fb=M/S=0.25 If 30% loading is used for lagging design, Design Pressure = 0.09 Pile Spacing =8.0, Max. Moment in lagging = 0.73 For 4"x12" Timber, Section Modules S=23.47 in3. The request allowable bending strength, fb=M/S=0.38
For 6"x12" Timber, Section Modules S=57.98 in3. The request allowable bending strength, fb=M/S=0.15 Unit: Pressure: ksf, Spacing: ft, Moment: kip-ft, Bending Strength, fb: ksi



Get	PROJECT	DATE
STRUCTURAL		PROJ. #
ENGINEERING		DESIGN
		SHEET

()

WHALER DESIGN **O** 206 443.6212 W= 1.92 Mb-L = 8'-0°% 2124 Third Ave, Suite 100, Seattle, WA 98121 934 Broadway, Suite 100, Tacoma, WA 98402 AS A MULTISPH BON Mucx = 15.364.6 Rm#= 19.22 $P_{1} = \frac{15.36^{14} (12)}{36/1.67} = 8.5^{1/3} \text{ Ald Group}$ $Srevid = \frac{15.36^{14} (12)}{36/1.67} = 6.7^{1/3}$ $Srevid = \frac{15.36^{14} (12)}{46/1.67} = 6.7^{1/3}$ USIWH CUANNER USILIE TUBE SEATTLE TACOMA SELVET HISS BX4 x 1/2 Sy= 11.8 1.3 Stengineers.com 01-SWENSON SAY FAGÉT

STRUCTURAL

PROJECT

DATE

PROJ. #

DESIGN

SHEET

This Wall in File: K:\2019\0	1519-2019-01 Yuan\Cal	culations\pin piles\061819 Typica	l Detail	l Co-04-07.		
RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	d 11.19.06.12 SAY FAGET	Cantilevered Retain	ing V	Vall	Code: IBC 2012,A	CI 318-11,ACI 530-11
Criteria		Soil Data				
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 10.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Soil Bearing = 2 Equivalent Fluid Pressure Method Active Heel Pressure = Active Heel Pressure = = Passive Pressure = = Soil Density, Heel = = Soil Density, Toe = = Footing Soil Friction = Soil height to ignore for passive pressure =	2,000.0 /d 35.0 400.0 125.00 0.00 0.450 12.00) psf) psf/ft) psf/ft) pcf) pcf) in	Rostrain	
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing L	_oad
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= 0.0 psf & Overturning = 0.0 rturning	Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Se	0.0 #/ 0.00 ft 0.00 ft nd (W) rvice Le	/ft evel)	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 lbs = 0.0 in	Wind on Exposed Stem ₌ (Service Level)	0.0 ps	sf	Base Above/Below Soil at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Design Summary		Stem Construction	—	Bottom		
Wall Stability Ratios Overturning Slab Resis	= 2.00 OK sts All Sliding !	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness] ft = ' = =	Stem OK 0.00 Concrete LRFD 8.00		
Total Bearing Loadresultant ecc.	= 4,211 lbs = 0.00 in	Rebar Spacing Rebar Placed at	=	# 7 12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Les	= 711 psf Oł = 711 psf Oł = 2,000 psf s Than Allowable - 996 psf	Design Data fb/FB + fa/Fa Total Force @ Section Service Level Strength Level	= Ibs = Ibs =	0.711 2,800.0		
ACI Factored @ Heel	= 996 psf	MomentActual Service Level	ft-# =	-		
Footing Shear @ Heel Allowable Sliding Calcs	= 6.1 psi OF = 75.0 psi	Strength Level MomentAllowable ShearActual	ft-# = =	9,333.3 13,107.2		
Lateral Sliding Force	= 2,314.4 lbs	Service Level Strength Level ShearAllowable	psi = psi = psi =	41.9 75.0		
		Rebar Depth 'd' Masonry Data	in2 = in = psi =	5.56		
Vertical component of activ NOT considered in the calc	re lateral soil pressure la culation of soil bearing	Fs S Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf =	100.0		
Load Factors Building Code Dead Load Live Load	IBC 2012,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	=	Medium V ASD	Veight	
Earth, H Wind, W Seismic, E	1.600 1.000 1.000	Concrete Data f'c Fy	psi = psi =	2,500.0 60,000.0		

Page : 2 Date: 16 JUL 2019

RetainPro (c) 1987-2019, Build 11.19.06.12 License : KW-06052576 License To : SWENSON SAY FAGET	Cantilevered	Retaining Wall	Code: IBC 2012,ACI 318-11,ACI 530-11
Concrete Stem Rebar Area D	etails		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3955 in2/ft	0	
(4/3) * As :	0.5274 in2/ft	Min Stem T&S Reinf Are	a 1.920 in2
200bd/fy : 200(12)(5.5625)/60000 :	0.2225 in2/ft	Min Stem T&S Reinf Are	a per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing O	ptions :
		One layer of : Two la	ayers of :
Required Area :	0.3955 in2/ft	#4@ 12.50 in #4@	25.00 in
Provided Area :	0.6 in2/ft	#5@ 19.38 in #5@	38.75 in
Maximum Area :	0.7535 in2/ft	#6@ 27.50 in #6@	55.00 in
Footing Data	Footing De	esign Results	
Toe Width =	3.75 ft	<u>Toe</u> <u>He</u> e	<u>el</u>
Heel Width =	2.17 Factored Pressu	re = 996 99	96 psf
Total Footing Width =	5.92 Mu' : Upward	= 7,002 1,12	25 ft-#
Footing Thickness = 18	3.00 in Mu: Design	= 2,426 2,00	00 ft-# 75 ft-#
Key Width = 0	0.00 in Actual 1-Way Sh	ear = 829 60	no nei
Key Depth = (Allow 1-Way She	ar = 40.00 40.0	00 psi
Key Distance from Loe = 0	0.00 ft Toe Reinforcing	= #7 @ 12.00 in	
f'c = 2,500 psi $Fy = 60,Footing Concrete Density = 150$	000 psi Heel Reinforcing 0.00 pcf Key Reinforcing	= # 4 @ 18.00 in = None Spec'd	
Min. As % = 0.0	018 Footing Torsion,	Tu = 0	.00 ft-lbs
Cover @ Top 2.00 @ Btm.=	3.00 in Footing Allow. To	orsion, phi Tu = 0	.00 ft-lbs
	If torsion exc supplementa	eeds allowable, provide l design for footing torsio	n.
	Other Acceptab Toe: #4@ 6.1 Heel: Not req'o Key: No key o	le Sizes & Spacings 6 in, #5@ 9.56 in, #6@ 13.5 I: Mu < phi*5*lambda*sqrt(fo defined	57 in, #7@ 18.51 in, #8@ 24.37 in, #9@ 30. c)*Sm
	Min footing T& Min footing T& If one layer of H #4@ 6.17 in #5@ 9.57 in #6@ 13.58 ii	S reinf Area 2.3 S reinf Area per foot 0.3 norizontal bars: If two 4 4 5 6 #5 6 #6	30 in2 39 in2 /ft 0 layers of horizontal bars: @ 12.35 in @ 19.14 in @ 27.16 in

License : KW-06052576 License To : SWENSON	I SAY	FAGET		Cantilevere	d Retaining Wall	Code: IBC 20	012,ACI 318	-11,ACI 530-
Summary of Ove	rturr	ning & R	esisting F	orces & Mon	nents			
Item		Force Ibs	ERTURNING Distance ft	G Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tb HL Act Pres (be water tb Hydrostatic Force	l) l)	2,314.4	3.83	8,871.8	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	9,712.2 9,712.2
Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load Added Lateral Load Load @ Stem Above So	= = = = il =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe =		1.88	
	=				Surcharge Over Toe = Stem Weight(s) = Earth @ Stem Transitions =	1,000.0	4.08	4,083.3
Total Resisting/Overturnin	= a Rati	2,314.4	O.T.M. =	8,871.8 2.00	Footing Weigh1 = Key Weight = Vert Component =	1,332.0	2.96	3,942.7
Vertical Loads used f	or Soi	Pressure	= 4,211.	.2 lbs	Total = * Axial live load NOT included resistance, but is included for	4,211.2 I in total display r soil pressure	bs R.M.= ed, or used fo calculation.	17,738.2 r overturning

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	рсі
Horizontal Defl @ Top of Wall (approximate only)	0.000	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

nilan/061810 Typical Datail Co. 04.07

RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	a 11.19 AY FA	.06.12 AGET		Cantilevered Retain	ing V	Vall	Code: IBC 2012,ACI 318-11,ACI 530-		
Criteria			S	oil Data					
Retained Height Wall height above soil Slope Behind Wall	= = =	3.00 ft 0.00 ft 0.00	All Ec Ac	low Soil Bearing = uivalent Fluid Pressure Metho tive Heel Pressure =	2,667.0 od 35.0) psf) psf/ft			
Height of Soil over Toe Water height over heel	=	6.00 in 0.0 ft	Pa So So Fo	assive Pressure = pil Density, Heel = pil Density, Toe = poting Soil Friction = pil height to ignore for passive pressure =	400.0 125.00 0.00 0.450 12.00) psf/ft) pcf) pcf) in	Restrait		
Surcharge Loads			L	ateral Load Applied to	Stem		Adjacent Footing I	Load	
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= & Ove = turning	0.0 psf rturning 0.0	La 	ateral Load = Height to Top = Height to Bottom =	0.0 #, 0.00 ft 0.00 ft	/ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft	
Axial Load Applied	l to S	tem		(Se	rvice Le	evel)	Footing Type	Line Load	
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in	v (Vind on Exposed Stem _ Service Level)	0.0 p	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300	
Earth Pressure Se	ismi	c Load							
Method : Uniform Multiplier Used (Multiplier used on soil d	= ensity)	6.000	Ui To	niform Seismic Force = 2 otal Seismic Force = 8	2.000 0.667				
Design Summary				Stem Construction		Bottom			
Wall Stability Ratios Overturning Slab Resis	= its All \$	1.38 Rat Sliding !	0 < 1.	Design Height Above Ft Wall Material Above "Ht 5! Design Method Thickness Rebar Size	g ft = " = = =	Stem OK 0.00 Concrete LRFD 8.00 # 4			
Total Bearing Loadresultant ecc.	= =	605 lbs 0.00 in		Rebar Spacing Rebar Placed at	=	18.00 Edge	1		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	403 psf 403 psf 2,667 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.09	5		
Soil Pressure Les ACI Factored @ Toe ACI Factored @ Heel	s Than = =	Allowable 565 psf 565 psf		Strength Level MomentActual	lbs =	318.0			
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	0.2 psi 0.0 psi 75.0 psi	OK OK	Strength Level MomentAllowable	ft-# = =	351.0 3,655.6)		
Sliding Calcs Lateral Sliding Force	=	291.7 lbs		Service Level Strength Level	psi = psi =	4.2	1		
				ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = in2 = in =	75.0 6.25			

Masonry Data -

Solid Grouting

Wall Weight

Concrete Data

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

f'm Fs

f'c

Fy

psi =

psi =

psf =

psi =

=

=

=

=

= ASD

100.0

= Medium Weight

2,500.0 psi = 60,000.0

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

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

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Concrete Stem Rebar Area Deta	ails	
Bottom Stem	Vertical Reinforcing Horizontal Reinforcing	g
As (based on applied moment) :	0.0132 in2/ft	
(4/3) * As :	0.0175 in2/ft Min Stem T&S Reinf	Area 0.576 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft Min Stem T&S Reinf	Area per ft of stem Height : 0.192 in2/ft
0.0012bh : 0.0012(12)(8) :	0.1152 in2/ft Horizontal Reinforcing	g Options :
	========= One layer of : Tw	vo layers of :
Required Area :	0.1152 in2/ft #4@ 12.50 in #	4@ 25.00 in
Provided Area :	0.1333 in2/ft #5@ 19.38 in #	5@ 38.75 in
Maximum Area :	0.8467 in2/ft #6@ 27.50 in #	6@ 55.00 in
Footing Data	Footing Design Results	
Toe Width = 0.42	2 ft <u>Toe</u>	Heel
Heel Width = 1.08	B Factored Pressure = 565	565 psf
Total Footing Width = 1.50	Mu': Upward = 50	48 ft-#
Footing Thickness = 8.00) in Mu': Downward = 17 Mu: Design - 33	49 ft-#
Key Width = 0.00) in $Actual 1-Way Shear = 0.22$	0.03 psi
Key Depth = 0.00	Allow 1-Way Shear = 40.00	40.00 psi
Key Distance from Toe = 0.00) ft Toe Reinforcing = None Spec'd	
f'c = 2,500 psi Fy = 60,000 Footing Concrete Density = 150.00	ppsi Heel Reinforcing = None Spec'd ppcf Key Reinforcing = None Spec'd	
Min. As % = 0.0018	B Footing Torsion, Tu =	0.00 ft-lbs
Cover @ Top 2.00 @ Btm.= 3	.00 in Footing Allow. Torsion, phi Tu =	0.00 ft-lbs
	If torsion exceeds allowable, provic supplemental design for footing to	de rsion.
	Other Acceptable Sizes & Spacings	
	Toe: #4@ 13.88 in, #5@ 21.52 in, #60 Heel: Not req'd: Mu < phi*5*lambda*sq Key: No key defined	@ 30.55 in, #7@ 41.66 in, #8@ 54.85 in, #9@ 6 ∣rt(f'c)*Sm
	Min footing T&S reinf Area Min footing T&S reinf Area per foot If one layer of horizontal bars: If #4@ 13.89 in #5@ 21.53 in #6@ 30.56 in	0.26 in2 0.17 in2 /ft two layers of horizontal bars: #4@ 27.78 in #5@ 43.06 in #6@ 61.11 in

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Summary of Overt	urning & R	esisting F	orces & Mon	nents			
Item	Force	ERTURNING Distance ft	Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	2,314.4	3.83	287.6	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	200.5 200.5
Buoyant Force = Surcharge over Heel = Surcharge Over Toe = Adjacent Footing Load =	= = =			Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =			
Load @ Stem Above Soil = Seismic Earth Load	= = = 56.5 =	1.83	103.5	Soil Over Toe = Surcharge Over Toe = Stem Weight(s) = Earth @ Stem Transitions	300.0	0.21 0.75	226.0
Total :	= 291.7	O.T.M. =	391.1	Footing Weight = Key Weight =	150.0	0.75	112.5
Vertical Loads used for	Soil Pressure	= 605.0	0 lbs	Total = * Axial live load NOT included resistance, but is included for	605.0 ll in total displaye	bs R.M.= ed, or used fo calculation.	539.0 r overturning

If seismic is included, the OTM and sliding ratios be 1.1 per section 1807.2.3 of IBC 2009 or IBC 201

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

|--|

Horizontal Defl @ Top of Wall (approximate only) 0.000 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON S	d 11.19.06.12	i i c ai c	Cantilevered Retaini	ing V	Vall	Code: IBC 2012,ACI 318-11,ACI 530-11
Criteria			Soil Data			
Retained Height Wall height above soil Slope Behind Wall	$= 12.50 \text{ ft} \\ = 0.00 \text{ ft} \\ = 0.00 \\ c.00 \text{ in} $		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = -	2,000.0 d 35.0	psf psf/ft	
Water height over heel	= 0.00 m = 0.0 ft		Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	400.0 125.00 0.00 0.450 12.00	psf/ft pcf pcf in	Restant
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= 0.0 psf & Overturning = 0.0 turning	-	Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 #/ 0.00 ft 0.00 ft d (W)	/ft	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
Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 lbs = 0.0 in		(Ser Wind on Exposed Stem ₌ (Service Level)	vice Le 0.0 p	evel) sf	Base Above/Below Soil at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary			Stem Construction		Bottom	
Wall Stability Ratios Overturning Slab Resis	= 1.58 C sts All Sliding !	рК	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size	ft = = = =	Stem OK 0.00 Concrete LRFD 10.00 # 7	
resultant ecc.	= 5,152 lb = 0.00 in	5	Rebar Spacing Rebar Placed at Design Data	=	12.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Les	= 772 ps = 772 ps = 2,000 ps s Than Allowable	if OK if OK if	fb/FB + fa/Fa Total Force @ Section Service Level	= Ibs =	0.984	
ACI Factored @ Toe ACI Factored @ Heel	= 1,081 ps = 1,081 ps	sf sf	Strength Level MomentActual	lbs =	4,375.0	
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 13.5 ps = 7.4 ps = 75.0 ps	i OK i OK i	Strength Level MomentAllowable ShearActual	ft-# = =	18,229.2 18,507.2	
Lateral Sliding Force	= 3,430.0 lbs	3	Service Level Strength Level ShearAllowable Anet (Masonry) Bebar Denth 'd'	psi = psi = psi = in2 = in =	48.2 75.0 7.56	
			Masonry Data f'm Fs Solid Crouting	psi = psi =	7.50	
NOT considered in the calc	e lateral soil press culation of soil bear	ing	Modular Ratio 'n' Wall Weight	= = psf =	125.0	
Building Code Dead Load Live Load Earth, H	IBC 2012,ACI 1.200 1.600 1.600		Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = =	Medium V ASD	Veight
Wind, W Seismic, E	1.000 1.000		f'c Fy	psi = psi =	2,500.0 60,000.0	

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Concrete Stem Rebar Area Deta	ails		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment): $(4/2) * A_{2}$	0.5592 III2/II	Min Stom TRS Doinf Aroo	3 000 in 3
(4/3) AS. 200bd/($4/2$)/7 EE2E)/E0000 ·	0.7430 III2/It	Min Stem T&S Reini Area	3.000 IIIZ
$20000/19 \cdot 200(12)(7.3823)/80000 \cdot 0.0018hh \cdot 0.0018(12)(10) \cdot 0.0018(12)(10)(10)(10)(10)(10)(10)(10)(10)(10)(10$	0.3023 112/11	Harizontal Painforning Ont	
0.0018011. 0.0018(12)(10) .	0.218 112/10		
Poquired Area :	======================================		
Required Area :	0.5592 III2/II	#4@10.00 III #4@2	1.00 in
		#5@ 15.50 III #5@ 3	1.00 in 4.00 in
	1.0245 In2/ft	#6@ 22.00 In #6@ 4	4.00 IN
Footing Data	Footing Des	ign Results	
Toe Width= 4.50 Heel Width= 2.17 Total Footing Width= 6.67 Footing Thickness= 18.00 Key Width= 0.00 Key Depth= 0.00 Key Distance from Toe= 0.00 f'c= $2,500$ psiFyFooting Concrete Density= 150.00 Min. As %= 0.0018 Cover @ Top 2.00 @ Btm.=3.	0 ft Factored Pressure 7 Mu': Upward 9 in Mu': Downward 9 in Actual 1-Way Shea 9 in Actual 1-Way Shea 9 in Allow 1-Way Shea 9 ft Toe Reinforcing 9 psi Heel Reinforcing 9 pcf Key Reinforcing 8 Footing Torsion, To 00 in Footing Allow. Tors If torsion exce supplemental	Toe Heel = $1,081$ $1,081$ = $10,949$ 966 = $3,493$ $1,916$ = $7,455$ 950 ar = 13.46 7.41 r = 75.00 40.00 = # 7 @ 12.00 in = = # 4 @ 18.00 in = = None Spec'd J = 0.0 sion, phi Tu = 0.0 eds allowable, provide	psf ft-# ft-# ft-# psi psi 0 ft-lbs 0 ft-lbs
	Other Acceptable Toe: #4@ 6.16 Heel: Not req'd: Key: No key de Min footing T&S If one layer of ho #4@ 6.17 in #5@ 9.57 in #6@ 13.58 in	Sizes & Spacings in, #5@ 9.56 in, #6@ 13.57 Mu < phi*5*lambda*sqrt(f'c)* fined reinf Area 2.59 reinf Area per foot 0.39 rizontal bars: If two la #4@ #5@ #6@	in, #7@ 18.51 in, #8@ 24.37 in, #9@ 30. *Sm in2 in2 /ft ayers of horizontal bars: 12.35 in 19.14 in 27.16 in

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Summary of Ove	rturning &	Resisting F	orces & Mon	nents			
Item	Force	VERTURNING Distance ft	G Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tb HL Act Pres (be water tb Hydrostatic Force Buoyant Force Surcharge over Heel Surcharge Over Toe)) 2,314.4)) = = =	4 3.83	16,006.7	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load =	1,879.2	5.17 5.17	12,534.7 12,534.7
Adjacent Footing Load Added Lateral Load Load @ Stem Above Soi	= = = =			* Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe =	4 500 5	2.25	7 000 0
Total	= 3,430.0) O.T.M. =	16,006.7	Stem Weight(s) = Earth @ Stem Transitions = Footing Weight = Key Weight =	1,562.5	4.92 3.34	5,005.0
Vertical Loads used f	g Ratio or Soil Pressur	= = 5,151	1.38 .8 lbs	Vert. Component _= Total = * Axial live load NOT included i resistance. but is included for	5,151.8 I in total display soil pressure	bs R.M.= ed, or used fo calculation.	25,222.0 r overturning

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	рсі
Horizontal Defl @ Top of Wall (approximate only)	0.000	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

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Criteria	Soil Data	
Retained Height=12.50 ftWall height above soil=0.00 ftSlope Behind Wall=0.00Height of Soil over Toe=6.00 inWater height over heel=0.0 ft	Allow Soil Bearing=2,000.0 psfEquivalent Fluid PressureMethodActive Heel Pressure=35.0 psf/ft=	Restrant
Surcharge Loads	Lateral Load Applied to Stem	Adjacent Footing Load
Surcharge Over Heel = 0.0 psf Used To Resist Sliding & Overturning Surcharge Over Toe = 0.0 Used for Sliding & Overturning	Lateral Load = 0.0 #/ft Height to Top = 0.00 ft Height to Bottom = 0.00 ft Load Type = Wind (W)	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
Axial Load Applied to Stell	(Service Level)	Base Above/Below Soil0 0 ft
Axial Dead Load = 0.0 lbs Axial Live Load = 0.0 lbs Axial Load Eccentricity = 0.0 in	(Service Level)	at Back of Wall = 0.300 Poisson's Ratio = 0.300
Earth Pressure Seismic Load		
Method:Uniform Multiplier Used = 6.000 (Multiplier used on soil density)	Uniform Seismic Force = 84.000 Total Seismic Force = 1,176.000	
Design Summary	Stem Construction Bottom	
Wall Stability RatiosOverturning=Slab Resists All Sliding !Total Bearing Load=resultant ecc.=0.00 in	Design Height Above Ftg ft = 0.00 Wall Material Above "Ht" = Concrete < 1.5!	
Soil Pressure @ Toe = 784 psf C	Design Data M fb/FB + fa/Fa = 0.879	
Soil Pressure @ Heel = 784 psf (Allowable = 2,000 psf Soil Pressure Less Than Allowable ACI Factored @ Toe = 1,098 psf ACI Factored @ Heel = 1.098 psf	JK Total Force @ Section Service Level lbs = Strength Level lbs = 5,425.0 MomentActual Image: Strength Level lbs = 5,425.0	
Footing Shear @ Toe=1,000 psiFooting Shear @ Heel=7.7 psiConting Shear @ Heel=7.7 psi	Service Level ft-# = K Strength Level ft-# = 24,791.7 Margaret Allowable = 28,158.8	
Allowable = 75.0 psi	ShearAntual	
Lateral Sliding Force = 4,253.2 lbs	Service Level psi = Strength Level psi = 60.8	
	ShearAllowable psi = 75.0 Anet (Masonry) in2 =	
	Masonry Data f'm psi =	

Fs

f'c

Fy

Solid Grouting

Wall Weight

Concrete Data

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

psi =

psf =

psi =

=

=

=

=

= ASD

125.0

= Medium Weight

2,500.0 psi = 60,000.0

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

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

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Concrete Stem Rebar Area Detai	ls		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.7739 in2/ft		
(4/3) * As :	1.0319 in2/ft	Min Stem 1&S Reinf Area	3.000 in2
200bd/fy : 200(12)(7.4375)/60000 :	0.2975 in2/ft	Min Stem T&S Reinf Area	per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Opt	tions :
		One layer of : Two lay	vers of :
Required Area :	0.7739 in2/ft	#4@ 10.00 in #4@ 2	20.00 in
Provided Area :	1 in2/ft	#5@ 15.50 in #5@ 3	31.00 in
Maximum Area :	1.0075 in2/ft	#6@ 22.00 in #6@ 4	14.00 in
Footing Data	Footing Des	sign Results	
Toe Width= 4.50 fm Heel Width= 2.25 Total Footing Width= 6.75 Footing Thickness= 18.00 im Key Width= 0.00 im Key Depth= 0.00 im Key Distance from Toe= 0.00 fm f'c= $2,500 \text{ psi}$ Fy = $60,000 \text{ pm}$ Footing Concrete Density= 150.00 pm Min. As %= 0.0018 Cover @ Top 2.00 @ Btm.= 3.000 pm	t Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shea Allow 1-Way Shea t Toe Reinforcing bocf Key Reinforcing Footing Torsion, To 0 in Footing Allow. Tors If torsion exce supplemental	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	l 3 psf 2 ft-# 2 ft-# 0 ft-# 2 psi 0 psi 00 ft-lbs 00 ft-lbs
	Other Acceptable Toe: #4@ 6.16 Heel: Not req'd: Key: No key de Min footing T&S Min footing T&S If one layer of ho #4@ 6.17 in #5@ 9.57 in #6@ 13.58 in	e Sizes & Spacings in, #5@ 9.56 in, #6@ 13.57 Mu < phi*5*lambda*sqrt(f'c) fined reinf Area 2.62 reinf Area per foot 0.33 prizontal bars: If two 1 #4@ #5@ #6@	7 in, #7@ 18.51 in, #8@ 24.37 in, #9@ 30. *Sm 2 in2 9 in2 <i>f</i> t layers of horizontal bars: 2 12.35 in 2 19.14 in 2 27.16 in

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Summary of Overt	urning & R	esisting F	orces & Mon	nents			
Item	Force Ibs	/ERTURNING Distance ft	Moment ft-#		R Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	2,314.4	3.83	16,006.7	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	13,373.5 13,373.5
Buoyant Force = Surcharge over Heel = Surcharge Over Toe = Adjacent Footing Load =	: : :			Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =			
Load @ Stem Above Soil = Seismic Earth Load =	= = = 823.2 =	7.00	5,762.4	Soil Over Toe = Surcharge Over Toe = Stem Weight(s) =	1,562.5	2.25 4.92	7,682.3
Total :	= 4,253.2 Ratio	O.T.M. = =	21,769.1	Footing Weight = Key Weight = Vert. Component =	1,518.8	3.38	5,125.8
Vertical Loads used for	Soil Pressure	= 5,294.	8 lbs	Total = * Axial live load NOT included i resistance, but is included for	5,294.8 n total display soil pressure	lbs R.M.= yed, or used fo calculation.	26,181.6 r overturning

If seismic is included, the OTM and sliding ratios be 1.1 per section 1807.2.3 of IBC 2009 or IBC 201

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0 pc	i
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Horizontal Defl @ Top of Wall (approximate only) 0.000 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

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Criteria				Soil	Data				
Retained Height = Wall height above soil = Slope Behind Wall =	= 1(= (= (0.00 ft 0.00 ft 0.00		Allow Equiv Active	Soil Bearing = ralent Fluid Pressure Me e Heel Pressure =	2,667.0 ethod : 35.0	psf psf/ft		
Height of Soil over Toe = Water height over heel =	= 6	6.00 in 0.0 ft		Passi Soil E Soil E Footir Soil h for	= ve Pressure = Density, Heel = Density, Toe = ng Soil Friction = ueight to ignore passive pressure =	400.0 125.00 0.00 0.450	psf/ft pcf pcf in	Restraint	
Surcharge Loads				Late	eral Load Applied	to Stem		Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overt	& Overti = urning	0.0 psf urning 0.0		Later Hei Hei Load	ral Load = ight to Top = ight to Bottom = Type = V	0.0 #/ 0.00 ft 0.00 ft Wind (W)	ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft
Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	to Ste = = =	0.0 lbs 0.0 lbs 0.0 in		Wind (Se	d on Exposed Stem ₌ rvice Level)	(Service Le 0.0 ps	evel) sf	Base Above/Below Soil at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Earth Pressure Sei	smic	Load							
Method:Uniform Multiplier Used = (Multiplier used on soil de	= 6. ensity)	000		Unifo Total	rm Seismic Force = Seismic Force =	69.000 793.500			
Design Summary				Ste	em Construction		Bottom		
Wall Stability Ratios Overturning Slab Resist	= s All Sli	1.47 F iding !	Ratio <	1.5!	Design Height Above Wall Material Above Design Method Thickness	Ftg ft = "Ht" = =	Concrete LRFD 8.00		
Total Bearing Loadresultant ecc.	= =	4,211 II 0.00 ii	os 1		Rebar Size Rebar Spacing Rebar Placed at Design Data	= = =	# 7 12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	711 p 711 p 2,667 p	osf OK osf OK osf		fb/FB + fa/Fa Total Force @ Secti Service Level	= on lbs =	0.974	i -	
ACI Factored @ Toe ACI Factored @ Heel	= =	996 p 996 p	osf osf		Strength Level MomentActual Service Level	lbs = ft-# =	3,490.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	8.3 p 6.1 p 75.0 p	osi OK osi OK osi		Strength Level MomentAllowable	ft-# = =	12,783.3 13,107.2	i	
Lateral Sliding Force	= 2	2,869.8 lk	os		Service Level Strength Level ShearAllowable Anet (Masonry)	psi = psi = psi = in2 =	52.3 75.0		
					Rebar Depth 'd' Masonry Data f'm	in =	5.56		
Vertical component of active NOT considered in the calcu	e lateral lation c	soil pres of soil bea	sure IS aring	6	rs Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf =	100.0		

Short Term Factor

Equiv. Solid Thick.

Concrete Data

f'c

Fy

Masonry Block Type

Masonry Design Method

=

=

psi =

= ASD

psi = 60,000.0

= Medium Weight

2,500.0

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

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Concrete Stem Rebar Area Detai	ls		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.5417 in2/ft	C C	
(4/3) * As :	0.7223 in2/ft	Min Stem T&S Reinf Area	1.920 in2
200bd/fy : 200(12)(5.5625)/60000 :	0.2225 in2/ft	Min Stem T&S Reinf Area	per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Opt	tions :
		One layer of : Two lay	vers of :
Required Area :	0.5417 in2/ft	#4@ 12.50 in #4@ 2	25.00 in
Provided Area :	0.6 in2/ft	#5@ 19.38 in #5@ 3	38.75 in
Maximum Area :	0.7535 in2/ft	#6@ 27.50 in #6@ 5	55.00 in
Footing Data	Footing Des	ign Results	
Toe Width= 3.75° Heel Width= 2.17° Total Footing Width= 5.92° Footing Thickness= 18.00° Key Width= 0.00° Key Depth= 0.00° Key Distance from Toe= 0.00° f'c= $2,500$ psiFy =Footing Concrete Density= 150.00° Min. As %= 0.0018 Cover @ Top 2.00° @ Btm.= 3.0°	ft Factored Pressure Mu': Upward Mu': Downward Mu: Design n Actual 1-Way Shea n Allow 1-Way Shea it Toe Reinforcing bof Key Reinforcing Footing Torsion, Tu 0 in Footing Allow. Tors If torsion exce supplemental	Toe Heel = 996 996 = 7,002 1,125 = 2,426 2,000 = 4,577 875 ar = 8.29 6.06 r = 40.00 40.00 = # 7 @ 12.00 in = # 4 @ 18.00 in = None Spec'd	L 6 psf 5 ft-# 0 ft-# 5 ft-# 6 psi 0 psi 00 ft-lbs 00 ft-lbs
	Other Acceptable Toe: #4@ 6.16 Heel: Not req'd: Key: No key de Min footing T&S Min footing T&S If one layer of ho #4@ 6.17 in #5@ 9.57 in #6@ 13.58 in	Sizes & Spacings in, #5@ 9.56 in, #6@ 13.57 Mu < phi*5*lambda*sqrt(f'c)	7 in, #7@ 18.51 in, #8@ 24.37 in, #9@ 30. *Sm 9 in2 9 in2 <i>I</i> ft layers of horizontal bars: 9 12.35 in 9 19.14 in 9 27.16 in

RetainPro (c) 1987-2019, Bui License : KW-06052576 License To : SWENSON 3	ild 11. SAY I	19.06.12 FAGET		Cantilevere	d Retaining Wall	Code: IBC 20	012,ACI 318	-11,ACI 530-1
Summary of Over	turn	ing & R	esisting F	orces & Mom	nents			
Item		Force Ibs	ERTURNING Distance ft	G Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		2,314.4	3.83	8,871.8	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	9,712.2 9,712.2
Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load Added Lateral Load	= = =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =			
Load @ Stem Above Soil Seismic Earth Load	= = =	555.5	5.75	3,193.8	Soll Over Toe = Surcharge Over Toe = Stem Weight(s) =	1,000.0	1.88 4.08	4,083.3
Total	=	2,869.8	O.T.M. =	12,065.6	Footing Weight = Key Weight =	1,332.0	2.96	3,942.7
Resisting/Overturning Vertical Loads used fo	r Soil	o Pressure :	= = 4,211	1.47 .2 lbs	Vert. Component = Total = * Axial live load NOT included resistance, but is included	4,211.2	bs R.M.= ed, or used fo	17,738.2 r overturning

If seismic is included, the OTM and sliding ratios be 1.1 per section 1807.2.3 of IBC 2009 or IBC 201

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

|--|

Horizontal Defl @ Top of Wall (approximate only) 0.000 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

This Wall in File: K:\2019\0	1519-2019-01 Yuan\Cal	culations\pin piles\061819 Typica	l Detail	l Co-04-07.		
RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	d 11.19.06.12	Cantilevered Retain	ing V	Vall	Code: IBC 2012,A	CI 318-11,ACI 530-11
Criteria		Soil Data				
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 8.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	2,000.0 d 35.0 400.0 125.00 0.00 0.450 12.00) psf) psf/ft) psf/ft) pcf) pcf) in	Bestrand	
Surcharge Loads		Lateral Load Applied to	Stem	1	Adjacent Footing I	_oad
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= 0.0 psf & Overturning = 0.0 rturning d to Stem	Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 #/ 0.00 ft 0.00 ft id (W)	/ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
Axial Dead Load Axial Live Load	= 0.0 lbs = 0.0 lbs	Wind on Exposed Stem = (Service Level)	0.0 p	sf	Base Above/Below Soil at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
	= 0.0 in	Otomo Comotinuation		Pattam		
Design Summary		Stem Construction		Stem OK		
Wall Stability Ratios Overturning Slab Resis	= 1.84 OK sts All Sliding !	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Beber Size	J ft = = = =	0.00 Concrete LRFD 8.00		
Total Bearing Loadresultant ecc.	= 2,455 lbs = 0.00 in	Rebar Spacing Rebar Placed at	=	# 5 12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 557 psf OK = 557 psf OK = 2,000 psf	besign Data fb/FB + fa/Fa Total Force @ Section Service Level	= Ibs =	0.587		
ACI Factored @ Toe ACI Factored @ Heel	= 779 psf = 779 psf	Strength Level MomentActual	lbs =	1,792.0		
Footing Shear @ Toe	= 8.5 psi OK	Service Level	ft-# =	4.778.7		
Allowable	= 5.0 psi OK = 75.0 psi	MomentAllowable	=	8,121.3		
Sliding Calcs Lateral Sliding Force	= 1,417.5 lbs	ShearActual Service Level Strength Level	psi = psi =	24.1		
		ShearAllowable Anet (Masonry)	psi = in2 =	75.0		
		Rebar Depth ˈdˈ Masonry Data ťm	in = 	6.19		
Vertical component of activ NOT considered in the calc	/e lateral soil pressure IS culation of soil bearing	Fs Solid Grouting Modular Ratio 'n'	psi = psi = =			
Load Factors Building Code	IBC 2012.ACI	Wall Weight Short Term Factor	psf = =	100.0		
Dead Load Live Load Earth, H	1.200 1.600 1.600	Masonry Block Type Masonry Design Method	= = =	Medium V ASD	Veight	
Wind, W Seismic, E	1.000	f'c Fy	psi = psi =	2,500.0 60,000.0		

Page : 2 Date: 16 JUL 2019

RetainPro (c) 1987-2019, Build 11.19.06.12 License : KW-06052576 License To : SWENSON SAY FAGET	Cantilevered	Retaining Wall	Code: IBC 2012,ACI 318-11,ACI 530-11
Concrete Stem Rebar Area Det	ails		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1809 in2/ft	Ŭ	
(4/3) * As :	0.2413 in2/ft	Min Stem T&S Reinf Area	a 1.536 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area	a per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Op	tions :
	===========	One layer of : Two lay	yers of :
Required Area :	0.2413 in2/ft	#4@ 12.50 in #4@ 2	25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in #5@ 3	38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 9	55.00 in
Footing Data	Footing Des	sign Results	
Toe Width= 2.7 Heel Width= 1.6 Total Footing Width= 4.4 Footing Thickness= 12.0 Key Width= 0.0 Key Depth= 0.0 Key Distance from Toe= 0.00 f'c= $2,500$ psiFy =Footing Concrete Density= 150.0 Min. As %= 0.0013 Cover @ Top 2.00 @ Btm= 33	5 ft 6 Factored Pressure 7 Mu': Upward 9 in Mu': Downward 9 in Actual 1-Way Shea 9 in Actual 1-Way Shea 9 Din Actual 1-Way Shea 9 Ort Toe Reinforcing 9 Opsi Heel Reinforcing 9 Opsi Feoting Torsion, T 8 Footing Allow. Tor 16 torsion exco 8 supplemental	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	I 9 psf 4 ft-# 1 ft-# 6 ft-# 7 psi 0 psi 00 ft-lbs 00 ft-lbs
	Other Acceptable Toe: #4@ 9.25 Heel: Not req'd: Key: No key d Min footing T&S Min footing T&S If one layer of h #4@ 9.26 in #5@ 14.35 in #6@ 20.37 in	e Sizes & Spacings 5 in, #5@ 14.34 in, #6@ 20.3 : Mu < phi*5*lambda*sqrt(f'c) efined 6 reinf Area aper foot 0.2 orizontal bars: If two #4@ #4@ #6@	36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46)*Sm 4 in2 6 in2 /ft layers of horizontal bars: 9 18.52 in 9 28.70 in 9 24.70 in

Summary of Ove	<u>SAY</u>		esistina F	orces & Mon	nents			
Item		OV Force Ibs	ERTURNING Distance ft	G Moment ft-#		R Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tb) HL Act Pres (be water tb) Hydrostatic Force Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load Added Lateral Load Load @ Stem Above Soi)) = = = = = ! =	2,314.4	3.83	4,252.5	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe = Stem Weight(s) =	1,879.2	5.17 5.17 1.38 3.08	3,887.2 3,887.2 2,466.7
Total	=	1,417.5	O.T.M	4,252.5	Earth @ Stem Transitions = Footing Weight = Key Weight =	661.5	2.21	1,458.6
Vertical Loads used for	g Rat or Soi	il Pressure	= = 2,454	1.84 .8 lbs	Vert. Component = Total = * Axial live load NOT included resistance, but is included for	2,454.8 I in total display	lbs R.M.= yed, or used fo	7,812.5 r overturning

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soi	Soil Spring Reaction Modulus								250.0	pci					
					~ -										

Horizontal Defl @ Top of Wall (approximate only)0.000inThe above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

ailaa\061910 Typical Datail Co. 04.07

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON S	d 11.19 AY F	9.06.12 AGET		Cantilevered Retain	ing V	Vall	Code: IBC 2012,	ACI 318-11,ACI 530-11
Criteria				Soil Data				
Retained Height Wall height above soil Slope Behind Wall	= = =	8.00 ft 0.00 ft 0.00	A E A	Nlow Soil Bearing = 5 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,667.0 od 35.0) psf) psf/ft		
Height of Soil over Toe Water height over heel	=	6.00 in 0.0 ft	F S F S	= = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	400.0 125.00 0.00 0.450 12.00) psf/ft) pcf) pcf) in	Rest rate	
Surcharge Loads				Lateral Load Applied to	Stem		Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= & Ove = turnin	0.0 psf erturning 0.0 g	רי ש ו י י	Lateral Load = Height to Top = Height to Bottom =	0.0 #, 0.00 ft 0.00 ft	/ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft
Axial Load Applied	to S	Stem		_oad Type = Wii (Se	rvice Le	evel)	Footing Type	Line Load
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in	•	Wind on Exposed Stem _ (Service Level)	0.0 p	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Earth Pressure Se	ismi	c Load						
Method : Uniform Multiplier Used (Multiplier used on soil d	= ensity	6.000 ')	- -	Jniform Seismic Force5Fotal Seismic Force486	4.000 5.000			
Design Summary			[Stem Construction] _	Bottom	,	
Wall Stability Ratios Overturning Slab Resis	= ts All	1.36 Rat Sliding !	i0 < 1	Design Height Above Ft Wall Material Above "Ht Design Method Thickness Rebar Size	g ft = ' = = = =	Concrete LRFD 8.00 # 5		
resultant ecc.	=	2,466 lbs 0.00 in		Rebar Spacing Rebar Placed at	=	12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	558 psf 558 psf 2,667 psf	OK OK	Design Data fb/FB + fa/Fa Total Force @ Section Service Level	= lbs =	0.800)	
ACI Factored @ Toe ACI Factored @ Heel	= = =	781 psf 781 psf 781 psf	OK	Strength Level MomentActual Service Level	lbs = ft-# =	2,224.0		
Footing Shear @ Heel Allowable Sliding Calcs	= =	5.0 psi 75.0 psi	OK	Strength Level MomentAllowable ShearActual	ft-# = =	6,506.7 8,121.3	7	
Lateral Sliding Force	=	1,757.7 lbs		Service Level Strength Level ShearAllowable	psi = psi = psi =	30.0 75.0)	
				Anet (Masonry) Rebar Depth 'd'	in2 = in =	6.19)	

Masonry Data

Solid Grouting

Wall Weight

Concrete Data

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

psi =

psi =

psf =

psi =

=

=

=

=

= ASD

100.0

= Medium Weight

2,500.0 psi = 60,000.0

f'm

Fs

f'c

Fy

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

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

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Concrete Stem Rebar Area De	tails		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2464 in2/ft	0	
(4/3) * As :	0.3285 in2/ft	Min Stem T&S Reinf Area	a 1.536 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area	a per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Op	otions :
		One layer of : Two lag	yers of :
Required Area :	0.2475 in2/ft	#4@ 12.50 in #4@ 2	25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in #5@ 3	38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@	55.00 in
Footing Data	Footing Des	sign Results	
Toe Width = 2.7	75 ft	<u>Toe</u> <u>Hee</u>	<u>4</u>
Heel Width = <u>1.</u>	67 Factored Pressure	= 781 78	1 psf
Total Footing Width = 4.4	42 Mu': Upward	= 2,954 39	3 ft-#
Footing Thickness = 12.0	0 in Mu ⁺ : Downward Mu ⁺ : Design	= 964 69 - 1990 30	5 IT-# 1 ft-#
Key Width = 0.0	00 in Actual 1-Way She	r = 8.53 50	1 nsi
Key Depth = 0.0	00 in Allow 1-Way Shea	r = 40.00 40.0	0 psi
Key Distance from Toe = 0.0	00 ft Toe Reinforcing	= #5 @ 12.00 in	
$f'_{c} = 2,500 \text{psi}$ Fy = 60,00	00 psi Heel Reinforcing	= #4 @ 18.00 in	
Footing Concrete Density = 150.0	50 pcr Key Reinforcing		00 ft-lbs
Cover @ Top 2.00 @ Btm.=	3.00 in Footing Allow Tors	sion phiTu = 0.	00 ft-lbs
	If torsion exce	eds allowable, provide	
	supplemental	design for footing torsior	1.
	Other Acceptable Toe: #4@ 9.25 Heel: Not req'd: Key: No key de	e Sizes & Spacings in, #5@ 14.34 in, #6@ 20.3 Mu < phi*5*lambda*sqrt(f'c fined	36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46)*Sm
	Min footing T&S Min footing T&S If one layer of ho #4@ 9.26 in #5@ 14.35 in #6@ 20.37 in	reinf Area 1.1 reinf Area per foot 0.2 prizontal bars: If two #4@ #5@ #6@	5 in2 6 in2 /ft layers of horizontal bars: 2 18.52 in 2 28.70 in 2 40.74 in

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON SA	11.19.06.12 Y FAGET		Cantilevere	d Retaining Wall	Code: IBC 2012,ACI 318-11,ACI 530-1						
Summary of Overtu	rning & R	esisting F	orces & Morr	ients							
ltem	OV Force Ibs	/ERTURNING Distance ft	Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#				
HL Act Pres (ab water tbl) 2,314 HL Act Pres (be water tbl) Hydrostatic Force		3.83	4,252.5	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	3,931.4 3,931.4				
Buoyant Force = Surcharge over Heel = Surcharge Over Toe =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load =							
Added Lateral Load = Load @ Stem Above Soil =				* Axial Live Load on Stem = Soil Over Toe =		1.38					
Seismic Earth Load =	340.2	4.50	1,530.9	Stem Weight(s) =	800.0	3.08	2,466.7				
Total =	1,757.7	O.T.M. =	5,783.4	Footing Weight =	663.0	2.21	1,465.2				
Resisting/Overturning R Vertical Loads used for S	Resisting/Overturning Ratio = Vertical Loads used for Soil Pressure = 2,			Vert. Component	2.466.3	hs R.M.=	7 863 3				

If seismic is included, the OTM and sliding ratios be 1.1 per section 1807.2.3 of IBC 2009 or IBC 201

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci

Horizontal Defl @ Top of Wall (approximate only) 0.000 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

This Wall in File: K:\2019\01	519-2019-01 Yuan\Cal	culations\pin piles\061819 Typica	l Detail	Co-04-07.						
RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON S	a 11.19.06.12 AY FAGET	Cantilevered Retain	ing V	Vall	Code: IBC 2012,ACI 318-11,ACI 530-11					
Criteria		Soil Data								
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 6.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = Active Heel Pressure = = Passive Pressure = = Soil Density, Heel = = Soil Density, Toe = = Footing Soil Friction = Soil height to ignore for passive pressure =	2,000.0 d 35.0 400.0 125.00 0.00 0.450 12.00) psf) psf/ft) psf/ft) pcf) pcf in	Pestain					
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing I	_oad				
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= 0.0 psf & Overturning = 0.0 turning	Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 #, 0.00 ft 0.00 ft d (W)	/ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load				
Avial Dead Load		(Sel		evel) of	Base Above/Below Soil	= 0.0 ft				
Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 in	(Service Level)	0.0 p	SI	at Back of Wall Poisson's Ratio	= 0.300				
Design Summary		Stem Construction] _	Bottom						
Wall Stability Ratios Overturning Slab Resis	= 1.73 OK ts All Sliding !	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size] ft = = = =	Concrete LRFD 8.00 # 4						
Total Bearing Load resultant ecc.	= 1,326 lbs = 0.00 in	Rebar Spacing Rebar Placed at	=	12.00 Edge						
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= 398 psf Or = 398 psf Or = 2,000 psf s Than Allowable	Design Data fb/FB + fa/Fa Total Force @ Section Service Level	= Ibs =	0.371						
ACI Factored @ Toe ACI Factored @ Heel	= 558 psf = 558 psf	Strength Level MomentActual	lbs =	1,008.0						
Footing Shear @ Toe	= 5.5 psi Ok	Strength Level	ft-# =	2.016.0						
Allowable Sliding Calcs Lateral Sliding Force	= 2.1 psi Or = 75.0 psi = 817.2 lbs	MomentAllowable ShearActual Service Level	= psi =	5,412.6						
Ū		Strength Level	psi =	13.4						
		ShearAllowable	psi =	75.0						
		Rebar Depth 'd'	in2 = in =	6.25						
Vertical component of activ NOT considered in the calc	e lateral soil pressure Is ulation of soil bearing	Masonry Data f'm Fs S Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = psf =	100.0						
Load Factors		Short Term Factor	=							
Dead Load	1.200	Equiv. Solid Thick. Masonry Block Type	=	Medium M	/eight					
Live Load	1.600	Masonry Design Method	=	ASD	roigin					
Earth, H	1.600	Concrete Data	no:	2 500 0						
Seismic, E	1.000	Fy	psi = psi =	∠,500.0 60,000.0						

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Concrete Stem Rebar Area D	etails		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
(4/3) * As:	0.1007 in2/ft	Min Stem T&S Reinf Are	a 1.152 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Are	a per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing O	ptions :
	============	One layer of : Two la	ayers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in #4@	25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in #5@	38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@	55.00 in
Footing Data	Footing I	Design Results	
Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width= $(Key Depth)$ = $(Key Distance from Toe)$ = $(fc) = 2,500 psi$ Fy =Footing Concrete Density= $(for A = 0.0)$ Cover @ Top $(Cover @ Top)$ $(Cover @ Btm = 0.0)$	2.25 ft 1.08 Factored Press 3.33 Mu' : Upward 0.00 in Mu' : Downwar 0.00 in Mu' : Design 0.00 in Actual 1-Way S 0.00 in Allow 1-Way S 0.00 ft Toe Reinforcin 0.00 psi Heel Reinforcin 0.00 pcf Key Reinforcin 0.18 Footing Torsion 3.00 in Footing Allow. If torsion e supplement	ToeHesure= 558 53 =1,411 570 9 = 842 56 = 842 66 Shear= 5.47 2.6 hear= 40.00 40.00 g=None Spec'dng=None Spec'dng=None Spec'dn, Tu=00Torsion, phi Tu=00exceeds allowable, provide 66 ntal design for footing torsio	el 58 psf 48 ft-# 90 ft-# 42 ft-# 12 psi 00 psi 0.00 ft-lbs 0.00 ft-lbs
	Other Accepta Toe: #4@ 1 Heel: Not re Key: No ke Min footing 7 If one layer o #4@ 11.1 #5@ 17.2 #6@ 24.4	able Sizes & Spacings 11.10 in, #5@ 17.21 in, #6@ 2 q'd: Mu < phi*5*lambda*sqrt(f'	4.43 in, #7@ 33.32 in, #8@ 43.88 in, #9@ 5 c)*Sm 72 in2 22 in2 <i>f</i> t b layers of horizontal bars: @ 22.22 in @ 34.44 in @ 48.89 in

RetainPro (c) 1987-2019, B License : KW-06052576 License To : SWENSON	uild 11	1.19.06.12 FAGET		Cantilevere	d Retaining Wall	Code: IBC 2012,ACI 318-11,ACI 530-1						
Summary of Ove	ertur	ning & R	esisting I	Forces & Mon	nents							
Item		Force Ibs	ERTURNIN Distance ft	G Moment ft-#		RI Force Ibs	ESISTING Distance ft	Moment ft-#				
HL Act Pres (ab water the HL Act Pres (be water the Hydrostatic Force Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load Added Lateral Load Load @ Stem Above So	bl) bl) = = = = : il = =	2,314.4	3.83	1,861.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe =	1,879.2	5.17 5.17 1.13	968.2 968.2				
Total Resisting/Overturnin	=	817.2	O.T.M. =	1,861.3	Earth @ Stem Transitions = Footing Weight = Key Weight = Vert. Component _=	416.3	2.58	693.1				
Vertical Loads used	for So	il Pressure	= 1,326	5.3 lbs	Total = * Axial live load NOT included resistance, but is included for	1,326.3 d in total display or soil pressure	lbs R.M.= red, or used for calculation.	3,211.3 r overturning				

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus								25	50.0	pci	I								

Horizontal Defl @ Top of Wall (approximate only) 0.000 in The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

ailaa\061910 Typical Datail Co. 04.07

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON S	AY F	9.06.12 AGET	Jaicula	Cantilevered Reta	ining W	/all	Code: IBC 2012,4	ACI 318-11,ACI 530-11
Criteria			Sc	oil Data				
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe	= = =	6.00 ft 0.00 ft 0.00 6.00 in	Allo Equ Act	w Soil Bearing = uivalent Fluid Pressure Mer ive Heel Pressure = = ssive Pressure =	2,667.0 thod 35.0 400.0	psf psf/ft psf/ft		
Water height over heel	=	0.0 ft	Soi Soi Foc Soi	I Density, Heel = I Density, Toe = bing Soil Friction = I height to ignore = or passive pressure =	125.00 0.00 0.450 12.00	pcf pcf in	Restraint	
Surcharge Loads			La	ateral Load Applied	to Stem		Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= & Ove = turnin	0.0 psf erturning 0.0 g	Lat F F	eral Load = leight to Top = leight to Bottom = ad Type = V	0.0 #/ 0.00 ft 0.00 ft Vind (W)	ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft
Axial Load Applied	to S	Stem		(;	Service Le	evel)	Footing Type Base Above/Below Soil	Line Load
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in	W (5	ind on Exposed Stem ₌ Service Level)	0.0 ps	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Earth Pressure Se	ismi	c Load						
Method : Uniform Multiplier Used (Multiplier used on soil de	= ensity	6.000)	Un To	iform Seismic Force = al Seismic Force = 2	41.000 280.167			
Design Summary			S	tem Construction		Bottom		
Wall Stability Ratios Overturning Slab Resis	= ts All	1.27 Rat Sliding !	io < 1.5	Design Height Above Wall Material Above " Design Method Thickness	Ftg ft = Ht" = =	0.00 Concrete LRFD 8.00		
		4 000 "		Rebar Size	=	# 4		
resultant ecc.	=	1,326 Ibs 0.00 in		Rebar Spacing Rebar Placed at	=	12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel	= =	398 psf 398 psf	ok ok	fb/FB + fa/Fa	=	0.508	•	
Allowable Soil Pressure Less	= Tha	2,667 psf		Service Level	lbs =			
ACI Factored @ Toe ACI Factored @ Heel	= =	558 psf 558 psf		Strength Level MomentActual	lbs =	1,254.0		
Footing Shear @ Toe	=	5.5 psi	ОК	Service Level	ft-# =	0 75 4 0		
Footing Shear @ Heel	=	2.1 psi	OK	Strength Level	n-# =	2,754.0		
Allowable	=	75.0 psi		ShearActual	-	5,412.0		
Lateral Sliding Force	=	1.013.3 lbs		Service Level	psi =			
0	_	.,		Strength Level	psi =	16.7		
				ShearAllowable	psi =	75.0		
				Anet (Masonry) Rebar Depth 'd'	in2 = in =	6.25		
				Masonry Data		0.20		
				f'm	psi =			

psi =

psf =

psi =

=

=

=

=

= ASD

100.0

= Medium Weight

2,500.0 psi = 60,000.0

Fs

f'c

Fy

Solid Grouting

Wall Weight

Concrete Data

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

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

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

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Concrete Stem Rebar Area	Details			
Bottom Stem As (based on applied moment) :	Vertical Reinfo	brcing H	lorizontal Reinfo	orcing
(4/3) * As :	0.1376 in2/ft	Ν	lin Stem T&S Re	einf Area 1.152 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	N	lin Stem T&S Re	einf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Н	Iorizontal Reinfo	prcing Options :
		= C	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#	4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#	5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#	6@ 27.50 in	#6@ 55.00 in
Footing Data		Footing Desig	n Results	
Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c=2,500 psiFy=Footing Concrete Density=Min. As %=CCover @ Top2.00@ Btm	2.25 ft Fac 3.33 Mu 10.00 in Mu 0.00 in Act 0.00 in All 0.00 ft Too 50.00 psi He 50.00 pcf Key 0.0018 Foc	ctored Pressure ': Upward : Downward : Design ual 1-Way Shear w 1-Way Shear e Reinforcing el Reinforcing y Reinforcing oting Torsion, Tu oting Allow. Torsion If torsion exceed	Toe = 558 = 1,411 = 570 = 842 = 5.47 = 40.00 = # 4 @ 12.00 = # 4 @ 12.00 = None Specie = None Specie = n, phi Tu = sallowable, pro	Heel 558 psf 48 ft-# 90 ft-# 42 ft-# 2.12 psi 40.00 psi 0 in d 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs
		supplemental de	sign for footing	g torsion.
	Utn T H	er Acceptable S Foe: #4@ 11.10 ir Heel: Not req'd: Mu Key: No key defin	izes & Spacing n, #5@ 17.21 in, u < phi*5*lambda ed	gs , #6@ 24.43 in, #7@ 33.32 in, #8@ 43.88 in, #9@ 5 a*sqrt(f'c)*Sm
	N N 11	Ain footing T&S rei Ain footing T&S rei one layer of horiz #4@ 11.11 in #5@ 17.22 in #6@ 24.44 in	inf Area nf Area per foot ontal bars:	0.72 in2 0.22 in2 /tt If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

RetainPro (c) 1987-2019, Build 11.19.06.12 License : KW-06052576 License To : SWENSON SAY FAGET				Cantilevere	d Retaining Wall	Code: IBC 20	012,ACI 318	-11,ACI 530-1
Summary of Over	rturnin	g & Re	esisting F	orces & Mom	nents			
Item	Fo	OV orce bs	ERTURNING Distance ft	G Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force) 2,)	,314.4	3.83	1,861.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	968.2 968.2
Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load Added Lateral Load	= = = =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =			
Load @ Stem Above Soil Seismic Earth Load	= = =	196.1	3.42	670.1	Soil Over Toe = Surcharge Over Toe = Stem Weight(s) =	600.0	1.13 2.58	1,550.0
Total	= 1,	,013.3	O.T.M. =	2,531.4	Footing Weight = Key Weight =	416.3	1.67	693.1
Resisting/Overturning Vertical Loads used fo	y Ratio or Soil Pre	essure :	= = 1,326	1.27 .3 lbs	Vert. Component = Total = * Axial live load NOT included resistance but is included for	1,326.3 I in total display	bs R.M.= ed, or used fo	3,211.3 r overturning

If seismic is included, the OTM and sliding ratios be 1.1 per section 1807.2.3 of IBC 2009 or IBC 201

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci

Horizontal Defl @ Top of Wall (approximate only) 0.000 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

		4'-0" Ret	aining	Wall w/ Sla	ab	
This Wall in File: K:\2019\0 RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON \$	1519-2019-01 Yuan\Cal d 11.19.06.12 SAY FAGET	culations\pin piles\061819 Typica Cantilevered Retain	Detail	Co-04-07. Vall	Code: IBC 2012,4	ACI 318-11,ACI 530-11
Criteria		Soil Data				
Retained Height Wall height above soil Slope Behind Wall	= 4.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 35.0	psf psf/ft		
Height of Soil over Toe Water height over heel	= 6.00 in = 0.0 ft	=Passive Pressure=Soil Density, Heel=Soil Density, Toe=Footing Soil Friction=Soil height to ignore for passive pressure=	400.0 125.00 0.00 0.450 12.00	psf/ft pcf pcf	Restraint	
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Ove Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 psf & Overturning = 0.0 rturning d to Stem = 0.0 lbs = 0.0 lbs = 0.0 lbs = 0.0 lbs	Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Ser Wind on Exposed Stem = (Service Level)	0.0 #/ 0.00 ft 0.00 ft d (W) rvice Le 0.0 p:	'ft / F E evel) F sf	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type Base Above/Below Soil at Back of Wall Poisson's Ratio	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load = 0.0 ft = 0.300
Design Summary		Stem Construction		Bottom		
Wall Stability Ratios Overturning Slab Resis Total Bearing Load resultant ecc.	= 1.92 OK sts All Sliding ! = 815 lbs = 0.00 in	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Rebar Spacing Rebar Placed at Design Data	ft = = = = = =	Concrete LRFD 8.00 # 4 18.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Les ACI Factored @ Toe ACI Factored @ Heel	= 392 psf Ok = 392 psf Ok = 2,000 psf s Than Allowable = 548 psf = 548 psf	fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual	= Ibs = Ibs =	0.162 448.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs Lateral Sliding Force	= 2.9 psi Ok = 1.0 psi Ok = 75.0 psi = 381.1 lbs	Service Level Strength Level MomentAllowable ShearActual Service Level Strength Level	ft-# = ft-# = psi = psi =	597.3 3,655.6 6.0		
		ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm	psi = in2 = in = psi =	75.0 6.25		
Vertical component of activ NOT considered in the calo Load Factors	ve lateral soil pressure Is culation of soil bearing	Fs Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor	psi = = = psf = =	100.0		
Building Code Dead Load Live Load Earth, H	IBC 2012,ACI 1.200 1.600 1.600	Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data	= = =	Medium W ASD	leight	
Wind, W Seismic, E	1.000 1.000	f'c Fy	psi = psi =	2,500.0 60,000.0		

Page : 2 Date: 16 JUL 2019

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Concrete Stem Rebar Area	a Details			
Bottom Stem As (based on applied moment) :	Vertical 0.0224	Reinforcing H in2/ft	Horizontal Reinford	cing
(4/3) * As :	0.0298	in2/ft	Min Stem T&S Rei	inf Area 0.768 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2	/ft I	Min Stem T&S Rei	inf Area per ft of stem Height : 0.192 in2/ft
0.0012bh : 0.0012(12)(8) :	0.1152	in2/ft I	Horizontal Reinford	cing Options :
	=====	====== (One layer of :	Two layers of :
Required Area :	0.1152	in2/ft #	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.1333	in2/ft #	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467	in2/ft #	#6@ 27.50 in	#6@ 55.00 in
Footing Data		Footing Desig	gn Results	
Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Distance from Toe=f'c $2,500 \text{ psi}$ Fy =Footing Concrete Density=Min. As %=Cover @ Top 2.00 @ Bt	1.00 ft 1.08 2.08 8.00 in 0.00 in 0.00 ft 60,000 psi 150.00 pcf 0.0018 m= 3.00 in	Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing Key Reinforcing Footing Torsion, Tu Footing Allow. Torsice If torsion exceed	Toe = 548 = 274 = 98 = 177 = 2.85 = 40.00 = None Spec'd = None Spec'd = None Spec'd = on, phi Tu = allowable, provide	Heel 548 psf 47 ft-# 62 ft-# 15 ft-# 0.99 psi 40.00 psi 0.00 ft-lbs 0.00 ft-lbs vide
		Othor Accontable S		
		Toe: #4@ 13.88 i Heel: Not req'd: M Key: No key defir	in, #5@ 21.52 in, # lu < phi*5*lambda* ned	s #6@ 30.55 in, #7@ 41.66 in, #8@ 54.85 in, #9@ 6 *sqrt(f'c)*Sm
		Min footing T&S re Min footing T&S re If one layer of hori: #4@ 13.89 in #5@ 21.53 in #6@ 30.56 in	einf Area einf Area per foot zontal bars:	0.36 in2 0.17 in2 /ft If two layers of horizontal bars: #4@ 27.78 in #5@ 43.06 in #6@ 61.11 in

License : KW-06052576 License To : SWENSON SA	Y FAGET		Cantilevere		Code: IBC 2012,ACI 318-11,ACI 530-1		
Summary of Overtu	rning & R	esisting F	orces & Mon	nents			
Item	Force Ibs	/ERTURNING Distance ft	G Moment ft-#		Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force Buoyant Force = Surcharge over Heel = Surcharge Over Toe = Adjacent Footing Load = Added Lateral Load = Load @ Stem Above Soil =	2,314.4	3.83	592.8	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe = Stem Weight(s) =	1,879.2	5.17 5.17 0.50 1.33	387.2 387.2 533.3
Total =	381.1	O.T.M. =	592.8	Footing Weight = Key Weight =	208.0	1.04	216.3
Resisting/Overturning Ra Vertical Loads used for S	itio oil Pressure	= 814.	1.92 .7 lbs	Vert. Component = Total = * Axial live load NOT included	814.7 in total display	bs R.M.=	1,136.8

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.000	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

minal Datail Co. 04.07 -.

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON S	a 11.19.06.12 AY FAGET		Cantilevered Retair	ning V	Vall	Code: IBC 2012,	ACI 318-11,ACI 530	D-11
Criteria		Sc	oil Data					
Retained Height Wall height above soil Slope Behind Wall	= 4.00 ft = 0.00 ft = 0.00	Allo Equ Act	ow Soil Bearing = uivalent Fluid Pressure Meth ive Heel Pressure =	2,667.0 od 35.0) psf) psf/ft			
Height of Soil over Toe Water height over heel	= 6.00 in = 0.0 ft	Pas Soi Soi Foo Soi	= ssive Pressure = il Density, Heel = il Density, Toe = oting Soil Friction = il height to ignore or passive pressure =	400.0 125.00 0.00 0.450 12.00) psf/ft) pcf) pcf in	Pestairt		
Surcharge Loads		La	ateral Load Applied to	Stem		Adjacent Footing	Load	
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= 0.0 psf & Overturning = 0.0 turning	Lat F	teral Load = Height to Top = Height to Bottom =	0.0 #/ 0.00 ft 0.00 ft	/ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft	
Axial Load Applied	to Stem		au rype = wi (Se	ervice Le	evel)	Footing Type	Line Load	
Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 lbs = 0.0 in	W (5	ind on Exposed Stem ₌ Service Level)	0.0 ps	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300	
Earth Pressure Se	ismic Load							
Method : Uniform Multiplier Used (Multiplier used on soil d	= 6.000 ensity)	Un To	iform Seismic Force = 2 tal Seismic Force = 13	28.000 80.667				
Design Summary		5	Stem Construction		Bottom			
Wall Stability Ratios Overturning Slab Resis	= 1.41 F ts All Sliding !	Ratio < 1.5	Design Height Above Fr Wall Material Above "H Design Method Thickness Rebar Size	ig ft = t" = = =	Stem Ok 0.00 Concrete LRFD 8.00 # 4			
Total Bearing Loadresultant ecc.	= 815 lk = 0.00 ir)S I	Rebar Spacing Rebar Placed at	=	18.00 Edge	1		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 392 p = 392 p = 2,667 p	sf OK sf OK sf	fb/FB + fa/Fa Total Force @ Section	=	0.224	L		
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	s Than Allowable = 548 p = 548 p	sf sf	Service Level Strength Level MomentActual	lbs = lbs =	560.0	1		
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 2.9 p = 1.0 p = 75.0 p	si OK si OK si	Service Level Strength Level MomentAllowable	ft-# = ft-# = =	821.3 3,655.6	3		
Sliding Calcs Lateral Sliding Force	= 472.6 lb	S	ShearActual Service Level Strength Level	psi =	7 6			
			ShearAllowable Anet (Masonry)	psi = psi = in2 =	75.0			
			Rebar Depth 'd'	in =	6 25			

Masonry Data f'm

Solid Grouting

Wall Weight

Concrete Data

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

Fs

f'c

Fy

psi =

psi =

psf =

psi =

=

=

=

=

= ASD

100.0

= Medium Weight

2,500.0 psi = 60,000.0

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

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

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Concrete Stem Rebar Area	Details			
Bottom Stem As (based on applied moment)	Vertical	Reinforcing I	Horizontal Reinfor	rcing
(4/3) * As :	0.041 ir	12/ft I	Min Stem T&S Re	einf Area 0.768 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2	2/ft I	Min Stem T&S Re	einf Area per ft of stem Height : 0.192 in2/ft
0.0012bh : 0.0012(12)(8) :	0.1152	in2/ft	Horizontal Reinfor	rcing Options :
	======		One layer of :	Two layers of :
Required Area :	0.1152	in2/ft a	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.1333	in2/ft a	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467	in2/ft	#6@ 27.50 in	#6@ 55.00 in
Footing Data		Footing Desig	gn Results	
Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c=2,500 psiFyFooting Concrete Density=Min. As %=Cover @ Top2.00@ Btr	1.00 ft 1.08 2.08 8.00 in 0.00 in 0.00 in 0.00 ft 60,000 psi 150.00 pcf 0.0018 m= 3.00 in	Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing Key Reinforcing Footing Torsion, Tu Footing Allow. Torsion	Toe = 548 = 274 = 98 = 177 = 2.85 = 40.00 = None Spec'd = None Spec'd = None Spec'd = none Spec'd = station of the specified of the	Heel 548 psf 47 ft-# 62 ft-# 15 ft-# 0.99 psi 40.00 psi 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs
		supplemental de	esign for footing	torsion.
		Other Acceptable S Toe: #4@ 13.88 i Heel: Not req'd: M Key: No key defin	Sizes & Spacing in, #5@ 21.52 in, ; lu < phi*5*lambda ned	JS #6@ 30.55 in, #7@ 41.66 in, #8@ 54.85 in, #9@ 6 *sqrt(f'c)*Sm
		Min footing T&S re Min footing T&S re If one layer of hori: #4@ 13.89 in #5@ 21.53 in #6@ 30.56 in	einf Area einf Area per foot zontal bars:	0.36 in2 0.17 in2 /ft If two layers of horizontal bars: #4@ 27.78 in #5@ 43.06 in #6@ 61.11 in

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON S	d 11.19.06.12 AY FAGET		Cantilevere	d Retaining Wall	Code: IBC 20	012,ACI 318	-11,ACI 530-1					
Summary of Overturning & Resisting Forces & Moments												
Item	Force Ibs	ERTURNING Distance ft	Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#					
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	2,314.4	3.83	592.8	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	387.2 387.2					
Buoyant Force = Surcharge over Heel = Surcharge Over Toe = Adjacent Footing Load =	= = = =			Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =								
Load @ Stem Above Soil = Seismic Earth Load =	= = = 91.5 =	2.33	213.4	Soil Over Toe = Surcharge Over Toe = Stem Weight(s) = Earth @ Stem Transitions =	400.0	0.50 1.33	533.3					
Total :	= 472.6 Ratio	O.T.M. =	806.3	Footing Weight = Key Weight = Vert. Component =	208.0	1.04	216.3					
Vertical Loads used for	Soil Pressure	= 814.	7 lbs	Total = * Axial live load NOT included resistance, but is included fo	814.7 I in total display or soil pressure	bs R.M.= ed, or used fo calculation.	1,136.8 r overturning					

If seismic is included, the OTM and sliding ratios be 1.1 per section 1807.2.3 of IBC 2009 or IBC 201

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0 pci
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Horizontal Defl @ Top of Wall (approximate only) 0.000 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

This Wall in File: K:\2019\01	519-2019-01 Yuan\Calo	culations\pin piles\061819 Typica	I Detail Co-0	4-07.
RetainPro (c) 1987-2019, Build 11.19.06.12 License : KW-06052576 License To : SWENSON SAY FAGET		Cantilevered Retain	ing Wall	Code: IBC 2012,ACI 318-11,ACI 530-1
Criteria		Soil Data		
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 3.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = Active Heel Pressure = = Passive Pressure = = Soil Density, Heel = = Soil Density, Toe = = Footing Soil Friction = = Soil height to ignore = =	2,000.0 psf d 35.0 psf/f 400.0 psf/f 125.00 pcf 0.00 pcf 0.450 12.00 in	t t
Surcharge Loads		Lateral Load Applied to	Stem	Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= 0.0 psf & Overturning = 0.0 turning	Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 #/ft 0.00 ft 0.00 ft id (W)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine Load
Axial Load Load Axial Live Load Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 lbs = 0.0 in	(Se Wind on Exposed Stem ₌ (Service Level)	0.0 psf	Base Above/Below Soil at Back of Wall=0.0 ftPoisson's Ratio=0.300
Design Summary		Stem Construction	Bott	om
Wall Stability Ratios Overturning Slab Resis Total Bearing Load resultant ecc.	= 1.87 OK ts All Sliding ! = 605 lbs = 0.00 in	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Rebar Spacing Rebar Placed at	ft = Ste ft = Cor = I = : = : = :	m OK 0.00 crete _RFD 8.00 # 4 18.00 Edge
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs Lateral Sliding Force	= 403 psf OK = 403 psf OK = 2,000 psf 5 Than Allowable = 565 psf = 0.2 psi OK = 0.0 psi OK = 75.0 psi = 235.3 lbs	Design Data fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual Service Level Strength Level MomentAllowable ShearAllowable ShearAllowable Anet (Masonry)	= lbs = lbs = ft-# = ft-# = 3,4 psi = psi = psi = in2 =	0.068 252.0 252.0 555.6 3.4 75.0
Vertical component of activ NOT considered in the calc Load Factors Building Code Dead Load Live Load Earth, H Wind, W	e lateral soil pressure IS ulation of soil bearing IBC 2012,ACI 1.200 1.600 1.600 1.000	Rebar Depth 'd' Masonry Data f'm Fs Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data f'c	in = psi = psi = = psf = = Med = ASE psi = 2,	6.25 100.0 ium Weight 500.0
Seismic, E	1.000	Fy	psi = 60,	000.0

RetainPro (c) 1987-2019, Build 11.19.06.1 License : KW-06052576 License To : SWENSON SAY FAGET	2 Г	Cantilevered Ro	etaining Wal	Code: IBC 2012,ACI 318-11,ACI 530-11	
Concrete Stem Rebar Area	Details				
Bottom Stem As (based on applied moment) :	Vertical 0.0094	Reinforcing H in2/ft	Horizontal Reinford	cing	
(4/3) * As :	0.0126	n2/ft M	Min Stem T&S Reinf Area 0.576 in2		
200bd/fy : 200(12)(6.25)/60000 : 0.25 in2		/ft N	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft		
0.0012bh : 0.0012(12)(8) : 0.1152		n2/ft H	Horizontal Reinford	cing Options :	
	=====	====== (One layer of : Two layers of :		
Required Area :	0.1152	n2/ft #	#4@ 12.50 in	#4@ 25.00 in	
Provided Area :	0.1333	n2/ft #	#5@ 19.38 in	#5@ 38.75 in	
Maximum Area :	0.8467	n2/ft #	#6@ 27.50 in	#6@ 55.00 in	
Footing Data		Footing Desig	gn Results		
Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c =2,500 psiFy =Footing Concrete Density =15Min. As %=0.0Cover @ Top2.00@ Btm.st	0.42 ft <u>1.08</u> 1.50 8.00 in 0.00 in 0.00 in 0.00 ft 0,000 psi 50.00 pcf 0018 = 3.00 in	Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing Key Reinforcing Footing Torsion, Tu Footing Allow. Torsio If torsion exceed supplemental de	Toe = 565 = 50 = 17 = 33 = 0.22 = 40.00 = None Spec'd = None Spec'd = None Spec'd = none Spec'd = stallowable, prospector	Heel 565 psf 48 ft-# 49 ft-# 0.03 psi 40.00 psi 0.00 ft-lbs 0.00 ft-lbs vide torsion.	
		Other Acceptable S Toe: #4@ 13.88 i Heel: Not req'd: M Key: No key defir Min footing T&S re Min footing T&S re If one layer of horiz #4@ 13.89 in #5@ 21.53 in #6@ 30.56 in	Sizes & Spacing: n, #5@ 21.52 in, # u < phi*5*lambda* hed sinf Area sinf Area per foot zontal bars:	s #6@ 30.55 in, #7@ 41.66 in, #8@ 54.85 in, #9@ 6 *sqrt(f'c)*Sm 0.26 in2 0.17 in2 /ft If two layers of horizontal bars: #4@ 27.78 in #5@ 43.06 in #6@ 61.11 in	

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Summary of Overtu	ırning & R	esisting F	orces & Mom	nents			
ltem	O\ Force الbs	/ERTURNING Distance ft	G Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	2,314.4	3.83	287.6	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,879.2	5.17 5.17	200.5 200.5
Buoyant Force = Surcharge over Heel = Surcharge Over Toe = Adjacent Footing Load =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe = Surcharge Over Toe =		0.21	
				Stem Weight(s) = Earth @ Stem Transitions=	300.0	0.75	226.0
Total =	235.3 atio	O.T.M. =	287.6 1.87	Footing Weight = Key Weight = Vert. Component =	150.0	0.75	112.5
Vertical Loads used for S	Soil Pressure	= 605.	.0 lbs	Total =	605.0 l	bs R.M.=	539.0

resistance, but is included for soil pressure calculation.

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.000	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,