

Revised Structural Calculations:

Huber Residence

9611 SE 72nd St Mercer Island, WA 98040

Prepared for: Brandt Design Group Job #: 01519-2021-06 September 10, 2021 Date: Revised: November 16, 2022





		Huber Residence	DATE	9/10/2021
X	Y	Criteria	PROJ. #	01519-2021-06
			DESIGN	DMR
			SHEET	1

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	ismic Analy	sis	Equivalen	t Lateral Fo	orce Proce	dure						
eismic Force	Resisting S	ystem Per	System	Bearing W	/all System	IS						
able 12.2-1			Oystern	Light from	o (wood) M	Valle Shoot	thad with	Wood Struc	tural Panak	Potod for	Shoor Poci	stanco
			Туре:	цунстат	ie (wood) v	Valls Shea				s Rated IOI	Shear Kesk	stance
Seismic E	Design Cat.		D						Section 12	2.8.1.3 Exce	ptions	
RIS	Site Class		ll ofoult)	I, II, OF III, Assumed	or IV per I default soil	able 1.5-1 I properties	per 11	43	Regular St ≤ 5 Stories	tructure above grad	de	Yes
Diaphragr	m Flexibility	Elex	xihle	, looumou		rproportioe	, por 11.	1.0.	T < 0.5s	Ŭ		Yes
		1.107		1					$\rho = 1.0$			No
Ss	1.451	g	2% in 50 y	r, Latitude	& Longitud	de lookup			Not Site C	lass E or F		Yes
S ₁	0.501	g	2% in 50 y	r, Latitude/	& Longitud	de lookup			Risk Categ	gory I or II		Yes
R	6.50								If all excep	otions are m	et, S _{DS} may	/ be taken
C _d	4.0		-						as 1, but n	ot less than	0.7*(Calcu	lated S _{DS})
	2.5		Table 1.5	っ						c l Y	- 40	0.7
'e hr	1.00	ft	1 4018 1.5	2					$I_a = 0$	$L_t n_n^2$	Eq. 12	.8.7
Ct	0.02		Table 12 8	3-2								
X	0.75		Table 12.8	3-2	Building F	Period Per			$S_{MS} =$	$F_a S_S$	Eq. 11	4-1
Ta	0.28	sec			Alternate	e Analysis			$S_{M1} =$	$F_v S_1$	Eq. 11	4-2
Т	0.28	sec	Eq. 12.8-7	7	T (sec)				$S_{DS} =$	$\frac{2}{3}S_{MS}$	Eq. 11	4-3
T ₀	0.10	sec			-		_		$S_{D1} =$	$^{2}/_{3}S_{M1}$	Eq. 11	4-4
I _S	0.49	sec								c		
۱ _L	6.00	sec	Toble 11	4 4	Per Geote	ech Report	1		$C_S = \frac{S_{DS}}{(R/I_c)}$ Eq. 12.8-2			
F.	1.20			+- I 1_2	F.		-		$C_{c} = \frac{S_{D1}}{S_{D1}}$ Eq. 12.8-3			
S _{MS}	1.70	a	Eq. 11.4-1		· v		1		$C_{S} = \frac{T(R/I_{e})}{T(R/I_{e})}$			
S _{M1}	0.85	g	Eq. 11.4-2	2					$C_S = \frac{1}{2}$	$S_{D1}T_L$	Eq. 12	.8-4
S _{DS}	1.161	g	Eq. 11.4-3	3					$C_{\rm s} > 0.044S_{\rm Ds}I_a$ Eq. 12.8-5			8-5
S _{D1}	0.568	g	Eq. 11.4-4	1				$C_{\rm s} \ge 0.01$ Eq. 12.8-5			8-5	
										$S_{1} = S_{1}$	Eq. 12	
	0.179	Controls	Eq. 12.8-2	q. 12.8-2 q. 12.8-3 need not exceed, T < T _L			$C_S \ge 0.5 \frac{1}{(R/I_e)}$ Eq. 12.8-6					
Cs	0.317		Eq. 12.0-3									
C _e , design	0.010		Section 1	1 4 8 Excer	ninininum otion 2 App	lied		$C_{VX} = w$	$w_x h_x^k / \sum_{i=1}^n w_x h_i^k$ Eq. 12.8-12			8-12
3, 0	00				54011 2 74pp							
Bldg. Weight	151.8	k						$F_{nx} = \sum_{i=1}^{n}$	$\frac{1}{2}x^{F_i}/\sum_{n}$	W_{nx}	Eq. 12.	.10-1
								F > 0	$F > 0.2S_{i=x} W_i = V_i$ Eq. 12.10-2			
$V = C_S W$	27.1	k	Eq. 12.8-1	, Strength	Level Base	e Shear		$F \leq 0$	$\leq 0.25_{DSTe} w_{px}$ Eq. 12.10-2			
$V = C_{Sasd}W$	19.0	k	Eq. 12.8-1	ASD Base	e Shear			$T_{px} \leq 0.5$	+SDS1ewp)x	LQ. 12.	.10-5
ortical Distril	bution	ASD	07	13	k-	1 000						
		, CD	ρ- 	1.0	N=	Story Shea	ır			Diaphraon	n	
Level	h _x (ft)	W _x (k)	h _x ^k (ft)	W _x h _x ^k	Ĺ	ASD			Ford	ce (ρ not inc	luded)	
					C _{vx} (%)	F _x (k)	SV (k)	F _{px,calc}	F _{px,min}	F _{px,max}	F _{px,design}	$\gamma = F_{px}/F_x$
								_				
							1		+			
Roof	33.0	26.40	33.0	871	0.281	6.9	6.9	5.3	4.3	8.6	5.3	0.77



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Huber Residence
Seismic Criteria

3101

24.7

151.8

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Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method ASD

Wind Coefficients

Exposure	С					
V=	98	mph				
K _d =	0.85	Table 26.6-1				
K _h =	1.02	Table 26.10-1				
K _e =	1.00	Table 26.9-1				
G=	0.85	26.9.4				

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

Pressure Coefficients from Figure 27.3-1:						
Bldg Face	Cp					
Windward Wall	0.8					
Leeward Wall	-0.50					
Windward Roof	-1.08 / -0.18					
Leeward Roof	-0.59					

Kz

0.85

0.9

0.94

0.98

1.04

1.09

1.13

1.17

1.21

1.24

1.26

qz

17.73

18.78

19.61

20.44

21.70

22.74

23.57

24.41

25.24

25.87

26.29

Pww walls

12.06

12.77

13.33

13.90

14.75

15.46

16.03

16.60

17.16

17.59

17.87

Plwwalls

9.08

9.08

9.08

9.08

9.08

9.08

9.08

9.08

9.08

9.08

9.08

Location and Building Dimensions

Calculate Kzt?	No	
Kzt	1.00	
Roof Type	Gable	
Roof Angle - Transverse Dir	0	degrees
Roof Angle - Long Dir	26.6	degrees
Ground to top of roof	40	ft
Bot of roof to top of roof	7	ft
Mean Roof Height, h	36.5	ft
Short Plan Dimension	50	ft
Long Plan Dimension	50	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	15	ft
Velocity Pressure at Mean	21.4	psf

21.4 Roof Height, q_h =

12.7

13.1

13.4

13.8

14.3

14.7

15.1

15.4

15.7

16.0

16.2

ASD

P_{walls} (psf)

Roof Pressures (Unfactored)

		,	
Wind	lward	Looword	Horiz Proj
Max Min		Leeward	(psf)
-3.3	-19.7	-10.7	4.80

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Longitudinal Wind Pressures

L/B = 1.00 h/L = 0.73

Pressure Coefficients from Figure 27.4-1:					
Bldg Face	Cp				
Windward Wall	0.8				
Leeward Wall	-0.50				
Windward Roof	-0.35 / 0.14				
Leeward Roof	-0.60				

Wall Pressures	(Unfactored):				ASD
Ht	Kz	qz	P _{ww walls}	Plwwalls	P _{walls} (psf)
0-15	0.85	17.73	12.06	9.08	12.68
15-20	0.9	18.78	12.77	9.08	13.11
20-25	0.94	19.61	13.33	9.08	13.45
25-30	0.98	20.44	13.90	9.08	13.79
30-40	1.04	21.70	14.75	9.08	14.30
41-50	1.09	22.74	15.46	9.08	14.72
51-60	1.13	23.57	16.03	9.08	15.06
61-70	1.17	24.41	16.60	9.08	15.40
71-80	1.21	25.24	17.16	9.08	15.74
81-90	1.24	25.87	17.59	9.08	16.00
91-100	1.26	26.29	17.87	9.08	16.17

Roof Press	ASD		
Wind	lward	Leeward	Horiz Proj
Max	Min	Leewalu	(psf)
2.5	-6.3	-10.9	4.80

Roof Pressu	ctored)	ASD	
Wind	ward	Leeward	Horiz Proj
Max	Min	Leewalu	(psf)
2.5	-6.3	-10.9	4.80

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Wind Criteria

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Force Transfer Around Openings Calculator THREE OPENINGS The force transfer around openings (FTAO) method of shear wall endysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach leads do advantages over segmented shear walls, more versatility, because it all over for narrower wall segments while still meeting the height-o-width ratios and, often, fewer required held-downs.



1. Hold-down forces: H = Vh _{wall} /L _{wall}	1847 lbf
2. Unit shear above + below opening	
First opening: va1 = vb1 = H/(h _a 1+h _b 1) =	443 plf
Second opening: $va2 = vb2 = H/(h_a2+h_b2) =$	443 plf
Third opening: $va3 = vb3 = H/(h_a3+h_b3) =$	443 plf
3. Total boundary force above + below openings	
First opening: O1 = va1 x (Lo1) =	1329 lbf
Second opening: O2 = va2 x (Lo2) =	2436 lbf
Third opening: O3 = va3 x (Lo3) =	2436 lbf
4. Corner forces	
F1 = O1(L1)/(L1+L2) =	583 lbf
F2 = O1(L2)/(L1+L2) =	746 lbf
F3 = O2(L2)/(L2+L3) =	1344 lbf
F4 = O2(L3)/(L2+L3) =	1092 lbf
F5 = O3(L3)/(L3+L4) =	1439 lbf
F6 = O3(L4)/(L3+L4) =	997 lbf
5. Tributary length of openings	
T1 = (L1*L01)/(L1+L2) =	1.32 ft
T2 = (L2*Lo1)/(L1+L2) =	1.68 ft
T3 = (L2*Lo2)/(L2+L3) =	3.03 ft
T4 = (L3*Lo2)/(L2+L3) =	2.47 ft
T5 = (L3*Lo3)/(L3+L4) =	3.25 ft
T6 = (L4*Lo3)/(L3+L4) =	2.25 ft

6. Unit snear beside opening	
v1 = (V/L)(L1+T1)/L1 =	239 plf
v2 = (V/L)(T2+L2+T3)/L2 =	342 plf
v3 = (V/L)(T4+L3+T5)/L3 =	421 plf
v4 = (V/L)(T6+L4)/L4 =	318 plf
Check v1*L1+v2*L2+v3*L3+v4*L4=V?	5600 lbf O
7. Resistance to corner forces	
R1 = v1*L1 =	997 lbf
R2 = v2*L2 =	1825 lbf
R3 = v3*L3 =	1824 lbf
R4 = v4*L4 = 8. Difference corner force + resistance	954 lbf
R4 = v4*L4 = 8. Difference corner force + resistance R1-F1 = R2-F2-F3 = R3-F4-F5 =	954 lbf 413 lbf -265 lbf -707 lbf
R4 = v4*L4 = 8. Difference corner force + resistance R1-F1 = R2-F2-F3 = R3-F4-F5 = R4-F6 =	954 lbf 413 lbf -265 lbf -707 lbf -43 lbf
R4 = v4*L4 = 8. Difference corner force + resistance R1-F1 = R2-F2-F3 = R3-F4-F5 = R4-F6 = 9. Unit shear in corner zones	954 lbf 413 lbf -265 lbf -707 lbf -43 lbf
R4 = v4*L4 = 8. Difference corner force + resistance R1-F1 = R2-F2-F3 = R3-F4-F5 = R4-F6 = 9. Unit shear in corner zones vc1 = (R1-F1)/L1 =	954 lbf 413 lbf -265 lbf -707 lbf -43 lbf 99 plf
R4 = v4*L4 = 8. Difference corner force + resistance R1-F1 = R2-F2-F3 = R3-F4-F5 = R4-F6 = 9. Unit shear in corner zones vc1 = (R1-F1)/L1 = vc2 = (R2-F2-F3)/L2 =	954 lbf 413 lbf -265 lbf -707 lbf -43 lbf 99 plf -50 plf
R4 = v4*L4 = 8. Difference corner force + resistance R1-F1 = R2-F2-F3 = R3-F4-F5 = R4-F6 = 9. Unit shear in corner zones vc1 = (R1-F1)/L1 = vc2 = (R2-F2-F3)/L2 = vc3 = (R3-F4-F5)/L3 =	954 lbf 413 lbf -265 lbf -707 lbf -43 lbf -99 plf -50 plf -163 plf



*The Design Summary assumes that the shear wall is designed as blocked.



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		Huber Garage	DATE	9/10/2021
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2	STRUCTURAL		DESIGN	DMR
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SCE 7-16 Se	ismic Analy	sis	Equivalen	t Lateral Fo	orce Proced	dure						
Seismic Force able 12.2-1	Resisting S	ystem Per	System	Bearing W	/all System	S						
			Туре:	Light-fram	e (wood) V	/alls Shea	thed with	Wood Strue	ctural Panels	s Rated for	Shear Resis	stance
				_								
Seismic I	Design Cat.		D						Section 12	2.8.1.3 Exce	eptions	No.
Ris	Site Class	Class D (Defeult)		I, II, Or III, Assumed	or IV per Ta default soil	able 1.5-1	per 11	43	Regular Si ≤ 5 Stories	tructure above gra	de	Yes
Diaphrag	m Flexibility	Ele:	xible	Assumed		properties	, per 11.	4.0.	T≤0.5s	J		Yes
Bidpinidg.	in r londonity	1 102		1					$\rho = 1.0$			No
Ss	1.451	g	2% in 50	yr, Latitude	& Longitud	le lookup			Not Site C	lass E or F		Yes
S ₁	0.501	g	2% in 50	yr, Latitude	& Longitud	le lookup			Risk Cateo	gory I or II		Yes
R	6.50								If all excep	otions are m	iet, S _{DS} may	be taken
C _d	4.0								as 1, but n	ot less thar	n 0.7*(Calcu	lated S _{DS})
Ω₀	2.5		L									
l _e	1.00		Table 1.5	-2					$T_a = 0$	$C_t h_n^x$	Eq. 12	.8.7
n _n	12.0	ft										
Ct	0.02		Table 12.	5-2	Duilden - D	ania d. D.:			$S_{MS} =$	$F_a S_s$	Eq. 11	.4-1
X T.	0.75	800	Table 12.	5-∠	Alternate	Analysis			$S_{M1} =$	$F_{v}S_{1}$	Eq. 11	.4-2
'а Т	0.13	300	Fg 12.0	7			1		$S_{DS} =$	$\frac{2}{3}S_{MS}$	Eq. 11	.4-3
To	0.13	Sec			1 (386)		1		$S_{D1} =$	$\frac{2}{3}S_{M1}$	Ea. 11	.4-4
T _s	0.49	sec	-						- 01	/ 3 - MI		
TL	6.00	sec	1		Per Geote	ch Report			C -	S _{DS}	E~ 13	0.7
Fa	1.20		Table 11.4	4-1	Fa		1		$c_S = \frac{1}{C}$	(R/I_e)	Eq. 12	
Fv	1.70		Table 11.4	4-2	Fv				$C_{\rm S} = \frac{1}{2}$	S_{D1}	Eq. 12	.8-3
S _{MS}	1.74	g	Eq. 11.4-	1			4			Sp1Ti		
S _{M1}	0.85	g	Eq. 11.4-2	2					$C_S = \frac{1}{7}$	$\Gamma^2(R/L_0)$	Eq. 12	.8-4
S _{DS}	1.161	g	Eq. 11.4-3	3					$C_{s} \geq 0$	$0.044S_{DS}$	<i>I</i> _e Eg. 12	.8-5
S _{D1}	0.568	g	Eq. 11.4-4	1					$C_{\rm s} > 0$	0.01	Ea. 12	.8-5
										$S_1 = S_1$		0.0
	0.179	Controls	Eq. 12.8-2	<u>2</u> 2 m a a d m a t		. –			$c_S \ge 0$	$J.5 \overline{(R/I_e)}$	Eq. 12	.0-0
Cs	0.677		Eq. 12.8-		exceed, I «	< 1	Г					
C. design	0.010		Eq. 12.8-3	o or 12.8-6	minimum	lind		$C_{VX} = w$	$v_x h_x^k / \sum_{i=1}^n h_x^k$	$_1 w_x h_i^k$	Eq. 12.	8-12
O _s , acoign	0.179		Section	1.4.0 EXCe	Duon z App	lieu						
Blda Weiaht	12.5	k	-					$F = \sum_{i=1}^{r} \sum_{j=1}^{r} \sum_{i=1}^{r} \sum_{i=1}^{r} \sum_{i=1}^{r} \sum_{j=1}^{r} $	$\sum_{x=x}^{l} F_{i/\dots}$	142	Fa 12	10-1
bidgi molgini	.2.0							p_x	$\sum_{i=x}^{n}$	$w_i w_p x$		
$V = C_S W$	2.2	k	Eq. 12.8-	I, Strength	Level Base	e Shear		$F_{px} \geq 0.$	$2S_{DS}I_e w_p$	0x	Eq. 12.	10-2
$V = C_{Sasd}W$	1.6	k	Eq. 12.8-	ASD Base	e Shear			$F_{px} \leq 0.$	$4S_{DS}I_ew_p$	0x	Eq. 12.	10-3
			-4				L					
ertical Distril	bution	ASD	ρ=	1.3	k=	1.000		-				
	b (#)	M (F)	h ^k /m	M/ L K		Story Shea	ar		For	Diaphragn	n Nuded)	
Level	¹¹ x (11)	VV _X (K)	n _x (ii)	vvxnx	C (%)	F (k)	SV (k)	F.	F .			, v=F /F
					O _{VX} (70)	1 _X (K)	3V (K)	 px,calc 	' px,min	px,max	 px,design 	Y-ipx/ix
									1			
									1	1	1	
							1		1			1
								-				
				I			I	-	1	1	1	



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Huber Garage
Seismic Criteria

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Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method ASD

Wind Coefficients

Exposure	С	
V=	98	mph
K _d =	0.85	Table 26.6-1
K _h =	0.85	Table 26.10-1
K _e =	1.00	Table 26.9-1
G=	0.85	26.9.4

Leeward Roof

Pressure Coefficients from Figure 27.3-1:				
Bldg Face	Cp			
Windward Wall	0.8			
Leeward Wall	-0.50			
Windward Roof	-1.05 / -0.18			

Location and Building Dimensions

Calculate Kzt?	No	
Kzt	1.00	
Roof Type	Gable	
Roof Angle - Transverse Dir	0	degrees
Roof Angle - Long Dir	26.6	degrees
Ground to top of roof	19	ft
Bot of roof to top of roof	7	ft
Mean Roof Height, h	15.5	ft
Short Plan Dimension	22.5	ft
Long Plan Dimension	38	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	12	ft
Velocity Pressure at Mean	17.8	psf

17.8 Roof Height, q_h =

ASD

Roof Pressures (Unfactored)

Wind	lward	Looword	Horiz Proj
Max	Min	Leeward	(psf)
-2.7	-15.9	-8.7	4.80

ASD	
oriz Proj	
4.80	

Wall Pressures (Unfactored): Г Нt Т ĸ

Ht	Kz	qz	P _{ww walls}	Plwwalls	P _{walls} (psf)
0-15	0.85	17.73	12.06	7.58	11.8
15-20	0.9	18.78	12.77	7.58	12.2
20-25	0.94	19.61	13.33	7.58	12.5
25-30	0.98	20.44	13.90	7.58	12.9
30-40	1.04	21.70	14.75	7.58	13.4
41-50	1.09	22.74	15.46	7.58	13.8
51-60	1.13	23.57	16.03	7.58	14.2
61-70	1.17	24.41	16.60	7.58	14.5
71-80	1.21	25.24	17.16	7.58	14.8
81-90	1.24	25.87	17.59	7.58	15.1
91-100	1.26	26.29	17.87	7.58	15.3

-0.58

Longitudinal Wind Pressures

L/B = 1.69 h/L = 0.41

Pressure Coefficients from Figure 27.4-1:		
Bldg Face	Cp	
Windward Wall	0.8	
Leeward Wall	-0.36	
Windward Roof	-0.24 / 0.24	
Leeward Roof	-0.60	

Wall Pressures	(Unfactored):				ASD
Ht	Kz	qz	Pww walls	Plwwalls	P _{walls} (psf)
0-15	0.85	17.73	12.06	5.49	10.53
15-20	0.9	18.78	12.77	5.49	10.95
20-25	0.94	19.61	13.33	5.49	11.30
25-30	0.98	20.44	13.90	5.49	11.64
30-40	1.04	21.70	14.75	5.49	12.15
41-50	1.09	22.74	15.46	5.49	12.57
51-60	1.13	23.57	16.03	5.49	12.91
61-70	1.17	24.41	16.60	5.49	13.25
71-80	1.21	25.24	17.16	5.49	13.59
81-90	1.24	25.87	17.59	5.49	13.85
91-100	1.26	26.29	17.87	5.49	14.02

Roof Press	ASD		
Wind	lward	Leeward	Horiz Proj
Max	Min	Leewalu	(psf)
3.6 -3.7		-9.1	4.80

STRUCTURAL ENGINEERING

Huber Garage

Wind Criteria

9/10/2021 DATE PROJ. # 01519-2021-06 DMR DESIGN SHEET ____ 10

2124 Third Ave, Suite 100, Seattle, WA 98121 1 O 206,443,6212 934 Broadway, Suite 100, Tacoma, WA 98402 1 O 253,284,9470

Estengineers.com SWENSON SAY FAGÉT

SEATTLE TACOMA





STRUCTURAL ENGINEERING DATE 01519-2021-06 PROJ. # DMR DESIGN 12 SHEET

<u>B2</u> L= 17'	P= 2.3 k (@ mid-span)	Rxn= 1.83 k	
f₅= 1236 psi f₅= 43 psi	∆= 0.42" L/486	<u>GL 5.125x12</u>	
<u>H1</u> L= 6'	P= 4.5 k (@ 3.5')	Rxn= 2.63 k	
f₅= 1138 psi f _v = 85 psi	Δ= 0.06" L/1200	<u>GL 5.125x9</u>	
<u>H2</u> L= 6'	w= 600 plf	Rxn= 1.8 k	
f₅= 757 psi f _v = 72 psi H3	Δ= 0.07" L/1060	<u>(2)2x10</u>	
 L= 6.5'	w= 280 plf	Rxn= 0.56 k	
f₅= 675 psi f _v = 51 psi	Δ= 0.09" L/859	<u>(2)2x8</u>	
<u>H4</u>			
L= 6'	P= 2.3 k (@ mid-span)	Rxn= 1.15 k	
f₅= 829 psi f _v = 53 psi	Δ= 0.05" L/1394	4x10	
H5			
L= 12'	w= 300 plf	Rxn= 1.8 k	
DCR _M : 0.04	Δ= 0.09"		
DCR _v : 0.11	L/1600	<u>W6x25</u>	

Cef	
601	STRUCTURAL ENGINEERING

PROJECT

	08/06/21
DATE	01519-2021-06
PROJ. #	
DESIGN	
SHEET	13



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-	 	

ENGINEERING

SHEET

DESIGN

<u>B4</u> L= 9'			
L= 9	w 700 plf		
	w= 700 pi	RXII= 3.15 K	
f₀= 570 p	si $\Delta = 0.04$ "	1 SL 2 5x16	
l _v = 59 psi	L/2497	<u>LSL 3.5x16</u>	
<u>B5</u>			
L= 15'	w= 700 plf P= 1.8 k	K Rxn= 6.0 k	
f _b = 1364	osi ∆= 0.28"		
f _v = 96 psi	L/644	(<u>3) LVL 1.75x16</u>	
<u>B6</u>			
L= 18'	w= 1.38 klf P= 9.8 k	x Rxn= 20.3 k	
DCR _M : 0.	08 Δ= 0.21"		
DCR _v : 0.	18 L/1029	<u>W14x68</u>	
<u>B7</u>			
L= 17'	w= 150 plf P= 20.3	k Rxn= 20.74 k	
DCR _M : 0.	14 Δ= 0.09"		
DCR _v : 0.	18 L/2519	<u>W14x68</u>	
<u>B8</u>			
L= 12'	w= 420 plf	Rxn= 2.52 k	
f _b = 1103	osi Δ= 0.26"		
f _v = 76 psi	L/556	LSL 3.5x11.875	
<u>H1</u>			
L= 6'	w= 700 plf P= 4.5 k	K Rxn= 5.1 k	
f₅= 707 n	si $\Delta = 0.03''$		
f _v = 112 p	si L/2725	LSL 3.5x16	
H2			
 L= 10'	w= 150 plf P= 1.2 k	K Rxn= 1.9 k	
f - 613 n	' (@ 1.5'/8.5 si Δ= 0.06"	5)	
f _v = 46 psi	L/1907	LSL 3.5x16	
H3			
l = 12'	w= 400 plf	Rxn = 2.4 k	
£ 570 -			
i₀= 579 p f₀= 50 psi	$\Delta = 0.10$ L/1429	LSL 3.5x16	
Ни			
<u> </u>	w- 700 plf	Ryn- 1 58 k	
L- 4.J		1.50 K	
f – 70 pc	$\Delta = 0.05^{"}$	(2) 2x8	

SSF

	Huber Residence	08/06/21
A	PROJECT	DATE 01519-2021-06
	ET	PROJ. #
STRUCTURAL		DMR
ENGINEERING		DESIGN
		SHEET



	Huber Residence	08/06/21
1	PROJECT	DATE 01519-2021-06
4		PROJ. #
STRUCTURAL		DMR
ENGINEERING		DESIGN
		SHEET

B3		mmm
L= 10' w= 1	080 plf P= 23.5 k	Rxn= 26.2 k
DCR _M : 0.25 DCR _V : 0.21	Δ= 0.05" L/2450	<u>W14x90</u>
<u>B4</u>		<u><u><u>(B10</u></u></u>
L= 18' w=	96 plf P= 16.7 k	Rxn= 12.93 k L= 10' w= 528 plf Rxn= 2.6 k
DCR _M : 0.36 DCR _v : 0.11	Δ= 0.14" L/1565	fb= 530 psi Δ= 0.06" W14x68 fb= 71 psi L/10000+ LSL 3.5x10
<u>B5</u>		
L= 5'	w= 764 plf	Rxn= 1.9 k
f₅= 192 psi f₅= 24 psi	∆= 0.01" L/10000+	LSL 3.5x16
B6		
 L= 17' w=	150 plf P= 1.9 k	Rxn= 2.3 k
f₀= 1081 psi f₀= 56 psi	Δ= 0.33" L/613	LSL 3.5x16
B7		
L= 17' w=	576 plf P= 1.1 k	Rxn= 3.4 k
f _b = 940 psi	(@ 0'-5') (@ 9.5') Δ= 0.31"	
f _v = 69 psi	L/666	(3) LVL 1.75x16
<u>B8</u>		
L= 14'	w= 552 plf	Rxn= 6.4 k
f _b = 798 psi	Δ= 0.16"	
f _v = 72 psi	L/876	(3) LVL 1.75x13
<u>B9</u>		
L= 17'	w= 690 plf	Rxn= 5.86 k
f₀= 1308 psi f₀= 77 psi	Δ= 0.41" L/504	LSL 3.5x11.875
<u>H1</u>		
L= 12'	w= 690 plf	Rxn= 4.2 k
f₀= 652 psi f _v = 51 psi	Δ= 0.10" L/1432	(3) LVL 5.25x14
H2		
 L= 6'	w= 1224 plf	Rxn= 3.67 k
f₅= 443 psi f _v = 55 psi	Δ= 0.02" L/3735	LSL 3.5x16

	Huber Residence	08/06/21
	PROJECT	DATE 01519-2021-06
/		PROJ. #
STRUCTURAL		DESIGN 17
		SHEET



STRUCTURAL

PROJ. #

DESIGN

SHEET

RetainPro (c) 1987-2019, Buil	ld 11.20.03.31	Cantilovorad Patain	ing Wall				
License : KW-06052576 License To : SWENSON S	AY FAGET		ing wall	Code: IBC 2015,ACI 318-14,ACI 530-13			
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 = C 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 = =	3,000.0 psf d 35.0 psf/ft 300.0 psf/ft 125.00 pcf 0.00 pcf 0.450 12.00 in				
Surcharge Loads		Lateral Load Applied to	Stem	Adjacent Footing Load			
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied	= 0.0 psf & Overturning = 0.0 rturning	Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 #/ft 0.00 ft 0.00 ft id (W) rvice Level)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine 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 psf	Base Above/Below Soil at Back of Wall=0.0 ftPoisson's Ratio=0.300			
Design Summary		Stem Construction	Bottom	/			
Wall Stability Ratios Overturning Slab Resis	= 1.87 OK sts All Sliding !	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Pebas Size	t = 0.0 = Concret = LRFI = 8.0	0 e D 0			
Total Bearing Loadresultant ecc.	= 605 lbs = 4.01 in	Rebar Spacing Rebar Placed at	$=$ $\frac{\pi}{18.0}$ = Edg	• 0 e			
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= 971 psf Of = 0 psf Of = 3,000 psf s Than Allowable = 1,359 psf	C Design Data fb/FB + fa/Fa Total Force @ Section Service Level Strength Level	= 0.06 lbs = lbs = 252.	8 0			
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 0.7 psi Or = 0.7 psi Or = 3.1 psi Or = 75.0 psi	Service Level Strength Level MomentAllowable ShearActual	ft-# = ft-# = 252. = 3,655.0	0 6			
Lateral Sliding Force	= 235.3 lbs	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = 3. psi = 75.0 in2 = in = 6.23	4 0 5			
Vertical component of activ NOT considered in the calo	re lateral soil pressure la culation of soil bearing	Masonry Data f'm Fs S Solid Grouting Modular Ratio 'n'	psi = psi = = =				
Load Factors Building Code Dead Load Live Load Earth. H	IBC 2015,ACI 1.200 1.600 1.600	Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	psf = 100. = = = Medium = ASD	0 Weight			
Wind, W Seismic, E	1.000 1.000	f'c Fy	psi = 2,500.0 psi = 60,000.0	0 0			

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06052576 License To : SWENSON SAY FAGET	Cantilevered Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area Details		
Bottom Stem Vertical As (based on applied moment) : 0.0094 (4/3) * As : 0.0126 200bd/fy : 200(12)(6.25)/60000 : 0.25 in: 0.0012bh : 0.0012(12)(8) : 0.1152 Required Area : 0.01152	I Reinforcing Horizontal Reinforcing in2/ft Min Stem T&S Reinf Ar 2/ft Min Stem T&S Reinf Ar in2/ft Horizontal Reinforcing (======= One layer of : Two in2/ft #4@ 12.50 in #4@	rea 0.576 in2 rea per ft of stem Height : 0.192 in2/ft Options : layers of : © 25.00 in
Provided Area : 0.1333 Maximum Area : 0.8467	in2/ft #6@ 27.50 in #6@	ພ 38.75 ll ລ 55 00 in
Footing Data	Footing Design Results	20.00 m
Toe Width= 0.42 ft Heel Width= 1.08 Total Footing Width= 1.50 Footing Thickness= 8.00 in Key Width= 0.00 in Key Depth= 0.00 in Key Distance from Toe= 0.00 ft f'c = $2,500 \text{ psi}$ Fy = $60,000 \text{ psi}$ Footing Concrete Density= 150.00 pcf Min. As %= 0.0018 Cover @ Top 2.00 @ Btm.= 3.00 in	ToeHFactored Pressure $=$ 1,359Mu': Upward $=$ 1,277Mu': Downward $=$ 206Mu: Design $=$ 89Actual 1-Way Shear $=$ 0.70Allow 1-Way Shear $=$ 40.0040Toe Reinforcing $=$ None Spec'dHeel Reinforcing $=$ None Spec'dKey Reinforcing $=$ None Spec'dFooting Torsion, Tu $=$ Footing Allow. Torsion, phi Tu $=$ If torsion exceeds allowable, providesupplemental design for footing torsiOther Acceptable Sizes & SpacingsToe:Toe:phiMn = phi'5'lambda'sqrt(fc)'SmHeel:phiMn = phi'5'lambda'sqrt(fc)'SmKey:No key definedMin footing T&S reinf Area per foot0If one layer of horizontal bars:If tw#4@ 13.89 in##6@ 30.56 in#	eel 0 psf 1 ft-# 49 ft.# 48 ft.# 8.08 psi 0.00 psi 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.17 in2 /ft vo layers of horizontal bars: 4@ 27.78 in 5@ 43.06 in 6@ 61.11 in

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Summary of Overturning & Res	sting Forces & Moments	

		OV	ERTURNI	NG				RES	SISTING	
Item		Force lbs	Distance ft	e Moi ft	ment -#			Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tb	D	235.3	1.22		287.6	Soil Over HL (ab. water	tbl)	155.0	1.29	200.5
HL Act Pres (be water to	l)					Soil Over HL (bel. water Watre Table	tbl)		1.29	200.5
Buoyant Force	=					Sloped Soil Over Heel	=			
Surcharge over Heel	=					Surcharge Over Heel	=			
Surcharge Over Toe	=					Adjacent Footing Load	=			
Adjacent Footing Load	=					Axial Dead Load on Ster	n =			
Added Lateral Load	=					Soil Over Tee	_		0.04	
Load @ Stem Above Soi	=					Surcharge Over Toe	=		0.21	
	=					Stem Weight(s)	_	300.0	0.75	226.0
			_			Earth @ Stem Transition	IS=			
Total	=	235.3	O.T.M.	=	287.6	Footing Weight	=	150.0	0.75	112.5
						Key Weight	=			
Resisting/Overturnin	g Rat	io	=	1.87		Vert. Component	=			
Vertical Loads used f	or Soi	Pressure =	= 6	05.0 lbs		Tot	al =	605.0 lb	s R.M.=	539.0
						* Axial live load NOT inclu resistance, but is include	ded in d for s	total displaye oil pressure c	d, or used for alculation.	roverturning

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)0.054inThe above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

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RetainPro (c) 1987-2019, Buil	d 11.20	03.31		Ca	ntilevered Retai	ining V	Vall	Codo: IBC 2015 ACI 219 14 ACI 520 4			
License : KW-06052576 License To : SWENSON SAY FAGET				Ud				Code: IBC 2015,ACI 318-14,ACI 530-1			
Criteria				Soil I	Data						
Retained Height Wall height above soil Slope Behind Wall	= = =	3.00 ft 0.00 ft 0.00	A E A	Allow S Equiva Active	Soil Bearing = lent Fluid Pressure Met Heel Pressure =	4,000.0 thod 35.0	psf psf/ft				
Height of Soil over Toe Water height over heel	=	6.00 in 0.0 ft	P S S F S	Passiv Soil De Soil De Soil De Soil he for p	e Pressure = ensity, Heel = ensity, Toe = g Soil Friction = ight to ignore assive pressure =	300.0 125.00 0.00 0.450 12.00	psf/ft pcf pcf in				
Surcharge Loads					ral Load Applied 1	to Stom		Restraint			
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied	= & Over = turning	0.0 psf turning 0.0		_atera Heig Heig _oad 1	I Load = ht to Top = ht to Bottom = Fype = V (1)	0.0 #/ 0.00 ft 0.00 ft Vind (W) Service Le	/ft evel)	Adjacent Pooling Load=0.0 lbsAdjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadPase Abyso/Rolew Soil-			
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in	- , -	Wind (Serv	on Exposed Stem ₌ rice Level)	0.0 p	sf	at Back of Wall=0.0 ftPoisson's Ratio=0.300			
Method : Uniform Multiplier Used (Multiplier used on soil d	= 6 ensity)	5.000		Jnifori Fotal S	m Seismic Force = Seismic Force =	22.000 80.667	Bottom				
Wall Stability Ratios Overturning Slab Resis	= ts All S	1.38 Ra liding !	utio < 1	1.5!	Design Height Above Wall Material Above " Design Method Thickness Rebar Size	Ftg ft = Ht" = = =	Stem OK 0.00 Concrete LRFD 8.00 # 4				
Total Bearing Load resultant ecc.	= =	605 lbs 6.07 in			Rebar Spacing Rebar Placed at	=	,, 18.00 Edge				
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	1,650 psf 0 psf 4,000 psf	OK OK		fb/FB + fa/Fa Total Force @ Section	= on	0.096	5			
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	s Than = =	Allowable 2,310 psf 0 psf			Strength Level MomentActual Service Level	lbs = ft-# =	318.0				
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	1.3 psi 3.3 psi 75.0 psi	OK OK		Strength Level MomentAllowable ShearActual	ft-# = =	351.0 3,655.6				
Lateral Sliding Force	=	291.7 lbs			Service Level Strength Level ShearAllowable	psi = psi = psi =	4.2 75.0				
				I	Anet (Masonry) Rebar Depth 'd' Asonry Data	in2 = in =	6.25				
Vertical component of activ NOT considered in the calc	e latera ulation	al soil pressu of soil beari	ire IS ng		t'm Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = =	100.0				
Load Factors Building Code Dead Load	IBC	C 2015,ACI 1.200		_	Short Term Factor Equiv. Solid Thick. Masonry Block Type	- 164 	Medium V	Veiaht			

Masonry Design Method

Concrete Data

f'c

Fy

= ASD

psi = 60,000.0

2,500.0

psi =

1.200
1.600
1.600
1.000
1.000

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Concrete Stem Rebar Area Details		
Bottom Stem Vertical As (based on applied moment) : 0.0132 (4/3) * As : 0.0175 200bd/fy : 200(12)(6.25)/60000 : 0.25 in 0.012b : 0.0012(12)(9) : 0.01450	al Reinforcing Horizontal Reinforcing 2 in2/ft 3 in2/ft Min Stem T&S Reinf Are 12/ft Min Stem T&S Reinf Are 12/ft Lorizontal Reinforcing C	ea 0.576 in2 ea per ft of stem Height : 0.192 in2/ft
0.0012bh : 0.0012(12)(8) : 0.1152 Required Area : 0.1152 Provided Area : 0.1333 Maximum Area : 0.8467	Prozential Reinforcing C ====== One layer of : 2 in2/ft #4@ 12.50 in #4@ 12.50 in #6@ 27.50 in	ayers of : 2 25.00 in 2 38.75 in 2 55.00 in
Footing Data	Footing Design Results	
Toe Width = 0.42 ft Heel Width = 1.08 Total Footing Width = 1.50 Footing Thickness = 8.00 in Key Width = 0.00 in Key Depth = 0.00 ft f'c = $2,500$ psi Fy = $60,000$ psi Footing Concrete Density = 150.00 pcf Min. As % = 0.0018 Cover @ Top 2.00 @ Btm.= 3.00 in	ToeHeFactored Pressure=2,310Mu': Upward=1,978Mu': Downward=206Mu: Design=148Actual 1-Way Shear=1.26Allow 1-Way Shear=40.00Toe Reinforcing=None Spec'dHeel Reinforcing=None Spec'dKey Reinforcing=None Spec'dFooting Torsion, Tu=0If torsion exceeds allowable, provide supplemental design for footing torsioOther Acceptable Sizes & Spacings Toe: phiMn = phi'5'lambda'sqrt(fc)'Sm Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm Key: No key definedMin footing T&S reinf Area per foot #4@ 13.89 in0.Min footing T&S reinf Area per foot #6@ 30.56 in#6	19 0 psf 0 ft-# 49 ft-# 49 ft-# 27 psi .00 psi 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.01 ft-lbs 0.02 ft-lbs 0.03 ft-lbs 0.04 ft-lbs 0.05 ft-lbs 0.06 ft-lbs 0.07 ft-lbs 0.08 ft-lbs 0.09 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.01 ft-lbs 0.02 ft-lbs 0.03 ft-lbs 0.04 ft-lbs 0.17 ft-lbs 0.17 ft-lbs 0.18 ft-lbs 0.19 ft-lbs 0.11 ft-lbs

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		ŌV	'ERTURNING	}		RE	RESISTING		
Item		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl	")	235.3	1.22	287.6	Soil Over HL (ab. water tbl)	155.0	1.29	200.5	
HL Act Pres (be water tb) Hydrostatic Force	l)	-			Soil Over HL (bel. water tbl) Watre Table		1.29	200.8	
Buoyant Force	=				Sloped Soil Over Heel =				
Surcharge over Heel	=				Surcharge Over Heel =				
Surcharge Over Toe	=				Adjacent Footing Load =				
Adjacent Footing Load	=				Axial Dead Load on Stem =				
Added Lateral Load	=				* Axial Live Load on Stem =				
Load @ Stem Above Soil	! =				Soil Over Toe =		0.21		
Seismic Earth Load	=	56.5	1.83	103.5	Surcharge Over Toe =				
	=				Stem Weight(s) =	300.0	0.75	226.0	
-			- o .		Earth @ Stem Transitions =				
Total	=	291.7	0.T.M. =	391.1	Footing Weight =	150.0	0.75	112.5	
					Key Weight =				
Resisting/Overturning	g Rati	io	=	1.38	Vert. Component =				
Vertical Loads used for	or Soi	I Pressure	= 605.	0 lbs	Total =	605.0 h	bs R.M.=	539.(
If seismic is included the	2 OTM	1 and elidin	a ratios	-	+ Axial live load NOT included resistance, but is included for	in total display	ed, or used fo calculation.	r overturr	

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.092 in

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

RetainPro (c) 1987-2019, Build	d 11.20.03.31	Cantilevered Retain	ing Wall	Codo: IBC 2015 ACI 218 14 ACI 520 12			
License To : SWENSON S	AY FAGET	Canthevered Retain		Code: IBC 2015,ACI 318-14,ACI 530-13			
Criteria		Soil Data					
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 4.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Soil Bearing = C Equivalent Fluid Pressure Metho Active Heel Pressure = Active Heel Pressure = = Passive Pressure = = Soil Density, Heel = = Soil Density, Toe = =	3,000.0 psf d 35.0 psf/ft 300.0 psf/ft 125.00 pcf 0.00 pcf				
		Soil height to ignore for passive pressure =	12.00 in	Restraint			
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 0.00 ft	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ft			
Axial Load Applied	to Stem	(Se	rvice Level)	Footing Type Line Load Base Above/Below Soil			
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 psf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300			
Design Summary		Stem Construction	Botto	n			
Wall Stability Ratios Overturning Slab Resis	= 1.92 OK ts All Sliding !	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = 0 = Conc = LF = {	OK .00 rete RFD 3.00			
Total Bearing Loadresultant ecc.	= 815 lbs = 4.47 in	Rebar Size Rebar Spacing Rebar Placed at	= # = 18 = F	4 9.00 dae			
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= 813 psf Ok = 0 psf Ok = 3,000 psf s Than Allowable = 1 139 psf	Design Data fb/FB + fa/Fa Total Force @ Section Service Level Strength Level	= 0 lbs = lbs = 44	.163 8.0			
ACI Factored @ Heel	= 0 psf	MomentActual Service Level	ft-# =				
Footing Shear @ Heel Allowable	= 3.7 psi OK = 75.0 psi	Strength Level MomentAllowable	ft-# = 59 = 3,65	07.3 05.6			
Lateral Sliding Force	= 381.1 lbs	Service Level Strength Level	psi = psi =	6.0			
		Anet (Masonry) Rebar Depth 'd'	in2 = 6	3.25			
Vertical component of activ	e lateral soil pressure IS	f'm Fs Solid Grouting	psi = psi = =				
NOT considered in the calc	ulation of soil bearing	Modular Ratio 'n' Wall Weight	= psf = 1(0.0			
Building Code Dead Load Live Load Farth H	IBC 2015,ACI 1.200 1.600 1 600	Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = Mediu = ASD	m Weight			
Wind, W Seismic, E	1.000 1.000	Concrete Data f'c Fy	psi = 2,50 psi = 60,00	0.0 0.0			

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06052576 License To : SWENSON SAY FAGET	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area Detai	S		
Bottom Stem As (based on applied moment) : (4/3) * As : 200bd/fy : 200(12)(6.25)/60000 : 0.0012bh : 0.0012(12)(8) : Required Area : Provided Area :	Vertical Reinforcing 0.0224 in2/ft 0.0298 in2/ft 0.25 in2/ft 0.1152 in2/ft 0.1152 in2/ft 0.1152 in2/ft 0.1333 in2/ft	Horizontal Reinforcing Min Stem T&S Reinf Are Min Stem T&S Reinf Are Horizontal Reinforcing C One layer of : Two I #4@ 12.50 in #4@ #5@ 19.38 in #5@	ea 0.768 in2 ea per ft of stem Height : 0.192 in2/ft Dptions : layers of : 2 25.00 in 3 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@	9 55.00 in
Footing Data	Footing Des	sign Results	
Toe Width=1.00 fHeel Width= 1.08 Total Footing Width= 2.08 Footing Thickness= 8.00 inKey Width= 0.00 inKey Depth= 0.00 inKey Distance from Toe= 0.00 ff'c = $2,500$ psiFy = $60,000$ pFooting Concrete Density= 150.00 pMin. As %= 0.0018 Cover @ Top 2.00 @ Btm.= 3.00	Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shea Toe Reinforcing Footing Torsion, T O in Footing Allow. Tors If torsion exce supplemental Other Acceptable Toe: phiMn = p Heel: phiMn = p Heel: phiMn = p Key: No key de Min footing T&S Min footing T&S If one layer of ho #4@ 13.89 in #5@ 21.53 in #6@ 30.56 in	Toe He $e = 1,139$ = 5,695 $= 1,170$ = 377 $ar = 6.43$ 3 $r = 40.00$ 40 $= None Spec'd$ = None Spec'd $= None Spec'd$ = None Spec'd $= None Spec'd$ = 0 sion, phi Tu = 0 seds allowable, provide design for footing torsic $e Sizes & Spacings$ hi'5'lambda'sqrt(fc)'Sm hi'5'lambda'sqrt(fc)'Sm sfined reinf Area 0 print Area per foot 0 prizontal bars: If tw	2921 0 psf 4 ft-# 62 ft-# 58 ft-# .69 psi .00 psi .00 psi 0.00 ft-lbs .00 ft-lbs 0.00 ft-lbs .00 ft

RetainPro (c) 1987-20 ⁻ License : KW-0605257 License To : SWEN	19, Build 11.20.03.31 /6 ISON SAY FAGET		Cantileve	ed Retaining Wall	Code: IBC 2	2015,ACI 318	-14,ACI 530-
Summary of	Overturning & F	Resisting F	orces & Mo	ments			
	O` Force	VERTURNING Distance	S Moment		R Force	ESISTING Distance	Moment
ltem	lbs	ft	ft-#		lbs	ft	ft-#

HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hvdrostatic Force	381	1.1	1.56		592.8	Soil Over HL (ab. wat Soil Over HL (bel. wat Watre Table	er tbl) ter tbl)	206.7	1.87 1.87	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 Si	= = l = tem =			
Added Lateral Load Load @ Stem Above Soil	= = =					Axial Live Load on Ste Soil Over Toe Surcharge Over Toe	em = = =	400.0	0.50	533 3
Total	= 381	1.1 (О.Т.М.	=	592.8	Earth @ Stem Transiti Footing Weight Key Weight	- ons= = =	208.0	1.04	216.3
Resisting/Overturning Vertical Loads used fo	r Ratio F Soil Pressu	ure =	= 8	1.92 314.7 lbs		Vert. Component To * Axial live load NOT inc	= otal = cluded in tot	814.7 lbs tal displayed,	R.M.=	1,136.8 erturning

* Axial live load NOT included in total displayed, or used for over 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) 0.043 in

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

because the wall would then tend to rotate into the retained soil.

nce\Calcs\Typical Detail Co-04-07 RPX

his Wall in File: K:\2021\01	510 2021 06 Hubor	Posidon	4'-0" Ret	aining	Wall w/ S	ab, w/ Seismic			
etainPro (c) 1987-2019, Buil icense : KW-06052576 icense To : SWENSON S	a 11.20.03.31	C	antilevered Retain	ing V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-1			
Criteria		Soi	I Data						
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 4.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Equir Activ Pass Soil I Soil I Footi Soil I	v Soil Bearing = 4 valent Fluid Pressure Metho e Heel Pressure =	1,000.0 d 35.0 300.0 125.00 0.00 0.450 12.00) psf) psf/ft) psf/ft) pcf) pcf in	Pestan			
Surcharge Loads		Lat	eral Load Applied to	Stem		Adjacent Footing	Load		
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied Axial Dead Load Axial Load Eccentricity	= 0.0 psf & Overturning = 0.0 turning to Stem = 0.0 lbs = 0.0 lbs = 0.0 in	Late He Load Win (Se	ral Load = eight to Top = ight to Bottom = th Type = Win (Se d on Exposed Stem = ervice Level)	0.0 #/ 0.00 ft 0.00 ft (d (W) rvice Le 0.0 p	/ft evel) 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		
Farth Pressure Se									
Multiplier Used (Multiplier used on soil de	= 7.000 ensity)	Tota	em Construction	2.444	Bottom				
Wall Stability Ratios Overturning Slab Resis Total Bearing Load	= 1.35 Rati ts All Sliding ! = 815 lbs	0 < 1.5!	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Rebar Spacing	ft = = = = =	Stem OK 0.00 Concrete LRFD 8.00 # 4 18.00				
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 1,500 psf = 0 psf = 4,000 psf	OK OK	Rebar Placed at Design Data fb/FB + fa/Fa Total Force @ Section Service Level	= = lbs =	0.234				
ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe	= 2,100 psf = 0 psf = 11.1 psi	ОК	Strength Level MomentActual Service Level	lbs = ft-# =	578.7				
Footing Shear @ Heel Allowable Sliding Calcs	= 4.1 psi = 75.0 psi	OK	Strength Level MomentAllowable ShearActual	ft-# = =	858.7 3,655.6				
Lateral Sliding Force	= 487.8 lbs		Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data	psi = psi = psi = in2 = in =	7.7 75.0 6.25				
ertical component of activ OT considered in the calc	e lateral soil pressure ulation of soil bearing	e IS g	f'm Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = psf =	100.0				
Load Factors Building Code	IBC 2015,ACI		Short Term Factor Equiv. Solid Thick.	=					

Masonry Block Type

Concrete Data

f'c

Fy

Masonry Design Method

= Medium Weight

2,500.0 psi = 60,000.0

= ASD

psi =

IBC 2015,ACI
1.200
1.600
1.600
1.000
1.000

.

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-07.RPX

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06052576 License To : SWENSON SAY FAGET	Cantilevered Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area Details		
Bottom Stem Vertical As (based on applied moment) : 0.0322 (4/3) * As : 0.0429 200bd/fu : 200/12)/6 25//60000 : 0.25 in	I Reinforcing Horizontal Reinforcing in2/ft in2/ft Min Stem T&S Reinf Are	ea 0.768 in2
0.0012bh : 0.0012(12)(8) : 0.1152	in2/ft Horizontal Reinforcing C	Depine of stem neight : 0.132 m2/n Depines : layers of :
Required Area : 0.1152 Provided Area : 0.1333 Maximum Area : 0.8467	in2/ft #4@ 12.50 in #4@ in2/ft #5@ 19.38 in #5@ in2/ft #6@ 27.50 in #6@	2 25.00 in 2 38.75 in 2 55.00 in
Footing Data	Footing Design Results	
Toe Width= 1.00 ft Heel Width= 1.08 Total Footing Width= 2.08 Footing Thickness= 8.00 in Key Width= 0.00 in Key Depth= 0.00 in Key Distance from Toe= 0.00 ft f'c = $2,500 \text{ psi}$ Fy = $60,000 \text{ psi}$ Footing Concrete Density = 150.00 pcf Min. As %= 0.0018 Cover @ Top 2.00 @ Btm.= 3.00 in	ToeHeFactored Pressure=2,100Mu': Upward=8,733Mu': Downward=1,170Mu: Design=630Actual 1-Way Shear=11.07Allow 1-Way Shear=40.0040.Toe Reinforcing=None Spec'dHeel Reinforcing=Heel Reinforcing=None Spec'dKey Reinforcing=None Spec'dFooting Torsion, Tu=(0)If torsion exceeds allowable, providesupplemental design for footing torsioOther Acceptable Sizes & SpacingsToe: phiMn = phi'5'lambda'sqrt(fc)'SmHeel: phiMn = phi'5'lambda'sqrt(fc)'SmKey:Key:No key definedMin footing T&S reinf Area0.0If one layer of horizontal bars:If tw#4@ 13.89 in#4#5@ 21.53 in#5#6@ 30.56 in#6	1 0 psf 0 ft-# 62 ft-# 62 ft-# 13 psi 00 psi 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs

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- -

		OV	ERTURNING	<u>۱</u>		RE	SISTING	
Item		Force lbs	Distance ft	Moment ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl	1)	381.1	1.56	592.8	Soil Over HL (ab. water tbl)	206.7	1.87	387.2
HL Act Pres (be water tb Hydrostatic Force	Í)	·	-	-	Soil Over HL (bel. water tbl) Watre Table		1.87	387.2
Buoyant Force	=				Sloped Soil Over Heel =			
Surcharge over Heel	=				Surcharge Over Heel =			
Surcharge Over Toe	=				Adjacent Footing Load =			
Adjacent Footing Load	=				Axial Dead Load on Stem =			
Added Lateral Load	=				* Axial Live Load on Stem =			
Load @ Stem Above Soi	1 =				Soil Over Toe =		0.50	
Seismic Earth Load	=	106.7	2.33	249.0	Surcharge Over Toe =			
	=	-			Stem Weight(s) =	400.0	1.33	533.3
- / •		407.0	- o T :: -		Earth @ Stem Transitions =			
Total	=	487.8	0.T.M. =	841.8	Footing Weight =	208.0	1.04	216.3
					Key Weight =			
Resisting/Overturnin	g Rat	tio	=	1.35	Vert. Component _=			
Vertical Loads used f	or So	I Pressure	= 814.	7 lbs	Total =	814.7	bs R.M.=	1,136.8
If seismic is included the	∋ OT	M and slidin	a ratios		* Axial live load NOT included in resistance, but is included for s	n total display	ed, or used fo calculation.	r overturning

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.080 in

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

because the wall would then tend to rotate into the retained soil.

icense · KW-06052576	5.51	Cantilevered Retain	ina V	Code: IBC 2015.ACI 318-14.ACI 530-12				
icense To : SWENSON SAY FAG	ET							
Criteria		Soil Data						
Retained Height=0Wall height above soil=0Slope Behind Wall=	6.00 ft 0.00 ft 0.00	Allow Soil Bearing = 3 Equivalent Fluid Pressure Metho Active Heel Pressure =	3,000.0 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 =	300.0 125.00 0.00 0.450 12.00) psf/ft) pcf) pcf in				
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing I	_oad		
Surcharge Over Heel = Used To Resist Sliding & Overt Surcharge Over Toe = Used for Sliding & Overturning	0.0 psf urning 0.0	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	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft		
Axial Load Applied to Ste	em	(Sei	vice L	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		
Design Summary		Stem Construction	٦.	Bottom				
Wall Stability Ratios Overturning =	1.55 OK	Design Height Above Ftg Wall Material Above "Ht" Design Method	ft = = =	Stem OK 0.00 Concrete LRFD				
SIAD RESISTS AII SI	iaing !	Thickness Rebar Size	=	8.00 # 5				
Total Bearing Load = resultant ecc. =	1,295 lbs 9.01 in	Rebar Spacing Rebar Placed at	=	12.00 Edge				
Soil Pressure @ Toe = Soil Pressure @ Heel =	1,094 psf OK 0 psf OK	Design Data fb/FB + fa/Fa	=	0.248				
Allowable = Soil Pressure Less Than /	3,000 psf Allowable	Service Level	lbs =					
ACI Factored @ Toe = ACI Factored @ Heel =	1,531 psf 0 psf	Strength Level MomentActual	lbs =	1,008.0				
Footing Shear @ Toe =	15.1 psi OK	Service Level	ft-# =	2.016.0				
Allowable =	4.5 psi OK 75.0 psi	MomentAllowable	=	8,121.3				
Sliding Calcs Lateral Sliding Force =	817.2 lbs	Service Level	psi =	10.0				
		ShearAllowable	psi = psi =	13.6 75.0				
		Anet (Masonry) Rebar Depth 'd'	in2 = in =	6.19				
		Masonry Data	nsi –					
		Fs	psi =					
<pre>/ertical component of active lateral JOT considered in the calculation of</pre>	l soil pressure IS of soil bearing	S Solid Grouting Modular Ratio 'n'	=					
Load Factors		Wall Weight	psf = =	100.0				
Building Code IBC	2015,ACI	Equiv. Solid Thick.	=					
Live Load	1.600	Masonry Block Type Masonry Design Method	=	Medium V	leight			
Earth, H	1.600	Concrete Data						
Mund M/	1 000	f'c	nci –	2 500 0				

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-07.RPX

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Concrete Stem Rebar Area Detai	ls		
Bottom Stem As (based on applied moment) :	Vertical Reinforcing 0.0763 in2/ft	Horizontal Reinforcing	
(4/3) * As :	0.1018 in2/ft	Min Stem T&S Reinf Area	1.152 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 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	ers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in #4@ 2	5.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in #5@ 3	8.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 5	5.00 in
Footing Data	Footing Des	ign Results	
Toe Width= 2.00 Heel Width= 1.08 Total Footing Width= 3.08 Footing Thickness= 10.00 Key Width= 0.00 Key Depth= 0.00 Key Distance from Toe= 0.001 f'c = $2,500$ psiFy = $60,000$ Footing Concrete Density= 150.00 Min. As %= 0.0018 Cover @ Top 2.00 @ Btm.= 3.00	ft Factored Pressure Mu': Upward Mu': Downward Mu: Design n Actual 1-Way Shear n Allow 1-Way Shear it Toe Reinforcing ft Heel Reinforcing poof Key Reinforcing Footing Torsion, Tu 0 in Footing Allow. Tors	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$) psf) ft-#) ft-# 2 psi) psi 0 ft-lbs 00 ft-lbs
	If torsion excee	eds allowable, provide	
	Other Acceptable Toe: #4@ 11.11 Heel: phiMn = ph Key: No key def Min footing T&S Min footing T&S If one layer of ho #4@ 11.11 in #5@ 17.22 in	Sizes & Spacings in, #5@ 17.22 in, #6@ 24. ni'5'lambda'sqrt(fc)'Sm fined reinf Area 0.67 reinf Area per foot 0.22 rizontal bars: If two la #4@ #5@	44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 7 in2 2 in2 /ft ayers of horizontal bars: 2 22.22 in 2 34.44 in

etainPro (c) 1987-2019, E icense : KW-06052576 icense To : SWENSON	Build 11.20.03.31		Cantileve	red Retaining Wall	Code: IBC	2015,ACI 318	-14,ACI 530	J-13
Summary of Ove	erturning & F	Resisting F	orces & Mo	oments				
	0	VERTURNING				RESISTING		
	Force	Distance	Moment		Force	Distance	Moment	
ltem	lbs	ft	ft-#		lbs	ft	ft-#	

HL Act Pres (ab water tb)) (317.2	2.28	1.861.3	Soil Over HL (ab. wate	r tbl)	310.0	2.87	890.7
HL Act Pres (be water tbl)				Soil Over HL (bel. wate	er tbl)		2.87	890.7
Hydrostatic Force	·				Watre Table				
Buoyant Force	=				Sloped Soil Over Heel	=			
Surcharge over Heel	=				Surcharge Over Heel	=			
Surcharge Over Toe	=				Adjacent Footing Load	=			
Adjacent Footing Load	=				Axial Dead Load on Ste	em =			
Added Lateral Load	=				* Axial Live Load on Ster	n =			
Load @ Stem Above Soil	=				Soil Over Toe	=		1.00	
	=				Surcharge Over Toe	=			
					Stem Weight(s)	=	600.0	2.33	1,400.0
					Earth @ Stem Transitio	ns=			
Total	= 8	317.2	O.T.M. =	1,861.3	Footing Weight	=	385.0	1.54	592.9
					Key Weight	=			
Resisting/Overturning	J Ratio		= 1	.55	Vert. Component	=			
Vertical Loads used for	or Soil Pressure =		1,295.0 lbs		То	tal =	1,295.0 lbs	R.M.=	2,883.6
					 * Axial live load NOT incl resistance, but is includ 	uded in ed for so	total displayed, bil pressure cal	or used for or culation.	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	pci

Horizontal Defl @ Top of Wall (approximate only) 0.059 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.
RetainPro (c) 1987-2019, Bui	Id 11.20.0	3.31	Reside	Cantilevered Retain	ainina V	Vall	Code: IBC 2015 /	ACI 318-14 ACI 530-13
License To : SWENSON S	SAY FAG	ET			<u>9</u> -			
Criteria			5	Dii Data				
Retained Height	= (6.00 ft	All	ow Soil Bearing	= 4,000.0	psf		
Wall height above soil	= (0.00 ft	⊑q Ac	tive Heel Pressure	= 35.0	psf/ft		
Slope Behind Wall	= 0	0.00				P		
Height of Soil over Toe	= 6	6.00 in	De		=			
Water height over heel	=	0.0 ft	Pa	SSIVE Pressure	= 300.0	psi/π		
			50	il Density, neel	= 125.00	pci pcf		
			Fo	otinallSoil Friction	= 0.450	por		
			So	il height to ignore				
			f	or passive pressure	= 12.00	in	Restraint	
Surcharge Loads			L	ateral Load Applied	I to Stem		Adjacent Footing	Load
Surcharge Over Heel	=	0.0 psf	La	teral Load =	0.0 #/	/ft	Adjacent Footing Load	= 0.0 lbs
Used To Resist Sliding	& Overt	urning	!	Height to Top =	0.00 ft		Footing Width	= 0.00 ft
Used for Sliding & Over	- rturnina	0.0	l	Height to Bottom =	0.00 ft		Wall to Eta CL Dist	= 0.00 m
Avial Load Applied	to St	om	Lo	ad Type =	Wind (W)	N	Footing Type	Line Load
					(Service Le	evel)	Base Above/Below Soil	- 0.0.4
Axial Dead Load	=	0.0 lbs	W	ind on Exposed Stem =	0.0 p	sf	at Back of Wall	- 0.0 II
Axial Load Eccentricity	=	0.0 in	(•	Service Level)			Poisson's Ratio	= 0.300
Earth Pressure Se	eismic	Load						
Method : Uniform			Ur	iform Seismic Force =	41.000			
Multiplier Used	= 6. Iensity)	.000	То	tal Seismic Force =	280.167			
	icrisity)							
Design Summary				Stem Construction		Bottom		
				Design Height Above	eFtg ft =	0.00		
Wall Stability Ratios	_			Wall Material Above	"Ht" =	Concrete		
Slah Resig	- sts All Sli	1.14 Rat iding I	10 < 1.5	Design Method This lange	=	LRFD		
		ianig .		Rebar Size	=	8.00 # 5		
Total Bearing Load	=	1,295 lbs		Rebar Spacing	=	12.00		
resultant ecc.	=	15.22 in		Rebar Placed at	=	Edge		
Soil Pressure @ Toe	=	3,174 psf	OK	Design Data	_	0 330	1	
Soil Pressure @ Heel	=	0 psf	OK	Total Force @ Sect	tion –	0.000	·	
Allowable	=	4,000 psf		Service Level	lbs =			
Soli Pressure Les	s Than A	Allowable 4 443 nsf		Strength Level	lbs =	1,254.0		
ACI Factored @ Heel	=	0 psf		MomentActual				
Footing Shear @ Toe	=	18.6 psi	OK	Service Level	ft-# =	0 75 4 0		
Footing Shear @ Heel	=	4.5 psi	OK	Strength Level	ft-# =	2,754.0		
Allowable	=	75.0 psi			e =	8,121.3		
Sliding Calcs				SnearActual	nci –			
Lateral Sliding Force	=	1,013.3 lbs		Strength Level	psi =	16.0		
				Shear Allowable	psi =	75.0		
				Anet (Masonry)	in2 =			
				Rebar Depth 'd'	in =	6.19		
				Masonry Data				
				f'm	psi =			
Vertical component of activ	a lateral	soil pressu	21 01	rs Solid Grouting	psi =			
NOT considered in the calc	culation of	of soil bearir	ig ig	Modular Ratio 'n'	=			
			5	Wall Weight	psf =	100.0		
Load Factors				Short Term Factor	. =			
Building Code	IBC	2015,ACI		Equiv. Solid Thick.	=			
Deau Luau		1.200		Masonry Block Type) =	Medium V	Veight	

Masonry Design Method

Concrete Data

f'c

Fy

= ASD

2,500.0 psi = 60,000.0

psi =

IBC 2015,ACI
1.200
1.600
1.600
1.000
1.000

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Concrete Stem Rebar Area Deta	ails		
Bottom Stem As (based on applied moment) :	Vertical Reinforcing 0.1043 in2/ft	Horizontal Reinforcing	
(4/3) * As :	0.139 in2/ft	Min Stem T&S Reinf Area	1.152 in2
200bd/fv : 200(12)(6.1875)/60000 :	0.2475 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 Op	tions :
		One layer of : Two lay	vers of :
Required Area :	0.1728 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@ 5	55.00 in
Footing Data	Footing Des	sign Results	
Toe Width= 2.00 Heel Width= 1.01 Total Footing Width= 3.02 Footing Thickness= 10.00 Key Width= 0.00 Key Depth= 0.00 Key Distance from Toe= 0.00 f'c = $2,500$ psiFy = $60,000$ Footing Concrete Density= 150.00 Min. As %= 0.0018 Cover @ Top 2.00 @ Btm= 3	0 ft Factored Pressure 3 Mu': Upward 0 in Mu': Downward 0 in Actual 1-Way Sheat 0 in Allow 1-Way Sheat 0 in Allow 1-Way Sheat 0 ft Toe Reinforcing 0 psi Heel Reinforcing 0 pcf Key Reinforcing 3 Footing Torsion, T .00 in Footing Allow. Torsion	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	I 0 psf 0 ft-# 0 ft-# 2 psi 0 psi 00 ft-lbs 00 ft-lbs
	If torsion exce	eds allowable, provide	
	supplemental	design for footing torsion	
	Other Acceptable Toe: #4@ 11.1 Heel: phiMn = p Key: No key de	Sizes & Spacings 1 in, #5@ 17.22 in, #6@ 24 hi'5'lambda'sqrt(fc)'Sm fined	.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
	Min footing T&S Min footing T&S If one layer of ho #4@ 11.11 in #5@ 17.22 in #6@ 24.44 in	reinf Area 0.6 reinf Area per foot 0.2 prizontal bars: If two #4@ #5@ #6@	7 in2 2 in2 /ft layers of horizontal bars: 2 22.22 in 2 34.44 in 2 48.89 in

Summary of Overturning & Resisting Forces & Moments

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OVERTURNING						·		RE	SISTING	
ltem		Force lbs	Dis	ft ft	e	Moment ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tb HL Act Pres (be water tb Hydrostatic Force	l) l)	817.2		2.28		1,861.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	310.0	2.87 2.87	890. 890.
Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load Added Lateral Load .oad @ Stem Above Soil	= = = = !						Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe =		1.00	
Seismic Earth Load	=	196.1		3.42	2	670.1	Surcharge Over Toe = Stem Weight(s) =	600.0	2.33	1,400.0
Total	=	1,013.3	0.1	т.м.	=	2,531.4	Footing Weight =	385.0	1.54	592.9
Resisting/Overturning Vertical Loads used for	g Rati or Soil	i o I Pressure =	=	= 1.2	295.	1.14 0 lbs	Vert. Component =	1 205 0	bo DM -	

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.172 in

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

RetainPro (c) 1987-2019, Buil License : KW-06052576	ld 11.20.03.31	Cantilevered Retain	ing V	Vall	Code: IBC 2015 A	CI 318-14.ACI 530-1
License To : SWENSON S	AY FAGET	0.110				
Criteria		Soil Data				
Retained Height Wall height above soil Slope Behind Wall	= 8.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = 3 Equivalent Fluid Pressure Metho Active Heel Pressure =	3,000.0 od 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 =	300.0 125.00 0.00 0.450 12.00) psf/ft) pcf) pcf in	Restrant	
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 rturning	Lateral Load = Height to Top = Height to Bottom = Load Type = Wir	0.0 #, 0.00 ft 0.00 ft nd (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 Stem	(Se	rvice L	evel)	Footing Type	Line Load
Axial Dead Load Axial Live Load	= 0.0 lbs = 0.0 lbs	Wind on Exposed Stem ₌ (Service Level)	0.0 p	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Axial Load Eccentricity	= 0.0 In	Stom Construction		Bottom		
Design Summary		Stelli 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] ft = = = =	0.00 Concrete LRFD 8.00		
	-	Rebar Size	=	# 5		
Total Bearing Load resultant ecc.	= 2,455 lbs = 9.06 in	Rebar Spacing Rebar Placed at	=	12.00 Edge		
Soil Pressure @ Toe	= 1,128 psf C	K fb/FB + fa/Fa	=	0.588		
Soil Pressure @ Heel Allowable	= 0 psf C = 3,000 psf	K Total Force @ Section				
Soil Pressure Less	s Than Allowable	Service Level	lbs =	1 700 0		
ACI Factored @ Toe ACI Factored @ Heel	= 1,580 psf = 0 psf	MomentActual	IDS =	1,792.0		
Footing Shear @ Toe	= 18.6 psi O	K Service Level	ft-# =	4 770 7		
Footing Shear @ Heel	= 10.6 psi O	K Strength Level	π-# = _	4,778.7		
Allowable Sliding Calcs	= 75.0 psi	ShearActual	_	0,121.0		
Lateral Sliding Force	= 1.417.5 lbs	Service Level	psi =			
C C	,	Strength Level	psi =	24.1		
		ShearAllowable	psi =	75.0		
		Anet (Masonry)	in2 =			
		Rebar Depth 'd'	in =	6.19		
		f'm	nsi –			
		Fs	psi =			
Vertical component of activ	e lateral soil pressure	IS Solid Grouting	. =			
NOT considered in the calc	culation of soil bearing	Modular Ratio 'n'	=			
Load Factors		Wall Weight	psf =	100.0		
Building Code	IBC 2015.ACI	SNOR LERM FACTOR	=			
Dead Load	1.200	Masonry Block Type	=	Medium V	/eight	
Live Load	1.600	Masonry Design Method	=	ASD		
Earth, H	1.600	Concrete Data		-		
Wind, W	1.000	f'c	psi=	2,500.0		
Seismic, E	1.000	Fy	psi =	60,000.0		

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON SA	11.20.03.31	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13			
Concrete Stem Reba	r Area Detai	Is					
Bottom Stem As (based on applied mom	ent):	Vertical Reinforcing 0.1809 in2/ft	Horizontal Reinforcing	g			
(4/3) * As :	, -	0.2413 in2/ft	Min Stem T&S Reinf Area 1,536 in2				
200bd/fy : 200(12)(6.1875)/	60000 :	0.2475 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 Options :				
		===========	One layer of : Tw	o layers of :			
Required Area :		0.2413 in2/ft	#4@ 12.50 in #	4@ 25.00 in			
Provided Area :		0.31 in2/ft	#5@ 19.38 in #	5@ 38.75 in			
Maximum Area :		0.8382 in2/ft	#6@ 27.50 in #	6@ 55.00 in			
Footing Data		Footing De	sign Results				
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Depth Key Distance from Toe f'c = 2,500 psi F Footing Concrete Density Min. As % Cover @ Top 2.00	= 2.75 + 1.66 = 1.66 = 4.41 = 12.00 = 0.00 = 0.00 = 0.00 = 0.00 = 0.00 = 0.00 = 0.001 = 0.0018 = 0.0018 = 0.0018	t Factored Pressu Mu' : Upward Mu' : Downward Mu: Design n Actual 1-Way Sh t Toe Reinforcing bosi Heel Reinforcing Footing Torsion, 0 in Footing Allow. To	$\begin{array}{rcl} & & \textbf{Toe} \\ re & = & 1,580 \\ & = & 56,583 \\ & = & 11,571 \\ & = & 3,751 \\ ear & = & 18.60 \\ ear & = & 75.00 \\ & = & \# 5 @ 12.00 \text{ in} \\ & = & \# 5 @ 12.00 \text{ in} \\ & = & \# 5 @ 12.00 \text{ in} \\ & = & \text{None Spec'd} \end{array}$	Heel 0 psf 49 ft-# 681 ft-# 632 ft-# 10.64 psi 75.00 psi 0.00 ft-lbs 0.00 ft-lbs			
		If torsion exc	eeds allowable, provid	e			
		supplementa	I design for footing tor	sion.			
		Other Acceptab Toe: #4@ 9.2 Heel: #4@ 9.2 Key: No key of Min footing T& Min footing T& If one layer of f	le Sizes & Spacings 5 in, #5@ 14.35 in, #6@ 5 in, #5@ 14.35 in, #6@ defined S reinf Area S reinf Area per foot norizontal bars: If	20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 1.14 in2 0.26 in2 /ft two layers of horizontal bars:			

#4@ 18.52 in

#5@ 28.70 in

#6@ 40.74 in

#4@ 9.26 in

#5@ 14.35 in

#6@ 20.37 in

=

=

=

1.38 3.08

2,466.7

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Summary of Overtui	rning & R	esisting F	orces & Mom	ents						
ltem	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	1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	993.3	3.91 3.91	3,887.2 3,887.2			
Buoyant Force =				Sloped Soil Over Heel = Surcharge Over Heel =						

Adjacent Footing Load

Axial Dead Load on Stem =

* Axial Live Load on Stem =

Load @ Stem Above Stem	Soil =				Soil Over Toe	=	
	=				Surcharge Over Toe	=	
					Stem Weight(s)	=	800.0
					Earth @ Stem Trans	itions =	
Total	=	1,417.5	O.T.M. =	4,252.5	Footing Weight	=	661.5
					Key Weight	=	
Resisting/Overturr	ning Rat	io	= 1	.84	Vert. Component	=	
Vertical Loads use	d for So	I Pressure =	2,454.8	lbs		Total =	2,454.8
					* * * * * * * * * * * * * * * *		

2.21 1,458.6 7,812.5 lbs R.M.=

=

* 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

Surcharge Over Toe

Added Lateral Load

Adjacent Footing Load

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

pci	
0	0 pci

Horizontal Defl @ Top of Wall (approximate only) 0.057 in

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

Earth, H

Wind, W

Seismic, E

1.600

1.000

1.000

Concrete Data

psi =

2,500.0

psi = 60,000.0

f'c

Fy

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-07.RPX

This Wall In File. K. 2021 01	519-2021-06 Huber Re	sidence/Calcs/Typical Detail Co-0	4-07.RPA	
License : KW-06052576 License To : SWENSON S	a 11.20.03.31 AY FAGET	Cantilevered Retaini	ng Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height Wall height above soil Slope Behind Wall	= 8.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = 4 Equivalent Fluid Pressure Method Active Heel Pressure =	,000.0 psf d 35.0 psf/ft	
Water height over heel	= 0.0 ft	Passive Pressure=Soil Density, Heel=Soil Density, Toe=Footing Soil Friction=Soil height to ignore for passive pressure=	300.0 psf/ft 125.00 pcf 0.00 pcf 0.450 12.00 in	Restrant
Surcharge Loads		Lateral Load Applied to	Stem	Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied	= 0.0 psf & Overturning = 0.0 turning to Stem	Lateral Load = Height to Top = (Height to Bottom = (Load Type = Wind (Ser	0.0 #/ft 0.00 ft 0.00 ft d (W) vice Level)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil= 0 ft
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 psf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Earth Pressure Se		Uniform Seismic Force = 54	.000	
(Multiplier used on soil d	ensity)	l otal Seismic Force = 486	.000	
Design Summary		Stem Construction	Bottom	ОК
Wall Stability Ratios Overturning Slab Resis	= 1.36 Ratio < ts All Sliding !	Design Height Above Ftg Wall Material Above "Ht" 1.5! Design Method Thickness Rebar Size	ft = 0.0 = Concre = LRF = 8.0 = #	00 te 50 5
Total Bearing Loadresultant ecc.	= 2,466 lbs = 16.40 in	Rebar Spacing Rebar Placed at	= 12.0 = Edg	00 ge
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 1,950 psf Ok = 0 psf Ok = 4,000 psf	fb/FB + fa/Fa Total Force @ Section	= 0.8	01
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	s Than Allowable = 2,730 psf = 0 psf	Service Level Strength Level MomentActual Service Level	lbs = lbs = 2,224 ft-# =	.0
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 27.0 psi Ok = 12.1 psi Ok = 75.0 psi	Strength Level MomentAllowable ShearActual	ft-# = 6,506 = 8,121	.7 .3
Lateral Sliding Force	= 1,757.7 lbs	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Denth	psi = psi = 30 psi = 75 in2 = in = 6	.0 .0
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 = = =	
Load Factors Building Code Dead Load Live Load	IBC 2015,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = = Medium = ASD	n Weight

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Concrete Stem Rebar Area	Details					
Bottom Stem	Vertical Reir	nforcing H	lorizor	ntal Reinfor	rcing	
As (based on applied moment) :	0.2464 in2/ft	t			0	
(4/3) * As :	0.3285 in2/f	t N	/lin Ste	em T&S Re	einf Area 1.5	536 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	t N	/lin Ste	em T&S Re	einf Area pe	r ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/f	t F	lorizor	ntal Reinfor	rcing Optior	IS :
		=== 0	One lay	/er of :	Two layers	s of :
Required Area :	0.2475 in2/ft	t #	4@ 12	2.50 in	#4@ 25.0	00 in
Provided Area :	0.31 in2/ft	#	5@ 19	9.38 in	#5@ 38.7	75 in
Maximum Area :	0.8382 in2/f	t #	6@ 2	7.50 in	#6@ 55.0	00 in
Footing Data		Footing Desig	n Re	sults		
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 %=0Cover @ Top2.00@ Btm	2.75 ft 1.67 F 4.42 M 12.00 in M 0.00 in A 0.00 in A 0.00 ft T 0,000 psi H 50.00 pcf K 0018 F = 3.00 in F	actored Pressure Au': Upward Au: Downward Au: Design Autual 1-Way Shear Ilow 1-Way Shear Toe Reinforcing Ieel Reinforcing Ieel Reinforcing ooting Torsion, Tu ooting Allow. Torsio If torsion exceed supplemental de	= = = = # = # n, phi s allo sign f	Toe 2,730 79,002 11,571 5,619 26.99 75.00 5 @ 12.00 5 @ 12.00 5 @ 12.00 cone Spec'd = Tu = wable, pro or footing	Heel 0 p 0 ft 695 ft 12.15 p 75.00 p in in 0.00 0.00 0.00 0.00 0.00 0.00	sf -# -# si si ft-lbs ft-lbs
	0	ther Acceptable S Toe: #4@ 9.25 in, Heel: #4@ 9.25 in, Key: No key defin Min footing T&S re	izes & #5@ #5@ ed inf Are	& Spacing 14.35 in, # 14.35 in, #	s 6@ 20.37 i 6@ 20.37 i 1.15 0 26	n, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 n, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 in2 in2_ft

If one layer of horizontal bars:

- one layer of horizontal bars: #4@ 9.26 in #5@ 14.35 in #6@ 20.37 in
- 1.15 in2 0.26 in2 /ft If two layers of horizontal bars: #4@ 18.52 in #5@ 28.70 in #6@ 40.74 in

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		OV	ERTURNI	NG				R	RESISTING		
		Force	Distance		Moment			Force	Distance	Moment	
Item		lbs	ft		ft-#			lbs	ft	ft-#	
HL Act Pres (ab water tbl)	1.417.5	3.00		4.252.5	Soil Over HL (ab. w	ater tbl)	1,003.3	3.92	3,931.4	
HI Act Pres (be water th	n)	.,			.,	Soil Over HL (bel. v	ater tbl)		3.92	3,931.4	
Hydrostatic Force	'					Watre Table					
Buoyant Force	=					Sloped Soil Over He	el =				
Surcharge over Heel	=					Surcharge Over Hee	el =				
Surcharge Over Toe	=					Adjacent Footing Lo	ad =				
Adjacent Footing Load	=					Axial Dead Load on	Stem =				
Added Lateral Load	=					* Axial Live Load on S	Stem =				
Load @ Stem Above Soi	=					Soil Over Toe	=		1.38		
Seismic Earth Load	_	340.2	4 50		1 530 9	Surcharge Over Toe	=				
Colornio Editir Educ	_	040.2	4.00		1,000.0	Stem Weight(s)	=	800.0	3.08	2,466.7	
			_			Earth @ Stem Trans	sitions =				
Total	=	1,757.7	O.T.M.	=	5,783.4	Footing Weight	=	663.0	2.21	1,465.2	
						Key Weight	=				
Resisting/Overturning	g Rati	0	=	1.:	36	Vert. Component	=				
Vertical Loads used for	or Soil	Pressure	= 2,46	6.3	bs		Total =	2,466,3	lbs R.M.=	7 863 3	

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.098 in

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

RetainPro (c) 1987-2019, Buil	d 11.20.03.31	Cantilevered Retain	ina V	Vall	Code: IBC 2015 A	
License To : SWENSON S	AY FAGET			Tan		CI 310-14,ACI 330-13
Criteria		Soil Data				
Retained Height Wall height above soil Slope Behind Wall	= 10.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = 3 Equivalent Fluid Pressure Metho Active Heel Pressure =	3,000.0 id 35.0	psf psf/ft		
Height of Soli 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 =	300.0 125.00 0.00 0.450 12.00	psf/ft pcf pcf in	Restrain	
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 rturning	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	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft
Axial Load Applied	to Stem	(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 ps	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Design Summary		Stem Construction		Bottom		
Wall Stability Ratios Overturning	= 1.65 OK	Design Height Above Ft g Wall Material Above "Ht" Design Method] ft = ' = =	Stem OK 0.00 Concrete LRFD		
Slab Resis	ts All Sliding !	Thickness Rebar Size	=	8.00 # 7		
Total Bearing Load resultant ecc.	= 3,786 lbs = 14.21 in	Rebar Spacing Rebar Placed at	=	12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= 1,655 psf C = 0 psf C = 3,000 psf s Than Allowable	K fb/FB + fa/Fa K Total Force @ Section Service Level	= Ibs =	0.712		
ACI Factored @ Toe ACI Factored @ Heel	= 2,316 psf = 0 psf	Strength Level MomentActual	lbs =	2,800.0		
Footing Shear @ Toe Footing Shear @ Heel	= 18.0 psi C = 11.7 psi C	K Strength Level	ft-# =	9,333.3		
Sliding Calcs Lateral Sliding Force	= 75.0 psi = 2,314.4 lbs	ShearActual Service Level	psi =	10,101.2		
		Strength Level ShearAllowable Anet (Masonry)	psi = psi = in2 =	41.9 75.0		
		Rebar Depth ['] d' Masonry Data	in =	5.56		
Vertical component of activ NOT considered in the calc	re lateral soil pressure culation of soil bearing	IS Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = =	100.0		
Load Factors Building Code	IBC 2015,ACI	Short Term Factor Equiv. Solid Thick.	=	100.0		
Dead Load Live Load Farth H	1.200 1.600	Masonry Block Type Masonry Design Method	=	Medium V ASD	/eight	
Wind, W Seismic, E	1.000 1.000	Concrete Data f'c Fy	psi = psi =	2,500.0 60,000.0		

RetainPro (c) 1987-2019, Build 11.20.03.3 License : KW-06052576 License To : SWENSON SAY FAGE	51	Cantilevered R	etaining Wa	all Code: IBC 2015,ACI 318-14,ACI 530
Concrete Stem Rebar Area I	Details			
Bottom Stem As (based on applied moment) :	Vertical R 0.3955 in	einforcing 2/ft	Horizontal Reinfo	orcing
(4/3) * As :	0.5274 in	2/ft	Min Stem T&S R	Reinf Area 1.920 in2
200bd/fv : 200(12)(5.5625)/60000 :	0.2225 in:	2/ft	Min Stem T&S R	Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in:	2/ft	Horizontal Reinfo	orcing Options :
	=======	====	One laver of :	Two lavers of :
Required Area :	0.3955 in:	2/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 in:	2/ft	#6@ 27.50 in	#6@ 55.00 in
Footing Data		Footing Desi	an Results	
		Tooting Desi	gir 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 %=0.Cover @ Top2.00@ Btm.	3.50 ft <u>1.92</u> 5.42 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	Toe = 2,316 = 126,854 = 25,358 = 8,458 = 18.00 = 75.00 = # 6 @ 13.5 = # 6 @ 13.5 = Wone Spec = = on, phi Tu =	Heel 0 psf 6 ft-# 1,390 ft-# 1,384 ft-# 11.70 psi 75.00 psi 58 in 58 in 58 in 54 0.00 ft-lbs 0.00 ft-lbs
		If torsion excee	ds allowable, p	rovide
		supplemental d	esign for footin	g torsion.
		Other Acceptable S Toe: #4@ 6.17 ir Heel: #4@ 6.17 ir Key: No key defi	Sizes & Spacin n, #5@ 9.56 in, # n, #5@ 9.56 in, # ned	ngs #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.
		Min footing T&S r Min footing T&S r If one layer of hori	einf Area einf Area per foo zontal bars:	2.11 in2 t 0.39 in2 /ft If two layers of horizontal bars:

I one layer of nor	Ŀ
#4@ 6.17 in	
#5@ 9.57 in	
#6@ 13.58 in	

0.39 in2 /ft If two layers of horizontal bars: #4@ 12.35 in #5@ 19.14 in #6@ 27.16 in

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06052576 License To : SWENSON SAY FAGET	Cantilevered Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Summary of Overturning & Resis	ting Forces & Moments	

		OV	ERTURNING	G		RESISTING			
Item		Force lbs	Distance ft	Moment ft-#		Force Ibs	Distance ft	Moment ft-#	
HL Act Pres (ab water to	D	2.314.4	3.83	8.871.8	Soil Over HL (ab. water tbl)	1,566.7	4.79	7,509.6	
HL Act Pres (be water tb Hydrostatic Force	l)	_,		-,	Soil Over HL (bel. water tbl) Watre Table		4.79	7,509.6	
Buoyant Force	=				Sloped Soil Over Heel =				
Surcharge over Heel	=				Surcharge Over Heel =				
Surcharge Over Toe	=				Adjacent Footing Load =				
Adjacent Footing Load	=				Axial Dead Load on Stem =				
Added Lateral Load	=				* Axial Live Load on Stem =				
Load @ Stem Above Soi	=				Soil Over Toe =		1.75		
	=				Surcharge Over Toe =				
					Stem Weight(s) =	1,000.0	3.83	3,833.3	
					Earth @ Stem Transitions =				
Total	=	2,314.4	0.T.M. =	8,871.8	Footing Weight =	1,219.5	2.71	3,304.8	
					Key Weight =				
Resisting/Overturning	g Rati	io	=	1.65	Vert. Component =				
Vertical Loads used for	or Soi	I Pressure	= 3,786.	.2 lbs	Total =	3.786.2	bs R.M.=	14.647.7	
					* Axial live load NOT included in resistance, but is included for s	n total display soil pressure	ed, or used fo calculation.	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 pci
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Horizontal Defl @ Top of Wall (approximate only) 0.085 in

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

because the wall would then tend to rotate into the retained soil.

1.000

1.000

Wind, W

Seismic, E

Concrete Data

f'c

Fy

psi = 2,500.0

psi = 60,000.0

RetainPro (c) 1987-2019. Build	11.20.03.31	sidence Calcs Typical Detail Co-0	4-07.RPX	
License : KW-06052576 License To : SWENSON SA	AY FAGET	Cantilevered Retaini	ng Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height = Wall height above soil = Slope Behind Wall =	= 10.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = 4 Equivalent Fluid Pressure Method Active Heel Pressure =	4,000.0 psf d 35.0 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 =	300.0 psf/ft 125.00 pcf 0.00 pcf 0.450 12.00 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 & Overt Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 psf & Overturning = 0.0 urning to Stem = 0.0 lbs = 0.0 lbs = 0.0 lbs = 0.0 lbs	Lateral Load = Height to Top = Height to Bottom = Load Type = Wind (Ser Wind on Exposed Stem = (Service Level)	0.0 #/ft 0.00 ft 0.00 ft d (W) vice Level) 0.0 psf	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil=0.0 ftat Back of Wall=0.300
Earth Pressure Sei Method : Uniform Multiplier Used (Multiplier used on soil de	smic Load = 6.000 ensity)	Uniform Seismic Force = 69 Total Seismic Force = 793	.000 .500	
Design Summary	,	Stem Construction	Bottom	
Wall Stability Ratios Overturning Slab Resist Total Bearing Load resultant ecc.	= 1.21 Ratio < s All Sliding ! = 3,786 lbs = 24.34 in	Design Height Above Ftg Wall Material Above "Ht" 1.5! Design Method Thickness Rebar Size Rebar Spacing Rebar Placed at	ft = 0.00 = Concrete = LRFE = 8.00 = # 7 = 12.00 = Edge	())) ;
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= 3,701 psf OK = 0 psf OK = 4,000 psf Than Allowable = 5,182 psf = 0 psf	fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual	= 0.97 lbs = lbs = 3,490.0	5
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 25.6 psi Ok = 11.9 psi Ok = 75.0 psi	Service Level Strength Level MomentAllowable ShearActual Service Level	ft-# = ft-# = 12,783.3 = 13,107.2	3 2
	= 2,000.0 103	Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = 52.3 psi = 75.0 in2 = in = 5.56	3) 5
Vertical component of active NOT considered in the calcu	e lateral soil pressure Is alation of soil bearing	f'm Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = psf = 100.0)
Load Factors Building Code Dead Load Live Load Earth, H	IBC 2015,ACI 1.200 1.600 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = = Medium = ASD	Weight

#4@ 12.35 in

#5@ 19.14 in

#6@ 27.16 in

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-07.RPX

RetainPro (c) 1987-2019, Build 11.20.03 License : KW-06052576 License To : SWENSON SAY FAGE	31 T	Cantilevered R	etaining Wal	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area	Details			
Bottom Stem As (based on applied moment) :	Vertical F 0.5417 in	Reinforcing 2/ft	Horizontal Reinfor	sing
(4/3) * As :	0.7223 in	2/ft	Min Stem T&S Rei	inf Area 1.920 in2
200bd/fv : 200(12)(5.5625)/60000 :	0.2225 in	2/ft	Min Stem T&S Rei	inf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in	2/ft	Horizontal Reinfor	cina Options :
	======	=====	One laver of :	Two lavers of :
Required Area :	0.5417 in	2/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 in	2/ft	#6@ 27.50 in	#6@ 55.00 in
Footing Data		Footing Desig	an Results	
r ooting bata		I cotting Desig	giritesuits	
Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c = $2,500 \text{ psi}$ Fy =Footing Concrete Density =1Min. As %=0Cover @ Top 2.00 @ Btm	3.50 ft <u>1.92</u> 5.42 18.00 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. Torsion If torsion excee supplemental de	Toe = 5,182 = 179,247 = 25,358 = 12,824 = 25.59 = 75.00 = #6 @ 13.58 = #6 @ 13.58 = Mone Spec'd = con, phi Tu = ds allowable, pro esign for footing	Heel 0 psf 0 ft-# 1,390 ft-# 1,390 ft-# 11.93 psi 75.00 psi 75.00 psi in 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs vide torsion.
		Other Acceptable S Toe: #4@ 6.17 ir Heel: #4@ 6.17 ir Key: No key defi Min footing T&S re Min footing T&S re If one layer of hor	Sizes & Spacings n, #5@ 9.56 in, #60 n, #5@ 9.56 in, #60 ned einf Area einf Area per foot izontal bars:	 3 @ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. @ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. 2.11 in2 0.39 in2 /ft

#4@ 6.17 in

#5@ 9.57 in

#6@ 13.58 in

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		RESISTING		
		Force Ibs	Distance ft	Moment ft-#
Soil Over HL (ab. water t	tbl)	1,566.7	4.79 4 70	7,509.
Natre Table	101)		4.79	7,509.0
Sloped Soil Over Heel	=			
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Sterr	n =			
Axial Live Load on Stem	=			
Soil Over Toe	=		1.75	
Surcharge Over Toe	=			
Stem Weight(s)	=	1,000.0	3.83	3,833.3
Earth @ Stem Transitions	S=			
Footing Weight	=	1,219.5	2.71	3,304.8
Key Weight	=			
/ert. Component	=			
Tota	ગ =	3,786.2 II	bs R.M.=	14,647.7
< / e	Key Weight /ert. Component Tot a (xial live load NOT inclu esistance, but is include	<pre>Key Weight = /ert. Component _= Total = xial live load NOT included in so sistance, but is included for so </pre>	<pre>Key Weight = /ert. Component = Total = 3,786.2 li vxial live load NOT included in total displaye sistance, but is included for soil pressure of</pre>	<pre>(ey Weight =</pre>

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.190 in

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

because the wall would then tend to rotate into the retained soil.

This Wall in File: K:\2021\01	1519-2021-06 Huber Re	esidence\Calcs\Typical Detail Co-(04-07.RPX			
RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	Id 11.20.03.31	Cantilevered Retain	ing Wall	Co	de: IBC 2015,A	CI 318-14,ACI 530-13
Criteria		Soil Data				
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 12.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Soil Bearing = 3 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 =	3,000.0 psf d 35.0 psf/ 300.0 psf/ 125.00 pcf 0.00 pcf 0.450 12.00 in	ft	Restant	2
Surcharge Loads		Lateral Load Applied to	Stem	Adjac	ent Footing L	oad
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied Axial Dead Load	= 0.0 psf & Overturning = 0.0 rturning I to Stem = 0.0 lbs	Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Set Wind on Exposed Stem =	0.0 #/ft 0.00 ft 0.00 ft d (W) rvice Level) 0.0 psf	Adjacen Footing Eccentri Wall to I Footing Base At at Bac	t Footing Load Width icity Ftg CL Dist Type pove/Below Soil ck of Wall	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load = 0.0 ft
Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 in	(Service Level)		Poisson	's Ratio	= 0.300
Design Summary		Stem Construction	Bot St	em OK		
Wall Stability Ratios Overturning Slab Resis	= 1.78 OK sts All Sliding !	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Pobor Sizo	ft = = Con = =	0.00 hcrete LRFD 10.00		
Total Bearing Loadresultant ecc.	= 5,463 lbs = 14.41 in	Rebar Spacing Rebar Placed at	= = =	# 7 8.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= 1,777 psf Ol = 0 psf Ol = 3,000 psf s Than Allowable = 2,488 psf	C Design Data fb/FB + fa/Fa Total Force @ Section Service Level Strength Level Moment Actual	= lbs = lbs = 4	0.612 032.0		
Footing Shear @ Heel Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 0 psr = 24.9 psi Oł = 16.7 psi Oł = 75.0 psi	Service Level Strength Level MomentAllowable ShearActual	ft-# = ft-# = 16 = 26	,128.0 327.0		
Lateral Sliding Force	= 3,189.4 lbs	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = psi = psi = in2 = in =	44.4 75.0 7.56		
Vertical component of activ NOT considered in the calc	re lateral soil pressure l culation of soil bearing	Masonry Data f'm Fs S Solid Grouting Modular Ratio 'n'	psi = psi = =	105.5		
Load Factors Building Code Dead Load Live Load Earth, H	IBC 2015,ACI 1.200 1.600 1.600	Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data	psf = = = = Med = ASI	125.0 lium Weight		
Wind, W Seismic, E	1.000 1.000	f'c Fy	psi = 2 psi = 60	500.0 000.0		

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Concrete Stem Rebar Area	a Details			
Bottom Stem	Vertical I	Reinforcing H	Horizontal Reinfo	prcing
As (based on applied moment) : 0.4948		n2/ft		5
(4/3) * As :	0.6597 ir	n2/ft M	/lin Stem T&S Re	einf Area 2.880 in2
200bd/fy : 200(12)(7.5625)/60000	: 0.3025 ir	n2/ft M	/lin Stem T&S Re	einf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2	2/ft H	Horizontal Reinfo	prcing Options :
	======	(One layer of :	Two layers of :
Required Area :	0.4948 ir	12/ft #	4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.9 in2/ft	#	[‡] 5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.0245 ir	12/ft #	¢6@ 22.00 in	#6@ 44.00 in
Footing Data		Footing Desig	jn 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@ Bt	4.00 ft 2.50 6.50 18.00 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. Torsio If torsion exceed supplemental de	Toe = 2,488 = 187,056 = 33,120 = 12,828 = 24.92 = 75.00 = # 6 @ 12.00 = # 6 @ 12.00 = Mone Spector = n, phi Tu = the allowable, pro- sign for footing	Heel 0 psf 153 ft-# 2,875 ft-# 2,722 ft-# 16.67 psi 75.00 psi 0 in 0 in 0 d 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0 ovide g torsion.
		Other Accentable S	izes & Spacing	
		Toe: #4@ 6.17 in Heel: #4@ 6.17 in Key: No key defir	, #5@ 9.56 in, #6 , #5@ 9.56 in, #6 ned	6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. 6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.
		Min footing T&S re Min footing T&S re	inf Area inf Area per foot	2.53 in2 0.39 in2 <i>/</i> ft

If one layer of horizontal bars:							
#4@ 6.17 in							
#5@ 9.57 in							
#6@ 13.58 in							

0.39 in2 *f*t If two layers of horizontal bars: #4@ 12.35 in #5@ 19.14 in #6@ 27.16 in

This Wall in File: K:\2021\0151	9-2021-06	Huber Resider	nce\Calcs\Typic	al Detail Co-04-07.RPX			
RetainPro (c) 1987-2019, Build 1 License : KW-06052576 License To : SWENSON SAN	1.20.03.31 (FAGET	(Cantilevere	d Retaining Wall	Code: IBC 20	015,ACI 318	-14,ACI 530-1
Summary of Overtur	ning & R	esisting Fo	orces & Mon	nents			
ltem	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	3,189.4	4.50	14,352.2	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	2,500.0	5.67 5.67	14,166.7 14,166.7
Buoyant Force=Surcharge over Heel=Surcharge Over Toe=				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load =			
Adjacent Footing Load = Added Lateral Load = Load @ Stem Above Soil =				Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe =		2.00	

	=			
Total	=	3,189.4	O.T.M. =	14,352.2
Resisting/Overturn	ing Rat d for Soi	io Il Pressure :	=	1.78 Ibs

Total :	= 5,462.5	lbs R.M.=	25,544.8
Vert. Component =	=	_	
Key Weight =	=		
Footing Weight =	= 1,462.5	3.25	4,753.1
Earth @ Stem Transitions =	=		
Stem Weight(s) =	= 1,500.0	4.42	6,625.0
Surcharge Over Toe =	=		
Soil Over Toe =	-	2.00	
* Axial Live Load on Stem =	-		
Axial Dead Load on Stem =	-		
Adjacent Footing Load =	=		
Surcharge Over Heel =	=		
Sloped Soil Over Heel =	=		
Watre Table			
Soil Over HL (bel. water tb	I)	5.67	14,166.7

* 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
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Horizontal Defl @ Top of Wall (approximate only) 0.091 in

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

because the wall would then tend to rotate into the retained soil.

Earth, H

Wind, W

Seismic, E

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-07.RPX

RetainPro () 1987-2021 () 1919-2021-00 Huber () License : KW-06052576 License To : SWENSON SAY FAGET	Cantilevered Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria	Soil Data	
Retained Height = 12.00 ft Wall height above soil = 0.00 ft Slope Behind Wall = 0.00	Allow Soil Bearing = 4,000.0 psf Equivalent Fluid Pressure Method Active Heel Pressure = 35.0 psf/fi	■ t
Water height over heel = 0.00 ft	Passive Pressure=300.0 psf/ftSoil Density, Heel=125.00 pcfSoil Density, Toe=0.00 pcfFooting Soil Friction=0.450Soil height to ignore for passive pressure=12.00 in	Restraint
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 Axial Load Applied to Stem	Lateral Load = 0.0 #/ft Height to Top = 0.00 ft Height to Bottom = 0.00 ft Load Type = Wind (W) (Service Level)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil-
Axial Dead Load=0.0 lbsAxial Live Load=0.0 lbsAxial Load Eccentricity=0.0 in	Wind on Exposed Stem _ 0.0 psf (Service Level)	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Earth Pressure Seismic Load Method : Uniform Multiplier Used = 6.000 (Multiplier used on soil density)	Uniform Seismic Force = 81.000 Total Seismic Force = 1,093.500	
Design Summary Wall Stability Ratios Overturning = 1.31 Ratio Slab Resists All Sliding ! Total Bearing Load = 5,463 lbs resultant ecc. = 25.76 in Soil Pressure @ Toe = 3,301 psf O Soil Pressure @ Heel = 0 psf O Allowable = 4,000 psf Soil Pressure @ Heel = 0 psf O Allowable = 4,622 psf ACI Factored @ Toe = 36.9 psi O Footing Shear @ Toe = 36.9 psi O Footing Shear @ Toe = 36.9 psi O Allowable = 75.0 psi Sliding Calcs	Stem Construction Botta Design Height Above Ftg ft = Wall Material Above "Ht" = Con < 1.5! Design Method = L Thickness = 1 Rebar Size = 4 Rebar Spacing = 4 Rebar Placed at = 1 Design Data - - K fb/FB + fa/Fa = Total Force @ Section Service Level Ibs = Strength Level Ibs = 5,0 MomentActual Service Level ft-# = K Strength Level ft-# = ShearActual Service Level psi = Strength Level psi = 3 ShearActual Service Level psi = Strength Level psi = 3 Strength Level psi = 3 Strength Level psi = 3	>m OK 0.00 orete .RFD IO.00 # 7 8.00 Edge 0.834 O04.0 960.0 327.0 55.1 55.1
Vertical component of active lateral soil pressure I NOT considered in the calculation of soil bearing Load Factors Building Code IBC 2015,ACI Dead Load 1.200 Live Load 1.600	ShearAllowable psi = Anet (Masonry) in2 = Rebar Depth 'd' in = Masonry Data f'm psi = Fs psi = Solid Grouting = Modular Ratio 'n' = Wall Weight psf = 11 Short Term Factor = Equiv. Solid Thick. = Masonry Block Type = Medi	75.0 7.56 125.0 ium Weight

Masonry Design Method

Concrete Data

f'c

Fy

1.600

1.000

1.000

= ASD

2,500.0 psi = 60,000.0

psi =

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Concrete Stem Rebar A	Area Details			
Bottom Stem	Verti	cal Reinforcing	Horizontal Reinfo	prcing
As (based on applied moment) : 0.6737 i		37 in2/ft		5
(4/3) * As :	0.898	32 in2/ft	Min Stem T&S R	einf Area 2.880 in2
200bd/fy : 200(12)(7.5625)/600	0.302	25 in2/ft	Min Stem T&S R	einf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216	S in2/ft	Horizontal Reinfo	prcing Options :
	====	=======	One layer of :	Two layers of :
Required Area :	0.673	37 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.9 ir	n2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.024	15 in2/ft	#6@ 22.00 in	#6@ 44.00 in
Footing Data		Footing Desi	gn Results	
Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c2,500 psiFyFooting Concrete Density=Min. As %=Cover @ Top2.00	4.00 ft <u>2.50</u> 6.50 18.00 in 0.00 in 0.00 in 0.00 ft = 60,000 psi 150.00 pcf 0.0018 2 Btm = 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	Toe = 4,622 = 265,846 = 33,120 = 19,394 = 36.94 = 75.00 = # 6 @ 12.00 = # 6 @ 12.00 = None Spec' = on phi Tu =	Heel 0 psf 0 ft-# 2,875 ft-# 2,875 ft-# 18.55 psi 75.00 psi 0 in 0 in 0 d 0.00 ft-lbs 0 00 ft-lbs
	5 Bunn - 0.00 m	If torsion excee	de allowable pr	
		supplemental d	esian for footing	a torsion.
		Other Acceptable S Toe: #4@ 5.92 in Heel: #4@ 6.17 in Key: No key defi Min footing T&S r	Sizes & Spacing n, #5@ 9.18 in, #4 n, #5@ 9.56 in, #4 ned einf Area	z gs 6@ 13.03 in, #7@ 17.76 in, #8@ 23.39 in, #9@ 29. 6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. 2.53 in2

	2.00
Min footing T&S reinf Area per foot	0.39 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

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Summary of Overturning & Resi	sting Forces & Moments	

		OV	ERTURNING	G		R	ESISTING	
ltem		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tb	D	3.189.4	4.50	14.352.2	Soil Over HL (ab. water tbl)	2,500.0	5.67	14,166.7
HL Act Pres (be water to	l)	0,10011		,002.12	Soil Over HL (bel. water tbl)	5.67	14,166.7
Hydrostatic Force	-,				Watre Table			
Buovant Force	=				Sloped Soil Over Heel =			
Surcharge over Heel	=				Surcharge Over Heel =			
Surcharge Over Toe	=				Adjacent Footing Load =			
Adjacent Footing Load	=				Axial Dead Load on Stem =			
Added Lateral Load	=				* Axial Live Load on Stem =			
Load @ Stem Above Soi	=				Soil Over Toe =		2.00	
Seismic Earth Load	=	765.5	6.75	5,166.8	Surcharge Over Toe =			
	=				Stem Weight(s) =	1,500.0	4.42	6,625.0
T - 4 - 1		0.054.0	- 	10 540 0	Earth @ Stem Transitions =			
lotal	=	3,954.8	0.1.M. =	19,519.0	Footing Weight =	1,462.5	3.25	4,753.1
					Key Weight =			
Resisting/Overturnin	g Rat	io	=	1.31	Vert. Component =			
Vertical Loads used f	or So	il Pressure	= 5,462	.5 lbs	Total =	5,462.5	lbs R.M.=	25,544.8
If seismic is included th	e OTI	M and slidin	a ratios		* Axial live load NOT included resistance, but is included for	d in total display or soil pressure	ved, or used for calculation.	r overturning

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.169 in

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

because the wall would then tend to rotate into the retained soil.

This Wall in File: K:\2021\01	519-2021-06 Hu	iber Res	sidence\Calcs\Typical Detail Co-	04-06.F	RPX			
License : KW-06052576 License To : SWENSON SA	AY FAGET		Cantilevered Retain	ing V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13		
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 = 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 =	3,000.0 od 35.0 125.00 0.00 0.500 12.00) psf) psf/ft) psf/ft) pcf) pcf) in			
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing	Load	
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overt Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 psf & Overturning = 0.0 urning to Stem = 0.0 lbs = 0.0 lbs = 0.0 in		Lateral Load = Height to Top = Height to Bottom = Load Type = Wir (Se Wind on Exposed Stem = (Service Level)	0.0 # 0.00 ft 0.00 ft nd (W) rvice L 0.0 p	/ft evel) 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 Sliding Total Bearing Load	= 1.87 = 1.52 = 605	OK OK Ibs	Design Height Above Ft Wall Material Above "Ht Design Method Thickness Rebar Size Rebar Spacing	g ft = " = = = =	0.00 Concrete LRFD 8.00 # 4 18.00			
resultant ecc.	= 4.03	in nef OK	Rebar Placed at Design Data	=	Edge			
Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= 979 = 0 = 3,000 Than Allowable = 1,370	psi OK psf OK psf psf	fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual	= Ibs = Ibs =	0.068 252.0	1		
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 0.6 = 3.1 = 75.0	psi OK psi OK psi OK psi	Service Level Strength Level MomentAllowable	ft-# = ft-# = =	252.0 3,655.6			
Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= 235.3 e = - 54.2 s = - 302.3	lbs lbs lbs	StearAllowable	psi = psi = psi =	3.4 75.0			
for 1.5 Stability	= 0.0	lbs OK	Rebar Depth 'd' Masonry Data f'm	inz = in = psi =	6.25			
Vertical component of active NOT considered in the calcu	e lateral soil pre ulation of soil be	ssure IS aring	Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf =	100.0			
Load Factors Building Code Dead Load Live Load Earth. H	IBC 2015,A(1.2(1.6(1.6(CI 00 00	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = 1 =	Medium V ASD	Veight		
Wind, W Seismic, E	1.00)0)0	f'c Fy	psi = psi =	2,500.0 60,000.0			

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Concrete Stem Rebar Area Details			
Bottom Stem Vertical As (based on applied moment) : 0.0094 in (4/3) * As : 0.0126 in 200bd/fy : 200(12)(6.25)/60000 : 0.25 in2/ 0.0012bh : 0.0012(12)(8) : 0.1152 in Required Area :	Reinforcing H n2/ft N n2/ft N fft N n2/ft H n2/ft H n2/ft H n2/ft H n2/ft H	Horizontal Reinford Ain Stem T&S Rei Ain Stem T&S Rei Horizontal Reinford Dne layer of : 44@ 12.50 in	ting nf Area 0.576 in2 nf Area per ft of stem Height : 0.192 in2/ft ting Options : Two layers of : #4@ 25.00 in
Provided Area : 0.1333 in Maximum Area : 0.8467 in	n2/ft #	5@ 19.38 in	#5@ 38.75 in #6@ 55.00 in
Footing Data	Footing Desig	in Results	
Toe within= 0.42 ft Heel Width= 1.08 Total Footing Width= 1.50 Footing Thickness= 8.00 in Key Width= 0.00 in Key Depth= 0.00 in Key Distance from Toe= 0.00 ft f'c = $2,500 \text{ psi}$ Fy = $60,000 \text{ psi}$ Footing Concrete Density= 150.00 pcf Min. As %= 0.0018 Cover @ Top 2.00 @ Btm.= 3.00 in	Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing Footing Torsion, Tu Footing Allow. Torsion If torsion exceed supplemental de Other Acceptable S Toe: phiMn = phi's Heel: phiMn = phi's Key: No key defin Min footing T&S rei If one layer of horiz #4@ 13.89 in #5@ 21.53 in #6@ 30.56 in	<pre>1,200 = 1,370 = 1,263 = 202 = 88 = 0.64 = 40.00 = None Spec'd = None Spec'd = None Spec'd = an, phi Tu = sign for footing for sizes & Spacings 5'lambda'sqrt(fc)'S 5'lambda'sqrt(fc)'S bilambda'sqrt(fc)'S bilambda'sqrt(fc)'S</pre>	0 psf 1 ft-# 49 ft-# 48 ft-# 3.09 psi 40.00 psi 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs vide torsion. 5 6 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 SA	11.20.03.31 Y FAGET		Cantilevere	d Retaining Wall	Code: IBC 2	015,ACI 318-	-14,ACI 530-
Summary of Overtu	rning & R	esisting F	orces & Mon	nents			
	OV) Momont		RE	SISTING	Moment
Item	lbs	ft	ft-#		lbs	ft	ft-#
HL Act Pres (ab water tbl)	235.3	1.22	287.6	Soil Over HL (ab. water tbl)	155.0	1.29	199.8
HL Act Pres (be water tbl) Hvdrostatic Force				Soil Over HL (bel. water tbl) Watre Table		1.29	199.8
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =		0.21	

	-			
Total	=	235.3	O.T.M. =	287.6
Resisting/Overturn	= 1 .	87 Ibs		

Tota	al =	604.6 lbs	R.M.=	536.5
Vert. Component	=			
Key Weight	=			
Footing Weight	=	149.6	0.75	111.9
Earth @ Stem Transition	IS=			
Stem Weight(s)	=	300.0	0.75	224.8
Surcharge Over Toe	=			
Soil Over Toe	=		0.21	
* Axial Live Load on Stem	=			
Axial Dead Load on Ster	n =			
Adjacent Footing Load	=			
Surcharge Over Heel	=			
Sloped Soil Over Heel	=			

* 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 p	pci
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Horizontal Defl @ Top of Wall (approximate only) 0.055 in

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

Patain Bro (a) 1087 2010 Buil		esidence/Calcs/Typical Detail C	0-04-00.RPX	
License : KW-06052576 License To : SWENSON S	SAY FAGET	Cantilevered Retain	ining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height Wall height above soil Slope Behind Wall	= 3.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = Equivalent Fluid Pressure Met Active Heel Pressure =	4,000.0 psf thod 35.0 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 =	300.0 psf/ft 125.00 pcf 0.00 pcf 0.500 12.00 in	
Surcharge Loads		Lateral Load Applied t	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 rturning	Lateral Load = Height to Top = Height to Bottom = Load Type = V	0.0 #/ft 0.00 ft 0.00 ft Vind (W)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ft
Axial Load Applied	d to Stem	(;	Service Level)	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 psf	at Back of Wall=0.0 ftPoisson's Ratio=0.300
Earth Pressure Se	eismic Load			
Method : Uniform Multiplier Used (Multiplier used on soil d	= 6.000 density)	Uniform Seismic Force = Total Seismic Force =	22.000 80.667	
Design Summary		Stem Construction	Bottom	
Wall Stability Ratios Overturning Sliding	= 1.37 Ratio = 1.22 Ratio	Design Height Above Wall Material Above " < 1.5!	Stem OK Stem OK Ftg ft = 0.00 Ht" = Concrete = LRFD = = 8.00 =	
Total Bearing Loadresultant ecc.	= 605 lbs = 6.09 in	Rebar Size Rebar Spacing Rebar Placed at	= # 4 = 18.00 = Edge) 2
Soil Pressure @ Toe Soil Pressure @ Heel	= 1,675 psf C = 0 psf C	K fb/FB + fa/Fa K Fb/FB + fa/Fa	= 0.096	<u> </u>
Allowable Soil Pressure Less ACI Factored @ Toe	= 4,000 psf s Than Allowable = 2,345 psf	Service Level Strength Level	lbs = lbs = 318.0)
Footing Shear @ Toe Footing Shear @ Toe Footing Shear @ Heel	= 0 pst = 1.2 psi 0 = 3.3 psi 0	K Service Level K Strength Level	ft-# = ft-# = 351.0)
Allowable Sliding Calcs Lateral Sliding Force	= 75.0 psi	ShearActual Service Level	= 3,000.0	
less 100% Passive Ford	= 54.2 lbs	Strength Level	psi = 4.2	2
Added Force Regid	e = - 302.3 lbs	ShearAllowable	psi = 75.0)
for 1.5 Stability	= 81.2 lbs N	G Rebar Depth 'd' Masonry Data	$\sin = 6.25$;
Vertical component of activ NOT considered in the calc	ve lateral soil pressure culation of soil bearing	f'm Fs IS Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = = psf = 100.0	
Load Factors		Short Term Factor	=	
Building Code Dead Load	IBC 2015,ACI 1.200	Equiv. Solid Thick. Masonry Block Type	= = Medium \	Veight

= ASD

psi = 2,500.0

psi = 60,000.0

Masonry Design Method

Concrete Data

f'c

Fy

Building Code	IDC 2015,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 Vertica As (based on applied moment) : 0.0132	I Reinforcing Horizontal Reinforcing	
(4/3) * As : 0.0175	in2/ft Min Stem T&S Reinf Area	a 0.576 in2
200bd/fv · 200(12)(6.25)/60000 · 0.25 in	2/ft Min Stem T&S Reinf Area	a per ft of stem Height : 0 192 in2/ft
0.0012 bh $\cdot 0.0012(12)(8) \cdot 0.1152$	in2/ft Horizontal Reinforcing Or	ations :
	One layer of : Two la	vers 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 ft Heel Width = 1.08 Total Footing Width = 1.50 Footing Thickness = 8.00 in Key Width = 0.00 in Key Depth = 0.00 in Key Distance from Toe = 0.00 ft f'c = $2,500 \text{ psi}$ Fy = $60,000 \text{ psi}$ Footing Concrete Density = 150.00 pcf Min. As % = 0.0018 Cover @ Top 2.00 @ Btm.= 3.00 in	ToeHeeFactored Pressure=2,345Mu': Upward=1,967Mu': Downward=2024Mu: Design=147Actual 1-Way Shear=1.173.2Allow 1-Way Shear=40.0040.00Toe Reinforcing=None Spec'dHeel Reinforcing=None Spec'dFooting Torsion, Tu=0.Footing Allow. Torsion, phi Tu=0.If torsion exceeds allowable, providesupplemental design for footing torsiorOther Acceptable Sizes & SpacingsToe:phiMn = phi'5'lambda'sqrt(fc)'SmHeel:phiMn = phi'5'lambda'sqrt(fc)'SmKey:No key definedMin footing T&S reinf Area0.20.1If one layer of horizontal bars:If two#4@ 13.89 in#40#5@ 21.53 in#50	9 0 psf 0 ft-# 99 ft-# 99 ft-# 97 psi 00 psi 00 ft-lbs 00 ft-lbs 00 ft-lbs 00 ft-lbs 00 ft-lbs 00 ft-lbs 02 ft 1 26 in2 7 in2 /ft layers of horizontal bars: 20 27.78 in 20 43.06 in

Moment

ft-#

199.8

199.8

224.8

111.9

536.5

.....RESISTING....

Distance

ft

1.29

1.29

0.21

0.75

0.75

Force

lbs

* Axial live load NOT included in total displayed, or used for overturning

resistance, but is included for soil pressure calculation.

155.0

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

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Summary of Overturning & Resisting Forces & Moments								
Item	Force Ibs	/ERTURNING Distance ft	Moment ft-#					
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	235.3	1.22	287.6	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table				
Buoyant Force =				Sloped Soil Over Heel =				

vertical Loads used to	JF 2011	Pressure =	- 604.6	IDS		Total =	604.6 lb	s R.M.=
Resisting/Overturning	Ratio)	= 1.	37	Vert. Component	=		
					Key Weight	=		
Total	=	291.7	O.T.M. =	391.1	Footing Weight	=	149.6	0.75
					Earth @ Stem Trans	sitions =		
	=				Stem Weight(s)	=	300.0	0.75
smic Earth Load	=	56.5	1.83	103.5	Surcharge Over Toe	= =		
ad @ Stem Above Soil	=				Soil Over Toe	=		0.2
ded Lateral Load	=				* Axial Live Load on S	Stem =		
acent Footing Load	=				Axial Dead Load on	Stem =		
rcharge Over Toe	=				Adjacent Footing Lo	ad =		
rcharge over Heel	=				Surcharge Over Hee	el =		
oyant Force	=				Sloped Soil Over He	el =		
drostatic Force					walle Table			

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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

Surcharge over Heel

Surcharge Over Toe

Added Lateral Load

Seismic Earth Load

Adjacent Footing Load

Load @ Stem Above Soil

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) 0.093 in

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

RetainPro (c) 1987-2019, Buil License : <u>K</u> W-06052576	d 11.20	.03.31		Cantilevered Retaini	ing V	Vall	Code: IBC 2012,ACI 318-11,ACI 530-1
License To : SWENSON S	AY FA	GET		Soil Data	-		
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= = =	4.00 ft 0.00 ft 0.00 6.00 in 0.0 ft		Allow Soil Bearing = 3 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 =	3,000.0 d 35.0 350.0 125.00 0.00 0.500) psf) psf/ft) psf/ft) pcf) pcf	
Surcharge Loads			I	Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	= & Over turning to S 1 = = =	0.0 psf turning 0.0 tem 0.0 lbs 0.0 lbs 0.0 lbs 0.0 in	-	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) vice Lo 0.0 p	/ft evel) sf	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil at Back of Wall=0.0 ftPoisson's Ratio=0.300
Design Summary				Stem Construction		Bottom	
Wall Stability Ratios Overturning Sliding	=	2.21 OK 1.62 OK		Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Bebar Spacing	ft = = = =	0.00 Concrete LRFD 8.00 # 4	
resultant ecc.	=	4.74 in		Rebar Spacing Rebar Placed at Design Data	=	Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Heel	= = s Than =	1,143 psf 0 psf 3,000 psf Allowable 1,600 psf	OK OK	fb/FB + fa/Fa Total Force @ Section Service Level Strength Level Moment Actual	= Ibs = Ibs =	0.16 3 448.0	3
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	1.0 psi 6.3 psi 75.0 psi	OK OK	Service Level Strength Level MomentAllowable	ft-# = ft-# = =	597.3 3,655.6	3
Lateral Sliding Force less 100% Passive Forc less 100% Friction Force	= e = - e = -	381.1 lbs 63.2 lbs 555.1 lbs	ОК	Service Level Strength Level ShearAllowable	psi = psi = psi =	6.0 75.0	
for 1.5 Stability	=	0.0 lbs	OK	Rebar Depth 'd' Masonry Data f'm	in =	6.25	;
Vertical component of activ NOT considered in the calc	e latera ulation	al soil pressur of soil bearin	e IS g	Solid Grouting Modular Ratio 'n' Wall Weight	psi = = psf =	100.0	
Load Factors Building Code Dead Load Live Load Earth, H	IBC	C 2012,ACI 1.200 1.600 1.600		Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data	= = =	Medium V ASD	Veight
Wind, W Seismic, E		1.000 1.000		f'c Fy	psi = psi =	2,500.0 60,000.0	

RetainPro (c) 1987-2019, Build 1 License : KW-06052576 License To : SWENSON SAY	1.20.03.31 FAGET	Cantilevered R	etaining	Wall	Code: I	BC 2012,ACI 318-11,ACI 530-11
Concrete Stem Rebar	Area Details					
Bottom Stem	Vertica	Reinforcing I	-Iorizontal F	Reinforc	ing	
As (based on applied momen	t): 0.0224	in2/ft			•	
(4/3) * As :	0.0298	in2/ft	Min Stem T	&S Reir	nf Area 0.768 in2	
200bd/fy : 200(12)(6.25)/6000	0 : 0.25 in2	2/ft l	Min Stem T	&S Reir	nf Area per ft of ste	m Height : 0.192 in2/ft
0.0012bh : 0.0012(12)(8) :	0.1152	in2/ft ł	-Iorizontal F	Reinforc	ing Options :	-
	======	(One layer o	f: -	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	yn Resul	ts		
Toe Width =	0.42 ft		То	e	Heel	
Heel Width =	1.67	Factored Pressure	= 1,	600	0 psf	
Total Footing Width =	2.09	Mu' : Upward	= 1,	542	88 ft-#	
Footing Thickness =	8.00 in	Mu: Design	=	202	362 ft-# 275 ft_#	
Key Width =	0.00 in	Actual 1-Way Shear	_ 1	03	6 32 nsi	
Key Depth =	0.00 in	Allow 1-Way Shear	= 75	5.00	75.00 psi	
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= #4@	12.00 i	n	
f'c = 2,500 psi Fy	= 60,000 psi	Heel Reinforcing	= #4@	12.00 i	n	
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= None	Spec'd		
Min. As $\%$ =	0.0018 @ Btm = 3.00 in	Footing Torsion, Tu		=	0.00 ft-lbs	
	@ Dim.= 0.00 m	Footing Allow. Torsic	n, phí tu	. =	0.00 ft-lbs	
		If torsion exceed	ds allowab	le, prov	ride	
		supplemental de	esign for fo	oting t	orsion.	
		Other Acceptable S	Sizes & Sp	acings		
		Toe: #4@ 13.88 i Heel: #4@ 13.88 i Key: No key defir	n, #5@ 21. n, #5@ 21. ned	52 in, # 52 in, #	6@ 30.55 in, #7@ 6@ 30.55 in, #7@	41.66 in, #8@ 54.86 in, #9@ 6 41.66 in, #8@ 54.86 in, #9@ 6

Min footing T&S reinf Area	0.36	in2
Min footing T&S reinf Area per foot	0.17	in2 /ft
If one layer of horizontal bars:	If two lay	ers of horizontal bars:
#4@ 13.89 in	#4@ 2	7.78 in
#5@ 21.53 in	#5@ 4	3.06 in
#6@ 30.56 in	#6@ 6	1.11 in

.

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Summary of Overturning & Resisting Forces & Moments										
Item	Force Ibs	/ERTURNING Distance ft	Moment ft-#		Force Ibs	SISTING Distance ft	Moment ft-#			
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	381.1	1.56	592.8	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	501.7	1.58 1.58	794.8 794.8			
Juoyant 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 = Soil Over Toe =		0.21				
Load @ Stem Above Soil =	=			Surcharge Over Toe = Stem Weight(s) =	400.0	0.21	299.7			
Total :	= 381.1 Ratio	O.T.M. =	592.8	Earth @ Stem Transitions = Footing Weight = Key Weight =	208.6	1.04	217.6			
Vertical Loads used for	Soil Pressure	= 1,110.	3 lbs	Total =	1,110.3	bs R.M.=	1,312.1			

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) 0.061 in

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

RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	Id 11.20.03.31	Cantilevered Reta	ining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe	= 4.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = Equivalent Fluid Pressure Me Active Heel Pressure =	4,000.0 psf thod 35.0 psf/ft	
Water height over heel	= 0.0 ft	Passive Pressure=Soil Density, Heel=Soil Density, Toe=Footing Soil Friction=Soil height to ignore for passive pressure=	300.0 psf/ft 125.00 pcf 0.00 pcf 0.500 12.00 in	
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 rturning	Lateral Load = Height to Top = Height to Bottom =	0.0 #/ft 0.00 ft 0.00 ft Vind (W)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ft
Axial Load Applied	to Stem		Service Level)	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 psf	at Back of Wall=0.0 ftPoisson's Ratio=0.300
Earth Pressure Se	eismic Load			
Method : Uniform Multiplier Used (Multiplier used on soil d	= 6.000 lensity)	Uniform Seismic Force = Total Seismic Force =	28.000 130.667	
Design Summary		Stem Construction	Bottom	
Wall Stability Ratios Overturning Sliding	= 1.63 OK = 1.29 Ratio	 < 1.5! Design Height Above " Wall Material Above " Design Method Thickness 	Ftg ft = 0.00 Ht" = Concrete = LRFD = 0.00	
Total Bearing Loadresultant ecc.	= 1,110 lbs = 7.05 in	Rebar Size Rebar Spacing Rebar Placed at	= # 4 = 18.00 = Edge	
Soil Pressure @ Toe	= 1,625 psf C	DESIGN Data DK fb/FB + fa/Fa	= 0.224	i i i i i i i i i i i i i i i i i i i
Allowable	= 4,000 psf	Total Force @ Section	on lbo	
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	s Than Allowable = 2,274 psf = 0 psf	Strength Level MomentActual	lbs = 560.0	
Footing Shear @ Toe Footing Shear @ Heel	= 1.5 psi C = 9.9 psi C	K Strength Level	ft-# = 821.3	
Allowable Sliding Calcs	= 75.0 psi	MomentAllowable ShearActual	= 3,655.6	
Lateral Sliding Force less 100% Passive Force	= 472.6 lbs ce = - 54.2 lbs	Service Level Strength Level	psi= 75	
less 100% Friction Force	e = - 555.1 lbs	ShearAllowable	psi = 75.0	
Added Force Req'd for 1.5 Stability	= 0.0 lbs C = 99.6 lbs N	K Anet (Masonry) IG Rebar Depth 'd' Masonry Data	in2 = in = 6.25	
Vertical component of activ NOT considered in the calc	re lateral soil pressure culation of soil bearing	f'm Fs IS Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = = psf = 100.0	
Load Factors		Short Term Factor	= 100.0	
Building Code Dead Load	IBC 2015,ACI 1.200	Equiv. Solid Thick. Masonry Block Type	= = Medium V	Veight

Masonry Design Method = ASD

psi = 2,500.0

psi = 60,000.0

Concrete Data

f'c

Fy

Dulluling Code	100 2013,701
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 Are	ea Details				
Bottom Stem	Vertical	Reinforcing I	Horizonta	I Reinfor	rcing
As (based on applied moment) :	0.0308 i	n2/ft			0
(4/3) * As :	0.041 in	2/ft I	Min Stem	T&S Re	einf Area 0.768 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2	/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	n2/ft	Horizonta	I Reinfor	rcing Options :
		====== (One lave	of :	Two layers of :
Required Area :	0.1152	n2/ft #	, #4@ 12.5	50 in	#4@ 25.00 in
Provided Area :	0.1333 i	n2/ft #	#5@ 19.3	88 in	#5@ 38.75 in
Maximum Area :	0.8467	n2/ft #	#6@ 27.5	in 0	#6@ 55.00 in
Footing Data		Footing Desig	gn Res	ults	
Toe Width =	0.42 ft		-	<u>Foe</u>	Heel
Heel Width = _	1.67	Factored Pressure	=	2,274	0 psf
I otal Footing Width =	2.09	Mu' : Upward	=	2,122	6 ft-#
Footing Thickness =	8.00 in	Mu: Design	=	202	302 II-# 356 ft-#
Key Width =	0.00 in	Actual 1-Way Shear	_	1 53	9 93 nsi
Key Depth =	0.00 in	Allow 1-Way Shear	=	75.00	75.00 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= #4	@ 12.00) in
f'c = 2,500 psi Fy = Footing Concrete Density =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing	= #4 = Non	@ 12.00 e Spec'd) in d
Min. As % =	0.0018	Footing Torsion, Tu		=	0.00 ft-lbs
Cover @ Top 2.00 @ E	3tm.= 3.00 in	Footing Allow. Torsic	on, phi Tu	=	0.00 ft-lbs
		If torsion exceed	ds allowa	able, pro	ovide
		supplemental de	esign for	footing	y torsion.
		Other Acceptable S	Sizes & S	Spacing	IS
		Toe: #4@ 13.88 i Heel: #4@ 13.88 i Key: No key defir	in, #5@ 2 in, #5@ 2 ned	21.52 in, 21.52 in,	#6@ 30.55 in, #7@ 41.66 in, #8@ 54.86 in, #9@ 6 #6@ 30.55 in, #7@ 41.66 in, #8@ 54.86 in, #9@ 6
		Min footing T&S re	einf Area		0.36 in2

Min footing T&S reinf Area0.36irMin footing T&S reinf Area per foot0.17irIf one layer of horizontal bars:If two layers#4@ 13.89 in#4@ 27.7

- #5@ 21.53 in #6@ 30.56 in
- 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

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Summary of Overturning & Resisting Forces & Moments

		0\	ERTURNING	.		RI	ESISTING	
		Force	Distance	Moment		Force	Distance	Moment
Item		lbs	ft	ft-#		lbs	ft	ft-#
HL Act Pres (ab water th	bl)	381.1	1.56	592.8	Soil Over HL (ab. water tbl) 501.7	1.58	794.8
HL Act Pres (be water th	, bl)				Soil Over HL (bel. water tb	I)	1.58	794.8
Hvdrostatic Force	- /				Watre Table			
Buovant Force	=				Sloped Soil Over Heel =	:		
Surcharge over Heel	_				Surcharge Over Heel =	:		
Surcharge Over Toe	_				Adjacent Footing Load =	:		
Adjacent Footing Load	_				Axial Dead Load on Stem =	:		
Added Lateral Load	=				* Axial Live Load on Stem =	:		
Load @ Stem Above Sc	nil =				Soil Over Toe =	:	0.21	
Seismic Earth Load	_	91 5	2 33	213.4	Surcharge Over Toe =	:		
Ocisinic Lann Load	_	51.5	2.00	210.4	Stem Weight(s) =	400.0	0.75	299.7
	_				Earth @ Stem Transitions =			
Total	=	472.6	O.T.M. =	806.3	Footing Weight =	208.6	1.04	217.6
					Key Weight =	:		
Resisting/Overturnir	ng Rat	io	=	1.63	Vert. Component =	:		
Vertical Loads used	for So	il Pressure	= 1,110.	3 lbs	Total :	= 1.110.3	lbs R.M.=	1.312.1
					* Axial live load NOT include	d in total display	ed, or used fo	roverturning
If seismic is included, th	he OT	M and slidir	na ratios		resistance, but is included f	or soil pressure	calculation.	5

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.087 in

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

This Wall in File: K:\2021\01	519-2021-06 H	luber Res	idence\Calcs\Typical Detail Co-0	4-06.F	RPX		
RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	d 11.20.03.31 AY FAGET		Cantilevered Retaini	ng V	Vall	Code: IBC 2015,4	ACI 318-14,ACI 530-13
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 = 3 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 =	300.0 35.0 300.0 125.00 0.500 12.00) psf) psf/ft) psf/ft) pcf) pcf) in		
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied	= 0.0 ps & Overturning = 0.0 turning	f	Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Ser	0.0 # 0.00 ft 0.00 ft d (W) vice L	/ft evel)	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type Base Above/Below Soil	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load = 0.0 ft
Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 lbs = 0.0 in	6	(Service Level)	0.0 p	st	at Back of Wall Poisson's Ratio	= 0.300
Design Summary			Stem Construction] _	Bottom		
Wall Stability Ratios Overturning Sliding Total Bearing Load	= 2.60 = 1.8 = 2,708	3 OK 0 OK 3 Ibs	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Rebar Spacing	ft = = = = =	0.00 Concrete LRFD 8.00 # 4 12.00		
resultant ecc. Soil Pressure @ Toe	= 0.62	2 in 4 psf OK	Rebar Placed at Design Data fb/FB + fa/Fa	=	Edge 0.367		
Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= 8 = 3,000 5 Than Allowab = 2,259 - 1	3 psf OK) psf lle 9 psf	Total Force @ Section Service Level Strength Level MomentActual	- Ibs = Ibs =	1,008.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 0.4 = 7.0 = 94.9	4 psi OK 0 psi OK 9 psi	Service Level Strength Level MomentAllowable	ft-# = ft-# = =	2,016.0 5,492.3		
Sliding Calcs Lateral Sliding Force less 100% Passive Forc less 100% Friction Force	= 817.2 e = - 116.7 e = - 1,353.8	2 lbs 7 lbs 3 lbs	ShearActual Service Level Strength Level ShearAllowable	psi = psi = psi =	13.4 94.9		
for 1.5 Stability	= 0.0) lbs OK	Rebar Depth 'd' Masonry Data	in =	6.25		
Vertical component of activ NOT considered in the calc	e lateral soil pr ulation of soil b	essure IS bearing	Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = = psf =	100.0		
Load Factors Building Code Dead Load Live Load	IBC 2015,/ 1.2 1.6	ACI 200 500	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = =	Medium V ASD	/eight	
Wind, W Seismic, E	1.0 1.0 1.0	000 000	Concrete Data f'c Fy	psi = psi =	4,000.0 60,000.0		

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Concrete Stem Reba	r Area Detai	ls		
Bottom Stem As (based on applied mom	ent) :	Vertical Reinforcing 0.0755 in2/ft	Horizontal Reinfor	rcing
(4/3) * As :	- /	0.1007 in2/ft	Min Stem T&S Re	einf Area 1.152 in2
200bd/fy : 200(12)(6.25)/60	0000 :	0.25 in2/ft	Min 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	Horizontal Reinfor	rcing Options :
		===========	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 :		1.3547 in2/ft	#6@ 27.50 in	#6@ 55.00 in
Footing Data		Footing Des	ign Results	
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Depth Key Distance from Toe f'c = 4,000 psi F Footing Concrete Density Min. As % Cover @ Top 2.00	$\begin{array}{r} = & 0.42 \\ = & 2.92 \\ = & 3.34 \\ = & 10.00 \\ = & 0.00 \\ = & 0.00 \\ = & 0.00 \\ = & 0.00 \\ = & 150.00 \\ = & 0.0018 \\ @ Btm.= & 3.0 \end{array}$	t Factored Pressure Mu': Upward Mu': Downward Mu: Design n Actual 1-Way Shear t Toe Reinforcing bosi Heel Reinforcing footing Torsion, Tu 0 in Footing Allow. Tors	Toe = 2,259 = 2,291 = 238 = 171 r = 0.39 = 94.87 = #4 @ 12.00 = #4 @ 12.00 = None Spec'd = =	Heel 11 psf 1,311 ft-# 2,666 ft-# 1,355 ft-# 7.03 psi 94.87 psi in
		If torsion excee	eds allowable, pro	ovide
		supplemental of	lesign for footing	torsion.
		Other Acceptable Toe: #4@ 11.11 Heel: #4@ 11.11 Key: No key def	Sizes & Spacings in, #5@ 17.22 in, in, #5@ 17.22 in, ined	IS #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
		Min footing T&S Min footing T&S If one layer of ho	reinf Area reinf Area per foot rizontal bars:	0.72 in2 0.22 in2 <i>i</i> ft If two layers of horizontal bars:

#4@ 11.11 in	
#5@ 17.22 in	
#6@ 24.44 in	

0.22 in2 *f*t If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

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Summary of Overtu	rning & R	esisting F	orces & Mon	nents			
Item	Force Ibs	/ERTURNING Distance ft	Moment ft-#		Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	817.2	2.28	1,861.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,690.0	2.21 2.21	3,740.5 3,740.5
Buoyant Force = Surcharge over Heel = Surcharge Over Toe =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load =			
Adjacent Footing Load = Added Lateral Load = Load @ Stem Above Soil =				Axial Dead Load on Stem = * Axial Live Load on Stem = Soil Over Toe =		0.21	
Load @ Stem Above Soil =				Soil Over Toe = Surcharge Over Toe =		0.21	

			-	-	
Total	=	817.2	O.T.M.	=	1.861.3
		-	-		,
Resisting/Overturning	=		2.63		
Vertical Loads used for	= 2,	707	.5 lbs		

Surcharge Over Hee	=			
Adjacent Footing Loa	ad =			
Axial Dead Load on	Stem =			
* Axial Live Load on S	item =			
Soil Over Toe	=		0.21	
Surcharge Over Toe	=			
Stem Weight(s)	=	600.0	0.75	452.0
Earth @ Stem Trans	itions=			
Footing Weight	=	417.5	1.67	697.2
Key Weight	=			
Vert. Component	=		_	
	Total =	2,707.5	lbs R.M.=	4,889.8

* 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) 0.081 in

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

because the wall would then tend to rotate into the retained soil.
Live Load

Earth, H

Wind, W

Seismic, E

1.600

1.600

1.000

1.000

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

PotainBro (c) 1987-2019 Buil		sidence/Caics/Typical Detail	C0-04-00.RPX	
License : KW-06052576 License To : SWENSON S	SAY FAGET	Cantilevered Reta	aining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height Wall height above soil Slope Behind Wall	= 6.00 ft = 0.00 ft = 0.00	Allow Soil Bearing Equivalent Fluid Pressure M Active Heel Pressure	= 4,000.0 psf ethod = 35.0 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	= = 300.0 psf/ft = 125.00 pcf = 0.00 pcf = 0.500 = 12.00 in	
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 rturning	Lateral Load = Height to Top = Height to Bottom =	0.0 #/ft 0.00 ft 0.00 ft Wind (W)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ft
Axial Load Applied	to Stem		(Service Level)	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 psf	at Back of Wall= $0.0 ft$ Poisson's Ratio= 0.300
Earth Pressure Se	sismic Load			
Method : Uniform Multiplier Used (Multiplier used on soil d	= 6.000 Jensity)	Uniform Seismic Force = Total Seismic Force =	41.000 280.167	
Design Summary		Stem Construction	Bottom	
Wall Stability Ratios Overturning Sliding	= 1.93 OK = 1.45 Ratio <	Design Height Above Wall Material Above Design Method 1.5! Thickness	Example a fit and the second s	
Total Bearing Loadresultant ecc.	= 2,707 lbs = 9.61 in	Rebar Size Rebar Spacing Rebar Placed at	= # 4 = 12.00 = Edge) }
Soil Pressure @ Toe	= 2,081 psf Or	fb/FB + fa/Fa	= 0.508	3
Allowable	= 0 psi 0r = 4,000 psf	Total Force @ Sect	ion	
Soil Pressure Les ACI Factored @ Toe ACI Factored @ Heel	s Than Allowable = 2,913 psf = 0 psf	Strength Level MomentActual	lbs = 1,254.0	1
Footing Shear @ Toe	= 0.4 psi Ok	Strength Level	ft-# = 2,754.0)
Allowable Sliding Calcs	= 75.0 psi	MomentAllowable ShearActual	e = 5,412.6	i
Lateral Sliding Force	= 1,013.3 lbs	Service Level	psi =	7
less 100% Friction Forc	e = - 1,353.5 lbs	ShearAllowable	psi = 75.0)
Added Force Req'dfor 1.5 Stability	= 0.0 lbs Ok = 49.7 lbs NC	Anet (Masonry) Rebar Depth 'd'	in2 = in = 6.25	;
Vertical component of activ NOT considered in the calc	/e lateral soil pressure l culation of soil bearing	f'm Fs S Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = = psf = 100.0	
Load Factors		Short Term Factor	=	
Building Code Dead Load	IBC 2015,ACI 1.200	Equiv. Solid Thick. Masonry Block Type	= = Medium \	Neight

Masonry Design Method

Concrete Data

f'c

Fy

= ASD

psi = 60,000.0

2,500.0

psi =

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06052576 License To : SWENSON SAY FAGET		С	Cantilevered Retaining Wall			1	Code: IBC 2015,ACI 318-14,ACI 530-13	
Concrete Stem Reba	r Area Deta	ils						
Bottom Stem		Vertical Rei	nforcing H	lorizont	al Reinfor	cing		
As (based on applied mome	ent):	0.1032 in2/f	't					
(4/3) * As :		0.1376 in2/f	it N	1in Ster	n T&S Rei	inf Area 1.1	52 in2	
200bd/fy : 200(12)(6.25)/60	: 000	0.25 in2/ft	N	1in Ster	n T&S Re	inf Area pe	r ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :		0.1728 in2/f	it H	lorizont	al Reinfor	cing Option	IS :	
		========	=== C	one laye	er of :	Two layers	s of :	
Required Area :		0.1728 in2/1	ft #	4@ 12.	50 in	#4@ 25.0	00 in	
Provided Area :		0.2 in2/ft	#	5@ 19.	38 in	#5@ 38.7	75 in	
Maximum Area :		0.8467 in2/1	ft #	6@ 27.	50 in	#6@ 55.0	00 in	
Footing Data			Footing Desig	n Res	ults			
Toe Width	= 0.42	ft			Toe	Heel		
Heel Width	= 2.92	F	Factored Pressure	=	2,913	0 ps	sf	
Total Footing Width	= 3.34	ľ.	/lu': Upward	=	2,864	654 ft-	-#	
Footing Thickness	= 10.00	in ^r	Mu': Downward	=	234	2,666 ft- 2,012 ft-	-# -#	
Key Width	= 0.00	in 2	Actual 1-Way Shear	_	0.40	11 93 n	π si	
Key Depth	= 0.00	in ,	Allow 1-Way Shear	=	75.00	75.00 pt	si	
Key Distance from Toe	= 0.00	ft 7	Foe Reinforcing	= #4	@ 12.00	in .		
f'c = 2,500 psi F	y = 60,000	psi ł	Heel Reinforcing	= #4	@ 12.00	in		
Footing Concrete Density	= 150.00	pcf ł	Key Reinforcing	= No	ne Spec'd			
Min. As %	= 0.0018	F F	ooting Torsion, Tu		=	0.00 f	ft-lbs	
Cover @ Top 2.00	@ Btm.= 3.	UU IN F	ooting Allow. Torsion	n, phi T	u =	0.00 1	it-lbs	
			If torsion exceed	s allow	able, pro	vide		
			supplemental de	sign fo	r footing	torsion.		
		C	other Acceptable Si	izes &	Spacing	S		
			Toe: #4@ 11.11 ir Heel: #4@ 11.11 ir Key: No key defin	n, #5@ n, #5@ ed	17.22 in, a 17.22 in, a	#6@ 24.44 #6@ 24.44	in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5	
			Min footing T&S rei Min footing T&S rei If one layer of horiz	inf Area nf Area ontal b	per foot ars:	0.72 0.22 If two laye	in2 in2 /ft ers of horizontal bars:	

i one layer or i	10112
#4@ 11.11 ir	۱
#5@ 17.22 ir	۱
#6@ 24.44 ir	۱

0.22 in2 /ft If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

Moment ft-# 3,733.8

3,733.8

449.6

695.6

4,878.9

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

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	0V	ERTURNING.			F	RESISTING	
Item	Force Ibs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	1,690.0	2.21	3,733.
HL Act Pres (be water tbl) Hydrostatic Force				Soil Over HL (bel. water tbl) Watre Table		2.21	3,733.
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =		0.21	
Seismic Earth Load =	196.1	3.42	670.1	Surcharge Over Toe =			
=				Stem Weight(s) =	600.0	0.75	449.
				Earth @ Stem Transitions =			
Total =	1,013.3	O.T.M. =	2,531.4	Footing Weight =	417.0	1.67	695.
				Key Weight =			
Resisting/Overturning R	atio	=	1.93	Vert. Component =			
Vertical Loads used for S	Soil Pressure	= 2,707.0) lbs	Total =	2,707.0	bs R.M.=	4.878.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.104 in

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

This Wall in File: K:\2021\01	1519-2021-06 Huber F	esidence\Calcs\Typical Detail Co-	04-06.RPX	
RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	Id 11.20.03.31	Cantilevered Retain	ing Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
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 = 3 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 = =	3,000.0 psf d 35.0 psf/ft 300.0 psf/ft 125.00 pcf 0.00 pcf 0.500 12.00 in	
Surcharge Loads		Lateral Load Applied to	Stem	Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over 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 in	Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Se Wind on Exposed Stem = (Service Level)	0.0 #/ft 0.00 ft 0.00 ft d (W) rvice Level) 0.0 psf	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil at Back of Wall=0.0 ftPoisson's Ratio=0.300
Design Summary		Stem Construction	Bottom	,
Wall Stability Ratios Overturning Sliding Total Bearing Load	= 2.56 OK = 1.62 OK = 4,212 lbs	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Rebar Spacing	tt = 0.00 = Concrete = LRFD = 8.00 = # 5 = 12.00	
resultant ecc.	= 7.58 in	Rebar Placed at Design Data	= Edge	•
Soil Pressure @ Heel Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= 1,773 psi (= 135 psf (= 3,000 psf s Than Allowable = 2,482 psf = 190 psf	K fb/FB + fa/Fa Total Force @ Section Service Level Strength Level Moment Actual	= 0.58 lbs = lbs = 1,792.0	3
Footing Shear @ Heel	= 6.1 psi 0 = 11.5 psi 0	K Service Level K Strength Level	ft-# = ft-# = 4,778.7	7
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= 1,417.5 lbs = 1,417.5 lbs ce = - 187.5 lbs ce = - 2,105.9 lbs	ShearActual Service Level Strength Level ShearAllowable	psi = 24.1 psi = 75.0	
Added Force Req'd for 1.5 Stability	= 0.0 lbs 0 = 0.0 lbs 0	K Anet (Masonry) K Rebar Depth 'd' Masonry Data	in2 = in = 6.19)
Vertical component of activ NOT considered in the calc	ve lateral soil pressure culation of soil bearing	Fs IS Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf = 100.0)
Load Factors Building Code Dead Load Live Load Farth, H	IBC 2015,ACI 1.200 1.600 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = = Medium \ = ASD	Veight
Wind, W Seismic, E	1.000	f'c Fy	psi = 2,500.0 psi = 60,000.0)

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Concrete Stem Rebar A	Area Details			
Bottom Stem	Vertical	Reinforcing I	Horizontal Reinford	cing
As (based on applied moment): 0.1809	in2/ft		-
(4/3) * As :	0.2413	in2/ft	Vin Stem T&S Rei	inf Area 1.536 in2
200bd/fy : 200(12)(6.1875)/600	0.2475	in2/ft	Vin Stem T&S Rei	inf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728	in2/ft I	Horizontal Reinfor	cing Options :
	======		One layer of :	Two layers of :
Required Area :	0.2413	in2/ft #	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2	2/ft #	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382	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	1.00 ft <u>3.42</u> 4.42 12.00 in 0.00 in 0.00 ft = 60,000 psi 150.00 pcf 0.0018 ⊉ Btm.= 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. Torsic If torsion exceed supplemental de	Toe = 2,482 = 13,851 = 1,530 = 1,027 = 6.08 = 75.00 = #5 @ 12.00 = #5 @ 12.00 = #5 @ 12.00 = m, phi Tu = ds allowable, pro- esign for footing	Heel 189 psf 2,512 ft:# 5,216 ft:# 2,703 ft:# 11.51 psi 75.00 psi in 0.00 ft-lbs 0.00 ft-lbs ovide torsion.
		Othor Accontable S		
		Toe: #4@ 9.25 in Heel: #4@ 9.25 in Key: No key defir	, #5@ 14.35 in, #6 , #5@ 14.35 in, #6 ned	s 6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
		Min footing T&S re Min footing T&S re	einf Area einf Area per foot	1.14 in2 0.26 in2 <i>i</i> ft

If one layer of horizontal bars:

#4@ 9.26 in

#5@ 14.35 in

#6@ 20.37 in

If two layers of horizontal bars:

#4@ 18.52 in

#5@ 28.70 in

#6@ 40.74 in

This Wall in File: K:\2021\0151	9-2021-06	Huber Reside	nce\Calcs\Typic	al Detail Co-04-06.RPX			
RetainPro (c) 1987-2019, Build 1 License : KW-06052576 License To : SWENSON SAY	1.20.03.31 / FAGET		Cantilevere	d Retaining Wall	Code: IBC 20	015,ACI 318	-14,ACI 530-1
Summary of Overtur	ning & R	esisting F	orces & Mon	nents			
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	1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	2,749.3	3.04 3.04	8,361.6 8,361.6
Hydrostatic Force=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 =			
Added Lateral Load = Load @ Stem Above Soil =				* Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe =		0.50	
= 	1.417.5	 O.T.M	4.252.5	Stem Weight(s) = Earth @ Stem Transitions =	800.0	1.33	1,066.7

Key Weight

Resisting/Overturning Ratio 2.56 = Vertical Loads used for Soil Pressure = 4,211.7 lbs

Vert. Component = Total = 4,211.7 lbs R.M.= 10,890.9 * 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) 0.089 in

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

because the wall would then tend to rotate into the retained soil.

RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	d 11.20.03.31	Cantilevered Retair	ing Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe	= 8.00 ft = 0.00 ft = 0.00 = 6.00 in	Allow Soil Bearing = Equivalent Fluid Pressure Meth Active Heel Pressure =	4,000.0 psf od 35.0 psf/ft	
Water height over heel	= 0.0 ft	Passive Pressure=Soil Density, Heel=Soil Density, Toe=Footing Soil Friction=Soil height to ignore for passive pressure=	300.0 psf/ft 125.00 pcf 0.00 pcf 0.500 12.00 in	
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 trurning	Lateral Load = Height to Top = Height to Bottom = Load Type = Wi	0.0 #/ft 0.00 ft 0.00 ft nd (W)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ft
Axial Load Applied	to Stem	(Se	ervice Level)	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 psf	at Back of Wall=0.0 ftPoisson's Ratio=0.300
Earth Pressure Se	eismic Load			
Method : Uniform Multiplier Used (Multiplier used on soil d	= 6.000 lensity)	Uniform Seismic Force = 5 Total Seismic Force = 48	54.000 36.000	
Design Summary		Stem Construction	Bottom	
Wall Stability Ratios Overturning Sliding	= 1.88 OK = 1.30 Ratio	Design Height Above Fr Wall Material Above "H Design Method < 1.5! Thickness	In the second se	
Total Bearing Loadresultant ecc.	= 4,212 lbs = 11.94 in	Rebar Size Rebar Spacing Rebar Placed at	= # 5 = 12.00 = Edge	
Soil Pressure @ Toe	= 2,315 psf Ol	fb/FB + fa/Fa	= 0.801	I
Allowable	= 4,000 psf	Total Force @ Section	1 11	
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	s Than Allowable = 3,242 psf = 0 psf	Service Level Strength Level MomentActual	lbs = 2,224.0	
Footing Shear @ Toe	= 8.1 psi Ol	Strength Level	ft-# = 6,506.7	
Allowable Sliding Calcs	= 75.0 psi	MomentAllowable ShearActual	= 8,121.3	
Lateral Sliding Force	= 1,757.7 lbs	Service Level	psi =	
less 100% Friction Force	e = - 2,105.9 lbs	ShearAllowable	psi = 30.0 psi = 75.0	
Added Force Req'dfor 1.5 Stability	= 0.0 lbs Of = 343.2 lbs No	G Anet (Masonry) G Rebar Depth 'd'	in2 = in = 6.19	
Vertical component of activ NOT considered in the calc	re lateral soil pressure l culation of soil bearing	f'm Fs S Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = = psf = 100.0	
Load Factors		Short Term Factor	=	
Building Code Dead Load	IBC 2015,ACI 1.200	Equiv. Solid Thick. Masonry Block Type	= = Medium V	Veight

Masonry Design Method = ASD

psi = 2,500.0

psi = 60,000.0

Concrete Data

f'c

Fy

Dunuing Oouc	100 2010,701
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

#4@ 18.52 in

#5@ 28.70 in

#6@ 40.74 in

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Concrete Stem Rebar Area	Details			
Bottom Stem As (based on applied moment) :	Vertical Rein 0.2464 in2/ft	forcing H	lorizontal Reinf	forcing
(4/3) * As :	0.3285 in2/ft	Ν	/lin Stem T&S F	Reinf Area 1.536 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Ν	/lin Stem T&S F	Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	F	lorizontal Reinf	forcing Options :
· · · · ·		== 0	One layer of :	Two layers of :
Required Area :	0.2475 in2/ft	#	4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#	5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382 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 psiFyFooting Concrete Density=Min. As %=0Cover @ Top2.00@ Btm	1.00 ft 3.42 Fa 4.42 M 12.00 in M 0.00 in Aa 0.00 in Aa 0.00 ft Ta 0,000 psi H 50.00 pcf K .0018 Fa = 3.00 in Fa	actored Pressure u': Upward u': Downward u: Design ctual 1-Way Shear llow 1-Way Shear be Reinforcing eel Reinforcing ey Reinforcing boting Torsion, Tu boting Allow. Torsio	Toe = 3,242 = 17,667 = 1,530 = 1,345 = 8.10 = 75.00 = #5 @ 12.0 = #5 @ 12.0 = None Spec = n, phi Tu =	Heel 0 psf 1,138 ft-# 5,216 ft-# 4,078 ft-# 18.09 psi 75.00 psi 00 in 00 in c'd 0.00 ft-lbs 0.00 ft-lbs
		If torsion exceed	ls allowable, p	provide
		supplemental de	sign for footin	ng torsion.
	Ot	her Acceptable S Toe: #4@ 9.25 in, Heel: #4@ 9.25 in, Key: No key defin Min footing T&S re Min footing T&S re If one layer of horiz	izes & Spacir #5@ 14.35 in, #5@ 14.35 in, ed inf Area inf Area per foc	ngs , #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 , #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 1.14 in2 ot 0.26 in2 /ft If two layers of horizontal bars:

#4@ 9.26 in

#5@ 14.35 in

#6@ 20.37 in

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	OVERTURNING					RESISTING		
Item		Force lbs	Distance ft	ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl	1)	1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl)	2,749.3	3.04	8,361.6
HL Act Pres (be water tb) Hydrostatic Force	I)				Soil Over HL (bel. water tbl) Watre Table		3.04	8,361.6
Buoyant Force	=				Sloped Soil Over Heel =			
Surcharge over Heel	=				Surcharge Over Heel =			
Surcharge Over Toe	=				Adjacent Footing Load =			
Adjacent Footing Load	=				Axial Dead Load on Stem =			
Added Lateral Load	=				* Axial Live Load on Stem =			
Load @ Stem Above Soi	1 =				Soil Over Toe =		0.50	
Seismic Earth Load	=	340.2	4.50	1,530.9	Surcharge Over Toe =			
	=			-	Stem Weight(s) =	800.0	1.33	1,066.7
Tatal		4 757 7		E 700 4	Earth @ Stem Transitions =			
i otal	=	1,/5/./	0.1.M. =	5,783.4	Footing Weight =	662.4	2.21	1,462.6
					Key Weight =			
Resisting/Overturning	g Rat	tio	=	1.88	Vert. Component =			
Vertical Loads used for	or So	I Pressure	= 4,211.	.7 lbs	Total =	4,211.7 I	bs R.M.=	10,890.9
If seismic is included the	∋ OT	V and slidin	a ratios		* Axial live load NOT included in resistance, but is included for s	n total display soil pressure	ed, or used fo calculation.	r overturning

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.117 in

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

because the wall would then tend to rotate into the retained soil.

This Wall in File: K:\2021\01	519-2021-06 Huber Re	sidence\Calcs\Typical Detail Co-0	04-06.RPX	
RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON SA	11.20.03.31 AY FAGET	Cantilevered Retaini	ing Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
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 = 3 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 =	3,000.0 psf d 35.0 psf/ft 300.0 psf/ft 125.00 pcf 0.00 pcf 0.500 12.00 in	
Surcharge Loads		Lateral Load Applied to	Stem	Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overt Axial Load Applied	= 0.0 psf & Overturning = 0.0 urning to Stem	Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Ser	0.0 #/ft 0.00 ft 0.00 ft d (W) rvice Level)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil0.00 ft
Axial Dead Load Axial Live Load Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 lbs = 0.0 in	Wind on Exposed Stem _ (Service Level)	0.0 psf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary		Stem Construction	Bottom	
Wall Stability Ratios Overturning Sliding	= 2.98 OK = 1.72 OK	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size	ft = 0.0 = Concret = LRFI = 8.0 = #	Control (Control (Contro) (Control (Contro) (Contro) (Contro) (Contro) (Contro) (
Total Bearing Load resultant ecc.	= 7,074 lbs = 7.14 in	Rebar Spacing Rebar Placed at	= 12.0 = Edg	D e
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe Footing Shear @ Heel	= 1,811 psf OK = 483 psf OK = 3,000 psf Than Allowable = 2,536 psf = 676 psf = 6.5 psi OK = 10.6 psi OK	fb/FB + fa/Fa fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual Service Level Strength Level	= 0.71 lbs = lbs = 2,800.4 ft-# = ft-# = 9,333.	2) 3
Allowable Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= 75.0 psi = 2,314.4 lbs = - 450.0 lbs = - 3,537.0 lbs	MomentAllowable ShearActual Service Level Strength Level ShearAllowable	= 13,107.2 psi = psi = 41.2 psi = 75.0	2 9 0
Added Force Req'd for 1.5 Stability	= 0.0 lbs OK = 0.0 lbs OK	Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs	in2 = in = 5.5 psi = psi =	6
Vertical component of active NOT considered in the calcu	lateral soil pressure IS lateral soil bearing	Solid Grouting Modular Ratio 'n' Wall Weight	= = psf = 100.4	0
Building Code Dead Load Live Load Farth, H	IBC 2015,ACI 1.200 1.600 1.600	Snort Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = = Medium = ASD	Weight
Wind, W Seismic, E	1.000 1.000	f'c Fy	psi = 2,500. psi = 60,000.	D D

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON SA	11.20.03.31 AY FAGET	Cantilevered F	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13	
Concrete Stem Reba	r Area Detai	ls			
Bottom Stem As (based on applied mom	ent) :	Vertical Reinforcing 0.3955 in2/ft	Horizontal Reinford	ing	
(4/3) * As :	,-	0.5274 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 Rei	of Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :		0.1728 in2/ft	Horizontal Reinford	ing Options :	
		===========	One layer of :	Two layers 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 Des	ign Results		
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Depth Key Distance from Toe f'c = 2,500 psi F Footing Concrete Density Min. As % Cover @ Top 2.00	= 1.75 f $= 4.42$ $= 6.17$ $= 18.00 i$ $= 0.00 i$ $= 0.00 f$ $= 0.00 f$ $= 0.00 f$ $= 0.0018$ @ Btm.= 3.0	t Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear t Toe Reinforcing bocf Key Reinforcing Footing Torsion, Tu 0 in Footing Allow. Tors	Toe = 2,536 = 43,366 = 6,339 = 3,086 ur = v = u = ion, phi Tu =	Heel 676 psf 7,403 ft# 12,441 ft-# 5,038 ft-# 10.65 psi 75.00 psi 0.00 ft-lbs 0.00 ft-lbs	
		If torsion exce	eds allowable, prov	ide	
		supplemental	design for footing t	orsion.	
		Other Acceptable Toe: #4@ 6.17 Heel: #4@ 6.17 Key: No key de Min footing T&S Min footing T&S If one layer of ho	Sizes & Spacings in, #5@ 9.56 in, #6@ fined reinf Area reinf Area per foot rizontal bars:	 2 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. 2 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. 2.40 in2 0.39 in2 /ft If two layers of horizontal bars: 	

	ayer or nonz
#4@	6.17 in
#5@	9.57 in
#6@	13.58 in

0.39 in2 /ft If two layers of horizontal bars: #4@ 12.35 in #5@ 19.14 in #6@ 27.16 in

This Wall in File: K:\2021\07	1519-2021-06 l	Huber Reside	ence\Calcs\Typic	al Detail Co-04-06.RPX			
RetainPro (c) 1987-2019, Bui License : KW-06052576 License To : SWENSON S	Id 11.20.03.31		Cantilevere	d Retaining Wall	Code: IBC 20	015,ACI 318	-14,ACI 530-13
Summary of Overt	urning & 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 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	8,871.8	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 =	4,686.7	4.29 4.29 0.88	20,112.0 20,112.0
Total Resisting/Overturning	= 2,314.4 Ratio	 O.T.M. = =	8,871.8 2.98	Stem Weight(s) = Earth @ Stem Transitions = Footing Weight = Key Weight = Vert. Component =	1,000.0	2.08 3.08	2,083.3 4,277.2

Vertical Loads used for Soil Pressure = 7,074.0 lbs

Total = 7,074.0 lbs **R.M.=** 26,472.6 * 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) 0.082 in

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

because the wall would then tend to rotate into the retained soil.

Dead Load

Live Load

Earth, H

Wind, W

Seismic, E

1.200

1.600

1.600

1.000

1.000

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06 RPX -

RetainPro (c) 1987-2019, Build License : KW-06052576	d 11.20.03.31	C	antilevered Retain	ning W	r^ /all	Code: IBC 2015,4	ACI 318-14,ACI 530-13
Criteria	ATTAGET	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 Equiv Active Passi Soil D	Soil Bearing = alent Fluid Pressure Meth Heel Pressure = = ve Pressure = Pensity, Heel =	4,000.0 nod 35.0 300.0 125.00	psf psf/ft psf/ft		
		Footir Soil h for	eight to ignore passive pressure =	0.500	in		
Surcharge Loads		Late	eral Load Applied to	o Stem		Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overt	= 0.0 psf & Overturning = 0.0 turning	Later Hei Hei Load	al Load = ght to Top = ght to Bottom = Type = W	0.0 #/f 0.00 ft 0.00 ft ind (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	= 0.0 lbs = 0.0 lbs = 0.0 in	Wind (Sei	(S d on Exposed Stem ₌ rvice Level)	ervice Le 0.0 ps	vel) f	Base Above/Below Soil 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 de	= 6.000 ensity)	Unifo Total	rm Seismic Force = Seismic Force = 7	69.000 93.500			
Design Summary		Ste	em Construction		Bottom		
Wall Stability Ratios Overturning Sliding	= 2.19 O = 1.39 Ra	K tio < 1.5!	Design Height Above F Wall Material Above "H Design Method Thickness	itg ft = t" = = =	Concrete LRFD 8.00		
Total Bearing Load resultant ecc.	= 7,074 lbs = 12.56 in		Rebar Size Rebar Spacing Rebar Placed at Design Data	= =	# 7 12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 2,316 psi = 0 psi = 4,000 psi	OK OK	fb/FB + fa/Fa Total Force @ Section Service Level	n Ibs =	0.975		
ACI Factored @ Toe ACI Factored @ Heel	= 3,242 ps = 0 ps		Strength Level MomentActual Service Level	lbs =	3,490.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 8.5 psi = 16.2 psi = 75.0 psi	OK OK	Strength Level MomentAllowable	ft-# = =	12,783.3 13,107.2		
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= 2,869.8 lbs e = - 450.0 lbs e = - 3,537.0 lbs		StreamActual Service Level Strength Level ShearAllowable	psi = psi = psi =	52.3 75.0		
Added Force Req'd for 1.5 Stability	= 0.0 lbs = 317.7 lbs	OK NG	Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =	5.56		
Vertical component of active NOT considered in the calco	e lateral soil pressu ulation of soil beari	ire IS ng	rm Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = = psf =	100.0		
Load Factors Building Code	IBC 2015,ACI		Short Term Factor Equiv. Solid Thick.	= = 	100.0		

Masonry Block Type

Concrete Data

f'c

Fy

Masonry Design Method

= Medium Weight

2,500.0

= ASD

psi = 60,000.0

psi =

#4@ 12.35 in

#5@ 19.14 in

#6@ 27.16 in

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

RetainPro (c) 1987-2019, Build 11.20.03.3 License : KW-06052576 License To : SWENSON SAY FAGET	¹ (Cantilevered R	etaining	Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area	etails				
Bottom Stem As (based on applied moment) :	Vertical Re 0.5417 in2	einforcing l	Horizontal Re	inforcing	
(4/3) * As :	0.7223 in2	/ft	Min Stem T&S	S Reinf Area 1	I.920 in2
200bd/fy : 200(12)(5.5625)/60000 :	0.2225 in2	/ft	Min Stem T&S	S Reinf Area	per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2	/ft	Horizontal Re	, inforcing Opti	ons :
		===== (One layer of :	Two lave	ers of :
Required Area :	0.5417 in2	/ft a	, #4@ 12.50 in	#4@ 2	5.00 in
Provided Area :	0.6 in2/ft	;	#5@ 19.38 in	#5@ 38	3.75 in
Maximum Area :	0.7535 in2	/ft a	#6@ 27.50 in	#6@ 5	5.00 in
Footing Data		Footing Desig	gn Results	5	
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 %=0.0Cover @ Top2.00@ Btm.=	1.75 ft <u>4.42</u> 6.17 8.00 in 0.00 in 0.00 ft 0.00 psi 0.00 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	Toe = 3,24 = 53,88 = 6,33 = 3,96 = 8.4 = 75.0 = # 7 @ 12 = # 6 @ 12 = None Sp = = on, phi Tu =	Heel 42 0 32 4,455 39 12,441 52 7,986 49 16.22 00 75.00 2.00 in 2.00 in 5ec'd 9 = 0.00	psf ft-# ft-# ft-# psi psi 0 ft-lbs 0 ft-lbs
		If torsion exceed	ds allowable	, provide	
		supplemental de	esign for foo	ting torsion.	
		Other Acceptable S Toe: #4@ 6.17 in Heel: #4@ 6.17 in Key: No key defin	Sizes & Spac n, #5@ 9.56 ir n, #5@ 9.56 ir ned	cings n, #6@ 13.58 n, #6@ 13.58	in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.
		Min footing T&S re Min footing T&S re If one laver of hori	einf Area einf Area per f zontal bars:	2.40 foot 0.39 If two la	in2 in2 /ft wers of horizontal bars:

#4@ 6.17 in

#5@ 9.57 in

#6@ 13.58 in

1

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

License To : SWENSON SAY FAGET	Cantilevered Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
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	OV	ERTURNING			RE	SISTING	
Item	Force lbs	Distance ft	Moment ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2.314.4	3.83	8.871.8	Soil Over HL (ab. water tbl)	4,686.7	4.29	20,112.0
HL Act Pres (be water tbl)	,		-,	Soil Over HL (bel. water tbl)		4.29	20,112.0
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =	:			Adjacent Footing Load =			
Adjacent Footing Load =	:			Axial Dead Load on Stem =			
Added Lateral Load =	:			* Axial Live Load on Stem =			
Load @ Stem Above Soil =	:			Soil Over Toe =		0.88	
Seismic Earth Load =	555.5	5.75	3,193.8	Surcharge Over Toe =			
=	:		-	Stem Weight(s) =	1,000.0	2.08	2,083.3
				Earth @ Stem Transitions =			
Total =	2,869.8	O.T.M. =	12,065.6	Footing Weight =	1,387.4	3.08	4,277.2
				Key Weight =			
Resisting/Overturning F	Ratio	=	2.19	Vert. Component =			
Vertical Loads used for	Soil Pressure	= 7,074.0) lbs	Total =	7.074.0	bs R.M.=	26.472.6

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.104 in

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

because the wall would then tend to rotate into the retained soil.

This Wall in File: K:\2021\01	519-2021-06 Huber Re	sidence\Calcs\Typical Detail Co-(04-06.RPX	
RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON SA	11.20.03.31 AY FAGET	Cantilevered Retain	ing Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe = Water height over heel =	= 12.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Allow Soil Bearing = 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 =	3,000.0 psf d 35.0 psf/ft 300.0 psf/ft 125.00 pcf 0.00 pcf 0.500 12.00 in	
Surcharge Loads		Lateral Load Applied to	Stem	Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overtr Axial Load Applied	= 0.0 psf & Overturning = 0.0 urning to Stem	Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Set	0.0 #/ft 0.00 ft 0.00 ft nd (W) rvice Level)	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Aboye/Below Soil
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 psf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary		Stem Construction	Bottom	
Wall Stability Ratios Overturning Sliding	= 2.35 OK = 1.50 OK	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Bobor Sizo	Stem O ft = 0.0 = Concret = LRFI = 10.0	K 0 e D 0 7
Total Bearing Loadresultant ecc.	= 8,693 lbs = 11.72 in	Rebar Spacing Rebar Placed at	= # = 9.0 = Edg	/ 0 e
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe	= 2,592 psf OK = 118 psf OK = 3,000 psf Than Allowable = 3,629 psf = 165 psf = 9.7 psi OK	Design Data fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual Service Level	= 0.67 lbs = lbs = 4,032. ft-# =	7 6 0
Footing Shear @ Heel Allowable Sliding Calcs Lateral Sliding Force	= 17.9 psi OK = 75.0 psi = 3.189.4 lbs	Strength Level MomentAllowable ShearActual Service Level	ft-# = 16,128. = 23,826. psi =	0 6
less 100% Passive Force less 100% Friction Force Added Force Req'd for 1.5 Stability	e = - 450.0 lbs = - 4,346.3 lbs = 0.0 lbs OK = 0.0 lbs Ok	Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = 44. psi = 75. in2 = in = 7.5	4 0 6
Vertical component of active NOT considered in the calcu	e lateral soil pressure Is Ilation of soil bearing	Masonry Data f'm Fs Solid Grouting Modular Ratio 'n'	psi = psi = = =	<u>^</u>
Load Factors Building Code Dead Load Live Load Earth	IBC 2015,ACI 1.200 1.600	Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	pst = 125. = = Medium I = ASD	0 Weight
Wind, W Seismic, E	1.000 1.000	Concrete Data f'c Fy	psi = 2,500. psi = 60,000.	0

RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON SA	111.20.03.31 AY FAGET	Cantilevered F	Retaining Wal	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Reba	r Area Detai	ls		
Bottom Stem As (based on applied mom	ent) :	Vertical Reinforcing 0.4948 in2/ft	Horizontal Reinford	ing
(4/3) * As :	0	0.6597 in2/ft	Min Stem T&S Rei	nf Area 2.880 in2
200bd/fy : 200(12)(7.5625)/	/60000 :	0.3025 in2/ft	Min Stem T&S Rei	nf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10)	:	0.216 in2/ft	Horizontal Reinford	ing Options :
			One layer of :	Two layers of :
Required Area :		0.4948 in2/ft	, #4@ 10.00 in	#4@ 20.00 in
Provided Area :		0.8 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :		1.0245 in2/ft	#6@ 22.00 in	#6@ 44.00 in
Footing Data		Footing Des	ign Results	
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Depth Key Distance from Toe f'c = 2,500 psi F Footing Concrete Density Min. As % Cover @ Top 2.00	= 1.75 f = 4.67 = 6.42 = 18.00 i = 0.00 i = 0.00 f = 0.00	tt Factored Pressure Mu': Upward Mu': Downward Mu: Design n Actual 1-Way Shear t Toe Reinforcing osi Heel Reinforcing Footing Torsion, Tu 0 in Footing Allow. Tors	Toe = 3,629 = 60,893 = 6,339 = 4,546 ir = 9.69 = 75.00 = # 7 @ 12.00 i = # 6 @ 12.00 i = None Spec'd i = ion, phi Tu =	Heel 165 psf 6,276 ft# 15,203 ft-# 8,928 ft-# 17.94 psi 75.00 psi n 0.00 ft-lbs 0.00 ft-lbs
		If torsion exce	eds allowable, prov	vide
		supplemental	design for footing t	orsion.
		Other Acceptable Toe: #4@ 6.17 Heel: #4@ 6.17 Key: No key de Min footing T&S	Sizes & Spacings in, #5@ 9.56 in, #6@ in, #5@ 9.56 in, #6@ fined reinf Area	❷ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. ❷ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. 2.49 in2
		Min footing T&S If one layer of ho	reinf Area per foot rizontal bars:	0.39 in2 /ft If two layers of horizontal bars:

#4@ 12.35 in

#5@ 19.14 in #6@ 27.16 in

#4@ 6.17 in

#5@ 9.57 in

#6@ 13.58 in

License : KW-06052576 License : KW-06052576 License To : SWENSON \$	AY FAGET		Cantilevere	d Retaining Wall	Code: IBC 20	015,ACI 318	-14,ACI 530-1
Summary of Over	turning & F	Resisting F	orces & Mon	nents			
Item	Force Ibs	VERTURNING 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 Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load Added Lateral Load	3,189.4 = = = =	4.50	14,352.2	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 =	5,749.0	4.50 4.50	25,868.6 25,868.6
Load @ Stem Above Soil	=			Soil Over Toe = Surcharge Over Toe = Stem Weight(s) = Farth @ Stem Transitions =	1,500.0	0.88 2.17	3,250.0
Total	= 3,189.4	O.T.M. =	14,352.2	Footing Weight	1 443 6	3 21	4 631 1

Footing Weight

Key Weight

Resisting/Overturning Ratio 2.35 = Vertical Loads used for Soil Pressure = 8,692.6 lbs

Vert. Component = 33,749.7 Total = 8,692.6 lbs R.M.= * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

=

=

1,443.6

3.21

4,631.1

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
Soil Spring Reaction Modulus	250.0 pci

Horizontal Defl @ Top of Wall (approximate only) 0.135 in The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

RetainPro (c) 1987-2019, Build License : KW-06052576	11.20.03.31	Cantilevered Reta	aining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria		Soil Data		
Retained Height = Wall height above soil = Slope Behind Wall =	= 12.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = Equivalent Fluid Pressure Me Active Heel Pressure =	= 4,000.0 psf ethod = 35.0 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 =	= 300.0 psf/ft = 125.00 pcf = 0.00 pcf = 0.500 = 12.00 in	
Surcharge Loads		Lateral Load Applied	to Stem	Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overte	= 0.0 psf & Overturning = 0.0 urning	Lateral Load = Height to Top = Height to Bottom =	0.0 #/ft 0.00 ft 0.00 ft	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ft
Axial Load Applied	to Stem	Load Type =	(Service Level)	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 psf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Earth Pressure Sei	smic Load			
Method:Uniform Multiplier Used = (Multiplier used on soil de	= 6.000 ensity)	Uniform Seismic Force = Total Seismic Force = 1	81.000 ,093.500	
Design Summary		Stem Construction	Bottom	
Wall Stability Ratios Overturning	= 1.73 OK	Design Height Above Wall Material Above Design Method	Ftg ft = 0.00 "Ht" = Concrete = LRFE	() e
Total Bearing Load	= 8,693 lbs	Rebar Size Rebar Size	= 10.00 = # 7 = 9.00) 7)
Soil Pressure @ Toe	= 18.85 In = 3,540 psf O	Rebar Placed at Design Data K fb/FB + fa/Fa	= Edge = 0.92	<u>)</u>
Allowable Soil Pressure Less	= 0 psi 0 = 4,000 psf Than Allowable	Total Force @ Secti Service Level	ion lbs =	
ACI Factored @ Toe ACI Factored @ Heel	= 4,956 psf = 0 psf	MomentActual Service Level	IDS = 5,004.0)
Footing Shear @ Heel Allowable	= 28.0 psi Ol = 75.0 psi	K Strength Level MomentAllowable	ft-# = 21,960.0 ft-# = 23,826.0	2 3
Sliding Calcs Lateral Sliding Force less 100% Passive Force	= 3,954.8 lbs e = - 450.0 lbs	ShearActual Service Level Strength Level	psi = psi = 55.7	1
less 100% Friction Force Added Force Req'd	= - 4,346.3 lbs = 0.0 lbs Ol = 1,135.9 lbs N	ShearAllowable K Anet (Masonry) G Rebar Depth 'd'	psi = 75.0 in2 = in = 7.50)
	.,	Masonry Data	psi =	<u>, </u>
Vertical component of active NOT considered in the calcu	e lateral soil pressure l Ilation of soil bearing	Fs IS Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf = 125 (0
Load Factors Building Code	IBC 2015,ACI	Short Term Factor Equiv. Solid Thick.	=	,

Masonry Block Type

Concrete Data

f'c

Fy

Masonry Design Method

= Medium Weight

2,500.0 psi = 60,000.0

= ASD

psi =

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

RetainPro (c) 1987-2019, Build 11.20.03.3 License : KW-06052576 License To : SWENSON SAY FAGET	¹ Cantile	vered Retain	ing Wa	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area	Details			
Bottom Stem As (based on applied moment) :	Vertical Reinforcing 0.6737 in2/ft	Horizor	ntal Reinfo	orcing
(4/3) * As :	0.8982 in2/ft	Min Ste	em T&S Re	einf Area 2.880 in2
200bd/fy : 200(12)(7.5625)/60000 :	0.3025 in2/ft	Min Ste	em T&S Re	einf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizor	ntal Reinfo	prcing Options :
		One lav	/er of :	Two layers of :
Required Area :	0.6737 in2/ft	, #4@ 1(0.00 in	#4@ 20.00 in
Provided Area :	0.8 in2/ft	#5@ 1	5.50 in	#5@ 31.00 in
Maximum Area :	1.0245 in2/ft	#6@ 2:	2.00 in	#6@ 44.00 in
Footing Data	Foo	ting Design Re	sults	
Toe Width =	1.75 ft		Toe	Heel
Heel Width =	4.67 Factored	Pressure =	4.956	0 psf
Total Footing Width =	6.42 Mu' : Up	ward =	80,246	2,122 ft-#
Footing Thickness = 1	8.00 in Mu' : Do	wnward =	6,339	15,203 ft-#
Key Width =	0.00 in Mu: De	sign =	6,159	13,082 ft-#
Key Depth =	0.00 in Actual 1	-Way Shear =	13.42	27.95 psi 75.00 psi
Key Distance from Toe =	0.00 ft Too Rei	forcing - #	7 @ 12 00	75.00 psi Din
f'c = 2,500 psi Ev = 60	000 nsi Heel Re	inforcina = #	6 @ 12.00) in
Footing Concrete Density = 15	0.00 pcf Key Rei	nforcing = N	one Spec'o	d
Min. As % = 0.0	0018 Footing	Forsion, Tu	=	0.00 ft-lbs
Cover @ Top 2.00 @ Btm.=	= 3.00 in Footing	Allow. Torsion, phi	Tu =	0.00 ft-lbs
	If tor	sion exceeds allo	wable, pro	ovide
	supp	lemental design f	or footing	g torsion.
	Other A	cceptable Sizes 8	Spacing	gs
	Toe: Heel: Key:	#4@ 6.17 in, #5@ #4@ 6.17 in, #5@ No key defined	9.56 in, #6 9.56 in, #6	6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30. 6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.
	Min fo Min fo If one	oting T&S reinf Are oting T&S reinf Are layer of horizontal	ea a per foot bars:	2.49 in2 0.39 in2 /ft If two layers of horizontal bars:

Win footing 1&S reinf Area
If one layer of horizontal ba
#4@ 6.17 in
#5@ 9.57 in
#6@ 13.58 in

0.39 in2 /ft If two layers of horizontal bars: #4@ 12.35 in #5@ 19.14 in #6@ 27.16 in

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

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OVERTURNING						RESISTING				
Item	F	orce lbs	Distanc ft	e	Moment ft-#			Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl) ;	3.189.4	4.50)	14.352.2	Soil Over HL (ab. water	tbl)	5,749.0	4.50	25,868.6
HL Act Pres (be water tbl Hvdrostatic Force)	-,0.		-	· ·,- ·	Soil Over HL (bel. water Watre Table	tbl)		4.50	25,868.6
Buovant Force	=					Sloped Soil Over Heel	=			
Surcharge over Heel	=					Surcharge Over Heel	=			
Surcharge Over Toe	=					Adjacent Footing Load	=			
Adjacent Footing Load	=					Axial Dead Load on Ster	n =			
Added Lateral Load	=					* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=					Soil Over Toe	=		0.88	
Seismic Earth Load	=	765.5	6.75	5	5,166.8	Surcharge Over Toe	=			
	=					Stem Weight(s)	=	1,500.0	2.17	3,250.0
Tatal		054.0	- 		40 540 0	Earth @ Stem Transition	IS=			
Iotal	=	3,954.8	0.1.M.	=	19,519.0	Footing Weight	=	1,443.6	3.21	4,631.1
						Key Weight	=			
Resisting/Overturning	g Ratio		=	1	1.73	Vert. Component	=			
Vertical Loads used for	or Soil P	ressure =	= 8,0	692.6	lbs	Tota	al =	8,692.6 I	bs R.M.=	33,749.7

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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) 0.184 in

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

because the wall would then tend to rotate into the retained soil.





Huber	Res	iden	ce
PROJECT			

03/08/22 DATE 01519-2021-06 PROJ. # DMR DESIGN 90 SHEET







Based on pile spacing: 7.0 foot or meter

User Input Pile, W14X43: E (ksi)=29000.0, I (in4)/pile=428.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\garage wall_temp.sh8





Based on pile spacing: 7.0 foot or meter

User Input Pile, W14X43: E (ksi)=29000.0, I (in4)/pile=428.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\garage wall_perm.sh8





Based on pile spacing: 7.0 foot or meter

User Input Pile, W14X43: E (ksi)=29000.0, I (in4)/pile=428.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\garage wall_perm EQK.sh8





Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X89: E (ksi)=29000.0, I (in4)/pile=1300.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\trash wall temp.sh8





Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X89: E (ksi)=29000.0, I (in4)/pile=1300.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\trash wall perm.sh8





Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X89: E (ksi)=29000.0, I (in4)/pile=1300.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\trash wall perm EQK.sh8





Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X36: E (ksi)=29000.0, I (in4)/pile=448.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\Temporary basement shoring.sh8


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



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.0 foot or meter

User Input Pile, W18X65: E (ksi)=29000.0, I (in4)/pile=1070.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\north basement wall_temp.sh8

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



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.0 foot or meter

User Input Pile, W18X65: E (ksi)=29000.0, I (in4)/pile=1070.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\north basement wall_perm.sh8

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PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.0 foot or meter

User Input Pile, w18x65: E (ksi)=29000.0, I (in4)/pile=1070.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\north basement wall_perm EQK.sh8

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Concrete Lagging Design



Reinforced Concrete Beams (ACI 318-2005)

Transverse Shear REINF	S	hear Reinf is not required per 11.5.6.	1 Shear:				
Fy	60 ks	si		Vn,max	122	kips =	10.00*sqrt(f'c)*bw*d
Transverse Bar Marl	κ 0			Vc	24	kips =	2.00*sqrt(f'c)*bw*d
Spacing, _T	6 in	L Contraction of the second		Vs	0	kips =	0.00*sqrt(f'c)*bw*d
# Legs, _T	2						
A _{vr} /layer	0.00 in	2		φVn	18.23	kips	
				Vu	1.28	kips	(OK)
Longitudinal Skin REINF						1	
Required?	No						
Maximum Spacing	z in						
Side Bars	0 m	ark					
Number of Side Bar Pair	s 0 #	or "Above"					
Spacing.	N/A in						
I O'L							
Deflections:							
I /h max	16	No Deflection Calculations R	ea'd	fr	375	nsi	
L/n max	12	No Deficetion calculations R	.cqu	h eff	36	in	
Check Anyaya	Ves			Ig	1536	in ⁴	
L/A Limit	360			Mcr	12.0	ft_kin	
Ma DI	2 ft	kin		n	10.18	п-кір	
Ma, DL	2 10	-кip 1:			10.18	:2	
Ma, DL+LL	Distributed	-кір		Ac,u	243	111 :4	
Loading Type	Distributed			ICTACK	265	in	
E.	29501			ρ	0.00329		
Ec	2850 ks	4		v	1.72		
le DL	1536 m	1			_		
le DL+LL	1536 in	Auto-Calculated	_	Slab Depth	0	1n	1
+ DI	0.005	Deflections:	Compre	ession Zone Enti	rely W/in Slab?	No	
A DL	$\Delta DL = 0.005 \text{ in } 0.005 \text$						
Δ DL+LL	0.007 in	0.007 in		Crac	ked Moment of	Inertia Calcu	lation
			h	Beam	Slab	Top Steel	Bottom Steel
Allowed Deflection	n 0.27 in	(OK)	Ybar /c	0.50	0.00	1.00	1.00 in
Total Long Term Deflection	n 0.02 in	l	Ybar	0.00	0.00	-1.25	-6.75 in
	r		Area /c	36.00	0.00	0.00	0.00 in ²
Uncracked Ixx Calo	culation		Area	0.00	0.00	7.34	8.14 in ²
Beam	Slab		A*Ybar /c ²	18.00	0.00	0.00	0.00 in ³
Ybar 4.00	0.00 in		A*Ybar /c	0.00	0.00	7.34	8.14 in ³
Area 288	8 0 in	2	A*Ybar	0.00	0.00	-9.18	-54.95 in ³
A*Ybar 1152	2 0 in	3	с	1.51	in		
Ybar,G 4.00) in		Ybar	0.75	0.00	0.26	-5.24 in
Iself 1530	5 0 in	4	Area	54.21	0.00	7.34	8.14 in ²
AY ² +Iself 1530	5 0 in	4	Iself	10	0		in ⁴
I,gross	1536 in	4	AY^2	31	0	0	224 in ⁴
						Icrack	265 in ⁴
	Ic	crack/Igross 17%					