REVISED STRUCTURAL CALCULATIONS FOR:

6221 83RD PL SE

MERCER ISLAND, WA

ARCHITECT: JULIAN WEBER ARCH + DESIGN

AUGUST 1, 2023





DESIGN CR	I TER s	IA	IBC 20)18										
ROOF	:			ROO	F DECK		FLOC)R						
Composition	2.5	psf	Co	mposition	2.5 psf	- 3/4" Ply	wood	2.4	psf					
3/4" Plywood	2.4	psf	3/4	" Plywood	2.4 psf	- TJI @ 16	" o.c.	2.3	psf					
Truss @ 24" o.c.	3.0	psf	Truss	@ 24" o.c.	3.0 psf	Flo	oring	1.0	psf					
Insulation	1.0	psf	1	1/2" Rigid	2.3 psf	Gyp Board	(5/8")	2.8	psf					
Gyp Board (5/8")	2.8	psf	Gyp Bo	oard (5/8")	2.8 psf		MEP	1.5	psf					
MEP	1.5	psf		MEP	1.5 psf									
Solar Panels	5.0	psf	Pallet	ized Deck	5.0 psf									
Total	18.2	psf	· –	Total	19.5 psf		Total	10.0	psf					
Use	20.0	psf		Use	20.0 psf		Use	15.0	psf					
LIVE LOADS		UPAN	CY											
Risk Category		II		ROO	F LIVE		FLOC	or Liv	Έ			DECK		
Roof Deck		No		Snow =	25 psf	Occupa	ncy =	40	psf	0	ccupa	ncy =	60	psf
Common Access		No				Stair/Corr	dor =	40	psf					
SEISMIC CDIT							CDIT							
	1 00	ASCE 7-	Soism	& Ch. 12	45 ft			110	ASCE 7-1	6 Ch. 2	/ Directi	0 85	ocedure	
Site Class =		foult)	т	Ruilding-	43 11	Expos	v –		прп			0.00		
B Value -	D(De	5	Ι,	Dulluling-	0.5	Expos	ure – h –	D 25	ft		G –	1.60	*800 K	-+
	0	.0		15-	0.5			20	п		r _{zt} –	1.00	Workel	
Goo, Ground Ha	vard?		No w/AS	CE 11 / 8 Ev	vcon's	Roof SI	nne =	Д	· 12	=	18	0	VVOIKSI	leet
$S_{a} = 14$.64		F. =	1 200	Table 11 4-1		ope	т	. 12		10			
$S_4 = 0.5$	607		F., =	NULL	Table 11 4-2	PRESS				S (Cn)			
$S_{ma} = 1.7$	·57	x 2/3 =	S., =	1 171	Fan 11 4-3	Windy	vard V	Vall =	0.8		, Windv	vard F	Roof =	02
$S_{ms} = NU$		x 2/3 =	Su =		Eqn. 11.4-0		vard V	Vall =	-0.5			vard F	Roof =	-0.6
		x 2/3 -		NOLL	Eqn. 11.4-4		valu v	van –	-0.5		LCCV	varu i	(001 -	-0.0
C _{SULT} = 0.1	80					PRESS	URE (PSF)	q = 0.00)256K _z	KztKdV	2		
C _{SALL} = 0.1	26					Ht	Kz	q _z	0.6xq_1	q _h	P _{ww}	P_{LW}	P _{WALL}	P _{ROOF}
T/Ts= 0.672	≤	1.5				0-15	0.57	24.0	14.4		9.8	7.1	16.9	
Okay, Cs Eqn. 12	.8-2					15-20	0.62	26.1	15.7		10.7	7.1	17.7	
						20-25	0.66	27.8	16.7	16.7	11.3	7.1	18.4	11.3
SEISMIC WEIG	HT	ASCE 7-	16 12.7.2			25-30	0.70	29.5	17.7		12.0	7.1	19.1	
Partitions =	15	psf				30-35	0.73	30.8	18.5		12.5	7.1	19.6	
*Roof weight :	= 1/2 Pa	rtition ·	+ Roof Di	L		35-40	0.76	32.0	19.2		13.1	7.1	20.2	
*Floor weight	= Full F	artition	+ Floor	DL		40-45	0.79	33.3	20.0		13.6	7.1	20.7	
ROOF	26.0	psf	RO	OF DECK	27.0 psf	45-50	0.81	34.1	20.5		13.9	7.1	21.0	
FLOOR	25.0	psf				1	Per IBC	2018 1	605.3.1 Bo	asic Loa	d Combi	nations		
SEISMIC DESIG	GN CA	TEGO	RY I	BC 1613.2.5										
Seismic DC	=	D												
					6221 83rd Pl	I SF							5/25/2	2022
> <				Project							-	Date		

MALSAM TSANG STRUCTURAL ENGINEERING

122 South Jackson Suite 210 Seattle, WA 98104 † 206.789.6038 f 206.789.6042

Sheet

Proj. No.

Desian

BRR

DC1



OSHPD

6221 83rd PL SE

6221 83rd PI SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5464898, -122.228772

77th Ave SE	SE 63rd PI	r Benefits Robin Angus SE 62nd St R & R Properties SE 64th St
C	-21	
G00	gie 65	th St Map data ©2022
Date		5/10/2022, 8:50:35 AM
Design (Code Reference Document	ASCE7-16
Risk Cat	egory	II
Site Clas	SS	D - Default (See Section 11.4.3)
Туре	Value	Description
SS	1.464	MCE _R ground motion. (for 0.2 second period)
S ₁	0.507	MCE _R ground motion. (for 1.0s period)
S _{MS}	1.757	Site-modified spectral acceleration value
S _{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S _{DS}	1.171	Numeric seismic design value at 0.2 second SA
S _{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA
Туре	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
Fa	1.2	Site amplification factor at 0.2 second
Fv	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.627	MCE _G peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.752	Site modified peak ground acceleration
TL	6	Long-period transition period in seconds
SsRT	1.464	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.624	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	4.26	Factored deterministic acceleration value. (0.2 second)
S1RT	0.507	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.565	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.642	Factored deterministic acceleration value. (1.0 second)
PGAd	1.42	Factored deterministic acceleration value. (Peak Ground Acceleration)
C _{RS}	0.902	Mapped value of the risk coefficient at short periods



TYPICAL BEAM CASES







CASE #3: (C3)



CASE #4: (C4)







CASE #7: (C7)





LATERAL ANALYSIS

Seismic:

Laval	Area	Unit Wt	Weight	Avg Ht	Wi∙Hi	Distrib.	Shear, V	Uniform	
Level	(ft ²)	(psf)	(kips)	(ft)	(k-ft)	(%)	(kips)	(plf)	
Roof	2000	26	52.70	22.5	1185.75	61%	8.73	239 / 157	1
Level 2	2400	25	61.50	12.5	768.75	39%	5.66	124 / 102	
Totals:			114.20 k		1954.50	100%	14.39 k		
Base Shea	r:								
V = 0	C _s x W								
=	0.18 x 114.2	2k = 20.56	kips (Ultin	nate)					
=	0.126 x 114	.2k = 14.3	9 kips (Allo	wable)					
nd·									
nu.									
North-South B	Exposure								
Laval	Trib	Wind L	oad					Length	Shear,
Levei	(ft)	(#/f	t)					(ft)	(kips)
Roof	5.5	2.5' x 18.	4 + 3' x 17.7 =	100 plf				36.5	3.65
Level 2	11.25	2' x 17 7	+ 9 25' x 16 9 :	- 192 nlf				15.5	9 74

12.39 k

East-West Exposure

Loval	Trib	Wind Load	Length	Shear, V	
Level	(ft)	(#/ft)	(ft)	(kips)	
Roof	5.5	2.5' x 18.4 + 3' x 17.7 = 100 plf	55.5	5.55	EC
Level 2	11.25	2' x 17.7 + 9.25' x 16.9 = 192 plf	55.5	10.66	

	6221 83rd PL SE	5/25/2022
	Project	Date
	Mercer Island, WA	0329.2022.01.01
122 South Jackson		Proj. No.
Suite 210		BRR
Seattle, WA 98104		Design
t 206.789.6038		L-1
† 206./89.6042		Sheet
	122 South Jackson Suite 210 Seattle, WA 98104 t 206.789.6038 f 206.789.6042	6221 83rd PL SE Project Mercer Island, WA 122 South Jackson Suite 210 Seattle, WA 98104 t 206.789.6038 f 206.789.6042

16.21 k

LATERAL ANALYSIS



6221 83rd PL SE 5/11/2022 Date Project Mercer Island, WA 0329.2022.01.01 Proj. No. 122 South Jackson Suite 210 BRR MAI SAM Seattle, WA 98104 Design TSANG 1 206.789.6038 L-2 STRUCTURAL f 206.789.6042 Sheet

LATERAL ANALYSIS



VERTICAL ANALYSIS	Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi Units in (Parenthesis) represent Dead Load or 0.6DL (Qo=2.5)
HOO-CANT BU	
Co L> 22 A-6	
$W_1 = (24 2)(0.02) = 0.24$	
W2=(24/2)(0.045)=0.54	
P=2.2	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
GL 51/2×18	
#301-CANT BM	
C3 L=9.25 A=1.25 W1=W2= (18/2)(0.045)=0.41	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
GL SICIS GL FICHD	
4302-CANT BM	
63 L=15 A=3 w.=wz=0.09	
P=2.5	
$\begin{array}{cccc} p_{1}=0.15 & p_{2}=-0.3 \\ p_{2}=4.0 & p_{2}=40 \\ M_{2}=7.9 & p_{2}=0.04=241927 \\ g_{2}=572\times18 \end{array}$	
#303-INT BM	
 L=20.5	
W = (41.5/2)(0.045) = 0.93	
P = 9.5 M = 48.9 $D_T = 0.48 = 4/509$	
6-5/2×21	
<u>ر</u> ځ	
w = 7 w = (18/2)(0.02) = 0.18	
W2= (18/2) (0.045)= 0.41	
P=0 D = -0.2	
R=0.7 R= 17	
M=-51 ALEDIULI - 11607	
6L 5/2×21	



122 South Jackson Suite 210 Seattle, WA 98104 † 206.789.6038 f 206.789.6042 6221 83rd PL SE

Mercer Island, WA

5/12/2022

Date

0329.2022.01.01	
Proj. No.	
BRR	
Design	
V-1	
Sheet	

VERTICAL	ANALYSIS		Typical Units: L = ft, W = klf, P = kif), R = klp, M = k-ft, V = k, Fb = ksi, Fv = psi
SECOND FLO	or Framing		Units in (Parenthesis) represent Dead Load or 0.6DL (Ωo=2.5)
			CZ	-
-			$L_1 = 8.15$	
			W,=0.07	
,			Wi=0.07+(7/2)(0.05)=0.	26
			P=0.8	
#200-INT 1	BM AT GARAGE		$P_{1} = 1.4$ $P_{2} = 0.9$ $P_{2} = 2.3$ $P_{2} = 46$	
L=13 W=(23.25)	(2)(0,095)=0.64		M=9.8 DT=0.36=	4577
R=4.2.	G=1.3		GL 5/2×11/18	
M = 13.9	Ar= 0.30= 4524		#205-BM AT DINING	
6151/2×117	8		L=13	2045-045
iller Bild	AT A ARAF T		R=2.9 $R=0.9$	5,013 20,05
C4			M=9.5 D= 57 Dr=0.21=4	745
4=8			GL572X117/8	
13=12.25		\sim	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	m
WI=W2=W	3=0.07+(8.5/2)(0.045)+0.1 +0.045=0.46	s (#206-INT BM	
$P_{1} = 4.2$		3	$L_1 = 1.5$ $L_2 = 6.5$	-
P2 = [5.0]		4	L3 = 5.75	
R1= 8.1 R2= 6.8	D= 82 D= 82	5	$W_1 = W_2 = (31/2)(0.045) = 1.70$ (31/2)(0.045) = 1.70	-
M= 50.2		Ç	W3=0.045+ (9/2)0.055)to.u	51 .
BL 7/27		3	R- F+3.8]	-
#202-BM A	t garage door	4	Pz= 4.3[=3.6]	-
L=20.5 W= 18,5/2)(a045)=0.19	5	P 12.5 [15.8]	-
R=2.0 M=100	fo= 0.4 f= 28	Ę	$p_{z=10.3}$ [12.1] s_x (55.6/50)(12)(1.67) = 22.3 ³
	AT=0.10=4/2365	4	Tey WIOKZE Sx = 27.9	> 22.3
6- 3/2X.24		4	△ = 0.25 =	L/650
#203- E/W E	BM AT STME	5	WIDK ZE WIDK45	-
L26.5		Ç		-
W= (412)0.1	\$=0.1Z			
M=1.3	AT= 0.007 = 410732	Ŭ		
GL 5/2×117	18		L. L.	
		6221 83ml DI	SE	5/12/2022
\geq	Proje	d		Date 0000 0000 01 01
	122 South Jackson	Mercer Island	, WA	0329.2022.01.01 Proj. No.
MALSAM	Suite 210 Seattle, WA 98104			BRR Design
I SANG STRUCTURAL ENGINEERING	t 206.789.6038 f 206.789.6042			V-2

\frown	VERTICAL	NALYSIS	\sim	Түрі	cal Units: L = ft, W = kff, P = kip, R = kip, M = l	<-ft, V = k, Fb = ksi, Fv = psi ad Load or 0.6DL (Ωc=2.5)
7	#207-8 M 01			#210-INT RAA	, , , , , , , , , , , , , , , , , , ,	
7	17201-BAD	HE MIMEN		C3)
7	L1=13			L=16.5)
7	(19 5/2)/0	0.45) = 0.42		A = 3.0	51+(17.5/2)(0.055)	ro.15)
($W_1 = (10.5/2)(0)$	(045) = 0.42		+ (24/2)(0.	045)=1.46	
Č	$W_2 = (14.5)^2$	= 0.64		W2 = 0.29		
Č	B , 10 2[15 2]			P = 0		ノ
(F 3 10.5[15.5]	-		R1=0	fb = -0.12	·
4	R = 12.4[16.5]	0.72 [0.98]		R2=1.0 M=-1.3	fv = 14 delta = 0.03 = L/2352	
4	₩ = 31.7[42.9	9] Δτ: 0.12 = L/1619				
4	6L 5/2X24					
6				GL 5-1/2x11-7/8		$\boldsymbol{\gamma}$
4	#208- BM 64	ER DECK				$\boldsymbol{\mathcal{A}}$
8	L=13.5					$\boldsymbol{\zeta}$
8	A = 3.5					$\boldsymbol{\zeta}$
7	M/4 0.07					$\boldsymbol{\zeta}$
7	W1 = 0.07 W2 = 0.09					3
7	P = 0.7					3
7)
3	R1=0.25 R2=1.7	S = -0.6 S = 34				2
(M=-3.0	Δ.: 0.13 = 2L/643				\sum
(PSL 5/4×117/2	3				\sum
4						\downarrow
4	1209-BMUNT	see while				~
> w1	$= W^2 = ((3.5/2))/($	0.0551 + 3/2/10 045/172	15			\langle
<u> </u>	+/13.5/2)(0.043)=0.89				4
8	P=2.7 R1=5.4	6 = 0.6				$\boldsymbol{\zeta}$
7	R2=3.5 M=6.9	Δ ₁ = L/1872				$\boldsymbol{\zeta}$
8	GL 5-1/2x11-7/8					\mathbf{z}
7						
6			ىبىر	uu	,	
u	, in the second		-		2	
			6221 83rd PL S	SE		5/12/2022
			Project Mercer Island	WA	Date At	329,2022 01 01
		122 South Jackson	interest relativity		Proj. No.	
	MALSAM	Seattle, WA 98104			Design	BKK
	STRUCTURAL	f 206.789.6038 f 206.789.6042			Sheet	V-3



STRUCTURAL

VERTICAL ANALYSIS	Foundation:	1,500 psf Assumed Soil Bearing
SideNorthRoof.54Wali.15Level 2.41Wali.15Level 1.07Wali.50		
Totals: 1.82		
North: 1.82 / 1.50 (12) = 14.6" Wide Ftg Req'd Use 18"	Wide Ftg	
Point Loads on the Stem Walls: Maximum 8.0 kip point load distributed over 4'-0" of continuous 18" wide footing = 1.33 psf OK		
PTLOADS		
P=6/1.5KSF== 4.09 > USE 2'2'2 F P= 22.6/1.5 = 15.04 > USE 4'-0'SQ F		
P=42/1.5 = 28.04 - USE 3'0" WX10'0	TL	
Project	221 83rd PL SE	5/18/2022
122 South Jackson	flercer Island, WA	0329.2022.01.01 Proj. No.
Suite 210 MALSAM South WA 98104		BRR

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STRUCTURAL	

Seattle, WA 98104 t 206.789.6038 f 206.789.6042

Design V-5 Sheet

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RetainPro 10 (c) 1987-2012, Build 10.13.7.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING

Criteria			Soil Data						
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel		4.00 ft 0.50 ft 0.00 : 1 4.00 in 0.0 ft	Allow Soil Bearing = Equivalent Fluid Pressure Metho Heel Active Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	1,500.0 d 35.0 150.0 120.00 0.350 0.00	0 psf 0 psf/ft 0 psf/ft 0 pcf 0 pcf 0 in				
Surcharge Loads			Lateral Load Applied to	Stem	n 📕	Adjacent Footing I	oad		i.
Surcharge Over Heel NOT Used To Resist Surcharge Over Toe NOT Used for Sliding	Slidin = & Ove	0.0 psf g & Overturning 0.0 psf erturning	Lateral Load = Height to Top = Height to Bottom = The above lateral load	0.0 # 0.00 ft 0.00 ft	l/ft t t	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist	= = =	0.0 lbs 0.00 ft 0.00 in 0.00 ft	-1
Axial Load Applie	d to	Stem	has been increased by a factor of	1.00		Footing Type			
Axial Dead Load	-	0.0 lbs	Wind on Exposed Stem =	0.0 p	osf	at Back of Wall	=	0.0 ft	
Axial Load Eccentricity	=	0.0 in	St			Poisson's Ratio	=	0.300	
Design Summary			Stem Construction	1-	Top Stem		_		
Wall Stability Ratios Overturning Slab Resist	= ts All	2.23 OK Sliding !	Design Height Above Ftg Wall Material Above "Ht" Thickness Rebar Size	ft = = = =	Concret 6.0 #	0 e 0 4			
Total Bearing Load resultant ecc.	=	865 lbs 3.77 in	Rebar Spacing Rebar Placed at	=	18.0 Edg	0 e			
Soil Pressure @ Toe	=	640 psf OK	fb/FB + fa/Fa	=	0.24	3			
Allowable	=	1,500 psf	Total Force @ Section MomentActual	lbs = ft-# =	448. 597.	D 3			
ACI Factored @ Toe	=	768 psf	MomentAllowable	=	2,455.	6			
ACI Factored @ Heel	=	94 psf	ShearActual	psi =	8.	B			
Footing Shear @ Toe	=	6.7 psi OK	Wall Weight	- ieq	75.	0			
Allowable	2	2.9 psi OK	Rebar Depth 'd'	in =	4.2	5			
Iding Calcs Slab Resi Lateral Sliding Force	sts Al	I Sliding ! 394.8 lbs	LAP SPLICE IF ABOVE LAP SPLICE IF BELOW HOOK EMBED INTO FT	in = in = Gin =	18.7	2			
			Hook emi	bedme	ent reduced	d by stress ratio			
			Masonry Data	nei -					
			Es	psi =					
			Solid Grouting	=					
			Use Half Stresses	=					
oad Factors			Modular Ratio 'n'	=					
Building Code		1.	Short Term Factor	=					
Dead Load		1.200	Equiv. Solid Trick. Masonry Block Tune	-					
Live Load		1.600	Masonry Design Method	_	ASD				
Earth, H		1.600	Concrete Data	-					
Wind, W Seismic, E		1.600 1.000	fc Fy	psi = psi =	2,500.	0			

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 4'-0" Wall with Slab 6" Wall Job # : Dsgnr: ICT Descr: 4'-0" wall with Slab 6" wall

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RetainPro 10 (c) 1987-2012, Build 10.13.7.31 License : KW-60655289 License : C MALSAM TSANG ENGINEERING

Footing Dimension	ns & S	Strengths	Footing Desig	n	Results	
Toe Width Heel Width Total Footing Width Footing Thickness		1.50 ft 0.91 2.41	Factored Pressure Mu' : Upward Mu' : Downward		<u>Toe</u> 768 706 206	Heel 94 ps 11 ft- 60 ft-
Key Width Key Depth Key Distance from Toe	= =	0.00 in 0.00 in 0.00 ft	Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing		501 6.68 75.00 None Spec'd	49 ft- 2.94 ps 75.00 ps
fc = 2,500 psi Footing Concrete Densit	Fy = y =	60,000 psi 150.00 pcf	Key Reinforcing	=	None Spec'd None Spec'd	
Cover @ Top 2.00	_ @ E	3tm.= 3.00 in	Other Acceptable S Toe: Not req'd, M Heel: Not req'd, M Key: No key defir	u < u < ned	es & Spacings S * Fr S * Fr	

el Active Pressure Ircharge over Heel	=	Force lbs	Distance ft	Moment					
el Active Pressure Ircharge over Heel	=	204.0		16-11			Force lbs	Distance ft	Moment ft-#
Ircharge over Heel		394.8	1.58	625.2	Soil Over Heel	=	196.8	2.21	433.9
inchases Over Tee	=				Sloped Soil Over Hee	=			
incriaige over roe	=				Surcharge Over Heel	=			
Jjacent Footing Load	=				Adjacent Footing Load	d =			
Ided Lateral Load	=				Axial Dead Load on S	item =			
ad @ Stem Above S	= lio				 Axial Live Load on St 	em =			
	=				Soil Over Toe	=	60.0	0.75	45.0
					Surcharge Over Toe	=			
Total		204.0	0.7.14	605.0	Stem Weight(s)	=	337.5	1.75	590.6
Total		384.0	0.1.M.	025.2	Earth @ Stem Transit	tions =			
	=		=		Footing Weight	=	271.1	1.21	326.7
Resisting/Overturnin	ng Rati	io	=	2.23	Key Weight	=			
Vertical Loads used	for Soi	Pressure :	= 865	.4 lbs	Vert. Component	=			
					T	otal =	865.4 1	s R.M.=	1,396.3
Resisting/Overturnin Vertical Loads used	= ng Rati for Soi	io I Pressure :	= = 865	2.23 4 lbs	Footing Weight Key Weight Vert. Component T * Axial live load NOT in resistance, but is inclu	= = fotal = cluded in uded for	271.1 865.4 I total display soli pressure	os ed,	1.21 R.M.= or used fo culation.

 Title
 5'-0" Wall with Slab 6" Wall
 Page:

 Job #
 Dsgnr:
 ICT
 Date:
 25 JUN 2014

 Descr:
 5'-0" wall with Slab 6" wall
 Date:
 25 JUN 2014

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	-	C 444 6	Allow Soil Rearing = 1	500.0	nef				
Retained Height	-	5.00 ft	Equivalent Fluid Pressure Metho	,000.0	psi				
Wall height above soil	=	0.50 ft	Heel Active Pressure =	35.0	psf/ft				
Slope Behind Wall	=	0.00:1	=						
Height of Soil over Toe	=	4.00 in	Passive Pressure =	150.0	psf/ft				
Water height over heel	=	0.0 ft	Soil Density, Heel =	120.00	pcf				
-			Soil Density, Toe =	120.00	pcf				
			Footing Soil Friction =	0.350	6				
			Soil height to ignore						
			for passive pressure =	0.00	in				
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing L	oad		ī,
Surcharge Over Heel	-	0.0.osf		0.0.4	10	Adjacent Footing Load		0.0 lbs	e.
NOT Used To Resist S	Slidina	& Overturning	Height to Top =	0.0 #	/n	Footing Width	=	0.00 ft	
Surcharge Over Toe	= 0	0.0 psf	Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in	
NOT Used for Sliding &	& Over	turning	The above lateral load			Wall to Ftg CL Dist	=	0.00 ft	
Axial Load Applie	d to S	Stem =	has been increased	1.00		Footing Type			
			by a factor of			Base Above/Below Soil	-	0.0.0	
Axial Live Load	=	0.0 lbs	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall		0.011	
Axial Load Eccentricity	-	0.0 in				Poisson's Ratio	=	0.300	
Design Summary			Stem Construction	1-	Top Stem				
Vall Stability Ratios		- 124 - C.C.C.M C.G.	Design Height Above Ftg	ft =	0.00	;			
Overturning	=	2.27 OK	Wall Material Above "Ht"	=	Concrete	t);			
Slab Resist	ts All S	liding !	Thickness	=	6.00				
			Rebar Size	=	# 4				
Total Bearing Load	=	1,308 lbs	Rebar Spacing	=	18.00	1			
resultant ecc.	-	4.49 in	Rebar Placed at	=	Edge	2			
Soil Pressure @ Toe	=	762 psf OK	Design Data		0.47				-
Soil Pressure @ Heel	=	110 psf OK	ID/FB + Ta/Fa		700.0				
Allowable	=	1,500 psf	Total Porce @ Section	105 -	1 400.0				
Soil Pressure Less	Than	Allowable	MomentActual	n-# =	1,100.1				
ACI Factored @ Toe	=	914 psf	MomentAllowable	-	2,405.0				
ACI Factored @ Heel	=	132 psf	Shear Allowette	psi =	13./				
Footing Shear @ Toe	=	8.4 psi OK	SnearAllowable	psi =	75.0				
Footing Shear @ Heel	=	5.3 psi OK	vvali vveight	1	/5.0				
Allowable	=	75.0 psi	LAP SPLICE IE APOVE	in =	4.20				
liding Calcs Slab Resis	sts All	Sliding !	LAP SPLICE IF ABOVE	in T	10.74				
Lateral Sliding Force	=	595.5 lbs	HOOK EMBED INTO FT	G in =	6.00)			
			Masonry Data Hook emi	oedme	nt reduced	by stress ratio			
			fm	psi =					-
			Fs	psi =					
			Solid Grouting	=					
			Use Half Stresses	=					
and Eastars			Modular Ratio 'n'	=					
Building Code			Short Term Factor	=					
Dead Load		1.200	Equiv. Solid Thick.	=					
Live Load		1,600	Masonry Block Type						
Earth, H		1,600	Masonry Design Method	=	ASD				
Wind, W		1,600	Concrete Data	main	2 600 /)			-
Seismic F		1.000		hai =	2,500.0				

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 5'-0" Wall with Slab 6" Wall Job # : Dsgnr: ICT Descr: 5'-0" wall with Slab 6" wall

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Footing Dimensio	ns & \$	Strengths	Footing Desig	In	Results	
Toe Width	=	1.75 ft			Toe	Heel
Heel Width	=	1.25	Factored Pressure	=	914	132 p
Total Footing Width	=	3.00	Mu': Upward	=	1,167	55 ft
Footing Thickness	=	10.00 in	Mu': Downward	=	303	245 ft
Key Width	=	0.00 in	Mu: Design Actual 1-Way Shear	-	864 8.41	189 ft 5.34 p
Key Depth	=	0.00 in	Allow 1-Way Shear	=	75.00	75.00 p
Key Distance from Toe	=	0.00 ft	Toe Reinforcing	=	None Spec'd	
fc = 2,500 psi Footing Concrete Densit	Fy =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing		None Spec'd None Spec'd	
Min. As % Cover @ Top 2.00	" @ E	0.0018 Stm = 3.00 in	Other Acceptable S Toe: Not req'd, M Heel: Not req'd, M	Size	es & Spacings S * Fr S * Fr	

		OV	ERTURNI	NG			RE	SISTING	
ltem		Force Ibs	Distance ft	Moment ft-#			Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	595.5	1.94	1,157.9	Soil Over Heel	=	450.0	2.63	1,181.3
Surcharge over Heel	=				Sloped Soil Over He	el =			
Surcharge Over Toe	=				Surcharge Over Hee	= 1			
Adjacent Footing Load	=				Adjacent Footing Loa	= be			
Added Lateral Load	=				Axial Dead Load on 3	Stem =			
Load @ Stem Above So	il =				* Axial Live Load on S	tem =			
	=				Soil Over Toe	=	70.0	0.88	61.
					Surcharge Over Toe	=		0.00	
Total	-	505.5	OTH	1 157.0	Stem Weight(s)	=	412.5	2.00	825.
rotar		595.5	0.1.M.	1,157.9	Earth @ Stem Trans	itions =			
	=			=	Footing Weight	=	375.0	1.50	562.
Resisting/Overturnin	g Rati	o	=	2.27	Key Weight	=			
Vertical Loads used f	or Soi	Pressure :	= 1,30	07.5 lbs	Vert. Component	=			
						Total =	1,307.5 II	s R.M.=	2,630.
					 Axial live load NOT is resistance, but is included 	ncluded in luded for s	total display	ed, or used fo calculation.	r overturning

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Criteria			Soil Data					
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel		6.00 ft 0.50 ft 0.00 : 1 4.00 in 0.0 ft	Allow Soil Bearing = Equivalent Fluid Pressure Metho Heel Active Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Fricton = Soil height to ignore for passive pressure =	1,500.0 d 35.0 150.0 120.00 0.350 0.00) psf) psf/ft) psf/ft) pcf) pcf) in			
Surcharge Loads	_		Lateral Load Applied to	Stem		Adjacent Footing I	oad	
Curshame Oursellad	-	10000		-		Adjacent Contine Lond	roud	0.0.0
NOT Used To Resist \$	Sliding	& Overturning	Lateral Load =	0.0 #	/ft	Footing Width	-	0.0 lbs
Surcharge Over Toe	= 3	0.0 psf	Height to Bottom =	0.00 #		Eccentricity	=	0.00 in
NOT Used for Sliding	& Over	turning	The above lateral load			Wall to Ftg CL Dist	=	0.00 ft
Axial Load Applie	d to !	Stem =	has been increased	1.00		Footing Type		0.000
Avial Deed Load		0.0.11-2	by a factor of			Base Above/Below Soil	-	0.0.0
Axial Dead Load	-	0.0 lbs	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall		0.01
Axial Load Eccentricity	-	0.0 in				Poisson's Ratio	=	0.300
Design Summary			Stem Construction	1-	Top Stem			
Wall Stability Ratios			Design Height Above Ftg	ft =	5tem OF 0.00	ì		
Overturning	=	2.03 OK	Wall Material Above "Ht"	=	Concrete	3		
Slab Resist	ts All S	iliding !	Thickness	=	6.00)		
			Rebar Size	=	# 4	1		
Total Bearing Load	-	1,555 lbs	Rebar Spacing	=	16.00)		
resultant ecc.	5	0.25 IN	Rebar Placed at	=	Edge	3		
Soil Pressure @ Toe	=	841 psf OK	fb/FB + fa/Fa	=	0.73	3		
Soil Pressure @ Heel	=	48 psf OK	Total Force @ Section	lbs =	1.008.0)		
Allowable	=	1,500 psf	MomentActual	ft-#=	2.016.0)		
Soil Pressure Less	Than	Allowable	MomentAllowable	=	2,749.3	3		
ACI Factored @ 108	2	57 osf	ShearActual	psi =	19.8	3		
Ecoting Shear @ Too	-	12.3 nei OK	ShearAllowable	psi =	75.0)		
Footing Shear @ Heel	2	7 1 psi OK	Wall Weight	=	75.0)		
Allowable	2	75.0 psi	Rebar Depth 'd'	in =	4.25	5		
liding Calcs Slab Resi	sts All	Sliding !	LAP SPLICE IF ABOVE	in =	18.72	2		
Lateral Sliding Force	=	817.2 lbs	LAP SPLICE IF BELOW	in =				
			HOOK EMBED INTO FT	G in =	6.09	1		
			Masonry Data Hook em	bedme	nt reduced	by stress ratio		
			fm	psi =				
			Fs	psi =				
			Solid Grouting	=				
			Use Half Stresses	=				
oad Factors	-		Modular Ratio 'n' Short Term Factor	2				
Building Code			Equiv Solid Thick	-				
Dead Load		1.200	Masonry Block Type	-				
Live Load		1.600	Masonry Design Method	=	ASD			
Earth, H		1.600	Concrete Data					
Wind, W		1.600	fc	psi =	2,500.0)		
Seismic, E		1.000	Ev	nei =	60,000,0			

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 6'-0" Wall with Slab 6" Wall Job # : Dsgnr: ICT Descr: 6'-0" wall with Slab 6" wall

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Footing Dimension	ns & S	trengths	Footing Desig	ın	Results	
Toe Width Heel Width Total Footing Width Footing Thickness		2.25 ft 1.25 3.50 10.00 in	Factored Pressure Mu' : Upward Mu' : Downward		<u>Toe</u> 1,009 2,038 501	Heel 57 p 35 ft 285 ft
Key Width Key Depth Key Distance from Toe fc = 2,500 psi	= = Fy =	0.00 in 0.00 in 0.00 ft 60,000 psi	Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing	1 1 1 1 1	1,536 12.32 75.00 None Spec'd None Spec'd	250 ft- 7.12 p 75.00 p
Footing Concrete Densit Min. As % Cover @ Top 2.00	y = = @ B	150.00 pcf 0.0018 etm.= 3.00 in	Key Reinforcing Other Acceptable S Toe: Not req'd, M Heel: Not req'd, M Key: No key defir	= bize lu < lu < ned	None Spec'd es & Spacings S * Fr S * Fr	

		OV	ERTURNI	NG			RE	SISTING	
Item		Force Ibs	Distance ft	Moment ft-#			Force Ibs	Distance ft	Moment ft-#
Heel Active Pressure	=	817.2	2.28	1,861.3	Soil Over Heel	=	540.0	3.13	1,687.
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Si	tem =			
Load @ Stem Above So	il =				* Axial Live Load on Ste	em =			
	=				Soil Over Toe	=	90.0	1.13	101.
					Surcharge Over Toe	=			
Tatal		017.0	0.7.14	4 001 2	Stem Weight(s)	=	487.5	2.50	1,218.8
rotai		017.2	0.1.M.	1,001.5	Earth @ Stem Transiti	ons=			
	=				Footing Weight	=	437.5	1.75	765.
Resisting/Overturnin	g Rati	io	=	2.03	Key Weight	=			
Vertical Loads used f	or Soi	Pressure :	= 1,55	5.0 lbs	Vert. Component	=			
					T * Axial live load NOT in	otal =	1,555.0 I total display	bs R.M.= ed, or used fo	3,773. r overturning

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Criteria			Soil Data						
Retained Height	=	4.00 ft	Allow Soil Bearing = 1	,500.0) psf				
Wall height above soil	=	0.50 ft	Equivalent Fluid Pressure Metho	d					
Slone Behind Wall	-	0.00 1	Heel Active Pressure =	35.0) psf/ft	5			
Height of Soil over Toe	2	4.00 in	E Passiva Prossura =	150.0	neflt				
Water brieft aver heal	Ξ.	4.00 m	Fassive Flessure =	100.0) psi/it				
water neight over neer	÷.,	0.0 ft	Soil Density, Neel =	120.00) por				
			Son Density, Toe =	0.250	/ per				
			Footing[[Soil Friction =	0.350					
			for passive pressure =	0.00	in				
Surcharge Loade			Lateral Load Applied to	Stor		Adiacont Fosting I	and		1
Surcharge Loaus	-		Lateral Load Applied to	Stell		Adjacent Footing I	oad	a second second	1
Surcharge Over Heel		0.0 psf	Lateral Load =	0.0 #	/ft	Adjacent Footing Load	=	0.0 lbs	
Surcharge Over Toe	=	a overturning	Height to Top =	0.00 ft		Fooung Width	-	0.00 ft	
NOT Used for Sliding a	& Over	rturning	The above lateral lead	0.00 ft		Wall to Etc CL Diet	2	0.00 ft	
Avial Load Apalla	dto	Stom	has been increased	1.00		Footing Type	-	0.00 it	
Axial Load Applie	u to i	Stem	by a factor of	19222		Base Above/Below Soil			
Axial Dead Load	=	0.0 lbs	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall	=	0.0 ft	
Axial Live Load Axial Load Eccentricity	=	0.0 lbs 0.0 in				Poisson's Ratio	=	0.300	
Design Summary			Stem Construction	1-1	Top Stem				
Wall Stability Ratios			Design Height Above Ftg	ft =	Stem OK 0.00				
Overturning	=	2.35 OK	Wall Material Above "Ht"	=	Concrete				
Slab Resist	ts All S	Sliding !	Thickness	=	8.00	ing.			
			Rebar Size	=	# 4	100			
Total Bearing Load	=	961 lbs	Rebar Spacing	=	18.00	100			
resultant ecc.	=	3.42 in	Rebar Placed at	=	Edge				
Soil Pressure @ Toe	=	715 nsf OK	Design Data	-	0.40				-
Soil Pressure @ Heel	=	110 psf OK	TD/FB + Ta/Fa		0.16				
Allowable	=	1,500 psf	Total Force @ Section	IDS =	448.0				
Soil Pressure Less	Than	Allowable	MomentActual	ft-# =	597.3				
ACI Factored @ Toe	=	858 psf	MomentAllowable	=	3,655.6				
ACI Factored @ Heel	=	132 psf	ShearActual	psi =	6.0				
Footing Shear @ Toe	=	6.4 psi OK	ShearAllowable	psi =	75.0				
Footing Shear @ Heel	=	2.7 psi OK	Wall Weight	=	100.0				
Allowable	=	75.0 psi	Rebar Depth 'd'	in =	6.25	0			
liding Calcs Slab Resis	sts All	Sliding !	LAP SPLICE IF ABOVE	in =	18.72				
Lateral Sliding Force	=	394.8 lbs	HOOK EMBED INTO FT	G in =	6.00	6			
			Hook emt	oedme	nt reduced	by stress ratio			
			fm	nsi =					_
			Fs	psi =					
			Solid Grouting	=					
			Use Half Stresses	=					
and Freedom			Modular Ratio 'n'	=					
Building Code			Short Term Factor	=					
Dead Load		1 200	Equiv. Solid Thick.	=					
Live Load		1.600	Masonry Block Type	=					
Farth H		1.600	Masonry Design Method	=	ASD				
Wind W		1.600	Concrete Data		0.000				-
Seismic F		1,000	fc	psi =	2,500.0				
Contractino, L		1.000	Ev	nsi =	60.000.0				

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 4*-0" Wall with Slab 8" Wall Job # : Dsgnr: ICT Descr: 4*-0" wall with Slab 8" wall Page: _____ Date: 25 JUN 2014

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Footing Dimension	s & S	Strengths	Footing Desig	n	Results	
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Depth Key Distance from Toe		1.25 ft 1.08 2.33 9.00 in 0.00 in 0.00 in 0.00 ft	Factored Pressure Mu': Upward Mu: Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear		<u>Toe</u> 858 569 143 426 6.42 75.00	Heel 132 ps 15 ft- 61 ft- 46 ft- 2.73 ps 75.00 ps
fc = 2,500 psi Footing Concrete Density Min. As % Cover @ Top 2.00	Fy = = @ E	60,000 psi 150.00 pcf 0.0018 8tm.= 3.00 in	Heel Reinforcing Key Reinforcing Other Acceptable S Toe: Not req'd, M Heel: Not req'd, M	= = = u < u <	None Spec'd None Spec'd S & Spacings S * Fr S * Fr	

Sector Concernation and		OV	ERTURNIN	IG			RE	SISTING	ALL AND ADDRESS
Item		Force lbs	Distance ft	Moment ft-#			Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	394.8	1.58	625.2	Soil Over Heel	=	198.4	2.12	421.3
Surcharge over Heel	=				Sloped Soil Over Hee	si =			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Loa	d =			
Added Lateral Load	=				Axial Dead Load on S	Stem =			
Load @ Stem Above So	il =				* Axial Live Load on St	em =			
	=				Soil Over Toe	=	50.0	0.63	31.3
					Surcharge Over Toe	=			
Tetal		204.0	0.7.11	625.2	Stem Weight(s)	=	450.0	1.58	712.5
Total		384.0	0.1.M.	025.2	Earth @ Stem Transi	tions =			
	=			13 A.	Footing Weight	=	262.1	1.17	305.4
Resisting/Overturnin	g Rati	0	=	2.35	Key Weight	=			
Vertical Loads used f	or Soil	Pressure	= 96	0.5 lbs	Vert. Component	=			
					* Axial live load NOT in resistance, but is incl	fotal = included in unded for	960.5 I n total display soil pressure	bs R.M.= ed, or used fo	1,470.4 r overturning

 Title
 5'-0" Wall with Slab 8" Wall
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Criteria			Soil Data					
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel		5.00 ft 0.50 ft 0.00 : 1 4.00 in 0.0 ft	Allow Soil Bearing = Equivalent Fluid Pressure Metho Heel Active Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	1,500.0 d 35.0 150.0 120.00 120.00 0.350 0.00) psf) psf/ft) psf/ft) pcf) pcf) in			
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing I	oad	
Suraharaa Ouar Haal	-	0.0.00				Adiagent Feeting Load	-	0.0 lbs
NOT Used To Resist \$	= Sliding	& Overturning	Lateral Load =	0.0 #	/ft	Footing Width	-	0.00 ft
Surcharge Over Toe	=	0.0 psf	Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in
NOT Used for Sliding	& Over	rturning	The above lateral load			Wall to Ftg CL Dist	=	0.00 ft
Axial Load Applie	d to :	Stem 🔳	has been increased	1.00		Footing Type		
Avial Dead Load		0.0 lbc	oy a 10000 01			Base Above/Below Soil	=	0.0 ft
Axial Live Load	-	0.0 lbs	Wind on Exposed Stem =	0.0 p	st	at Back of Wall	1	0.200
Axial Load Eccentricity	=	0.0 in				Puisson's Ratio		0.300
Design Summary			Stem Construction	1-	Top Stem			
Wall Stability Ratios	10	1000000000000	Design Height Above Ft	ç ft=	Stem 04	5		
Overturning	=	2.04 OK	Wall Material Above "Ht	* =	Concrete			
Slab Resist	ts All S	Sliding !	Thickness	=	8.00			
			Rebar Size	=	# 4			
Total Bearing Load	5	1,222 lbs	Rebar Spacing	=	18.00			
resultant ecc.	-	5.19 In	Rebar Placed at	=	Edge			
Soil Pressure @ Toe	=	828 psf OK	fb/FB + fa/Fa	=	0.31	9		
Soil Pressure @ Heel	=	36 psf OK	Total Force @ Section	lbs =	700.0)		
Allowable	=	1,500 psf	MomentActual	ft-#=	1,166.7	,		
Soil Pressure Less	Than	Allowable	MomentAllowable	=	3,655.6	3		
ACI Factored @ 10e	2	43 osf	ShearActual	psi =	9.3	1		
Footing Shear @ Too	-	8.9 nsi OK	ShearAllowable	psi=	75.0)		
Footing Shear @ Heel	-	3.5 psi OK	Wall Weight	=	100.0)		
Allowable	=	75.0 psi	Rebar Depth 'd'	in =	6.25	j.		
iliding Calcs Slab Resi	sts All	Sliding !	LAP SPLICE IF ABOVE	in =	18.72			
Lateral Sliding Force	=	595.5 lbs	LAP SPLICE IF BELOW HOOK EMBED INTO F	/ in = TG in =	6.00			
			Hask on	bedme	nt reduced	by strass ratio		
			Masonry Data	ocume	in requiced	by 50055 (duo		
			fm	psi =				
			Fs Solid Crowling	psi =				
			Solid Grouting	-				
			Modular Ratio 'p'	-				
Load Factors			Short Term Factor	=				
Building Code		1 200	Equiv. Solid Thick.	=				
Live Load		1.200	Masonry Block Type	=				
Earth H		1.600	Masonry Design Method	i =	ASD			
Wind W		1.600	Concrete Data	1	0.000			
Seismic, E		1.000	fc	psi =	2,500.0			
			E.V.	051 =	- CELEBRE			

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 5'-0" Wall with Slab 8" Wall Job # : Dsgnr: ICT Descr: 5'-0" wall with Slab 8" wall Page: Date: 25 JUN 2014

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Footing Dimension	ns & S	Strengths	Footing Desig	n	Results	
Toe Width	=	1.75 ft			Toe	Heel
Heel Width	=	1.08	Factored Pressure	=	993	43 ps
Total Footing Width	=	2.83	Mu': Upward	=	1,221	8 ft-
Footing Thickness	=	10.00 in	Mu' : Downward	=	303	74 ft-
		10100 111	Mu: Design	=	918	67 ft-
Key Width	=	0.00 in	Actual 1-Way Shear	=	8.93	3.48 ps
Key Depth	=	0.00 in	Allow 1-Way Shear	=	75.00	75.00 ps
Key Distance from Toe	=	0.00 ft	Toe Reinforcing	=	None Spec'd	
f'c = 2,500 psi Footing Concrete Density	Fy =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing	= =	None Spec'd None Spec'd	
Min. As % Cover @ Top 2.00	=	0.0018 Btm = 3.00 in	Other Acceptable S	Size	es & Spacings	
	6.		Toe: Not req'd, M Heel: Not req'd, M Key: No key defir	lu < lu <	S*Fr S*Fr	

		OV	ERTURNIN	G			RE	SISTING	1 Sandary
ltem		Force Ibs	Distance ft	Moment ft-#			Force Ibs	Distance ft	Moment ft-#
Heel Active Pressure	=	595.5	1.94	1,157.9	Soil Over Heel	=	248.0	2.62	650.6
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	d =			
Added Lateral Load	=				Axial Dead Load on S	item =			
Load @ Stem Above So	il =				* Axial Live Load on Ste	em =			
	=				Soil Over Toe	=	70.0	0.88	61.3
					Surcharge Over Toe	=			
Total		EOE E		4 457.0	Stem Weight(s)	=	550.0	2.08	1,145.8
Total		595.5	0.1.m.	1,137.8	Earth @ Stern Transit	tions =			
	=		=		Footing Weight	=	353.8	1.42	500.0
Resisting/Overturnin	g Rat	io	=	2.04	Key Weight	=			
Vertical Loads used f	or Soi	I Pressure	= 1,22	1.8 lbs	Vert. Component	=			
					* Axial live load NOT in resistance, but is inclu	otal = cluded in ided for s	1,221.8 II total displaye	os R.M.= ed, or used fo	2,358.1 r overturning

 Title
 : 6'-0" Wall with Slab 8" Wall
 Page:

 Job #
 :
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 ICT
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 25 JUN 2014

 Descr: 6'-0" wall with Slab 8" wall

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 25 JUN 2014

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RetainPro 10 (c) 1987-2012, Build 10.13.7.31 License To: MALSAM TSANG ENGINEERING Cantilevered Retaining Wall Design

Criteria			Soil Data						
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	N. N. N. SHOLM	6.00 ft 0.50 ft 0.00 : 1 4.00 in 0.0 ft	Allow Soil Bearing = 1 Equivalent Fluid Pressure Method Heel Active Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = for passive pressure =	1,500.0 d 35.0 150.0 120.00 0.350 0.00) psf) psf/ft) psf/ft) pcf) pcf) in				
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing I	oad		ī,
Surcharge Over Heel	-	0.0 psf	Lateral Load =	0.0#	/6+	Adjacent Footing Load		0.0 lbs	
NOT Used To Resist	Sliding	& Overturning	Height to Toc =	0.00 ft	YIL .	Footing Width	=	0.00 ft	
Surcharge Over Toe	=	0.0 psf	Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in	
NOT Used for Sliding	& Over	rturning	The above lateral load has been increased	1.00		Wall to Ftg CL Dist Footing Type	=	0.00 ft	
Avia Load Applie		otom	by a factor of			Base Above/Below Soil	_	0.0.0	
Axial Dead Load	=	0.0 lbs	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall	-	0.0 ft	
Axial Load Eccentricity	-	0.0 lbs 0.0 in				Poisson's Ratio	=	0.300	
Design Summary			Stem Construction	1-	Top Stem	,			_
Wall Stability Ratios		1.5.5 P.5.5 P.5.5 M.	Design Height Above Ftg	ft =	0.00	ò			
Overturning	=	2.12 OK	Wall Material Above "Ht"	=	Concrete	9			
Slab Resist	ts All S	Sliding !	Thickness	=	8.00	0			
			Rebar Size	=	# 4	4 -			
Total Bearing Load	2	1,691 lbs	Rebar Spacing	=	18.00)			
resultant ecc.	100	5.04 In	Rebar Placed at	=	Edge	e			
Soil Pressure @ Toe	=	907 psf OK	b/EB + fa/Ea	-	0.55	1			
Soil Pressure @ Heel	=	85 psf OK	Total Force @ Section	lbe =	1 008 (
Allowable	=	1,500 psf	Moment Actual	ft.# =	2 016 (5			
Soil Pressure Less	s Than	Allowable	Moment Allowable		3 655 /	R			
ACI Factored @ Toe	=	1,088 psf	Shear Actual	nei =	13	1			
ACI Factored @ Heel	=	103 pst	Shear Allowable	psi =	75.0	0			
Footing Shear @ Toe	=	12.4 psi OK	Wall Weight	=	100.0	0			
Footing Shear @ Heel	=	6.6 psi OK	Rebar Denth 'd'	in =	6.2	5			
Allowable	=	75.0 psi	LAP SPLICE IF ABOVE	in=	18.7	2			
liding Calcs Slab Resi	sts All	Sliding !	LAP SPLICE IF BELOW	in=	0.000	50			
Lateral Sliding Force	=	817.2 lbs	HOOK EMBED INTO FT	G in =	6.00	D			
			Masonry Data Hook emb	bedme	nt reduced	d by stress ratio			
			fm	psi=					
			Fs	psi=					
			Solid Grouting	=					
			Use Half Stresses	=					
oad Factors	-		Modular Ratio 'n'	=					
Building Code			Short Term Factor	=					
Dead Load		1.200	Equiv. Solid Thick.	=					
Live Load		1.600	Masonry Block Type	. 5	ACD				
Earth, H		1.600	Masonry Design Method	-	ASD				
Wind, W		1.600	fo	nsi =	2 500 (0			
Seismic, E		1.000	Fv	psi=	60,000.0	0			

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 6'-0" Wall with Slab 8" Wall Job # : Dsgnr: ICT Descr: 6'-0" wall with Slab 8" wall Page: _____ Date: 25 JUN 2014

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Footing Dimension	ns & \$	Strengths	Footing Desig	n	Results	
Toe Width Heel Width Total Footing Width Footing Thickness		2.00 ft 1.41 3.41 10.00 in	Factored Pressure Mu' : Upward Mu' : Downward		<u>Toe</u> 1,088 1,791 396	Heel 103 ps 48 ft- 280 ft-
Key Width Key Depth Key Distance from Toe ftc = 2,500 psi Exercise Consecto Descrit	= = Fy_=	0.00 in 0.00 in 0.00 ft 60,000 psi	Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing Key Reinforcing		1,395 12.40 75.00 None Spec'd None Spec'd	232 ft- 6.64 ps 75.00 ps
Min. As % Cover @ Top 2.00	@ E	0.0018 Btm.= 3.00 in	Other Acceptable S Toe: Not req'd, M Heel: Not req'd, M Key: No key defir	Size	s * Fr S * Fr	

		OV	ERTURNIN	G			RE	SISTING	and to shall
ltem		Force lbs	Distance ft	Moment ft-#			Force Ibs	Distance ft	Moment ft-#
Heel Active Pressure	=	817.2	2.28	1,861.3	Soil Over Heel	=	535.2	3.04	1,626.
Surcharge over Heel	=				Sloped Soil Over Hee	= 1			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	d =			
Added Lateral Load	=				Axial Dead Load on S	stem =			
Load @ Stem Above So	= lic				* Axial Live Load on Ste	em =			
	=				Soil Over Toe	=	80.0	1.00	80.
					Surcharge Over Toe	=			
Tetal		047.0	0.7.1	4 004 2	Stem Weight(s)	=	650.0	2.33	1,516.
lotal		017.2	0.1.M.	1,001.3	Earth @ Stem Transit	tions =			
	=		=		Footing Weight	=	426.3	1.71	726.
Resisting/Overturnin	g Rat	io	=	2.12	Key Weight	=			
Vertical Loads used f	or So	I Pressure	= 1,691	1.5 lbs	Vert. Component	=			
					Т	otal =	1,691.5 lt	s R.M.=	3,949.
					 Axial live load NOT in resistance, but is inclu 	cluded in uded for	total displaye	d, or used fo alculation.	r overturning

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Criteria	21-7		Soil Data						
Retained Height Wall height above soil	=	7.00 ft	Allow Soil Bearing = 1 Equivalent Fluid Pressure Methor Heel Active Pressure =	,500.0 d 35.0) psf				
Slope Behind Wall		0.00 : 1	=						
Height of Soil over Toe	=	4.00 in	Passive Pressure =	150.0) psf/ft				
Water height over heel	=	0.0 ft	Soil Density, Heel =	120.00) pcf				
			Soil Density, Toe =	120.00) pcf				
			Footing Soil Friction =	0.350)				
			Soil height to ignore for passive pressure =	0.00	in				
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing L	oad		1
Surcharge Over Heel	-	0.0 psf	Lateral Load =	0.0#	10	Adjacent Footing Load	2	0.0 lbs	1
NOT Used To Resist \$	Sliding	& Overturning	Height to Toc =	0.00 ft	744	Footing Width	=	0.00 ft	
Surcharge Over Toe	=	0.0 psf	Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in	
Axial Load Applie	d to	rturning	The above lateral load has been increased	1.00		Wall to Ftg CL Dist Footing Type	=	0.00 ft	
Avial Deed Load		0.0.16-	by a factor of			Base Above/Below Soil	=	0.0 ft	
Axial Live Load Axial Live Load Axial Load Eccentricity	=	0.0 lbs 0.0 in	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall Poisson's Ratio	=	0.300	
Design Summary			Stem Construction	1	Top Stem				
Wall Stability Ratios			Design Height Above Ftg	ft =	Stem OF 0.00	5			
Overturning	=	2.08 OK	Wall Material Above "Ht"	=	Concrete	3			
Slab Resist	ts All S	Sliding !	Thickness	=	8.00) =			
			Rebar Size	=	# 4	- 10 C			
Total Bearing Load	=	2,163 lbs	Rebar Spacing	=	11.00)			
resultant ecc.	-	6.00 IN	Rebar Placed at	=	Edge	3			
Soil Pressure @ Toe	=	1,020 psf OK	fb/FB + fa/Fa	=	0.54	4			
Soil Pressure @ Heel	=	86 psf OK	Total Force @ Section	lbs =	1.372.0)			
Allowable	=	1,500 psf	MomentActual	ft-#=	3,201.3	3			
Soll Pressure Less	Than	Allowable	MomentAllowable	=	5,883.6	3			
ACI Factored @ Toe	-	103 psf	ShearActual	psi =	18.3	3			
Easting Shear @ Tee	-	16.9 pci OV	ShearAllowable	psi=	75.0)			
Footing Shear @ Heel	-	10.1 psi OK	Wall Weight	=	100.0)			
Allowable	=	75.0 psi	Rebar Depth 'd'	in =	6.25	5			
liding Calcs Slab Resi	sts All	Sliding !	LAP SPLICE IF ABOVE	in =	18.72	2			
Lateral Sliding Force	=	1,073.8 lbs	LAP SPLICE IF BELOW HOOK EMBED INTO FT	in = Gin =	6.00)			
			Masonry Data Hook emb	edme	nt reduced	l by stress ratio			
			fm	psi=					
			Fs	psi =					
			Solid Grouting	=					
			Use Half Stresses	=					
oad Factors			Short Term Factor	-					
Building Code			Equiv. Solid Thick	-					
Dead Load		1.200	Masonry Block Type	=					
Live Load		1.600	Masonry Design Method	=	ASD				
Earth, H		1.600	Concrete Data						_
Wind, W Seismin E		1.600	fc	psi =	2,500.0)			
Seismic, E		1.000	Fy	psi =	60,000.0)			

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Title : 7'-0" Wall with Slab 8" Wall Job # : Dsgnr: ICT Descr: 7'-0" wall with Slab 8" wall

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Footing Dimension	ns & S	strengths	Footing Desig	n	Results	1
Toe Width Heel Width Total Footing Width		2.25 ft 1.66 3.91	Factored Pressure Mu' : Upward Mu' : Downward		<u>Toe</u> 1,225 2,555 501	Heel 103 psf 98 ft# 571 ft#
Key Width Key Depth Key Distance from Toe fc = 2,500 psi Footing Concrete Densith	= = = Fy =	0.00 in 0.00 in 0.00 in 0.00 ft 60,000 psi 150.00 pcf	Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing Key Reinforcing		2,054 16.77 75.00 # 4 @ 11.00 in None Spec'd None Spec'd	474 ft# 10.07 psi 75.00 psi
Min. As % Cover @ Top 2.00	= @ E	0.0018 8tm.= 3.00 in	Other Acceptable S Toe: #4@ 11.25 Heel: Not req'd, M Key: No key defit	Size	es & Spacings #5@ 17.25 in, #6 S * Fr	5@ 24.50 in, #7@ 33.50 in, #8@ 44.00 in, #9@ 4

Summary of Overturning & Resisting Forces & Moments

		OV	ERTURNIN	G			RE	SISTING	Contractor 1
Item		Force lbs	Distance ft	Moment ft-#			Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,073.8	2.61	2,803.9	Soil Over Heel	=	834.4	3.41	2,848.1
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on St	em =			
Load @ Stem Above So	il =				* Axial Live Load on Ste	m =			
	=				Soil Over Toe	=	90.0	1.13	101.3
					Surcharge Over Toe	=			
Total		1 072 0	0.7.11	2 002 0	Stem Weight(s)	=	750.0	2.58	1,937.5
Total		1,073.0	0.1.M.	2,003.8	Earth @ Stern Transiti	ons=			
	=		=		Footing Weight	=	488.8	1.96	955.5
Resisting/Overturnin	g Rat	io	=	2.08	Key Weight	=			
Vertical Loads used f	or Soi	I Pressure	= 2,163	.2 lbs	Vert. Component	=			
					Т	otal =	2,163.2	s R.M.=	5.842.3
					 Axial live load NOT inc resistance, but is include 	cluded in ded for s	total display	ed, or used fo calculation.	roverturning

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Criteria			Soil Data					
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel		8.00 ft 0.50 ft 0.00 : 1 4.00 in 0.0 ft	Allow Soil Bearing = 1 Equivalent Fluid Pressure Metho Heel Active Pressure = Passive Pressure = Soil Density, Heel =	d 35.0 150.0 120.00) psf) psf/ft) psf/ft) pcf			
			Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	120.00 0.350 0.00	i pcf in			
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing L	oad	
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe	= Sliding & =	0.0 psf Overturning 0.0 psf	Lateral Load = Height to Top = Height to Bottom =	0.0 # 0.00 ft 0.00 ft	/ft	Adjacent Footing Load Footing Width Eccentricity	H H	0.0 lbs 0.00 ft 0.00 in
Axial Load Applie	d to Si	tem	The above lateral load has been increased by a factor of	1.00		Wall to Ftg CL Dist Footing Type	=	0.00 ft
Axial Dead Load Axial Live Load	-	0.0 lbs 0.0 lbs	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall	-	0.0 ft
Axial Load Eccentricity	=	0.0 in		-		F VISSON S POBU	-	0.300
Design Summary			Stem Construction		Stem OK			
Nall Stability Ratios Overturning Slab Resist	= ts All Sli	2.03 OK ding !	Design Height Above Ftg Wall Material Above "Ht" Thickness Rebar Size	ft = = =	0.00 Concrete 8.00 # 4			
Total Bearing Load resultant ecc.	=	2,623 lbs 8.01 in	Rebar Spacing Rebar Placed at	=	9.00 Edoe			
Soil Pressure @ Toe	-	1,047 psf OK	Design Data fb/FB + fa/Fa	=	0.67	L		
Allowable Soil Pressure Less	= = Than A	1,500 psf	Total Force @ Section MomentActual	lbs = ft-# =	1,792.0 4,778.7			
ACI Factored @ Toe	=	1,256 psf	MomentAllowable	=	7,122.4			
ACI Factored @ Heel	=	95 psf	ShearActual ShearAllowable	psi =	23.8			
Footing Shear @ Toe	-	16.3 psi OK	Wall Weight	=	100.0	6		
Allowable	-	75.0 psi	Rebar Depth 'd'	in =	6.25			
Iding Calcs Slab Resident	sts All S	liding ! 1 417 5 lbs	LAP SPLICE IF ABOVE LAP SPLICE IF BELOW	in = in =	18.72			
Lotoral analig i araa	-	1,411,0100	HOOK EMBED INTO FT	G in =	6.00			
			Masonry Data Hook emb	bedme	nt reduced	by stress ratio		
			fm	psi =				
			Fs	psi =				
			Solid Grouting	=				
			Use nan Stresses Modular Ratio 'n'	-				
oad Factors			Short Term Factor					
Building Code		4 000	Equiv. Solid Thick.	=				
Live Load		1.200	Masonry Block Type	=				
Earth H		1.600	Masonry Design Method	=	ASD			
Larui, T		1.600	Concrete Data	100				
Seismic, E		1.000	f'c Ev	psi =	2,500.0			
00101110, 6		1.000	80.37	- nei =	PART IN REFE			

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 8'-0" Wall with Slab 8" Wall Job # : Dsgnr: ICT Descr: 8'-0" wall with Slab 8" wall

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Footing Dimensio	ns & S	Strengths	Footing Desig	In	Results		
Toe Width	=	3.00 ft			Toe	Heel	
Heel Width	=	1.66	Factored Pressure	=	1,256	95 psf	
Total Footing Width	=	4.66	Mu' : Upward	=	4,530	87 ft-#	
Footing Thickness	=	12.00 in	Mu' : Downward	=	1,026	657 ft-#	
Key Width Key Depth	=	0.00 in 0.00 in	Actual 1-Way Shear		3,504 16.32 75.00	9.70 π-# 9.70 psi 75.00 psi	
Key Distance from Toe	=	0.00 ft	Toe Reinforcing	=	# 4 @ 9.00 in	10.00 por	
fc = 2,500 psi Footing Concrete Densi	Fy = ity =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing	=	None Spec'd None Spec'd		
Min. As % Cover @ Top 2.00	= @ E	0.0018 3tm.= 3.00 in	Other Acceptable S Toe: #4@ 9.50 in Heel: Not reg'd, M	Size , #8	es & Spacings 5@ 14.50 in, #6 S * Fr	@ 20.50 in, #	7@ 28.00 in, #8@ 36.75 in, #9@ 46

Key: No key defined

		OV	ERTURNIN	NG			RE	SISTING	
Item		Force lbs	Distance ft	Moment ft-#			Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,417.5	3.00	4,252.5	Soil Over Heel	=	953.6	4.16	3,970.2
Surcharge over Heel	=				Sloped Soil Over Hee	e le			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Loa	d =			
Added Lateral Load	=				Axial Dead Load on S	Stem =			
Load @ Stem Above So	il =				* Axial Live Load on St	em =			
	=				Soil Over Toe	=	120.0	1.50	180.0
					Surcharge Over Toe	=			
Total		1 417 5	OTM	4 252 5	Stem Weight(s)	=	850.0	3.33	2,833.3
Total		1,417.5	0.1.M.	4,202.0	Earth @ Stern Transi	tions =			
	=		1		Footing Weight	=	699.0	2.33	1,628.7
Resisting/Overturning	g Rati	0	=	2.03	Key Weight	=			
Vertical Loads used f	or Soil	Pressure =	= 2,62	2.6 lbs	Vert. Component	=			
					* Axial live load NOT in resistance, but is incl	Total =	2,622.6 It total displaye	d, or used for	8,612.2 r overturning

 Title
 9'-0" Wall with Slab 8" Wall
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 9'-0" wall with Slab 8" wall
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Criteria			Soil Data						
Retained Height	= 9.00	ft	Allow Soil Bearing = 1	,500.0) psf				
Wall height above soil	= 0.50	e.	Equivalent Fluid Pressure Metho	d					
Slone Behind Wall	= 0.00	4	Heel Active Pressure =	35.0) psf/ft				
Height of Soil over Toe	- 4.00	in .	= Paceiva Proceuro	150.0	nef/ft				
Meter beight over roe	- 4.00	61 6	Coll Dessity Heal	120.00	paint				
water height over heel	= 0.0	nt –	Soil Density, neel =	120.00) pci				
			Soli Density, Toe =	0.250	per				
			Fooung Son Friction =	0.550					
			for passive pressure =	0.00	in				
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing I	oad		ť,
Sureborne Over Heel		land			1	Adiagont Easting Load		0.0.160	-
NOT Used To Resist \$	= 0.0 Sliding & Over	turnina	Lateral Load =	0.0 #	/nt	Footing Width	-	0.00 fbs	8
Surcharge Over Toe	= 0.0	psf	Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in	
NOT Used for Sliding	& Overturning		The above lateral load			Wall to Ftg CL Dist	=	0.00 ft	
Axial Load Applie	d to Stem		has been increased	1.00		Footing Type			
Avial Deedland			by a factor of			Base Above/Below Soil	=	0.0.0	
Axial Live Load	= 0.0	lbs	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall		0.0 11	
Axial Load Eccentricity	= 0.0	in				Poisson's Ratio	=	0.300	
Design Summary			Stem Construction	1-	Stem OK				-
Wall Stability Ratios	-2.9 - 0.39	201034402	Design Height Above Ftg	ft =	0.00				
Overturning	- 1.8	7 OK	Wall Material Above "Ht"	=	Concrete				
Slab Resist	ts All Sliding !		Thickness	=	8.00				
			Rebar Size	-	# 5				
Total Bearing Load	= 2,93	/ Ibs	Rebar Spacing	7	12.00				
eounain eou.	- 10.5	1.000	Rebar Placed at	=	Edge	2			
Soil Pressure @ Toe	= 1,13	8 psf OK	fb/FB + fa/Fa	=	0.838				
Soil Pressure @ Heel	=	0 psf OK	Total Force @ Section	lbs=	2.268.0				
Allowable	= 1,50	0 psf	MomentActual	ft-#=	6,804.0				
Soll Pressure Less	Than Allowat	ble F. cof	MomentAllowable	=	8,121.3				
ACI Factored @ 108	= 1,36	0 pst	ShearActual	psi =	30.5				
Footing Cheer @ Too	- 20	6 pei OK	ShearAllowable	psi =	75.0				
Footing Shear @ Heel	- 20.	7 psi OK	Wall Weight	=	100.0				
Allowable	= 11.	n psi OK	Rebar Depth 'd'	in =	6.19				
Iliding Cales Sigh Port	ete All Slidion	i hai	LAP SPLICE IF ABOVE	in =	23.40				
Lateral Sliding Force	= 1 750	0 lbe	LAP SPLICE IF BELOW	in =					
Enterer annung i orob	- 1,750.	0 105	HOOK EMBED INTO FT	G in =	8.70				
			Masonry Data Hook emb	bedme	nt reduced	by stress ratio			
			fm	psi =					
			Fs	psi =					
			Solid Grouting	=					
			Use Half Stresses	=					
Load Factors			Short Term Eactor	2					
Building Code			Equiv. Solid Thick	2					
Dead Load	1	.200	Masonry Block Type	=					
Live Load	1	.600	Masonry Design Method	=	ASD				
Earth, H	1	.600	Concrete Data						
Wind, W	1	.600	fc	psi =	2,500.0				
Seismic, E	1	.000	Fy	psi =	60,000.0				

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206,789,6038 Title : 9'-0" Wall with Slab 8" Wall Job # : Dsgnr: ICT Descr: 9'-0" wall with Slab 8" wall Page: _____ Date: 25 JUN 2014

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Footing Dimension	15 & S	trengths	Footing Desig	n	Results	1	
Toe Width		3.50 ft			Toe	Heel	
Heel Width	=	1.66	Factored Pressure	=	1.365	0 psf	
Total Footing Width	=	5.16	Mu': Upward	=	6,473	43 ft-#	
Footing Thickness	=	12.00 in	Mu' : Downward Mu: Design	= =	1,397	728 ft-# 685 ft-#	
Key Width	=	0.00 in	Actual 1-Way Shear	-	20.59	11.71 pci	
Key Depth	=	0.00 in	Allow 1-Way Shear	- 2	75.00	75.00 pei	
Key Distance from Toe	=	0.00 ft	Toe Reinforcing	=	# 5 @ 12.00 in	10.00 par	
fc = 2,500 psi Footing Concrete Density	Fy =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing	=	None Spec'd None Spec'd		
Min. As % Cover @ Top 2.00	= @ B	0.0018 htm.= 3.00 in	Other Acceptable S Toe: #4@ 9.50 in Heel: Not req'd, M Key: No key defir	Size	es & Spacings 5@ 14.50 in, #6(S*Fr	@ 20.50 in, ≴	#7@ 28.00 in, #8@ 36.75 in, #9@ 46

Summary of Overturning & Resisting Forces & Moments

		OV	ERTURNING	i			RI	SISTING	Charles and the
Item		Force lbs	Distance ft	Moment ft-#			Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,750.0	3.33	5,833.3	Soil Over Heel	=	1,072.8	4.66	5,002.8
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Ste	-m =			
Load @ Stem Above So	il =				* Axial Live Load on Sten	n =			
	=				Soil Over Toe	=	140.0	1.75	245.0
					Surcharge Over Toe	=			
Tetal		1 750 0	0.7.11	E 022.2	Stem Weight(s)	=	950.0	3.83	3,641.7
Total		1,750.0	0.1.M.	0,000.0	Earth @ Stem Transitio	ns=			
	=		=		Footing Weight	=	774.0	2.58	1,996.9
Resisting/Overturnin	g Rat	io	=	1.87	Key Weight	=			
Vertical Loads used f	or So	I Pressure	= 2,936.	8 lbs	Vert. Component	=			
					То	tal =	2,936.8	bs R.M.=	10,886.4
					 Axial live load NOT incl resistance, but is includ 	uded in ed for s	total display soil pressure	ed, or used for calculation.	roverturning

 Title
 : 10'-0" Wall with Slab 8" Wall
 Page:

 Job #
 Dsgnr:
 ICT
 Date:
 25 JUN 2014

 Descr:
 10'-0" wall with Slab 8" wall
 Date:
 25 JUN 2014

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Criteria	-		Son Data		_				
Retained Height	=	10.00 ft	Allow Soil Bearing = 1	,500.0	psf				
Wall height above soil	=	0.50 ft	Equivalent Fluid Pressure Metho	d 25.0	netifi				
Slope Behind Wall	=	0.00:1	Heel Active Pressure =	35.0	pst/tt				
Height of Soil over Toe	=	4.00 in	Passive Pressure =	150.0	nsf/ft				
Meter beight of Soli over 108	2	4.00 m	Seil Dessity Head	100.0	point				
vvater neight over neel	-	0.0 π	Soil Density, Heel =	120.00	poi				
			Soli Density, roe =	0.250	per				
			Footing[[Soil Friction =	0.350					
			for passive pressure =	0.00	in				
Surcharge Loads			Lateral Load Applied to	Stem	_	Adjacent Footing I	oad		ť,
Carlonarge Ectado	-	and the second se	Later and a second second second	-		Adjubent Footing I	ouu	0.0.0	-
NOT Used To Resist !	= Slidico	0.0 psr	Lateral Load =	0.0 #/	ft	Footing Width	-	0.0 lbs	
Surcharge Over Toe	=	0.0 psf	Height to Pottom =	0.00 ft		Eccentricity	-	0.00 in	
NOT Used for Sliding	& Ove	rturning	The above lateral load	0.00 11		Wall to Eto CL Dist	=	0.00 0	
Avial Load Applie	dto	Stom	has been increased	1.00		Footing Type		0.00 11	
Anai Loau Applie	10	Stelli	by a factor of			Base Above/Below Soil			
Axial Dead Load	=	0.0 lbs	Wind on Exposed Stem =	0.0 ps	sf	at Back of Wall	=	0.0 ft	
Axial Live Load Axial Load Eccentricity	=	0.0 lbs 0.0 in				Poisson's Ratio	=	0.300	
Design Summary			Stem Construction	1-	Stem OK			_	-
Wall Stability Ratios		121210-2222	Design Height Above Ftg	ft =	0.00				
Overturning		1.94 OK	Wall Material Above "Ht"	=	Concrete				
Slab Resis	ts All a	Sliding !	Thickness	=	8.00				
			Rebar Size	=	# 5	19			
Total Bearing Load	2	4,043 lbs	Rebar Spacing	=	10.00				
resultant ecc.	-	10.69 In	Rebar Placed at	=	Edge				
Soil Pressure @ Toe	=	1,402 psf OK	fb/EB + fa/Ea	-	0.970	1			
Soil Pressure @ Heel	=	27 psf OK	Total Force @ Section	lbe =	2 800 0				
Allowable	=	1,500 psf	Mamont Actual	4.#-	0 333 3				
Soil Pressure Less	s Than	Allowable	Moment Allowable	=	0,623 1				
ACI Factored @ Toe	=	1,682 psf	Sheer Actual	-	3,023.1	2			
ACI Factored @ Heel	=	32 psf	Shear Allowable	psi =	75.0				
Footing Shear @ Toe	=	18.8 psi OK	Wall Weight	psi =	100.0				
Footing Shear @ Heel	=	14.1 psi OK	Pobar Dooth 'd'	in T	6.40	2			
Allowable	=	75.0 psi	LAP SPLICE IE APOVE	in =	23.40				
Sliding Calcs Slab Resi	sts All	Sliding !	LAP SPLICE IF ABOVE	in E	20.40				
Lateral Sliding Force	=	2,214.8 lbs	HOOK EMBED INTO FT	G in =	10.16	i -			
			Masonry Data Hook emi	bedme	nt reduced	by stress ratio			
			fm	psi=					
			Fs	psi =					
			Solid Grouting	=					
			Use Half Stresses	=					
oad Eactors			Modular Ratio 'n'	=					
Building Code			Short Term Factor	=					
Dead Load		1,200	Equiv. Solid Thick.	=					
Live Load		1.600	Masonry Block Type		-				
Earth, H		1,600	Masonry Design Method	=	ASD				
Wind W		1 600	Concrete Data	and a	0 500 5				
Seismic, E		1.000	TC E.	psi =	2,500.0				
Groupfille, la		1.000	Fy	psi =	60,000.0	8 F			

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 10'-0" Wall with Slab 8" Wall Job # : Dsgnr: ICT Descr: 10'-0" wall with Slab 8" wall Page: _____ Date: 25 JUN 2014

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Footing Dimensio	ns & S	Strengths	Footing Desig	In	Results	1	
Toe Width	=	3.50 ft			Toe	Heel	
Heel Width	=	2.16	Factored Pressure	=	1,682	32 psf	
Total Footing Width	=	5.66	Mu': Upward	=	8,220	198 ft-#	
Footing Thickness	Ξ.	15.00 in	Mu' : Downward Mu: Design	= =	1,672 6,548	1,857 ft-# 1,659 ft-#	
Key Width	=	0.00 in	Actual 1-Way Shear	=	18.84	14.09 nsi	
Key Depth	=	0.00 in	Allow 1-Way Shear	=	75.00	75.00 psi	
Key Distance from Toe	=	0.00 ft	Toe Reinforcing	=	# 5 @ 10.00 in	Totoo par	
fc = 2,500 psi Footing Concrete Densit	Fy =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing	=	None Spec'd None Spec'd		
Min. As % Cover @ Top 2.00	" @ E	0.0018 3tm.= 3.00 in	Other Acceptable S Toe: #4@ 7.50 in Heel: Not req'd, M Key: No key defit	Size	es & Spacings 5@ 11.50 in, #6 : S * Fr	@ 16.50 in, #7@	@ 22.25 in, #8@ 29.50 in, #9@ 3

Summary of Overturning & Resisting Forces & Moments

		OV	ERTURNIN	3			RE	SISTING	and the second
Item		Force Ibs	Distance ft	Moment ft-#			lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,214.8	3.75	8,305.7	Soil Over Heel	=	1,792.0	4.91	8,804.7
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Ste	m =			
Load @ Stem Above So	il =				* Axial Live Load on Sterr	1 =			
	=				Soil Over Toe	=	140.0	1.75	245.0
					Surcharge Over Toe	=			
Tatal		2 244 9	OTH	9 205 7	Stem Weight(s)	=	1,050.0	3.83	4,025.0
Total		2,214.8	0.1.M.	8,305.7	Earth @ Stern Transition	ns=			
	=		=		Footing Weight	=	1,061.3	2.83	3,003.3
Resisting/Overturning	g Rat	io	=	1.94	Key Weight	=			
Vertical Loads used f	or So	I Pressure	= 4,043	.3 lbs	Vert. Component	=			
					Tot	al =	4,043.3 1	s R.M.=	16,078.0
					* Axial live load NOT inclu resistance, but is include	ided in ed for :	total displaye	ed, or used fo calculation.	r overturning

Title : 11'-0" Wall with Slab 10" Wall Job # : Dsgnr: ICT Descr: 11'-0" wall with Slab 10" wall Page: _____ Date: 25 JUN 2014

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Criteria			Soil Data					
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel		11.00 ft 0.50 ft 0.00 : 1 4.00 in 0.0 ft	Allow Soil Bearing = Equivalent Fluid Pressure Metho Heel Active Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing[[Soil Friction = foot ignore for passive pressure =	1,500.0 d 35.0 150.00 120.00 0.350 0.00	psf/ft psf/ft pcf pcf in			
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing I	Load	
Surcharge Quar Heel	-	0.0 pef	and the second se			Adjacent Ecoting Load	-	0.0 lbc
NOT Used To Resist S	Sliding	& Overturning	Height to Tor =	0.00 #	m	Footing Width	-	0.00 ft
Surcharge Over Toe	=	0.0 psf	Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in
NOT Used for Sliding a	& Ove	rturning	The above lateral load			Wall to Ftg CL Dist	=	0.00 ft
Axial Load Applie	d to	Stem I	has been increased	1.00		Footing Type		
Avial Deedll and		0.0.11-2	by a factor of			Base Above/Below Soil	=	0.0 ft
Axial Dead Load	2	0.0 lbs	Wind on Exposed Stem =	0.0 p	sf	at Back of Wall	10	0.011
Axial Load Eccentricity	- E	0.0 in				Poisson's Ratio	=	0.300
Design Summary			Stem Construction	1-1	Top Stem			
Wall Stability Ratios			Design Height Above Fto	ft =	Stem OK 0.00			
Overturning	=	2.00 OK	Wall Material Above "Ht"	=	Concrete			
Slab Resist	s All S	Sliding !	Thickness	=	10.00	Day .		
			Rebar Size	=	# 6	5. S.		
Total Bearing Load	=	4,760 lbs	Rebar Spacing	=	12.00	1 m.		
resultant ecc.	=	10.93 in	Rebar Placed at	=	Edge			
Soil Pressure @ Toe	=	1.401 nsf OK	Design Data	_	0.00			
Soil Pressure @ Heel	=	103 psf OK	Total Fasta @ Section	lbe m	2 200 0			
Allowable	=	1,500 psf	fotal Porce @ Section	ibs -	10,000.0			
Soil Pressure Less	Than	Allowable	MomentActual	1(-# =	12,422.7			
ACI Factored @ Toe	=	1,681 psf	MomentAllowable		14,009.3			
ACI Factored @ Heel	=	123 psf	Shear Allowable	psi =	37.0			
Footing Shear @ Toe	=	22.4 psi OK	SnearAllowable	psi =	105.0			
Footing Shear @ Heel	=	15.0 psi OK	vvali vveight		125.0			
Allowable	=	75.0 psi		in =	28.09			
iliding Calcs Slab Resi	sts All	Sliding !	LAP SPLICE IF ABOVE	in =	20.00			
Lateral Sliding Force	=	2,626.1 lbs	HOOK EMBED INTO FT	Gin =	11.02			
			Hook em	hedme	nt reduced	hy stress ratio		
			Masonry Data	- Junito		-7		
			fm	psi=				
			FS Solid Crowline	psi =				
			Liee Half Stresson	-				
			Modular Ratio 'n'	-				
oad Factors			Short Term Factor	=				
Building Code			Equiv. Solid Thick.	=				
Dead Load		1.200	Masonry Block Type	=				
Live Load		1.600	Masonry Design Method	=	ASD			
Earth, H		1.600	Concrete Data					
Wind, W		1.600	fc	psi =	2,500.0			
Seismic, E		1.000	E.	and an	20.000.0			

psi = 2,500.0 psi = 60,000.0 fc Fy

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Title : 11'-0" Wall with Slab 10" Wall Job # : Dsgnr: ICT Descr: 11'-0" wall with Slab 10" wall

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levered	Retaining	Wall	Design	
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Footing Dimension	ns & S	Strengths	Footing Desig	ŋn	Results	1
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Depth Key Depth Key Distance from Toe		4.00 ft 2.33 6.33 15.00 in 0.00 in 0.00 in 0.00 ft	Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear Too Reinforcing		Toe 1,681 10,826 2,184 8,642 22.44 75.00 # 6 @ 12.00 in	Heel 123 psf 276 ft.# 2,026 ft.# 1,751 ft.# 1,4.98 psi 75.00 psi 75.00 psi
fc = 2,500 psi Footing Concrete Density	Fy =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing	= =	None Spec'd None Spec'd	
Min. As % Cover @ Top 2.00	= @ E	0.0018 8tm.= 3.00 in	Other Acceptable S Toe: #4@ 7.50 in Heel: Not req'd, M Key: No key defir	Size	es & Spacings 5@ 11.50 in, #6 S * Fr	@ 16.50 in, #7@ 22.25 in, #8@ 29.50 in, #9@ 37

Summary of Overturning & Resisting Forces & Moments

		OV	ERTURNING	3			RE	SISTING	122 - 274
Item		Force Ibs	Distance ft	Moment ft-#			Force Ibs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,626.1	4.08	10,723.2	Soil Over Heel	=	1.975.6	5.58	11,027.1
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Ster	m =			
Load @ Stem Above So	il =				* Axial Live Load on Stem	1 =			
	=				Soil Over Toe	=	160.0	2.00	320.0
					Surcharge Over Toe	=		2.00	
Tetal		2 626 4	0.7.11	10 702 0	Stem Weight(s)	=	1,437.5	4.42	6,349.0
Total		2,020.1	0.1.M.	10,723.2	Earth @ Stem Transition	ns=			
	=		=		Footing Weight	=	1,186.9	3.17	3,756.5
Resisting/Overturnin	g Rat	io	=	2.00	Key Weight	=			
Vertical Loads used f	or Soi	I Pressure	= 4,760	.0 lbs	Vert. Component	=			
					Tot	al =	4,760.0	s R.M.=	21,452.6
					 Axial live load NOT inclu resistance, but is include 	uded in ed for s	total display	ed, or used for calculation.	roverturning

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Criteria			Soil Data		_			
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel		12.00 ft 0.50 ft 0.00 : 1 4.00 in 0.0 ft	Allow Soil Bearing = 1 Equivalent Fluid Pressure Metho Heel Active Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	1,500.0 35.0 150.0 120.00 120.00 0.350 0.00	psf psf/ft pcf pcf in			
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent Footing I	oad	
Surcharge Over Heel	-	0.0.psf	Lateral Load -	0.0.#	10	Adjacent Footing Load	=	0.0 lbs
NOT Used To Resist S	Sliding	g & Overturning	Height to Toc =	0.00 ft	ii.	Footing Width	=	0.00 ft
Surcharge Over Toe	=	0.0 psf	Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in
NUT Used for Sliding	a Ove	enuming	The above lateral load	1.00		Wall to Ftg CL Dist	=	0.00 ft
Axial Load Applie	d to	Stem	by a factor of	1.00		Pooling Type Race Aboue/Releva Call		
Axial Dead Load	=	0.0 lbs	Wind on Exposed Stern -	0.0 ~	ef	at Back of Wall	=	0.0 ft
Axial Live Load	=	0.0 lbs	while on Exposed otent =	0.0 p		Poisson's Ratio	=	0.300
Axial Load Eccentricity	=	0.0 in						
Design Summary			Stem Construction	1-	Stem OF			
Wall Stability Ratios	2		Design Height Above Ftg	ft =	0.00			
Overturning Slab Resist	-	1.88 OK Sliding I	Wall Material Above "Ht"	=	Concrete			
Slab Resist	IS All	Sliding !	Thickness Rober Size	-	10.00			
Total Rearing Load	2	5 178 lbe	Rebar Spacing	- 2	" Q OC	-		
resultant ecc.	=	13.18 in	Rebar Placed at		Edge			
202 0.02200			Design Data	_	2031			
Soil Pressure @ Toe	2	1,489 psf OK	fb/FB + fa/Fa	=	0.88			
Allowable	-	1,500 pcf	Total Force @ Section	lbs =	4,032.0	1		
Soil Pressure Less	Than	Allowable	MomentActual	ft-# =	16,128.0			
ACI Factored @ Toe	=	1,787 psf	MomentAllowable		18,302.4			
ACI Factored @ Heel	=	32 psf	ShearActual	psi =	44.1	2		
Footing Shear @ Toe	=	26.8 psi OK	SnearAllowable	psi =	105.0			
Footing Shear @ Heel	=	17.2 psi OK	Rebar Depth 'd'	in =	7.65			
Allowable	=	75.0 psi	LAP SPLICE IF ABOVE	in =	28.08			
iliding Calcs Slab Resi	sts Al	I Sliding !	LAP SPLICE IF BELOW	in =	20100	143		
Lateral Sliding Force	=	3,072.3 lbs	HOOK EMBED INTO FT	G in =	10.96	1		
			Hook emb	bedme	nt reduced	by stress ratio		
			fm	nei z				
			Fs	psi =				
			Solid Grouting	=				
			Use Half Stresses	=				
oad Factors			Modular Ratio 'n'	=				
Building Code			Short Term Factor					
Dead Load		1.200	Equiv. Solid Thick.	-				
Live Load		1.600	Masonny Block Type	5	ASD			
Earth, H		1.600	Concrete Data		100			
Wind, W		1.600	fc	psi =	2,500.0			
Seismic, E		1.000	Fv	psi =	60,000.0			

Malsam Tsang Engineering Corporation 122 S. Jackson St., Suite 210 Seattle, WA 98104 206.789.6038 Title : 12'-0" Wall with Slab 10" Wall Job # : Dsgnr: ICT Descr: 12'-0" wall with Slab 10" wall Page: _____ Date: 25 JUN 2014

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Footing Dimensio	ns & \$	Strengths	Footing Desig	ŋn	Results		
Toe Width	=	4.50 ft			Toe	Heel	
Heel Width	=	2.33	Factored Pressure	=	1,787	32 psf	
Total Footing Width	=	6.83	Mu' : Upward	=	14,194	180 ft-#	
Footing Thickness	=	15.00 in	Mu' : Downward	=	2,764	2,187 ft-#	
Key Width Key Depth Key Distance from Toe		0.00 in 0.00 in 0.00 ft	Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing	1 1 1	26.78 75.00 # 6 @ 9.00 in	17.25 psi 75.00 psi	
fc = 2,500 psi Footing Concrete Densit	Fy = ty =	60,000 psi 150.00 pcf	Heel Reinforcing Key Reinforcing	11 11	None Spec'd None Spec'd		
Min. As % Cover @ Top 2.00	= @ 6	0.0018 Btm.= 3.00 in	Other Acceptable S Toe: #4@ 7.50 in Heel: Not req'd, M	Size	es & Spacings 5@ 11.50 in, #6 S*Fr	@ 16.50 in, #7@ 22	2.25 in, #8@ 29.50 in, #9@ 3

Key: No key defined

		OV	ERTURNING	3	1322300 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		RE	SISTING	
Item		Force lbs	Distance ft	Moment ft-#			Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	3,072.3	4.42	13,569.5	Soil Over Heel	=	2,155.2	6.08	13,107.2
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Si	tem =			
Load @ Stem Above So	il =				* Axial Live Load on Ste	em =			
	=				Soil Over Toe	=	180.0	2.25	405.0
					Surcharge Over Toe	=			
Total		2 072 2	0.7.11	12 560 5	Stem Weight(s)	=	1,562.5	4.92	7,682.3
Total		3,072.5	0.1.M.	13,309.5	Earth @ Stem Transiti	ions =			
	=				Footing Weight	=	1,280.6	3.42	4,373.3
Resisting/Overturnin	g Rat	io	=	1.88	Key Weight	=			
Vertical Loads used f	or So	il Pressure	= 5,178	.3 lbs	Vert. Component	=			
					* Axial live load NOT inclusion	otal =	5,178.3 I total display	bs R.M.= ed, or used fo	25,567.8 r overturning

Project Name/Number :	(C02-D10)	200
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etainPro (c) 1987-2019, Build icense : KW-06055289 icense To : MALSAM TSA	11.20.03.31 NG ENGINEERIN	G	Cantilevered Retain	ing V	Code: IBC 2015,ACI 318-14,ACI 530-13			
Criteria			Soil Data					
Retained Height = Wall height above soil =	= 12.00 ft = 0.50 ft	E A A	Ilow Soil Bearing = 2 quivalent Fluid Pressure Metho Active Heel Pressure =	2,666.0 od 40.0) psf) psf/ft			
Slope Benind Wall =	= 0.00		-					
Height of Soll over Toe =	= 4.00 in	F	assive Pressure =	150.0) psf/ft			
vvater neight over neel	= 0.0 π	S	Soil Density, Heel =	120.00) pcf			
		S	Soil Density, Toe =	120.00) pcf			
		F	ooting Soil Friction =	0.450)			
		S	Soil height to ignore					
			for passive pressure =	12.00	in	Restrie		
Surcharge Loads			Lateral Load Applied to	Stem	1	Adjacent Footing Load		
Surcharge Over Heel :	= 0.0 psf		ateral Load = 1	108.0 #	/ft	Adjacent Footing Load = 0.0 lbs		
NOT Used To Resist Sli	ding & Overturning		Height to Top = 1	12.00 ft		Footing Width = 0.00 ft		
NOT Used for Sliding &	= 0.0 Overturning		Height to Bottom =	0.00 ft	t	Eccentricity = 0.00 in		
		l I	_oad Type = Sei	smic (E	E)	Wall to Ftg CL Dist = 0.00 ft		
Axial Load Applied	to Stem		(Se	rvice L	evel)	Base Above/Below Soil		
Axial Dead Load :	= 0.0 lbs		Wind on Exposed Stem =	0.0 p	sf	at Back of Wall = 0.0 ft		
Axial Live Load = Axial Load Eccentricity =	= 0.0 lbs = 0.0 in		(Service Level)			Poisson's Ratio = 0.300		
Design Summary		Í	Stem Construction	<u> </u>	Bottom			
			Design Height Above Ft	q ft=	Stem OK 0.00			
Wall Stability Ratios			Wall Material Above "Ht	=	Concrete			
Overturning	= 1.42 Ra	itio < 1	.5! Design Method	=	LRFD)		
Slab Resist	s All Sliding !		Thickness	=	12.00)		
Total Dessing Land	- 0.405 lbs		Rebar Size	=	# 6			
resultant ecc.	= 0,105 lbs		Rebar Spacing	=	8.00]		
ooditaint 000.	27.00 11		Repar Placed at	-	Eage			
Soil Pressure @ Toe	= 2,393 psf	OK	fb/FB + fa/Fa	=	0.997	7		
Soil Pressure @ Heel	= 0 pst	OK	Total Force @ Section					
Allowable Soil Pressure Less	= 2,000 pst		Service Level	lbs =				
ACI Eactored @ Toe	= 3 350 nsf	F	Strength Level	lbs =	5,904.0)		
ACI Factored @ Heel	= 0 psf		MomentActual					
Footing Shear @ Toe	= 51.4 psi	OK	Service Level	ft-# =				
Footing Shear @ Heel	= 21.9 psi	OK	Strength Level	ft-# =	26,208.0)		
Allowable	= 75.0 psi		MomentAllowable	=	26,273.2	2		
Sliding Calcs			Shear Actual					
Lateral Sliding Force	= 4,807.3 lbs		Service Level	psi =				
			Strength Level	psi =	51.1			
			ShearAllowable	psi =	75.0)		
			Anet (Masonry)	in2 =				
			Rebar Depth 'd'	in =	9.63	3		
			Masonry Data					
			ťm	psi=				
rtical component of	latoral coil pro	100	FS Solid Grouting	psi =				
T considered in the color	lation of soil board	11015	Modular Ratio 'n'	=				
or considered in the calcu	nation of soil beam	чy	Wall Weight	nsf=	150.0			
Load Factors			- Short Term Factor	- req	100.0			
Building Code	IBC 2015,ACI		Equiv. Solid Thick	_				
Dead Load	1.200		Masonry Block Type	=	Medium \	Weight		
Live Load	1.600		Masonry Design Method	=	ASD	5		
Earth, H	1.600		Concrete Data					
Wind, W	1.000		fc	psi=	2,500.0)		
Seismic, E	1.000		Fy	psi =	60,000.0)		

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area Details			
Bottom Stem Ve As (based on applied moment) : 0.6	rtical Reinforcing 258 in2/ft	Horizontal Reinforcing	
(4/3) * As : 0.8	344 in2/ft	Min Stem T&S Reinf Area	a 3.600 in2
200bd/fy : 200(12)(9.625)/60000 : 0.3	85 in2/ft	Min Stem T&S Reinf Area	a per ft of stem Height : 0.288 in2/ft
0.0018bh : 0.0018(12)(12) : 0.2	592 in2/ft	Horizontal Reinforcing Op	otions :
==		One layer of : Two la	ivers of :
Required Area : 0.6	258 in2/ft	#4@ 8.33 in #4@ *	16.67 in
Provided Area : 0.6	6 in2/ft	#5@ 12.92 in #5@	25.83 in
Maximum Area : 1.3	039 in2/ft	#6@ 18.33 in #6@	36.67 in
Footing Data	Footing De	esign Results	
Toe Width = 5.25 ft Heel Width = 2.75 Total Footing Width = 8.00 Footing Thickness = 15.00 in Key Width = 0.00 in Key Distance from Toe = 0.00 in Footing Concrete Density = 0.000 pc Footing Concrete Density = 0.0018 Cover @ Top 2.00 @ Btm.= 3.00 in	Factored Pressu Mu': Upward Mu': Downward Mu: Design Actual 1-Way Sh Alow 1-Way Sh Toe Reinforcing Heel Reinforcing Footing Torsion, Footing Torsion, Footing Jose,	Tog Heg re 3,350 = 364,019 = 45,147 2,99 = 26,573 2,99 bear = 51,38 21.9 bear = 75.00 40.0 = None Spec'd = None Spec'd = 0. Tu = 0. orsion, phi Tu = 0.0	1 0 psf 0 ft# 11 ft# 11 ft# 11 psi 10 psi 00 ft-lbs 00 ft-lbs
	supplement	al design for footing torsion	n.
	Other Acceptab	le Sizes & Spacings	-
	Toe: #4@ 4.5 Heel: phiMn = Key: No key	54 in, #5@ 7.04 in, #6@ 9.99 phi/5'lambda'sqrt(fc)'Sm defined	in, #7@ 13.63 in, #8@ 17.95 in, #9@ 22.7
	Min footing T8 Min footing T8 If one layer of #4@ 7.41 ii #5@ 11.48 i #6@ 16.30 i	S reinf Area 2.5 S reinf Area per foot 0.3 horizontal bars: If two n #40 in #50 in #60	i9 in2 :2 in2 /ft layers of horizontal bars: @ 14.81 in @ 22.96 in @ 32.59 in

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING Cantilevered Retaining Wall Code: IBC 2015,ACI 318-14,ACI 530-13 Summary of Overturning & Pesisting Forces & Moments

OVERTURNING							RESISTING			
Item		lbs	ft	ft-#		lbs	ft	ft-#		
HL Act Pres (ab water tbl)	, –	3,511.3	4.42	15,508.0	Soil Over HL (ab. water tbl)	2,520.0	7.13	17,955.0		
HL Act Pres (be water tbl) Hydrostatic Force)				Soil Over HL (bel. water tbl) Watre Table		7.13	17,955.0		
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	=	1,296.0	7.25	9,396.0	* Axial Live Load on Stem =					
Load @ Stem Above Soil	=	,			Soil Over Toe =	210.0	2.63	551.3		
-	=				Surcharge Over Toe =					
					Stem Weight(s) =	1,875.0	5.75	10,781.3		
T 1		4.007.0	- o t tr -	04.001.0	Earth @ Stem Transitions=					
iotal	=	4,807.3	0.1.M. =	24,904.0	Footing Weight =	1,500.0	4.00	6,000.0		
	_				Key Weight =					
Resisting/Overturning	Rati	0	=	1.42	Vert. Component =					
vertical Loads used fo	r Soil	Pressure	= 6,105.0	Ulbs	Total =	6,105.0 li	bs R.M.=	35,287.5		
					* Axial live load NOT included resistance, but is included for	in 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

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.

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Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe	= = =	8.00 ft 0.50 ft 0.00 4.00 in		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = = Passive Pressure =	2,000.0 d 40.0 150.0) psf) psf/ft) psf/ft	
water neight over neer	-	0.0 11	:	Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	120.00 120.00 0.450 12.00) pcf) pcf) in	Particular and Partic
Surcharge Loads			I	Lateral Load Applied to	Stem	۱ I	Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding &	= iding a = Overt	0.0 psf & Overturning 0.0 urning		Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 # 0.00 ft 0.00 ft d (W)	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft Footing Type Line Load Line Load
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in		(Ser Wind on Exposed Stem = (Service Level)	0.0 p	evei) sf	Base Above/Below Soil = 0.0 ft at Back of Wall = 0.300 Poisson's Ratio = 0.300
Design Summary				Stem Construction	<u> </u>	Bottom	
Wall Stability Ratios Overturning Slab Resis	= ts All	1.91 OK Sliding !		Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = = = =	Stem OK 0.00 Concrete LRFD 8.00	
Total Bearing Load resultant ecc.	= =	2,670 lbs 9.62 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 5 11.25 6.25 i	
Soil Pressure @ Toe Soil Pressure @ Heel	=	1,077 psf 11 psf	OK OK	fb/FB + fa/Fa	=	0.626	
Allowable Soil Pressure Less	= Thar	2,000 psf Allowable		Service Level	lbs =	2 048 0	
ACI Factored @ Toe ACI Factored @ Heel	=	1,507 pst 15 psf		MomentActual	ft_# =	2,040.0	
Footing Shear @ Toe Footing Shear @ Heel	=	21.9 psi 9.7 psi	OK OK	Strength Level	ft-# =	5,461.3	
Allowable Sliding Calcs	-	75.0 psi		ShearActual Service Level	– psi=	0,713.4	
g	-	1,020.0103		Strength Level ShearAllowable Anet (Masonry)	psi = psi = in2 =	27.3 75.0	
				Rebar Depth 'd' Masonry Data fm	in =	6.25	
Vertical component of activ NOT considered in the calc	e later ulatior	ral soil pressu n of soil bearin	re IS g	Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi= psi= = psf=	100.0	
Load Factors Building Code Dead Load	IB	C 2015,ACI		Short Term Factor Equiv. Solid Thick.	=	Madium	Voiaht
Live Load Earth, H		1.600		Masonry Design Method	=	ASD	veign
Wind, W Seismic, E		1.000 1.000		fc Fy	psi = psi =	2,500.0 60,000.0	

Project Name/Number	: 1	(C02-D10)	200
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cense : KW-06055289 cense To : MALSAM TSANG		Cantilevered I	Retain	ing Wa	Code: IBC 2015,ACI 318-14,ACI 53
Concrete Stem Rebar A	rea Details				
Bottom Stem	Vertica	Reinforcing	Horizon	tal Reinfo	prcing
As (based on applied moment)): 0.2046	in2/ft			5
4/3) * As :	0.2728	in2/ft	Min Ste	m T&S R	einf Area 1.632 in2
00bd/fy : 200(12)(6.25)/60000): 0.25 in:	2/ft	Min Ste	m T&S R	einf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728	in2/ft	Horizon	tal Reinfo	orcing Options :
			One lay	er of :	Two layers of :
Required Area :	0.25 in	2/ft	#4@ 12	2.50 in	#4@ 25.00 in
Provided Area :	0.3307	in2/ft	#5@ 19	.38 in	#5@ 38.75 in
laximum Area :	0.8467	in2/ft	#6@ 27	.50 in	#6@ 55.00 in
Footing Data		Footing Des	ign Re	sults	
Toe Width =	3.25 ft	_		Тое	Heel
Heel Width =	1.66	Factored Pressure	=	1,507	15 psf
Total Footing Width =	4.91	Mu' : Upward	=	74,669	57 ft-#
Footing Thickness =	12.00 in	Mu': Downward	=	14,450	657 ft-#
Key Width =	0.00 in	Actual 1 Way She	-	21.86	9.65 psi
Key Depth =	0.00 in	Allow 1-Way Shea	n =	75.00	40.00 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= # :	5 @ 12.00) in
fc = 2,500 psi Fy =	= 60,000 psi	Heel Reinforcing	= No	one Spec'	d
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= No	one Spec'	d
Min. As % =	0.0018	Footing Torsion, Tu			0.00 ft-lbs
Cover@iop 2.00 @	у Бип.= 3.00 in	Footing Allow. Fors	ion, phi	lu =	0.00 ft-lbs
		If torsion exce supplemental	eds allov design f	wable, pro or footing	ovide g torsion.
		Other Acceptable	Sizes 8	Spacino	as
		Toe: #4@ 9.25	in #5@	14.35 in. #	#6@ 20.37 in. #7@ 27.77 in. #8@ 36.57 in. #9@ 46
		Heel: phiMn = pl Key: No key de	ni'5'lambo fined	da'sqrt(fc)	'Sm
		Min footing T&S	reinf Are	a	1.27 in2
		If one laver of bo	rizontal h	a per 1001	If two layers of horizontal bars:
		#4@ 9.26 in	nzontai t	/ul 5.	#4@ 18.52 in
		#5@ 14.35 in			#5@ 28.70 in
		#6@ 20.37 in			#6@ 40.74 in

Item	OV Force	ERTURNING					
		ft	ft-#		Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	953.6	4.41 4.41	4,208.6 4,208.6
Buoyant Force = Surcharge over Heel = Surcharge Over Toe = Adjacent Footing Load =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe = Surcharge Over Toe =	130.0	1.63	211.3
				Stem Weight(s) = Earth @ Stem Transitions=	850.0	3.58	3,045.8
Total = Resisting/Overturning Ratic	1,620.0	O.T.M. = =	4,860.0	Footing Weight = Key Weight = Vert. Component =	736.5	2.46	1,808.1

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	o settlem	nent of soil
(Deflection due to wall bending not considered)		
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.052	in
The above calculation is not valid if the heel soil bearing	i pressure e	exceeds that of the toe,

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

Project Name/Number : (C02-D10	200
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icense : KW-06055289 icense : KW-06055289 icense To : MALSAM TSA	111.20 ANG E	0.03.31 ENGINEERIN	G	Cantilevered Retaining Wall				Code: IBC 2015,ACI 318-14,ACI 530-13			
Criteria				Soil Data							
Retained Height Wall height above soil Slope Behind Wall	= = =	7.00 ft 0.50 ft 0.00		Allow Soil Bearing Equivalent Fluid Pressure M Active Heel Pressure	= 2 lethor =	2,666.0 d 40.0) psf) psf/ft				
Height of Soil over Toe	=	4.00 in		Passive Pressure	=	150.0	nsf/ft				
Water height over heel	=	0.0 ft		Soil Density, Heel	-	120.00	pon				
				Soil Density, Toe	= -	120.00	pcf				
				Footing Soil Friction	=	0.450					
				Soil height to ignore for passive pressure	=	12.00	in				
Surcharge Loads				Lateral Load Applied	d to	Stem		Adjacent Footing L	oad		
Surcharge Over Heel	=	0.0 psf		Lateral Load =		63.0#	/ft	Adjacent Footing Load	= 0.0 lbs		
NOT Used To Resist SI	iding	& Overturning		Height to Top =		7.00 ft		Footing Width	= 0.00 ft		
NOT Used for Sliding &	= Overl	U.U Turning		Height to Bottom =		0.00 ft		Eccentricity	= 0.00 in		
Avial Load Applied	1010	tom		Load Type =	Seis	mic (E	.)	vvaii io Fig CL Dist Footing Type	= 0.00 π Line Load		
Axial Loau Applied	10 5	nem			(Ser	vice Le	evel)	Base Above/Below Soil	2		
Axial Dead Load	=	0.0 lbs		Wind on Exposed Stem =		0.0 p	sf	at Back of Wall	= 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			Bottom Stem OK				
				Design Height Abov	e Ftg	ft =	0.00				
Wall Stability Ratios	-	107.0		Wall Material Above	e "Ht"	=	Concrete				
Slah Resist	te ΔII	1.37 Kai Sliding I	10 <	1.5! Design Method		=	LRFD				
Oldb Resis		Silulity :		I hickness Rebar Size		-	8.00				
Total Bearing Load	=	2.255 lbs		Rebar Spacing		-	8.75				
resultant ecc.	=	16.56 in		Rebar Placed at		=	Edae				
Soil Pressure @ Too	_	1.912 pcf	OK	Design Data							
Soil Pressure @ Heel	-	1,012 psi 0 psf	OK	fb/FB + fa/Fa		=	0.711				
Allowable	=	2,666 psf		Total Force @ Sec	tion						
Soil Pressure Less	s Thar	Allowable		Service Level		lbs =	0 000 0				
ACI Factored @ Toe	=	2,536 psf		Strength Level		IDS =	2,009.0				
ACI Factored @ Heel	=	0 pst		Service Level		ft-# =					
Footing Shear @ Toe	=	33.9 psi	OK	Strength Level		ft-# =	5,202,2				
Footing Snear @ Heel	=	12.1 psi	OK	Moment Allowabl	e	=	7 314 8				
Allowable	=	/ p.u psi		Shear Actual	-	_	.,				
Lateral Sliding Force	_	1.669.2 lbc		Service Level		psi =					
Eateral oliding i oloc	=	1,000.2 IDS		Strength Level		nei=	26.8				
				Shear Allowable		nsi=	75.0				
				Anet (Masonry)		in2 =					
				Rebar Depth 'd'		in =	6.25				
				Masonry Data							
				fm		psi =					
				Fs		psi =					
rtical component of activ	e late	ral soil pressu	re IS	Solid Grouting		=					
JI considered in the calc	ulatio	n of soil bearir	ng	Modular Ratio 'n'		=	400.0				
oad Factors				vvaii vveight		pst=	100.0				
Building Code	IB	C 2015 ACI		Short Lerm Factor		=					
Dead Load	.0	1,200		Equiv. Soliu Trick. Masonry Block Type		=	Medium	Veight			
Live Load		1.600		Masonry Design Me	athod	-		. o.g			
Earth, H		1.600		Concrete Data	aiou	-	100				
Wind, W		1.000		fc fc		psi =	2,500.0				
Seismic, E		1.000		Fy		psi=	60,000.0				

icense : KW-06055289 icense To : MALSAM TSANG EN	IGINEERING	Cantilevered R	eta	ining Wal	I	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Are	a Details					
Bottom Stem	Vertical	Reinforcing I	Horiz	ontal Reinford	cing	
As (based on applied moment) :	0.1949 i	n2/ft			-	
(4/3) * As :	0.2599 i	n2/ft I	Min \$	Stem T&S Rei	inf Area 1.	440 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2	/ft I	Min \$	Stem T&S Rei	inf Area pe	er ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 i	n2/ft I	Horiz	ontal Reinford	cing Optio	ns :
	======	====== (Dne	layer of :	Two layer	s of :
Required Area :	0.25 in2	/ft #	t4@	12.50 in	#4@ 25.	.00 in
Provided Area :	0.2743 i	n2/ft #	‡5@	19.38 in	#5@ 38.	75 in
Maximum Area :	0.8467 i	n2/ft #	¢6@	27.50 in	#6@ 55.	00 in
Footing Data		Footing Desig	jn F	Results		
Toe Width =	2.75 ft			Toe	Heel	
Heel Width =	1.67	Factored Pressure	=	2,536	p	osf
Total Footing Width =	4.42	Mu' : Upward	=	72,750	0 f	t-#
Footing Thickness =	10.00 in	Mu' : Downward	=	8,984	583 f	t-#
Key Width =	0.00 in	Mu: Design	-	5,314	10 40 -	L-#
Key Depth =	0.00 in	Actual 1-Way Shear	-	33.90	12.10 p	
Key Distance from Toe =	0.00 ft	Toe Reinforcing	-	# 4 @ 9 00 in	40.00 p	551
fc = 2,500 psi Ev =	60 000 psi	Heel Reinforcing	=	None Spec'd		
Footing Concrete Density =	150.00 pcf	Key Reinforcing	=	None Spec'd		
Min. As % =	0.0018	Footing Torsion, Tu		=	0.00	ft-lbs
Cover @ Top 2.00 @ Bt	m.= 3.00 in	Footing Allow. Torsic	n, p	niTu =	0.00	ft-lbs
		If torsion exceed	is al	lowable, pro	vide	
		supplemental de	sig	n for footing	torsion.	
		Other Acceptable S	Size	s & Spacings	S	
		Toe: #4@ 9.42 in Heel: phiMn = phi' Key: No key defir	, #5(5'lar ned	@ 14.60 in, #6 nbda'sqrt(fc)'S	6@ 20.72 Sm	in, #7@ 28.26 in, #8@ 37.21 in, #9@ 47
		Min footing T&S re Min footing T&S re	inf A	vrea vrea per foot	0.95 0.22	in2 in2 ,ft

Min footing 1&S reinf Area per foot	0.22 In2 /π
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

RetainPro (c) 1987-2019, Build 11:20:03:31 License : KW06055299 License To : MALSAM TSANG ENGINEERING Code: IBC 2015,ACI 318-14,ACI 530-13 Summary of Overfurning & Recisting Forces & Momente

	0\	/ERTURNING			RES	STING	
Item	Force lbs	Distance ft	ft-#		Force Ibs	Distance ft	ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl)	1,227.2	2.61	3,204.4	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl)	842.8	3.92 3.92	3,302.4 3,302.4
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 =	441.0	4.33	1,911.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	110.0	1.38	151.3
=				Surcharge Over Toe =			
				Stem Weight(s) =	750.0	3.08	2,312.5
Total -	1 668 2	отм -	5 115 4	Earth @ Stem Transitions=			
- Julian -	- 1,000.2	0.1.41	0,110.4	Footing Weight =	552.5	2.21	1,221.0
Projecting/Overturning	Patia	_	4 27	Key weight =			
Vertical Loads used for	Soil Pressure	- 2,255	1.37 3 lbc	vert. Component =		_	
Vertical Loads used for	Join Fressure	- 2,200.	5 105	Total =	2,255.3 lbs	R.M.=	6,987.1
				* Axial live load NOT included in resistance, but is included for s	i total displayed soil pressure ca	, or used fo lculation.	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

 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,
 Image: Constraint of the toe,
 Image: Constraint of the toe,

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

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20.03.31 NG ENGINEERIN	Cantilevered Reta	ining V	/all	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 =	7.00 ft 0.50 ft 0.00 4.00 in 0.0 ft	Allow Soil Bearing = Equivalent Fluid Pressure Me Active Heel Pressure = Passive Pressure =	2,000.0 ethod 40.0 150.0	psf psf/ft psf/ft		
		Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	= 120.00 = 120.00 = 0.450 = 12.00	pcf pcf in	Reduce	
Surcharge Loads		Lateral Load Applied	to Stem		Adjacent Footing	Load
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & 0 Axial Load Applied	= 0.0 psf ding & Overturning = 0.0 Overturning to Stem	Lateral Load = Height to Top = Height to Bottom = Load Type =	0.0 #/ 0.00 ft 0.00 ft Wind (W) (Service Le	ft svel)	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type Bace Abyo/Balow Soil	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =	= 0.0 lbs = 0.0 lbs = 0.0 in	Wind on Exposed Stem ₌ (Service Level)	0.0 ps	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Design Summary		Stem Construction	<u> </u>	Bottom		
Wall Stability Ratios Overturning Slab Resiste	= 1.86 Ol s All Sliding !	K Design Height Above Wall Material Above K Design Method Thickness	Ftg ft = "Ht" = =	Stem OK 0.00 Concrete LRFD 8.00		
Total Bearing Load resultant ecc.	= 2,014 lbs = 8.66 in	Rebar Size Rebar Spacing Rebar Placed at	=	# 4 9.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= 985 psf = 0 psf = 2,000 psf Than Allowable = 1,378 psf = 0 psf	f OK besign bata f OK fb/FB + fa/Fa f OK Total Force @ Secti f Service Level f Strength Level f MomentActual	= Ibs = Ibs =	0.513 1,568.0		
Footing Shear @ Toe Footing Shear @ Heel	= 22.4 psi = 8.3 psi	i OK Service Level i OK Strength Level	ft-# = ft-# = -	3,658.7		
Allowable Sliding Calcs Lateral Sliding Force	= 1,227.2 lbs	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data fm	psi = psi = psi = in2 = in =	20.9 75.0 6.25		
Vertical component of active NOT considered in the calcu Load Factors Building Code	e lateral soil pressu lation of soil beari IBC 2015,ACI	Fs Solid Grouting ing Modular Ratio 'n' Wall Weight Short Term Factor Equiv. Solid Thick.	psi = = = psf = =	100.0		
Live Load Live Load Earth, H Wind, W Seismic, E	1.200 1.600 1.600 1.000 1.000	Masonry Block Type Masonry Design Mett Concrete Data fc Fy	hod = psi = psi =	Medium W ASD 2,500.0 60,000.0	/eight	

Project Name/Number	: 1	(C02-D10)	200
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cense : KW-06055289 cense To : MALSAM TSANG EN	IGINEERING	Cantilevered	Retain	ing Wa	Code: IBC 2015,ACI 318-14,ACI 530
Concrete Stem Rebar Area	a Details				
Bottom Stem	Vertical	Reinforcing	Horizor	tal Reinfor	rcing
As (based on applied moment) :	0.1371	in2/ft			-
4/3) * As :	0.1828	in2/ft	Min Ste	em T&S Re	einf Area 1.440 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2	2/ft	Min Ste	em T&S Re	inf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728	in2/ft	Horizor	tal Reinfor	cing Options :
	======		One lay	/er of :	Two layers of :
Required Area :	0.1828	in2/ft	#4@ 12	2.50 in	#4@ 25.00 in
Provided Area :	0.2667	in2/ft	#5@ 19	9.38 in	#5@ 38.75 in
/laximum Area :	0.8467	in2/ft	#6@ 27	7.50 in	#6@ 55.00 in
Footing Data		Footing De	sign Re	sults	
Toe Width =	2.75 ft			Тое	Heel
Heel Width =	1.42	Factored Pressur	e =	1,378	0 psf
Total Footing Width =	4.17	Mu': Upward	=	48,532	17 ft-#
Footing Thickness =	10.00 in	Mu': Downward	=	8,984	329 ft-#
Key Width =	0.00 in	Actual 1-Way Sh	- ar =	22 43	8 29 nsi
Key Depth =	0.00 in	Allow 1-Way She	ar =	75.00	40.00 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= #	4 @ 9.00 ir	n
f'c = 2,500 psi Fy =	60,000 psi	Heel Reinforcing	= N	one Spec'd	
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= N	one Spec'd	
Min. As % =	0.0018	Footing Forsion, I	u 	=	0.00 ft-lbs
Cover@10p 2.00 @ Bi	III 3.00 III	Footing Allow. 10	sion, phi	iu =	U.UU π-IDS
		If torsion exc supplementa	eeds allo [.] I design f	wable, pro or footing	torsion.
		Other Acceptabl	e Sizes &	Spacing	s
		Toe: #4@ 11. Heel: phiMn = Key: No key d	l 1 in, #5@ ohi'5'lamb efined) 17.22 in, da'sqrt(fc)\$	#6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Sm
		Min footing T&S Min footing T&S If one layer of h #4@ 11.11 ir #5@ 17.22 ir #6@ 24 44 ir	S reinf Are S reinf Are orizontal I	a a per foot pars:	0.90 in2 0.22 in2 ift If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

Summary of Over	turr	ning & R	esisting F	orces & Mor	nents			
Item		OV Force Ibs	ERTURNING Distance ft	Moment		Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		1,227.2	2.61	3,204.4	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	632.8	3.79 3.79	2,400.4 2,400.4
Suoyant 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 =			
oad @ Stem Above Soil.	=				Soil Over Toe =	110.0	1.38	151.3
-	=				Surcharge Over Toe =			
					Stem Weight(s) =	750.0	3.08	2,312.5
					Earth @ Stem Transitions=			
Total	=	1,227.2	O.T.M. =	3,204.4	Footing Weight =	521.3	2.09	1,086.8
					Key Weight =			
Resisting/Overturning	Rati	io	=	1.86	Vert. Component =			
Vertical Loads used for	r Soi	I Pressure	= 2,014.	1 lbs	Total =	2 014 1	-	E 0E1 (

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	<u>e to settlement of soil</u>							
(Deflection due to wall bending not considered)	(Deflection due to wall bending not considered)							
Soil Spring Reaction Modulus	250.0 pci							
Horizontal Defl @ Top of Wall (approximate only)	0.049 in							
The above calculation is not valid if the heel soil bea	ring pressure exceeds that of the toe,							

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

Project Name/Number : (C02-D10	200
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Criteria				Soil Data							
Retained Height Wall height above soil Slope Behind Wall	= = =	5.00 ft 0.50 ft 0.00		Allow Soil Bearing Equivalent Fluid Pressure I Active Heel Pressure	= 2 Metho =	2,666.0 od 40.0	psf psf/ft				
Height of Soil over Toe	=	4.00 in		Passive Pressure	-	150.0	nsf/ft				
Water height over heel	=	0.0 ft		Soil Density Heel	-	120.00	ncf				
				Soil Density, Toe	=	120.00	pcf				
				Footing Soil Friction	=	0.450					
				Soil height to ignore						_	
				for passive pressure	=	12.00	in	Restraint			
Surcharge Loads				Lateral Load Applie	d to	Stem		Adjacent Footing	Load	1	
Surcharge Over Heel	=	0.0 psf		Lateral Load =		45.0 #	′ft	Adjacent Footing Load	=	0.0 lbs	-
NOT Used To Resist Sli	iding 8	& Overturning		Height to Top =		5.00 ft		Footing Width	=	0.00 ft	
NOT Used for Sliding &	- Overt	urning		Height to Bottom =		0.00 ft		Well to Eta CL Dist	-	0.00 m	
Avial Load Applied	10.0	tom		Load Type =	Sei	smic (E	.)	Footing Type	=	Line Load	
Axial Load Applied	10 5	lem			(Se	rvice Le	evel)	Base Above/Below Soil			
Axial Dead Load	=	0.0 lbs		Wind on Exposed Stem =		0.0 p	sf	at Back of Wall	=	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	ı]-	Bottom				
				Design Height Abov	ve Ftg	g ft=	0.00				
Wall Stability Ratios	=	1 00 P		Wall Material Abov	e "Ht		Concrete				
Slah Resist	te ΔII ?	1.29 Kat Sliding I	10 <	1.5! Design Method		=	LRFD				
Oldb Tresisi		Siluing :		I hickness Rebar Size		-	8.00				
Total Bearing Load	=	1.263 lbs		Rebar Spacing		_	10 00				
resultant ecc.	=	12.82 in		Rebar Placed at		=	Edge				
Coll Deserves @ Tes	_	4 700		Design Data			3-				
Soil Pressure @ Heel	-	0 nsf	OK	fb/FB + fa/Fa		=	0.307	,			
Allowable	=	2.666 nsf	0	Total Force @ See	ction						
Soil Pressure Less	Than	Allowable		Service Level		lbs =					
ACI Factored @ Toe	=	2,500 psf		Strength Level		lbs =	1,075.0				
ACI Factored @ Heel	=	0 psf		MomentActual		a					
Footing Shear @ Toe	=	18.1 psi	OK	Strength Level		ft # -	1 070 1	,			
Footing Shear @ Heel	=	4.4 psi	OK	Suengui Lever		11-# -	1,979.2				
Allowable	=	75.0 psi		womentAllowat	ле	=	0,444.1				
Sliding Calcs				SnearActual		noi r					
Lateral Sliding Force	=	905.6 lbs		Service Level		psi=					
				Strength Level		psi=	14.3				
				ShearAllowable		psi=	/5.0				
				Anet (Masonry)		in2 =	0.05				
				Repar Depth 'd'		in =	0.25				
				fm		nsi =					
				Fs		psi=					
ertical component of active	e later	al soil pressu	re IS	Solid Grouting		=					
OT considered in the calc	ulation	n of soil bearin	ng	Modular Ratio 'n'		=					
			-	Wall Weight		psf=	100.0				
oad Factors				Short Term Factor		=					
Building Code	IB	C 2015,ACI		Equiv. Solid Thick.		=					
Dead Load		1.400		Masonry Block Typ	be	=	Medium \	Veight			
Live Load		1.700		Masonry Design M	ethod	=	ASD				
Eartn, H		1.700		Concrete Data							
wind, W		1.300		fc		psi=	2,500.0				
Seismic, E		1.000		⊢y		psi =	60,000.0				

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Concrete Stem Reb	ar Ar	ea Details					
Bottom Stem		Vertical	Reinforcing I	Horiz	ontal Reinfor	rcing	
As (based on applied mor	nent):	0.0742	in2/ft			•	
(4/3) * As :		0.0989	in2/ft	Min S	Stem T&S Re	einf Area 1.0	056 in2
200bd/fy : 200(12)(6.25)/6	0000 :	0.25 in2	/ft I	Min \$	Stem T&S Re	einf Area pe	r ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :		0.1728	in2/ft I	Horiz	ontal Reinfor	rcing Option	is :
		======	====== (One	laver of :	Two lavers	s of :
Required Area :		0.1728	in2/ft #	4@	12.50 in	, #4@ 25.0	00 in
Provided Area :		0.24 in2	/ft a	¥5@	19.38 in	#5@ 38	75 in
Maximum Area :		0.8467	in2/ft #	#6@	27.50 in	#6@ 55.0	D0 in
Footing Data			Footing Desig	jn F	Results		
Toe Width	=	2.00 ft			Toe	Heel	
Heel Width	=	1.08	Factored Pressure	=	2,500	0 p	sf
Total Footing Width	=	3.08	Mu' : Upward	=	32,432	0 ft	-#
Footing Thickness	=	10.00 in	Mu' : Downward	=	5,544	87 ft	-#
Kev Width	=	0.00 in	Mu: Design	=	2,241	8/ Tt-	-#
Key Depth	=	0.00 in	Actual 1-Way Shear	-	75.00	4.37 p	si
Key Distance from Toe	=	0.00 ft	Toe Reinforcing	_	# 4 @ 10.00	40.00 p) in	51
fc = 2.500 psi	Fv =	60.000 psi	Heel Reinforcing	=	None Spec'o	d	
Footing Concrete Density	/ =	150.00 pcf	Key Reinforcing	=	None Spec'o	d	
Min. As %	=	0.0018	Footing Torsion, Tu		=	0.00	ft-lbs
Cover @ Top 2.00	@ E	3tm.= 3.00 in	Footing Allow. Torsic	n, pl	niTu =	0.00	ft-lbs
			If torsion exceed	ds al	lowable, pro	ovide	
			supplemental de	esigi	n for footing	y torsion.	
			Other Acceptable S	Sizes	s & Spacing	js	
			Toe: #4@ 11.11 i Heel: phiMn = phi Key: No key defir	n, #8 5'lan ned	5@ 17.22 in, nbda'sqrt(fc)'	#6@ 24.44 'Sm	in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
			Min footing T&S re	einf A	vrea	0.67	in2

min looding rao ronn raoa	0.01 1112
Min footing T&S reinf Area per foot	0.22 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

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	0	VERTURNING			RE\$	SISTING	
Item	Force lbs	Distance ft	ft-#		Force Ibs	Distance ft	ft-#
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	248.0	2.87	712.6
HL Act Pres (be water tbl) Hydrostatic Force				Soil Over HL (bel. water tbl) Watre Table		2.87	712.6
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	= 225.0	3.33	750.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil	=			Soil Over Toe =	80.0	1.00	80.0
-	=			Surcharge Over Toe =			
				Stem Weight(s) =	550.0	2.33	1,283.3
	007 -		0.070.0	Earth @ Stem Transitions=			
Total	= 905.6	0.T.M. =	2,073.3	Footing Weight =	385.0	1.54	592.9
				Key Weight =			
Resisting/Overturning	Ratio	=	1.29	Vert. Component =			
Vertical Loads used for	Soil Pressure	e = 1,263.0	0 lbs	Total =	1,263.0 lb	s R.M.=	2,668.8
				* Axial live load NOT included in resistance, but is included for	n total displaye soil pressure ca	d, or used fo alculation.	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

 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-06055289 License To : MALSAM TS	d 11.20 ANG E	0.03.31 ENGINEERING	}	Cantilevered Retaini	ing V	Vall	Code: IBC 2015,AC	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	= = = =	6.00 ft 0.50 ft 0.00 4.00 in 0.0 ft		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = = Passive Pressure = Soil Density Heel =	2,000.0 d 40.0 150.0) psf) psf/ft) psf/ft		
			:	Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	120.00 120.00 0.450 12.00) pcf) in	Reter	
Surcharge Loads			l	Lateral Load Applied to	Sterr	1 I	Adjacent Footing Lo	bad
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding 8	= liding a = Overt	0.0 psf & Overturning 0.0 turning	•	Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 # 0.00 ft 0.00 ft d (W)	/ft	Adjacent Footing Load = Footing Width = Eccentricity = Wall to Ftg CL Dist = Footing Tune	= 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		(Ser Wind on Exposed Stem ₌ (Service Level)	vice L 0.0 p	evel) sf	Base Above/Below Soil at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Design Summary	_	0.0		Stem Construction		Bottom		
Design Guinnary				Design Height About Fts		Stem Ok		
Wall Stability Ratios Overturning Slab Resis	= sts All	2.06 OK Sliding !	1	Wall Material Above "Ht" Design Method Thickness	=	Concrete LRFD 8.00		
Total Bearing Loadresultant ecc.	=	1,733 lbs 6.37 in		Rebar Size Rebar Spacing Rebar Placed at Design Data	=	# 4 11.00 Edge	 	
Soil Pressure @ Toe Soil Pressure @ Heel	=	886 psf 61 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.39	I	
Allowable Soil Pressure Les	= s Thar	2,000 pst Allowable		Service Level	lbs =			
ACI Factored @ Toe ACI Factored @ Heel	=	1,240 psf 86 psf		Strength Level MomentActual	lbs =	1,152.0	1	
Footing Shear @ Toe	=	16.6 psi	ок	Service Level	ft-# =			
Footing Shear @ Heel	=	6.3 psi	OK	Strength Level	ft-# =	2,304.0)	
Allowable	=	75.0 psi		Shoar Actual	=	5,663.0		
Lateral Sliding Force	_	033 0 lbc		Service Level	psi=			
Latoral onding 1 0100	-	333.3 103		Strength Level	psi=	15.4		
				ShearAllowable	psi =	75.0		
				Anet (Masonry)	in2 =			
				Rebar Depth 'd'	in =	6.25		
				fm	psi=			
				Fs	psi=			
Vertical component of activ	/e later	ral soil pressur	re IS	Solid Grouting Modular Patio 'n'	=			
NOT considered in the cald	Julation	n of soll bearin	g	Wall Weight		100.0	1	
Load Factors				Short Term Factor	=			
Building Code	IB	C 2015,ACI		Equiv. Solid Thick.	=			
Live Load		1.200		Masonry Block Type	=	Medium \	Veight	
Earth, H		1.600		Masonry Design Method	=	ASD		
Wind, W		1.000		fc	psi=	2,500.0	1	
Seismic, E		1.000		Fy	psi =	60,000.0	1	

Project Name/Number	: 1	(C02-D10)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENG	INEERING Canti	evered Reta	aining Wa	Code: IBC 2015,ACI 318-14,ACI 530
Concrete Stem Rebar Area	Details			
Bottom Stem	Vertical Reinforci	ng Hori	zontal Reinfo	orcing
As (based on applied moment) :	0.0863 in2/ft	-		-
4/3) * As :	0.1151 in2/ft	Min	Stem T&S R	teinf Area 1.248 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min	Stem T&S R	Reinf Area per ft of stem Height : 0.192 in2/ft
.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Hori	zontal Reinfo	prcing Options :
		One	alayer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@) 12.50 in	#4@ 25.00 in
Provided Area :	0.2182 in2/ft	#5@) 19.38 in	#5@ 38.75 in
/laximum Area :	0.8467 in2/ft	#6@) 27.50 in	#6@ 55.00 in
Footing Data	Fo	oting Design	Results	
Toe Width =	2.25 ft		Toe	Heel
Heel Width =	1.41 Factor	ed Pressure =	1.240	86 psf
Total Footing Width =	3.66 Mu': L	Jpward =	30,479	45 ft-#
Footing Thickness =	10.00 in Mu' : E	ownward =	6,014	280 ft-#
Key Width =	0.00 in Mu: D	esign =	2,039	235 ft-#
Key Depth =	0.00 in Actual	1-Way Shear =	16.57	6.28 psi
Key Distance from Toe =	0.00 ft Toe R	einforcing =	#4@1100	40.00 psi 0 in
fc = 2,500 psi Ev = 6	0.000 nsi Heel F	einforcina =	None Spec'	'd
Footing Concrete Density = 1	50.00 pcf Key Re	einforcing =	None Spec'	'd
Min. As % = 0	.0018 Footing	J Torsion, Tu	=	0.00 ft-lbs
Cover @ Top 2.00 @ Btm	.= 3.00 in Footing	Allow. Torsion, p	ohiTu =	0.00 ft-lbs
	lf te	orsion exceeds a	Illowable, pr	rovide a torsion.
	Other	Accentable Size	s & Spacing	as a state of the
	Toe	· #4@ 11 11 in #	5⊚ 17 22 in	#6@ 24 44 in #7@ 33 33 in #8@ 43 88 in #9@ 5
	Hee Key	I: phiMn = phi'5'lai No key defined	mbda'sqrt(fc)	, #0@ 24.44 II, #7@ 00.00 II, #0@ 40.00 II, #0@ 0 /Sm
	Min	footing T&S reinf	Area	0.79 in2
	IVIIN If on	e laver of horizoni	niea per 100t tal hars:	If two layers of horizontal bars:
	#4	@ 11 11 in	tai bai3.	#4@ 22 22 in
	#5	@ 17.22 in		#5@ 34.44 in
	#6	@ 24.44 in		#6@ 48.89 in

Summary of Overturning & Resisting Forces & Moments										
ltem		OV Force Ibs	ERTURNII Distance ft	NG Mo ft	ment -#	_		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		933.9	2.28	2	,127.2	Soil Over HL (ab. wate Soil Over HL (bel. wate Watre Table	r tbl) er tbl)	535.2	3.29 3.29	1,759.9 1,759.9
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 =			
oad @ Stem Above Soil	=					Soil Over Toe	=	90.0	1.13	101.3
0	=					Surcharge Over Toe	=			
						Stem Weight(s)	=	650.0	2.58	1,679.2
						Earth @ Stem Transitio	ns=			
Total	=	933.9	O.T.M.	= 2	,127.2	Footing Weight	=	457.5	1.83	837.2
						Key Weight	=			
Resisting/Overturning	Rati	io	=	2.06		Vert. Component	=			
Vertical Loads used fo	r Soi	Pressure	= 1,73	2.7 lbs		To	tal =	1 732 7	he PM =	4 377 6

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) 0.044 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.

Project Name/Number :	(C02-D10)	200
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tetainPro (c) 1987-2019, Build icense : KW-06055289 icense To : MALSAM TSA	111.20 ANG E	.03.31 ENGINEERIN	G	Cantilevered Reta	inin	gV	Vall	Code: IBC 2015,4	ACI 31	8-14,ACI 530
Criteria				Soil Data						
Retained Height Wall height above soil Slope Behind Wall	= = =	6.00 ft 0.50 ft 0.00		Allow Soil Bearing = Equivalent Fluid Pressure Me Active Heel Pressure =	2,6 ethod	66.0 40.0) psf) psf/ft			
Height of Soil over Toe	=	4.00 in		Passive Pressure =	: 1	50.0	nsf/ft			
Water height over heel	=	0.0 ft		Soil Density Heel =	12	00.0 0 00	ncf			
				Soil Density, Tee =	= 12	0.00	por			
				Footing Soil Friction =	: 0	.450				
				Soil height to ignore						
				for passive pressure =	12	2.00	in	Restraint		
Surcharge Loads				Lateral Load Applied	to St	tem		Adjacent Footing	Load	
Surcharge Over Heel	=	0.0 psf		Lateral Load =	54	.0 #/	/ft	Adjacent Footing Load	=	0.0 lbs
NUT Used To Resist SI	iding a	& Overturning		Height to Top =	6.0	00 ft		Footing Width	=	0.00 ft
NOT Used for Sliding &	= Overt	U.U Urning		Height to Bottom =	0.0	00 ft		Eccentricity	=	0.00 In
Avial Land Av. "	4- 0		_	Load Type = S	Seism	ic (E	E)	vvali to Ftg CL Dist	=	U.UU Π Line Load
Axial Load Applied	to S	tem		((Servio	ce Le	evel)	Base Above/Below Soil		LINE LUQU
Axial Dead Load	=	0.0 lbs	-	Wind on Exposed Stem _	0	.0 ps	sf	at Back of Wall	=	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		I —	Bottom			
				Design Height Above	Ftg	ft =	Stem OK 0.00			
Wall Stability Ratios	_			Wall Material Above '	"Ht"	=	Concrete			
Overturning Slob Booist	- +o All 1	1.24 Rat	tio <	1.5! Design Method		=	LRFD			
Siab Resis	IS All	Siluing !		Thickness		=	6.00			
Total Bearing Load	=	1.596 lbs		Rebar Size		-	# 4			
resultant ecc.	=	16.50 in		Rebar Placed at		_	Edge			
0.1D 0.T		0.400	~	Design Data			Lugo			
Soil Pressure @ Toe	-	2,129 psi 0 psf	OK	fb/FB + fa/Fa		=	0.835			
Allowable	_	2.666 psf	011	Total Force @ Section	on					
Soil Pressure Less	- Thar	Allowable		Service Level	lb	s =				
ACI Factored @ Toe	=	2,981 psf		Strength Level	lb	os =	1,476.0			
ACI Factored @ Heel	=	0 psf		MomentActual		<i>щ</i> _				
Footing Shear @ Toe	=	23.3 psi	OK	Strength Level	11- ft	-# - # -	3 276 0			
Footing Shear @ Heel	=	7.9 psi	OK	Strength Level	n.	-# -	3,270.0			
Allowable	=	75.0 psi		NomentAllowable		=	3,920.0			
Sliding Calcs				SnearActual	_					
Lateral Sliding Force	=	1,257.9 lbs		Service Level	р	si=				
				Strength Level	р	si=	28.9			
				ShearAllowable	р	si =	/5.0			
				Anet (Masonry)	in	12 =	4.05			
				Repar Depth I'd	I	in =	4.25			
				fm	n	si =				
				Fs	p n	si=				
ertical component of activ	e later	al soil pressu	re IS	Solid Grouting	Ρ	=				
OT considered in the calc	ulation	n of soil bearin	ng	Modular Ratio 'n'		=				
			-	Wall Weight	p	sf=	75.0			
oad Factors				Short Term Factor		=				
Building Code	IB	C 2015,ACI		Equiv. Solid Thick.		=				
Dead Load		1.200		Masonry Block Type		=	Medium V	Veight		
Live Load		1.600		Masonry Design Meth	hod	=	ASD			
Earui, H		1.600		Concrete Data			0.500.0			
wind, W Sciemic E		1.000		ťc	р	si =	2,500.0			
SeisiTIIC, E		1.000		⊢y	р	si =	60,000.0			

icense : KW-06055289 icense To : MALSAM TSANG EN	GINEERING	Cantilevered F	letai	ning Wa	II Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Are	a Details				
Bottom Stem	Vertica	al Reinforcing	Horizo	ntal Reinfor	rcina
As (based on applied moment) :	0.1852	! in2/ft			5
(4/3) * As :	0.2469	in2/ft	Min S	em T&S Re	einf Area 0.936 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 ir	2/ft	Min S	tem T&S Re	einf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296	in2/ft	Horizo	ontal Reinfor	rcing Options :
	=====		One la	ayer of :	Two layers of :
Required Area :	0.1852	in2/ft	#4@ '	16.67 in	#4@ 33.33 in
Provided Area :	0.2182	in2/ft	#5@ 2	25.83 in	#5@ 51.67 in
/laximum Area :	0.5757	in2/ft	#6@ 3	86.67 in	#6@ 73.33 in
Footing Data		Footing Desi	gn R	esults	
Toe Width =	2.50 ft			Тое	Heel
Heel Width =	1.25	Factored Pressure	=	2,981	0 psf
Total Footing Width =	3.75	Mu': Upward	=	53,639	0 ft-#
Footing Thickness =	10.00 in	Mu: Design	-	7,425	285 TT-# 285 ft #
Key Width =	0.00 in	Actual 1-Way Shea	r =	23.28	7.92 nei
Key Depth =	0.00 in	Allow 1-Way Shear		75.00	40.00 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= #	4 @ 11.00	in .
f'c = 2,500 psi Fy =	60,000 psi	Heel Reinforcing	1 =	Ione Spec'd	1
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= r	vone Specio	0.00 ft lba
Cover@Top 2.00 @Bi	tm = 3.00 in	Footing Allow Tors	on nh	- Tu =	0.00 ft-lbs
		If toroion avon	de elle		
		supplemental of	lesian	for footing	torsion.
		Other Acceptable	Sizes	& Spacing	ļs
		Toe: #4@ 11.11 Heel: phiMn = ph Key: No key def	in, #5(i'5'lam ined	@ 17.22 in, bda'sqrt(fc)'	#6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Sm
		Min footing T&S f Min footing T&S r If one layer of hor #4@ 11.11 in #5@ 17.22 in #6@ 24.44 in	reinf Ar reinf Ar izontal	ea ea per foot bars:	0.81 in2 0.22 in2 .ft If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 44.89 in

footing T&S reinf Area per foot	0.22 in2 /ft
ne layer of horizontal bars:	If two layers of horizontal bars:
4@ 11.11 in	#4@ 22.22 in
5@ 17.22 in	#5@ 34.44 in
6@ 24.44 in	#6@ 48.89 in

RetainPro (c) 1987-2019, Build 11:20:03:31 License : KW06055299 License To : MALSAM TSANG ENGINEERING Code: IBC 2015,ACI 318-14,ACI 530-13 Summary of Overfurning & Recisting Forces & Momente

	-	OV	ERTURNIN	G		RE	RESISTING		
Item	Fo	bs	Distance ft	ft-#		Force lbs	Distance ft	ft-#	
HL Act Pres (ab water tbl)		933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	540.0	3.38	1,822.5	
HL Act Pres (be water tbl) Hydrostatic Force				·	Soil Over HL (bel. water tbl) Watre Table		3.38	1,822.5	
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 Stem =				
Added Lateral Load	=	324.0	3.83	1,242.0	* Axial Live Load on Stem =				
Load @ Stem Above Soil	=			· -	Soil Over Toe =	100.0	1.25	125.0	
	=				Surcharge Over Toe =				
					Stem Weight(s) =	487.5	2.75	1,340.6	
-		057.0	·		Earth @ Stem Transitions=				
Total	= 1,	,257.9	0.T.M. =	3,369.2	Footing Weight =	468.8	1.88	878.9	
					Key Weight =				
Resisting/Overturning Ratio = 1.24				Vert. Component =					
Vertical Loads used for	Soil Pre	essure :	= 1,596	5.3 lbs	Total =	1,596.3 I	bs R.M.=	4,167.0	
					* Axial live load NOT included resistance, but is included fo	in total display r 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

 Horizontal Defl @ Top of Wall (approximate only)
 0.103 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 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING			3	Cantilevered Retain	ing V	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	= = =	6.00 ft 0.50 ft 0.00 4.00 in	1	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = =	2,000.0 d 40.0) psf) 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 =	150.0 120.00 120.00 0.450 12.00) psf/ft) pcf) pcf) in		
Surcharge Loads				Lateral Load Applied to	Stem	ו ו	Adjacent Footing Load	
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding & Axial Load Applied	= liding & Overt I to S	0.0 psf & Overturning 0.0 urning Stem		Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Ser	0.0 # 0.00 ft 0.00 ft d (W) vice L	evel)	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft Footing Type Line Load	
Axial 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	śf	Base Above/Below Soil=0.0 ftat Back of Wall=0.300	
Design Summary				Stem Construction		Bottom		
Wall Stability Ratios Overturning Slab Resis	= its All :	2.13 Ok Sliding !	ĩ	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Paper Size	ft = = =	Concrete LRFD 6.00		
Total Bearing Load resultant ecc.	= =	1,766 lbs 6.11 in		Rebar Spacing Rebar Placed at	=	# 4 11.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel	=	855 psf 87 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.587		
Allowable Soil Pressure Les ACI Factored @ Toe	s Thar	Allowable 1,197 psf		Service Level Strength Level MomentActual	lbs = lbs =	1,152.0		
Footing Shear @ Toe Footing Shear @ Heel	=	16.2 psi 7.8 psi	OK OK	Service Level Strength Level	ft-# = ft-# =	2,304.0		
Allowable Sliding Calcs Lateral Sliding Force	=	75.0 psi		MomentAllowable ShearActual Service Level	= psi=	3,920.0		
Ĵ				Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = psi = in2 = in =	22.6 75.0 4.25		
Vertical component of activ	re later	ral soil pressu	re IS	fm Fs Solid Grouting	psi= psi= =			
NOT considered in the calc	ulation	n of soil bearin	g	Modular Ratio 'n' Wall Weight Short Term Factor	= psf= =	75.0		
Building Code Dead Load Live Load Farth H	IB	C 2015,ACI 1.200 1.600 1.600		Equiv. Solid Thick. Masonry Block Type Masonry Design Method	=	Medium \ ASD	Veight	
Wind, W Seismic, E		1.000		fc Fy	psi = psi =	2,500.0 60,000.0		
Project Name/Number	: 1	(C02-D10)	200					
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cense : KW-06055289 cense To : MALSAM TSANG ENG	Cantilevere	ed Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforci	ng
As (based on applied moment) :	0.1302 in2/ft		-
4/3) * As :	0.1737 in2/ft	Min Stem T&S Rein	f Area 0.936 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Rein	f Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforci	ng Options :
	============	One layer of : T	wo layers of :
Required Area :	0.17 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2182 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in
Footing Data	Footing I	Design Results	
Toe Width =	2.25 ft	Тое	Heel
Heel Width =	1.50 Factored Pres	sure = 1,197	122 psf
Total Footing Width =	3.75 Mu': Upward	= 29,827	109 ft-#
Footing Thickness =	10.00 in Mu': Downwai	rd = 6,014	507 ft-#
Key Width =	0.00 in Actual 1-Way	- 1,904 Shear = 16.17	7 80 nsi
Key Depth =	0.00 in Allow 1-Way S	Shear = 75.00	40.00 psi
Key Distance from Toe =	0.00 ft Toe Reinforcin	ng = # 4 @ 11.00 in	
fc = 2,500 psi Fy = 60),000 psi Heel Reinforci	ng = None Spec'd	
Footing Concrete Density = 1	50.00 pcf Key Reinforcin	ig = None Spec'd	
Min. As % = 0.	U018 Footing Iorsio	n, lu =	0.00 ft-lbs
Cover @ rop 2.00 @ Buil.	= 5.00 III Footing Allow.	Torsion, pni Tu =	0.00 π-IDS
	If torsion e supplement	exceeds allowable, provi ntal design for footing to	de orsion.
	Other Accept	able Sizes & Spacings	
	Toe: #4@.	11.11 in, #5@ 17.22 in, #6	@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
	Heel: phiMn Key: No ke	ı = phi'5'lambda'sqrt(fc)'Sn y defined	
	Min footing	T&S reinf Area	0.81 in2
	Min tooting	i &o reini Area per toot	U.22 III2 /IL f two lowers of borizontal bars:
	#4@ 11 1	1 in	#4@ 22.22 in
	#5@ 17.2	2 in	#5@ 34.44 in
	#6@ 24.4	4 in	#6@ 48.89 in

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Summary of Over	turni	ing & R	esisting F	orces & Mon	nents			
Item		OV 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		933.9	2.28	2,127.2	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	720.0	3.25 3.25	2,340.0 2,340.0
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 =	90.0	1.13	101.3
	=				Surcharge Over Toe =			
					Stem Weight(s) =	487.5	2.50	1,218.8
					Earth @ Stem Transitions =			
Total	=	933.9	O.T.M. =	2,127.2	Footing Weight =	468.8	1.88	878.9
					Key Weight =			
Resisting/Overturning	Ratio		=	2.13	Vert. Component =			
Vertical Loads used fo	r Soil I	Pressure :	= 1,766	.3 lbs	Total =	1.766.3	bs R.M.=	4.538.9
					* Axial live load NOT included in resistance, but is included for	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
Horizontal Defl @ Top of Wall (approximate only)	0.041 in
The above calculation is not valid if the heel soil bearing	ng pressure exceeds that of the toe,

Project Name/Number : (C02-D10	200
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etainPro (c) 1987-2019, Build cense : KW-06055289 icense To : MALSAM TS/	11.20 ANG E	.03.31 NGINEERIN	3	Cantilevered Retaini	ing V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	5.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Methor Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
Height of Soil over Toe Water height over heel	=	4.00 in 0.0 ft		= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore	250.0 120.00 120.00 0.450) psf/ft) pcf) pcf)	
			- r	for passive pressure =	12.00	in	Restriet
Surcharge Loads			ιL	Lateral Load Applied to	Stem	1	Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding &	= iding & = Overti	0.0 psf Verturning 0.0 urning		Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 # 0.00 ft 0.00 ft d (W)	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied Axial Dead Load	to S =	0.0 lbs		(Ser Wind on Exposed Stem ₌	vice L 0.0 p	evel) sf	Base Above/Below Soil at Back of Wall = 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] -	Bottom	,
Wall Stability Ratios Overturning Slab Resis	= ts All \$	1.78 Ok Sliding !	¢	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = = = =	0.00 Concrete LRFE 8.00	
Total Bearing Load resultant ecc.	= =	1,222 lbs 6.82 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 4 11.00 Edge	•) 9
Soil Pressure @ Toe Soil Pressure @ Heel	=	962 psf 0 psf	OK OK	Design Data fb/FB + fa/Fa Total Force @ Section	=	0.22	6
Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= Than = =	Allowable 1,346 psf 0 psf		Service Level Strength Level MomentActual	lbs = Ibs =	800.0)
Footing Shear @ Toe Footing Shear @ Heel	= =	10.2 psi 3.7 psi	OK OK	Service Level Strength Level Moment Allowable	ft-# = ft-# = =	1,333.3	3
liding Calcs Lateral Sliding Force	=	680.6 lbs		ShearActual Service Level	psi=	0,000.0	
				Strength Level ShearAllowable Anet (Masonry)	psi = psi = in2 =	10.7 75.0	·)
				Rebar Depth 'd' Masonry Data	in =	6.25	;
rtical component of activ IT considered in the calc	e later ulatior	al soil pressu ı of soil bearir	re IS	rm Fs Solid Grouting Modular Ratio 'n'	psi= psi= =		
bad Factors Building Code	IB	C 2015,ACI		 Wall Weight Short Term Factor Equiv. Solid Thick. 	psf = = =	100.0)
Dead Load Live Load Farth, H		1.200 1.600 1.600		Masonry Block Type Masonry Design Method	=	Medium \ ASD	Neight
Wind, W Seismic, E		1.000		fc Fy	psi = psi =	2,500.0 60,000.0)

RetainPro (c) 1987-2019, Build 11.20.03 License : KW-06055289 License To : MALSAM TSANG EN	GINEERING	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
(4/3) * As :	0.0666 in2/ft	Min Stem T&S Reinf A	rea 1.056 in2
200bd/fv : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf A	rea per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing	Options :
		One laver of : Two	lavers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in #4	@ 25.00 in
Provided Area :	0.2182 in2/ft	#5@ 19.38 in #50	@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6	@ 55.00 in
Footing Data	Footing De	esign Results	
Toe Width = Heel Width = Total Footing Width = Footing Thickness = Key Width = Key Depth = Key Distance from Toe = fc = 2,500 psi Fy = Footing Concrete Density = Min. As % = = Cover @ Top 2.00 @ Btr	1.75 ft 1.08 Factored Pressu 2.83 Mu': Upward 10.00 in Mu': Design 0.00 in Actual 1-Way Sh 0.00 in Allow 1-Way Sh 0.00 in Allow 1-Way Sh 0.00 in Allow 1-Way Sh 0.00 ft Toe Reinforcing 60,000 psi Heel Reinforcing 150.00 pcf Key Reinforcing Torsian, 0.0018 Footing Allow. To	Toe H re 1,346 - = 1,9058 - - = 1,285 - - = 1,285 - - - ear = 0.22 - - - ear = 0.04 - <t< td=""><td>eel 0 psf 0 ft# 74 ft-# 74 ft-# 0.00 psi 0.00 ft-lbs 0.00 ft-lbs</td></t<>	eel 0 psf 0 ft# 74 ft-# 74 ft-# 0.00 psi 0.00 ft-lbs 0.00 ft-lbs
	If torsion exe	ceeds allowable, provide	
	supplementa	al design for footing tors	ion.
	Other Acceptab	le Sizes & Spacings	
	Toe: phiMn = Heel: phiMn = Key: No key	phi'5'lambda'sqrt(fc)'Sm phi'5'lambda'sqrt(fc)'Sm defined	
	Min footing T& Min footing T& If one layer of #4@ 11.11 i #5@ 17.22 i #6@ 24.44 i	S reinf Area (S reinf Area per foot (horizontal bars: If tv in # in #	0.61 in2 0.22 in2.ft vo layers of horizontal bars: 14@ 22.22 in 15@ 34.44 in 6@ 48.89 in

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW06055289 License To : MALSAM TSANG ENGINEERING Summary of Overturning & Resisting Forces & Moments

OVERTURNING				RI				
Item	_	Force lbs	Distance ft	ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	248.0	2.62	650.6
HL Act Pres (be water tbl Hydrostatic Force)				Soil Over HL (bel. water tbl) Watre Table		2.62	650.6
Buoyant Force	=				Sloped Soil Over Heel =			
Surcharge over Heel	=				Surcharge Over Heel =			
Surcharge Over Toe	=				Adjacent Footing Load =			
Adiacent Footing Load	=				Axial Dead Load on Stem =			
Added Lateral Load	=				* Axial Live Load on Stem =			
oad @ Stem Above Soi	=				Soil Over Toe =	70.0	0.88	61.3
-	=				Surcharge Over Toe =			
					Stem Weight(s) =	550.0	2.08	1,145.8
					Earth @ Stem Transitions=			
Total	=	680.6	O.T.M. =	1,323.3	Footing Weight =	353.8	1.42	500.6
					Key Weight =			
Resisting/Overturning	g Rat	io	=	1.78	Vert. Component =			
Vertical Loads used for	or Soi	il Pressure	= 1,221.	8 lbs	Total =	1,221.8	lbs R.M.=	2,358.2
					* Axial live load NOT included resistance, but is included fo	in total display r soil pressure	red, or used for calculation.	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)
 0.052
 in

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

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

RetainPro (c) 1987-2019, Buil License : KW-06055289 License To : MALSAM TS	d 11.20 ANG E	.03.31 NGINEERING	}	Cantilevered Retaini	ing V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-1
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	5.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
Height of Soil over Toe Water height over heel	=	4.00 in 0.0 ft		= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	250.0 120.00 120.00 0.450 12.00) psf/ft) pcf) pcf in	
Surcharge Loads			ľ	Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding & Axial Load Applied	liding & = Overti I to S	0.0 psf & Overturning 0.0 urning tem		Lateral Load = Height to Top = Height to Bottom = Load Type = Seis (Ser	45.0 # 5.00 ft 0.00 ft mic (E vice Le	/ft E) evel)	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft Footing Type Line Load
Axial 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 = 0.0 ft Poisson's Ratio = 0.300
Design Summary				Stem Construction] -	Bottom	
Wall Stability Ratios Overtuming Slab Resis	= sts All \$	1.43 Rat Sliding !	io <	Design Height Above Ftg Wall Material Above "Ht" 1.5! Design Method Thickness Rehar Size	ft = = = =	0.00 Concrete LRFD 6.00	
Total Bearing Load resultant ecc.	= =	1,349 lbs 11.59 in		Rebar Spacing Rebar Placed at	=	11.00 Edge	, ,
Soil Pressure @ Toe Soil Pressure @ Heel	=	1,365 psf 0 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.483	3
Soil Pressure Les	s Than	Allowable		Service Level Strength Level	lbs = lbs =	1.025.0	
ACI Factored @ Heel	=	0 psf		MomentActual	ft_# =	,	
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	18.5 psi 6.8 psi 75.0 psi	OK OK	Strength Level MomentAllowable	ft-# = =	1,895.8 3,920.0	3
Sliding Calcs Lateral Sliding Force	=	905.6 lbs		SnearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = psi = psi = in2 = in =	20.1 75.0 4.25	
V	- 1-4	-1 11	- 10	Masonry Data fm Fs Solid Crouting	psi = psi =		
NOT considered in the calc	ulation	a soil pressui of soil bearin	g IS	Modular Ratio 'n' Wall Weight	= = psf=	75.0)
Load Factors Building Code Dead Load Live Load	IB	C 2015,ACI 1.200 1.600		Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = =	Medium \ ASD	Veight
Wind, W Seismic, E		1.000 1.000 1.000		Concrete Data fc Fy	psi = psi =	2,500.0 60,000.0)

Project Name/Number	:	(C02-D10	200
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cense : KW-06055289 cense To : MALSAM TSA	NG ENGINEERING	Cantilevered	1 Retaining V	Code: IBC 2	015,ACI 318-14,ACI 530-1
Concrete Stem Reba	r Area Details				
Bottom Stem	Vertica	Reinforcing	Horizontal Reir	forcing	
As (based on applied mome	ent): 0.1072	in2/ft			
4/3) * As :	0.1429	in2/ft	Min Stem T&S	Reinf Area 0.792 in2	
200bd/fy : 200(12)(4.25)/60	000 : 0.17 in	2/ft	Min Stem T&S	Reinf Area per ft of stem He	ight : 0.144 in2/ft
).0018bh : 0.0018(12)(6) :	0.1296	in2/ft	Horizontal Reir	forcing Options :	
	=====		One layer of :	Two layers of :	
Required Area :	0.1429	in2/ft	#4@ 16.67 in	#4@ 33.33 in	
Provided Area :	0.2182	in2/ft	#5@ 25.83 in	#5@ 51.67 in	
Maximum Area :	0.5757	in2/ft	#6@ 36.67 in	#6@ 73.33 in	
Footing Data		Footing De	esign Results		
Toe Width	= 2.00 ft		Toe	Heel	
Heel Width	= 1.25	Factored Pressu	ure = <u>1.91</u> 0	0 psf	
Total Footing Width	= 3.25	Mu' : Upward	= 30,387	0 ft-#	
Footing Thickness	= 10.00 in	Mu' : Downward	= 4,752	245 ft-#	
Key Width	= 0.00 in	Mu: Design	= 2,136	245 ft-#	
Key Depth	= 0.00 in	Actual 1-Way Sr	1ear = 18.54	6.80 psi	
Key Distance from Toe	= 0.00 ft	Toe Reinforcing	= #4@11	10.00 psi	
fc = 2.500 psi F	v = 60.000 psi	Heel Reinforcing	a = None Spe	c'd	
Footing Concrete Density	= 150.00 pcf	Key Reinforcing	= None Spe	c'd	
Min. As %	= 0.0018	Footing Torsion,	Tu =	0.00 ft-lbs	
Cover @ Top 2.00	@ Btm.= 3.00 in	Footing Allow. To	orsion, phi Tu =	0.00 ft-lbs	
		If torsion ex supplement	ceeds allowable, al design for foot	provide ng torsion.	
		Other Acceptat	ole Sizes & Spac	nas	
		Toe: #4@ 11 Heel: phiMn = Key: No key	.11 in, #5@ 17.22 phi'5'lambda'sqrt(defined	n, #6@ 24.44 in, #7@ 33.33 c)'Sm	in, #8@ 43.88 in, #9@ 5
		Min footing T8 Min footing T8 If one layer of #4@ 11.11 #5@ 17.22 #6@ 24.44	S reinf Area S reinf Area per fo horizontal bars: in in in	0.70 in2 ot 0.22 in2 /ft If two layers of horizonta #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in	il bars:

Item OVERTURNING Force OVERTURNING ft Broce Moment bis HL Act Pres (ab water tbl) HL Act Pres (be water tbl) HL Act Pres (be water tbl) HL Act Pres (be water tbl) Hydrostatic Force 680.6 1.94 1,323.3 Soil Over HL (ab. water tbl) Water Table 450.0 2.88 Buoyant Force = Soil Over HL (bel. water tbl) Water Table 2.88 Soil Over HL (bel. water tbl) Water Table 2.88 Surcharge Over Toe = Surcharge Over Heel = Surcharge Over Heel = Adjacent Footing Load = Adjacent Footing Load = Axial Dead Load on Stem = Load @ Stem Above Soil = = Soil Over Toe = Soil Over Toe = Total = 905.6 O.T.M. = 2.073.3 Earth @ Stem Transitions=	Summary of Overturning & Resisting Forces & Moments											
HL Act Pres (ab water tbi) HL Act Pres (ab water tbi) HL Act Pres (be water tbi) HL Act Pres (be water tbi) HJ	em	_	OV Force Ibs	ERTURNING Distance ft	G Moment ft-#		Rl Force Ibs	Moment ft-#				
Duoyant 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 = 225.0 3.33 750.0 * Axial Live Load on Stem = Load @ Stem Above Soil = Surcharge Over Toe = Soil Over Toe = 80.0 1.00	HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		680.6	1.94	1,323.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	450.0	2.88 2.88	1,293.8 1,293.8			
Surcharge over Heel = Surcharge Over Heel = Surcharge Over Toe = Adjacent Footing Load = Adjacent Footing Load = Axial Dead Load on Stem = Added Lateral Load = 225.0 3.33 750.0 * Axial Live Load on Stem = Load @ Stem Above Soil =	uoyant Force	=				Sloped Soil Over Heel =						
Surcharge Over Toe = Adjacent Footing Load = Adjacent Footing Load = Axial Dead Load on Stem = Added Lateral Load = 225.0 3.33 750.0 * Axial Dead Load on Stem = .coad @ Stem Above Soil = = Soil Over Toe = 80.0 1.00	urcharge over Heel	=				Surcharge Over Heel =						
Adjacent Footing Load = Axial Dead Load on Stem = Added Lateral Load = 225.0 3.33 750.0 * Axial Live Load on Stem = -coad @ Stem Above Soil = Soil Over Toe = 80.0 1.00 = Surcharge Over Toe = 412.5 2.25 Earth @ Stem Transitions= Total = 905.6 O.T.M. = 2,073.3 Footing Weight = 406.3 1.63	urcharge Over Toe	=				Adjacent Footing Load =						
Added Lateral Load = 225.0 3.33 750.0 * Axial Live Load on Stem = .cad @ Stem Above Soil = Soil Over Toe = 80.0 1.00 = Surcharge Over Toe = Stem Weight(s) = 412.5 2.25 Earth @ Stem Transitions= Total = 905.6 0.T.M. = 2,073.3 Follow Provided Action Stem = Stem Weight = 406.3 1.63	djacent Footing Load	=				Axial Dead Load on Stem =						
.oad @ Stem Above Soil =	dded Lateral Load	=	225.0	3.33	750.0	* Axial Live Load on Stem =						
Total = Surcharge Over Toe = Total = 905.6 O.T.M. = 2,073.3 Earth @ Stem Transitions= Footing Weight = 406.3 1.63	oad @ Stem Above Soi	=				Soil Over Toe =	80.0	1.00	80.0			
Total = 905.6 O.T.M. = 2,073.3 Earth @ Stem Transitions= Footing Weight(s) = 412.5 2.25		=				Surcharge Over Toe =						
Total = 905.6 O.T.M. = 2,073.3 Footing Weight = 406.3 1.63						Stem Weight(s) =	412.5	2.25	928.1			
Footing Weight = 406.3 1.63	Total	_	005.6	отм <u>–</u>	2 072 2	Earth @ Stem Transitions=						
0 0	TOLAI	=	905.0	0.1.WI. =	2,073.3	Footing Weight =	406.3	1.63	660.2			
Key Weight =						Key Weight =						
Resisting/Overturning Ratio = 1.43 Vert. Component =	Resisting/Overturnin	Rat	10	=	1.43	Vert. Component =		-				

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 onl	y) 0.064 in
The above calculation is not valid if the heel soi	bearing pressure exceeds that of the toe,

Project Name/Number : (C02-D10	200
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RetainPro (c) 1987-2019, Build .icense : KW-06055289 .icense To : MALSAM TS/	d 11.20. ANG E	03.31 NGINEERIN	3	Cantilevered Retaini	ng V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	5.00 ft 0.50 ft 0.00	•	Allow Soil Bearing = 2 Equivalent Fluid Pressure Methor Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
Height of Soil over Toe Water height over heel	=	4.00 in 0.0 ft		= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore	150.0 120.00 120.00 0.450	psf/ft pcf pcf	
Surobarga Laada			. (tor passive pressure =	12.00	n l	Adjacent Feeting Lood
Surcharge Loads				Lateral Load Applied to	Stern		Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding &	= liding & = Overtu	0.0 psf Overturning 0.0 urning		Lateral Load = Height to Top = 1 Height to Bottom = 1 Load Type = Win	0.0 # 0.00 ft 0.00 ft d (W)	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied	l to Si	0.0 lbs		(Ser Wind on Exposed Stem =	vice Lo 0.0 p	evel) sf	Footing Type Line Load Base Above/Below Soil at Back of Wall = 0.0 ft
Axial Load Eccentricity	=	0.0 in		(Service Level)			Poisson's Ratio = 0.300
Design Summary)		Stem Construction] -	Bottom	
				Design Height Above Ftg	ft =	Stem OK 0.00	
Wall Stability Ratios	=	4.00.04		Wall Material Above "Ht"	=	Concrete	
Slab Resie		1.99 OF	•	Design Method	=	LRFD	
Sidu Nesis		siung :		I hickness	=	6.00	
Total Bearing Load	-	1 308 lbc		Rebar Size	-	# 4	
resultant ecc	-	6.01 in		Rebar Spacing	=	12.00)
ooditant ooo.		0.01 11		Repar Placed at	=	Eage	
Soil Pressure @ Toe	=	872 psf	OK	fb/EB + fa/Ea	=	0.369	9
Soil Pressure @ Heel	=	0 psf	OK	Total Force @ Section		0.000	•
Allowable	=	2,000 psf		Sanvica Lavel	lbe =		
Soil Pressure Less	s Than	Allowable		Strongth Lovel	Ibo =	000 0	
ACI Factored @ Toe	=	1,221 psf		Moment Actual	ibs –	800.0)
ACI Factored @ Heel	=	0 pst		Service Level	ft_# =		
Footing Shear @ Toe	=	9.6 psi	OK	Strength Level	ft_# =	1 333 3	3
Footing Shear @ Heel	=	5.6 psi	OK	Moment Allowable	-	3 612 6	
Allowable	=	75.0 psi		Sheer Actual	-	3,012.0	,
Bliding Calcs				SnearActual	noi r		
Lateral Sliding Force	=	680.6 lbs		Strength Level	psi =		
				Strength Level	psi=	15.7	
				SnearAllowable	psi=	75.0	1
				Anet (Masonry)	in2 =	4.05	
				Repar Deptn .d	in =	4.25	
				fm	nei =		
				Fs	psi=		
rtical component of activ	e later:	al soil pressu	re IS	Solid Grouting	=		
OT considered in the calc	ulation	of soil bearing	a .c	Modular Ratio 'n'	=		
			5	Wall Weight	psf=	75.0)
oad Factors				Short Term Factor	=	. 0.0	
Building Code	IBC	C 2015,ACI		Equiv. Solid Thick.	=		
Dead Load		1.200		Masonry Block Type	=	Medium \	Weight
Live Load		1.600		Masonry Design Method	=	ASD	-
Earth, H		1.600		Concrete Data			
Wind, W		1.000		fc	psi=	2,500.0)
Seismic, E		1.000		Fy	psi =	60,000.0)

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20.03.31 NG ENGINEERING	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Reba	r Area Details			
Bottom Stem As (based on applied mome	vertica	I Reinforcing	Horizontal Reinforcin	g
(4/3) * As :	0.1005	in2/ft	Min Stem T&S Reinf	Area 0.792 in2
200bd/fv : 200(12)(4.25)/60	000 : 0.17 ir	2/ft	Min Stem T&S Reinf	Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296	in2/ft	Horizontal Reinforcin	a Options :
	=====	======	One laver of : Tv	vo lavers of :
Required Area :	0.1296	in2/ft	#4@ 16.67 in #	4@ 33.33 in
Provided Area :	0.2 in2	/ft	#5@ 25.83 in #	5@ 51.67 in
Maximum Area :	0.5757	in2/ft	#6@ 36.67 in #	46@ 73.33 in
Footing Data		Footing De	sign Results	
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Distance from Toe fc = 2,500 psi F Footing Concrete Density Min. As % Cover @ Top 2.00	$\begin{array}{c} = & 1.75 \text{ ft} \\ = & 1.25 \\ = & 3.00 \\ = & 0.00 \text{ in} \\ = & 0.00 \text{ in} \\ = & 0.00 \text{ ft} \\ y = & 60,000 \text{ psi} \\ = & 150.00 \text{ pci} \\ = & 0.0018 \\ @ Btm.= & 3.00 \text{ in} \end{array}$	Factored Pressu Mu': Upward Mu': Downward Mu: Design Actual 1-Way Sh Allow 1-Way She Toe Reinforcing Heel Reinforcing Key Reinforcing Footing Torsion, Footing Allow. To	Toe e 1,221 = 18,072 = 3,638 = 1,203 ear 9,58 ar 40.00 = None Spec'd = None Spec'd = None Spec'd ru = rsion, phi Tu =	Heel O psf 28 ft.# 245 ft.# 245 ft.# 216 ft.# 5.61 psi 40.00 psi 0.00 ft-lbs 0.00 ft-lbs
		If torsion exc	eeds allowable, provid	de
		supplementa	I design for footing tor	rsion.
		Other Acceptab	e Sizes & Spacings	
		Toe: phiMn = Heel: phiMn = Key: No key o	phi'5'lambda'sqrt(fc)'Sm phi'5'lambda'sqrt(fc)'Sm lefined	
		Min footing T& Min footing T& If one layer of I #4@ 11.11 ii #5@ 17.22 ii #6@ 24.44 ii	S reinf Area S reinf Area per foot norizontal bars: If n n	0.65 in2 0.22 in2 /tt two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

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Summary of Overturning & Resisting	ng Forces & Moments	
OVERTUR	NING	DEGUGENIO

Mar	Force	Distance	Moment		Force	Distance	Moment
item	IDS	п	IL-#		IDS	п	11-#
HL Act Pres (ab water tbl)	680.6	1.94	1.323.3	Soil Over HL (ab. water tbl)	450.0	2.63	1,181.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.63	1,181.3
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 =	70.0	0.88	61.3
=				Surcharge Over Toe =			
				Stem Weight(s) =	412.5	2.00	825.0
- · · · -				Earth @ Stem Transitions=			
Total =	680.6	O.T.M. =	1,323.3	Footing Weight =	375.0	1.50	562.5
				Key Weight =			
Resisting/Overturning R	atio	=	1.99	Vert. Component =			
Vertical Loads used for S	ioil Pressure	= 1,307.5	5 lbs	Total =	1,307.5	s R.M.=	2,630.0
				* Axial live load NOT included i resistance, but is included for	n total displaye soil pressure o	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

 Horizontal Defl @ Top of Wall (approximate only)
 0.044
 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.
 bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Criteria				Soil Data				
Retained Height Wall height above soil Slope Behind Wall	= = =	12.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft		
Height of Soil over Toe Water height over heel	=	4.00 in 0.0 ft	 : :	= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	150.0 120.00 120.00 0.450 12.00) psf/ft) pcf) pcf in	Restart .	
Surcharge Loads				Lateral Load Applied to	Stem		Adjacent Footing	Load
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding & Axial Load Applied	= liding Over d to \$	0.0 psf & Overturning 0.0 turning Stem		Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Ser	0.0 # 0.00 ft 0.00 ft d (W) vice Le	/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
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	= 0.011 = 0.300
Design Summary				Stem Construction] _	Bottom		
Wall Stability Ratios Overturning Slab Resis	= sts All	1.98 Ok Sliding !	(Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rehar Size	ft = = = =	Concrete LRFD 12.00		
Total Bearing Load resultant ecc.	=	5,641 lbs 12.76 in		Rebar Spacing Rebar Placed at	=	8.00 Edge	• •	
Soil Pressure @ Toe Soil Pressure @ Heel	= =	1,392 psf 113 psf	OK OK	fb/FB + fa/Fa	=	0.701	l	
Allowable Soil Pressure Les ACI Factored @ Toe ACI Factored @ Heel	s Tha = =	2,000 psf n Allowable 1,949 psf 158 psf		Service Level Strength Level MomentActual	lbs = lbs =	4,608.0	1	
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	34.5 psi 15.5 psi 75.0 psi	OK OK	Service Level Strength Level MomentAllowable	ft-# = ft-# = =	18,432.0 26,273.2	1	
Sliding Calcs Lateral Sliding Force	=	3,511.3 lbs		ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = psi = psi = in2 = in =	39.9 75.0 9.63	1	
				Masonry Data fm Fs	psi = psi =			
Vertical component of activ NOT considered in the calc	ve late culatio	ral soil pressu n of soil bearir	re IS Ig	Solid Grouting Modular Ratio 'n' Wall Weight	= = psf=	150.0		
Load Factors Building Code Dead Load Live Load Farth H	IE	8C 2015,ACI 1.200 1.600		Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	=	Medium V ASD	Veight	
Wind, W Seismic, E		1.000		Concrete Data fc Fy	psi = psi =	2,500.0		

Project Name/Number	: 1	(C02-D10)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENGI	Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
s (based on applied moment) :	0.4401 in2/ft		
4/3) * As :	0.5868 in2/ft	Min Stem T&S Reinf Area	3.600 in2
00bd/fy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Area	per ft of stem Height : 0.288 in2/ft
.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Op	tions :
		One layer of : Two lay	yers of :
Required Area :	0.4401 in2/ft	#4@ 8.33 in #4@ 1	6.67 in
Provided Area :	0.66 in2/ft	#5@ 12.92 in #5@ 2	25.83 in
/laximum Area :	1.3039 in2/ft	#6@ 18.33 in #6@ 3	36.67 in
Footing Data	Footing D	Design Results	
Toe Width =	5.00 ft	Toe Hee	I
Heel Width =	2.50 Factored Press	sure = 1,949 15	8 psf
Total Footing Width =	7.50 Mu': Upward	= 232,581 31	2 ft-#
Footing Thickness = 1	5.00 in Mu: Downwar	d = 40,950 2,19 - 15,060 1,89	7π-# 6ft #
Key Width =	0.00 in Actual 1-Way	Shear = 34.47 15.5	4 nei
Key Depth =	0.00 in Allow 1-Way S	hear = 75.00 40.0	0 psi
Key Distance from Toe =	0.00 ft Toe Reinforcing	g = #6@11.00 in	
fc = 2,500 psi Fy = 60	,000 psi Heel Reinforcir	ng = None Spec'd	
Footing Concrete Density = 15	60.00 pcf Key Reinforcin	g = None Spec'd	20. 6 11
Min. As % = 0.0	JU18 Footing Lorsion	n, Tu = 0.0	JU T-IDS
Cover @ 10p 2.00 @ Dun.•	= 5.00 III FOOLING Allow.		JU II-IDS
	If torsion e supplemen	xceeds allowable, provide ital design for footing torsion	1.
	Other Accepta	ble Sizes & Spacings	
	Toe: #4@ 5	.67 in, #5@ 8.79 in, #6@ 12.41	7 in, #7@ 17.01 in, #8@ 22.40 in, #9@ 28.
	Heel: phiMn Key: No key	= phi'5'lambda'sqrt(fc)'Sm / defined	
	Min footing T	&S reinf Area 2.4	3 in2
	Min footing I	45 remi Area per toot 0.3	Z IIIZ /IL lovers of horizontal hars:
	#4@ 7.41	in #46	14.81 in
	#5@ 11.41	3 in #5@	0 22.96 in
	#6@ 16.30) in #60	0 32.59 in

Summary of Overturning & Resisting Forces & Moments										
Item	O Force Ibs	VERTURNING 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	3,511.3	4.42	15,508.0	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	2,160.0	6.75 6.75	14,580.0 14,580.0			
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 =						
dded Lateral Load =				* Axial Live Load on Stem =						
.oad @ Stem Above Soil =				Soil Over Toe =	200.0	2.50	500.0			
				Surcharge Over Toe =						
				Stem Weight(s) =	1,875.0	5.50	10,312.5			
	0 511 0		45 500 0	Earth @ Stem Transitions=						
i otai =	3,511.3	0.1.M. =	15,508.0	Footing Weight =	1,406.3	3.75	5,273.4			
				Key Weight =						
Resisting/Overturning F	latio	=	1.98	Vert. Component =						
Vertical Loads used for	Soil Pressure	e = 5,641.	3 lbs	Total =	5.641.3 II	os R.M.=	30,665,9			

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 onl	y) 0.064 in
The above calculation is not valid if the heel soi	bearing pressure exceeds that of the toe,

Project Name/Number : (C02-D10	200
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etainPro (c) 1987-2019, Build icense : KW-06055289 .icense To : MALSAM TSA	1 11.20 ANG E	0.03.31 ENGINEERING	G	Cantilevered Retain	ning V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	4.00 ft 0.50 ft 0.00		Allow Soil Bearing = Equivalent Fluid Pressure Meth Active Heel Pressure =	2,000.0 nod 40.0) psf) psf/ft	
Height of Soil over Loe	=	4.00 in		Passive Pressure =	150.0) psf/ft	
vvater neight over neel	=	0.0 π		Soil Density, Heel =	120.00) pcf	
				Soil Density, Toe =	120.00) pcf	
				Footing Soil Friction =	0.450)	
				Soil height to ignore for passive pressure =	12.00	in	Restrain •
Surcharge Loads				Lateral Load Applied to	o Stem	1	Adjacent Footing Load
Surcharge Over Heel	=	0.0 psf		Lateral Load =	36.0 #	/ft	Adjacent Footing Load = 0.0 lbs
NUT Used To Resist Sil	iaing a	& Overturning		Height to Top =	4.00 ft		Footing Width = 0.00 ft Eccentricity = 0.00 in
NOT Used for Sliding &	Overt	turning		Height to Bottom =	0.00 1		Wall to Etg CL Dist = 0.00 ft
Axial Load Applied	to S	Stem		Load type = Se	eismic (E	=) ev(el)	Footing Type Line Load
Avial Dood Lood		0.0.lba		(S		- 4	Base Above/Below Soil = 0.0 ft
Axial Live Load	=	0.0 lbs		(Service Level)	0.0 p	SI	at Back of Wall
Axial Load Eccentricity	=	0.0 in		(Poisson's Ratio = 0.300
Design Summary				Stem Construction		Bottom	<u>, </u>
Wall Ctability Datias				Design Height Above F	tg ft=	0.00	ò
Overturning	=	1 45 Pot	tio <	Wall Material Above "H	It" =	Concrete	
Slab Resist	ts All !	Sliding !	10 <	Thickness	=		
		5		Rebar Size	_	# 4	4
Total Bearing Load	=	1,095 lbs		Rebar Spacing	=	9.00	0
resultant ecc.	=	9.18 in		Rebar Placed at	=	Edge	9
Soil Pressure @ Toe	=	1,392 psf	ΟК	fb/ER + fa/Ea	-	0.12	6
Soil Pressure @ Heel	=	0 psf	OK	Total Force @ Section		0.13	0
Allowable	=	2,000 psf		Service Level	lbe =		
Soil Pressure Less	; Than	n Allowable		Strength Level	lbs =	656 (n
ACI Factored @ Toe ACI Factored @ Heel	-	1,948 pst 0 psf		MomentActual		000.0	-
Footing Shear @ Toe	=	9.4 nsi	OK	Service Level	ft-# =		
Footing Shear @ Heel	=	2.6 nsi	OK	Strength Level	ft-# =	970.7	7
Allowable	=	75.0 psi	0.1	MomentAllowable	=	7,122.4	4
Bliding Calcs				ShearActual			
Lateral Sliding Force	=	644.0 lbs		Service Level	psi =		
				Strength Level	psi =	8.7	7
				ShearAllowable	psi =	75.0)
				Anet (Masonry)	in2 =		
				Rebar Depth 'd'	in =	6.25	5
				Masonry Data	nei -		
				Fs	psi=		
rtical component of active	e later	ral soil pressu	re IS	Solid Grouting	- 100		
OT considered in the calc	ulation	n of soil bearin	ng	Modular Ratio 'n'	=		
			-	Wall Weight	psf=	100.0	0
oad Factors		0.0045.4.6		Short Term Factor	=		
Building Code	ιB	1 2015,ACI		Equiv. Solid Thick.	=		
Live Load		1.200		Masonry Block Type	=	Medium \	Weight
Earth H		1.000		Masonry Design Metho	= bd	ASD	
Wind W		1.000		Concrete Data	nei -	2 500 0	2
Seismic, F		1.000		Fv	psi=	2,000.0	5 1
00.0/110, L		1.000		i y	pai –	00,000.0	<i>.</i>

RetainPro (c) 1987-2019, Build 11.20.03.3 License : KW-06055289 License To : MALSAM TSANG ENG	³¹ Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0364 in2/ft	•	
(4/3) * As :	0.0485 in2/ft	Min Stem T&S Reinf Area	0.864 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area	per ft of stem Height : 0.192 in2/ft
0.0018bh : 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 :	0.2667 in2/ft	#5@ 19.38 in #5@ 3	38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 5	55.00 in
Footing Data	Footing De	esign Results	
Toe Width =	1.50 ft	<u>Toe</u> Hee	<u>l</u>
Heel Width =	1.08 Factored Pressu	re = 1,948 (0 psf
Total Footing Width =	2.58 Mu': Upward	= 17,949 (0 ft-#
Footing Thickness =	12.00 in Mu: Downward Mu: Design	= 3,078 6	5 ft-#
Key Width =	0.00 in Actual 1-Way Sh	ear = 9.43 2.6	0 psi
Key Depth =	0.00 in Allow 1-Way She	ear = 75.00 40.0	0 psi
Key Distance from Toe =	0.00 ft Toe Reinforcing	= #4@9.00 in	
fc = 2,500 psi Fy = 6	0,000 psi Heel Reinforcing	= None Spec'd	
Min As % = 0	0018 Footing Torsion	Tu = 0(00 ft-lbs
Cover @ Top 2.00 @ Btm.	.= 3.00 in Footing Allow. To	prsion.phiTu = 0.0	00 ft-lbs
0.0	If torsion ex	novide	
	supplementa	al design for footing torsion	I.
	Other Acceptab	le Sizes & Spacings	
	Toe: #4@ 9.2 Heel: phiMn = Key: No key	25 in, #5@ 14.35 in, #6@ 20.3 phi'5'lambda'sqrt(fc)'Sm defined	37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
	Min footing T& Min footing T& If one layer of #4@ 9.26 ir #5@ 14.35 #6@ 20.37 i	S reinf Area 0.6 S reinf Area per foot 0.20 horizontal bars: If two n #40 n #50 n #60	7 in2 6 in2 .ft Jayers of horizontal bars: 9 18.52 in 9 28.70 in 9 40.74 in

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OVERTURNING				RESISTING				
Item	- F	lbs	ft	ft-#		lbs	ft	ft-#
HL Act Pres (ab water tbl)		500.0	1.67	833.3	Soil Over HL (ab. water tbl)	198.4	2.37	470.9
HL Act Pres (be water tbl) Hydrostatic Force					Soil Over HL (bel. water tbl) Watre Table		2.37	470.9
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	=	144.0	3.00	432.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil	=				Soil Over Toe =	60.0	0.75	45.0
-	=				Surcharge Over Toe =			
					Stem Weight(s) =	450.0	1.83	825.0
Tetel		C44.C		4 005 0	Earth @ Stem Transitions=			
i otal	=	644.0	U.I.M. =	1,265.3	Footing Weight =	387.0	1.29	499.2
					Key Weight =			
Resisting/Overturning	Ratio		=	1.45	Vert. Component =			
Vertical Loads used for	r Soil P	ressure	= 1,095.4	4 lbs	Total =	1,095.4 lb	s R.M.=	1,840.1
					* Axial live load NOT included in resistance, but is included for	n total displaye soil pressure c	d, or used fo alculation.	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

Horizontal Defl @ Top of Wall (approximate only) 0.067 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-06055289 License To : MALSAM TS	d 11.20.0 ANG EN	3.31 IGINEERING	Cantilevered Retaining Wall Code: IBC 2015,ACI 318-14,ACI 5				Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= .	4.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
Height of Soil over Toe Water height over heel	=	4.00 in 0.0 ft	 : :	= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	150.0 120.00 120.00 0.450 12.00) psf/ft) pcf) pcf)	Rotan
Surcharge Loads			ſ	Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding & Axial Load Applied	= liding & = Overtu I to St	0.0 psf Overturning 0.0 rning em		Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Ser	0.0 # 0.00 ft 0.00 ft d (W) vice Le	/ft evel)	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft Footing Type Line Load Base Above/Below Soil
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 = 0.0 It Poisson's Ratio = 0.300
Design Summary				Stem Construction] _	Bottom	-
Wall Stability Ratios Overturning Slab Resis	= its All Si	1.89 Ok liding !	(Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = = =	Concrete LRFE 8.00	
Total Bearing Load resultant ecc.	= =	1,048 lbs 5.52 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 4 9.00 Edge	4) 9
Soil Pressure @ Toe Soil Pressure @ Heel	= =	991 psf 0 psf	OK OK	fb/FB + fa/Fa	=	0.09	5
Allowable Soil Pressure Les	= s Than <i>i</i>	2,000 psf Allowable		Service Level	lbs =	512 (1
ACI Factored @ Toe ACI Factored @ Heel	=	1,387 pst 0 psf	ok	MomentActual Service Level	ft-# =	012.0	
Footing Shear @ Heel Allowable	-	2.5 psi 75.0 psi	OK	Strength Level MomentAllowable	ft-# = =	682.7 7,122.4	7 4
Sliding Calcs Lateral Sliding Force	=	500.0 lbs		ShearActual Service Level Strength Level	psi= psi=	6.8	3
				Anet (Masonry) Rebar Depth 'd'	in2 = in =	6.25	5
Vartical companent of activ	o latara		- 10	fm Fs Solid Grouting	psi= psi=		
NOT considered in the calc	ulation	of soil bearin	ig ig	Modular Ratio 'n' Wall Weight	= psf=	100.0)
Load Factors Building Code Dead Load Live Load Farth H	IBC	2015,ACI 1.200 1.600		Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	=	Medium \ ASD	Weight
Wind, W Seismic, E		1.000		Concrete Data fc Fy	psi = psi =	2,500.0 60,000.0	

Project Name/Number	: 1	(C02-D10)	200
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ense : KW-06055289 cense : To : MALSAM TSANG ENGINEERING	Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area Details			
Sottom Stem Vertic	al Reinforcing	Horizontal Reinforc	ina
s (based on applied moment) : 0.025	6 in2/ft		5
4/3) * As : 0.034	1 in2/ft	Min Stem T&S Reir	nf Area 0.864 in2
.00bd/fy : 200(12)(6.25)/60000 : 0.25 ir	n2/ft	Min Stem T&S Reir	nf Area per ft of stem Height : 0.192 in2/ft
.0018bh : 0.0018(12)(8) : 0.172	8 in2/ft	Horizontal Reinforc	ing Options :
====		One layer of :	Two layers of :
Required Area : 0.172	8 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area : 0.266	7 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area : 0.846	7 in2/ft	#6@ 27.50 in	#6@ 55.00 in
Footing Data	Footing D	esign Results	
Toe Width = 125 ft		Too	Heal
Heel Width = 1.08	Factored Press	ure = 1.387	0 psf
Total Footing Width = 2.33	Mu': Upward	= 10,443	1 ft-#
Footing Thickness = 12.00 in	Mu' : Downward	= 2,138	65 ft-#
Key Width = 0.00 in	Mu: Design	= 692	64 ft-#
Key Depth = 0.00 in	Actual 1-Way S	hear = 4.36	2.50 psi
Key Distance from Toe = 0.00 ft	Toe Reinforcing	ieai = 40.00 = None Spec'd	40.00 psi
fc = 2,500 psi Ev = 60,000 psi	Heel Reinforcin	g = None Spec'd	
Footing Concrete Density = 150.00 pcf	Key Reinforcing	= None Spec'd	
Min. As % = 0.0018	Footing Torsion	, Tu =	0.00 ft-lbs
Cover @ Top 2.00 @ Btm.= 3.00 in	Footing Allow. T	orsion, phi Tu =	0.00 ft-lbs
	If torsion ex	ceeds allowable, prov	ide
	supplement	tal design for footing t	orsion.
	Other Accepta	ble Sizes & Spacings	
	Toe: phiMn = Heel: phiMn = Key: No key	= phi'5'lambda'sqrt(fc)'S = phi'5'lambda'sqrt(fc)'S defined	m m
	Min footing T	&S reinf Area	0.60 in2
	If one laver of	horizontal bars:	If two layers of horizontal bars:
	#4@ 9.26	in	#4@ 18.52 in
	#5@ 14.35	in	#5@ 28.70 in
	#6@ 20.37	in	#6@, 40.74 in

Summary of Overtu	rning & R	osistina F	orces & Mon	nents			
Item	O\ Force Ibs	/ERTURNING Distance ft	Moment	lenta	RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	500.0	1.67	833.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	198.4	2.12 2.12	421.3 421.3
Buoyant Force = Surcharge over Heel =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load =			
Adjacent Footing Load = Added Lateral Load =				Axial Dead Load on Stem = * Axial Live Load on Stem =			
_oad @ Stem Above Soil =				Soil Over Toe = Surcharge Over Toe =	50.0	0.63	31.3
_				Stem Weight(s) =	450.0	1.58	712.5
Total =	500.0	O.T.M. =	833.3	Footing Weight =	349.5	1.17	407.2
Resisting/Overturning Ra	tio	=	1.89	Vert. Component =		_	
Vertical Loads used for S	oil Pressure	= 1,047.	9 lbs	Total = * Axial live load NOT included in	1,047.9 li n total display	bs R.M.=	1,572.2 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)	0.053 in	
The above calculation is not valid if the heel soil bearing	ng pressure exceeds that of the to	<u>e,</u>

Project Name/Number : (C02-D10	200
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icense : KW-06055289 icense To : MALSAM TSA	NG E	NGINEERING	3	Cantilevered Re	etain	ing V	vali	Code: IBC 2015,ACI 3	18-14,ACI 530-
Criteria				Soil Data					
Retained Height Wall height above soil Slope Behind Wall	=	4.00 ft 0.50 ft 0.00		Allow Soil Bearing Equivalent Fluid Pressure Active Heel Pressure	= : Metho =	2,000.0 od 40.0	psf psf/ft		
Height of Soil over Toe Water height over heel	=	4.00 in 0.0 ft		Passive Pressure Soil Density, Heel Soil Density, Toe Footing/ISoil Friction	= = = =	250.0 120.00 120.00 0 450	psf/ft pcf pcf		
				Soil height to ignore for passive pressure	=	12.00	in	Restraint	
Surcharge Loads				Lateral Load Applie	ed to	Stem		Adjacent Footing Load	1
Surcharge Over Heel NOT Used To Resist Sli Surcharge Over Toe NOT Used for Sliding &	= iding & = Overtu	0.0 psf Overturning 0.0		Lateral LoadHeight to TopHeight to Bottom	=	36.0 #/ 4.00 ft 0.00 ft	ſft	Adjacent Footing Load = Footing Width = Eccentricity =	0.0 lbs 0.00 ft 0.00 in
Axial Load Applied	to Si	tem		Load Type :	= Sei: (Se	smic (E rvice Le	i) evel)	Footing Type	0.00 π 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	n	<u> </u>	Bottom		
Wall Stability Ratios Overturning	-	1.27 Rat	io <	Design Height Abo Wall Material Abo 1.5! Design Method	ve Ftg ve "Ht	g ft = ' = =	Stem OK 0.00 Concrete		
Slab Resist	s All S	liding !		Thickness Rebar Size		=	6.00 # 4		
Total Bearing Load resultant ecc.	=	871 lbs 10.39 in		Rebar Spacing Rebar Placed at		=	12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel	=	1,687 psf 0 psf	OK OK	fb/FB + fa/Fa	ection	=	0.268	3	
Allowable Soil Pressure Less ACI Factored @ Toe	Than	2,000 psf Allowable 2,361 psf		Service Level Strength Level Moment Actual		lbs = lbs =	656.0		
Footing Shear @ Toe	=	15.3 psi	ок	Service Level		ft-# = ft-# =	970 7		
Footing Shear @ Heel Allowable	=	3.6 psi 75.0 psi	OK	MomentAllowa	ble	=	3,612.6		
Sliding Calcs Lateral Sliding Force	=	595.3 lbs		ShearActual Service Level		psi =			
				Strength Level ShearAllowable Anet (Masonny)	e	psi = psi = in2 =	12.9 75.0		
				Rebar Depth 'd'		in =	4.25	i	
				fm Fs		psi = psi =			
ertical component of active OT considered in the calc	e latera ulation	al soil pressu of soil bearin	re IS ng	Solid Grouting Modular Ratio 'n'		=	75.0		
Load Factors Building Code	IBC	C 2015,ACI		Short Term Factor Equiv. Solid Thick	r	=	73.0		
Dead Load Live Load Earth, H		1.200 1.600 1.600		Masonry Block Ty Masonry Design N	pe /lethod	=	Medium V ASD	Veight	
Wind, W Seismic, E		1.000		fc Fy		psi = psi =	2,500.0 60,000.0		

icense : KW-06055289 icense : KW-06055289 icense To : MALSAM TSANG E	NGINEERING	Cantilevered Re	etair	ning Wa	ll	Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Are	ea Details					
Bottom Stem	Vertical R	einforcing H	lorizo	ntal Reinfo	rcing	
As (based on applied moment) :	0.0549 in2	2/ft			-	
(4/3) * As :	0.0732 in2	2/ft M	∕lin St	em T&S Re	einf Area 0.6	648 in2
200bd/fy: 200(12)(4.25)/60000:	0.17 in2/ft	N	∕lin St	em T&S Re	einf Area pe	r ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2	2/ft H	lorizo	ntal Reinfo	rcing Option	IS :
	=======	(One la	ver of :	Two layers	s of :
Required Area :	0.1296 in2	2/ft #	4@ 1	6.67 in	#4@ 33.3	33 in
Provided Area :	0.2 in2/ft	#	- 5@ 2	5.83 in	#5@ 51.6	67 in
Maximum Area :	0.5757 in2	2/ft #	46@ 3	6.67 in	#6@ 73.3	33 in
Footing Data		Footing Desig	In R	esults		
Toe Width =	1.50 ft			Toe	Heel	
Heel Width =	0.92	Factored Pressure	=	2,361	0 p:	sf
Total Footing Width =	2.42	Mu': Upward	=	16,916	0 ft-	-#
Footing Thickness =	9.00 in	Mu: Downward	-	2,471	63 T-	-# #
Key Width =	0.00 in	Actual 1 Way Shear		15.34	3 56 p	ei
Key Depth =	0.00 in	Allow 1-Way Shear	-	75.00	40.00 p	si
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= #	4 @ 12.00) in	
f'c = 2,500 psi Fy =	60.000 psi	Heel Reinforcing	= N	Ione Spec'o	d	
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= N	Ione Spec'o	d	
Min. As % =	0.0018	Footing Torsion, Tu		=	0.00	ft-lbs
Cover @ Top 2.00 @ E	8tm.= 3.00 in	Footing Allow. Torsio	n, phi	Tu =	0.00	ft-lbs
		If torsion exceed	ls allo	wable, pro	ovide	
		supplemental de	sign	for footing	y torsion.	
		Other Acceptable S	izes	& Spacing	js	
		Toe: #4@ 12.34 i Heel: phiMn = phi Key: No key defin	n, #5(5'lami ied	2) 19.13 in, oda'sqrt(fc)'	#6@ 27.16 'Sm	in, #7@ 37.03 in, #8@ 48.76 in, #9@ 6
		Min footing T&S re	inf Ar	ea	0.47	in2

win looung 1&5 reini Area	0.47 Inz
Min footing T&S reinf Area per foot	0.19 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@, 27.16 in	#6@ 54.32 in

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		OV	ERTURNING			RE	SISTING	
ltem		Force Ibs	Distance ft	ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl))	451.3	1.58	714.5	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl)	201.6	2.21 2.21	445.5 445.5
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	=	144.0	2.75	396.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil	=	-	-		Soil Over Toe =	60.0	0.75	45.0
J	=				Surcharge Over Toe =			
					Stem Weight(s) =	337.5	1.75	590.6
-					Earth @ Stem Transitions=			
Total	=	595.3	O.T.M. =	1,110.5	Footing Weight =	272.3	1.21	329.4
					Key Weight =			
Resisting/Overturning	Ratio	2	=	1.27	Vert. Component =			
Vertical Loads used fo	or Soil	Pressure	= 871.4	1 lbs	Total =	871.4	bs R.M.=	1.410.6
					* Axial live load NOT included i resistance, but is included for	n total display soil pressure	ed, or used for 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

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.

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20.0	3.31 IGINEERIN	3	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	= .	4.00 ft 0.50 ft 0.00 4.00 in 0.0 ft		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = FootingliSoil Friction = Soil helight to ignore for passive pressure =	2,000.0 d 150.0 120.00 0.450 12.00) psf) psf/ft) psf/ft) pcf) pcf) in		
Surcharge Loads			Ē	Lateral Load Applied to	Stem		Adiacent Footing	Load
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding & Axial Load Applied Axial Live Load Axial Load Eccentricity	= iding & Overtu to St = = =	0.0 psf Overturning 0.0 ming em 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 L 0.0 p	evel)	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 ft Line Load = 0.0 ft = 0.300
Design Summary		Ì		Stem Construction		Bottom		
Wall Stability Ratios Overturning Slab Resist Total Bearing Load resultant ecc. Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = = = = =	1.97 OF iding ! 871 lbs 4.93 in 727 psf 0 psf	OK OK	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Rebar Size Rebar Placed at Design Data fb/FB + fa/Fa Total Force @ Section	ft = = = = = = =	0.00 Concrete LRFD 6.00 # 4 12.00 Edge 0.188	8	
Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= Than / = =	2,000 psf Allowable 1,018 psf 0 psf		Service Level Strength Level MomentActual	lbs = lbs =	512.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= = =	7.4 psi 3.2 psi 75.0 psi	OK OK	Service Level Strength Level MomentAllowable ShearActual	ft-# = =	682.7 3,612.6		
Lateral Sliding Force	=	451.3 lbs		Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data	psi = psi = psi = in2 = in =	10.0 75.0 4.25		
Vertical component of active NOT considered in the calco	e latera ulation	l soil pressu of soil bearir	re IS 1g	fm Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = psf =	75.0		
Building Code Dead Load Live Load Earth, H	IBC	2015,ACI 1.200 1.600 1.600		Giorci reminicación Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data	=	Medium V ASD	Veight	
Wind, W Seismic, E		1.000 1.000		fc Fy	psi = psi =	2,500.0 60,000.0		

Project Name/Number	:	(C02-D10)	200
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ense : KW-06055289 cense To : MALSAM TSANG ENGINEERIN	G Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
oncrete Stem Rebar Area Details			
ottom Stem	ertical Reinforcing	Horizontal Reinforci	na
s (based on applied moment) : 0	.0386 in2/ft		5
1/3) * As : 0	.0515 in2/ft	Min Stem T&S Rein	f Area 0.648 in2
00bd/fy : 200(12)(4.25)/60000 : 0	.17 in2/ft	Min Stem T&S Rein	f Area per ft of stem Height : 0.144 in2/ft
.0018bh : 0.0018(12)(6) : 0	.1296 in2/ft	Horizontal Reinforci	ng Options :
=		One layer of : T	wo layers of :
equired Area : 0	.1296 in2/ft	#4@ 16.67 in	#4@. 33.33 in
rovided Area : 0	.2 in2/ft	#5@ 25.83 in	#5@ 51.67 in
laximum Area : 0	.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in
Footing Data	Eooting D	esian Results	
	. counge	-	
loe Width = 1.50 ft	Contrary Davage	<u>Toe</u>	Heel
Total Footing Width = 2.42	Mul: Linward	ure = 1,018 = 10,876	0 psi 4 ft_#
Footing Thickness = 9.00 in	Mu' : Downward	d = 2,471	63 ft-#
	Mu: Design	= 700	58 ft-#
Key Width = 0.00 in	Actual 1-Way S	ihear = 7.41	3.16 psi
Key Distance from Toe = 0.00 ft	Allow 1-Way Sh	near = 40.00	40.00 psi
	Loe Reinforcing	a = None Specia	
C = 2,500 psi Fy = 60,000 psi Footing Concrete Density = 150.00 psi	Key Reinforcing	= None Spec'd	
Min. As % = 0.0018	Footing Torsion	. Tu =	0.00 ft-lbs
Cover @ Top 2.00 @ Btm.= 3.00	n Footing Allow. 1	orsion, phi Tu =	0.00 ft-lbs
	If torsion ex	ceeds allowable, prov	ide
	supplemen	tal design for footing to	orsion.
	Other Accepta	ble Sizes & Spacings	
	Toe: phiMn	= phi'5'lambda'sqrt(fc)'Sr	n
	Heel: phiMn Key: No key	= phi'5'lambda'sqrt(fc)'Sr defined	n
	Min footing T	&S reinf Area	0.47 in2
	If one laver of	f horizontal bars:	If two layers of horizontal bars:
	#4@ 12.35	in	#4@ 24.69 in
	#5@ 19.14	in	#5@ 38.27 in
	#6@ 27.16	in	#6@ 54.32 in

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Summary of Overturning & Resisting	Forces & Moments	

		OVERTURNI	NG				RI	RESISTING		
Item	Force Ibs	Distance ft	e Mor ft-	nent #			Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hvdrostatic Force	451	.3 1.58		714.5	Soil Over HL (ab. wa Soil Over HL (bel. w Watre Table	ater tbl) ater tbl)	201.6	2.21 2.21	445.5 445.5	
Buoyant Force	=				Sloped Soil Over Hee	el =				
Surcharge over Heel	=				Surcharge Over Hee	I =				
Surcharge Over Toe	=				Adjacent Footing Loa	ad =				
Adjacent Footing Load	=				Axial Dead Load on	Stem =				
Added Lateral Load	=				* Axial Live Load on S	tem =				
oad @ Stem Above Soil	=				Soil Over Toe	=	60.0	0.75	45.0	
	=				Surcharge Over Toe	=				
					Stem Weight(s)	=	337.5	1.75	590.6	
					Earth @ Stem Trans	itions=				
Total	= 451	.3 О.Т.М.	=	714.5	Footing Weight	=	272.3	1.21	329.4	
					Key Weight	=				
Resisting/Overturning	Ratio	=	1.97		Vert. Component	=				
Vertical Loads used fo	r Soil Pressu	ire = 8	71.4 lbs			Total =	871.4	bs R.M.=	1.410.6	
					* Axial live load NOT in resistance, but is incl	ncluded ir luded for	n total display soil pressure	red, or used for 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 settlem	nent of soil
(Deflection due to wall bending not considered)		
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.038	in
The above calculation is not valid if the heel soil bearing	ng pressure e	exceeds that of the toe,

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Criteria				Soil Data						
Retained Height Wall height above soil Slope Behind Wall	= (= (= (0.00 ft 0.00 ft 0.00		Allow Soil Bearing = Equivalent Fluid Pressure Metho Active Heel Pressure =	0.0 d 0.0) psf) psf/ft				
Height of Soil over Toe	= (0.00 in 0.0 ft		= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	0.0 0.00 0.00 0.000) psf/ft) pcf) pcf)				
Surcharge Loads			1	Lateral Load Applied to	Stem		Adj	acent Footing I	oad	
Surcharge Over Heel NOT Used To Resist Sli Surcharge Over Toe NOT Used for Sliding &	= iding & = Overtur	0.0 psf Overturning 0.0 ning		Lateral Load = Height to Top = Height to Bottom = Load Type =	0.0 # 0.00 ft 0.00 ft	/ft	Adja Footi Ecce Wall	cent Footing Load ng Width ntricity to Ftg CL Dist	= = =	0.0 lbs 0.00 ft 0.00 in 0.00 ft
Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	to Ste = = =	0.0 lbs 0.0 lbs 0.0 in		(Ser Wind on Exposed Stem ₌ (Service Level)	o.0 p	evel) sf	Base at Poise	Above/Below Soil Back of Wall son's Ratio	=	0.0 ft 0.300
Design Summary				Stem Construction	<u> </u>	Bottom				
Wall Stability Ratios Overturning Sliding	-	0.00 OK		Design Height Above Ftg Wall Material Above "Ht" Design Method	g ft = = =	Stem Ok 0.00 ERFE	() }			
Total Bearing Load resultant ecc.	=	0 lbs 3.00 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 0 0.00 Cente)) r			
Soil Pressure @ Toe Soil Pressure @ Heel	=	0 psf 0 psf 0 psf	OK OK	Design Data fb/FB + fa/Fa Total Force @ Section	=	0.00	D			
Soil Pressure Less	Than A	llowable 0 psf		Service Level Strength Level	lbs = lbs =					
ACI Factored @ Heel	=	0 psf 25.9 psi	ОК	MomentActual Service Level	ft-# =					
Footing Shear @ Heel Allowable	= =	0.0 psi 67.1 psi	ОK	Strength Level MomentAllowable	ft-# = =	0.0)			
Lateral Sliding Force less 0 % Passive Force less 0 % Friction Force	= = . = .	0.0 lbs 0.0 lbs 0.0 lbs		Service Level Strength Level ShearAllowable	psi = psi = psi =	0.0)			
Added Force Req'd for 1.5 Stability	=	0.0 lbs 0.0 lbs	OK OK	Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =	0.00)			
Vertical component of active NOT considered in the calcu	e lateral ulation o	soil pressu of soil bearin	re IS	fm Fs Solid Grouting Modular Ratio 'n'	psi = psi = = =	1,500 32,000 No 0.00)))			
Load Factors Building Code Dead Load Live Load	IBC	2018,ACI 1.400 1.700		Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	pst = = in = =	0.0 1.000 0.00 Medium \ ASD)) //eigh	t		
Earth, H Wind, W Seismic, E		1.700 1.000 1.700		Concrete Data fc Fy	psi = psi =	2,500.0))			

Project Name/Number : (C02-D10) 200

License : KW-06055289 License To : MALSAM TSANG ENG		Cantilevered	Retaining Wall	Co	de: IBC 20	18,ACI 318-	14,TMS 402-1
Footing Data		Footing De	esign Results				
Toe Width = Heel Width = Total Footing Width = Footing Thickness = Key Digth = Key Digth = Key Digth = Footing Concrete Density =	0.00 ft 0.50 0.00 in 0.00 in 0.00 in 0.00 ft 0.00 psi 0.00 pcf	Factored Pressu Mu': Upward Mu': Downward Mu: Design Actual 1-Way Sh Allow 1-Way She Toe Reinforcing Heel Reinforcing Key Reinforcing	re = 0 = 0 = 0 tear = 25.94 aar = 35.78 = None Spec'd = None Spec'd = None Spec'd	Heel 0 psf 0 ft-# 0 ft-# 0 ft-# 0.00 psi 35.78 psi			
Min. As % = 0	.0000	Footing Torsion,	Tu =	0.00 ft-lk	S		
Cover @ Top 0.00 @ Bill	0.00 11	Footing Allow. 10	orsion, pni i u =	0.00 π-ια)S		
		If torsion exc supplementa	ceeds allowable, prov al design for footing t	ride orsion.			
		Other Acceptab	le Sizes & Spacings				
		Toe: phiMn = Heel: phiMn = Key: No key	phi/5'lambda'sqrt(fc)'Si phi/5'lambda'sqrt(fc)'Si defined	m m			
		Min footing T& Min footing T& If one layer of #4@ 0.00 ir #5@ 0.00 ir #6@ 0.00 ir	S reinf Area S reinf Area per foot horizontal bars: 1 1 1	0.00 in: 0.00 in: If two layers #4@ 0.00 #5@ 0.00 #6@ 0.00	2 2 ,ft of horizonta in in in	al bars:	
Summary of Overturning	& Resistin	g Forces & Mom	ents				
	OVERTUR	IING			RI	SISTING	
		o Moment			Force	Distance	Moment
ItemIbs	e Distand ft	ft-#			lbs	ft	ft-#
Item Forc Ibs	e Distano ft	ft-#	Soil Over HL (ab.)	water tbl)	lbs	ft	ft-#
Item Force lbs	e Distano ft	ft-#	Soil Over HL (ab.) Soil Over HL (bel.	water tbl) water tbl)	lbs	ft	ft-#
Item Forc Ibs HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	e Distano ft	ft-#	Soil Over HL (ab. Soil Over HL (bel. Watre Table	water tbl) water tbl)	lbs	ft	ft-#
Item Force =	e Distand ft	ft-#	Soil Over HL (ab.) Soil Over HL (bel. Watre Table Sloped Soil Over H	water tbl) water tbl) leel =	lbs	ft	ft-#
ttem	e Distanc	ft-#	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over He Surcharge Over He	water tbl) water tbl) leel = eel =	lbs	ft	ft-#
Item Force Ibs HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force Buoyant Force = Surcharge Over Heel = Surcharge Over Toe =	e Distanc	ft-#	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over He Surcharge Over He Adjacent Footing L	water tbl) water tbl) leel = eel = oad =	lbs	ft	ft-#
Item Force Surcharge Over Toe Su	e Distanc	ft-#	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over He Surcharge Over He Adjacent Footing L Axial Dead Load ou	water tbl) water tbl) leel = eel = oad = n Stem =	lbs	ft	ft-#
Item Force HL Act Pres (ab water tb) HJ Act Pres (be water tb) Hydrostatic Force Buoyant Force = Surcharge over Heel = Surcharge over Heel = Adjacent Footing Load = Adjacent Footing Load =	e Distanc	ft-#	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over He Adjacent Footing L Axial Dead Load on * Axial Live Load on	water tbl) water tbl) leel = eel = oad = n Stem = Stem =	lbs	ft	ft-#
Item Interview Item Item Item Item Item Item Item Item	e Distanc	<u>ft</u> #	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over H Surcharge Over He Adjacent Footing L Axial Dead Load on Soil Over Toe	water tbl) water tbl) leel = oad = n Stem = Stem = =	lbs	ft	ft-#
Item Constraints of the second	e Distanc	<u>t.</u>	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over H Surcharge Over He Adjacent Footing L Axial Dead Load or * Axial Live Load on soil Over Toe Surcharge Over To	water tbl) water tbl) deel = oad = n Stem = Stem = = we =	lbs	ft	ft-#
Item Force HL Act Pres (ab water tb) HL Act Pres (be water tb) Hydrostatic Force Buoyant Force = Surcharge over Heel = Surcharge over Heel = Adjacent Footing Load = Adjacent Footing Load = Load @ Stem Above Soil = =	e Distanc	<u>f.</u> #	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over H Adjacent Footing L Axial Dead Load on * Axial Live Load on Soil Over Toe Surcharge Over To Stern Weight(5)	water tbl) water tbl) leel = eel = oad = n Stem = Stem = ee = 	lbs	<u>ft</u>	ft-#
Item For Item Ibs It Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force Buoyant Force = Surcharge Over Toe = Adjacent Footing Load = Added Lateral Load = Load @ Stem Above Soil = Total =	e Distanc ft		Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over H Adjacent Footing L Axial Dead Load on * Axial Live Load on Soil Over Toe Surcharge Over To Stem Weight(s) Earth @ Stem Trat	water tbl) water tbl) leel = oad = n Stem = Stem = = pe = nsitions =	lbs	ft	ft-#
Item Total =	e Distanc ft 0.T.M.		Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over H Surcharge Over He Adjacent Footing L Axial Dead Load or * Axial Live Load on * Axial Live Load on Soil Over Toe Surcharge Over Toe Stern Weight(s) Earth @ Stem Trar Footing Weight	water tbl) water tbl) leel = oad = n Stem = Stem = stem = = nsitions = =	Ibs	ft 0.25	ft-#
Item Force HL Act Pres (ab water tb) HL Act Pres (be water tb) Hydrostatic Force Buoyant Force = Surcharge over Heel = Surcharge over Heel = Adjacent Footing Load = Adjacent Footing Load = Load @ Stem Above Soil = Total = Besisting(Overturning Patio	e Distanc ft O.T.M.	=	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over H Adjacent Footing L Axial Dead Load on * Axial Live Load on Soil Over Toe Surcharge Over To Stem Weight(s) Earth @ Stem Trar Footing Weight Key Weight	water tbl) water tbl) deel = eel = oad = n Stem = Stem = = we = nsitions = = =	lbs	ft 0.25	ft-#
tem Force HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force Buoyant Force = Surcharge Over Toe = Adjacent Footing Load = Added Lateral Load = Load @ Stem Above Soil = Total = Resisting/Overturning Ratio Vertical Loads used for Soil Press	e Distanc ft O.T.M. sure =	=	Soil Over HL (ab. Soil Over HL (bel. Watre Table Sloped Soil Over H Adjacent Footing L Axial Dead Load on * Axial Live Load on Soil Over Toe Surcharge Over To: Stem Weight(s) Earth @ Stem Trai Footing Weight Vert. Component	water tbl) water tbl) leel = eel = oad = n Stem = stitions = = = =		ft 0.25	ft-#

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.

Project Name/Number : (C02-D10) 200

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING Cantilevered Retaining Wall Code: IBC 2018,ACI 318-14,TMS 402-16 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) 0.038 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-06055289 License To : MALSAM TSA	11.20.0	3.31 IGINEERIN	G	Cantilevered Retain	ing V	Vall	Code: IBC 2018,A	ACI 318-14,TMS 402-1
Criteria				Soil Data				
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe	=	0.00 ft 0.00 ft 0.00 0.00 in		Allow Soil Bearing = Equivalent Fluid Pressure Metho Active Heel Pressure = = Passive Pressure =	0.0 d 0.0 0.0) psf) psf/ft) psf/ft		
vvater neignt over neer	-	0.011		Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	0.00 0.00 0.000) pcf) pcf) in		
Surcharge Loads				Lateral Load Applied to	Stem	1	Adjacent Footing	Load
Surcharge Over Heel NOT Used To Resist Sli Surcharge Over Toe NOT Used for Sliding & (Axial Load Applied Axial Dead Load	ding & Overtur to St	0.0 psf Overturning 0.0 ming em 0.0 lbs	, ,	Lateral Load = Height to Top = Height to Bottom = Load Type = (Ser (Ser disc Level)	0.0 # 0.00 ft 0.00 ft vice 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	= 0.0 lbs = 0.00 ft = 0.00 ft Line Load
Axial Load Eccentricity	-	0.0 in		(Service Level)	_		Poisson's Ratio	= 0.000
Design Summary				Stem Construction		Bottom Stem Of	<	
Wall Stability Ratios Overtuming Sliding	= =	0.00 O 0.00 O	K K	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size	ft = = = =	0.00 LRFE 0.00) 3))	
Total Bearing Load resultant ecc.	= =	0 lbs 0.00 in		Rebar Spacing Rebar Placed at	=	0.00 Cente	,) r	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = = Than (0 ps 0 ps 0 ps	f OK f OK f	fb/FB + fa/Fa Total Force @ Section Service Level	= Ibs =	0.00	D	
ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe	= = =	0 ps 0 ps 25.9 ps	f f i OK	Strength Level MomentActual Service Level	lbs = ft-# =			
Footing Shear @ Heel Allowable Sliding Calcs	= =	0.0 ps 67.1 ps	i OK	Strength Level MomentAllowable ShearActual	ft-# = =	0.0)	
Lateral Sliding Force less 0 % Passive Force less 0 % Friction Force	= = - = -	0.0 lbs 0.0 lbs 0.0 lbs		Service Level Strength Level ShearAllowable	psi = psi = psi =	0.0)	
Added Force Req'd for 1.5 Stability	=	0.0 lbs 0.0 lbs	OK OK	Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =	0.00)	
Vertical component of active NOT considered in the calcu	e latera	l soil pressi of soil beari	ure IS	f'm Fs Solid Grouting Modular Ratio 'n'	psi= psi= =	1,500 (No 0.00)))	
Load Factors Building Code Dead Load Live Load	IBC	2018,ACI 1.400 1.700		Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type	psf = = in = =	0.0 1.000 0.00 Medium))) Weight	
Earth, H Wind, W Seismic, E		1.700 1.000 1.700		fc Fy	= psi = psi =	2,500.0 0.0)	

Project Name/Number : (C02-D10) 200

	OANO ENON	NEERING				COUC. IL	2010,101010	
Footing Data			Footing D	Design Result	s			
Toe Width Heel Width Total Footing Width Footing Thickness Key Width Key Depth Key Distance from Too	-	0.00 ft 0.00 0.00 0.00 in 0.00 in 0.00 in	Factored Press Mu' : Upward Mu' : Downwar Mu: Design Actual 1-Way S Allow 1-Way S	Toe sure = d = Shear = 25. hear = 35.	Hee 0 0 0 94 0.0 78 35.7	L D psf D ft-# D ft-# D ft-# D psi B psi		
fc = 2,000 psi Footing Concrete Densi Min. As % Cover @ Top 0.00	Fy = 60, ity = = 0.0 @ Btm.=	000 psi 0.00 pcf 1000 = 0.00 in	Toe Reinforcin Heel Reinforcin Key Reinforcin Footing Torsior Footing Allow.	g = NoneS ng = NoneS g = NoneS n,Tu Torsion,phiTu	pec'd pec'd = 0.1 = 0.1	00 ft-Ibs 00 ft-Ibs		
			If torsion e	xceeds allowable	e, provide			
			Other Accepte	blo Sizon & Spr				
			Toe: phiMn Heel: phiMn Key: No key	= phi'5'lambda'sqi = phi'5'lambda'sqi y defined	rt(fc)'Sm rt(fc)'Sm			
			Min footing T Min footing T If one layer o #4@ 0.00 #5@ 0.00	&S reinf Area &S reinf Area per f horizontal bars: in	0.0 foot 0.0 If two #4@ #50	0 in2 0 in2 /ft layers of hor 0 0.00 in	izontal bars:	
Summary of Over	rturnina &	Resisting	#6@ 0.00	nents	#6@	0.00 in		
Summary of Over	rturning &		#6@ 0.00 Forces & Mor	in in nents	#5@ #6@	0.00 in	RESISTING	
Summary of Over	rturning &	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mon G Moment ft-#	in nents	#6@	0.00 in 0.00 in Forc	RESISTING e Distance ft	Moment ft-#
summary of Over em Act Pres (ab water tbl drostatic Force	rturning & Force Ibs	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mor G Moment ft-#	in nents Soil Over HL Soil Over HL Watre Table	(ab. water t	0.00 in Forc Ibs	RESISTING e Distance ft	Moment ft-#
summary of Over emAct Pres (ab water tbl Act Pres (be water tbl /drostatic Force lovant Force	rturning & Force bs	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mor G Moment ft-#	in nents Soil Over HL Soil Over HL Watre Table Sloped Soil	#30 #6@ . (ab. water t . (bel. water Over Heel	0.00 in Forc Ibs bl) tbl)	RESISTING e Distance ft	Moment ft-#
Summary of Over em - Act Pres (ab water tbl - Act Pres (be water tbl /drostatic Force Joyant Force Ircharge over Heel	rturning & Force bs)) = =	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mor G Moment ft-#	in nents Soil Over HL Soil Over HL Watre Table Sloped Soil Surcharge C	#30 #6@ . (ab. water t . (bel. water Over Heel Iver Heel	0.00 in Forc Ibs bl) tbl) =	RESISTING e Distance ft	Moment ft-#
Summary of Over em L Act Pres (ab water tbl J Act Pres (be water tbl J drotstatic Force Joyant Force Jurcharge over Heel Jurcharge Over Toe	rturning & Force Ibs)) = = =	Resisting I OVERTURNIN Distance ft	#6@ 0.00 Forces & Mon G Moment ft-#	nents Soil Over HL Soil Over HL Watre Table Sloped Soil Surcharge C Adjacent Fo	#30 #6@ . (ab. water t . (bel. water Over Heel Dver Heel Dver Heel oting Load	bl) = = =	RESISTING e Distance ft	Moment ft-#
Summary of Over em L Act Pres (be water tbl Act Pres (be water tbl dytostatic Force Joyant Force Joyant Force Joyant Force Joyant Force Joyant Force Joyant Force Joyant Force Joyant Force Joyant Force	Force bs) = = = =	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mor G G tt-#	in in Soil Over HL Soil Over HL Watre Table Sloped Soil Surcharge C Adjacent Fo Axial Dead	#6(#6(. (ab. water t . (bel. water Over Heel Over Heel over Heel oting Load .oad on Ster	bl) = = =	RESISTING e Distance ft	Moment ft-#
summary of Over em L Act Pres (ab water tbl ydrostatic Force urcharge Over Toe diacent Footing Load dded Lateral Load	rturning & Force bs)) = = = = =	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mon G Moment ft-#	Soil Over HL Soil Over HL Soil Over HL Watre Table Sloped Soil Surcharge C Adjacent Fo Axial Dead I * Axial Dead I	#6(+6(- (ab. water to - (bel. water Over Heel Over Heel over Heel outing Load - coad on Stem - on Stem	6.00 in Force Ibs bl) tbl) = = = = -	RESISTING e Distance ft	Moment ft-#
Summary of Over em L Act Pres (ab water tbl) ydrostatic Force uoyant Force urcharge over Heel urcharge Over Toe djacent Footing Load dded Lateral Load oad @ Stem Above Soil	rturning & Force bs)) = = = = = = =	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mor G Moment ft-#	soil Over HL Soil Over HL Soil Over HL Watre Table Sloped Soil Surcharge C Adjacent Fo Axial Dead I Axial Dead Surcharge C	#30 #6(0.00 in Forc Ibs bl) tbl) = = = = = =	RESISTING e Distance ft	Moment ft-#
Em L Act Pres (ab water tibl L Act Pres (ab water tibl Viorstatic Force uoyant Force urcharge over Heel urcharge Over Toe djacent Footing Load dded Lateral Load ad @ Stem Above Soil	rturning & Force Ibs)) = = = = = = = = =	Resisting OVERTURNIN Distance ft	#6@ 0.00 Forces & Mor G Moment ft-#	soil Over HI Soil Over HI Soil Over HI Watre Table Sloped Soil Surcharge C Adjacent Fo Axial Dead I Axial Live L Soil Over To Surcharge C Stem Weigh	#30 #66 . (ab. water t . (bel. water Ver Heel bing Load on Ster bad on Ster be bver Toe t(s)	0.00 in 0.00 in Forc lbs bl) lbs bl) = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =	RESISTING e Distance ft	Moment ft-#
Summary of Over em L Act Pres (ab water tbl L Act Pres (be water tbl Urcharge over Action urcharge over Heel urcharge Over Toe djacent Footing Load dded Lateral Load xad @ Stem Above Soil	rturning & Force)) = = = = = = = = = = = = =	Resisting OVERTURNIN Distance ft 0.T.M. =	#6@ 0.00 Forces & Mor G Moment ft-#	n nents Soil Over HL Soil Over HL Watre Table Sloped Soil Surcharge C Adjacent Fo Adjacent Fo Adjacent Fo Adjacent Fo Adjacent Fo Adjacent Fo Surcharge C Stern Weigh Earth @ Ste Footing Weight	+30 #60 	b) 0.00 in Forc Ibs b)) b)) tb)) = = = = = = = = = = = = =	RESISTING e Distance ft	Moment ft-#
Etem IL Act Pres (ab water tbi) IL Act Pres (ab water tbi) IL Act Pres (be water tbi) IL Act Pres (be water tbi) IV dyrdsstatic Force Woyant Force Workinge Over Toe djacent Footing Load dded Lateral Load coad @ Stem Above Soil Total Resisting/Overturning Vertical Loade used for	rturning & Force bs)) = = = = = = = = = = = = =	Resisting OVERTURNIN Distance ft O.T.M. =	#6@ 0.00 Forces & Mor G Moment ft.#	nin in nents Soil Over HL Soil Over HL Watre Table Sloped Soil Surcharge C Adjacent Fo Adjacent Fo Axial Dead 1 Axial Dead 1 Axial Dead 1 Axial Dead 1 Soil Over To Surcharge C Stem Weigh Earth @ Ste Footing Wei Key Weight Vert. Compc	#36 #66 (ab. water to (bel. water (bel. water (bel. water Voer Heel voer Heel and on Stem e voer Toe t(s) m Transition: ght	Force Ibs bl) = = = = = = = = =	RESISTING e Distance ft	Moment ft-#

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.

nPro (c) 1987-2019, Build 11.20.03.31 se : KW-06055289 Cai nse To : MALSAM TSANG ENGINEERING	ntilevered	d Retaining Wall	Code: IBC 2018,ACI 318-14,TMS 402-1
ilt			
Horizontal Deflection at Top of Wall due	to settlen	nent of soil	
(Deflection due to wall bending not considered)			
Soil Spring Reaction Modulus	250.0	pci	
Horizontal Defl @ Top of Wall (approximate only)	0.038	in	
The above calculation is not valid if the heel soil beari	ng pressure	exceeds that of the toe,	
because the wall would then tend to rotate into the ref	tained soil.		

Project Name/Number	:	(C02-D10)	200
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tetainPro (c) 1987-2019, Build icense : KW-06055289 .icense To : MALSAM TSA	11.20 ANG E	0.03.31 ENGINEERING	3	Cantilevered Ret	aini	ing V	Vall	Code: IBC 2018,A	CI 31	8-14,TMS 402	2-16
Criteria			:	Soil Data							
Retained Height Wall height above soil Slope Behind Wall	=	8.00 ft 0.50 ft 0.00	A E A	Allow Soil Bearing Equivalent Fluid Pressure M Active Heel Pressure	= 2 /letho =	2,666.0 d 35.0) psf) psf/ft				
Height of Soil over Toe	=	4.00 in	F	Passive Pressure	=	250.0	psf/ft				
Water height over heel	=	0.0 ft	5	Soil Density, Heel	=	120.00	pof				
			5	Soil Density, Toe	=	120.00	pcf				
			F	Footing Soil Friction	=	0.450					
			5	Soil height to ignore for passive pressure	=	12.00	in	Restain			
Surcharge Loads			1	Lateral Load Applied	d to	Stem		Adjacent Footing	Load		
Surcharge Over Heel	-	0.0 psf	ì	Lateral Load =		64.0 #/	/ft	Adjacent Footing Load	=	0.0 lbs	
Surcharge Over Toe	aing a =	& Overturning	-	Height to Top =		8.00 ft		Footing Width	-	0.00 ft	
NOT Used for Sliding &	Overt	urning		Height to Bottom =		0.00 11		Wall to Ftg CL Dist	=	0.00 ft	
Axial Load Applied	to S	tem		Load Type =	(Sor		avel)	Footing Type		Line Load	
Avial Dead Load		0.0.1ba		Wind on Evenend C:	(Ser	NUE LE	- 4	Base Above/Below Soil	=	0.0 ft	
Axial Live Load	=	0.0 lbs		(Service Level)		0.0 p	ST	at Back of Wall		0.01	
Axial Load Eccentricity	=	0.0 in		(POISSON'S RATIO	=	0.300	
Design Summary			[Stem Construction]-	Bottom				
				Design Height Abov	re Ftg	ft =	0.00				
Wall Stability Ratios	=	4 00 D 1		Wall Material Above	e "Ht"	=	Concrete				
Slah Resist	te ΔII :	1.26 Rat Sliding I	10 < .	1.5! Design Method		=	LRFD				
Sidb Resist	5 711 1	Siluing :		Thickness Rober Size		-	8.00				
Total Bearing Load	=	2 623 lbs		Rebar Size		-	# 5 12.00				
resultant ecc.	=	19.73 in		Rebar Placed at		=	Edae				
Soil Pressure @ Toe	=	2 548 nsf	OK	Design Data							
Soil Pressure @ Heel	=	0 psf	OK	fb/FB + fa/Fa		=	0.877				
Allowable	=	2,666 psf		I otal Force @ Sec	tion						
Soil Pressure Less	Than	Allowable		Service Level		lbs =	0 440 0				
ACI Factored @ Toe	=	3,567 psf		Strength Level		ibs =	2,416.0				
ACI Factored @ Heel	=	0 pst		Service Level		ft_# =					
Footing Shear @ Toe	=	29.8 psi	OK	Strength Level		ft-# =	7.125.3				
Allowable	-	12.9 psi 75.0 psi	OK	MomentAllowab	le	=	8.121.3				
	-	75.0 psi		ShearActual			-,				
Lateral Sliding Force	_	1 020 5 lbc		Service Level		psi =					
Editorial onlang 1 0100	-	1,525.5 105		Strength Level		nsi =	32.5				
				Shear. Allowable		psi =	75.0				
				Anet (Masonry)		in2 =					
				Rebar Depth 'd'		in =	6.19				
				Masonry Data							
				fm		psi =					
				Fs		psi =					
ertical component of active	a later	ral soil pressur	re IS	Solid Grouting		=					
JI considered in the calcu	Jatior	n of soil bearin	g	Modular Ratio 'n'		= nofr	100.0				
oad Factors				- Short Term Faster		psi=	100.0				
Building Code	IB	C 2018.ACI		Short Lerm Factor Equiv Solid Thick		-					
Dead Load	.0	1.400		Equiv. Solid Trick. Masonry Block Type	e	=	Medium V	Veight			
Live Load		1.700		Masonry Design Ma	- athod						
Earth, H		1.700		Concrete Data	Jaiod	-	100				
Wind, W		1.300		fc		psi =	2,500.0				
Seismic, E		1.000		Fy		psi=	60,000.0				

icense : KW-06055289 icense To : MALSAM TSANG EN	GINEERING	Cantilevered R	etai	ning Wa	11	Code: IBC	2018,ACI 318-14	TMS 402-1
Concrete Stem Rebar Area	Details							
Bottom Stem	Vertical Re	einforcing I	Horizo	ntal Reinfor	rcing			
As (based on applied moment) :	0.2698 in2	/ft						
(4/3) * As :	0.3597 in2	/ft I	Min St	em T&S Re	einf Area	a 0.000 in2		
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2	/ft I	Min St	em T&S Re	einf Area	a per ft of stem H	Height: 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2	/ft I	Horizo	ntal Reinfor	rcing Op	otions :		
	=======	(One la	iyer of :	Two la	yers of :		
Required Area :	0.2698 in2	/ft #	#4@	0.00 in	#4@	0.00 in		
Provided Area :	0.31 in2/ft	;	#5@	0.00 in	#5@	0.00 in		
Maximum Area :	0.8382 in2	/ft #	#6@	0.00 in	#6@	0.00 in		
Footing Data		Footing Desig	gn R	esults				
Toe Width =	3.00 ft			Toe	Hee	4		
Heel Width =	1.66	Factored Pressure	=	3,567		0 psf		
Total Footing Width =	4.66	Mu': Upward	=	101,945		0 ft-#		
Footing Thickness =	12.00 in	Mu': Downward	-	14,364	76	/π-# 7##		
Key Width =	0.00 in	Actual 1 Way Shear		20.75	12.8	6 nci		
Key Depth =	0.00 in	Allow 1-Way Shear	-	75.00	40.0	0 psi 0 psi		
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= #	5 @ 12.00	in	o po.		
f'c = 2,500 psi Fy = 0	60,000 psi	Heel Reinforcing	= N	Ione Spec'd	i			
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= N	Ione Spec'd	1			
Min. As % =	0.0018	Footing Torsion, Tu		=	0.	00 ft-lbs		
Cover @ Top 2.00 @ Btn	n.= 3.00 in	Footing Allow. Torsic	on, phi	Tu =	0.	00 ft-lbs		
		If torsion exceed	ds alle	owable, pro	ovide			
		supplemental de	esign	for footing	torsior	1.		
	(Other Acceptable S	Sizes	& Spacing	IS			
		Toe: #4@ 9.07 in Heel: phiMn = phi' Key: No key defir	n, #5@ '5'lami ned	! 14.07 in, # oda'sqrt(fc)'	6@ 19. Sm	97 in, #7@ 27.2	3 in, #8@ 35.86 in,	#9@ 45
		Min footing T&S re Min footing T&S re	einf Ar einf Ar	ea ea per foot	0.0 0.0	0 in2 0 in2,/ft		

Min footing T&S reinf Area per foot	0.00 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 0.00 in	#4@ 0.00 in
#5@ 0.00 in	#5@ 0.00 in
#6@ 0.00 in	#6@ 0.00 in

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		OV	ERTURNIN	G		RES	ISTING	
Item		Force lbs	Distance ft	ft-#		Force Ibs	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	953.6	4.16 4.16	3,970.2 3,970.2
Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load	= = =			0.000	Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem =			
Added Lateral Load Load @ Stem Above Soil	' = =	512.0	5.00	2,560.0	Soil Over Toe = Surcharge Over Toe =	120.0	1.50	180.0
					Earth @ Stem Transitions=	850.0	3.33	2,833.1
Total	=	1,929.5	O.T.M. =	6,812.5	Footing Weight = Key Weight =	699.0	2.33	1,628.7
Resisting/Overturning	Rati	0	=	1.26	Vert. Component =			
Vertical Loads used fo	or Soil	I Pressure	= 2,621	2.6 lbs	Total = * Axial live load NOT included in resistance, but is included for s	2,622.6 lbs total displayed soil pressure ca	R.M.= , or used for lculation.	8,612.2 r overturning

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil
(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci

 Horizontal Defl @ Top of Wall (approximate only)
 0.129
 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 relained soil.
 because the wall would then tend to rotate into the relained soil.

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Criteria		Soil I	Data						
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe = Water height over heel =	= 6.00 ft = 0.50 ft = 0.00 = 4.00 in = 0.0 ft	Allow S Equiva Active Passiv Soil De Soil De Footing Soil he	soil Bearing lent Fluid Pressure M Heel Pressure e Pressure sinsity, Heel sinsity, Toe g Soil Friction ight to ignore assive presure	= 2 ethoo = = = 1 = 1 =	666.0 40.0 150.0 20.00 20.00 0.450	psf psf/ft psf/ft pcf in			
Surcharge Loads		Late	ral Load Applied	l to 9	Stom	 	Adjacent Footing		_
Surcharge Loads	0.0	Late	rai Loau Applieu	100	Stem		Adjacent Footing		lle e
NOT Used To Resist Sli Surcharge Over Toe = NOT Used for Sliding & (Axial Load Applied Axial Dead Load	= 0.0 pst ding & Overturning = 0.0 Overturning to Stem = 0.0 lbs	Lateral Heig Heig Load T Wind	I Load = ht to Top = ht to Bottom = 'ype = on Exposed Stem =	Seisi (Serv	54.0 #/ 5.00 ft 0.10 ft mic (E vice Le 0.0 ps	ft) :vel) :f	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type Base Above/Below Soil at Back of Wall	= 0.0 = 0.00 = 0.00 = 0.00 Line Los = 0.0	nds ft in ft ad ft
Axial Load Eccentricity	= 0.0 ibs = 0.0 in	(Serv	ice Level)				Poisson's Ratio	= 0.300	
Design Summary		Ste	m Construction] _	Bottom			
Wall Stability Ratios Overturning Slab Resist Total Bearing Load	= 1.30 Ra s All Sliding ! = 1,733 lbs	tio < 1.5!	Design Height Above Wall Material Above Design Method Thickness Rebar Size Rebar Spacing	e Ftg "Ht"	ft = = = = =	0.00 Concrete LRFD 8.00 # 4 11.00			
resultant ecc. Soil Pressure @ Toe	= 15.01 in = 1,993 psf	ок	Rebar Placed at Design Data fb/FB + fa/Fa		=	Edge 0.556			
Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= 0 psf = 2,666 psf Than Allowable = 2,791 psf = 0 psf	ОК	Total Force @ Sect Service Level Strength Level MomentActual	ion	lbs = lbs =	1,476.0			
Footing Shear @ Toe	= 26.4 psi	ОК	Service Level		ft-# =	2 270 0			
Footing Shear @ Heel	= 7.9 psi	OK	Moment Allowable		= #=	5,270.0			
Sliding Calcs Lateral Sliding Force	= 75.0 psi = 1,263.3 lbs		ShearActual Service Level Strength Level		psi = psi =	19.7			
			Anet (Masonry)		in2 =	75.0			
		,	Rebar Depth 'd'		in =	6.25			
Vertical component of active	e lateral soil pressu	re IS	fm Fs Solid Grouting		psi = psi = =				
NOT considered in the calcu	ulation of soil beari	ng	Modular Ratio 'n' Wall Weight Short Term Factor		= psf= -	100.0			
Building Code Dead Load Live Load	IBC 2015,ACI 1.200 1.600		Equiv. Solid Thick. Masonry Block Type Masonry Design Met	thod	=	Medium V ASD	Veight		
⊨arth, H Wind, W Seismic, E	1.600 1.000 1.000	(fc Fy		psi = psi =	2,500.0 60,000.0			

Project Name/Number	: 1	(C02-D10)	200
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etainPro (c) 1987-2019, Build 11.20.03 cense : KW-06055289 icense To : MALSAM TSANG EN	Cantilevered	Retai	ning Wa	Code: IBC 2015,ACI 318-14,ACI 530	
Concrete Stem Rebar Area	Details				
Bottom Stem	Vertical	Reinforcing	Horizo	ontal Reinfo	prcing
As (based on applied moment) :	0.1227	in2/ft			
(4/3) * As :	0.1637	in2/ft	Min St	tem T&S R	einf Area 1.248 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2	2/ft	Min St	tem T&S R	einf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728	in2/ft	Horizo	ontal Reinfo	orcing Options :
	======	======	One la	ayer of :	Two layers of :
Required Area :	0.1728	in2/ft	#4@ ^	12.50 in	#4@ 25.00 in
Provided Area :	0.2182	in2/ft	#5@ ⁻	19.38 in	#5@ 38.75 in
Maximum Area :	0.8467	in2/ft	#6@ 2	27.50 in	#6@ 55.00 in
Footing Data		Footing De	sign R	esults	
Toe Width =	2 25 ft			Toe	Heel
Heel Width =	1.41	Factored Pressu	'e =	2,791	0 psf
Total Footing Width =	3.66	Mu' : Upward	=	48,627	0 ft-#
Footing Thickness =	10.00 in	Mu' : Downward	=	6,014	280 ft-#
Key Width =	0.00 in	Mu: Design	=	3,551	280 ft-#
Key Depth =	0.00 in	Actual 1-Way Sh	ear =	26.40	7.85 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing	- = ±	10.00 €4 @ 11 00	40.00 psi) in
fc = 2.500 psi Ev =	60.000 psi	Heel Reinforcing	1 =	Vone Spec'	d
Footing Concrete Density =	150.00 pcf	Key Reinforcing	1 =	Vone Spec'	d
Min. As % =	0.0018	Footing Torsion,	Tu	=	0.00 ft-lbs
Cover @ Top 2.00 @ Btr	n.= 3.00 in	Footing Allow. To	rsion, ph	iTu =	0.00 ft-lbs
		If torsion exe supplementa	eeds all	owable, pr for footing	ovide a torsion.
		Other Acceptab	le Sizes	& Spacing	gs
		Toe: #4@ 11. Heel: phiMn = Key: No key	11 in, #5(phi'5'lam lefined	@ 17.22 in, bda'sqrt(fc)	#6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 'Sm
		Min footing T& Min footing T& If one layer of #4@ 11.11 i #5@ 17.22 i #6@ 24.44 i	S reinf Ar S reinf Ar norizontal n n	ea ea per foot bars:	0.79 in2 0.22 in2 /t If two layers of horizontal bars: #4@ 22.22 in #6@ 34.44 in #6@ 48.89 in

Item	Force	/ERTURNING Distance ft	Moment ft-#		Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	535.2	3.29 3.29	1,759.9 1,759.9
Suoyant Force :	=			Sloped Soil Over Heel =			
Surcharge over Heel	=			Surcharge Over Heel =			
Surcharge Over Toe	=			Adjacent Footing Load =			
djacent Footing Load	=			Axial Dead Load on Stem =			
dded Lateral Load	= 329.4	3.78	1,246.2	* Axial Live Load on Stem =			
oad @ Stem Above Soil :	=			Soil Over Toe =	90.0	1.13	101.3
	=			Surcharge Over Toe =			
				Stem Weight(s) =	650.0	2.58	1,679.2
				Earth @ Stem Transitions=			
Total	= 1,263.3	O.T.M. =	3,373.4	Footing Weight =	457.5	1.83	837.2
				Key Weight =			
Resisting/Overturning	Ratio	=	1.30	Vert. Component =			
Vertical Loads used for	Soil Pressure	= 1,732.	7 Ibs	Total =	1 732 7	lbs RM =	4 377 F

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 settlem	nent 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	ng pressure e	exceeds that of the toe,

Project Name/Number : (C02-D10	200
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tetainPro (c) 1987-2019, Build icense : KW-06055289 icense To : MALSAM TSA	11.20.03.31 NG ENGINEERING	Cantilevered Retaining Wall			Code: IBC 2015,ACI 318-14,ACI 530-13			
Criteria		Soil Data						
Retained Height Wall height above soil Slope Behind Wall =	= 11.00 ft = 0.50 ft = 0.00	Allow Soil Bearing Equivalent Fluid Pressure Ma Active Heel Pressure	= 2,666.0 ethod = 40.0) psf) psf/ft				
Height of Soil over Toe	= 4.00 in		=					
Water height over heel	= 0.0 ft	Passive Pressure	= 150.0) pst/tt				
		Soil Density, Heel	- 120.00) pcf				
		Footing ISoil Friction	= 120.00) poi				
		Soil beight to ignore	- 0.400					
		for passive pressure	= 12.00	in	Restaint			
Surcharge Loads		Lateral Load Applied	to Stem	1	Adjacent Footing Load			
Surcharge Over Heel	= 0.0 psf	Lateral Load =	99.0 #	/ft	Adjacent Footing Load = 0.0 lbs			
NOT Used To Resist Sli	ding & Overturning	Height to Top =	11.00 ft		Footing Width = 0.00 ft			
Surcharge Over Toe	= 0.0 Overturning	Height to Bottom =	0.00 ft		Eccentricity = 0.00 in			
		Load Type =	Wind (W)		vvali to Ftg CL Dist = 0.00 ft			
Axial Load Applied	to Stem		(Service L	evel)	Base Above/Below Soil			
Axial Dead Load :	= 0.0 lbs	Wind on Exposed Stem _	0.0 p	sf	at Back of Wall = 0.0 ft			
Axial Live Load :	= 0.0 lbs	(Service Level)			Poisson's Ratio = 0.300			
Axiai Load Eccentricity :	= 0.0 in			Detter				
Design Summary		Stem Construction		Stem OK	< colored and set of the set of t			
Wall Stability Pation		Design Height Above	Ftg ft=	0.00)			
Overturning	= 1.34 Pati	Wall Material Above	"Ht" =	Concrete				
Slab Resist	s All Sliding !	Design Method	-	10.00				
	g -	Rebar Size	_	# 6				
Total Bearing Load	= 4,987 lbs	Rebar Spacing	=	8.00)			
resultant ecc.	= 27.81 in	Rebar Placed at	=	Edae				
Soil Pressure @ Toe	= 2.468 pcf	Design Data						
Soil Pressure @ Heel	= 2,400 psi = 0 psf	OK fb/FB + fa/Fa	=	0.992	2			
Allowable	= 2,666 psf	Total Force @ Sect	ion					
Soil Pressure Less	Than Allowable	Service Level	lbs =					
ACI Factored @ Toe	= 3,455 psf	Strength Level	lbs =	4,961.0)			
ACI Factored @ Heel	= 0 psf	NomentActual	6 # _					
Footing Shear @ Toe	= 42.1 psi	OK Strength Level	ft # -	20 186 9	3			
Footing Shear @ Heel	= 17.4 psi	OK Moment Allowable		20,100.0				
Allowable	= /5.0 psi	Shoar Actual	. –	20,000.2	-			
Sliding Calcs		SnearActual	nei -					
Lateral Sliding Force	= 4,090.3 lbs	Strength Level	psi=					
		Shoor Allewshi	psi =	54.2	2			
		Anet (Masons)	psi=	/ 5.0	J			
		Rebar Depth 'd'	in2 =	7 63				
		Masonry Data		1.03	,			
		fm	psi =					
		Fs	psi=					
ertical component of active	e lateral soil pressur	re IS Solid Grouting	. =					
OT considered in the calcu	lation of soil bearing	g Modular Ratio 'n'	=					
		Wall Weight	psf=	125.0)			
Load Factors	100 0045 4 01	Short Term Factor	=					
Building Code	IBC 2015,ACI	Equiv. Solid Thick.	=					
Live Load	1.200	Masonry Block Type	=	Medium \	Weight			
Live Load	1.000	Masonry Design Met	hod =	ASD				
Wind W	1.000	Concrete Data	nei -	2 500 0)			
Seismic E	1 000	Ev	psi=	2,000.0				
Colorillo, L	1.000	гу	psi=	JU,000.L	, ,			

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Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinfor	rcing
As (based on applied moment) :	0.614 in2/ft		
(4/3) * As :	0.8187 in2/ft	Min Stem T&S Re	einf Area 2.760 in2
200bd/fy: 200(12)(7.625)/60000:	0.305 in2/ft	Min Stem T&S Re	einf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinfor	rcing Options :
		One layer of :	Two layers of :
Required Area :	0.614 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.66 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.0329 in2/ft	#6@ 22.00 in	#6@ 44.00 in
Footing Data	Footing	Design Results	
Toe Width =	5.00 ft	Тое	Heel
Heel Width =	2.33 Factored Pres	sure = 3,455	0 psf
Total Footing Width =	7.33 Mu': Upward	= 306,045	0 ft-#
Footing Thickness =	15.00 in Mu' : Downwa	rd = 40,950	2,026 ft-#
Key Width =	0.00 in Actual 1 Max	= 22,091 Shoor = 42.12	2,020 IL-#
Key Depth =	0.00 in Allow 1-Way	Shear = 75.00	40.00 psi
Key Distance from Toe =	0.00 ft Toe Reinforci	na = #6@8.00 i	40.00 psi
fc = 2.500 psi Fv = 6	0.000 psi Heel Reinford	ing = None Spec'd	1
Footing Concrete Density =	50.00 pcf Key Reinforci	ng = None Spec'd	1
Min. As % = 0	.0018 Footing Torsic	on, Tu =	0.00 ft-lbs
Cover @ Top 2.00 @ Btm	.= 3.00 in Footing Allow	Torsion, phi Tu =	0.00 ft-lbs
	If torsion suppleme	exceeds allowable, pro ntal design for footing	ovide torsion.
	Other Accept	table Sizes & Spacing	IS
	Toe: #4@ Heel: phiM Key: No k	5.21 in, #5@ 8.08 in, #6 n = phi'5'lambda'sqrt(fc)' ey defined	@ 11.47 in, #7@ 15.65 in, #8@ 20.60 in, #9@ 26. Sm
	Min footing	TRC roinf Aroo	0.97 in 0

Min footing I&S reinf Area 2.37 in2	
Min footing T&S reinf Area per foot 0.32 in2 /ft	
If one layer of horizontal bars: If two layers of horizontal	l bars:
#4@ 7.41 in #4@ 14.81 in	
#5@ 11.48 in #5@ 22.96 in	
#6@ 16.30 in #6@ 32.59 in	

RetainPro (c) 1987-2019, Build 11:20:03:31 License : KW06055299 License To : MALSAM TSANG ENGINEERING Code: IBC 2015,ACI 318-14,ACI 530-13 Summary of Overfurning & Recisting Forces & Momente

		OV	ERTURNING			RE	SISTING	
Item		Force lbs	Distance ft	Moment ft-#		Force Ibs	Distance ft	ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hvdrostatic Force	1	3,001.3	4.08	12,255.1	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,975.6	6.58 6.58	13,002.7 13,002.7
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	= = =	1,089.0	6.75	7,350.8	* Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe =	200.0	2.50	500.0
					Stem Weight(s) = Earth @ Stem Transitions=	1,437.5	5.42	7,786.5
Total	=	4,090.3	O.T.M. =	19,605.9	Footing Weight = Key Weight =	1,374.4	3.67	5,037.1
Resisting/Overturning	Rati	0	=	1.34	Vert. Component =			
Vertical Loads used fo	r Soil	Pressure	= 4,987.	5 lbs	Total = * Axial live load NOT included i resistance, but is included for	4,987.5 lb n total displaye soil pressure c	d, or used fo alculation.	26,326.3 r overturning

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil
(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci

 Horizontal Defl @ Top of Wall (approximate only)
 0.108
 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 relained soil.
 0.108
 in

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	d 11.20 ANG I	0.03.31 ENGINEERING	}	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	= = =	11.00 ft 0.50 ft 0.00 4.00 in 0.0 ft		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	2,000.0 d 40.0 150.0 120.00 0.450 12.00) psf) psf/ft) psf/ft) pcf) pcf)		
Surcharge Loads			Ē	Lateral Load Applied to	Stem		Adjacent Footing Load	
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding & Axial Load Applied Axial Dead Load	= = Over I to S	0.0 psf & Overturning 0.0 turning Stem 0.0 lbs		Lateral Load = Height to Top = Height to Bottom = Load Type = Win (See Wind on Exposed Stem _	0.0 # 0.00 ft 0.00 ft d (W) vice L 0.0 p	evel)	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 ft Wall to Fig CL Dist = 0.00 ft Footing Type Line Load Base Above/Below Soil = 0.0 ft	
Axial Live Load Axial Load Eccentricity	=	0.0 lbs 0.0 in		(Service Level)	0.0 p		Poisson's Ratio = 0.300	
Design Summary				Stem Construction	٦.	Bottom		
Wall Stability Ratios Overturning Slab Resis	= its All	1.95 OK Sliding !		Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size	ft = = = =	Concrete LRFD 10.00 # 6		
resultant ecc.	=	12.40 in		Rebar Spacing Rebar Placed at	=	8.00 Edge	9	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= = s Thai = -	1,362 psf 66 psf 2,000 psf Allowable 1,906 psf 92 psf	OK OK	besign Data fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual	= Ibs = Ibs =	0.69 8 3,872.0	8	
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= = =	29.4 psi 14.6 psi 75.0 psi	OK OK	Service Level Strength Level MomentAllowable ShearActual Service Level	ft-# = ft-# = =	14,197.3 20,333.2	3	
	-	3,001.3105		Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data	psi = psi = in2 = in =	42.3 75.0 7.63	3	
Vertical component of activ NOT considered in the calc	e late ulatio	ral soil pressur n of soil bearin	re IS g	fm Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = psf =	125.0)	
Load Factors Building Code Dead Load Live Load Earth, H Wind, W	IE	C 2015,ACI 1.200 1.600 1.600 1.000		Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data fc	= = = psi=	Medium \ ASD 2,500.0	Weight	
Seismic, E		1.000		Fy	psi=	60,000.0)	

Project Name/Number	: 1	(C02-D10)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENG	Cantilevered	Retai	ning Wa	Code: IBC 2015,ACI 318-14,ACI 53	
Concrete Stem Rebar Area	Details				
Bottom Stem	Vertical	Reinforcing	Horiz	ontal Reinfo	prcing
As (based on applied moment) :	0.4318	in2/ft			•
4/3) * As :	0.5758	in2/ft	Min S	tem T&S R	einf Area 2.760 in2
200bd/fy : 200(12)(7.625)/60000 :	0.305 ir	n2/ft	Min S	tem T&S R	einf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 ir	n2/ft	Horiz	ontal Reinfo	orcing Options :
	=====		One I	ayer of :	Two layers of :
Required Area :	0.4318	in2/ft	#4@	10.00 in	#4@ 20.00 in
Provided Area :	0.66 in2	2/ft	#5@	15.50 in	#5@ 31.00 in
Maximum Area :	1.0329	in2/ft	#6@	22.00 in	#6@ 44.00 in
Footing Data		Footing De	sign R	lesults	
Toe Width =	4 50 ft			Toe	Heel
Heel Width =	2.33	Factored Pressur	e =	1.906	92 psf
Total Footing Width =	6.83	Mu' : Upward	=	183,187	251 ft-#
Footing Thickness =	15.00 in	Mu' : Downward	=	33,170	2,026 ft-#
Key Width =	0.00 in	Mu: Design	=	12,501	1,7/5 tt-#
Key Depth =	0.00 in	Actual 1-Way Sh	ear =	29.43	14.57 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing	ai = :	# 6 @ 11 00	40.00 psi 0 in
fc = 2.500 psi Ev = 6	50.000 psi	Heel Reinforcing	=	None Spec'	d
Footing Concrete Density =	150.00 pcf	Key Reinforcing	=	None Spec'	d
Min. As % = 0	0.0018	Footing Torsion,	Гu	=	0.00 ft-lbs
Cover @ Top 2.00 @ Btm	n.= 3.00 in	Footing Allow. To	rsion, ph	niTu =	0.00 ft-lbs
		If torsion exc supplementa	eeds all I design	lowable, pr	ovide g torsion.
		Other Acceptabl	e Sizes	& Spacing	as
		Toe: #4@ 7.2 Heel: phiMn = Key: No key c	4 in, #5@ phi'5'lam lefined	11.22 in, i bda'sqrt(fc)	96@ 15.93 in, #7@ 21.73 in, #8@ 28.61 in, #9@ 36 ⊮Sm
		Min footing T& Min footing T& If one layer of f #4@ 7.41 in #5@ 11.48 ii #6@ 16.30 ii	S reinf A S reinf A norizonta n	rea rea per foot Il bars:	2.21 in2 1.32 in2 /tt 1f two layers of horizontal bars: #4@ 14.81 in #5@ 22.96 in #6@ 32.59 in

Summary of Overtu	rning & R	esisting F	orces & Mor	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	3,001.3	4.08	12,255.1	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,975.6	6.08 6.08	12,014.9 12,014.9
Buoyant Force =				Sloped Soil Over Heel =			
urcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
djacent Footing Load =				Axial Dead Load on Stem =			
dded Lateral Load =				* Axial Live Load on Stem =			
oad @ Stem Above Soil =				Soil Over Toe =	180.0	2.25	405.0
=				Surcharge Over Toe =			
				Stem Weight(s) =	1,437.5	4.92	7,067.7
Total	2 001 2	отм <u>–</u>	10 055 1	Earth @ Stem Transitions=			
iotai =	3,001.3	0.1.IVI. =	12,255.1	Footing Weight =	1,280.6	3.42	4,373.3
				Key Weight =			
Resisting/Overturning Ra	tio	=	1.95	Vert. Component =			

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.

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Tilt		
Horizontal Deflection at Top of Wall due	to settlem	ent of soil
(Deflection due to wall bending not considered)		
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.064	in
The above calculation is not valid if the heel soil bear	ing pressure e	exceeds that of the toe,

Project Name/Number : (C02-D10	200
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License : KW-06055289 License To : MALSAM TSA	11.20.03.31 NG ENGINEERING	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 =	10.00 ft 0.50 ft 0.00	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,666.0 d 40.0) psf) psf/ft	
Height of Soil over Toe = Water height over heel =	4.00 in 0.0 ft	= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Exetined(Seil Existing =	150.0 120.00 120.00) psf/ft) pcf) pcf	
		Soil height to ignore for passive pressure =	12.00	in	Reitar
Surcharge Loads		Lateral Load Applied to	Stem	1	Adjacent Footing Load
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & 0	: 0.0 psf ling & Overturning : 0.0 Overturning	Lateral Load = Height to Top = 1 Height to Bottom =	90.0 # 0.00 ft 0.00 ft	t/ft t t	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied	to Stem	(Se	rvice L	evel)	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 p	sf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary		Stem Construction	7.	Bottom	
Wall Stability Ratios Overturning Slab Resists	= 1.39 Ratio All Sliding !	Design Height Above Ftg Wall Material Above "Ht' < 1.5! Design Method Thickness	; ft = ' = = =	Concrete LRFE 10.00	
Total Bearing Load resultant ecc.	= 4,512 lbs = 23.78 in	Rebar Size Rebar Spacing Rebar Placed at	=	# 5 8.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 2,300 psf (= 0 psf (= 2.666 psf	bK fb/FB + fa/Fa K Total Force @ Section	=	0.94	3
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	Than Allowable = 3,220 psf = 0 psf	Service Level Strength Level MomentActual	lbs = lbs =	4,100.0)
Footing Shear @ Toe Footing Shear @ Heel	= 37.7 psi 0 = 16.0 psi 0	K Strength Level	ft-# =	15,166.7	7
Allowable Sliding Calcs	= 75.0 psi	MomentAllowable ShearActual	=	15,984.2	2
Lateral Sliding Force	= 3,431.3 lbs	Service Level Strength Level ShearAllowable	psi = psi = psi =	41.7 75.0	,)
		Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =	8.19)
ertical component of active	lateral soil pressure	fm Fs IS Solid Grouting	psi = psi = =		
OT considered in the calcu	lation of soil bearing	Modular Ratio 'n' Wall Weight	= psf=	125.0)
Building Code Dead Load	IBC 2015,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type	=	Medium	Neight
Earth, H Wind, W Seismic, E	1.600 1.000 1.000	Masonry Design Method Concrete Data fc Fv	= psi= psi=	2,500.0)

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Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcin	g
As (based on applied moment) :	0.4283 in2/ft		-
(4/3) * As :	0.5711 in2/ft	Min Stem T&S Reinf	Area 2.520 in2
200bd/fy : 200(12)(8.1875)/60000 :	0.3275 in2/ft	Min Stem T&S Reinf	Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcin	g Options :
		One layer of : Tv	vo layers of :
Required Area :	0.4283 in2/ft	#4@ 10.00 in #	4@ 20.00 in
Provided Area :	0.465 in2/ft	#5@ 15.50 in #	45@ 31.00 in
Maximum Area :	1.1092 in2/ft	#6@ 22.00 in #	#6@ 44.00 in
Footing Data	Footing D	esign Results	
loe Width = Heel Width = Footing Thickness = Key Width = Key Distance from Toe foc = 2,500 psi Fy = 6 Footing Concrete Density = 1 Uie Ac ⁶ (4.25 tt 2.33 Factored Press 6.58 Mu': Upward 15.00 in Mu': Downwarc 0.00 in Actual 1-Way S 0.00 in Actual 1-Way S 0.00 ft Toe Reinforcing Toe Reinforcing 50.00 pcf 0.00 pcf Key Reinforcing Feelinforcing 50.00 pcf	$\begin{array}{rcl} 10e \\ 10e$	Heel 0 psf 0 ft# 1,865 ft# 1,865 ft# 15.97 psi 40.00 psi
Cover@Top 200 @Btm	= 3.00 in Ecoting Allow T	, iu =	0.00 ft lbs
	If torsion ex supplement	cceeds allowable, provid tal design for footing to	de rsion.
	Other Accepta	ble Sizes & Spacings	
	Toe: #4@ 5. Heel: phiMn Key: No key	.61 in, #5@ 8.70 in, #6@ = phi'5'lambda'sqrt(fc)'Sm r defined	12.36 in, #7@ 16.85 in, #8@ 22.19 in, #9@ 28.
	Min footing T Min footing T	&S reinf Area &S reinf Area per foot	2.13 in2 0.32 in2 .ft

Min footing T&S reinf Area per foot	0.32 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.41 in	#4@ 14.81 in
#5@ 11.48 in	#5@ 22.96 in
#6@ 16.30 in	#6@ 32.59 in

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Summany of Overturning & Pecieting	a Foress & Momente	

	0\	ERTURNING			RE	SISTING	
Item	Force lbs	Distance ft	ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2.531.3	3.75	9.492.2	Soil Over HL (ab. water tbl)	1,796.0	5.83	10,473.7
HL Act Pres (be water tbl)	,		., .	Soil Over HL (bel. water tbl) Watre Table		5.83	10,473.7
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 =	900.0	6.25	5.625.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =			.,	Soil Over Toe =	170.0	2.13	361.3
				Surcharge Over Toe =			
				Stem Weight(s) =	1,312.5	4.67	6,125.0
		–		Earth @ Stem Transitions=			
Total =	= 3,431.3	O.T.M. =	15,117.2	Footing Weight =	1,233.8	3.29	4,059.0
				Key Weight =			
Resisting/Overturning I	Ratio	=	1.39	Vert. Component =			
Vertical Loads used for	Soil Pressure	= 4,512.3	3 lbs	Total =	4.512.3	bs R.M.=	21.019.0
				* Axial live load NOT included in resistance, but is included for s	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

 Horizontal Defl @ Top of Wall (approximate only)
 0.102
 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.
 0.102
 in

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Criteria				Soil Data					
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= = =	10.00 ft 0.50 ft 0.00 4.00 in 0.0 ft		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure = Soil Density, Heel = Footing Soil Friction = Soil heright to ignore for passive orgessure =	2,000.0 d 150.0 120.00 0.450 12.00	D psf D psf/ft D psf/ft D psf/ft D pcf D pcf D pcf	1-5-5-000		
Surcharge Loads			. [Lateral Load Applied to	Ston				
Surcharge Loads			ιL	Lateral Load Applied to	Sten		Adjacent Footing	LUat	1
NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding &	= liding = Over	0.0 pst & Overturning 0.0 turning		Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 # 0.00 fi 0.00 fi d (W)	#/ft t t	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= = =	0.0 lbs 0.00 ft 0.00 in 0.00 ft Line Load
Axial Load Applied	1 10 3	stem		(Sei	vice L	evel)	Base Above/Below Soil	_	0.0.#
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	osf	at Back of Wall Poisson's Ratio	=	0.300
Design Summary				Stem Construction	٦.	Bottom			
				Design Height Above Fto	ft=	Stem OF	()		
Wall Stability Ratios				Wall Material Above "Ht"	=	Concrete	9		
Overturning	=	2.21 OK		Design Method	=	LRFE)		
Slab Resis	SIS AII	Sliding !		Thickness	=	10.00)		
Total Bearing Load	=	4.512 lbs		Rebar Size Rebar Spacing	=	# :	ס ו		
resultant ecc.	=	8.83 in		Rebar Placed at	=	Eda	,		
0.10			~	Design Data		Lugi	,		
Soll Pressure @ 10e Soil Pressure @ Heel	-	1,146 pst 226 psf	OK	fb/FB + fa/Fa	=	0.82	2		
Allowable	=	2.000 psf	011	Total Force @ Section					
Soil Pressure Les	s Tha	n Allowable		Service Level	lbs =				
ACI Factored @ Toe	=	1,604 psf		Strength Level	lbs =	3,200.0)		
ACI Factored @ Heel	=	316 psf		MomentActual	ft # -				
Footing Shear @ Toe	=	23.7 psi	OK	Strength Level	ft-# =	10 666 .	7		
Footing Shear @ Heel	=	11.5 psi	OK	Moment Allowable	=	12 971	1		
Allowable	=	75.0 psi		Shear Actual		.2,07 1.	•		
Lateral Sliding Force	_	2 521 2 lba		Service Level	psi=				
Eateral Olding Force	=	2,001.0105		Strenath Level	nei=	326	3		
				ShearAllowable	psi=	75.0)		
				Anet (Masonry)	in2 =				
				Rebar Depth 'd'	in =	8.19	9		
				Masonry Data					
				fm	psi=				
			- 10	Fs Solid Crouting	psi=				
NOT considered in the calc	ve rate	n of soil bearin	e 15 a	Modular Ratio 'n'	_				
NOT CONSIDERED IN THE CAR	Julatio	in or som bearin	9	Wall Weight	psf=	125.0)		
Load Factors				Short Term Factor	. =				
Building Code	IE	3C 2015,ACI		Equiv. Solid Thick.	=				
Dead Load		1.200		Masonry Block Type	=	Medium	Weight		
Earth H		1.000		Masonry Design Method	=	ASD			
Wind W		1.000		Concrete Data	nei -	2 500 0	า		
Seismic, E		1.000		Fy	psi=	60,000.0	,)		

Project Name/Number	: 1	(C02-D10)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENGINEE	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area Det	ails		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
s (based on applied moment) :	0.3012 in2/ft		
4/3) * As :	0.4017 in2/ft	Min Stem T&S Reinf Area	2.520 in2
00bd/fy : 200(12)(8.1875)/60000 :	0.3275 in2/ft	Min Stem T&S Reinf Area	per ft of stem Height : 0.240 in2/ft
.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Op	tions :
		One layer of : Two lay	vers of :
Required Area :	0.3275 in2/ft	#4@ 10.00 in #4@ 2	20.00 in
Provided Area :	0.372 in2/ft	#5@ 15.50 in #5@ 3	31.00 in
/laximum Area :	1.1092 in2/ft	#6@ 22.00 in #6@ 4	14.00 in
Footing Data	Footing De	sign Results	
Toe Width = 4.2	5 ft	Toe Hee	1
Heel Width = 2.3	3 Factored Pressur	re = 1,604 31	6 psf
Total Footing Width = 6.5	8 Mu': Upward	= 143,776 46	4 ft-#
Footing Thickness = 15.00	0 in Mu': Downward	= 29,586 1,86	5 ft-#
Key Width = 0.00	0 in Actual 1 Way Sh	- 9,510 1,40 ear - 23.68 11.5	1 IL-#
Key Depth = 0.00	0 in Allow 1-Way She	ar = 75.00 40.0	0 psi
Key Distance from Toe = 0.00	0 ft Toe Reinforcing	= #5@10.00 in	
fc = 2,500 psi Fy = 60,000	0 psi Heel Reinforcing	= None Spec'd	
Footing Concrete Density = 150.0	0 pcf Key Reinforcing	= None Spec'd	
Min. As % = 0.0018	B Footing Torsion,	lu = 0.0	JU ft-lbs
Cover@rop 2.00 @Bill.= 3	Footing Allow. I d	orsion, pni i u = 0.0	JU π-IDS
	If torsion exc supplementa	ceeds allowable, provide Il design for footing torsion	L.
	Other Acceptab	le Sizes & Spacings	
	Toe: #4@ 7.4	0 in, #5@ 11.48 in, #6@ 16.2	29 in, #7@ 22.22 in, #8@ 29.25 in, #9@ 37
	Heel: phiMn = Key: No key o	phi'5'lambda'sqrt(fc)'Sm defined	
	Min footing T&	S reinf Area 2.1	3 in2
	Min tooting 1&	S reini Area per 1001 U.3.	2 III2 /IL lavers of horizontal bars:
	#4@ 7.41 in	10112011a1 Dais. 11 two #4/6	ayers of nonzontal bars.
	#5@ 11.48 ii	n #4@	0 22.96 in
	#6@ 16.30 ii	n #6@	0 32.59 in

Summary of Overtu	Irning & R	esisting F	orces & Mon	nents			
Item	Force Ibs	ERTURNING Distance ft	Moment ft-#		Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hvdrostatic Force	2,531.3	3.75	9,492.2	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1,796.0	5.83 5.83	10,473.7 10,473.7
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
djacent Footing Load =				Axial Dead Load on Stem =			
dded Lateral Load =				* Axial Live Load on Stem =			
.oad @ Stem Above Soil =				Soil Over Toe =	170.0	2.13	361.3
=				Surcharge Over Toe =			
				Stem Weight(s) =	1,312.5	4.67	6,125.0
Total -	2 531 3	отм -	9 492 2	Earth @ Stem Transitions=			
	2,001.0	G.1.M	5,452.2	Footing Weight =	1,233.8	3.29	4,059.0
Projecting/Overturning B	atia	_	2.24	Key Weight =			
Vertical Loads used for S	allo Soil Drogouro	- 4512	2.21 2. lbo	vert. Component =		-	

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	e 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)	0.051 in
The above calculation is not valid if the heel soil bea	ring pressure exceeds that of the toe,

Project Name/Number :	(C02-D10)	200
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letainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING		3	Cantilevered Retain	ing \	Nall	Code: IBC 2015,ACI 318-14,ACI 530-13			
Criteria				Soil Data					
Retained Height Wall height above soil Slope Behind Wall	= = =	9.00 ft 0.50 ft 0.00		Allow Soil Bearing = Equivalent Fluid Pressure Metho Active Heel Pressure =	2,666.0 od 40.0	0 psf 0 psf/ft			
Height of Soil over Toe	=	4.00 in		=					
Water height over heel	=	0.0 ft		Passive Pressure =	150.0	0 psf/ft			
				Soil Density, Heel =	120.00	U pct			
				Soli Density, Toe =	0.450	n poi			
				Soil beight to ignore	0.430	5			
				for passive pressure =	12.00	in	Restraire		
Surcharge Loads				Lateral Load Applied to	Sten	n	Adjacent Footing Load		
Surcharge Over Heel	=	0.0 psf		lateral load =	810#	t/ft	Adjacent Footing Load = 0.0 lbs		
NOT Used To Resist S	liding	& Overturning		Height to Top =	9.00 f	t	Footing Width = 0.00 ft		
Surcharge Over Toe	= Over	0.0 turning		Height to Bottom =	0.00 f	t	Eccentricity = 0.00 in		
NOT Used for Silding a				Load Type = Win	nd (W)		Wall to Ftg CL Dist = 0.00 ft		
Axial Load Applied	to s	Stem		(Se	ervice L	.evel)	Base Above/Below Soil		
Axial Dead Load	=	0.0 lbs	-	Wind on Exposed Stem =	0.0 p	osf	at Back of Wall = 0.0 ft		
Axial Live Load	=	0.0 lbs		(Service Level)			Poisson's Ratio = 0.300		
Axiai Load Eccentricity	=	0.0 in							
Design Summary				Stem Construction		Stem Of	5		
Wall Stability Paties				Design Height Above Ft	g ft=	0.00	Ĵ		
Overturning	=	1 22 0		Wall Material Above "Ht	=	Concrete			
Slab Resis	sts All	Sliding !	.10 ~	Thickness	-				
				Rebar Size	_	# 5	5		
Total Bearing Load	=	3,339 lbs		Rebar Spacing	=	8.00	5		
resultant ecc.	=	22.95 in		Rebar Placed at	=	Edge	9		
Soil Pressure @ Too	-	2 135 pcf	OK	Design Data					
Soil Pressure @ Heel	-	2,100 psi 0 psf	OK	fb/FB + fa/Fa	=	0.93	7		
Allowable	=	2,666 psf		Total Force @ Section					
Soil Pressure Les	s Tha	n Allowable		Service Level	lbs =				
ACI Factored @ Toe	=	2,990 psf		Strength Level	lbs =	3,321.0)		
ACI Factored @ Heel	=	0 psf		MomentActual	4 # _				
Footing Shear @ Toe	=	38.0 psi	OK	Strength Level	ft # -	11.056	5		
Footing Shear @ Heel	=	15.3 psi	OK	Moment Allowable	-	11 700 1	2		
Allowable	=	75.0 psi		Shoar Actual	-	11,109.2	-		
Sliding Calcs				SnearActual	nei –				
Lateral Sliding Force	=	2,729.0 lbs		Strength Level	psi =		7		
				Choor Allought-	psi=	44.1			
				Anet (Masonni)	psi=	15.0	J		
				Rebar Depth 'd'	in2 =	6.10	2		
				Masonny Data	=	0.18	7		
				fm	psi =				
				Fs	psi=				
ertical component of activ	e late	ral soil pressu	re IS	Solid Grouting	. =				
OT considered in the calc	ulatio	n of soil bearir	ng	Modular Ratio 'n'	=				
				Wall Weight	psf=	100.0	0		
Load Factors		0.0045 4.01		Short Term Factor	=				
Building Code	IE	1 2015,ACI		Equiv. Solid Thick.	=				
Live Load		1.200		Masonry Block Type	=	Medium	Weight		
Farth H		1.000		Masonry Design Method	= t	ASD			
Wind W		1.000		Concrete Data	nei -	2 500 0	 ו		
Seismic. F		1.000		Fv	psi =	60 000 0	5 1		
00.07110, L		1.000		i y	pai –	00,000.0	<i>.</i>		

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Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.4187 in2/ft	Ű	
(4/3) * As :	0.5582 in2/ft	Min Stem T&S Reinf Area	a 1.824 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area	a per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Op	ptions :
	===========	One layer of : Two la	yers of :
Required Area :	0.4187 in2/ft	#4@ 12.50 in #4@	25.00 in
Provided Area :	0.465 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 D	esign Results	
Toe Width =	4.00 ft	Toe Hee	91
Heel Width =	1.91 Factored Press	ure = 2,990	0 psf
Total Footing Width =	5.91 Mu': Upward	= 165,915	0 ft-#
Footing Thickness =	12.00 in Mu ⁺ : Downward Mu ⁺ : Design	1 = 21,888 = 1,14 = 12,002 = 1,14	1 π-# 1 ft #
Key Width =	0.00 in Actual 1-Way S	hear = 37.96 15.2	
Key Depth =	0.00 in Allow 1-Way St	rar = 75.00 40.0	lo psi
Key Distance from Toe =	0.00 ft Toe Reinforcing	g = #5@8.00 in	
f'c = 2,500 psi Fy = 60	0,000 psi Heel Reinforcin	g = None Spec'd	
Footing Concrete Density = 1	50.00 pcf Key Reinforcing	g = None Spec'd	00 ft II
MIN. AS % = 0. Cover @ Top 200 @ Btm	= 3.00 in Easting Allow T	, IU = 0. Foreign phi Tu = 0	00 ft lba
Cover @ 10p 2.00 @ Buil.	= 5.00 III FOOLING Allow. I	orsion, phi tu = 0.	UU IL-IDS
	If torsion ex	cceeds allowable, provide	_
	Other Accenta	tal design for footing torsion	1.
			50 i= #7@ 04 47 i= #0@ 07 00 i= #0@ 05
	Heel: phiMn Key: No key	= phi'5'lambda'sqrt(fc)'Sm defined	52 iii, #7@ 21.17 iii, #6@ 27.66 iii, #8@ 55
	Min footing T Min footing T If one layer of	&S reinf Area 1.5 &S reinf Area per foot 0.2 f horizontal bars: If two	3 in2 6 in2 .ft layers of horizontal bars:
	#4@ 9.26 #5@ 14.35 #6@ 20.37	in #4(in #5(in #66	@ 18.52 in @ 28.70 in @ 40.74 in

looung rao reini Area	1.00 112
footing T&S reinf Area per foot	0.26 in2 /ft
ne layer of horizontal bars:	If two layers of horizontal bars:
4@ 9.26 in	#4@ 18.52 in
5@ 14.35 in	#5@,28.70 in
6@ 20.37 in	#6@ 40.74 in

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	0\	'ERTURNING			RE		
Item	Force lbs	Distance ft	Moment ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,000.0	3.33	6,666.7	Soil Over HL (ab. water tbl)	1,342.8	5.29	7,101.2
HL Act Pres (be water tbl) Hydrostatic Force				Soil Over HL (bel. water tbl) Watre Table		5.29	7,101.2
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	= 729.0	5.50	4,009.5	* Axial Live Load on Stem =			
Load @ Stem Above Soil :	=			Soil Over Toe =	160.0	2.00	320.0
	-			Surcharge Over Toe =			
				Stem Weight(s) =	950.0	4.33	4,116.7
	0 700 0		10.070.0	Earth @ Stem Transitions=			
Total	= 2,729.0	O.T.M. =	10,676.2	Footing Weight =	886.5	2.96	2,619.6
				Key Weight =			
Resisting/Overturning	Ratio	=	1.33	Vert. Component =			
Vertical Loads used for	Soil Pressure	= 3,339.3	3 lbs	Total =	3,339.3 lb	s R.M.=	14,157.4
				* Axial live load NOT included in resistance, but is included for s	total displaye	d, or used fo	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

 Horizontal Defl @ Top of Wall (approximate only)
 0.095
 in

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

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

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	d 11.20 ANG I	0.03.31 ENGINEERING	3	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	= = =	9.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	8000
Height of Soll over Toe Water height over heel	=	4.00 in 0.0 ft	:	Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	150.0 120.00 120.00 0.450 12.00) psf/ft) pcf) pcf in	Record
Surcharge Loads			Ιſ	Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Silding & Axial Load Applied Axial Dead Load	= liding Over l to S	0.0 psf & Overturning 0.0 turning Stem 0.0 lbs		Lateral Load = Height to Top = Height to Bottom = Load Type = Win (Ser Wind on Exposed Stem -	0.0 # 0.00 ft 0.00 ft d (W) vice Lo	/ft evel)	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Walt to Ftg CL Dist = 0.00 ft Footing Type Line Load Base Above/Below Soil = at Base Movie Walt = 0.0 ft
Axial Live Load Axial Load Eccentricity	=	0.0 lbs		(Service Level)	0.0 p		Poisson's Ratio = 0.300
Design Summary	-	0.0 11		Stem Construction		Bottom	
Wall Stability Ratios Overturning Slab Resis	= ts All	2.00 OK Sliding !		Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = = =	Stem OK 0.00 Concrete LRFD 8.00	
Total Bearing Loadresultant ecc.	=	3,292 lbs 9.67 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 5 8.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel	=	1,079 psf 85 psf	ok ok	fb/FB + fa/Fa Total Force @ Section	=	0.659)
Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	s Thai = =	Allowable 1,510 psf 118 psf		Service Level Strength Level MomentActual	lbs = lbs =	2,592.0	1
Footing Shear @ Toe Footing Shear @ Heel	=	26.6 psi 12.5 psi 75.0 psi	OK OK	Service Level Strength Level MomentAllowable	ft-# = ft-# = =	7,776.0 11,799.2	
Sliding Calcs Lateral Sliding Force	=	2,000.0 lbs		ShearActual Service Level Strength Level	psi = psi =	34.9	,
				ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data	psi = in2 = in =	6.19)
Vertical component of activ NOT considered in the calc	e late	ral soil pressu n of soil bearin	re IS	fm Fs Solid Grouting Modular Ratio 'n'	psi = psi = = =		
Load Factors Building Code Dead Load	IE	3C 2015,ACI 1.200	-	Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type	psf= = = =	100.0 Medium V) Neight
Live Load Earth, H Wind, W Seismic, E		1.600 1.600 1.000 1.000		Masonry Design Method Concrete Data fc Fy	= psi= psi=	ASD 2,500.0 60,000.0	

Project Name/Number	: 1	(C02-D10)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENGINE	Cantilevered	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area De	tails		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
s (based on applied moment) :	0.2944 in2/ft	0	
4/3) * As :	0.3926 in2/ft	Min Stem T&S Reinf Area	1.824 in2
00bd/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
.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Op	tions :
	==========	One layer of : Two lay	vers of :
Required Area :	0.2944 in2/ft	#4@ 12.50 in #4@ 2	25.00 in
Provided Area :	0.465 in2/ft	#5@ 19.38 in #5@ 3	38.75 in
/laximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 5	55.00 in
Footing Data	Footing D	esign Results	
Toe Width = 3.	75 ft	Toe Heel	
Heel Width = 1.9	Factored Pressu	ure = 1,510 118	3 psf
Total Footing Width = 5.	66 Mu': Upward	= 101,481 170) ft-#
Footing Thickness = 12.0	0 in Mu': Downward	= 19,238 1,141	l ft-#
Key Width = 0.0	0 in Actual 1 Way Si	- 0,004 97	l II-#
Key Depth = 0.0	0 in Allow 1-Way Sh	ear = 75.00 40.00) psi
Key Distance from Toe = 0.0	^{00 ft} Toe Reinforcing	= # 5 @ 10.00 in	
fc = 2,500 psi Fy = 60,00	0 psi Heel Reinforcing	g = None Spec'd	
Footing Concrete Density = 150.	00 pcf Key Reinforcing	= None Spec'd	
Min. As % = 0.00'	18 Footing Torsion,	Tu = 0.0	0 ft-lbs
Cover@Top 2.00 @Bun.=	3.00 In Footing Allow. I	orsion, phi l u = 0.0	10 ft-Ibs
	If torsion ex supplement	ceeds allowable, provide al design for footing torsion	
	Other Acceptal	ole Sizes & Spacings	
	Toe: #4@ 9	25 in. #5@ 14.35 in. #6@ 20.3	7 in. #7@ 27.77 in. #8@ 36.57 in. #9@ 46
	Heel: phiMn = Key: No key	phi'5'lambda'sqrt(fc)'Sm defined	
	Min footing Ta	S reinf Area 1.47	7 in2
	If one layer of	horizontal bars If two I	avers of horizontal bars:
	#4@ 9.26 i	n #4@) 18.52 in
	#5@ 14.35	in #5@	28.70 in
	#6@ 20.37	in #6@	40.74 in

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20.03.31 NG ENGINE	ERING	Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1			
Summary of Overtu	rning & R	esisting F	orces & Mor	nents				
Item	O\ 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 Buoyant Force = Surcharge over Heel = Surcharge Over Toe = Adjacent Footing Load =	2,000.0	3.33	6,666.7	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem =	1,342.8	5.04 5.04	6,765.5 6,765.5	
Load @ Stem Above Soil = =				Soil Over Toe = Surcharge Over Toe =	150.0	1.88	281.3	
				Stem Weight(s) = Earth @ Stem Transitions=	950.0	4.08	3,879.2	
Total = Resisting/Overturning Ra	2,000.0 atio	O.T.M. = =	6,666.7 2.00	Footing Weight = Key Weight = Vert. Component =	849.0	2.83	2,402.7	
Vertical Loads used for S	oil Pressure	= 3,291.	8 lbs	Total = * Axial live load NOT included i resistance, but is included for	3,291.8 I in total display soil pressure	bs R.M.= ed, or used for calculation.	13,328.6 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	settlem	nent of soil
(Deflection due to wall bending	not considered)		
Soil Spring Reaction Modulus		250.0	pci
Horizontal Defl @ Top of Wall (a	approximate only)	0.050	in
The above calculation is not vali	id if the heel soil bearing	pressure e	exceeds that of the toe,

Project Name/Number :	(C02-D10)	200
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RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20.03.31 NG ENGINEERING	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 =	8.00 ft 0.50 ft 0.00	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,666.0 d 40.0) psf) psf/ft	
Height of Soil over Toe = Water height over heel =	= 4.00 in = 0.0 ft	= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footingl Soil Friction =	150.0 120.00 120.00 0.450) psf/ft) pcf) pcf)	
		Soil height to ignore for passive pressure =	12.00	in	Restaur
Surcharge Loads		Lateral Load Applied to	Stem	ו ו	Adjacent Footing Load
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & 0	= 0.0 psf ding & Overturning = 0.0 Overturning	Lateral Load = Height to Top = Height to Bottom =	72.0 # 8.00 ft 0.00 ft	//ft t t	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Fig CL Dist = 0.00 ft
Axial Load Applied	to Stem	(Sei	vice L	-) evel)	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 p	sf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary		Stem Construction] _	Bottom	
Wall Stability Ratios Overturning Slab Resiste	= 1.29 Rati s All Sliding !	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebor Size	ft = = =	Concrete LRFD 8.00	
Total Bearing Loadresultant ecc.	= 2,718 lbs = 21.21 in	Rebar Spacing Rebar Placed at	=	# 5 11.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel	= 2,231 psf = 0 psf = 2,666 psf	OK fb/FB + fa/Fa OK Total Force @ Section	=	0.881	I
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	Than Allowable = 3,123 psf = 0 psf	Service Level Strength Level MomentActual	lbs = lbs =	2,624.0	
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 30.6 psi = 11.0 psi = 75.0 psi	OK Service Level OK Strength Level MomentAllowable	ft-# = =	7,765.3 8,809.0	3
Sliding Calcs Lateral Sliding Force	= 2,196.0 lbs	ShearActual Service Level	psi=	05.0	
		ShearAllowable Anet (Masonry)	psi = psi = in2 =	35.3	
		Rebar Depth 'd' Masonry Data f'm	in = psi =	6.19	
Vertical component of active NOT considered in the calcu	lateral soil pressur lation of soil bearin	Fs e IS Solid Grouting g Modular Ratio 'n' Wall Weight	psi= = = psf=	100.0	
Load Factors Building Code Dead Load	IBC 2015,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type	=	Medium V	Veight
Earth, H Wind, W Seismic, E	1.600 1.000 1.000	Masonry Design Method Concrete Data fc Fy	= psi = psi =	ASD 2,500.0 60,000.0	 }

icense : KW-06055289 icense To : MALSAM TSANG ENG		Cantilevered R	etai	ning Wa	II Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details				
Bottom Stem	Vertical	Reinforcing	Horiz	ontal Reinfor	rcing
As (based on applied moment) :	0.294 ir	12/ft			
(4/3) * As :	0.392 ir	i2/ft	Min S	tem T&S Re	einf Area 1.632 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475	in2/ft	Min S	tem T&S Re	einf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728	in2/ft	Horiz	ontal Reinfor	rcing Options :
	=====	======	One I	ayer of :	Two layers of :
Required Area :	0.294 ir	12/ft	#4@	12.50 in	#4@ 25.00 in
Provided Area :	0.3382	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 Desi	gn R	esults	
Toe Width =	3.50 ft			<u>Toe</u>	Heel
Heel Width =	1.66	Factored Pressure	=	3,123	0 psf
For the Thickness	5.10	Mu': Upward	-	122,714	0 π-# 657 ft-#
Fooung Thickness =	12.00 In	Mu: Design	=	8.830	657 ft-#
Key Width =	0.00 in	Actual 1-Way Shear	=	30.62	11.03 psi
Key Deptn =	0.00 In	Allow 1-Way Shear	=	75.00	40.00 psi
Key Distance nom roe =	0.00 1	Toe Reinforcing	= ;	# 5 @ 11.00	in
f'c = 2,500 psi Fy = 6	60,000 psi	Heel Reinforcing	=	None Spec'd	1
Min As % = 0	10018	Footing Torsion Tu	_	=	0.00 ft-lbs
Cover @ Top 2.00 @ Btm	.= 3.00 in	Footing Allow, Torsic	on ph	iTu =	0.00 ft-lbs
0.0		If torsion excee	de all	owable pro	vide
		supplemental d	esian	for footing	torsion
		Other Acceptable	Sizes	& Spacing	15
		Toe: #4@ 7.50 ir Heel: phiMn = phi Key: No key defi	n, #5@ '5'lam ned) 11.63 in, # bda'sqrt(fc)'\$	6@ 16.51 in, #7@ 22.51 in, #8@ 29.64 in, #9@ 37 Sm
		Min footing T&S n Min footing T&S n If one layer of hori #4@ 9.26 in #5@ 14.35 in #6@ 20.37 in	einf A einf A zonta	rea rea per foot I bars:	1.34 in2 0.26 in2 .ft If two layers of horizontal bars: #4@ 18.52 in #5@ 28.70 in #6@ 40.74 in

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING **Cantilevered Retaining Wall** Code: IBC 2015,ACI 318-14,ACI 530-13 1 Summary of Overturning & Resisting Forces & Moments

		OV	ERTURNING	Momont		Eoros	SISTING	Momort
Item		lbs	ft	ft-#		lbs	ft	ft-#
HL Act Pres (ab water tbl)	1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl)	953.6	4.66	4,447.0
HL Act Pres (be water tbl Hydrostatic Force)				Soil Over HL (bel. water tbl) Watre Table		4.66	4,447.0
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	=	576.0	5.00	2,880.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil	=				Soil Over Toe =	140.0	1.75	245.0
-	=				Surcharge Over Toe =			
					Stem Weight(s) =	850.0	3.83	3,258.3
-		0.400.0		7740.0	Earth @ Stem Transitions=			
i otal	=	2,196.0	0.1.M. =	7,740.0	Footing Weight =	774.0	2.58	1,996.9
					Key Weight =			
Resisting/Overturning) Rati	io	=	1.29	Vert. Component =			
Vertical Loads used for	or Soi	I Pressure	= 2,717.6	6 lbs	Total =	2,717.6 lb	s R.M.=	9,947.2
					* Axial live load NOT included in resistance, but is included for	n total displaye soil pressure c	d, or used fo alculation.	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 Horizontal Defl @ Top of Wall (approximate only) 0.102 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.

Project Name/Number : (C02-D30) 200

RetainPro (c) 1987-2019, Buil License : KW-06055289 License To : MALSAM TS	d 11.20	.03.31 NGINEERING		Cantilevered Retaini	ing V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	5.00 ft 0.50 ft 0.00	1	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0	psf psf/ft	
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft		= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soji height to ignore	300.0 110.00 110.00 0.400	psf/ft pcf pcf	
Suraharra Laada			Г	for passive pressure =	12.00	in f	Adia and Fraction Land
Surcharge Loads			L	Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding 8	= Sliding & = & Overti	0.0 psf & Overturning 0.0 urning		Lateral Load = Height to Top = Height to Bottom =	0.0 #/ 0.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Fta CL Dist = 0.00 ft
Axial Load Applied	d to S	tem		Load Type = Win (Ser	d (W) vice Le	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 ps	sf	Base Above/Below Soil at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Axial Load Eccentricity	=	0.0 In		04		Bottom	
Design Summary				Stem Construction		Stem OK	
Wall Stability Ratios Overturning Sliding	= =	2.16 OK 1.57 OK		Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	π= = =	0.00 Concrete LRFD 8.00	
Total Bearing Load resultant ecc.	=	1,281 lbs 6.12 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 4 11.00 Edge	
Soil Pressure @ Toe	=	710 psf	OK	fb/FB + fa/Fa	=	0.240)
Allowable	= =	2,000 psf	UK	Total Force @ Section Service Level	lbs =		
ACI Factored @ Toe	=	994 psf		Strength Level	lbs =	850.0	
ACI Factored @ Heel	=	55 psf	~	Service Level	ft-# =		
Footing Shear @ Heel	=	0.0 psi (JK JK	Strength Level	ft-# =	1,416.7	,
Allowable	=	75.0 psi		MomentAllowable	=	5,883.6	
Sliding Calcs Lateral Sliding Force less 100% Passive Fore	= ce = -	680.6 lbs 554.2 lbs		SnearActual Service Level Strength Level	psi = psi =	11.3	
less 100% Friction Ford	;e = -	512.4 lbs		ShearAllowable	psi=	75.0	
Added Force Req'd	=	0.0 lbs 0.0 lbs	DK OK	Anet (Masonry) Rebar Depth 'd'	in2 = in =	6.25	
,				Masonry Data		0.20	·
				fm Fs	psi=		
Vertical component of activ NOT considered in the cal	ve later culation	al soil pressure of soil bearing	e IS	Solid Grouting Modular Ratio 'n'	=		
Load Factors Building Code	IB	C 2015.ACI		Wall Weight Short Term Factor	psf= =	100.0	
Dead Load		1.400		Masonry Block Type	=	Medium V	Veight
Live Load		1.700		Masonry Design Method	=	ASD	
Earth, Fi Wind, W		1.300		Concrete Data	psi =	2,500.0	1
Seismic, E		1.000		Fy	psi =	60,000.0	

Project Name/Number	:	(C02-D30)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENG	Cantilevere	ed Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0531 in2/ft		
4/3) * As :	0.0708 in2/ft	Min Stem T&S Reinf Area	a 1.056 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area	a per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Op	otions :
		One layer of : Two lay	yers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in #4@ 1	25.00 in
Provided Area :	0.2182 in2/ft	#5@ 19.38 in #5@ 3	38.75 in
/laximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@	55.00 in
Footing Data	Footing I	Design Results	
Toe Width =	2.75 ft	Toe Hee	4
Heel Width =	0.67 Factored Pres	sure = 994 5	5 psf
Total Footing Width =	3.42 Mu': Upward	= 33,672	0 ft-#
Footing Thickness =	10.00 in Mu': Downwai	rd = 12,599	0 ft-#
Key Width =	12.00 in Actual 1 Way	= 1,750	0 II-#
Key Depth =	8.00 in Allow 1-Way S	Shear = 75.00 40.0	0 psi
Key Distance from Toe =	1.00 ft Toe Reinforcin	iq = #4@.9.00 in	
fc = 2,500 psi Fy = 6	0,000 psi Heel Reinforci	ng = None Spec'd	
Footing Concrete Density = 1	50.00 pcf Key Reinforcin	ig = #4@9.26 in	
Min. As % = 0	.0018 Footing Torsio	n, Tu = 0.0	00 ft-lbs
Cover@lop 2.00 @Btm	= 3.00 in Footing Allow.	Torsion, phi Tu = 0.0	00 ft-lbs
	If torsion e supplement	exceeds allowable, provide ntal design for footing torsior	٦.
	Other Accept	able Sizes & Spacings	
	Toe: #4@ · Heel: phiMn	11.11 in, #5@ 17.22 in, #6@ 24 = phi'5'lambda'sqrt(fc)'Sm	1.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
	Key: #4@	9.25 in, #5@ 14.35 in, #6@ 18	in, #7@ 18 in, #8@ 18
	Min footing	T&S reinf Area 0.7	4 in2
	Min footing	a s reinit Area per toot 0.2	2 III2 /IL Javers of horizontal bars:
	#1@ 11 1	1 in #4/	nayers or nonzonial bars. n 22 22 in
	#5@ 17.2	2 in #50	D 34.44 in
	#6@ 24.4	4 in #6@	0 48.89 in

Summary of Overturning & Resisting Forces & Moments								
Item	F	OV orce Ibs	ERTURNING Distance ft	Moment ft-#		Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		680.6	1.94	1,323.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table) 1.8	3.42 3.42	6.3 6.3
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 =			
oad @ Stem Above Soil.	=				Soil Over Toe =	201.7	1.38	277.3
	=				Surcharge Over Toe =			
					Stem Weight(s) =	550.0	3.08	1,695.8
Tetel		C00 C		4 202 2	Earth @ Stem Transitions=			
rotal	=	000.0	0.1.W. =	1,323.3	Footing Weight =	427.5	1.71	731.0
					Key Weight =	100.0	1.50	150.0
Resisting/Overturning	Ratio		=	2.16	Vert. Component =			
Vertical Loads used fo	r Soil P	ressure	= 1,281.0	0 lbs	Total =	1 281 0	lbs RM=	2 860 4

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.

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Tilt		
Horizontal Deflection at Top of Wall due t	to settlem	nent of soil
(Deflection due to wall bending not considered)		
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.032	in
The above calculation is not valid if the heel soil bearin	g pressure e	exceeds that of the toe,

etainPro (c) 1987-2019, Build cense : KW-06055289 cense To : MALSAM TSAI	1.20.03.31 NG ENGINEERING	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 =	10.00 ft 0.50 ft 0.00	Allow Soil Bearing = Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 od 40.0) 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	300.0 110.00 110.00 0.400) psf/ft) pcf) pcf)	
Overskame Lands		for passive pressure =	12.00	in	
Surcharge Loads		Lateral Load Applied to	Sterr	1	Adjacent Footing Load
Surcharge Over Heel = NOT Used To Resist Slic Surcharge Over Toe = NOT Used for Sliding & C	0.0 psf ing & Overturning 0.0 verturning	Lateral Load = Height to Top = Height to Bottom =	0.0 # 0.00 ft 0.00 ft	/ft 1	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied	o Stem	(Se	rvice 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 = 0.0 ft Poisson's Ratio = 0.300
Design Summary		Stem Construction]	Bottom	
		Design Height Above Ft	g ft=	Stem OF 0.00	5
Overturning	= 2.20 OK	Wall Material Above "Ht	' =	Concrete	3
Sliding	= 1.65 OK	Design Method Thickness	-	LRFL 8.00	
5		Rebar Size		# 6	5
Total Bearing Load	= 3,778 lbs	Rebar Spacing	=	8.00	- D
resultant ecc.	= 18.42 in	Rebar Placed at	=	Edge	9
Soil Pressure @ Toe	= 838 psf C	K fb/ER + fb/Ea	-	0.78	7
Soil Pressure @ Heel	= 0 psf C	K Total Force @ Section	-	0.70	
Allowable	= 2,000 psf	Service Level	lbs =		
Soil Pressure Less	Than Allowable	Strength Level	lbs =	3 400 0	h
ACI Factored @ Loe	= 1,1/3 pst = 0 psf	MomentActual	100 -	0,400.0	
Fortian Change @ Tee	- 0 psi	Service Level	ft-# =		
Footing Shear @ Toe	= 10.1 psi C	Strength Level	ft-# =	11,333.3	3
Allowable	= 75.0 psi C	MomentAllowable	=	14,393.2	2
Sliding Calcs	10.0 por	ShearActual			
Lateral Sliding Force	= 2.531.3 lbs	Service Level	psi=		
less 100% Passive Force	= - 2,666.7 lbs	Strength Level	psi=	50.4	4
less 100% Friction Force	= - 1,511.1 lbs	ShearAllowable	psi=	75.0)
Added Force Req'd	= 0.0 lbs C	K Anet (Masonry)	in2 =		
for 1.5 Stability	= 0.0 lbs C	K Rebar Depth 'd'	in =	5.63	3
		Masonry Data			
		fm	psi=		
		Fs Constitute	psi =		
erucal component of active	ation of soil bearing	Modular Ratio 'n'	=		
on considered in the calcu	ation of soil bearing	Wall Weight	nsf=	100 0	n
Load Factors		Short Term Factor	- req	100.0	5
Building Code	IBC 2015,ACI	Equiv. Solid Thick	_		
Dead Load	1.400	Masonry Block Type	=	Medium	Weight
Live Load	1.700	Masonry Design Method	=	ASD	.
	4 700				
Earth, H	1.700	Concrete Data			
Earth, H Wind, W	1.300	fc	psi =	2,500.0	D

NEERING			•	- 0006. IL	3C 2015,ACI 318-14,ACI 530-13
Details					
Vertical R	teinforcing I	Horiz	ontal Reinfo	cing	
0.4746 in	2/ft				
0.6328 in	2/ft I	Min S	tem T&S R	inf Area 2.016 in2	
0.225 in2	/ft I	Min S	tem T&S R	inf Area per ft of ster	m Height : 0.192 in2/ft
0.1728 in	2/ft I	Horiz	ontal Reinfo	cing Options :	
=======	===== (One I	ayer of :	Two layers of :	
0.4746 in	2/ft #	#4@	12.50 in	#4@ 25.00 in	
0.66 in2/f	t 🕫	#5@	19.38 in	#5@ 38.75 in	
0.762 in2	/ft #	#6@	27.50 in	#6@ 55.00 in	
	Footing Desig	gn R	esults		
8.25 ft			Toe	Heel	
0.83	Factored Pressure	=	1,173	0 psf	
9.08	Mu' : Upward	=	332,890	0 ft-#	
5.00 in	Mu': Downward	=	138,643	25 ft-#	
2.00 in	Actual 1 Way Shear	_	18 11	20 IL-# 1 02 pci	
31.00 in	Allow 1-Way Shear	-	75.00	40.00 psi	
1.00 ft	Toe Reinforcing	= ;	#6@8.00	10.00 poi	
),000 psi	Heel Reinforcing	=	None Spec'		
50.00 pcf	Key Reinforcing	= ;	# 5 @ 12.00	in	
0018	Footing Torsion, Tu		=	0.00 ft-lbs	
= 3.00 in	Footing Allow. Torsic	on, ph	iTu =	0.00 ft-lbs	
	If torsion exceed	ds all	owable, pr	vide	
	supplemental de	esign	for footing	torsion.	
	Other Acceptable S	Sizes	& Spacing	S	
	Toe: #4@ 5.59 in Heel: phiMn = phi	, #5@ '5'lam	8.67 in, #6 bda'sqrt(fc)	@ 12.30 in, #7@ 16. Sm	78 in, #8@ 22.10 in, #9@ 27.
	Key: #4@ 10 in,	#5@	15.5 in, #6@	18 in, #7@ 18 in, #	8@ 18 in
	Min footing T&S re	einf A	rea	2.94 in2	
	Min footing T&S re	einf A	rea per foot	0.32 in2 /ft	
	It one layer of hori	zonta	I bars:	If two layers of hori	zontal bars:
	#4@ 7.41 in #5@ 11.48 :			#4@ 14.81 in	
	#5@ 11.48 IN #6@ 16 30 in			#ວ@ ∠2.96 IN #6@ 32.59 in	
	Details Vertical R 0.4746 in 0.6328 in 0.225 in2 0.1728 in 0.4746 in 0.66 in2/f 0.762 in2 8.25 ft 9.08 15.00 in 1.00 ft 1.00 ft 0.00 psi 0.018 = 3.00 in	Details Vertical Reinforcing 0.4746 in2/ft 0.6328 in2/ft 0.225 in2/ft 0.1728 in2/ft 0.1728 in2/ft 0.4746 in2/ft 0.4746 in2/ft 0.4746 in2/ft 0.4746 in2/ft 0.4746 in2/ft 0.4746 in2/ft 0.66 in2/ft 0.762 in2/ft 1.00 in 1.00 in 1.00 it 1.00 it	Details Vertical Reinforcing Horiz 0.4746 in2/ft Min S 0.6328 in2/ft Min S 0.6328 in2/ft Min S 0.225 in2/ft Min S 0.1728 in2/ft Horiz Horiz 0.4746 in2/ft #4@ 0.66 in2/ft #4@ 0.66 in2/ft #4@ .66 in2/ft #6@ 0.762 in2/ft #6@ . . 8.25 ft Factored Pressure = 9.08 Factored Pressure = 9.08 Mu': Upward = 1.00 in Actual 1-Way Shear = 1.00 in Footing Allow. Torsion, pl = 1.00 in Footing Allow. Torsion, pl = 1.00 in Footing Allow. Torsion, pl = 1.00 in	Details Vertical Reinforcing Horizontal Reinfor 0.4746 in2/ft Min Stem T&S Re 0.6328 in2/ft Min Stem T&S Re 0.1728 in2/ft Min Stem T&S Re 0.1728 in2/ft Horizontal Reinfor ============== One layer of : 0.4746 in2/ft Horizontal Reinfor ============= One layer of : 0.4746 in2/ft #4@ 12.50 in 0.66 in2/ft #4@ 12.50 in 0.66 in2/ft #4@ 12.50 in 0.762 in2/ft #4@ 12.50 in 0.762 in2/ft #6@ 27.50 in 0.762 in2/ft #6@ 27.50 in Deg 0.762 in2/ft 8.25 ft Sacage 1.173 9.08 Mu' : Upward = 332.800 Mu' : Downward = 18.43 1.00 in Actual 1-Way Shear = 16.187 1.00 1.00 ft Ior Reinforcing = # 6.08.001 Mu : Deging = 16.864.3 1.00 in Actual 1-Way Shear = 18.11 1.11 1.00 Footing Allow Torsion, phi Tu = 3.00 in Footing Muw Torsion, phi Tu = # 50 12.00 Socing Allow. Torsion, phi Tu	Details Vertical Reinforcing Horizontal Reinforcing 0.4746 in2/ft Min Stem T&S Reinf Area 2.016 in2 0.6328 in2/ft Min Stem T&S Reinf Area per ft of ster 0.1728 in2/ft Horizontal Reinforcing Options : ============== One layer of : Two layers of : 0.4746 in2/ft #4@ 12.50 in #4@ 25.00 in 0.66 in2/ft #4@ 12.50 in #4@ 25.00 in 0.66 in2/ft #5@ 19.38 in #5@ 38.75 in 0.762 in2/ft #6@ 57.50 in #6@ 55.00 in 0.66 in2/ft #6@ 27.50 in #6@ 55.00 in 0.762 in2/ft #6@ 27.50 in #6@ 55.00 in 0.83 Factored Pressure = 1,17.3 0 psf 15.00 in Mu: Upward = 332.890 0 ft.# 11.00 in Actual 1.Way Shear = 18.11 1.92 psi 1.00 in Actual 1.Way Shear = 18.11 1.92 psi 1.00 in Actual 1.Way Shear = 0.00 ft-lbs 0.00 pcl 0.00 pcl Key Reinforcing = # 5 @ 12.00 in 0.00 pcl 0.00 pcl Key Reinforcing <

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING	Cantilevered Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13
Summary of Overturning & Resisting	g Forces & Moments	

	O\ Force	ERTURNING Distance	Moment		RE	SISTING Distance	Moment
Item	lbs	ft	ft-#		lbs	ft	ft-#
HL Act Pres (ab water tbl)	2.531.3	3.75	9,492,2	Soil Over HL (ab. water tbl)	183.3	9.00	1,650.0
HL Act Pres (be water tbl)	_,		-,	Soil Over HL (bel. water tbl)		9.00	1,650.0
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 =	453.8	4.13	1,871.7
-				Surcharge Over Toe =			
				Stem Weight(s) =	1,050.0	8.58	9,012.5
–				Earth @ Stem Transitions=			
Total :	= 2,531.3	O.T.M. =	9,492.2	Footing Weight =	1,703.1	4.54	7,735.0
				Key Weight =	387.5	1.50	581.3
Resisting/Overturning I	Ratio	=	2.20	Vert. Component =			
Vertical Loads used for	Soil Pressure	= 3,777.7	lbs	Total =	3,777.7	bs R.M.=	20,850.5

* 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 soi
(Deflection due to wall bending not considered)

 Soil Spring Reaction Modulus
 250.0
 pci

 Horizontal Defl @ Top of Wall (approximate only)
 0.027
 in

The above calculation is not valid if the heel soll 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-06055289 License To : MALSAM TS	d 11.20 ANG E	0.03.31 ENGINEERING	;	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	= = =	11.00 ft 0.50 ft 0.00	Ē	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 id 40.0	psf psf/ft	
Height of Soil over Toe Water height over heel	=	6.00 in 0.0 ft	F	= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	300.0 110.00 110.00 0.400	psf/ft pcf pcf	
Surcharge Loads			ιΓ	Lateral Load Applied to	Stem	 	Adiacent Footing Load
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding &	= = & Overl	0.0 psf & Overturning 0.0 turning		Lateral Load = Height to Top = Height to Bottom = Load Type = Win	0.0 #/ 0.00 ft 0.00 ft d (W)	'ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	= = = =	0.0 lbs 0.0 lbs 0.0 in		(Ser Wind on Exposed Stem ₌ (Service Level)	rvice Le 0.0 pt	evel) sf	at Back Above/Below Soil at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary				Stem Construction] _	Bottom	
Wall Stability Ratios Overturning Sliding	= =	2.17 OK 1.67 OK		Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = = = =	Concrete LRFD 12.00	
Total Bearing Load resultant ecc.	= =	4,424 lbs 17.96 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 6 8.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	906 psf 26 psf 2,000 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.574	L .
Soil Pressure Les ACI Factored @ Toe ACI Factored @ Heel	s Thar = =	n Allowable 1,268 psf 36 psf		Stervice Level Strength Level MomentActual	lbs =	4,114.0	
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	23.1 psi 1.9 psi 75.0 psi	OK OK	Strength Level MomentAllowable	ft-# = =	15,084.7 26,273.2	
Sliding Calcs Lateral Sliding Force less 100% Passive For less 100% Friction Force	= ce = -	3,001.3 lbs 3,234.4 lbs 1,769.5 lbs		SnearActual Service Level Strength Level ShearAllowable	psi = psi = psi =	35.6 75.0	
Added Force Req'd for 1.5 Stability	=	0.0 lbs 0.0 lbs	ok ok	Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =	9.63	
Vertical component of activ NOT considered in the cal	ve late	ral soil pressur n of soil bearin	e IS g	f'm Fs Solid Grouting Modular Ratio 'n'	psi = psi = = =	450.0	
Load Factors Building Code Dead Load Live Load	IB	C 2015,ACI 1.400 1.700		Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	- 184 = = =	Medium V	Veight
Earth, H Wind, W Seismic, E		1.700 1.300 1.000		Concrete Data fc Fy	psi = psi =	2,500.0	

Project Name/Number	:	(C02-D30)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENG	SINEERING Cantilever	ed Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
s (based on applied moment) :	0.3602 in2/ft	0	
4/3) * As :	0.4803 in2/ft	Min Stem T&S Reinf Are	a 3.312 in2
00bd/fy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Are	a per ft of stem Height : 0.288 in2/ft
1.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing O	ptions :
	============	One layer of : Two la	ayers of :
Required Area :	0.385 in2/ft	#4@ 8.33 in #4@	16.67 in
Provided Area :	0.66 in2/ft	#5@ 12.92 in #5@	25.83 in
/laximum Area :	1.3039 in2/ft	#6@ 18.33 in #6@	36.67 in
Footing Data	Footing	Design Results	
Toe Width =	8.50 ft	Toe He	el
Heel Width =	1.00 Factored Pres	sure = 1,268	 36 psf
Total Footing Width =	9.50 Mu': Upward	= 390,388	0 ft-#
Footing Thickness =	15.00 in Mu': Downwa	rd = 147,173 = 20,268	0 ft-#
Key Width =	12.00 in Actual 1-Way	Shear = 23.11 19	92 psi
Key Depth =	36.00 in Allow 1-Way S	Shear = 75.00 40.0	00 psi
Key Distance from Toe =	1.00 ft Toe Reinforci	ng = #6@8.00 in	
fc = 2,500 psi Fy = 6	0,000 psi Heel Reinforc	ing = None Spec'd	
Footing Concrete Density =	150.00 pct Key Reinforcii	ng = # 5 @ 10.00 in	00.6 lb-
Cover@Top 200 @Btm	= 3.00 in Easting Allow	Torpion phi Tu = 0	1.00 It-IDS
	- 0.00 m Pooling Allow.	Torsion, printu – 0	.00 It-lbs
	suppleme	exceeds allowable, provide ntal design for footing torsio	n.
	Other Accept	able Sizes & Spacings	
	Toe: #4@	5.21 in, #5@ 8.08 in, #6@ 11.4	47 in, #7@ 15.65 in, #8@ 20.60 in, #9@ 26.
	Heel: phiMr	n = phi'5'lambda'sqrt(fc)'Sm	
	Key: #4@	7.29 in, #5@ 11.31 in, #6@ 16	5.05 in, #7@ 18 in, #8@
	Min footing	T&S reinf Area 3.0	08 in2
	Min footing	T&S reinf Area per foot 0.3	32 in2 /ft
	If one layer	of horizontal bars: If two	layers of horizontal bars:
	#4@ 7.4	1 in #4	@ 14.81 in
	#5@ 11.4	8 in #5	@ 22.96 in @ 22.50 in
	#6@ 16.3	#6	(J) 22.39 III

OVERTURNING	Summary of Over	turning &	Resisting F	orces & Mor	nents			
HL Act Pres (ab water tb)) 3,001.3 4.08 12,255.1 Soil Over HL (ab. water tb)) HL Act Pres (be water tb)) Soil Over HL (bel. water tb)) Soil Over HL (bel. water tb)) Hydrostatic Force = Stoped Soil Over Hel = Surcharge Over Heel = Stoped Soil Over Hel = Surcharge Over Heel = Surcharge Over Hele = Adjacent Footing Load = Axial Live Load on Stem = Added Lateral Load = Surcharge Over Toe = Load @ Stem Above Soil = Surcharge Over Toe = Total = 3,001.3 O.T.M. = 12,255.1 Resisting/Overturning Ratio = 2,17 Vert Component =	Item	Force lbs	OVERTURNING Distance ft	Moment ft-#		RI Force Ibs	SISTING Distance ft	Moment ft-#
Duoyant Force = Sloped Soil Over Heel = Surcharge over Heel = Surcharge Over Heel = Surcharge over Heel = Surcharge Over Heel = Surcharge over Toe = Adjacent Footing Load = Added Lateral Load = Axial Dead Load on Stem = Load @ Stem Above Soil = Soil Over Toe = 467.5 4.25 1,986. Surcharge Over Toe = Soil Over Toe = 467.5 4.25 1,986. Load @ Stem Above Soil = Surcharge Over Toe = 0.10 ver Toe = 467.5 4.25 1,986. Total = 3.001.3 O.T.M. = 12,255.1 Earth @ Stem Transitions= Footing Weight = 1,781.3 4.75 8,460. Key Weight = 2.17 Vert Component = 50.0 1.50 675.	HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	3,001	.3 4.08	12,255.1	Soil Over HL (ab. water to Soil Over HL (bel. water to Watre Table	l) bl)		
Surcharge over Heel = Surcharge Over Heel = Surcharge over Heel = Adjacent Footing Load = Adjacent Footing Load = Axial Dead Load on Stem = Added Lateral Load = Surcharge Over Toe =	Buoyant Force	=			Sloped Soil Over Heel	=		
Jurcharge Over Toe = Adjacent Footing Load = vdjacent Footing Load = Axial Dead Load on Stem = vdjacent Footing Load = Soil Over Toe = oad @ Stem Above Soil = Surcharge Over Toe = 467.5 4.25 1,986.5 Total = 3,001.3 O.T.M. = 12,255.1 Earth @ Stem Transitions= Fesisting/Overturning Ratio = 2.17 Vert Component = 450.0 1.50 675.	Surcharge over Heel	=			Surcharge Over Heel	=		
vdjacent Footing Load = Axial Dead Load on Stem = vdded Lateral Load = * Axial Live Load on Stem = .oad @ Stem Above Soil = Soil Over Toe = 467.5 4.25 1,986.5	Surcharge Over Toe	=			Adjacent Footing Load	=		
vdded Lateral Load = * Axial Live Load on Stem = cad @ Stem Above Soil = Soil Over Toe =	djacent Footing Load	=			Axial Dead Load on Stem	=		
oad @ Stem Above Soil = Soil Over Toe = 467.5 4.25 1,986.	dded Lateral Load	=			* Axial Live Load on Stem	=		
Image: state of the set of the s	oad @ Stem Above Soil	=			Soil Over Toe	= 467.5	4.25	1,986.9
Total = 3,001.3 O.T.M. = 12,255.1 Stem Weight(s) = 1,725.0 9.00 15,525. Resisting/Overturning Ratio = 2.17 Orthough (s) = 1,781.3 4.75 8,460.1 Key Weight = 450.0 1.50 675.1 675.1 Vert Component =	0	=			Surcharge Over Toe	=		
Total = 3,001.3 O.T.M. = 12,255.1 Earth @ Stem Transitions= Footing Weight = 1,781.3 4.75 8,460. Key Weight Resisting/Overturning Ratio = 2.17 Vert Component =					Stem Weight(s)	= 1,725.0	9.00	15,525.0
Total = 3,001.3 O.T.M. = 12,255.1 Footing Weight = 1,781.3 4.75 8,460. Key Weight = 450.0 1.50 675. Resisting/Overturning Ratio = 2.17 Vert Component =					Earth @ Stem Transitions	=		
Key Weight = 450.0 1.50 675. Resisting/Overturning Ratio = 2.17 Vert. Component =	Total	= 3,001	.3 O.T.M. =	12,255.1	Footing Weight	= 1,781.3	4.75	8,460.9
Resisting/Overturning Ratio = 2.17 Vert. Component =					Key Weight	= 450.0	1.50	675.0
	Resisting/Overturning	Ratio	=	2.17	Vert. Component	=		

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

Criteria Retined Height = 12.00 ft Wall height allows soil = 0.50 ft Stope Behind Wall = 0.50 ft Stope Behind Wall = 0.00 ft Stope	RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20 ANG I	0.03.31 ENGINEERING		Cantilevered Retain	ing V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13
Realined Height = 12.00 ft Wall height above soil = 0.00 ft Wall height of Sui over Toe = 0.00 ft Wall relight over hell = 0.0 ft Allow Soil Bearing = 2.000.0 paf Active Hele Pressure = 4.0.0 paff. Wall height of Sui over Toe = 0.00 ft Wall height of Sui over Toe = 0.00 ft Soil Density, Heal = 11000 pcf Soil Density, Toe = 11000 pcf Soil Density, Toe = 1000 ft Wall height bignee for passive pressure = 12.00 in Adjacent Footing Load Surcharge Loads Interal Load Applied to Stem Lateral Load Applied to Stem Not Used for Siding & Over Inset Surcharge Over Toe = 0.0 NOT Used for Siding & Overtruning Interal Load Applied to Stem Axial Load Applied to Stem Lateral Load = 0.0 psf Mol to Exposed Stem = 0.0 psf Service Level 0.0 psf Axial Load Cosenticity = 0.0 hs Axial Load Cose	Criteria				Soil Data			
Height of Soil over Toe 6.00 in Water height over heel 0.0 ft Soil Density, Heel = 110.00 pcf Soil Density, Toe = 110.00 pcf Footanglool Friction = 0.400 Surcharge Over Heel 0.0 psf Surcharge Over Heel 0.0 psf Nor Used for Stiding & Overturning Itaral Load Applied to Stem Axial Load Load = 0.0 lbs Axial Load Coernitity = 0.0 lbs Stiding and Live Load = 0.0 lbs Avail Load Coernitity = 0.0 lbs Stiding and Live Load = 0.0 lbs Stiding and Live Load = 0.0 lbs Stiding Cace = 22.0 lok Stiding Cace = 0.0 lbs Stiding Cace = 0.97 pf Soil Pressure @ Heel = 0.97 pf Soil Pressure @ Heel 0 psf Add Factored = 0.0 lbs Stiding Cace = 0.1927 psi Stididing Cace = 0.0 lbs <	Retained Height Wall height above soil Slope Behind Wall	= = =	12.00 ft 0.50 ft 0.00	A E A	Ilow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
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Surcharge Over Heel = 0.0 psf 0.0 psf NOT Used for Resist Silicing & Overtuming atteral Load = 0.0 ft Footing Width = 0.00 ft Axial Load Applied to Stem Height to Top = 0.00 ft Eccentricity = 0.00 ft Axial Load = 0.0 lbs Height to Top = 0.0 psf Base Above/Below Soil = 0.00 ft Axial Load = 0.0 lbs Silong & OverVell = 0.0 psf Base Above/Below Soil = 0.00 ft Axial Load = 0.0 lbs Silong Sucharge Over Toe = 0.0 ft Escentricity = 0.0 ft Axial Load Coda = 0.0 lbs Silong = 0.0 ft Escentricity = 0.0 ft Vall Stability Ratios Verturning = 2.01 OK Stem Construction Stem OK	Surcharge Loads			4	Lateral Load Applied to	Stem	1	Adjacent Footing Load
Axial Load Applied to Stem Could Type Line Load Axial Dead Load = 0.0 lbs 0.0 psf Base Above/Below Soil at Back of Wall Base Above/Below Soil at Back of Wall Base Above/Below Soil at Back of Wall Dois on the submer Stee Council of the submer Stee Counci	Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding &	= iding = Over	0.0 psf & Overturning 0.0 turning		_ateral Load = Height to Top = Height to Bottom =	0.0 # 0.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Fta CL Dist = 0.00 ft
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Wall Stability Ratios Design Height Above Ftg ft Sum OK Wall Stability Ratios 0.00 Overturning = 2.01 OK Wall Material Above "Ht" = 0.00 Siding = 1.61 OK Mail Material Above "Ht" = Concrete Total Bearing Load = 4.806 lbs Rebar Size = # # 6 resultant ecc. = 22.23 in Rebar Size = # # 6 Soil Pressure @ Toe = 0.979 psf OK Robig Data = 0.660 Soil Pressure @ Toe = 1.371 psf Strength Level lbs = 4.896.0 ACI Factored @ Toe = 1.97 psi OK Strength Level lbs = 4.896.0 ACI Factored @ Toe = 3.571.3 lbs Strength Level lbs = 4.896.0 Stiding Cates 1.371 psi OK Strength Level ft.# = 19.584.0 Madet Force Req'd 0.0 lbs OK Strength Level psi = 42.4 Istaral Sliding Force 3.5726.0 lbs ShearAllowable psi = 42.4 Istar al Sliding Force 3.726.0 lbs OK ShearAllowable psi = 42.4 Material Sliding Force 1.922.3 lbs ShearAllowable psi = 75.0 Addef Force Req'd </td <td>Design Summary</td> <td></td> <td></td> <td>[</td> <td>Stem Construction</td> <td>٦_</td> <td>Bottom</td> <td></td>	Design Summary			[Stem Construction	٦_	Bottom	
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Join Pressure @ Heel = 0.95 pd OK Allowable = 2.000 psf Soil Pressure Less Than Allowable service Level lbs = ACI Factored @ Toe = 1.371 psf ACI Factored @ Toe = 0.58 psi Footing Shear @ Toe = 26.2 psi OK Footing Shear @ Toe = 26.2 psi OK Footing Shear @ Toe = 70 psi MomentActual Service Level ff./F.B + fa/F.a Service Level bs = 4.896.0 ACI Factored @ Toe = 0.511 3 lbs Strength Level ff./F.B + fa/F.a = Service Level bsi = Storing Shear @ Toe = 26.2 psi OK Strength Level ff./F.B + fa/F.a = Storing Shear @ Toe = 0.63 Strength Level psi = Stationg Force = 3.511 3 lbs Strength Level psi = 75.0 Added Force Req'd 0.0 lbs OK Nettoe for 1.5 Stability = 0.0 lbs OK <t< td=""><td>Soil Pressure @ Too</td><td>_</td><td>070 pcf (</td><td>าห</td><td>Design Data</td><td></td><td>5</td><td></td></t<>	Soil Pressure @ Too	_	070 pcf (าห	Design Data		5	
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RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-13			
Concrete Stem Rebar Area Details						
Bottom Stem Ve As (based on applied moment) : 0,	ertical Reinforcing 4676 in2/ft	Horizontal Reinforcino	9			
(4/3) * As : 0.	6235 in2/ft	Min Stem T&S Reinf Area 3.600 in2				
200bd/fy : 200(12)(9.625)/60000 : 0.	385 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft				
0.0018bh : 0.0018(12)(12) : 0.	2592 in2/ft	Horizontal Reinforcing Options :				
==		One layer of : Tw	o layers of :			
Required Area : 0.	4676 in2/ft	#4@ 8.33 in #4	@ 16.67 in			
Provided Area : 0.	7543 in2/ft	#5@ 12.92 in #	5@ 25.83 in			
Maximum Area : 1.	3039 in2/ft	#6@ 18.33 in #	6@ 36.67 in			
Footing Data	Footing De	sign Results				
$\begin{array}{rcrcrcr} \hline \mbox{Toe Width} & = & 9.25 \mbox{ ft} \\ \mbox{Heel Width} & = & 1.00 \\ \mbox{Total Footing Width} & = & 10.25 \\ \mbox{Footing Thickness} & = & 15.00 \mbox{ in} \\ \mbox{Key Width} & = & 12.00 \mbox{ in} \\ \mbox{Key Width} & = & 12.00 \mbox{ in} \\ \mbox{Key Distance from Toe} & = & 1.00 \mbox{ ft} \\ \mbox{Key Distance from Toe} & = & 1.00 \mbox{ ft} \\ \mbox{Fc} & = & 2.500 \mbox{ psi} & \mbox{Fy} & = & 60,000 \mbox{ psi} \\ \mbox{Footing Concrete Density} & = & 15.00 \mbox{ pri} \\ \mbox{Footing Concrete Density} & = & 0.0018 \\ \mbox{Cover @ Top} & 2.00 & \mbox{@ Btm.} & = & 3.00 \mbox{ in} \\ \end{array}$	Factored Pressur Mu': Upward Mu': Downward Mu: Design Actual 1-Way Sh Allow 1-Way She Toe Reinforcing Heel Reinforcing Footing Torsion, To Footing Allow. To If forsion exc	Toe a 482,651 = 174,291 = 25,697 ear 2,619 ar 75,00 = # 6 @ 7,00 in = % 8,00 in Tu = rsion, phi Tu = reads allowable, provide provide	Heel 0 psf 0 n.# 0 n.# 0 n.# 0 n.# 1.92 psi 40.00 psi 40.00 psi 40.00 psi 40.00 psi 40.00 ft-lbs 0.00 ft-lbs 0.00			
	supplementa	l desian for footing tor	sion.			
	Other Acceptabl	e Sizes & Spacings				
	Toe: #4@ 4.6 Heel: phiMn = Key: #4@ 5.7	9 in, #5@ 7.28 in, #6@ 1 phi'5'lambda'sqrt(fc)'Sm 1 in, #5@ 8.85 in, #6@	10.33 in, #7@ 14.09 in, #8@ 18.56 in, #9@ 23. 12.56 in, #7@ 17.13 in, #			
	Min footing T& Min footing T& If one layer of h #4@ 7.41 in #5@ 11.48 ir #6@ 16.30 ir	S reinf Area S reinf Area per foot norizontal bars: If n n	3.32 in2 0.32 in2, ft two layers of horizontal bars: #4@ 14.81 in #5@ 22.96 in #6@ 32.59 in			

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW06055289 License To : MALSAM TSANG ENGINEERING Summary of Overturning & Resisting Forces & Moments

	OVERTURNING					RESISTING			
Item		Force lbs	Distance ft	Moment ft-#	_		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tb HL Act Pres (be water tb Hvdrostatic Force	I) I)	3,511.3	4.42	15,508.0	Soil Over HL (ab. water Soil Over HL (bel. water Watre Table	r tbl) er tbl)			
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 Sten	n =			
Load @ Stem Above Soi	il =				Soil Over Toe	=	508.8	4.63	2,353.0
0	=				Surcharge Over Toe	=			
					Stem Weight(s)	=	1,875.0	9.75	18,281.3
					Earth @ Stem Transitio	ns=			
Total	=	3,511.3	O.T.M. =	15,508.0	Footing Weight	=	1,921.9	5.13	9,849.6
					Key Weight	=	500.0	1.50	750.0
Resisting/Overturnin	g Rati	o	=	2.01	Vert. Component	=			
Vertical Loads used f	or Soi	I Pressure	= 4,805.0	6 lbs	To	tal =	4.805.6	bs R.M.=	31.233.8
					* Axial live load NOT incl resistance, but is includ	uded ir ed for :	total display	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 soi
(Deflection due to wall bending not considered)

 Soil Spring Reaction Modulus
 250.0 pci

 Horizontal Defl @ Top of Wall (approximate only)
 0.033 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-06055289 License To : MALSAM TS/	11.20 ANG E	.03.31 NGINEERING	;	Cantilevered Retaini	ing V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	4.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,666.0 d 40.0	psf psf/ft	
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft	:	Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	250.0 110.00 110.00 0.400 12.00	psf/ft pcf pcf	
Surcharge Loads			I	Lateral Load Applied to	Stem		Adiacent Footing Load
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding &	= iding & = Overt	0.0 psf & Overturning 0.0 urning		Lateral Load = Height to Top = Height to Bottom = Load Type = Win	36.0 # 4.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied Axial Dead Load Axial Live Load	to S = =	0.0 lbs 0.0 lbs	I	Wind on Exposed Stem = (Service Level)	vice Le	evel) sf	Footing Type Line Load Base Above/Below Soil at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Axial Load Eccentricity	=	0.0 in		Stem Construction		Bottom	- 0.000
Design Summary				Design Height Above Etc		Stem OK	
Wall Stability Ratios Overturning Sliding	= =	1.87 OK 1.35 Rat	io <	Wall Material Above "Ht" Design Method 1.5! Thickness	=	Concrete LRFD 8.00	
Total Bearing Load resultant ecc.	= =	1,118 lbs 7.12 in		Rebar Size Rebar Spacing Rebar Placed at Design Data	=	# 4 12.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	822 psf 0 psf 2,666 psf	OK OK	fb/FB + fa/Fa Total Force @ Section Service Level	= Ibs =	0.203	
ACI Factored @ Toe ACI Factored @ Heel	=	1,151 psf 0 psf		Strength Level MomentActual Service Level	lbs =	731.2	
Footing Shear @ Toe Footing Shear @ Heel Allowable	=	10.2 psi 2.7 psi 75.0 psi	OK OK	Strength Level MomentAllowable	ft-# = =	1,099.7 5,412.6	
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= e = - e = -	611.2 lbs 375.0 lbs 447.3 lbs		ShearActual Service Level Strength Level Shear Allowable	psi = psi = psi =	9.7 75.0	
Added Force Req'dfor 1.5 Stability	= =	0.0 lbs 94.5 lbs	OK NG	Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =	6.25	
Vertical component of activ NOT considered in the calc	e later ulatior	al soil pressur 1 of soil bearin	e IS g	fm Fs Solid Grouting Modular Ratio 'n'	psi= psi= = =		
Load Factors Building Code	IB	C 2015,ACI		Wall Weight Short Term Factor Equiv. Solid Thick.	psf= = =	100.0	
Dead Load Live Load Earth, H		1.400 1.700 1.700		Masonry Block Type Masonry Design Method Concrete Data	=	Medium V ASD	Veight
Wind, W Seismic, E		1.300 1.000		fc Fy	psi= psi=	2,500.0 60,000.0	
Project Name/Number	: 1	(C02-D30)	200				
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etainPro (c) 1987-2019, Build 11.20 icense : KW-06055289 icense To : MALSAM TSANG E	.03.31 NGINEERING	Cantilevered	Retaining Wa	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Are	ea Details			
Bottom Stem	Vertical	Reinforcing	Horizontal Reinfo	prcing
As (based on applied moment) :	0.0412 i	n2/ft		-
(4/3) * As :	0.0549 i	n2/ft	Min Stem T&S R	einf Area 0.864 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2	ft	Min Stem T&S R	einf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 i	n2/ft	Horizontal Reinfo	orcing Options :
	======		One layer of :	Two layers of :
Required Area :	0.1728 i	n2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/f		#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 i	n2/ft	#6@ 27.50 in	#6@ 55.00 in
Footing Data		Footing De	sign Results	
Toe Width =	2.00 ft	-	Toe	Heel
Heel Width =	1.00	Factored Pressur	e = 1,151	0 psf
Total Footing Width =	3.00	Mu' : Upward	= 20,857	0 ft-#
Footing Thickness =	10.00 in	Mu': Downward	= 6,664	44 ft-#
Key Width =	0.00 in	Actual 1 Way Sh	- 1,103	44 IL-# 2 74 psi
Key Depth =	6.00 in	Allow 1-Way She	ar = 75.00	40.00 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing	= #4@9.00	in
fc = 2,500 psi Fy =	60,000 psi	Heel Reinforcing	= None Spec'	d
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= None Spec'	d
Min. As % =	0.0018	Footing Torsion, 1	Гu =	0.00 ft-lbs
Cover@Top 2.00 @E	5um.= 3.00 m	Footing Allow. To	rsion, phi I u =	0.00 ft-lbs
		If torsion exc supplementa	eeds allowable, pr I design for footing	ovide g torsion.
		Other Acceptabl	e Sizes & Spacin	qs
		Toe: #4@ 11. Heel: phiMn = Key: No key d	11 in, #5@ 17.22 in phi'5'lambda'sqrt(fc) lefined	,#6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 /Sm
		Min footing T&3 Min footing T&3 If one layer of h #4@ 11.11 ir #5@ 17.22 ir #6@ 24.44 ir	S reinf Area S reinf Area per foot lorizontal bars: 1 1 1	0.65 in2 0.22 in2 ift If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

Summary of Over	τurr	ning & R	esisting F	orces & Mon	nents			
Item		OV Force Ibs	ERTURNING Distance ft	Moment ft-#		Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl HL Act Pres (be water tbl Hvdrostatic Force)	467.2	1.61	752.7	Soil Over HL (ab. water tbl Soil Over HL (bel. water tb Watre Table) 146.7 I)	2.83 2.83	415.6 415.6
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	=	144.0	2.83	408.0	* Axial Live Load on Stem =			
oad @ Stem Above Soil	=				Soil Over Toe =	146.7	1.00	146.7
	=				Surcharge Over Toe =			
					Stem Weight(s) =	450.0	2.33	1,050.0
Total	-	611.2	отм -	1 160 7	Earth @ Stem Transitions=			
Totai	-	011.2	0.1.1	1,100.7	Footing Weight =	375.0	1.50	562.5
					Key Weight =			
Resisting/Overturning	Rati	io	=	1.87	Vert. Component =		_	
vertical Loads used to	or Soi	Pressure	= 1,118.	3 IDS	Total =	1,118.3	lbs R.M.=	2,174.7

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 To	p of Wall due to settle	ment of soil					
(Deflection due to wall bending not considered)							
Soil Spring Reaction Modulus	250.0) pci					
Horizontal Defl @ Top of Wall (appr	oximate only) 0.034	in					
The above calculation is not valid if t	he heel soil bearing pressure	exceeds that of the toe,					

License : KW-06055289 License To : MALSAM TSA	11.20. NG E	03.31 NGINEERING	3	C	antilevered Re	etain	ing V	Vall	Code: IBC 2015,	ACI 3	18-14,ACI 530-1
Criteria				Soil	Data						
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe = Water height over heel =	:	4.00 ft 0.50 ft 0.00 8.00 in 0.0 ft		Allow Equiv Active Passi Soil D Soil D	Soil Bearing alent Fluid Pressure Heel Pressure ve Pressure lensity, Heel ensity, Toe	= 2 Metho = = = =	2,666.0 d 40.0 300.0 110.00 110.00) psf) psf/ft) psf/ft) pcf) pcf			
				Soil h	eight to ignore passive pressure	=	12.00	in	:		
Surcharge Loads				Late	eral Load Applie	ed to	Stem		Adjacent Footing	Load	ł
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & C Axial Load Applied	: ding & : Overtu to S 1	0.0 psf Overturning 0.0 Irning tem		Latera Hei Hei Load	al Load s ght to Top s ght to Bottom s Type s	= = = Wir (Se	36.0 # 4.00 ft 0.00 ft nd (W)	/ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= = =	0.0 lbs 0.00 ft 0.00 in 0.00 ft Line Load
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =		0.0 lbs 0.0 lbs 0.0 in		Wind (Ser	l on Exposed Stem ; vice Level)	=	0.0 p	sf	Base Above/Below Soi at Back of Wall Poisson's Ratio	=	0.0 ft 0.300
Design Summary				Ste	m Constructio	n	<u> </u>	Bottom	-		
Wall Stability Ratios Overturning Sliding	= =	1.52 OK 1.35 Rat	io <	1.5!	Design Height Abo Wall Material Abo Design Method Thickness	ve Ftg ve "Ht	g ft = ' = = =	Concrete LRFE 6.00			
Total Bearing Load resultant ecc.	= =	940 lbs 9.74 in			Rebar Size Rebar Spacing Rebar Placed at Design Data		=	# 4 18.00 Edge	2		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= = Than	970 pst 0 psf 2,666 psf Allowable	OK		fb/FB + fa/Fa Total Force @ Se Service Level	ection	= Ibs =	0.44	7		
ACI Factored @ Toe ACI Factored @ Heel	=	1,357 psf 0 psf	OK		Strength Level MomentActual Service Level		lbs = ft-# =	731.2	2		
Footing Shear @ Heel Allowable	=	1.4 psi 75.0 psi	OK		Strength Level MomentAllowa ShearActual	ble	ft-# = =	1,099.7 2,455.6	7		
Lateral Sliding Force less 100% Passive Force less 100% Friction Force		611.2 lbs 450.0 lbs 376.2 lbs			Service Level Strength Level ShearAllowable	e	psi = psi = psi =	14.3 75.0	i 1		
Added Force Req'd for 1.5 Stability	=	0.0 lbs 90.7 lbs	OK NG		Anet (Masonry) Rebar Depth 'd' Masonry Data		in2 = in =	4.25	i		
/ertical component of active NOT considered in the calcu	latera	al soil pressur of soil bearin	re IS Ig		Fs Solid Grouting Modular Ratio 'n' Wall Weight		psi = psi = = psf =	75.0	1		
Load Factors Building Code Dead Load Live Load Earth, H	IBO	C 2015,ACI 1.400 1.700 1.700			Short Term Factor Equiv. Solid Thick Masonry Block Ty Masonry Design M	pe /lethod	=	Medium V ASD	Veight		
Wind, W Seismic, E		1.300			fc Fy		psi = psi =	2,500.0 60,000.0			

icense : KW-06055289 icense To : MALSAM TS	ANG E		Cantilevered R	eta	ining	g Wa	II	Code: IB0	C 2015,AC	CI 318-14,AC	0 530-1
Concrete Stem Reb	ar Ar	ea Details									
Bottom Stem		Vertical	Reinforcing	Hori	zontal	Reinfo	rcing				
As (based on applied mor	nent):	0.0622	in2/ft								
(4/3) * As :		0.0829	in2/ft	Min	Stem ⁻	F&S Re	einf Area 0	.648 in2			
200bd/fy : 200(12)(4.25)/6	: 0000	0.17 in2	/ft	Min	Stem ⁻	F&S Re	einf Area p	er ft of stem	Height : 0.1	144 in2/ft	
0.0018bh : 0.0018(12)(6)		0.1296	in2/ft	Hori	zontal	Reinfo	rcing Optio	ns :	-		
		======		One	layer	of :	Two layer	s of :			
Required Area :		0.1296	in2/ft	#4@	, 16.67	' in	#4@ 33	.33 in			
Provided Area :		0.1333	in2/ft	¥5@	25.83	in	#5@ 51	.67 in			
Maximum Area :		0.5757	in2/ft	¥6@	36.67	' in	#6@ 73	.33 in			
Footing Data			Footing Desig	gn I	Resu	lts					
Toe Width	=	2.25 ft	-		To	be	Heel				
Heel Width	=	0.67	Factored Pressure	=	1	,357	0	osf			
Total Footing Width	=	2.92	Mu' : Upward	=	25	,332	0 f	t-#			
Footing Thickness	=	10.00 in	Mu': Downward	=	8	,434	11 f	t-#			
Kev Width	=	0.00 in	Mu: Design	-	1	,408	111	t-#			
Key Depth	=	6.00 in	Actual 1-Way Shear	-	7	5.00	1.37	JSI			
Key Distance from Toe	=	0.00 ft	Toe Reinforcing	_	#16	0.00 0 0 0 0 i	40.00 j	751			
f'c = 2,500 psi	Ev =	60.000 psi	Heel Reinforcing	=	None	Spec'o	d				
Footing Concrete Densit	v =	150.00 pcf	Key Reinforcing	=	None	Spec'o	d				
Min. As %	=	0.0018	Footing Torsion, Tu			=	0.00	ft-lbs			
Cover @ Top 2.00	@	Btm.= 3.00 in	Footing Allow. Torsic	n, p	hi Tu	=	0.00	ft-lbs			
			If torsion exceed	ds a	llowat	ole, pro	ovide				
			supplemental de	esig	n for f	ooting	torsion.				
			Other Acceptable S	Size	s & S	pacino	as				
			Toe: #4@ 11.11 Heel: phiMn = phi Key: No key defi	n, # 5'lai ned	5@ 17 mbda's	.22 in, aqrt(fc)	#6@ 24.44 'Sm	4 in, #7@ 33	8.33 in, #8@) 43.88 in, #9	@ 5
			Min footing T&S re	einf .	Area	or foot	0.63	in2			

Min footing T&S reinf Area per foot	0.22 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in
-	-

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		OV	ERTURNING	3		RES	ISTING	
Item	_	Force lbs	Distance ft	ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hvdrostatic Force)	467.2	1.61	752.7	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	73.3	2.83 2.83	207.8 207.8
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	= = =	144.0	2.83	408.0	* Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe =	165.0	1.13	185.6
Total	=	611.2	 O.T.M. =	1,160.7	Earth @ Stem Transitions =	364.6	2.50	531 7
Resisting/Overturning	Rati	io	=	1.52	Key Weight = Vert. Component =	304.0	1.40	001. <i>1</i>
Vertical Loads used fc	or Soi	Il Pressure	= 940.	.4 lbs	Total = * Axial live load NOT included in resistance, but is included for	940.4 lbs total displayed soil pressure ca	R.M.=	1,768.8 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)
 0.042 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-06055289 License To : MALSAM TSAI	11.20.03.31 NG ENGINEERIN	Cantilevered Re	taining W	Vall	Code: 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 =	5.00 ft 0.50 ft 0.00 8.00 in 0.0 ft	Allow Soil Bearing Equivalent Fluid Pressure Active Heel Pressure Soil Density, Heel Soil Density, Toe Footing Soil Friction Soil height to ignore for passive pressure	= 2,666.0 Method = 40.0 = 300.0 = 110.00 = 110.00 = 0.400 = 12.00	psf psf/ft psf/ft pcf pcf		
Surcharge Loads		Lateral Load Applie	d to Stem		diacent Footing	oad
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & C Axial Load Applied 1	0.0 psf ling & Overturning 0.0 Overturning to Stem	Lateral Load = Height to Top = Height to Bottom = Load Type =	45.0 #/ 5.00 ft 0.00 ft Wind (W) (Service Le	ft A F E evel) F	djacent Footing Load ooting Width iccentricity Vall to Ftg CL Dist ooting Type lase Above/Below Soil	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =	0.0 lbs 0.0 lbs 0.0 in	Wind on Exposed Stem ₌ (Service Level)	: 0.0 ps	sf P	at Back of Wall 'oisson's Ratio	= 0.0 ft = 0.300
Design Summary		Stem Construction		Bottom		
Wall Stability Ratios Overturning Sliding	= 1.38 Ra = 1.18 Ra	Design Height Abo Wall Material Abov atio < 1.5! Design Method tio < 1.5! Thickness	ve Ftg ft = /e "Ht" = = =	Stem OK 0.00 Concrete LRFD 8.00		
Total Bearing Load resultant ecc.	= 1,281 lbs = 13.15 in	Rebar Size Rebar Spacing Rebar Placed at Design Data	=	# 4 11.00 Edge		
Soil Pressure @ Heel Allowable Soil Pressure Less ' ACI Factored @ Toe ACI Factored @ Heel	= 0 psf = 2,666 psf Than Allowable = 1,946 psf = 0 psf	f OK tb/FB + ta/Fa f OK Total Force @ Se Service Level f MomentActual	= ction lbs = lbs =	0.365 1,142.5		
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 14.5 psi = 0.0 psi = 75.0 psi	i OK Service Level i OK Strength Level i MomentAllowat ShearActual	ft-# = ft-# = ple =	2,147.9 5,883.6		
Lateral Sliding Force less 100% Passive Force less 100% Friction Force Added Force Req'd	= 905.6 lbs = 554.2 lbs = 512.4 lbs = 0.0 lbs	Service Level Strength Level ShearAllowable OK Anet (Masonry)	psi = psi = psi = in2 =	15.2 75.0		
for 1.5 Stability	= 291.8 lbs	NG Rebar Depth 'd' Masonry Data fm Fs Salid Crauties	in = psi = psi =	6.25		
Vertical component of active NOT considered in the calcul	ateral soil pressu ation of soil bearing	ing Modular Ratio 'n' Wall Weight Short Term Factor	= = psf= =	100.0		
Building Code Dead Load Live Load Earth, H	IBC 2015,ACI 1.400 1.700 1.700	Equiv. Solid Thick. Masonry Block Typ Masonry Design M Concrete Data	= pe = lethod =	Medium W ASD	eight	
Wind, W Seismic, E	1.300 1.000	fc Fy	psi = psi =	2,500.0 60,000.0		

Project Name/Number	:	(C02-D30)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENG	Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0805 in2/ft		
4/3) * As :	0.1073 in2/ft	Min Stem T&S Reinf Are	a 1.056 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Are	a per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing O	ptions :
		One layer of : Two la	ayers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in #4@	25.00 in
Provided Area :	0.2182 in2/ft	#5@ 19.38 in #5@	38.75 in
/laximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@	55.00 in
Footing Data	Footing D	esign Results	
Toe Width =	2.75 ft	Toe He	el
Heel Width =	0.67 Factored Press	ure = 1,946	0 psf
Total Footing Width =	3.42 Mu': Upward	= 45,959	0 ft-#
Footing Thickness =	10.00 in Mu': Downward	d = 12,599	0 ft-#
Key Width =	12.00 in Actual 1 May 9	= 2,780	0 II-#
Key Depth =	8.00 in Allow 1-Way S	hear = 75.00 40.0	00 psi
Key Distance from Toe =	1.00 ft Toe Reinforcing	g = #4@.9.00 in	
fc = 2,500 psi Fy = 6	0,000 psi Heel Reinforcin	ig = None Spec'd	
Footing Concrete Density = 1	50.00 pcf Key Reinforcing	g = # 4 @ 9.26 in	
Min. As % = 0	.0018 Footing Torsion	i, Tu = 0	.00 ft-lbs
Cover@lop 2.00 @Btm	= 3.00 in Footing Allow.	Forsion, phi Tu = 0	.00 ft-lbs
	If torsion e supplemen	xceeds allowable, provide tal design for footing torsio	n.
	Other Accepta	ble Sizes & Spacings	
	Toe: #4@ 1 Heel: phiMn	1.11 in, #5@ 17.22 in, #6@ 2 = phi'5'lambda'sqrt(fc)'Sm	4.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
	Key: #4@ 9	.25 in, #5@ 14.35 in, #6@ 18	in, #7@ 18 in, #8@ 18
	Min footing T	&S reinf Area 0.7	74 in2
	Min footing I	&S reint Area per toot 0.2	22 IN2 /TL lavers of borizontal bars:
	#1 @ 11 11	in #4	nayers or no⊓zontal bars. ⋒. 22.22 in
	#4@ 11.11 #5@ 17.22	?in #5	@ 34.44 in
	#6@ 24.44	in #6	@ 48.89 in

Summary of Ove	rtur	ning & R	esisting F	orces & Mon	nents			
Item		OV Force Ibs	ERTURNING Distance ft	Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tb HL Act Pres (be water tb Hvdrostatic Force	l) l)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1.8	3.42 3.42	6.3 6.3
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	=	225.0	3.33	750.0	* Axial Live Load on Stem =			
oad @ Stem Above So	il =				Soil Over Toe =	201.7	1.38	277.3
	=				Surcharge Over Toe =			
					Stem Weight(s) =	550.0	3.08	1,695.8
Total	-	005.6	отм -	2 073 3	Earth @ Stem Transitions=			
i Oldi	-	305.0	0.1.WI. =	2,013.3	Footing Weight =	427.5	1.71	731.
	- 0-4		_	4.00	Key Weight =	100.0	1.50	150.0
Resisting/Overturnin	g Rat	10	- 1.004	1.38	Vert. Component =		-	
Vertical Loads used f	or So	Il Pressure	= 1,281.	U Ibs	Total =	1,281.0 I	bs R.M.=	2,860.
					* Axial live load NOT included i resistance, but is included for	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	e 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)	0.062 in
The above calculation is not valid if the heel soil bear	ring pressure exceeds that of the toe,

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Criteria				Soil	Data				
Retained Height = Wall height above soil = Slope Behind Wall =	:	6.00 ft 0.50 ft 0.00		Allow Equiv Active	Soil Bearing valent Fluid Pressure Me Heel Pressure	= 2 ethoo =	,666.0 d 40.0) psf) psf/ft	
Height of Soil over Toe =		8.00 in	1	Passi	ive Pressure	=	300.0) psf/ft	
Water height over heer -		0.0 11	:	Soil E Soil E Footir	Density, Heel Density, Toe ng Soil Friction	= '	110.00 110.00 0.400) pcf) pcf)	
			 	for	passive pressure	=	12.00	in	
Surcharge Loads				Lat	eral Load Applied	to	Stem		Adjacent Footing Load
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & 0	: ding & : Overtu	0.0 psf Overturning 0.0 Irning	9	Later Hei Hei	al Load = ight to Top = ight to Bottom =		54.0 # 6.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Etc Cl. Dist = 0.00 ft
Axial Load Applied	to St	tem		Load	Type =	Wind (Ser	d (W) vice L	evel)	Footing Type Line Load
Axial Dead Load =		0.0 lbs		Wind (Set	d on Exposed Stem =		0.0 p	sf	at Back of Wall = 0.0 ft
Axial Load Eccentricity =		0.0 in	,	(56	IVICe Level)		_		Poisson's Ratio = 0.300
Design Summary				Ste	em Construction			Bottom Stem OK	ζ
Wall Stability Ratios	=	1 29 0	ntio <	1 51	Design Height Above Wall Material Above	Ftg "Ht"	ft = =	0.00 Concrete	
Sliding	=	1.20 Ra 1.24 Ra	atio <	1.5!	Thickness		=	8.00)
Total Bearing Load resultant ecc.	= =	1,605 lbs 18.07 in	6		Rebar Spacing Rebar Placed at		=	# 4 10.00 Edge	*) 9
Soil Pressure @ Toe Soil Pressure @ Heel	=	1,847 ps 0 ps	f OK f OK		fb/FB + fa/Fa	ion	=	0.575	5
Allowable Soil Pressure Less	= Than	2,666 ps Allowable	f		Service Level		lbs =	4 645 0	
ACI Factored @ Toe ACI Factored @ Heel	=	2,585 ps 0 ps	f f		MomentActual		105 -	1,040.2	2
Footing Shear @ Toe Footing Shear @ Heel	=	17.4 psi 0.0 psi	i OK		Service Level Strength Level		ft-# = ft-# =	3,711.6	6
Allowable	=	75.0 ps	i		MomentAllowable	9	=	6,444.1	1
Lateral Sliding Force	=	1,257.9 lbs			Service Level		psi =		
less 100% Passive Force less 100% Friction Force		916.7 lbs 642.0 lbs			Strength Level ShearAllowable		psi = psi =	21.9 75.0	9)
Added Force Req'd for 1.5 Stability	=	0.0 lbs 328.1 lbs	s OK s NG		Anet (Masonry) Rebar Depth 'd'		in2 = in =	6.25	5
					Masonry Data		noi =		
					Fs		psi =		
Vertical component of active NOT considered in the calcu	latera	al soil pressu of soil beari	ure IS ing		Solid Grouting Modular Ratio 'n' Wall Weight		= = psf=	100.0	0
Load Factors Building Code	IBC	C 2015,ACI		-	Short Term Factor Equiv. Solid Thick.		=		
Dead Load Live Load		1.400			Masonry Block Type Masonry Design Met	thod	=	Medium V ASD	Weight
Wind, W Seismic, E		1.300 1.000			fc Fy		psi = psi =	2,500.0 60,000.0))

icense : KW-06055289 icense To : MALSAM TSANG ENG	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1391 in2/ft	-	
(4/3) * As :	0.1854 in2/ft	Min Stem T&S Reinf Are	ea 1.248 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Are	ea per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing C	Options :
		One layer of : Two	layers of :
Required Area :	0.1854 in2/ft	#4@ 12.50 in #4@	25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in #5@	0 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@	0 55.00 in
Footing Data	Footing De	esign Results	
Toe Width =	3.50 ft	<u>Toe</u> He	eel
Heel Width =	0.67 Factored Pressu	re = 2,585	0 psf
Total Footing Width =	4.17 Mu': Upward	= 78,755	0 ft-#
Footing Thickness =	10.00 in Mu': Downward	= 20,409	0 ##
Key Width =	12.00 in Actual 1 May Sh	- 4,002	01
Key Depth =	14.00 in Allow 1-Way Sh	r = 75.00 40	.04 psi .00 psi
Key Distance from Toe =	1.00 ft Toe Reinforcing	= #4@800 in	.oo psi
fc = 2,500 psi Ev = 6	60 000 psi Heel Reinforcing	= None Spec'd	
Footing Concrete Density = 1	150.00 pcf Key Reinforcing	= #4@9.00 in	
Min. As % = 0	.0018 Footing Torsion,	Tu = (0.00 ft-lbs
Cover @ Top 2.00 @ Btm	.= 3.00 in Footing Allow. To	orsion, phi Tu = (0.00 ft-lbs
	If torsion exe	ceeds allowable, provide	
	supplementa	al design for footing torsion	on.
	Other Acceptab	le Sizes & Spacings	
	Toe: #4@ 10. Heel: phiMn = Key: #4@ 9.2	.29 in, #5@ 15.96 in, #6@ 2 phi'5'lambda'sqrt(fc)'Sm 25 in, #5@ 14.35 in, #6@ 1	22.65 in, #7@ 30.89 in, #8@ 40.67 in, #9@ 5 8 in, #7@ 18 in, #8@ 18
	Min footing T&	S reinf Area 0	.90 in2

with looung ras reini Area	0.90 IIIZ
Min footing T&S reinf Area per foot	0.22 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

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		OV	ERTURNING			RE		
Item	_	Force Ibs	Distance ft	ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tb	I)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	2.2	4.17	9.2
HL Act Pres (be water tb Hvdrostatic Force)			·	Soil Over HL (bel. water tbl) Watre Table		4.17	9.2
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	=	324.0	3.83	1,242.0	* Axial Live Load on Stem =			
Load @ Stem Above Soi	= 1				Soil Over Toe =	256.7	1.75	449.2
	=				Surcharge Over Toe =			
					Stem Weight(s) =	650.0	3.83	2,491.7
Tatal		4 057 0		2 200 2	Earth @ Stem Transitions=			
Total	=	1,257.9	U.I.W. =	3,309.2	Footing Weight =	521.3	2.09	1,086.8
					Key Weight =	175.0	1.50	262.5
Resisting/Overturnin	g Rat	io	=	1.28	Vert. Component =			
Vertical Loads used f	or Soi	Pressure	= 1,605.1	1 lbs	Total =	1.605.1	bs R.M.=	4.299.3

* 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)

ς **β** ,

 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.

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Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	=	6.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,666.0 id 40.0	psf psf/ft	
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft		Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	300.0 110.00 110.00 0.400	psf/ft pcf pcf	
Surcharge Loads			I	Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist Sli Surcharge Over Toe NOT Used for Sliding &	= iding = Over	0.0 psf & Overturning 0.0 turning	-	Lateral Load = Height to Top = Height to Bottom = I.oad Type = Win	54.0 #/ 6.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	to \$ = =	0.0 lbs 0.0 lbs 0.0 lbs 0.0 in		Wind on Exposed Stem = (Service Level)	rvice Le	evel) sf	Footing Type Line Load Base Above/Below Soil at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary				Stem Construction	٦_	Bottom	
Wall Stability Ratios Overturning	=	1.42 Rat	io <	Design Height Above Ftg Wall Material Above "Ht"	g ft = ' = =	Stem OK 0.00 Concrete	
Sliding	=	1.25 Rat	io <	1.5! Thickness Rebar Size	=	6.00 # 4	
Total Bearing Load resultant ecc.	=	1,649 lbs 17.69 in		Rebar Spacing Rebar Placed at Design Data	=	9.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	=	1,279 psf 0 psf 2.666 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.785	
Soil Pressure Less ACI Factored @ Toe	Thai	n Allowable 1,791 psf		Service Level Strength Level MomentActual	lbs = lbs =	1,645.2	
Footing Shear @ Toe Footing Shear @ Heel	=	16.3 psi 1.9 psi	ок ок	Service Level Strength Level	ft-# = ft-# =	3,711.6	
Allowable Sliding Calcs	=	75.0 psi		MomentAllowable ShearActual	= nei=	4,722.4	
less 100% Passive Force less 100% Friction Force	= - e = -	1,257.9 lbs 916.7 lbs 659.7 lbs		Strength Level ShearAllowable	psi = psi =	32.3 75.0	
Added Force Req'd for 1.5 Stability	=	0.0 lbs 310.5 lbs	OK NG	Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =	4.25	
Vertical component of activ	a lata	ral soil pressur	21 0	fm Fs Solid Grouting	psi = psi = =		
NOT considered in the calc	ulatio	n of soil bearin	g	Modular Ratio 'n' Wall Weight	= psf=	75.0	
Load Factors Building Code Dead Load Live Load	IE	8C 2015,ACI 1.400 1.700		Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Mathed	=	Medium V	Veight
Earth, H Wind, W Seismic, E		1.700 1.300 1.000		fc Fy	psi = psi =	2,500.0	

Project Name/Number	: 1	(C02-D30)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENG	"Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2098 in2/ft	-	
4/3) * As :	0.2797 in2/ft	Min Stem T&S Reinf Area	0.936 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area	per ft of stem Height : 0.144 in2/ft
).0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Op	ions :
	===========	One layer of : Two lay	ers of :
Required Area :	0.2098 in2/ft	#4@ 16.67 in #4@ 3	i3.33 in
Provided Area :	0.2667 in2/ft	#5@ 25.83 in #5@ 5	i1.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in #6@ 7	'3.33 in
Footing Data	Footing [Design Results	
Toe Width =	4.00 ft	Toe Heel	
Heel Width =	0.67 Factored Press	sure = 1,791 () psf
Total Footing Width =	4.67 Mu': Upward	= 87,016) ft-#
Footing Thickness =	10.00 in Mu ⁺ : Downwar Mu ⁺ : Design	d = 26,656 18 = 5,030 16	0 TL-# 5 ft_#
Key Width =	12.00 in Actual 1-Way 9	Shear = 16.31 1.91	nsi
Key Depth =	14.00 in Allow 1-Way S	hear = 75.00 40.00) psi
Key Distance from Toe =	1.00 ft Toe Reinforcin	g = # 4 @ 9.00 in	
fc = 2,500 psi Fy = 6	0,000 psi Heel Reinforcir	ng = None Spec'd	
Footing Concrete Density = 1	50.00 pcf Key Reinforcin	g = #4@9.26 in	
MIN. AS % = U	- 3 00 in Footing I orsion	n, Tu = 0.0	U π-IDS
Cover @ 10p 2.00 @ Dun	= 5.00 III FOOLING Allow.		S III O III O III O
	If torsion e supplemer	xceeds allowable, provide Ital design for footing torsion	
	Other Accepta	ble Sizes & Spacings	
	Toe: #4@ 9	.95 in, #5@ 15.42 in, #6@ 21.8	9 in, #7@ 29.86 in, #8@ 39.31 in, #9@ 49
	Heel: phiMn Key: #4@ 9	= phi'5'lambda'sqrt(fc)'Sm 9.25 in, #5@ 14.35 in, #6@ 18 i	n, #7@ 18 in, #8@ 18
	Min footing	&S reinf Area 1.01	in2
	Min footing I	&S reint Area per toot 0.22	in2 /π avers of horizontal bars:
	ii one layer o #/ ∩ 11 1	in 1012011talbars. IItwo I Lin #4@	ayers or nonzonital bars.) 22 22 in
	#5@ 17 2	2 in #4@	34.44 in
	#6@ 24.44	tin #6@	48.89 in

Summary of Overturning & Resisting Forces & Moments										
Item	Force Ibs	ft	Moment ft-#		Force Ibs	SISTING Distance ft	Moment ft-#			
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	110.0	4.58 4.58	504.2 504.2			
Buoyant Force =				Sloped Soil Over Heel =						
Surcharge over Heel =				Adjacent Footing Load =						
Surcharge Over Toe =				Axial Dead Load on Stem =						
Adjacent Fooling Load =	324.0	3.83	1 242 0	* Axial Live Load on Stem =						
.oad @ Stem Above Soil =	024.0	0.00	1,242.0	Soil Over Toe =	293.3	2.00	586.7			
=				Stem Weight(s) =	487.5	4.25	2,071.9			
	4 057 0		0.000.0	Earth @ Stem Transitions=						
Total =	1,257.9	O.T.M. =	3,369.2	Footing Weight =	583.3	2.33	1,361.1			
				Key Weight =	175.0	1.50	262.5			
Resisting/Overturning F	latio	=	1.42	Key Weight = Vert. Component =	175.0	1.50	2			
Vertical Loads used for \$	Soil Pressure	= 1,649.	2 lbs	Total =	1,649.2 I	bs R.M.=	4,786.			

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 settlem	<u>nent of soil</u>
(Deflection due to wall bending not considered)		
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.050	in
The above calculation is not valid if the heel soil bearing	ng pressure e	exceeds that of the toe,

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Criteria			S	oil Data				
Retained Height = Wall height above soil = Slope Behind Wall =	-	5.00 ft 0.50 ft 0.00	All Eq Ac	ow Soil Bearing = : uivalent Fluid Pressure Metho tive Heel Pressure =	2,666.0 od 40.0) psf) psf/ft		
Height of Soil over Toe =	-	8.00 in	De	=	200.0) pof/ft		
Water height over heel =	-	0.0 ft	F a	issive Flessure =	110.00) psi/it		
			So	bil Density, Toe =	110.00) pcf		
			Fo	oting Soil Friction =	0.400)		
			So	il height to ignore				
			t	for passive pressure =	12.00	in	· · · ·	·
Surcharge Loads			L	ateral Load Applied to	Stem	1 I	Adjacent Footing	Load
Surcharge Over Heel	-	0.0 psf	La	ateral Load =	45.0 #	/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sli	ding & -	& Overturning	!	Height to Top =	5.00 ft		Footing Width	= 0.00 ft
NOT Used for Sliding & (- Overti	urning		Height to Bottom =	0.00 ft		Wall to Eta CL Diat	= 0.00 m
Avial Load Applied	to S	tom	Lc	ad Type = Wir	nd (W)		Footing Type	Line Load
	.03	tolli		(Se	rvice L	evel)	Base Above/Below Soil	- 0.0#
Axial Dead Load =	=	0.0 lbs	N	/ind on Exposed Stem =	0.0 p	sf	at Back of Wall	- 0.0 II
Axial Live Load = Axial Load Eccentricity =	=	0.0 lbs 0.0 in	(Service Level)			Poisson's Ratio	= 0.300
Design Summary				Stem Construction	<u> </u>	Bottom		
				Design Height Above Ft	g ft=	0.00		
Wall Stability Ratios	-			Wall Material Above "Ht		Concrete		
Sliding	-	1.25 Rati 1.13 Rati	0 < 1. 0 < 1	5! Design Method	=	LRFD		
Siluing	-	1.10 1.44	0 - 1.	Pebar Size	=	6.00		
Total Bearing Load	=	1,170 lbs		Rebar Spacing	=	12.00		
resultant ecc.	=	15.74 in		Rebar Placed at	=	Edge		
Soil Pressure @ Toe	=	1,779 psf	OK	fb/EB + fa/Ea	-	0 59/		
Soil Pressure @ Heel	=	0 psf	OK	Total Force @ Section	-	0.004		
Allowable	=	2,666 psf		Service Level	lbs =			
Soil Pressure Less	I han	Allowable		Strength Level	lbs =	1.142.5		
ACI Factored @ Heel	-	2,491 psi 0 psf		MomentActual		, .		
Footing Shear @ Toe	=	11.6 psi	ОК	Service Level	ft-# =			
Footing Shear @ Heel	=	1.9 psi	OK	Strength Level	ft-# =	2,147.9		
Allowable	=	75.0 psi		MomentAllowable	=	3,612.6		
Sliding Calcs		-		ShearActual				
Lateral Sliding Force	=	905.6 lbs		Service Level	psi =			
less 100% Passive Force	e - e	554.2 lbs		Strength Level	psi =	22.4		
less 100% Friction Force		468.0 lbs		ShearAllowable	psi =	75.0		
Added Force Req'd	=	0.0 lbs	OK	Anet (Masonry)	in2 =			
for 1.5 Stability	=	336.2 lbs	NG	Rebar Depth 'd'	in =	4.25		
				Masonry Data	noi -			
				Fs	psi=			
/ertical component of active	alater	al soil pressur	e IS	Solid Grouting	= 100			
NOT considered in the calcu	latior	of soil bearing	q	Modular Ratio 'n'	=			
				Wall Weight	psf=	75.0		
Load Factors				Short Term Factor	. =			
Building Code	IB	C 2015,ACI		Equiv. Solid Thick.	=			
Dead Load		1.400		Masonry Block Type	=	Medium V	Veight	
Live Load		1.700		Masonry Design Method	i =	ASD		
Earth, H		1.700		Concrete Data				
Wind, W		1.300		fc	psi=	2,500.0		
Seismic, E		1.000		⊢y	psi =	60,000.0		

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Concrete Stem Reba	r Area	Details					
Bottom Stem		Vertica	I Reinforcing	Horiz	ontal Reinfo	rcing	
As (based on applied mome	ent) :	0.1214	in2/ft			5	
(4/3) * As :	,	0.1619	in2/ft	Min S	tem T&S R	einf Area 0.792 ir	12
200bd/fv : 200(12)(4.25)/600	: 000	0.17 in	2/ft	Min S	tem T&S R	einf Area per ft of	f stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :		0.1296	in2/ft	Horiz	ontal Reinfo	rcing Options :	5
		=====	======	One I	aver of :	Two lavers of :	
Required Area :		0.1619	in2/ft	#4@	, 16.67 in	, #4@ 33.33 in	
Provided Area :		0.2 in2	/ft	#5@	25.83 in	#5@ 51.67 in	
Maximum Area :		0.5757	in2/ft	#6@	36.67 in	#6@ 73.33 in	
Footing Data			Footing Desig	gn R	esults		
Toe Width	=	3.00 ft			Toe	Heel	
Heel Width	=	0.50	Factored Pressure	=	2,491	0 psf	
Total Footing Width	=	3.50	Mu' : Upward	=	50,350	0 ft-#	
Footing Thickness	=	10.00 in	Mu' : Downward	=	14,994	0 ft-#	
Key Width	=	12.00 in	Mu: Design	=	2,946	0π-#	
Key Depth	=	8.00 in	Actual 1-Way Shear	-	75.00	1.91 psi	
Key Distance from Toe	=	1.00 ft	Too Poinforcing	Ξ.	75.00 #1@0.00	40.00 pSi	
fo = 2,500 pci Et		60.000 pci	Heel Reinforcing	-	None Snec'	n. d	
Footing Concrete Density	y – =	150.00 pcf	Key Reinforcing	=	# 4 @ 9.26	in	
Min. As %	=	0.0018	Footing Torsion, Tu		=	0.00 ft-lbs	
Cover @ Top 2.00	@ Btr	n.= 3.00 in	Footing Allow. Torsid	on, ph	iTu =	0.00 ft-lbs	
			If torsion excee	ds all	owable, pr	ovide	
			supplemental d	esign	for footing	torsion.	
			Other Acceptable S	Sizes	& Spacin	as	
			Toe: #4@ 11.11 Heel: phiMn = phi Key: #4@ 9.25 ir	in, #5 '5'lam	@ 17.22 in, bda'sqrt(fc)	#6@ 24.44 in, # 'Sm #6@ 18 in #7@	7@ 33.33 in, #8@ 43.88 in, #9@ 5 18 in #8@ 18
			1.07	., "თ	5		

Min footing T&S reinf Area	0.76 in2	
Min footing T&S reinf Area per foot	0.22 in2 /ft	
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@, 48.89 in	

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		OV	ERTURNING.			F	RESISTING	
Item	_	Force lbs	Distance ft	ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tb HL Act Pres (be water tb Hvdrostatic Force	I) I)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) 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	=	225.0	3.33	750.0	* Axial Live Load on Stem =			
Load @ Stem Above Soi	il =				Soil Over Toe =	220.0	1.50	330.0
	=				Surcharge Over Toe =			
					Stem Weight(s) =	412.5	3.25	1,340.6
Total		005.0	- O T M -	2.072.2	Earth @ Stem Transitions=			
rotai	=	905.6	0.1.1/1. =	2,073.3	Footing Weight =	437.5	1.75	765.6
					Key Weight =	100.0	1.50	150.0
Resisting/Overturning	g Rat	io	=	1.25	Vert. Component =			
Vertical Loads used f	or So	il Pressure	= 1,170.0) Ibs	Total =	1.170.0	lbs R.M.=	2,586.3

* 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)
 0.078
 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,

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Criteria				Soil Data			
Retained Height Wall height above soil	= = -	7.00 ft 0.50 ft	ļ	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,666.0 d 40.0) psf) psf/ft	5×
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft		= Passive Pressure =	300.0) psf/ft	
5			:	Soil Density, Heel = Soil Density, Toe = Footing Soil Friction =	110.00 110.00 0.400) pcf) pcf	
			:	Soil height to ignore for passive pressure =	12.00	in	
Surcharge Loads				Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding &	= iding = Over	0.0 psf & Overturning 0.0 turning		Lateral Load = Height to Top = Height to Bottom =	63.0 # 7.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied	to S	Stem		Load Type = Win (Sei	a (w) vice Le	evel)	Footing Type Line Load
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in		Wind on Exposed Stem = (Service Level)	0.0 p	sf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300
Design Summary		, 		Stem Construction	<u> </u>	Bottom	
				Design Height Above Ftg	ft=	Stem OF 0.00	
Wall Stability Ratios	-	1 05 D .:		Wall Material Above "Ht"	=	Concrete	
Sliding	-	1.25 Ratio 1.19 Ratio) <) <	1.5! Design Method	=	LRFD	
onding				Rebar Size	=	# 4	
Total Bearing Load	=	1,954 lbs		Rebar Spacing	=	8.00)
resultant ecc.	=	23.20 in		Rebar Placed at	=	Edge	
Soil Pressure @ Toe	=	1 999 nef (лĸ	Design Data			
Soil Pressure @ Heel	=	0 psf (SK	fb/FB + fa/Fa	=	0.74	D
Allowable	=	2,666 psf		Total Force @ Section			
Soil Pressure Less	Tha	n Allowable		Service Level	IDS =	2 220 2	
ACI Factored @ Toe	=	2,798 psf		Moment Actual	ibs =	2,239.3	3
ACI Factored @ Heel	=	U psi	~~~	Service Level	ft-# =		
Footing Shear @ Toe Footing Shear @ Heel	-	19.9 psi (JK	Strength Level	ft-# =	5,893.9	9
Allowable	-	75.0 psi 0	Л	MomentAllowable	=	7,959.6	3
Sliding Calcs		10.0 por		ShearActual			
Lateral Sliding Force	=	1.668.2 lbs		Service Level	psi=		
less 100% Passive Forc	e = -	1,200.0 lbs		Strength Level	psi=	29.9)
less 100% Friction Force	e = -	781.5 lbs		ShearAllowable	psi=	75.0)
Added Force Req'd	=	0.0 lbs (ЭK	Anet (Masonry)	in2 =		
for 1.5 Stability	=	520.8 lbs l	NG	Rebar Depth 'd'	in =	6.25	5
				Masonry Data			
				rm Fe	psi=		
Vertical component of activ	o lato	ral soil pressure	210	Solid Grouting	= 100		
NOT considered in the calc	ulatio	n of soil bearing	10	Modular Ratio 'n'	=		
				Wall Weight	psf=	100.0)
Load Factors		0 0045 4 0		Short Term Factor	=		
Building Code	IE	3C 2015,ACI		Equiv. Solid Thick.	=		
Live Load		1.400		Masonry Block Type	=	Medium \	Weight
Earth H		1 700		Masonry Design Method	=	ASD	
Wind, W		1.300		fc	nsi =	2 500 0]
Seismic, E		1.000		Fv	psi =	60.000.0)
,				• ,	po	50,000.0	-

Project Name/Number	:	(C02-D30)	200
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Concrete Stem Rebar Are	ea Details			
Bottom Stem	Vertical Reinfo	ina Horiz	ontal Reinfor	cina
As (based on applied moment) :	0.2208 in2/ft	5		5
(4/3) * As :	0.2944 in2/ft	Min S	Stem T&S Re	inf Area 1.440 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min S	Stem T&S Re	inf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horiz	ontal Reinfor	cing Options :
	==========	One I	ayer of :	Two layers of :
Required Area :	0.25 in2/ft	#4@	12.50 in	#4@ 25.00 in
Provided Area :	0.3 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	1	ooting Design R	Results	
Toe Width = Heel Width = Total Footing Width = Footing Thickness = Key Width = Key Distance from Toe = fc = 2,500 psi Fy = Footing Concrete Density = Min. As % = Cover @ Top 2.00 @ E	4.50 ft 0.67 Fac 5.17 Mu' 10.00 in Mu' 12.00 in Act 18.00 in Allo 1.00 ft Too 60,000 psi Het 150.00 pcf Kes 0.0018 Foc stm.= 3.00 in Foc	red Pressure = Upward = Downward = Design = 1-Way Shear = 1-Way Shear = Reinforcing = Reinforcing = ag Torsion, Tu ng Allow. Torsion, ph torsion exceeds all upplemental design	Toe 2,798 126,315 33,737 7,715 19.86 75.00 # 4 @ 8.00 ir None Spec'd # 4 @ 9.00 ir = ni Tu = Iowable, pro	Heel 0 psf 0 ft# 0 ft# 0 ft# 0.04 psi 40.000 psi 1 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs vide torsion.
	T F N N If	e: #4@ 8.65 in, #5@ el: phiMn = phi'5'lam y: #4@ 9.25 in, #5@ 1 footing T&S reinf A 1 footing T&S reinf A ne layer of horizonta #4@ 11.11 in #5@ 17.22 in #6@ 24 44 in) 13.41 in, # hbda'sqrt(fc)%) 14.35 in, # wrea rea per foot al bars:	6@ 19.03 in, #7@ 25.95 in, #8@ 34.17 in, #9@ 43 3m 6@ 18 in, #7@ 18 in, #8@ 18 1.12 in2 0.22 in2 ft If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48 89 in

Summary of Over	turr	ning & R	esisting F	orces & Mon	nents			
Item		OV Force Ibs	ERTURNING Distance ft	Moment		Rl Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl)		1,227.2	2.61	3,204.4	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	2.6	5.17 5.17	13.3 13.3
Buoyant Force Burcharge over Heel	=				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load =			
Adjacent Footing Load	=	441.0	4.33	1,911.0	Axial Dead Load on Stem = * Axial Live Load on Stem =			
oad @ Stem Above Soil	=				Soil Over Toe = Surcharge Over Toe =	330.0	2.25	742.5
		4 000 0			Earth @ Stem Transitions=	750.0	4.83	3,625.0
Iotai	=	1,668.2	0.1.M. =	5,115.4	Footing Weight = Key Weight =	646.3 225.0	2.59	1,670.6 337.5
Resisting/Overturning	Rati	io	=	1 25	Vert Component =			

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 settlem	nent of soil
(Deflection due to wall bending r	ot considered)		
Soil Spring Reaction Modulus		250.0	pci
Horizontal Defl @ Top of Wall (a	pproximate only)	0.081	in
The above calculation is not valid	d if the heel soil bearing	ng pressure e	exceeds that of the toe,

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Criteria			:	Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	5.00 ft 0.50 ft 0.00	Ē	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft	FS	Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction =	300.0 110.00 110.00 0.400) psf/ft) pcf) pcf)	
				for passive pressure =	12.00	in	
Surcharge Loads			[Lateral Load Applied to	Sten	1	Adjacent Footing Load
Surcharge Over Heel NOT Used To Resist Sli Surcharge Over Toe NOT Used for Sliding &	= ding & = Overti	0.0 psf & Overturning 0.0 urning		_ateral Load = Height to Top = Height to Bottom =	0.0 # 0.00 f 0.00 f	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied	to S	tem		_oad Type(Ser	rvice 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 = 0.0 ft Poisson's Ratio = 0.300
Design Summary			[Stem Construction	7.	Bottom	
				Design Height Above Ftg	ft=	Stem Ol 0.0	K D
Wall Stability Ratios Overturning Sliding	= =	2.26 OK 1.57 OK		Wall Material Above "Ht" Design Method Thickness	=	Concrete LRFI 6.0	e D 0
Total Bearing Loadresultant ecc.	=	1,283 lbs 6.41 in		Rebar Size Rebar Spacing Rebar Placed at	=	# 16.0 Edg	4 0 e
Soil Pressure @ Toe Soil Pressure @ Heel	=	656 psf 44 psf	OK OK	fb/FB + fa/Fa	=	0.51	5
Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= Than =	2,000 psf Allowable 918 psf 62 psf		Service Level Strength Level MomentActual	lbs = lbs =	850.	D
Footing Shear @ Toe	=	10.4 psi	OK	Service Level Strength Level	ft-# = ft-# =	1,416.	7
Allowable Sliding Calcs	=	75.0 psi		MomentAllowable ShearActual	=	2,749.	3
Lateral Sliding Force less 100% Passive Force	= = -	680.6 lbs 554.2 lbs		Service Level Strength Level	psi= psi=	16.	7
less 100% Friction Force Added Force Req'd	= -	513.0 lbs 0.0 lbs	ОК	ShearAllowable Anet (Masonry)	psi = in2 =	75.	D
for 1.5 Stability	=	0.0 lbs	OK	Rebar Depth 'd' Masonry Data	in =	4.2	5
ertical component of active	e later	al soil pressur	e IS	ťm Fs Solid Grouting	psi = psi = =		
OT considered in the calcu	ulation	ı of soil bearin	9	Modular Ratio 'n' Wall Weight	= psf=	75.	0
Building Code Dead Load	IB	C 2015,ACI 1.400		Short Term Factor Equiv. Solid Thick. Masonry Block Type	=	Medium	Weight
Live Load Earth, H		1.700 1.700		Masonry Design Method	=	ASD	
Wind, W Seismic, E		1.300 1.000		fc Fy	psi = psi =	2,500. 60,000.	0 0

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Concrete Stem Rebar Area	Details				
Bottom Stem As (based on applied moment) :	Vertica 0.0801	l Reinforcing in2/ft	Horizontal Rei	nforcing	
(4/3) * As :	0.1068	in2/ft	Min Stem T&S	Reinf Area (0.792 in2
200bd/fv : 200(12)(4.25)/60000 :	0.17 in:	2/ft	Min Stem T&S	Reinf Area	per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296	in2/ft	Horizontal Rei	nforcing Opti	ons :
	======		One layer of :	Two laye	ers of :
Required Area :	0.1296	in2/ft	#4@ 16.67 in	#4@ 33	3.33 in
Provided Area :	0.15 in:	2/ft	#5@ 25.83 in	#5@ 51	1.67 in
Maximum Area :	0.5757	in2/ft	#6@ 36.67 in	#6@ 73	3.33 in
Footing Data		Footing Des	ign Results	Ĩ	
$\begin{array}{rcrcr} Toe Width & = \\ Heel Width & = \\ Total Footing Width & = \\ Footing Thickness & = \\ Key Width & = \\ Key Distance from Toe & = \\ fc & = 2,500 psi Fy & = 6i \\ Footing Concrete Density & = 1 \\ Min. As \% & = 0 \\ Cover @ Top & 2.00 & @ Btm. \end{array}$	3.00 ft 0.67 3.67 10.00 in 12.00 in 8.00 in 1.00 ft 0.000 psi 50.00 pcf 0.018 = 3.00 in	Factored Pressure Mu': Upward Mu': Downward Mu: Design Actual 1-Way Shea Toe Reinforcing Heel Reinforcing Heel Reinforcing Key Reinforcing Footing Allow. Tors If torsion exce	Toe 9 30.95 14.99 14.99 1.830 ar 10.4 r 75.00 = 9.10 =	Heel 3 62 1 1 4 13 0 12 4 1.50 0 40.00 .11 in ec'd 26 in 0.00 0.00 provide	psf ft# ft# ft# psi psi 0 ft-lbs 0 ft-lbs
		supplemental	design for foot	ing torsion.	
		Other Acceptable	Sizes & Spac	inas	
		Toe: #4@ 11.1 Heel: phiMn = p Key: #4@ 9.25	1 in, #5@ 17.22 hi'5'lambda'sqrt(in, #5@ 14.35 i	in, #6@ 24.4 fc)'Sm n, #6@ 18 in	14 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 , #7@ 18 in, #8@ 18
		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 reinf Area per fo prizontal bars:	0.79 oot 0.22 If two la #4@ #5@ #6@	in2 in2 .ft yers of horizontal bars: 22.22 in 34.44 in 48.89 in

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Summary of Overturning & Resisting	g Forces & Moments	i

		OV	ERTURNIN	IG		R	ESISTING	
Item		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	680.6	1.94	1.323.3	Soil Over HL (ab. water tbl)	91.7	3.58	328.5
HL Act Pres (be water tbl) Hydrostatic Force)			,	Soil Over HL (bel. water tbl) Watre Table		3.58	328.5
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 Stem =			
Added Lateral Load	=				* Axial Live Load on Stem =			
Load @ Stem Above Soil	=				Soil Over Toe =	220.0	1.50	330.0
0	=				Surcharge Over Toe =			
					Stem Weight(s) =	412.5	3.25	1,340.6
			-		Earth @ Stem Transitions=			
Total	=	680.6	O.T.M. =	= 1,323.3	Footing Weight =	458.3	1.83	840.3
					Key Weight =	100.0	1.50	150.0
Resisting/Overturning	g Rati	D	=	2.26	Vert. Component =			
Vertical Loads used for	or Soil	Pressure	= 1,28	2.5 lbs	Total =	1,282.5	lbs R.M.=	2,989,4

* 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)
 0.027
 in

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

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Criteria			;	Soil Data			
Retained Height	=	8.00 ft	Ă	Allow Soil Bearing = 2	2,666.0) psf	
Wall height above soil	=	0.50 ft	E	Equivalent Fluid Pressure Metho	d		
Slope Behind Wall	-	0.00	A	ctive Heel Pressure =	40.0) psf/ft	
Height of Soil over Toe	_	6.00 in		=			
Height of Soli over Toe	-	0.00 111	F	Passive Pressure =	300.0) psf/ft	
vvater neight over neel	=	0.0 π	S	Soil Density, Heel =	110.00) pcf	
			S	Soil Density, Toe =	110.00) pcf	
			F	ooting Soil Friction =	0.400) [`]	: : :
			S	Soil height to ignore			
				for passive pressure =	12.00	in	
Surcharge Loads				Lateral Load Applied to	Stem	1	Adjacent Footing Load
Surcharge Over Heel	=	0.0 psf	i	_ateral Load =	72.0 #	/ft	Adjacent Footing Load = 0.0 lbs
NOT Used To Resist SI	liding	& Overturning		Height to Top =	8.00 ft		Footing Width = 0.00 ft
NOT Used for Sliding &	- Over	turning		Height to Bottom =	0.00 ft		Eccentricity = 0.00 in
	0101		l	_oad Type = Win	d (W)		Footing Type Line Load
Axial Load Applied	to	stem		(Ser	vice L	evel)	Base Above/Below Soil
Axial Dead Load	=	0.0 lbs		Wind on Exposed Stem =	0.0 p	sf	at Back of Wall = 0.0 ft
Axial Live Load	=	0.0 lbs		(Service Level)			Poisson's Ratio = 0.300
Axial Load Eccentricity	=	0.0 In			_		
Design Summary			l	Stem Construction		Stem Of	5
				Design Height Above Ftg	ft =	0.00	0
Overturning	=	4.05 Datia		Wall Material Above "Ht"	=	Concrete	9
Sliding	=	1.25 Ralio 1.21 Ratio	< 1	1.5! Design Method	=	LRFL	
oliding				Pebar Size	-	8.00	J 5
Total Bearing Load	=	2.432 lbs		Rebar Spacing		10.00	5
resultant ecc.	=	29.15 in		Rebar Placed at	=	Edae	- a
Sail Drasaura @ Taa	_	2.076 pof (NK	Design Data		5	
Soil Pressure @ Heel	-	2,070 psi C)K	fb/FB + fa/Fa	=	0.91	4
Allowable	=	2.666 nsf		Total Force @ Section			
Soil Pressure Less	s Tha	n Allowable		Service Level	lbs =		
ACI Factored @ Toe	=	2,906 psf		Strength Level	lbs =	2,924.8	В
ACI Factored @ Heel	=	0 psf		MomentActual	a		
Footing Shear @ Toe	=	18.4 psi C	Ж	Strongth Lovel	11-# = # # =	0 707	0
Footing Shear @ Heel	=	0.0 psi C	Ж	Strength Level		0,797.	4
Allowable	=	75.0 psi		MomentAllowable	=	9,023.	I
Sliding Calcs				SnearActual			
Lateral Sliding Force	=	2,196.0 lbs		Strongth Loval	psi=		
less 100% Passive Ford	e = .	• 1,007.0 lbs		Strength Level	psi =	39.4	4
Added Cases Deeld		012.0 lbs	NK	ShearAllowable	psi=	/5.0	J
for 1.5 Stability	-	633.6 lbc N		Anet (Masonry) Rebar Donth 'd'	in2 =	6.10	2
ior 1.5 Stability	-	000.0 100 1	0	Masonny Data	- 111	0.18	9
				fm	nsi =		
				Fs	psi=		
ertical component of activ	e late	ral soil pressure	IS	Solid Grouting	. =		
IOT considered in the calc	ulatio	n of soil bearing		Modular Ratio 'n'	=		
		0		Wall Weight	psf=	100.0	0
Load Factors		0 0045 4 01		Short Term Factor	=		
Building Code	IE	3C 2015,ACI		Equiv. Solid Thick.	=		
Live Load		1.400		Masonry Block Type	=	Medium	Weight
Live Load		1.700		Masonry Design Method	=	ASD	
Earul, FI		1.700		Concrete Data		0.500.4	2
Seismic F		1.300		IC Ev	psi =	2,500.0	u n
oolamio, L		1.000		i y	psi=	00,000.0	U

Project Name/Number	:	(C02-D30)	200
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ense : KW-06055289 Cense To : MALSAM TSANG ENGINEERI	Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-
Concrete Stem Rebar Area Detail	s		
ottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
s (based on applied moment) :	0.3331 in2/ft		
4/3) * As :	0.4442 in2/ft	Min Stem T&S Reinf A	vrea 1.632 in2
00bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf A	rea per ft of stem Height : 0.192 in2/ft
.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing	Options :
		One layer of : Two	alayers of :
lequired Area :	0.3331 in2/ft	#4@ 12.50 in #4	@ 25.00 in
rovided Area :	0.372 in2/ft	#5@ 19.38 in #5	@ 38.75 in
laximum Area :	0.8382 in2/ft	#6@ 27.50 in #6	@ 55.00 in
Footing Data	Footing D	esign Results	
Toe Width = 5.75 ft		<u>Toe</u> <u>H</u>	leel
Heel Width = <u>0.67</u>	Factored Press	ure = 2,906	0 psf
I otal Footing Width = 6.42	Mu': Upward Mu': Downward	= 203,027	0 ft-#
-ooting i nickness = 12.00 in	Mu: Design	= 12.174	0 ft-#
Key Width = 12.00 in	Actual 1-Way S	hear = 18.38	0.04 psi
Key Depth = 24.00 in Key Distance from Tag = 1.00 ft	Allow 1-Way St	near = 75.00 4	0.00 psi
Rey Distance nominoe = 1.00 h	Toe Reinforcing	g = #5@10.00 in	
rc = 2,500 psi Fy = 60,000 p Footing Concrete Density = 150,00 p	si Heel Keinforcin of Key Reinforcing	g = None Special = #4 @ 9.00 in	
Min As % = 0.0018	Footing Torsion	Tu =	0.00 ft-lbs
Cover@Top 2.00 @Btm.= 3.00	in Footing Allow. 1	orsion, phi Tu =	0.00 ft-lbs
	If torsion e	ceeds allowable, provide	
	supplemen	tal design for footing tors	ion.
	Other Accepta	ble Sizes & Spacings	
	Toe: #4@ 7	05 in, #5@ 10.94 in, #6@	15.52 in, #7@ 21.17 in, #8@ 27.88 in, #9@ 35
	Heel: phiMn	= phi'5'lambda'sqrt(fc)'Sm	10: 1170 10: 1100 10
	Key: #4@ 9	.25 In, #5@ 14.35 In, #6@	18 In, #7@ 18 In, #8@ 18
	Min footing T	&S reinf Area	1.66 in2
	Min footing T	&S reinf Area per foot	0.26 in2 /ft
	If one layer o	horizontal bars: If t	wo layers of horizontal bars:
	#4@ 9.26 #5@ 14.25	in i	#4@ 18.52 IN #5@ 28.70 in
	#5@ 14.35 #6@ 20.37	in i	#0@ 20.70 m #6@ 40.74 in

Summary of Overtu	rning & R	esisting F	orces & Mon	nents			
Item	Force Ibs	ERTURNING Distance ft	Moment		RE Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	2.9	6.42 6.42	18.8 18.8
Buoyant Force = Surcharge over Heel =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load =			
Adjacent Footing Load =	576.0	5.00	2,880.0	Axial Dead Load on Stem = * Axial Live Load on Stem =			
oad @ Stem Above Soil = =				Soil Over Toe = Surcharge Over Toe =	316.3	2.88	909.2
				Stem Weight(s) = Earth @ Stem Transitions=	850.0	6.08	5,170.8
Total =	2,196.0	O.T.M. =	7,740.0	Footing Weight =	963.0	3.21	3,091.2
Resisting/Overturning Ra	tio	=	1.25	Vert. Component =	300.0	1.50	450.0
Vertical Loads used for Se	oil Pressure	= 2,432.	2 lbs	Total =	2,432.2	bs R.M.=	9,640.1

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 t	o settlement of soil
(Deflection due to wall bending not considered)	
Soil Spring Reaction Modulus	250.0 pci
Horizontal Defl @ Top of Wall (approximate only)	0.076 in
The above calculation is not valid if the heel soil bearing	g pressure exceeds that of the toe,

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20.03.31 NG ENGINEERIN	IG C	antilevered Reta	aining	Wall	Code: IBC 2015,	ACI 318-14,ACI 530-13
Criteria		Soi	l Data				
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe =	9.00 ft 0.50 ft 0.00 6.00 in	Allov Equi Activ	v Soil Bearing sivalent Fluid Pressure M re Heel Pressure sive Pressure sive Pressure	= 2,666. ethod = 40. =	0 psf 0 psf/ft 0 psf/ft		
Water height over heel =	: 0.0 ft	Soil Soil Foot Soil	Density, Heel Density, Toe ing Soil Friction height to ignore passive pressure	= 110.0 = 110.0 = 0.40 = 12.00	0 pcf 0 pcf 0 0 in		;
Surcharge Loads		Lat	eral Load Applied	to Ster	n	Adjacent Footing	Load
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & (= 0.0 psf ding & Overturning = 0.0 Dverturning	Late 9He He	ral Load = eight to Top = eight to Bottom = d Type =	81.0 a 9.00 f 0.00 f Wind (W)	#/ft ft ft	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft
Axial Load Applied	to Stem	Win	nd on Exposed Stem	(Service l	_evel)	Footing Type Base Above/Below Soil	Line Load = 0.0 ft
Axial Live Load = Axial Load Eccentricity =	0.0 lbs 0.0 in	(Se	ervice Level)	0.01		Poisson's Ratio	= 0.300
Design Summary		St	em Construction	-	Bottom Stem OK		
Wall Stability Ratios Overturning Sliding	= 1.24 R = 1.13 R	atio < 1.5! atio < 1.5!	Design Height Above Wall Material Above Design Method Thickness	eFtg ft = "Ht" = =	0.00 Concrete LRFD 8.00		
Total Bearing Load resultant ecc.	= 2,826 lbs = 35.06 in	5	Rebar Size Rebar Spacing Rebar Placed at Design Data	=	# 5 6.00 Edge	1	
Soil Pressure @ Heel Allowable Soil Pressure Less	= 2,003 ps = 0 ps = 2,666 ps Than Allowable	f OK f	fb/FB + fa/Fa Total Force @ Sect Service Level	= ion lbs =	0.822	2	
ACI Factored @ Toe ACI Factored @ Heel	= 2,888 ps = 0 ps	if if	Strength Level MomentActual Service Level	lbs = ft-# =	: 3,701.7 :		
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 20.1 ps = 0.0 ps = 75.0 ps	i OK i OK ii	Strength Level MomentAllowable	ft-# = e =	= 12,526.7 = 15,222.0		
Sliding Calcs Lateral Sliding Force less 100% Passive Force	= 2,729.0 lbs = - 1,959.4 lbs	5	ShearActual Service Level Strength Level	psi = psi =	49.9		
Added Force Req'd for 1.5 Stability	= 0.0 lbs = 1,003.6 lb	s OK s NG	Anet (Masonry) Rebar Depth 'd'	psi = in2 = in =	6.19		
Vertical component of active	lateral soil press	ure IS	fm Fs Solid Grouting	psi = psi = =			
NOT considered in the calcu	lation of soil bear	ing	Modular Ratio 'n' Wall Weight	= psf=	: 100.0		
Building Code Dead Load Live Load	IBC 2015,ACI 1.400 1.700		Equiv. Solid Thick. Masonry Block Type Masonry Design Met	= = thod =	· · · Medium \ · ASD	Veight	
Wind, W Seismic, E	1.300 1.000		fc Fy	psi = psi =	2,500.0 60,000.0		

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Concrete Stem Rebar Area	Details					
Bottom Stem As (based on applied moment) :	Vertical Reinford 0.4743 in2/ft	ing ⊢	lorizoi	ntal Reinfo	rcing	
(4/3) * As :	0.6324 in2/ft	N	/in Ste	em T&S Re	einf Area 1.	824 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Ν	∕lin Ste	em T&S Re	einf Area pe	er ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	F	lorizo	ntal Reinfo	rcing Option	ns :
		C	One la	ver of :	Two layer	s of :
Required Area :	0.4743 in2/ft	#	4@ 1	2.50 in	#4@ 25.	00 in
Provided Area :	0.62 in2/ft	#	5@ 1	9.38 in	#5@ 38.	75 in
Maximum Area :	0.8382 in2/ft	#	46@ 2	7.50 in	#6@ 55.	00 in
Footing Data	F	ooting Desig	ın Re	sults		
Toe Width = Heel Width = Total Footing Width = Footing Thickness = Key Width = Key Distance from Toe = fc = 2,500 psi Fy = 60 Footing Concrete Density = Min. As % = 0.0 Cover @ Top 2.00 @ Btm =	7.00 ft 0.67 Factx 7.67 Mu*: 2.00 in Mu*: 2.00 in Mu: 2.00 in Adux 7.00 in Adux 1.00 ft Allow 1.00 ft Ologo psi 0.000 pcf Key I 0.018 Footil = 3.00 in Footil	pred Pressure Upward Downward Design al 1-Way Shear r 1-Way Shear Reinforcing Reinforcing Reinforcing ng Torsion, Tu ng Allow. Torsio torsion exceed	= = = = # = # n, phi	Toe 2,888 289,000 84,378 17,052 20.07 75.00 5 @ 8.00 i one Spec'e 4 @ 9.00 i = Tu =	<u>Heel</u> 0 p 0 ff 0 ff 0 ff 0.04 p 40.00 p 40.00 p in d 0.00 0.00 0.00	sf # # si si ft-lbs ft-lbs
	SI	upplemental de	siant	or footing	torsion.	
	Other	Accentable S	izes	& Spacing	15	
	To He Ke	e: #4@ 5.18 in, el: phiMn = phi'5 y: #4@ 9.25 in	, #5@ 5'lamb , #5@	8.03 in, #6 da'sqrt(fc)' 14.35 in, #	5@ 11.39 in 'Sm #6@ 18 in, :	n, #7@ 15.54 in, #8@ 20.46 in, #9@ 25. #7@ 18 in, #8@ 18
	Min Mir fo f f f f f f	n footing T&S rei n footing T&S rei ne layer of horiz #4@ 9.26 in #5@ 14.35 in #6@ 20.37 in	inf Are inf Are contal	ea ⊧a per foot bars:	1.99 0.26 If two lay #4@ 1 #5@ 2 #6@ 4	in2 in2 .ft ers of horizontal bars: 8.52 in 8.70 in 0.74 in

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	OV	ERTURNING.			RE	SISTING	
Item	Force lbs	Distance ft	ft-#		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Iydrostatic Force	2,000.0	3.33	6,666.7	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	3.3	7.67 7.67	25.3 25.3
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 =	729.0	5.50	4,009.5	* Axial Live Load on Stem = Soil Over Toe = Surcharge Over Toe =	385.0	3.50	1,347.5
				Stem Weight(s) =	950.0	7.33	6,966.7
Total =	2,729.0	O.T.M. =	10,676.2	Footing Weight =	1,150.5	3.84	4,412.2
Resisting/Overturning Ra	atio	=	1.24	Key Weight = Vert. Component =	337.5	1.50	506.3
Vertical Loads used for S	Soil Pressure	= 2,826.3	3 lbs	Total = * Axial live load NOT included in	2,826.3 lb	os R.M.=	13,257.9

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)
 0.071
 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.
 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-06055289 License To : MALSAM TS/	d 11.20 ANG E	.03.31 ENGINEERING		Cantilevered Retaini	ng V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	10.00 ft 0.50 ft 0.00	E P	Allow Soil Bearing = 2 Equivalent Fluid Pressure Methor Active Heel Pressure =	,666.0 1 40.0	psf psf/ft	
Height of Soil over Toe Water height over heel	=	6.00 in 0.0 ft	F S F	assive Pressure = Soil Density, Heel = Soil Density, Toe = Soil negl[Soil Friction = Soil height to ignore for passive pressure =	300.0 110.00 110.00 0.400 12.00	psf/ft pcf pcf in	
Surcharge Loads			ιſ	Lateral Load Applied to	Stem		Adiacent Footing Load
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding & Axial Load Applied	= liding 8 = Overt	0.0 psf & Overturning 0.0 urning		Lateral Load = 1 Height to Top = 1 Height to Bottom = 1 Load Type = Winn	90.0 # 0.00 ft 0.00 ft d (W)	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft Footing Type Line Load
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in	l	Wind on Exposed Stem = (Service Level)	0.0 p	sf	Base Above/Below Soil at Back of Wall=0.0 ftPoisson's Ratio=0.300
Design Summary		ì		Stem Construction] _	Bottom	
Wall Stability Ratios Overturning Sliding	= =	1.43 Rati 1.26 Rati	o < o <	Design Height Above Ftg Wall Material Above "Ht" 1.5! Design Method Thickness	ft = = = =	Concrete LRFD 10.00	
Total Bearing Loadresultant ecc.	=	3,869 lbs 34.45 in		Rebar Size Rebar Spacing Rebar Placed at Design Data	=	# 6 8.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= = s Thar = =	1,544 psf 0 psf 2,666 psf Allowable 2,162 psf 0 psf	OK OK	fb/FB + fa/Fa Total Force @ Section Service Level Strength Level MomentActual	= Ibs = Ibs =	0.845 4,570.0	
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= = =	20.4 psi 0.0 psi 75.0 psi	OK OK	Service Level Strength Level MomentAllowable ShearActual	ft-# = ft-# = =	17,183.3 20,333.2	
Lateral Sliding Force less 100% Passive Forc less 100% Friction Force Added Force Req'd	e = - e = -	3,431.3 lbs 2,776.0 lbs 1,547.8 lbs 0.0 lbs	ок	Service Level Strength Level ShearAllowable Anet (Masonry)	psi = psi = psi = in2 =	49.9 75.0	
for 1.5 Stability	=	823.1 lbs	NG	Rebar Depth 'd' Masonry Data fm Fs	in = psi = psi =	7.63	
Vertical component of activ NOT considered in the calc	e later ulatior	al soil pressur of soil bearin	e IS g	Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor	= = psf= =	125.0	
Building Code Dead Load Live Load Earth, H	IB	C 2015,ACI 1.400 1.700 1.700		Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = =	Medium V ASD	/eight
Wind, W Seismic, E		1.300 1.000		fc Fy	psi = psi =	2,500.0 60,000.0	

Project Name/Number	:	(C02-D30)	200
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cense : KW-06055289 cense To : MALSAM TSANG E		Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1			
Concrete Stem Rebar Ar	ea Details						
Bottom Stem	Vertica	I Reinforcing	Horizontal Reinforcing				
As (based on applied moment) : 0.8		in2/ft	-				
4/3) * As :	0.6968	in2/ft	Min Stem T&S Reinf Area 2.520 in2				
200bd/fy : 200(12)(7.625)/60000	: 0.305 i	n2/ft	Min Stem T&S Reinf Area	per ft of stem Height : 0.240 in2/ft			
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft		Horizontal Reinforcing Options :				
	=====	======	One layer of : Two lay	vers of :			
Required Area :	0.5226	in2/ft	#4@ 10.00 in #4@ 2	20.00 in			
Provided Area :	0.66 in	2/ft	#5@ 15.50 in #5@ 3	31.00 in			
Maximum Area :	1.0329	in2/ft	#6@ 22.00 in #6@ 4	14.00 in			
Footing Data		Footing De	sign Results				
Toe Width =	8.25 ft		Toe Heel	1			
Heel Width =	0.83	Factored Pressure	e = 2,162 (0 psf			
Total Footing Width =	9.08	Mu': Upward	= 427,691 (D ft-#			
Footing Thickness =	15.00 in	Mu: Design	= 136,043 (D II-# D ft-#			
Key Width =	12.00 in	Actual 1-Way She	ar = 20.44 0.03	3 psi			
Key Depth =	32.00 in	Allow 1-Way Shea	ar = 75.00 40.00	0 psi			
Key Distance from Toe =	1.00 IL	Toe Reinforcing	= #6@8.00 in				
fc = 2,500 psi Fy =	60,000 psi	Heel Reinforcing	= None Spec'd				
Min As % =	0.0018	Footing Torsion T	-#3@12.00111	00 ft-lbs			
Cover @ Top 2.00 @ 1	Btm.= 3.00 in	Footing Allow, To	sion.phiTu = 0.0	00 ft-lbs			
		If torsion exc	eds allowable provide				
		supplemental	design for footing torsion	L			
		Other Acceptable	e Sizes & Spacings				
		Toe: #4@ 5.01	in, #5@ 7.77 in, #6@ 11.02	2 in, #7@ 15.03 in, #8@ 19.80 in, #9@ 25.			
		Heel: phiMn = p	ohi'5'lambda'sqrt(fc)'Sm				
		Key: #4@ 9.64	1 in, #5@ 14.94 in, #6@ 18 i	in, #7@ 18 in, #8@ 18			
		Min footing T&S	S reinf Area 2.94	4 in2			
		Min footing T&S	reinf Area per foot 0.32	2 in2 /ft			
		IT one layer of h	unzunial bars: If two	ayers of norizontal bars:			
		#4@ 7.41 II #5@ 11.48 in	#4@	0.22.96 in			
		#6@ 16.30 in	#50	32.59 in			

Item HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	LOV Force Ibs 2,531.3	ERTURNING Distance ft 3.75	Moment ft-# 9,492.2	Soil Over HL (ab. water tbl	Force Ibs	SISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force	2,531.3	3.75	9,492.2	Soil Over HL (ab. water tbl) 0.0	0.00	
				Soil Over HL (bel. water tb Watre Table) I)	9.08	0.0 0.0
Surcharge over Heel =				Sloped Soil Over Heel = Surcharge Over Heel = Adiacent Footing Load =			
Adjacent Footing Load =	900.0	6.25	5,625.0	Axial Dead Load on Stem = * Axial Live Load on Stem =			
oad @ Stem Above Soil = =				Soil Over Toe = Surcharge Over Toe =	453.8	4.13	1,871.7
				Stem Weight(s) = Earth @ Stem Transitions=	1,312.5	8.67	11,375.0
Total =	3,431.3	O.T.M. =	15,117.2	Footing Weight =	1,703.1	4.54	7,735.0
Resisting/Overturning Ratio		=	1.43	Key Weight = Vert. Component =	400.0	1.50	600.0

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 settlen	nent of soil
(Deflection due to wall bending n	ot considered)	
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (a	pproximate only) 0.050	in
The above calculation is not valid	if the heel soil bearing pressure	exceeds that of the toe,

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Criteria		Soil Data		
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe = Water height over heel =	11.00 ft 0.50 ft 0.00 6.00 in 0.0 ft	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure =	2,666.0 psf rd 40.0 psf/ft 300.0 psf/ft	
		Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	110.00 pcf 110.00 pcf 0.400 12.00 in	
Surcharge Loads		Lateral Load Applied to	Stem	Adjacent Footing Load
Surcharge Over Heel = NOT Used To Resist Slid Surcharge Over Toe = NOT Used for Sliding & C Axial Load Applied	0.0 psf ding & Overturning 0.0 Dverturning to Stem	Lateral Load = Height to Top = 1 Height to Bottom = Load Type = Win (Ser	99.0 #/ft 1.00 ft 0.00 ft id (W) rvice Level)	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft Footing Type Line Load Base Abroye/Relow 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	1
Wall Stability Ratios Overturning Sliding	= 1.36 Ratio = 1.22 Ratio	Design Height Above Ftg Wall Material Above "Ht" 0 < 1.5! Design Method 0 < 1.5! Thickness	ft = 0.1 = Concre = LRF = 12.	0K 00 ED 00
Total Bearing Load resultant ecc.	= 4,424 lbs = 37.90 in	Rebar Size Rebar Spacing Rebar Placed at Design Data	= # = 8.1 = Edy	6 00 ge
Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe	= 0 psf (= 2,666 psf Than Allowable = 2,594 psf	tb/FB + fa/Fa Total Force @ Section Service Level Strength Level	= 0.8 lbs = lbs = 5,529	.7
ACI Factored @ Heel Footing Shear @ Toe Footing Shear @ Heel Allowable	= 0 psf = 25.4 psi 0 = 0.0 psi 0 = 75.0 psi	MomentActual OK Service Level OK Strength Level MomentAllowable	ft-# = ft-# = 22,871 = 26,273	1.0
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= 4,090.3 lbs = 3,234.4 lbs = 1,769.5 lbs	ShearActual Service Level Strength Level ShearAllowable	psi = psi = 47 psi = 75	7.9 5.0
Added Force Req'd for 1.5 Stability	= 0.0 lbs (= 1,131.5 lbs	DK Anet (Masonry) NG Rebar Depth 'd' Masonry Data	in2 = in = 9.0	63
Vertical component of active NOT considered in the calcul	lateral soil pressure lation of soil bearing	Fs IS Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf = 150	0.0
Load Factors Building Code Dead Load Live Load Earth H	IBC 2015,ACI 1.400 1.700	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = = Medium = ASD	n Weight
Wind, W Seismic, E	1.300 1.000	Concrete Data fc Fy	psi = 2,500 psi = 60,000	0.0

etainPro (c) 1987-2019, Build 11.20.03 icense : KW-06055289 .icense To : MALSAM TSANG EN(³¹ Cantile	vered Retaining W	all Code: IBC 2015,ACI 318-14,ACI 530-13
Concrete Stem Rebar Area	Details		
Bottom Stem As (based on applied moment) :	Vertical Reinforcing 0.5461 in2/ft	Horizontal Reinfo	orcing
(4/3) * As ·	0.7282 in2/ft	Min Stem T&S F	Reinf Area 3 312 in2
200bd/fw · 200(12)/9 625)/60000 ·	0.385 in2/ft	Min Stem T&S F	Reinf Area per ft of stem Height : 0 288 in 2/ft
0.0018bb : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinf	forcing Options :
0.0010011.0.0010(12)(12).	0.2052 112/10	One laver of :	Two layers of :
Required Area :	0.5461 in2/ft	#4@ 833 in	#4@ 16.67 in
Browided Area :	0.66 in 2/ft	#5@ 12.02 in	#F@ 10.07 in
Movimum Area :	1 2020 in 2/ft	#0@ 12.92 III #6@ 19.33 in	#0@ 25.65 III #6@ 26.67 in
Maximum Area .	1.3039 112/11	#0@ 18.3311	#0@ 30.07 11
Footing Data	Foot	ng Design Results	
Toe Width = Heel Width = Total Footing Width = Footing Thickness = Key Width = Key Diption = Key Distance from Toe = fc = 2,500 psi Footing Concrete Density = Min. As % = Cover @ Top 2.00 @ Btn	8.50 ft <u>1.00</u> Factored 9.50 Mu': Upy 15.00 in Mu': Doy 12.00 in Actual 1- 36.00 in Actual 1- 36.00 in Actual 1- 30.00 pt Allow 1-y 1.00 ft Toce Rein 30.000 pt Heel Rein 1.0018 Footing T 1.018 Footing 7 1.00 in Footing 7 if tors	Toe Pressure = 2,594 vard = 513,407 ymward = 147,173 gn = 30,519 Way Shear = 25,42 vay Shear = 75,00 forcing = # 6@ 8.00 forcing = # 5@ 10.0 orsion, Tu = 10ew. Torsion, phi Tu ion exceeds allowable, p ion exceeds allowable, p	Heel 0 psf 0 ft# 0 ft# 0 ft# 0.03 psi 40.00 psi 0 in 0.00 ft-lbs 0.00 ft-lbs 0.00 ft-lbs
	supp	emental design for footin	ig torsion.
	Unter AC Toe: # Heel: ; Key: i Min foo Min foo If one I #4@ #5@	Very laure 512es & Späcin 4(4):3.95 in, #50; 6.13 in, # hhiMn = phi'51ambda'sqrt(fo t4(4):7.29 in, #50; 11.31 in, titing T&S reinf Area ting T&S reinf Area per foo ayer of horizontal bars: 7.41 in 11.48 in 12.520 is	ygs K6@ 8.70 in, #7@ 11.87 in, #8@ 15.62 in, #9@ 19.7)'Sm #6@ 16.05 in, #7@ 18 in, #8@ 3.08 in2 t 0.32 in2 ift If two layers of horizontal bars: #4@ 14.81 in #5@ 22.96 in #5@ 22.96 in

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		OV	ERTURNING				RE	SISTING	
Item	_	Force lbs	Distance ft	ft-#	_		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tb HL Act Pres (be water tb Hvdrostatic Force	I) I)	3,001.3	4.08	12,255.1	Soil Over HL (ab. wate Soil Over HL (bel. wate Watre Table	r tbl) er tbl)			
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	=	1.089.0	6.75	7.350.8	* Axial Live Load on Sten	n =			
Load @ Stem Above Soi	il =	.,	2.10	.,200.0	Soil Over Toe	=	467.5	4.25	1,986.9
	=				Surcharge Over Toe	=			
					Stem Weight(s)	=	1,725.0	9.00	15,525.0
					Earth @ Stem Transitio	ns=			
Total	=	4,090.3	O.T.M. =	19,605.9	Footing Weight	=	1,781.3	4.75	8,460.9
					Key Weight	=	450.0	1.50	675.0
Resisting/Overturning	g Rat	io	=	1.36	Vert. Component	=			
Vertical Loads used f	or So	il Pressure	= 4,423.	8 lbs	To	tal =	4.423.8	bs R.M.=	26.647.8
					* Axial live load NOT inclusion resistance, but is included	uded ir ed for	total display	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

Horizontal Defl @ Top of Wall (approximate only) 0.062 in The above calculation is not valid if the heel soli bearing pressure exceeds that of the toe,

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

RetainPro (c) 1987-2019, Build 11. License : KW-06055289 License To : MALSAM TSANG	20.03.31 ENGINEERING	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 =	12.00 ft 0.50 ft 0.00 6.00 in 0.0 ft	Allow Soil Bearing = 2 Equivalent Fluid Pressure Methe Active Heel Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	2,666.0 d 300.0 110.00 110.00 0.400 12.00) psf) psf/ft) psf/ft) pcf) pcf in		
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing	Load
Surcharge Over Heel = NOT Used To Resist Sildin Surcharge Over Toe = NOT Used for Sliding & Ow Axial Load Applied to Axial Dead Load = Axial Load Eccentricity =	0.0 psf g & Overturning 0.0 erturning Stem 0.0 lbs 0.0 lbs 0.0 in	Lateral Load = 1 Height to Top = 1 Height to Bottom = Load Type = Win (Ser Wind on Exposed Stem ₌ (Service Level)	08.0 # 2.00 ft 0.00 ft id (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
Design Summary		Stem Construction]	Bottom		
Wall Stability Ratios Overturning = Overturning = Stiding = Total Bearing Load = resultant ecc. = Soil Pressure @ Toe = Soil Pressure Less Th = Allowable = Soil Pressure Less Th = Allowable = Soil Pressure (Less Th =	1.25 Ratio 1.17 Ratio 4,806 lbs 45.69 in 2,432 psf Oł 0 psf Oł 2,666 psf an Allowable 3,405 psf	Casign Height Above Ftg Wall Material Above "Ht" Usign Method 1.51 Design Method Rebar Size Rebar Size Rebar Size Rebar Placed at Design Data Ch/FB + fa/Fa Total Force @ Section Stringth Level Strength Level	; ft = = = = = Ibs =	0.00 Concrete LRFD 12.00 # 7 9.00 Edge 0.957 6,580.8		
Footing Shear @ Toe = Footing Shear @ Heel = Allowable = Sliding Catcs Lateral Sliding Force = less 100% Priction Force =	27.4 psi Oł 0.0 psi Oł 75.0 psi 4,807.3 lbs - 3,726.0 lbs - 1,922.3 lbs	Service Level Strength Level MomentAllowable ShearActual Service Level Strength Level ShearAllowable	ft-# = ft-# = psi = psi = psi =	29,692.8 31,026.6 57.3 75.0		
Added Force Req'd = for 1.5 Stability = Vertical component of active la	0.0 lbs Of 1,562.6 lbs No teral soil pressure I	 Anet (Masonry) Rebar Depth 'd' Masonry Data fm Fs Solid Grouting Modular Ratio 'o' 	in2 = in = psi = psi = =	9.56		
Load Factors Building Code Dead Load Live Load Earth, H Wind, W Solemic E	IBC 2015,ACI 1.400 1.700 1.300 1.300	Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data fc	psf= = = = psi=	150.0 Medium V ASD 2,500.0	√eight	

Project Name/Number	:	(C02-D30)	200
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IG	u Retaining wan	Code: IBC 2015,ACI 318-14,ACI 530-1
5		
/ertical Reinforcing	Horizontal Reinforcing	
).7138 in2/ft		
).9518 in2/ft	Min Stem T&S Reinf Are	a 3.600 in2
).3825 in2/ft	Min Stem T&S Reinf Are	a per ft of stem Height : 0.288 in2/ft
).2592 in2/ft	Horizontal Reinforcing O	ptions :
	One layer of : Two la	avers of :
).7138 in2/ft	#4@ 8.33 in #4@	16.67 in
).8 in2/ft	#5@ 12.92 in #5@	25.83 in
1.2954 in2/ft	#6@ 18.33 in #6@	36.67 in
Footing D	esign Results	
	Toe Her	el
Factored Press	ure = 3,405	0 psf
Mu' : Upward	= 640,453	0 ft-#
Mu' : Downwar	d = 174,291	0 ft-#
Mu: Design	= 38,847	0 ft-#
Actual 1-Way S	beer = 27.36 0.0	J3 psi
Toe Reinforcing	r = #7 @ 9.00 in	bo psi
i Heel Reinforcin	ig = None Spec'd	
f Key Reinforcing	g = # 5 @ 8.00 in	
Footing Torsion	i, Tu = 0.	.00 ft-lbs
in Footing Allow.	Forsion, phi Tu = 0.	.00 ft-lbs
If torsion e	xceeds allowable, provide	-
Supplement		16
Other Accepta	ible Sizes & Spacings	
loe: #4@ 3	.10 in, #5@ 4.81 in, #6@ 6.83 = phi/5/lambda/sort/fc)/Sm	3 in, #7@ 9.32 in, #8@ 12.27 in, #9@ 15.54
Kev: #4@ 5	71 in. #5@ 8.85 in. #6@ 12.5	56 in. #7@ 17.13 in. #
10). "1@0		
Min footing T	&S reinf Area 3.3	32 in2
Min footing I	&S reint Area per toot 0.3	52 IN2 /π Javana of horizontal hora:
II One layer o	in in the second and	ayers or nonzontal bars: ⊚ 14 91 in
#4@ 7.41 #5@ 11 /s	111 #4(@ 22.96 in
#5@ 11.46 #6@ 16.30) in #6(@ 32.59 in
	Vertical Reinforcing 0.7138 in2/ft 0.9518 in2/ft 0.2592 in2/ft 0.2592 in2/ft 0.8 in2/ft 0.8 in2/ft 1.2954 in2/ft 1.295	Vertical Reinforcing Horizontal Reinforcing 0.7138 in2/ft Josta S Reinf Are 0.9518 in2/ft Min Stem T&S Reinf Are 0.3825 in2/ft Min Stem T&S Reinf Are 0.2592 in2/ft Horizontal Reinforcing O 0.138 in2/ft #400 8.33 in 0.8 in2/ft #500 12.92 in 1.2954 in2/ft #500 12.92 in Pooting Design Results Footing Design Results Factored Pressure 1748 8.847 Actual 1-Way Shear 7.500 Mu': Downward 174.291 Mu: Design = 38.847 Actual 1-Way Shear 7.500 Mu NWay Shear = 7.500 Mu NWay Shear = 7.500 Mu NWay Shear = 7.600 Footing Allow. Torsion, phi Tu = 0 in Footing Mow. Torsion, phi Tu = 0 in Footing Allow. Torsion, phi Tu = 0 in Footing Allow. Torsion

Summary of Over	tur	ning & R	esisting F	orces & Mor	nents			
Item		OV 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 Hvdrostatic Force)	3,511.3	4.42	15,508.0	Soil Over HL (ab. water tb Soil Over HL (bel. water tb Watre Table) I)		
Juoyant 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	=	1,296.0	7.25	9,396.0	* Axial Live Load on Stem =			
oad @ Stem Above Soil.	=				Soil Over Toe =	508.8	4.63	2,353.
	=				Surcharge Over Toe			
					Stem Weight(s) =	1,875.0	9.75	18,281.
T		4 007 0		04.004.0	Earth @ Stem Transitions=			
lotai	=	4,807.3	0.1.M. =	24,904.0	Footing Weight =	1,921.9	5.13	9,849.
					Key Weight =	500.0	1.50	750.
Resisting/Overturning	Rat	io	=	1.25	Vert Component =			

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 1	Fop of Wall due to settler	nent of soil
(Deflection due to wall bending no	ot considered)	
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (ap	pproximate only) 0.082	in
The above calculation is not valid	if the heel soil bearing pressure	exceeds that of the toe,

cense : KW-06055289 cense To : MALSAM TSA	ANG E	NGINEERIN	G	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	= = =	6.00 ft 0.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft		= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore	300.0 110.00 110.00 0.400) psf/ft) pcf) pcf)	
Surcharge Loads				I ateral L oad Applied to	Stor		Adjacent Feeting Lead
Surcharge Over Heel NOT Used To Resist SI Surcharge Over Toe NOT Used for Sliding &	= iding a = Overt	0.0 psf & Overturning 0.0		Lateral Load = Height to Top = Height to Bottom =	0.0 # 0.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in
Axial Load Applied	to S	tem		Load Type = Win (Ser	d (W) vice L	evel)	Footing Type Line Load Base Above/Below Soil = 0.0 ft
Axial Live Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in		(Service Level)	0.0 p	ST	at Back of Wall 5.5 K Poisson's Ratio = 0.300
Design Summary		Ì		Stem Construction]-	Bottom	
Wall Stability Ratios Overturning	-	2.55 O	<	Design Height Above Ftg Wall Material Above "Ht" Design Method	ft = =	Concrete	> > >
Sliding	=	1.78 OF	<	Thickness Rebar Size	=	8.00 # 4	2 D 4
Total Bearing Load resultant ecc.	=	1,864 lbs 5.79 in		Rebar Spacing Rebar Placed at	=	10.00 Edge) e
Soil Pressure @ Toe Soil Pressure @ Heel	=	681 psf 148 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.37	9
Allowable Soil Pressure Less ACI Factored @ Toe	= Thar =	Allowable 953 psf		Service Level Strength Level	lbs = lbs =	1,224.0)
ACI Factored @ Heel Footing Shear @ Toe	=	207 psf 15.5 psi	ок	MomentActual Service Level	ft-# =		
Footing Shear @ Heel Allowable	=	3.0 psi 75.0 psi	OK	Strength Level MomentAllowable	ft-# = =	2,448. 6,444.	0 1
Sliding Calcs Lateral Sliding Force	=	933.9 lbs		ShearActual Service Level	psi =		
less 100% Passive Force less 100% Friction Force	e = . e = .	916.7 lbs 745.7 lbs		Strength Level ShearAllowable	psi = psi =	16.3 75.0	3
Added Force Req'd for 1.5 Stability	=	0.0 lbs 0.0 lbs	OK OK	Anet (Masonry) Rebar Depth 'd'	in2 = in =	6.2	5
				fm Fs	psi = psi =		
ertical component of active OT considered in the calc	e later ulatior	al soil pressu of soil beari	re IS ng	Solid Grouting Modular Ratio 'n' Wall Weight	- = = psf=	100.0	0
oad Factors Building Code Dead Load	IB	C 2015,ACI 1.400		Short Term Factor Equiv. Solid Thick. Masonry Block Type	. =	Medium	Weight
Live Load Earth, H		1.700 1.700		Masonry Design Method Concrete Data	=	ASD	
Wind, W Seismic, E		1.300 1.000		fc Fy	psi = psi =	2,500.0 60,000.0	D D

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Concrete Stem Rebar Area	a Details				
Bottom Stem	Vertical F	Reinforcing H	Iorizontal	Reinford	cing
As (based on applied moment) :	0.0917 ir	12/ft			
(4/3) * As :	0.1223 ir	n2/ft M	Min Stem 1	T&S Rei	inf Area 1.248 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/	ft M	Min Stem 1	T&S Rei	inf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 ir	12/ft H	Horizontal	Reinford	cing Options :
	=======	(One layer o	of :	Two layers of :
Required Area :	0.1728 ir	12/ft #	4@ 12.50	in	#4@ 25.00 in
Provided Area :	0.24 in2/	ft #	¥5@ 19.38	in	#5@ 38.75 in
Maximum Area :	0.8467 ir	12/ft #	#6@ 27.50	in	#6@ 55.00 in
Footing Data		Footing Desig	yn Resu	lts	
Toe Width =	3.50 ft		To	De	Heel
Heel Width =	1.00	Factored Pressure	=	953	207 psf
Total Footing Width =	4.50	Mu': Upward	= 55	,828	13 ft-#
Footing Thickness =	10.00 in	Mu': Downward	= 20	,409	61 ft-#
Key Width =	12.00 in	Mu: Design	= 2	,952 E 49	49 IL-# 2 00 pai
Key Depth =	14.00 in	Allow 1-Way Shear	= 7	5.40	40.00 psi
Key Distance from Toe =	1.00 ft	Toe Reinforcing	= #4@) 11.00 i	in
fc = 2.500 psi Ev =	60.000 psi	Heel Reinforcing	= None	Spec'd	
Footing Concrete Density =	150.00 pcf	Key Reinforcing	= #4@	9.00 in	1
Min. As % =	0.0018	Footing Torsion, Tu		=	0.00 ft-lbs
Cover @ Top 2.00 @ Btr	m.= 3.00 in	Footing Allow. Torsio	n, phi Tu	=	0.00 ft-lbs
		If torsion exceed	ds allowat	ole, prov	vide
		supplemental de	esign for f	ooting	torsion.
		Other Acceptable S	Sizes & S	pacings	s
		Toe: #4@ 11.11 i Heel: phiMn = phi ⁴ Key: #4@ 9.25 in	n, #5@ 17 5'lambda's I, #5@ 14.3	.22 in, # sqrt(fc)'S 35 in, #6	#6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Sm 6@ 18 in, #7@ 18 in, #8@ 18
		Min footing T&S re	einf Area		0.97 in2

Mill looung ras tein Alea	0.37 1112
Min footing T&S reinf Area per foot	0.22 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

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Summary of Overturning & Resisting	g Forces & Moments	

-		VERTURNIN	G		RESISTING		
	Force	Distance	Moment		Force	Distance	Moment
Item	lbs	ft	ft-#		lbs	ft	ft-#
HI Act Pres (ab water thi)	033	9 2 28	2 127 2	Soil Over HL (ab. water tbl)	220.0	4.33	953.3
HI Act Pres (be water tbl)	500.	5 2.20	2,127.2	Soil Over HL (bel. water tbl)		4.33	953.3
Hydrostatic Force				Watre Table			
Buovant Force	-			Sloped Soil Over Heel =			
Suchara aver llast	_			Surcharge Over Heel =			
Surcharge over Heel	-			Adjacent Footing Load =			
Surcharge Over Toe	=						
Adjacent Footing Load	=			Axial Dead Load on Stem =			
Added Lateral Load	=			* Axial Live Load on Stem =			
Load @ Stem Above Soil	=			Soil Over Toe =	256.7	1.75	449.2
	-			Surcharge Over Toe =			
	-			Stem Weight(s) =	650.0	3.83	2,491.7
-				Earth @ Stem Transitions=			
Total	= 933.	9 O.T.M. =	2,127.2	Footing Weight =	562.5	2.25	1,265.6
				Kev Weight =	175.0	1.50	262.5
Resisting/Overturning	Ratio	=	2.55	Vert. Component =			
Vertical Loads used for	Soil Pressur	re = 1,864	4.2 lbs	Total =	1,864.2	bs R.M.=	5,422.3

* 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 soi
(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.027 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-06055289	ANG	ENGINEERING		Cantilevered Retaini	ng V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-
Criteria	7110		;	Soil Data			
Retained Height	=	6.00.ft	Ā	Allow Soil Bearing = 2	2,000.0) psf	
Wall height above soil	=	0.50 ft	E	Equivalent Fluid Pressure Metho	d		
Slone Behind Wall	-	0.00	P	Active Heel Pressure =	40.0) psf/ft	
Loight of Soil over Tee	2	0.00 in		=			
	-	0.00 11	F	Passive Pressure =	300.0	psf/ft	
Water height over heel	=	0.0 ft	5	Soil Density, Heel =	110.00	pcf	
			5	Soil Density. Toe =	110.00	pcf	
			F	ooting Soil Friction =	0.400	, i	
			5	Soil height to ignore			•
			-	for passive pressure =	12.00	in	•
Surcharge Loads				Lateral Load Applied to	Stem		Adjacent Footing Load
Surcharge Over Heel	=	0.0 psf		ateral Load =	00#	/#	Adjacent Footing Load = 0.0 lbs
NOT Used To Resist S	Bliding	& Overturning		Height to Top =	0.00 ft	/11	Footing Width = 0.00 ft
Surcharge Over Toe	=	0.0		Height to Bottom =	0.00 ft		Eccentricity = 0.00 in
NOT Used for Sliding 8	k Ove	rturning		oad Type = Win	d (W) b		Wall to Ftg CL Dist = 0.00 ft
Axial Load Applied	d to a	Stem		(Ser	vice Le	evel)	Footing Type Line Load
Avial Dead Load	-	0.0 lbs		Wind on Exposed Stem	0.0 -	of ,	Base Above/Below Soil = 0.0 ft
Axial Live Load	-	0.0 lbs		(Service Level)	0.0 p	51	at Back of Wall
Axial Load Eccentricity	=	0.0 in		(00/1100 20/01)			Poisson's Ratio = 0.300
Design Summary				Stem Construction		Bottom	,
				Design Height Above Ftg	ft =	0.00)
Wall Stability Ratios	_			Wall Material Above "Ht"	=	Concrete	
Overturning	_	2.25 OK		Design Method	=	LRFD)
Sliding	=	1.09 UK		Thickness	=	6.00)
Total Rearing Load	_	1.640 lba		Rebar Size	=	# 4	
resultant ecc.	-	8.65 in		Rebar Spacing	-	9.00]
				Design Data	=	Edge	
Soil Pressure @ Toe	=	681 psf C	ЭK	fb/FB + fa/Fa	=	0.518	В
Soil Pressure @ Heel	=	26 pst C	JK	Total Force @ Section			
Allowable Soil Drosouro Loo	=	2,000 psf		Service Level	lbs =		
ACI Eactored @ Top	-S 111a	053 pef		Strength Level	lbs =	1,224.0)
ACI Factored @ Heel	-	36 psf		MomentActual			
Footing Shear @ Toe	=	13.9 nsi (УK	Service Level	ft-# =		
Footing Shear @ Heel	_	1.8 psi C)K	Strength Level	ft-# =	2,448.0)
Allowable	=	75.0 psi c		MomentAllowable	=	4,722.4	1
Sliding Calcs				ShearActual			
Lateral Sliding Force	=	933.9 lbs		Service Level	psi=		
less 100% Passive For	ce =	 916.7 lbs 		Strength Level	psi=	24.0)
less 100% Friction Ford	;e =	 659.7 lbs 		ShearAllowable	psi=	75.0)
Added Force Reg'd	=	0.0 lbs C	Ж	Anet (Masonry)	in2 =		
for 1.5 Stability	=	0.0 lbs (ЭK	Rebar Depth 'd'	in =	4.25	5
				Masonry Data			
				fm	psi =		
				Fs	psi =		
ertical component of activ	ve late	eral soil pressure	IS	Solid Grouting	=		
UI considered in the cal	culatio	on of soil bearing		Modular Ratio 'n'	=	75 0	
oad Eactors				Wall Weight	pst=	/5.0)
Building Code		BC 2015 ACI		Short Lerm Factor	=		
Dead Load		1.400		Masonry Block Type	=	Medium	Neight
Live Load		1.700		Masonry Decian Method			rogin
Earth, H		1.700		Concrete Data	-	790	
Wind, W		1.300		fc	psi=	2,500.0)
Seismic, E		1.000		Fv	psi=	60.000.0)

Project Name/Number	:	(C02-D30)	200
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cense : KW-06055289 cense To : MALSAM TSANG ENG	" Cantilevere	ed Retaining Wal	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Area	Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinford	cina
As (based on applied moment) :	0.1384 in2/ft		5
4/3) * As :	0.1845 in2/ft	Min Stem T&S Rei	inf Area 0.936 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Rei	inf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinford	cing Options :
		One layer of :	Two layers of :
Required Area :	0.17 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2667 in2/ft	#5@ 25.83 in	#5@ 51.67 in
/laximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in
Footing Data	Footing I	Design Results	
Toe Width =	4.00 ft	Тое	Heel
Heel Width =	0.67 Factored Press	sure = 953	36 psf
Total Footing Width =	4.67 Mu': Upward	= 66,364	1 ft-#
Footing Thickness =	10.00 in Mu ⁺ : Downwar	10 = 26,656 - 3,300	15 π-# 15 π #
Key Width =	12.00 in Actual 1-Way	= 3,303 Shear = 13,91	1.82 nsi
Key Depth =	14.00 in Allow 1-Way S	Shear = 75.00	40.00 psi
Key Distance from Toe =	1.00 ft Toe Reinforcin	ig = #4@11.00 i	in .
fc = 2,500 psi Fy = 6	0,000 psi Heel Reinforcii	ng = None Spec'd	
Footing Concrete Density = 1	50.00 pcf Key Reinforcin	ig = #4@9.26in 	0.00 // //
Min. As % = U Cover @ Top 2.00 @ Btm	= 3.00 in Easting Allow	n, IU =	0.00 ft lba
	= 5.00 III FOOLING Allow.	Torsion, phi Tu =	0.00 It-Ibs
	If torsion e supplemen	exceeds allowable, provintal design for footing f	vide torsion.
	Other Accepta	able Sizes & Spacings	5
	Toe: #4@ 1	11.11 in, #5@, 17.22 in, #	#6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
	Heel: phiMn	= phi'5'lambda'sqrt(fc)'S	Sm
	Key: #4@ 9	9.25 in, #5@ 14.35 in, #6	6@ 18 in, #7@ 18 in, #8@ 18
	Min footing	T&S reinf Area	1.01 in2
	Min footing 1	KS reinf Area per foot	0.22 in2 /ft
	If one layer o	or norizontal bars:	IT two layers of horizontal bars:
	#4@ 11.1 #5@ 17.2	1 III 2 in	#4@ 22.22 IN #5@ 34.44 in
	#3@ 17.2 #6@ 24.4	∠ 1 in	#6@ 48 80 in

Summary of Over	turr	ning & R	esisting F	orces & Mor	nents			
tem		OV Force Ibs	ERTURNING Distance ft	G Moment ft-#		RE Force Ibs	SISTING Distance ft	Moment ft-#
IL Act Pres (ab water tbl) IL Act Pres (be water tbl) Iydrostatic Force		933.9	2.28	2,127.2	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	110.0	4.58 4.58	504.: 504.:
Buoyant Force	=				Sloped Soil Over Heel =			
Surcharge over Heel	=				Surcharge Over Heel =			
Surcharge Over Toe	=				Adjacent Footing Load =			
djacent Footing Load	=				Axial Dead Load on Stem =			
dded Lateral Load	=				* Axial Live Load on Stem =			
oad @ Stem Above Soil	=				Soil Over Toe =	293.3	2.00	586.
0	=				Surcharge Over Toe =			
					Stem Weight(s) =	487.5	4.25	2,071.
·					Earth @ Stem Transitions=			
Total	=	933.9	O.T.M. =	2,127.2	Footing Weight =	583.3	2.33	1,361.
					Key Weight =	175.0	1.50	262
Resisting/Overturning	Rati	0	=	2.25	Vert Component =			

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 a	t Top of Wall due to	o settlerr	nent of soil
(Deflection due to wall bending	not considered)		
Soil Spring Reaction Modulus		250.0	pci
Horizontal Defl @ Top of Wall	(approximate only)	0.026	in
The above calculation is not va	alid if the heel soil bearing	pressure e	exceeds that of the toe,

RetainPro (c) 1987-2019, Build License : KW-06055289 License To : MALSAM TSA	11.20	.03.31 INGINEERING		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 =	= = =	4.00 ft 0.50 ft 0.00	Ē	Now Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0) psf) psf/ft	
Height of Soil over Toe	=	8.00 in		=	300 () pef/ft	
Water height over heel	=	0.0 ft	S	Soil Density, Heel =	110.00) pof	
			s	Soil Density, Toe =	110.00) pcf	
			F	ooting Soil Friction =	0.400)	
			S	Soil height to ignore for passive pressure =	12.00	in	
Surcharge Loads				Lateral Load Applied to	Sterr	1 I	Adjacent Footing Load
Surcharge Over Heel	-	0.0 psf		ateral Load =	00#	t/ft	Adjacent Footing Load = 0.0 lbs
NOT Used To Resist Sli	ding 8	& Overturning		Height to Top =	0.00 ft	t	Footing Width = 0.00 ft
NOT Used for Sliding &	= Overt	U.U urning		Height to Bottom =	0.00 fl	t	Eccentricity = 0.00 in
Avial Land Applied	40.0		L	_oad Type = Win	nd (W)		Footing Type Line Load
Axial Load Applied	10 5	tem		(Sei	rvice L	evel)	Base Above/Below Soil
Axial Dead Load	=	0.0 lbs		Wind on Exposed Stem =	0.0 p	sf	at Back of Wall = 0.0 h
Axial Load Eccentricity	=	0.0 in		(Service Level)			Poisson's Ratio = 0.300
Design Summary			[Stem Construction		Bottom	
			L	Design Height Above Ftg	g ft=	Stem O 0.0	к 0
Wall Stability Ratios	_			Wall Material Above "Ht"		Concret	e
Overturning	_	1.89 OK		Design Method	=	LRFI	D
Siluliy	-	1.72 OK		Thickness Rober Size	=		0
Total Bearing Load	=	882 lbs		Rebar Spacing	=	12.0	0
resultant ecc.	=	5.45 in		Rebar Placed at	=	Edg	e
Soil Pressure @ Toe	=	779 nsf (ж	Design Data			
Soil Pressure @ Heel	=	0 psf 0	ЭK	tb/FB + ta/Fa	=	0.13	34
Allowable	=	2,000 psf		Service Level	lbs =		
Soil Pressure Less	Than	Allowable		Strength Level	lbs =	544	0
ACI Factored @ Toe	-	0 psi		MomentActual			-
Footing Shear @ Toe	=	7 7 nsi (ж	Service Level	ft-# =		
Footing Shear @ Heel	=	0.0 psi C	Ж	Strength Level	ft-# =	725.	3
Allowable	=	75.0 psi		MomentAllowable	=	5,412.	6
Sliding Calcs				ShearActual			
Lateral Sliding Force	=	467.2 lbs		Service Level	psi =		
less 100% Passive Force	9 = -	450.0 IDS 352 9 Ibs		Strengtri Level	psi=	7.	3
Added Force Regid	_	0.0 lbs (אר	SnearAllowable	psi=	75.	0
for 1.5 Stability	-	0.0 lbs 0	ЭК ЭК	Rebar Depth 'd'	in =	6.2	5
,				Masonry Data		0.2	
				fm	psi=		
				Fs	psi =		
ertical component of active	e later	al soil pressure	IS	Solid Grouting Modular Patio 'n'	=		
UT considered in the calcu	liation	1 OI SOII DEARING		Wall Weight	= nsf=	100	0
Load Factors				Short Term Factor	= 100	100.	•
Building Code	IB	C 2015,ACI		Equiv. Solid Thick.	=		
Dead Load		1.400		Masonry Block Type	=	Medium	Weight
Live Load		1.700		Masonry Design Method	=	ASD	
Earth, H		1.700		Concrete Data		0.500	0
wind, W Seismic E		1.300		TC Ev	psi =	2,500.	0
Jeiailliu, E		1.000		гy	psi=	00,000.	U

œtain≃ro (c) 1987-2019, Build 11.20. .icense : KW-06055289 .icense To : MALSAM TSANG E	NGINEERING	Cantilevered R	letai	ning Wa	Code: IBC 2015,ACI 318-14,ACI 530-
Concrete Stem Rebar Are	ea Details				
Bottom Stem	Vertica	I Reinforcing	Horizo	ontal Reinfor	rcing
As (based on applied moment) :	0.0272	in2/ft			
(4/3) * As :	0.0362	in2/ft	Min S	tem T&S Re	einf Area 0.864 in2
200bd/fy: 200(12)(6.25)/60000:	0.25 in	2/ft	Min S	tem T&S Re	einf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728	in2/ft	Horiz	ontal Reinfor	rcing Options :
	=====		One l	ayer of :	Two layers of :
Required Area :	0.1728	in2/ft	#4@	12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2	/ft	#5@	19.38 in	#5@ 38.75 in
Maximum Area :	0.8467	in2/ft	#6@	27.50 in	#6@ 55.00 in
Footing Data		Footing Desi	gn R	esults	
Toe Width =	1.75 ft			Toe	Heel
Heel Width =	0.67	Factored Pressure	=	1,090	0 psf
Total Footing Width =	2.42	Mu' : Upward	=	14,873	0 ft-#
Footing Thickness =	10.00 in	Mu' : Downward	=	5,102	0 ft-#
Key Width =	0.00 in	Mu: Design	=	814	0 ft-#
Key Depth =	6.00 in	Actual 1-Way Shear	-	7.74	0.03 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing		# 4 @ 9 00 i	40.00 psi
fc = 2.500 psi Ev =	60.000 psi	Heel Reinforcing	= 1	None Spec'd	t.
Footing Concrete Density =	150.00 pcf	Key Reinforcing	=	None Spec'd	d la
Min. As % =	0.0018	Footing Torsion, Tu		=	0.00 ft-lbs
Cover @ Top 2.00 @ E	3tm.= 3.00 in	Footing Allow. Torsi	on, ph	iTu =	0.00 ft-lbs
		If torsion excee	ds all	owable, pro	ovide
		supplemental d	lesign	for footing	torsion.
		Other Acceptable	Sizes	& Spacing	js
		Toe: #4@ 11.11 Heel: phiMn = ph Key: No key defi	in, #5 i'5'lam ined	@ 17.22 in, bda'sqrt(fc)'	#6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Sm
		Min footing T&S r Min footing T&S r If one layer of hor #4@ 11.11 in #5@ 17.22 in #6@ 24.44 in	einf A einf Ai izonta	rea rea per foot I bars:	0.52 in2 0.22 in2 ift If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 44.89 in

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06055289 License To : MALSAM TSANG ENGINEERING **Cantilevered Retaining Wall** Code: IBC 2015,ACI 318-14,ACI 530-13 Summary of Overturning & Resisting Forces & Moments ì

		OV	ERTURNING)		RESISTING			
Item		Force Ibs	Distance ft	Moment ft-#		Force Ibs	Distance ft	Moment ft-#	
HL Act Pres (ab water tb HL Act Pres (be water tb Hudrostatic Force	I) I)	467.2	1.61	752.7	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	1.5	2.42 2.42	3.5 3.5	
Buoyant Force Surcharge over Heel Surcharge Over Toe Adjacent Footing Load	= = =				Sloped Soil Over Heel = Surcharge Over Heel = Adjacent Footing Load = Axial Dead Load on Stem =				
Added Lateral Load Load @ Stem Above Soi	= il = =				Soil Over Toe = Surcharge Over Toe =	128.3	0.88	112.3	
					Stem Weight(s) = Earth @ Stem Transitions=	450.0	2.08	937.5	
Total	=	467.2	O.T.M. =	752.7	Footing Weight = Key Weight =	302.5	1.21	366.0	
Resisting/Overturning	g Rati	0	=	1.89	Vert. Component =				
Vertical Loads used f	or Soi	Pressure	= 882.	3 lbs	Total =	882.3 II	bs R.M.=	1,419.4	
					* Axial live load NOT included i resistance, but is included for	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

Horizontal Defl @ Top of Wall (approximate only) 0.040 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.

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Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= = =	4.00 ft 0.50 ft 0.00	, E	Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =	2,000.0 d 40.0	psf psf/ft	
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft	F S F	= Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	300.0 110.00 110.00 0.400 12.00	psf/ft pcf pcf	
Surcharge Loads				I ateral I oad Applied to	Stem		Adjacent Ecoting Load
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe NOT Used for Sliding &	= Bliding = & Over	0.0 psf & Overturning 0.0 turning		Lateral Load = Height to Top = Height to Bottom =	0.0 #/ 0.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in
Axial Load Applied	d to S	Stem		Load Type = Win (Ser	d (W) vice 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 = 0.0 ft Poisson's Ratio = 0.300
Design Summary				Stem Construction]	Bottom	
Wall Stability Pation				Design Height Above Ftg	ft =	0.00	
Overturning Sliding	=	2.35 Ok 1.77 Ok		Design Method Thickness	=	LRFD 6.00	
Total Bearing Load resultant ecc.	= =	940 lbs 4.53 in		Rebar Spacing Rebar Placed at	=	18.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	573 psf 72 psf 2,000 psf	OK OK	fb/FB + fa/Fa Total Force @ Section	=	0.29	5
Soil Pressure Les ACI Factored @ Toe ACI Factored @ Heel	s Thar = =	n Allowable 802 psf 101 psf		Service Level Strength Level MomentActual	lbs =	544.0	
Footing Shear @ Toe Footing Shear @ Heel	= =	6.5 psi 1.2 psi	OK OK	Service Level Strength Level Moment Allowable	ft-# = ft-# = =	725.3	8
Sliding Calcs Lateral Sliding Force less 100% Passive Ford	- = ce = -	467.2 lbs 450.0 lbs		ShearActual Service Level Strength Level	psi = psi =	10.7	
Added Force Req'd for 1.5 Stability	e = - = =	0.0 lbs 0.0 lbs	ок ок	ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = in2 = in =	75.0 4.25	
Vertical component of activ	ve late	ral soil pressu	re IS	fm Fs Solid Grouting	psi= psi= =		
NOT considered in the cale	culation	n of soil bearin	g	Modular Ratio 'n' Wall Weight Short Term Factor	= psf= =	75.0	
Dead Load Live Load	IB	1.400 1.700		Equiv. Solid Thick. Masonry Block Type Masonry Design Method	= = =	Medium \ ASD	Veight
Earth, H Wind, W Seismic, E		1.700 1.300 1.000		Concrete Data fc Fy	psi = psi =	2,500.0 60,000.0	

Project Name/Number	: 1	(C02-D30)	200
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ense : KW-06055289 cense To : MALSAM TSANG ENGIN	Cantilevered	Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-1
oncrete Stem Rebar Area D	etails		
ottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
s (based on applied moment) :	0.041 in2/ft	-	
/3) * As :	0.0547 in2/ft	Min Stem T&S Reinf A	Area 0.648 in2
00bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf A	Area per ft of stem Height : 0.144 in2/ft
0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing	Options :
		One layer of : Two	o layers of :
equired Area :	0.1296 in2/ft	#4@ 16.67 in #4	l@ 33.33 in
rovided Area :	0.1333 in2/ft	#5@ 25.83 in #5	5@ 51.67 in
laximum Area :	0.5757 in2/ft	#6@ 36.67 in #6	0 73.33 in
Footing Data	Footing D	esign Results	
Toe Width =	2.25 ft	Toe	Heel
Heel Width = 0	0.67 Factored Pressu	re = 802	101 psf
Total Footing Width = 2	2.92 Mu': Upward	= 18,888	2 ft-#
Footing Thickness = 10	.00 in Mu' : Downward	= 8,434	11 ft-#
Key Width = 0	.00 in Actual 1 Way St	= 0/1	9 II-# 1 16 pai
Key Depth = 6	i.00 in Allow 1-Way Sh	ear = 75.00 4	1.10 psi
Key Distance from Toe = 0	.00 ft Toe Reinforcing	= #4@.9.00 in	
°c = 2,500 psi Fy = 60,	000 psi Heel Reinforcing	<pre>= None Spec'd</pre>	
Footing Concrete Density = 150	0.00 pcf Key Reinforcing	= None Spec'd	
Min. As % = 0.0	018 Footing Torsion,	Tu =	0.00 ft-lbs
Cover@lop 2.00 @Btm.=	3.00 in Footing Allow. To	orsion, phi Tu 🛛 =	0.00 ft-lbs
	If torsion ex supplement	ceeds allowable, provide al design for footing tors	e sion.
	Other Acceptat	le Sizes & Spacings	
	Toe: #4@ 11 Heel: phiMn = Key: No key	.11 in, #5@ 17.22 in, #6@ phi'5'lambda'sqrt(fc)'Sm defined	9 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
	Min footing T8 Min footing T8 If one layer of	S reinf Area S reinf Area per foot horizontal bars: If t	0.63 in2 0.22 in2 /ft two layers of horizontal bars:
	#4@ 11.11	in	#4@ 22.22 in
	#5@ 17.22 #6@ 24.44	in	#5@ 34.44 IN #6@ 48.89 in

Summary of Overturning & Resisting Forces & Moments												
ltem		OV Force Ibs	ERTURNI Distance	NG M	oment ft-#	_		Force Ibs	SISTING Distance ft	Moment ft-#		
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hvdrostatic Force		467.2	1.61		752.7	Soil Over HL (ab. water Soil Over HL (bel. water Watre Table	r tbl) r tbl)	73.3	2.83 2.83	207.8 207.8		
Suoyant Force	=					Sloped Soil Over Heel	=					
Surcharge over Heel	=					Surcharge Over Heel	=					
Surcharge Over Toe	=					Adjacent Footing Load	=					
djacent Footing Load	=					Axial Dead Load on Ste	m =					
dded Lateral Load	=					* Axial Live Load on Sterr	ו =					
oad @ Stem Above Soil	=					Soil Over Toe	=	165.0	1.13	185.6		
0	=					Surcharge Over Toe	=					
						Stem Weight(s)	=	337.5	2.50	843.8		
						Earth @ Stem Transition	ns=					
Total	=	467.2	O.T.M.	=	752.7	Footing Weight	=	364.6	1.46	531.7		
						Key Weight	=					
Resisting/Overturning	Rati	0	=	2.3	5	Vert. Component	=					
Vertical Loads used fo	r Soi	Pressure	= 94	10.4 lb	s	Tot	- Ie	940.4	he PM =	1 769 9		

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	settlen	nent of soil
(Deflection due to wall bending	not considered)		
Soil Spring Reaction Modulus		250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.025	in
The above calculation is not val	id if the heel soil bearing p	ressure (exceeds that of the toe,

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Criteria			Soil Data							
Retained Height Wall height above soil Slope Behind Wall	= = =	7.00 ft 0.50 ft 0.00	Allow Soil Bearing Equivalent Fluid Pressure Active Heel Pressure	= Meth =	2,000.0 od 40.0	psf psf/ft				
Height of Soil over Toe Water height over heel	=	8.00 in 0.0 ft	Passive Pressure Soil Density, Heel Soil Density, Toe Footing Soil Friction Soil height to ignore	= = = =	300.0 110.00 110.00 0.400	psf/ft pcf pcf				
			for passive pressure	=	12.00	in				
Surcharge Loads			Lateral Load Applie	ed to	Stem	1	Adjacent Footing Load			
Surcharge Over Heel NOT Used To Resist Sli Surcharge Over Toe NOT Used for Sliding &	= iding = Over	0.0 psf & Overturning 0.0 turning	Lateral Load = Height to Top = Height to Bottom =	= = = - \\\/i	0.0 # 0.00 ft 0.00 ft	/ft	Adjacent Footing Load = 0.0 lbs Footing Width = 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist = 0.00 ft			
Axial Load Applied	to S	Stem	Loau Type -	- vvi (Se	ervice Le	evel)	Footing Type Line Load			
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in	Wind on Exposed Stem <u>-</u> (Service Level)	-	0.0 p	sf	at Back of Wall = 0.0 ft Poisson's Ratio = 0.300			
Design Summary			Stem Construction	n	<u> </u>	Bottom				
			Design Height Abo	ove Ft	tg ft=	Stem OF 0.00	K D			
Wall Stability Ratios	=	1.00 01	Wall Material Abov	ve "H	t" =	Concrete	e			
Sliding	=	1.60 OK	Design Method		=					
onding			Rebar Size		-	8.00 #	4			
Total Bearing Load	=	1,904 lbs	Rebar Spacing		=	8.00	0			
resultant ecc.	=	12.14 in	Rebar Placed at		=	Edge	e			
Soil Pressure @ Toe	=	876 psf C	K fb/FB + fa/Fa		=	0.48	8			
Soil Pressure @ Heel	=	0 psf C	K Total Force @ Se	ection	1					
Allowable	=	2,000 psf	Service Level		lbs =					
ACL Eastered @ Tee	= 1 nai	1 227 pof	Strength Level		lbs =	1.666.0	D			
ACI Factored @ Heel	-	0 psf	MomentActual							
Footing Shear @ Toe	=	19.2 nei ()	K Service Level		ft-# =					
Footing Shear @ Heel	=	0.0 psi 0	K Strength Level		ft-# =	3,887.	3			
Allowable	=	75.0 psi	MomentAllowal	ble	=	7,959.0	6			
Sliding Calcs			ShearActual							
Lateral Sliding Force	=	1.227.2 lbs	Service Level		psi =					
less 100% Passive Force	e = -	1,200.0 lbs	Strength Level		psi=	22.3	2			
less 100% Friction Force	e = -	761.7 lbs	ShearAllowable	е	psi=	75.0	D			
Added Force Req'd	=	0.0 lbs O	K Anet (Masonry)		in2 =					
for 1.5 Stability	=	0.0 lbs C	K Rebar Depth 'd'		in =	6.2	5			
			Masonry Data							
			fm		psi=					
	- 1-4		FS Solid Croutine		psi=					
erucal component of active	e late	rai soll pressure	Nodular Ratio 'n'		=					
O I CONSIDERED IN THE CAICI	uidtiO	n or soir bearing	Wall Weight		nsf=	100 0	n			
Load Factors			Short Term Factor	r	P31 -	100.0	~			
Building Code	IE	3C 2015,ACI	Equiv, Solid Thick		_					
Dead Load		1.400	Masonry Block Tv	pe	=	Medium	Weight			
Live Load		1.700	Masonry Design N	/letho	d =	ASD	.			
Earth, H		1.700	Concrete Data							
Wind, W Seismic, F		1.300	fc Fv		psi = psi =	2,500.	0			
oolonno, E		1.000	i y		hai -	50,000.0	•			

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Concrete Stem Rebar A	rea Details					
Bottom Stem	Vertica	Reinforcing I	Horizor	tal Reinfor	rcing	
As (based on applied moment)	: 0.1456	in2/ft				
(4/3) * As :	0.1942	in2/ft I	Min Ste	m T&S Re	einf Area 1.440 in2	
200bd/fy : 200(12)(6.25)/60000	: 0.25 in2	2/ft I	Min Ste	m T&S Re	einf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728	in2/ft I	Horizor	tal Reinfor	rcing Options :	
	======		One lav	er of :	Two lavers of :	
Required Area :	0.1942	in2/ft #	#4@ 12	2.50 in	#4@ 25.00 in	
Provided Area	0.3 in2/	ft	#5@ 19	38 in	#5@ 38 75 in	
Maximum Area :	0.8467	in2/ft #	#6@ 27	7.50 in	#6@ 55.00 in	
Footing Data		Footing Desig	gn Re	sults		
Toe Width =	4.25 ft			Toe	Heel	
Heel Width =	0.67	Factored Pressure	=	1.227	0 psf	
Total Footing Width =	4.92	Mu' : Upward	=	89,622	0 ft-#	
Footing Thickness =	10.00 in	Mu' : Downward	=	30,092	0 ft-#	
Key Width =	12.00 in	Mu: Design	=	4,961	0 ft-#	
Key Depth =	18.00 in	Actual 1-Way Shear	=	19.20	0.04 psi	
Key Distance from Toe =	1.00 ft	Allow 1-way Shear	= #	75.00 4 @ 0.00 ii	40.00 psi	
fo = 0.500 poi Ev =	60.000 pai	Heel Reinforcing	= # ·	4 @ 9.00 II one Snec'd	4	
Footing Concrete Density =	150.00 psi	Key Reinforcing	= #	4 @ 9.00 ir	in .	
Min. As %	0.0018	Footing Torsion, Tu		=	0.00 ft-lbs	
Cover @ Top 2.00 @	Btm.= 3.00 in	Footing Allow. Torsic	on, phi '	Tu =	0.00 ft-lbs	
		If torsion exceed	ds allo	wable, pro	ovide	
		supplemental de	esign f	or footing	torsion.	
		Other Acceptable S	Sizes &	Spacing	s	
		Toe: #4@ 10.09 i Heel: phiMn = phi' Key: #4@ 9.25 ir	in, #5@ '5'lamb n, #5@) 15.64 in, da'sqrt(fc)' 14.35 in, #	#6@ 22.20 in, #7@ 30.27 in, #8@ 39.86 in, #9@ 5 Sm #6@ 18 in, #7@ 18 in, #8@ 18	
		Min footing T&S re	einf Are	а	1.06 in2	

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Summary of Overturning & Resisting	g Forces & Moments	

ltem		OV Force	ERTURNIN Distance ft	NG Moment ft-#		R Force	ESISTING Distance ft	Moment
		4 007 0	0.04	0.001.1	Soil Over HI (ab water thi)	2.6	4 92	12.6
HL Act Pres (ab water tbl)		1,227.2	2.61	3,204.4	Soil Over HI (bel water tbl)	2.0	4.92	12.0
HL Act Pres (be water tbl)					Watre Table		4.52	12.0
Hydrostatic Force								
Buoyant Force	=				Sloped Soli 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 =	311.7	2.13	662.3
	_				Surcharge Over Toe =		2.10	
	-				Stem Weight(s) =	750.0	4.58	3.437.5
			_		Earth @ Stem Transitions=			
Total	=	1,227.2	O.T.M. :	= 3,204.4	Footing Weight =	615.0	2.46	1.512.9
					Key Weight =	225.0	1.50	337.5
Resisting/Overturning	Ratio	0	=	1.86	Vert. Component =			
Vertical Loads used for	r Soil	Pressure	= 1,90	4.2 lbs	Total =	1.904.2	lbs R.M.=	5,962,8

* 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) 0.037 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.

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Criteria	Alto			Soil Data				
Retained Height	=	8 00 ft		Allow Soil Bearing = 2	2,000.0) psf		
Wall height above soil	=	0.50 ft		Equivalent Fluid Pressure Metho	d			
Slone Behind Wall	=	0.00	4	Active Heel Pressure =	40.0) psf/ft		
Height of Soil over Tee	2	6.00 in		=				
	-	0.00 11		Passive Pressure =	300.0	psf/ft		
Water height over heel	=	0.0 ft		Soil Density, Heel =	110.00	pcf		
			:	Soil Density, Toe =	110.00	pcf		
				Footing Soil Friction =	0.400		• •	•
				Soil beight to ignore				•
				for passive pressure =	12.00	in		
Surcharge Loads			ſ	Lateral Load Applied to	Stem		Adjacent Footing	Load
Surcharge Over Heel	-	0.0 psf		Lateral Load =	00#	/#	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist S	Sliding	& Overturning		Height to Top =	0.00 ft	/it	Footing Width	= 0.00 ft
Surcharge Over Toe	=	0.0		Height to Bottom =	0.00 ft		Eccentricity	= 0.00 in
NOT Used for Sliding &	& Over	turning		Load Type = Win	d (M)		Wall to Ftg CL Dist	= 0.00 ft
Axial Load Applied	d to S	Stem		(Ser	rvice L	avel)	Footing Type	Line Load
Avial Daard Laard		0.0.15-		(56	0.00 L	,	Base Above/Below Soil	= 0.0 ft
Axial Dead Load	-	0.0 lbs		(Service Level)	0.0 p	sı	at Back of Wall	0.0 1
Axial Load Eccentricity	=	0.0 in		(Service Lever)			Poisson's Ratio	= 0.300
Design Summary				Stem Construction] -	Bottom		
				Design Height Above Ftg	ft=	5tem OK 0.00		
Wall Stability Ratios	_			Wall Material Above "Ht"	=	Concrete		
Overturning	=	1.98 OK		Design Method	=	LRFD		
Sliding	=	1.64 OK		Thickness	=	8.00		
T		0.400 #		Rebar Size	=	# 5		
Total Bearing Load	-	2,432 lbs		Rebar Spacing	=	10.00		
resultant ecc.	-	14.94 111		Rebar Placed at	=	Edge		
Soil Pressure @ Toe	=	825 psf	οк	fb/FB + fa/Fa	=	0.602		
Soil Pressure @ Heel	=	0 psf	ΟK	Total Force @ Section		0.001		
Allowable	=	2,000 psf		Service Level	lbc =			
Soil Pressure Les	s Thai	n Allowable		Strength Level	lbs =	2 176 0		
ACI Factored @ Toe	=	1,155 psf		Moment Actual	105 -	2,170.0		
ACI Factored @ Heel	=	0 psi		Service Level	ft-# =			
Footing Shear @ Toe	=	17.7 psi (JK	Strength Level	ft-# =	5 802 7		
Footing Shear @ Heel	=	0.0 psi (ЭK	Moment Allowable	-	0,623.1		
Allowable	=	75.0 psi		Shoor Actual	-	3,023.1		
Sliding Calcs				SilediActual	noi -			
Lateral Sliding Force	=	1,620.0 lbs		Strongth Lovel	psi-			
less 100% Passive For	ce = -	072.0 lbc		Strength Level	psi=	29.3		
		· 372.3103	~~	ShearAllowable	psi=	75.0		
Added Force Reg'd	=	0.0 lbs		Anet (Masonry)	in2 =			
for 1.5 Stability	=	0.0 lbs	ΟK	Rebar Depth 'd'	in =	6.19		
				Masonry Data				
				im Fe	psi=			
artical component of activ	ia lata	ral coil proceur	. 19	Solid Grouting	psi =			
OT considered in the cal	culatio	n of soil bearing	, 13 1	Modular Ratio 'n'	=			
	Jaiano	o. oon boaring	,	Wall Weight	psf=	100 0		
oad Factors				Short Term Factor	=			
Building Code	IE	3C 2015,ACI		Equiv. Solid Thick	=			
Dead Load		1.400		Masonry Block Type	_	Medium V	Veiaht	
Live Load		1.700		Masonry Design Method	=	ASD	U .	
Earth, H		1.700		Concrete Data				
Wind, W		1.300		fc	psi=	2,500.0		
Seismic, E		1.000		Fv	psi=	60,000.0		

Project Name/Number	:	(C02-D30)	200
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ense : KW-06055289 Cense To : MALSAM TSANG ENGINEER	Cantilevere	d Retaining Wall	Code: IBC 2015,ACI 318-14,ACI 530-
Concrete Stem Rebar Area Detai	ls		
ottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
s (based on applied moment) :	0.2197 in2/ft	5	
4/3) * As :	0.293 in2/ft	Min Stem T&S Reinf Area	a 1.632 in2
00bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area	a per ft of stem Height : 0.192 in2/ft
.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Op	otions :
		One layer of : Two lay	yers of :
tequired Area :	0.2475 in2/ft	#4@ 12.50 in #4@ :	25.00 in
rovided Area :	0.372 in2/ft	#5@ 19.38 in #5@	38.75 in
laximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@	55.00 in
Footing Data	Footing D	esign Results	
Foe Width = 5.75 f	t	<u>Toe</u> <u>Hee</u>	<u>I</u>
Heel Width = 0.67	Factored Press	ure = 1,155	0 psf
I otal Footing Width = 6.42	Mu': Upward Mu': Downward	= 154,644 = 56,934	0 ft-# 0 ft-#
-boung inickness = 12.00 in	Mu: Design	= 8,143	0 ft-#
Key Width = 12.00 ir	1 Actual 1-Way S	Shear = 17.68 0.0	4 psi
Key Distance from Toe = 1.00 ft	Allow 1-Way S	near = 75.00 40.0	0 psi
	Toe Reinforcing	g = #5@ 10.00 in	
rc = 2,500 psi Fy = 60,000 p Footing Concrete Density = 150.00 p	cf Key Reinforcing	= #4@9.00 in	
Vin. As % = 0.0018	Footing Torsion	, Tu = 0.0	00 ft-lbs
Cover @ Top 2.00 @ Btm.= 3.00) in Footing Allow.	Forsion, phi Tu = 0.0	00 ft-lbs
	If torsion e	ceeds allowable, provide	
	supplemen	tal design for footing torsior	1.
	Other Accepta	ble Sizes & Spacings	
	Toe: #4@ 8	.13 in, #5@ 12.61 in, #6@ 17.9	90 in, #7@ 24.41 in, #8@ 32.14 in, #9@ 40
	Heel: phiMn Kev: #4@ 9	= phi'5'lambda'sqrt(fc)'Sm .25 in. #5@ 14.35 in. #6@ 18	in. #7@ 18 in. #8@ 18
	Min footing T	&S reinf Area 1.6	6 in2
	Min footing T	&S reinf Area per foot 0.2	6 in2 /ft
	If one layer o	f horizontal bars: If two	layers of horizontal bars:
	#4@ 9.26	in #4@	2 18.52 in
	#5@ 14.35	in #5@	28.70 in
	#6@ 20.37	in #6@	2 40.74 IN

Summary of Over	tur	ning & R	esisting F	orces & Mon	nents			
ltem	_	OV 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) Hvdrostatic Force		1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	2.9	6.42 6.42	18.8 18.8
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 =			
oad @ Stem Above Soil	=				Soil Over Toe =	316.3	2.88	909.
0	=				Surcharge Over Toe =			
					Stem Weight(s) =	850.0	6.08	5,170.
					Earth @ Stem Transitions=			
Total	=	1,620.0	O.T.M. =	4,860.0	Footing Weight =	963.0	3.21	3,091.
					Key Weight =	300.0	1.50	450.
Resisting/Overturning	Rat	in	=	1 98	Vort Component =			

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)	0.030 in
The above calculation is not valid if the heel soil bear	ing pressure exceeds that of the toe,

Criteria Soil Data Retained Height = 0.00 ft Wall height above soil = 0.50 ft Slope Behind Wall = 0.00 Height of Soil over Toe = 6.00 in Water height over heel = 0.0 ft Soil Density, Heel = 110.00 pcf Soil Density, Toe = 110.00 pcf Footing Soil Friction = 0.400	
Retained Height = 9.00 ft Allow Soil Bearing = 2.000.0 psf Wall height above soil = 0.50 ft Equivalent Fluid Pressure Method Slope Behind Wall = 0.00 Active Heel Pressure = 40.0 psf/ft Height of Soil over Toe = 6.00 in = = 300.0 psf/ft Water height over heel = 0.0 ft Soil Density, Heel = 110.00 pcf Soil Density, Toe = 110.00 pcf Soil Density, Toe = 0.400 Soil height to ignore Soil height to ignore Soil height to ignore Soil height to ignore	
Height of Soil over Toe = 6.00 in = Water height over heel = 0.0 ft Passive Pressure = 300.0 psf/ft Soil Density, Heel = 110.00 pcf Soil Density, Toe = 110.00 pcf Footing Soil Friction = 0.400 Soil height to ignore Soil height to ignore	
for passive pressure = 12.00 in	1
Surcharge Loads Lateral Load Applied to Stem Adjace	ent Footing Load
Surcharge Over Heel = 0.0 psf Lateral Load = 0.0 #/ft Adjacent NOT Used To Resist Sliding & Overturning Height to Top = 0.00 ft Footing 1 Surcharge Over Toe = 0.0 Height to Bottom = 0.00 ft Eccentri NOT Used for Sliding & Overturning Load Top = 0.00 ft Eccentri	t Footing Load = 0.0 lbs Width = 0.00 ft city = 0.00 in ⁼ tg CL Dist = 0.00 ft
Axial Load Applied to Stem (Service Level)	Type Line Load
Axial Dead Load = 0.0 lbs Wind on Exposed Stem _ 0.0 psf at Bac Axial Live Load = 0.0 lbs (Service Level) Poisson' Axial Load Eccentricity = 0.0 ln Poisson'	sk of Wall = 0.0 ft 's Ratio = 0.300
Design Summary Stem Construction Bottom	
Design Height Above Ftg ft = 0.00	
Wall Stability Ratios Wall Material Above "Ht" = Concrete	
Sliding = 1.54 OK Design Method = LRFD	
Rebar Size = # 5	
Total Bearing Load = 2,826 lbs Rebar Spacing = 8.00	
resultant ecc. = 18.03 in Rebar Placed at = Edge	
Soil Pressure @ Toe = 808 psf OK fb/FB + fa/Fa = 0.700	
Soil Pressure @ Heel = 0 psf OK Total Force @ Section	
Allowable = 2,000 psf Service Level lbs =	
Soll Pressure Less Than Allowable Strength evel bs = 2,754,0	
ACI Factored @ Heel = 0 psf MomentActual	
Footing Shear @ Toe = 19.7 psi OK Service Level ft-# =	
Footing Shear @ Heel = 0.0 psi OK Strength Level ft-# = 8,262.0	
Allowable = 75.0 psi MomentAllowable = 11,799.2	
Sliding Calcs ShearActual	
Lateral Sliding Force = 2,000.0 lbs Service Level psi =	
less 100% Passive Force = - 1,959.4 lbs Strength Level psi = 37.1	
less 100% Friction Force = 1,130.5 lbs ShearAllowable psi = 75.0	
Added Force Req'd = 0.0 lbs OK Anet (Masonry) in2 =	
for 1.5 Stability = 0.0 lbs OK Rebar Depth 'd' in = 6.19	
Masonry Data	
ťm psi=	
rs psi =	
OT considered in the calculation of soil bearing Modular Ratio 'n' =	
Wall Weight psf= 100.0	
Load Factors Short Term Factor =	
Building Code IBC 2015,ACI Equiv. Solid Thick. =	
Dead Load 1.400 Masonry Block Type = Medium Weight	
Live Load 1.700 Masonry Design Method = ASD	
Earth, H 1.700 Concrete Data	
wing, w 1.300 fc psi = 2,500.0 Saingia E 1.000 Ev 1.000 Ev 1.000 Ev	
Seismic, E 1.000 Fy psi = 60,000.0	

icense : KW-06055289 icense To : MALSAM TSANG EI		Cantilevered R	eta	lin	ing Wal	I	Code: IBC 2015,ACI 318-14,ACI 530-1
Concrete Stem Rebar Are	a Details						
Bottom Stem	Vertical	Reinforcing I	Hori	izor	ntal Reinford	cing	
As (based on applied moment) :	0.3128 i	n2/ft				-	
(4/3) * As :	0.4171 i	n2/ft I	Min	Ste	em T&S Rei	nf Area	1.824 in2
200bd/fy : 200(12)(6.1875)/60000	: 0.2475 i	n2/ft I	Min	Ste	em T&S Rei	inf Area	per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 i	n2/ft I	Hori	zor	ntal Reinford	cing Opt	tions :
	======	(One	lay	yer of :	Two lay	vers of :
Required Area :	0.3128 i	n2/ft #	44@	ų 12	2.50 in	#4@ 2	25.00 in
Provided Area :	0.465 in:	2/ft #	¥5@	0 19	9.38 in	#5@ 3	38.75 in
Maximum Area :	0.8382 i	n2/ft #	#6@	, 27	7.50 in	#6@5	55.00 in
Footing Data		Footing Desig	gn I	Re	sults		
Toe Width =	7.00 ft				Тое	Heel	
Heel Width =	0.67	Factored Pressure	=		1,131) psf
Total Footing Width =	7.67	Mu' : Upward	=	2	221,640	0) ft-#
Footing Thickness =	12.00 in	Mu' : Downward	=		84,378	0) ft-#
Key Width =	12.00 in	Mu: Design	=		11,439	0) ft-#
Key Depth =	27.00 in	Actual 1-Way Shear	-		19.68	0.04	t psi
Key Distance from Toe =	1.00 ft	Too Poinforcing	-	#	7 0.00	40.00) psi
fc = 2,500 psi Ev =	60 000 psi	Heel Reinforcing	-	N	one Spec'd		
Footing Concrete Density =	150.00 pcf	Key Reinforcing	=	#	4 @ 9.00 in	1	
Min. As % =	0.0018	Footing Torsion, Tu			=	0.0	00 ft-lbs
Cover @ Top 2.00 @ B	tm.= 3.00 in	Footing Allow. Torsic	n, p	ohi '	Tu =	0.0	00 ft-lbs
		If torsion exceed	ds a	llo	wable, prov	vide	
		supplemental de	esig	jn f	or footing	torsion.	
		Other Acceptable S	Size	es 8	& Spacings	3	
		Toe: #4@ 7.05 in Heel: phiMn = phi'	, #5 5'lai	i@ mb	10.94 in, #6 da'sqrt(fc)'S	6@ 15.5 m	i2 in, #7@ 21.17 in, #8@ 27.88 in, #9@ 35
		Key: #4@ 9.25 ir	ı, #5	i@	14.35 in, #6	6@ 18 ir	n, #7@ 18 in, #8@ 18
		Min footing T&S re	einf .	Are	a	1.99	9 in2

win looung 1&5 reini Area	1.99 Inz
Min footing T&S reinf Area per foot	0.26 in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

4		ing a re	conounig	T OICES & WO	ments			
ltem		Force Ibs	ERTURNIN Distance ft	IG Moment ft-#		Force Ibs	ESISTING Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		2,000.0	3.33	6,666.7	Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table	3.3	7.67 7.67	25.3 25.3
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 =			
oad @ Stem Above Soil	=				Soil Over Toe =	385.0	3.50	1,347.5
	=				Surcharge Over Toe =			
					Stem Weight(s) =	950.0	7.33	6,966.7
-			-		Earth @ Stem Transitions=			
Total	=	2,000.0	O.T.M. =	= 6,666.7	Footing Weight =	1,150.5	3.84	4,412.2
					Key Weight =	337.5	1.50	506.3
Resisting/Overturning	Ratio	,	=	1.99	Vert. Component =			
Vertical Loads used for	r Soil I	Pressure	= 2,82	6.3 lbs	Total =	2 826 3	lbs RM =	13 257 9

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.



Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

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 Soil Spring Reaction Modulus
 250.0
 pci

 Horizontal Defl @ Top of Wall (approximate only)
 0.028
 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 relained soil,