STRUCTURAL CALCULATIONS: SITE RETAINING WALL DESIGN

PROJECT: SWC COLORADO BLVD. & THORNTON PKWY. THORNTON, CO

PROJECT NO.: 4665

SUBMITTAL: APRIL 25, 2016



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Lic. # : KW-06011271

Description : 6-FT- Wall "1"

Criteria						
Retained Height	=	6.00 ft				
Wall height above soil	=	0.00 ft				
Slope Behind Wall	=	3.00 : 1				
Height of Soil over Toe	=	22.00 in				
Water height over heel = 0.0 ft						
Vertical component of ac	tive					
Lateral soil pressure opti	Lateral soil pressure options:					
USED for Soil Pressure.						
USED for Sliding Resistance.						
USED for Over	rtürning	Resistance.				

Design Summary

Wall Stability Ratios Overturning Sliding	= =	2.32 OK 1.95 OK
Total Bearing Loadresultant ecc.	= =	3,373 lbs 6.14 in
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= = Than A	1,809 psf OK 118 psf OK 2,800 psf Nlowable
ACI Factored @ Toe	=	1,885 psf
ACI Factored @ Heel	=	123 psf
Footing Shear @ Toe	=	1.3 psi OK
Footing Shear @ Heel	=	16.2 psi OK
Allowable	=	82.2 psi
Sliding Calcs (Vertical C	ompon	ent Used)
Lateral Sliding Force	=	1,125.4 lbs
less 100% Passive Force	= -	845.8 lbs
less 100% Friction Force	= -	1,34 9.0 lbs
Added Force Req'd	=	0.0 lbs OK
for 1.5 : 1 Stability	=	0.0 lbs OK
Load Factors ——— Dead Load Live Load Earth, H Wind, W Seismic, E		1.200 1.600 1.600 1.600 1.600 1.000

Soil Da	ta					Calculations per ACI 318-11,	ACI 530-11, IBC 2012,
Allow S	oil Bearing	=	2,800.0	psf			CBC 2013, ASCE 7-10
Equival	ent Fluid Pressure Me	thod					
Heel Ac	tive Pressure	=	46.0	psf/ft			
Toe Act	ive Pressure	=	46.0	psf/ft			
Passive	e Pressure	=	300.0	psf/ft			
Soil De	nsity, Heel	=	125.00	pcf			
Soil De	nsity, Toe	=	125.00	pcf			
Friction	Coeff btwn Ftg & Soil	=	0.400	'			
Soil hei	aht to ignore						
for pa	ăssive pressure	=	22.00 i	n			
Sten	n Construction		_ _	Тор	Stem		
	Docian Holaht Abovo	Eta	n		Stem OK		
I	Wall Matarial Above	гцу "Цŧ"	11 =	C	0.00		
	Thicknoss	п	= in _	U			
	Rehar Size		= 111		# 5		
	Rebar Spacing		in =		18.00		
	Rebar Placed at		=	Use	r Spec		
I	Design Data ——						
	fb/FB + fa/Fa		=		0.256		
	Total Force @ Section	n	lbs =	1	,201.1		
	MomentActual		ft-I =	2	2,574.0		
	MomentAllowable		ft-I =	10),041.0		
	ShearActual		psi =		9.1		
	ShearAllowable		psi =		82.2		
	Wall Weight		psf =		175.0		
	Rebar Depth 'd'		in =		11.00		
	Lap splice if above		in =		21.36		
	Lap splice if below		in =		9.59		
	Hook embed into foo	ting	in =		9.59		
(
	IC		psi =	:	5,000.0		

psi = 3,000.0 psi =

Fy

Cantilevered Retaining Wall

Lic. # : KW-06011271

Description : 6-FT- Wall "1"

Footing Dimension	ons & S	Strength	IS	
Toe Width		=	1.	00 ft
Heel Width Total Footing Width	ı	=	<u>2.</u> 3.	<u>50</u> 50
Footing Thickness		=	14.(00 in
Key Width		=	0.0	00 in
Key Depth Key Distance from	Тое	=	0.0	JU IN DO ft
f'c = 3,000 Footing Concrete D Min. As % Cover @ Top	psi Density 2.00	Fy = = @ Bt	60,00 150.0 0.00 m.=	00 psi 00 pcf 18 3.00 in

Footing Design Resu	Ilts			
		Тое	Heel	
Factored Pressure	=	1,885	123 p	osf
Mu' : Upward	=	859	0 İ	t-lb
Mu' : Downward	=	243	1,973 f	t-lb
Mu: Design	=	616	1,973 f	t-lb
Actual 1-Way Shear	=	1.27	16.19 p	osi
Allow 1-Way Shear	=	82.16	82.16 p	osi
Toe Reinforcing	=	# 5 @ 18.00 in		
Heel Reinforcing	=	# 5 @ 18.00 in		
Key Reinforcing	=	None Spec'd		
Other Acceptable Sizes	& S	Spacings		
Toe: Not rea'd. Mu	< 5	 5*Fr		

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

Summary of Overturning & Resisting Forces & Moments

Item		0' Force Ibs	VERTURNING Distance ft	 Moment ft-lb	
Heel Active Pressure	=	1,332,4	2.54	3.380.3	
Surcharge over Heel	=				
Toe Active Pressure	=	-207.0	1.00	-207.0	
Surcharge Over Toe	=				
Adjacent Footing Load	=				
Added Lateral Load	=				
Load @ Stem Above Soil	=				
Total	=	1,125.4	O.T.M. =	3,173.3	
Resisting/Overturning Ratio = 2.32 Vertical Loads used for Soil Pressure = 3,372.6 lbs					
Vertical component of active pressure used for soil pressure					

		RE Force Ibs	SISTING Distance ft	Moment ft-lb	
Soil Over Heel	=	1,000.0	2.83	2,833.3	
Sloped Soil Over Heel	=	37.0	3.06	113.2	
Surcharge Over Heel	=				
Adjacent Footing Load	=				
Axial Dead Load on Ster	n =				
Axial Live Load on Stem	=				
Soil Over Toe	=	229.2	0.50	114.6	
Surcharge Over Toe	=				
Stem Weight(s)	=	1,050.0	1.58	1,662.5	
Earth @ Stem Transition	S =				
Footing Weight	=	612.5	1.75	1,071.9	
Key Weight	=				
Vert. Component	=	443.9	3.50	1,553.8	
To	otal =	3,372.6 lt	os R.M. =	7,349.2	
Avial live load NOT induded in total displayed, or youd for everturning					

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

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RETAINING WALL "1": 6-FT RETAINED HEIGHT CONDITION



Lic. # : KW-06011271

Description : 9-FT- Wall "1"

Criteria						
Retained Height	=	9.00 ft				
Wall height above soil	=	0.00 ft				
Slope Behind Wall	=	4.00 : 1				
Height of Soil over Toe	=	18.00 in				
Water height over heel = 0.0 ft						
Vertical component of ac	tive					
Lateral soil pressure opti	ons:					
USED for Soil Pressure.						
USED for Sliding Resistance.						
USED for Over	turning	Resistance.				

Design Summary

Wall Stability Ratios Overturning Sliding	= =	2.68 OK 1.57 OK
Total Bearing Loadresultant ecc.	= =	8,487 lbs 9.14 in
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= = Than	2,491 psf OK 338 psf OK 2,800 psf Allowable
ACI Factored @ Toe	=	2,696 psf
ACI Factored @ Heel	=	366 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	42.0 psi OK
Allowable	=	82.2 psi
Sliding Calcs (Vertical C	ompor	nent Used)
Lateral Sliding Force	=	2,812.7 lbs
less 100% Passive Force	= -	1,012.5 lbs
less 100% Friction Force	= -	3,39 6.0 lbs
Added Force Req'd	=	0.0 lbs OK
for 1.5 : 1 Stability	=	0.0 lbs OK
Load Factors ——— Dead Load Live Load Earth, H Wind, W Seismic, E		1.200 1.600 1.600 1.600 1.600 1.000

Soil Data			Calculations per ACI 318-11, ACI 530-11, IBC 2012,
Allow Soil Bearing =	2,800.0	psf	CBC 2013, ASCE 7-10
Equivalent Fluid Pressure Meth	od		
Heel Active Pressure =	46.0	psf/ft	
Toe Active Pressure =	46.0	psf/ft	
Passive Pressure =	300.0	psf/ft	
Soil Density, Heel	= 125.00	pcf	
Soil Density, Toe	= 125.00	pcf	
Friction Coeff btwn Ftg & Soil =	0.400	•	
Soil height to ignore			
for passive pressure =	= 18.00 i	n	
Stem Construction	_	Top Stem	
Decign Height Above F	ta fi	Stem OK	
Well Meterial Above "	lg [= ⊪"	0.00	
Thicknoss	ll =		
Dobar Sizo	= =	14.00 # 7	
Dobar Spacing	- in -	π / 18.00	
Rebai Spacing Dobar Diacod at		Lleor Spoc	
Design Data	-	User Spec	
fb/FB + fa/Fa	=	0.466	
Total Force @ Section	lbs =	2,898.0	
MomentActual	ft-l =	8,901.0	
MomentAllowable	ft-I =	19,092.0	
ShearActual	psi =	22.0	
ShearAllowable	psi =	82.2	
Wall Weight	psf =	175.0	
Rebar Depth 'd'	in =	11.00	
Lap splice if above	in =	37.57	
Lap splice if below	in =	13.42	
Hook embed into footin	ig in =	13.42	
Concrete Data ———			
fc	psi =	3,000.0	
Fy	psi =		

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Cantilevered Retaining Wall

Lic. # : KW-06011271

Key Distance from Toe

Footing Concrete Density

3,000 psi

f'C =

Min. As %

Cover @ Top

File=H:\4665\CO_THO~2.01-\3D02D~1.BID\35869~1.27S\466~1.EC6 ENERCAL, INC. 1983-2016, Build:6.16.4.15, Ver:6.16.4.15 Licensee : GALLOWAY & COMPANY, INC.

9-FT- Wall "1" Description :

Footing Dimensions & Strengths 1.00 Toe Width = Heel Width 5.00 = **Total Footing Width** = 6.00 Footing Thickness 18.00 = Key Width 0.00 = Key Depth 0.00 =

2.00

engths		Footing Design Res	sults	5
engths = = = = =	1.00 ft 5.00 6.00 18.00 in 0.00 in 0.00 in 0.00 ft 60,000 psi 150 00 pcf	Footing Design Res Factored Pressure Mu': Upward Mu: Downward Mu: Design Actual 1-Way Shear Allow 1-Way Shear Toe Reinforcing Heel Reinforcing Key Reinforcing	= = = = = = =	<u>Toe</u> 2,696 1,283 248 1,036 0.00 82.16 # 7 @ 18.00 in # 7 @ 21.75 in None Spec'd
= = @ Dtm	0.0018	Other Acceptable Size	- s & S	Spacings
₩ BIII	i.≕ 3.00 III			

Toe: Not req'd, Mu < S * Fr

Heel: #4@ 7.25 in, #5@ 11.25 in, #6@ 16.00 in, #7@ 21.75 in, #8@ 28.50 in, #9@ 36

Heel

366 psf

8,901 ft-lb

42.03 psi

82.16 psi

0 ft-lb

0 ft-lb

Key: No key defined

Summary of Overturning & Resisting Forces & Moments

=

Fy =

=

=

Item		0' Force Ibs	VERTURNING. Distance ft	 Moment ft-lb	
Heel Active Pressure	=	3,019.7	3.82	11,533.8	
Surcharge over Heel	=				
Toe Active Pressure	=	-207.0	1.00	-207.0	
Surcharge Over Toe	=				
Adjacent Footing Load	=				
Added Lateral Load	=				
Load @ Stem Above Soil	=				
Total	=	2,812.7	O.T.M. =	11,326.8	
Resisting/Overturning Ratio = 2.68 Vertical Loads used for Soil Pressure = 8,487.4 lbs					
Vertical component of active pressure used for soil pressure					

		RE Force Ibs	SISTING Distance ft	Moment ft-lb
Soil Over Heel	=	4,312.5	4.08	17,609.4
Sloped Soil Over Heel	=	229.6	4.72	1,084.2
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Ster	n =			
Axial Live Load on Stem	=			
Soil Over Toe	=	187.5	0.50	93.8
Surcharge Over Toe	=			
Stem Weight(s)	=	1,575.0	1.58	2,493.8
Earth @ Stem Transition	S =			
Footing Weight	=	1,350.0	3.00	4,050.0
Key Weight	=			
Vert. Component	=	832.8	6.00	4,996.8
Т	otal =	8,487.4 lt	os R.M. =	30,327.9

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

RETAINING WALL "1": 9-FT RETAINED HEIGHT CONDITION



Lic. # : KW-06011271

Description : 10.5-FT- Wall "1"

Criteria					
Retained Height	=	10.50 ft			
Wall height above soil	=	0.00 ft			
Slope Behind Wall	=	3.00 : 1			
Height of Soil over Toe	=	18.00 in			
Water height over heel	=	0.0 ft			
Vertical component of active					
Lateral soil pressure options:					
USED for Soil Pressure.					
USED for Sliding Resistance.					
USED for Over	turning	Resistance.			

Design Summary

=	3.17 OK 1.52 OK
=	13,680 lbs
=	8.74 in
=	2,644 psf OK
=	776 psf OK
=	2,800 psf
Than /	Allowable
=	2,828 psf
=	829 psf
=	0.0 psi OK
=	75.3 psi OK
=	82.2 psi
ompor	nent Used)
=	4,265.3 lbs
= -	1,012.5 lbs
= -	5,47 0.0 lbs
=	0.0 lbs OK
=	0.0 lbs OK
	1.200 1.600 1.600 1.600 1.000
	= = = Than = = = = = = = = = =

Soil Data			Calculations per ACI 318-11, ACI 530-11, IBC 2012,
Allow Soil Bearing =	2,800.0	psf	CBC 2013, ASCE 7-10
Equivalent Fluid Pressure Method	b		
Heel Active Pressure =	46.0	psf/ft	
Toe Active Pressure =	46.0	psf/ft	
Passive Pressure =	300.0	psf/ft	
Soil Density, Heel =	125.00	pcf	
Soil Density, Toe =	125.00	pcf	
Friction Coeff btwn Ftg & Soil =	0.400		
Soil height to ignore			
for passive pressure =	18.00 i	n	
Stem Construction	_	Top Stem	
Decian Height Above Etc		Stem OK	
Wall Material Above "Ut"	4 11=	0.00 Concrete	
	= in -		
Rehar Size		14.00 # 7	
Rebar Spacing	- in –	18.00	
Rebar Placed at	=	Liser Spec	
Design Data		Osci Opec	
fb/FB + fa/Fa	=	0.742	
Total Force @ Section	lbs =	3,974.4	
MomentActual	ft-l =	14,158.8	
MomentAllowable	ft-l =	19,092.0	
ShearActual	psi =	30.1	
ShearAllowable	psi =	82.2	
Wall Weight	psf =	175.0	
Rebar Depth 'd'	in =	11.00	
Lap splice if above	in =	37.57	
Lap splice if below	in =	13.42	
Hook embed into footing	in =	13.42	
Concrete Data ———			
fc	psi =	3,000.0	
Fy	psi =		

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Cantilevered Retaining Wall

Lic. # : KW-06011271

10.5-FT- Wall "1" Description :

Footing Dimensions & Strengths

Toe Width		=	1	.00 ft
Total Footing Widt	h	= -	8	.00
Footing Thickness		=	18.	00 in
Key Width Key Depth Key Distance from	Тое	= = =	0. 0. 0.	00 in 00 in 00 ft
f'c = 3,000 Footing Concrete I Min. As % Cover @ Top	psi Density 2.00	Fy = = @ B	60,0 150 0.00 tm.=	00 psi .00 pcf 18 3.00 in

Footing Design Resu				
		Тое	Heel	
Factored Pressure	=	2,828	829	psf
Mu' : Upward	=	1,372	0	ft-lb
Mu' : Downward	=	248	0	ft-lb
Mu: Design	=	1,125	14,159	ft-lb
Actual 1-Way Shear	=	0.00	75.25	psi
Allow 1-Way Shear	=	82.16	82.16	psi
Toe Reinforcing	=	# 7 @ 18.00 in		•
Heel Reinforcing	=	# 7 @ 21.75 in		
Key Reinforcing	=	None Spec'd		
Other Acceptable Sizes	& S	Spacings		

Toe: Not req'd, Mu < S * Fr Heel: #4@ 7.25 in, #5@ 11.25 in, #6@ 16.00 in, #7@ 21.75 in, #8@ 28.50 in, #9@ 36

Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		O' Force Ibs	VERTURNING Distance ft	 Moment ft-lb	
Hool Activo Prossuro		1 172 2	4.65	20 797 0	
Surchargo over Hool	_	4,472.3	4.05	20,707.9	
Too Active Dressure	=	207.0	1.00	207.0	
Surpharga Quar Taa	=	-207.0	1.00	-207.0	
Suicharge Over Toe	=				
Adjacent Footing Load	=				
Added Lateral Load	=				
Load @ Stem Above Soil	=				
Total	=	4,265.3	0.T.M. =	20,580.9	
Resisting/Overturning Ratio = 3.17 Vertical Loads used for Soil Pressure = 13,680.3 lbs					
Vertical component of active pressure used for soil pressure					

3
9
3
4
)
)
3

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

RETAINING WALL "1": 10.5-FT RETAINED HEIGHT CONDITION



Lic. # : KW-06011271

Description : 12.5-FT- Wall "1"

Criteria Retained Height 12.50 ft = Wall height above soil 0.00 ft = Slope Behind Wall = 3.00:1 Height of Soil over Toe 12.00 in = Water height over heel = 0.0 ft Vertical component of active Lateral soil pressure options: USED for Soil Pressure. USED for Sliding Resistance. USED for Overturning Resistance.

Design Summary		
Wall Stability Ratios Overturning Sliding	= =	3.14 OK 1.55 OK
Total Bearing Loadresultant ecc.	= =	18,319 lbs 8.06 in
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= = Than Al	2,747 psf OK 1,110 psf OK 2,800 psf lowable
ACI Factored @ Toe ACI Factored @ Heel	= =	2,912 psf 1,177 psf
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	2.8 psi OK 68.7 psi OK 82.2 psi
Sliding Calcs (Vertical Co Lateral Sliding Force less 100% Passive Force less 100% Friction Force	ompone = = - = -	ent Used) 6,186.4 lbs 2,250.0 lbs 7,32 0.0 lbs
Added Force Req'd for 1.5 : 1 Stability	= =	0.0 lbs OK 0.0 lbs OK
Load Factors Dead Load Live Load Earth, H Wind, W Seismic, E		1.200 1.600 1.600 1.600 1.600 1.000

Soil Data			Calculations per ACI 318-11,	ACI 530-11, IBC 2012,
Allow Soil Bearing =	2,800.0	psf		CBC 2013, ASCE 7-10
Equivalent Fluid Pressure Method				
Heel Active Pressure =	47.0	psf/ft		
Toe Active Pressure =	47.0	psf/ft		
Passive Pressure =	300.0	psf/ft		
Soil Density, Heel =	125.00	pcf		
Soil Density, Toe =	125.00	pcf		
Friction Coeff btwn Ftg & Soil =	0.400	•		
Soil height to ignore				
for passive pressure =	12.00 ii	n		
Stem Construction		Top Stem		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
I NICKNESS Dobar Sizo	IN =	18.00		
Rebai Size Dobar Spacing	= in –	# / 12.00		
Rebai Spacing Dobar Diacod at		Lisor Spoc		
Design Data		User Spec		
fb/FB + fa/Fa	=	0.629		
Total Force @ Section	lbs =	5,837.4		
MomentActual	ft-l =	24,466.6		
MomentAllowable	ft-l =	38,907.0		
ShearActual	psi =	32.4		
ShearAllowable	psi =	82.2		
Wall Weight	psf =	225.0		
Rebar Depth 'd'	in =	15.00		
Lap splice if above	in =	37.57		
Lap splice if below	in =	13.42		
Hook embed into footing	in =	13.42		
Concrete Data				
f'c	psi =	3,000.0		
Fy	psi =			

Cantilevered Retaining Wall

Lic. # : KW-06011271

Description : 12.5-FT- Wall "1"

Footing Dimensions & Strengths					
Toe Width	=	2.00 ft			
Heel Width	=	7.50			
Total Footing Width	=	9.50			
Footing Thickness	=	24.00 in			
Key Width	=	12.00 in			
Key Depth	=	12.00 in			
Key Distance from Toe	5 =	8.50 ft			
f'c = 3,000 psi	Fy =	60,000 psi			
Footing Concrete Dens	sity =	150.00 pcf			
Min. As %	=	0.0018			
Cover @ Top 2.	00 @ B	tm.= 3.00 in			

Footing Design Resu	ılts	5		
		Тое	Heel	
Factored Pressure	=	2,912	1,177	psf
Mu' : Upward	=	5,581	0	ft-lb
Mu' : Downward	=	1,020	0	ft-lb
Mu: Design	=	4,561	24,467	ft-lb
Actual 1-Way Shear	=	2.76	68.68	psi
Allow 1-Way Shear	=	82.16	82.16	psi
Toe Reinforcing	=	# 7 @ 12.00 in		•
Heel Reinforcing	=	# 7 @ 12.00 in		
Key Reinforcing	=	None Spec'd		
Other Acceptable Sizes	&	Spacings		

Toe: Not req'd, Mu < S * Fr Heel: #4@ 5.25 in, #5@ 8.25 in, #6@ 11.50 in, #7@ 15.75 in, #8@ 20.50 in, #9@ 26. Key: #4@ 12.50 in, #5@ 19.25 in, #6@ 27.25 in, #7@ 37.25 in,

Summary of Overturning & Resisting Forces & Moments

Item		0 Force Ibs	VERTURNING Distance ft	 Moment ft-lb
Heel Active Pressure	=	6.397.9	5.50	35,188,3
Surcharge over Heel	=			,
Toe Active Pressure	=	-211.5	1.00	-211.5
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=			
Total		6 186 4	- ОТМ -	34 976 8
	-	0,100.4	0.1.IVI. –	J4,770.0
Vertical Loads used	Ratio for Sc	il Pressure	= = 18,319.2	3.14 2 lbs
Vertical component of active pressure used for soil pressure				

		RES Force Ibs	SISTING Distance ft	Moment ft-lb		
Soil Over Heel	=	9.375.0	6.50	60.937.5		
Sloped Soil Over Heel	=	750.0	7.50	5.625.0		
Surcharge Over Heel	=			-,		
Adjacent Footing Load	=					
Axial Dead Load on Stem	=					
Axial Live Load on Stem	=					
Soil Over Toe	=	250.0	1.00	250.0		
Surcharge Over Toe	=					
Stem Weight(s)	=	2,812.5	2.75	7,734.4		
Earth @ Stem Transitions	=					
Footing Weight	=	2,850.0	4.75	13,537.5		
Key Weight	=	150.0	9.00	1,350.0		
Vert. Component	=	2,131.7	9.50	20,250.7		
Tota	al =	18,319.2 lb	s R.M. =	109,685.1		
Axial live load NOT included in total displayed, or used for overturning						

overturning resistance, but is included for soil pressure calculation.

RETAINING WALL "1": 12.5-FT RETAINED HEIGHT CONDITION



Cantilevered Retaining Wall

Lic. # : KW-06011271

Description : 6-FT- Wall "2"

Criteria Retained Height 6.00 ft = Wall height above soil 0.00 ft = Slope Behind Wall 0.00:1 = Height of Soil over Toe 18.00 in = Water height over heel 0.0 ft = Vertical component of active Lateral soil pressure options: USED for Soil Pressure. USED for Sliding Resistance. USED for Overturning Resistance.

Surcharge Loads		
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe Used for Sliding & Ove	iliding & = rturning	150.0 psf Overturning 0.0 psf
Axial Load Applied to	Stem	
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in
Design Summary		

Wall Stability Ratios Overturning Sliding	= =	3.02 OK 2.14 OK
Total Bearing Loadresultant ecc.	= =	3,936 lbs 7.79 in
Soil Pressure @ Toe	=	1,632 psf OK
Soil Pressure @ Heel	=	117 psf OK
Allowable	=	2,800 psf
Soil Pressure Less	5 Than A	Ilowable
ACI Factored @ Toe	=	1,958 psf
ACI Factored @ Heel	=	141 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	27.7 psi OK
Allowable	=	82.2 psi
Sliding Calcs (Vertical C	ompone	ent Used)
Lateral Sliding Force	=	1,075.4 lbs
less 100% Passive Force	= -	729.2 lbs
less 100% Friction Force	= -	1,57 0.0 lbs
Added Force Req'd for 1.5 : 1 Stability	=	0.0 lbs OK 0.0 lbs OK
Load Factors ——— Dead Load Live Load Earth, H Wind, W Seismic, E		1.200 1.600 1.600 1.600 1.000

Soil Data				Calculations per ACI	318-11,	ACI 530-11, IBC	2012,
Allow Soil Bearing	= 2,800	.0 psf				CBC 2013, ASC	E 7-10
Heel Active Pressure	= 35	0 nsf/	'ft				
Toe Active Pressure	= 35	0 ps/	'ft				
Passive Pressure	= 300	.0 psf/	'ft				
Soil Density, Heel Soil Density, Toe Friction Coeff btwn Ftg & Soil	= 125.0 = 125.0 = 0.40)0 pcf)0 pcf)0					
Soil height to ignore for passive pressure	= 18.0) in					
Lateral Load Applied to S	item] [/	Adjacent Footing Loa	d		
Lateral Load = Height to Top =	0.0	plf ft		Adjacent Footing Load Footing Width	= =	0.0 lbs 0.00 ft 0.00 ip	
	0.00	' IL		Wall to Ftg CL Dist Footing Type	=	0.00 ft Line Load	
Wind on Exposed Stem =	0.0	psf		Base Above/Below Soil at Back of Wall Poisson's Ratio	=	0.0 ft 0.500	
Stem Construction		Top	Stem				
Design Height Above Wall Material Above Thickness Rebar Size Rebar Spacing Rebar Placed at	Ftg ft "Ht" in in	= C = C = = = Us	Stem OK 0.00 Concrete 12.00 # 5 18.00 ser Spec				
fb/FB + fa/Fa		=	0.390	0			
Total Force @ Section	on Ibs	=	1,348.2)			
MomentActual	ft-l	=	3,194.1				
MomentAllowable	tt-I	=	8,181.0)			
Shear Allowable	psi	=	12.5)			
Silear Allowable	psi	=	δΖ.Ζ 1ΕΟ Ο				
waii weiyni Dobar Dopth 141	psi in	=	100.0)			
Lap splice if above	in	=	21.36)			

9.59

9.59

3,000.0

in =

in =

psi =

psi =

14 OF 19

Lap splice if below

Concrete Data

f'c

Fy

Hook embed into footing

Cantilevered Retaining Wall

Lic. # : KW-06011271

Description : 6-FT- Wall "2"

Footing Dimensions &	Strength	S
Toe Width Heel Width Total Ecoting Width	=	0.67 ft 3.83
Footing Thickness	=	4.50 14.00 in
Key Width Key Depth Key Distance from Toe	= = =	0.00 in 0.00 in 0.00 ft
f'c = 3,000 psi Footing Concrete Density Min. As % Cover @ Top 2.00	Fy = = @ Btr	60,000 psi 150.00 pcf 0.0018 n.= 3.00 in

			_
Footing Design Resu	ults	i	
		Тое	Heel
Factored Pressure	=	1,958	141 psf
Mu' : Upward	=	419	0 ft-lb
Mu' : Downward	=	98	0 ft-lb
Mu: Design	=	322	3,194 ft-lb
Actual 1-Way Shear	=	0.00	27.68 psi
Allow 1-Way Shear	=	82.16	82.16 psi
Toe Reinforcing	=	# 5 @ 18.00 in	•
Heel Reinforcing	=	# 5 @ 18.00 in	
Key Reinforcing	=	None Spec'd	
Other Acceptable Sizes	& S	Spacings	
Toe: Not rea'd. Mu	< 5	5 * Fr	

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

Summary of Overturning & Resisting Forces & Moments

Item		0 Force Ibs	/ERTURNING Distance ft	Moment ft-lb
Heel Active Pressure	=	898.8	2.39	2,147.2
Surcharge over Heel	=	301.0	3.58	1,078.6
Toe Active Pressure	=	-124.4	0.89	-110.6
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=			
Total	=	1,075.4	O.T.M. =	3,115.1
Resisting/Overturning Ratio = 3.02 Vertical Loads used for Soil Pressure = 3,935.6 lbs				

		DE	CICTINO	
		RE Force Ibs	Distance ft	Moment ft-lb
Soil Over Heel	=	2,122.5	3.09	6,547.9
Sloped Soil Over Heel	=			
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Sten	ן =			
Axial Live Load on Stem	=			
Soil Over Toe	=	125.6	0.34	42.1
Surcharge Over Toe	=			
Stem Weight(s)	=	900.0	1.17	1,053.0
Earth @ Stem Transitions	s =			
Footing Weight	=	787.5	2.25	1,771.9
Key Weight	=			
Vert. Component	=		4.50	
То	tal =	3,935.6 lt	os R.M. =	9,414.9
Avial live load NOT inclus	had in to	tal dicplayed a	r used for ave	turning

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

RETAINING WALL "2": 6-FT RETAINED HEIGHT CONDITION



Cantilevered Retaining Wall Lic. # : KW-06011271

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Description : 10-FT- Wall "2"

Criteria						
Retained Height	=	10.00 ft				
Wall height above soil	=	0.00 ft				
Slope Behind Wall	=	0.00 : 1				
Height of Soil over Toe	=	18.00 in				
Water height over heel	=	0.0 ft				
Vertical component of active Lateral soil pressure options:						
USED for Soil I	Pressu	re.				
USED for Sliding Resistance.						
USED for Over	turning	Resistance.				
Surcharge Loads						

Surcharge Loads		
Surcharge Over Heel NOT Used To Resist S Surcharge Over Toe Used for Sliding & Over	liding & = rturning	150.0 psf Overturning 0.0 psf
Axial Load Applied to	Stem	
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in
Design Summary		

Design Summary		
Wall Stability Ratios Overturning Sliding	= =	3.16 OK 1.88 OK
Total Bearing Loadresultant ecc.	= =	9,905 lbs 11.99 in
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= = 5 Than A	2,626 psf OK 203 psf OK 2,800 psf Allowable
ACI Factored @ Toe ACI Factored @ Heel	= =	3,152 psf 244 psf
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	0.0 psi OK 55.8 psi OK 82.2 psi
Sliding Calcs (Vertical C Lateral Sliding Force less 100% Passive Force less 100% Friction Force	ompon = = - = -	ent Used) 2,639.9 lbs 1,012.5 lbs 3,96 0.9 lbs
Added Force Req'd for 1.5 : 1 Stability	= =	0.0 lbs OK 0.0 lbs OK
Load Factors Dead Load Live Load Earth, H Wind, W Seismic, E		1.200 1.600 1.600 1.600 1.000

Soil Data			Calculations per ACI 3	18-11,	ACI 530-11, IBC 2012,
Allow Soil Bearing =	2,800.0 ps	f			CBC 2013, ASCE 7-10
Equivalent Fluid Pressure Method					
Heel Active Pressure =	35.0 ps	f/ft			
Toe Active Pressure =	35.0 ps	f/ft			
Passive Pressure =	300.0 ps	f/ft			
Soil Density, Heel =	125.00 pc	f			
Soil Density, Toe =	125.00 pc	f			
Friction Coeff btwn Ftg & Soil =	0.400				
Soil height to ignore	10.001				
tor passive pressure =	18.00 in				
Lateral Load Applied to Stem	า		Adjacent Footing Loa	d	
Lateral Load =	0.0 plf		Adjacent Footing Load	=	0.0 lbs
Height to Top =	0.00 ft		Footing Width	=	0.00 ft
Height to Bottom =	0.00 ft		Eccentricity	=	0.00 in
			Wall to Fig CL Dist	=	D.UU II bool ood
			Base Above/Below Soil		
	00 (at Back of Wall	=	0.0 ft
wind on Exposed Stem =	0.0 pst		Poisson's Ratio	=	0.500
Stem Construction	To	p Stem			
Stem construction		Stem Ok	<		
Design Height Above Ftg	ft =	0.00)		
Wall Material Above "Ht"	=	Concrete))		
Rebar Size	IN = _	14.00 # 7) 1		
Rebar Spacing	in =	, 16.00)		
Rebar Placed at	= U	ser Spec	2		
Design Data			0		
tb/FB + ta/Fa	=	0.59	2		
I otal Force @ Section	IDS =	3,409.0)		
Momont Allowable	11-1 = ft 1 _	12,001.0)		
Shear Actual	nsi =	21,370.5	7 }		
Shear Allowable	psi =	82 2)		
Wall Weight	psf =	175.0	-)		
Rebar Depth 'd'	in =	11.00)		
Lap splice if above	in =	37.57	7		
Lap splice if below	in =	13.42	2		
Hook embed into footing	in =	13.42	2		
	nci –	3 000 0	1		
Fv	psi = psi =	3,000.0	J		
• 3	P-0 -				

Cantilevered Retaining Wall

Lic. # : KW-06011271

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10-FT- Wall "2" Description :

Footing Dimensions & Strengths

Toe Width		=	0	.6/ ft	
Heel Width		=	6	.33	
Total Footing Width		=	7	.00	
Footing Thickness		=	18.	00 in	
Key Width		=	0.	00 in	
Key Depth		=	0.	00 in	
Key Distance from	Гое	=	0.	00 ft	
f'c = 3,000 p	osi	Fy =	60,0	00 psi	-
Footing Concrete D	ensity	=	150	.00 pct	
Min. As %		=	0.00	18	
Cover @ Top	2.00	@ E	Stm.=	3.00	in

ults					
	Toe	Heel			
=	3,152	244	psf		
=	687	0	İt-lb		
=	111	0	ft-lb		
=	575	12,662 1	ft-lb		
=	0.00	55.80	psi		
=	82.16	82.16	psi		
=	# 7 @ 18.00 in		•		
=	# 7 @ 21.75 in				
=	None Spec'd				
Other Acceptable Sizes & Spacings					
	= = = = = = = = = = 2 & S	JIts <u>Toe</u> = 3,152 = 687 = 111 = 575 = 0.00 = 82.16 = #7 @ 18.00 in = #7 @ 21.75 in = None Spec'd & Spacings	Jlts Toe Heel = 3,152 244 = 687 0 = 111 0 = 575 12,662 = 0.00 55.80 = 82.16 82.16 = # 7 @ 18.00 in = # 7 @ 21.75 in = None Spec'd & Spacings		

Toe: Not req'd, Mu < S * Fr Heel: #4@ 7.25 in, #5@ 11.25 in, #6@ 16.00 in, #7@ 21.75 in, #8@ 28.50 in, #9@ 36

Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		0 Force Ibs	/ERTURNING Distance ft	Moment ft-lb	
Heel Active Pressure	=	2,314.4	3.83	8,871.8	
Surcharge over Heel	=	483.0	5.75	2,777.3	
Toe Active Pressure	=	-157.5	1.00	-157.5	
Surcharge Over Toe	=				
Adjacent Footing Load	=				
Added Lateral Load	=				
Load @ Stem Above Soil	=				
Total	=	2,639.9	0.T.M. =	11,491.5	
Resisting/Overturning Ratio = 3.16 Vertical Loads used for Soil Pressure = 9,904.8 lbs					

		RE Force Ibs	ESISTING Distance ft	Moment ft-lb
Soil Over Heel	=	6,454.2	4.42	28,516.7
Sloped Soil Over Heel	=			
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Stem	=			
Axial Live Load on Stem	=			
Soil Over Toe	=	125.6	0.34	42.1
Surcharge Over Toe	=			
Stem Weight(s)	=	1,750.0	1.25	2,193.3
Earth @ Stem Transitions	=			
Footing Weight	=	1,575.0	3.50	5,512.5
Key Weight	=			
Vert. Component	=		7.00	
Tot	al =	9,904.8 l	bs R.M. =	36,264.6
Avial live lead NOT indud	~ ~ ! ~ + ·	بامميرما مماما مار	ar wood far awa	et un maine en

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

RETAINING WALL "2": 10-FT RETAINED HEIGHT CONDITION

