Cantilevered Retaining Wall

Lic. # : KW-06002811 — DEMITA ENGINEERING

DESCRIPTION: 4' HIGH

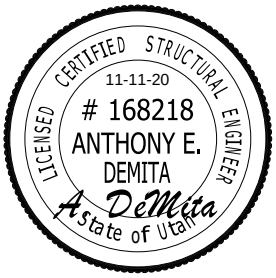
Criteria

Retained Height	=	3.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	30.00 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.		

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.450
Soil height to ignore for passive pressure	=	12.00 in

Calculations per ACI 318-14, ACI 530-11, IBC 2015, CBC 2016, ASCE 7-10



Design Summary

Wall Stability Ratios			
Overturning	=	4.01	OK
Sliding	=	14.12	OK
Total Bearing Load	=	955 lbs	
...resultant ecc.	=	1.37 in	
Soil Pressure @ Toe	=	642 psf	OK
Soil Pressure @ Heel	=	314 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	770 psf	
ACI Factored @ Heel	=	376 psf	
Footing Shear @ Toe	=	0.0 psi	OK
Footing Shear @ Heel	=	3.7 psi	OK
Allowable	=	82.2 psi	
Sliding Calcs (Vertical Component Used)			
Lateral Sliding Force	=	140.0 lbs	
less 100% Passive Force	= -	1,546.9 lbs	
less 100% Friction Force	= -	429.9 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

Stem OK

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	in =	8.00
Rebar Size	=	# 4
Rebar Spacing	in =	16.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	0.062
Total Force @ Section	lbs =	168.0
Moment....Actual	ft-l =	254.3
Moment.....Allowable	ft-l =	4,119.2
Shear.....Actual	psi =	2.2
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25
Lap splice if above	in =	12.00
Lap splice if below	in =	6.00
Hook embed into footing	in =	6.00
Concrete Data		
f'c	psi =	3,000.0
Fy	psi =	

Cantilevered Retaining Wall

Lic. # : KW-06002811 — DEMITA ENGINEERING

DESCRIPTION: 4' HIGH

Footing Dimensions & Strengths

Toe Width	=	0.67 ft
Heel Width	=	1.33
Total Footing Width	=	2.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	770	376 psf
Mu' : Upward	=	163	0 ft-lb
Mu' : Downward	=	114	141 ft-lb
Mu: Design	=	49	141 ft-lb
Actual 1-Way Shear	=	0.00	3.74 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 5 @ 18.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 12.50 in

Other Acceptable Sizes & Spacings

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

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	354.4	1.50	531.6	Soil Over Heel	= 255.4	1.67	426.1
Surcharge over Heel	=				Sloped Soil Over Heel	=		
Toe Active Pressure	=	-214.4	1.17	-250.1	Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	0.34	
					Surcharge Over Toe	=		
					Stem Weight(s)	= 400.0	1.00	401.3
					Earth @ Stem Transitions	=		
Total	=	140.0	O.T.M. =	281.5	Footing Weight	= 300.0	1.00	300.0
					Key Weight	=		
					Vert. Component	=	2.00	
					Total	= 955.4 lbs	R.M. =	1,127.4

Resisting/Overturning Ratio = 4.01
Vertical Loads used for Soil Pressure = 955.4 lbs

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

Cantilevered Retaining Wall

DESCRIPTION: 6' HIGH

Calculations per ACI 318-14, ACI 530-11, IBC 2015, CBC 2016, ASCE 7-10

Criteria

Retained Height	=	5.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	30.00 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.		

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Design Summary

Wall Stability Ratios			
Overturning	=	2.48	OK
Sliding	=	4.63	OK
Total Bearing Load	=	1,857 lbs	
...resultant ecc.	=	5.04 in	
Soil Pressure @ Toe	=	1,139 psf	OK
Soil Pressure @ Heel	=	99 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,366 psf	
ACI Factored @ Heel	=	119 psf	
Footing Shear @ Toe	=	2.0 psi	OK
Footing Shear @ Heel	=	10.6 psi	OK
Allowable	=	82.2 psi	
Sliding Calcs (Vertical Component Used)			
Lateral Sliding Force	=	525.0 lbs	
less 100% Passive Force	= -	1,687.5 lbs	
less 100% Friction Force	= -	742.0 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

Stem OK

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	in =	8.00
Rebar Size	=	# 4
Rebar Spacing	in =	16.00
Rebar Placed at	=	User Spec

Design Data

fb/FB + fa/Fa	=	0.356
Total Force @ Section	lbs =	672.0
Moment....Actual	ft-l =	1,407.0
Moment.....Allowable	ft-l =	3,950.4
Shear.....Actual	psi =	9.3
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.00
Lap splice if above	in =	12.00
Lap splice if below	in =	6.00
Hook embed into footing	in =	6.00

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	

Cantilevered Retaining Wall

Lic. # : KW-06002811 — DEMITA ENGINEERING

DESCRIPTION: 6' HIGH

Footing Dimensions & Strengths

Toe Width	=	1.00 ft
Heel Width	=	2.00
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,366	119 psf
Mu' : Upward	=	614	0 ft-lb
Mu' : Downward	=	255	805 ft-lb
Mu: Design	=	359	805 ft-lb
Actual 1-Way Shear	=	1.96	10.60 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 5 @ 18.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 12.50 in

Other Acceptable Sizes & Spacings

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

Summary of Overturning & Resisting Forces & Moments

Item		OVERTURNING Force lbs	Distance ft	Moment ft-lb		RESISTING Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	739.4	2.17	1,602.0	Soil Over Heel	= 806.7	2.33	1,882.2
Surcharge over Heel	=				Sloped Soil Over Heel	=		
Toe Active Pressure	=	-214.4	1.17	-250.1	Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	0.50	
					Surcharge Over Toe	=		
					Stem Weight(s)	= 600.0	1.33	800.0
					Earth @ Stem Transitions	=		
					Footing Weight	= 450.0	1.50	675.0
					Key Weight	=		
					Vert. Component	=	3.00	
Total	=	525.0	O.T.M. =	1,351.9	Total	= 1,856.7 lbs	R.M. =	3,357.2

Resisting/Overturning Ratio = 2.48
Vertical Loads used for Soil Pressure = 1,856.7 lbs

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

Cantilevered Retaining Wall

DESCRIPTION: 8' HIGH

Calculations per ACI 318-14, ACI 530-11, IBC 2015, CBC 2016, ASCE 7-10

Criteria

Retained Height	=	7.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	30.00 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.		

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Design Summary

Wall Stability Ratios

Overturning	=	2.50	OK
Sliding	=	2.81	OK
Total Bearing Load	=	3,156 lbs	
...resultant ecc.	=	6.48 in	
Soil Pressure @ Toe	=	1,309 psf	OK
Soil Pressure @ Heel	=	177 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,570 psf	
ACI Factored @ Heel	=	212 psf	
Footing Shear @ Toe	=	6.4 psi	OK
Footing Shear @ Heel	=	21.4 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs (Vertical Component Used)

Lateral Sliding Force	=	1,050.0 lbs	
less 100% Passive Force	= -	1,687.5 lbs	
less 100% Friction Force	= -	1,262.5 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

Stem OK

Design Height Above Ftg	ft =	0.00	
Wall Material Above "Ht"	=	Concrete	
Thickness	in =	8.00	
Rebar Size	=	# 5	
Rebar Spacing	in =	14.00	
Rebar Placed at	=	User Spec	

Design Data

fb/FB + fa/Fa	=	0.553
Total Force @ Section	lbs =	1,400.0
Moment....Actual	ft-l =	3,791.7
Moment.....Allowable	ft-l =	6,861.9
Shear.....Actual	psi =	19.4
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.00
Lap splice if above	in =	12.00
Lap splice if below	in =	6.00
Hook embed into footing	in =	6.00

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	

Cantilevered Retaining Wall

Lic. # : KW-06002811 — DEMITA ENGINEERING

DESCRIPTION: 8' HIGH

Footing Dimensions & Strengths

Toe Width	=	1.50 ft
Heel Width	=	2.75
Total Footing Width	=	4.25
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,570	212 psf
Mu' : Upward	=	1,587	0 ft-lb
Mu' : Downward	=	574	2,539 ft-lb
Mu: Design	=	1,013	2,539 ft-lb
Actual 1-Way Shear	=	6.39	21.38 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 5 @ 18.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 12.50 in

Other Acceptable Sizes & Spacings

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

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	1,264.4	2.83	3,582.4	Soil Over Heel	=	1,718.8	3.21	5,514.3
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-214.4	1.17	-250.1	Surcharge Over Heel	=			
Surcharge Over Toe	=				Adjacent Footing Load	=			
Adjacent Footing Load	=				Axial Dead Load on Stem	=			
Added Lateral Load	=				* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=				Soil Over Toe	=		0.75	
					Surcharge Over Toe	=			
					Stem Weight(s)	=	800.0	1.83	1,466.7
					Earth @ Stem Transitions	=			
Total	=	1,050.0	O.T.M. =	3,332.3	Footing Weight	=	637.5	2.13	1,354.7
					Key Weight	=			
					Vert. Component	=		4.25	
					Total	=	3,156.3 lbs	R.M. =	8,335.7

Resisting/Overturning Ratio = 2.50
Vertical Loads used for Soil Pressure = 3,156.3 lbs

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

Cantilevered Retaining Wall

Lic. # : KW-06002811 — DEMITA ENGINEERING

DESCRIPTION: 10' HIGH

Calculations per ACI 318-14, ACI 530-11, IBC 2015, CBC 2016, ASCE 7-10

Criteria

Retained Height	=	9.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	30.00 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.		

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Design Summary

Wall Stability Ratios			
Overturning	=	2.86	OK
Sliding	=	2.19	OK
Total Bearing Load	=	5,160 lbs	
...resultant ecc.	=	6.41 in	
Soil Pressure @ Toe	=	1,398 psf	OK
Soil Pressure @ Heel	=	397 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,678 psf	
ACI Factored @ Heel	=	476 psf	
Footing Shear @ Toe	=	11.7 psi	OK
Footing Shear @ Heel	=	36.7 psi	OK
Allowable	=	82.2 psi	
Sliding Calcs (Vertical Component Used)			
Lateral Sliding Force	=	1,715.0 lbs	
less 100% Passive Force	= -	1,687.5 lbs	
less 100% Friction Force	= -	2,060.2 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

Stem OK

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	in =	10.00
Rebar Size	=	# 5
Rebar Spacing	in =	10.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	0.600
Total Force @ Section	lbs =	2,352.0
Moment....Actual	ft-l =	7,856.3
Moment.....Allowable	ft-l =	13,093.5
Shear.....Actual	psi =	23.9
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	125.0
Rebar Depth 'd'	in =	8.19
Lap splice if above	in =	12.82
Lap splice if below	in =	6.00
Hook embed into footing	in =	6.00
Concrete Data		
f'c	psi =	3,000.0
Fy	psi =	

Cantilevered Retaining Wall

Lic. # : KW-06002811 — DEMITA ENGINEERING

DESCRIPTION: 10' HIGH

Footing Dimensions & Strengths

Toe Width	=	2.00 ft
Heel Width	=	3.75
Total Footing Width	=	5.75
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,678	476	psf
Mu' : Upward	=	3,077	0	ft-lb
Mu' : Downward	=	1,020	6,099	ft-lb
Mu: Design	=	2,057	6,099	ft-lb
Actual 1-Way Shear	=	11.68	36.69	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 5 @ 18.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 12.50 in

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: #4@ 11.75 in, #5@ 18.25 in, #6@ 25.75 in, #7@ 35.25 in, #8@ 46.25 in, #9@ 4
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb			.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	1,929.4	3.50	6,752.8	Soil Over Heel	=	3,047.9	4.29	13,080.6
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-214.4	1.17	-250.1	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	=		1.00	
					Surcharge Over Toe	=			
					Stem Weight(s)	=	1,250.0	2.42	3,020.8
					Earth @ Stem Transitions	=			
					Footing Weight	=	862.5	2.88	2,479.7
					Key Weight	=			
					Vert. Component	=		5.75	
Total	=	1,715.0	O.T.M. =	6,502.7		Total =	5,160.4 lbs	R.M. =	18,581.2

Resisting/Overturning Ratio = 2.86
Vertical Loads used for Soil Pressure = 5,160.4 lbs

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

Cantilevered Retaining Wall

DESCRIPTION: 12' HIGH

Calculations per ACI 318-14, ACI 530-11, IBC 2015, CBC 2016, ASCE 7-10

Criteria

Retained Height	=	11.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	30.00 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.

Soil Data

Allow Soil Bearing	=	1,504.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Design Summary

Wall Stability Ratios

Overturning	=	3.51	OK
Sliding	=	1.93	OK
Total Bearing Load	=	7,933 lbs	
...resultant ecc.	=	4.18 in	
Soil Pressure @ Toe	=	1,300 psf	OK
Soil Pressure @ Heel	=	748 psf	OK
Allowable	=	1,504 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,559 psf	
ACI Factored @ Heel	=	897 psf	
Footing Shear @ Toe	=	17.1 psi	OK
Footing Shear @ Heel	=	62.1 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs (Vertical Component Used)

Lateral Sliding Force	=	2,520.0 lbs	
less 100% Passive Force	= -	1,687.5 lbs	
less 100% Friction Force	= -	3,178.0 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

Stem OK

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	in =	10.00
Rebar Size	=	# 5
Rebar Spacing	in =	6.00
Rebar Placed at	=	User Spec

Design Data

fb/FB + fa/Fa	=	0.663
Total Force @ Section	lbs =	3,528.0
Moment....Actual	ft-l =	14,049.0
Moment.....Allowable	ft-l =	21,177.0
Shear.....Actual	psi =	35.9
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	125.0
Rebar Depth 'd'	in =	8.20
Lap splice if above	in =	14.17
Lap splice if below	in =	6.18
Hook embed into footing	in =	6.18

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	

Cantilevered Retaining Wall

Lic. # : KW-06002811 — DEMITA ENGINEERING

DESCRIPTION: 12' HIGH

Footing Dimensions & Strengths

Toe Width	=	2.75 ft
Heel Width	=	5.00
Total Footing Width	=	7.75
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,559	897	psf
Mu' : Upward	=	5,601	0	ft-lb
Mu' : Downward	=	1,928	0	ft-lb
Mu: Design	=	3,672	14,049	ft-lb
Actual 1-Way Shear	=	17.06	62.06	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 5 @ 18.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 12.50 in

Other Acceptable Sizes & Spacings

Toe: #4@ 13.25 in, #5@ 20.50 in, #6@ 29.00 in, #7@ 39.25 in, #8@ 48.25 in, #9@ 4
Heel: #4@ 6.50 in, #5@ 10.00 in, #6@ 14.00 in, #7@ 19.00 in, #8@ 25.00 in, #9@ 31
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb			.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	2,734.4	4.17	11,393.2	Soil Over Heel	=	5,270.8	5.67	29,868.1
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-214.4	1.17	-250.1	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	=		1.38	
					Surcharge Over Toe	=			
					Stem Weight(s)	=	1,500.0	3.17	4,750.0
					Earth @ Stem Transitions	=			
					Footing Weight	=	1,162.5	3.88	4,504.7
					Key Weight	=			
					Vert. Component	=		7.75	
Total	=	2,520.0	O.T.M. =	11,143.1	Total	=	7,933.3 lbs	R.M. =	39,122.7

Resisting/Overturning Ratio = 3.51
Vertical Loads used for Soil Pressure = 7,933.3 lbs

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

General Footing

DESCRIPTION: ELEVATOR FTG

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	Yes
Use Pedestal wt for stability, mom & shear	:	Yes

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	0.50	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

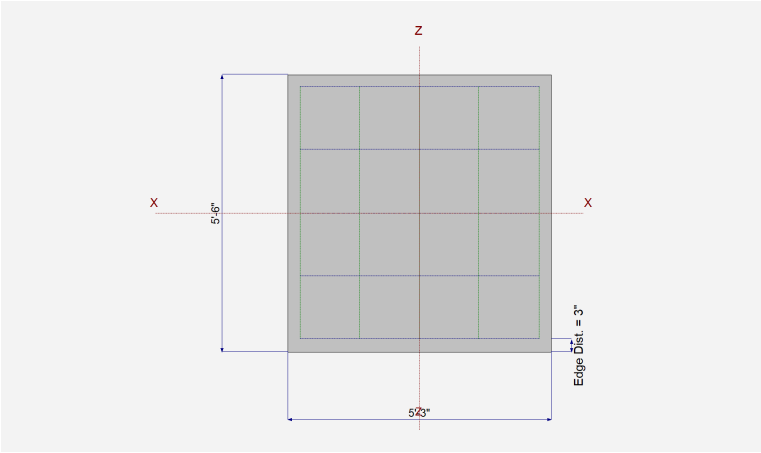
Width parallel to X-X Axis	=	5.250	ft
Length parallel to Z-Z Axis	=	5.50	ft
Footing Thickness	=	12.0	in

Pedestal dimensions...

px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0	in



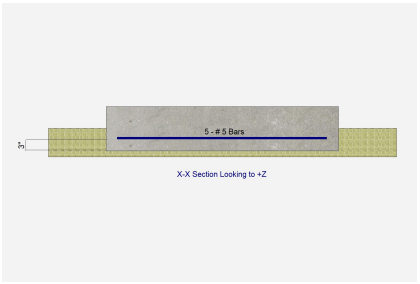
Reinforcing

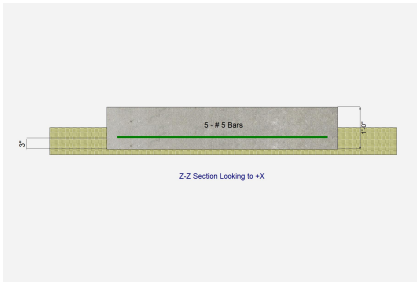
Bars parallel to X-X Axis			
Number of Bars	=		5.0
Reinforcing Bar Size	=	#	5
Bars parallel to Z-Z Axis			
Number of Bars	=		5.0
Reinforcing Bar Size	=	#	5

Bandwidth Distribution Check (ACI 15.4.4.2)
Direction Requiring Closer Separation

Bars along X-X Axis

# Bars required within zone	97.7 %
# Bars required on each side of zone	2.3 %





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.0		1.0					k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

General Footing

DESCRIPTION: ELEVATOR FTG

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.1890	Soil Bearing	0.2835 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.05608	Z Flexure (+X)	0.6205 k-ft/ft	11.063 k-ft/ft	+1.20D+1.60L
PASS	0.05608	Z Flexure (-X)	0.6205 k-ft/ft	11.063 k-ft/ft	+1.20D+1.60L
PASS	0.05884	X Flexure (+Z)	0.6810 k-ft/ft	11.573 k-ft/ft	+1.20D+1.60L
PASS	0.05884	X Flexure (-Z)	0.6810 k-ft/ft	11.573 k-ft/ft	+1.20D+1.60L
PASS	0.03836	1-way Shear (+X)	3.152 psi	82.158 psi	+1.20D+1.60L
PASS	0.03836	1-way Shear (-X)	3.152 psi	82.158 psi	+1.20D+1.60L
PASS	0.04019	1-way Shear (+Z)	3.302 psi	82.158 psi	+1.20D+1.60L
PASS	0.04019	1-way Shear (-Z)	3.302 psi	82.158 psi	+1.20D+1.60L
PASS	0.09576	2-way Punching	15.735 psi	164.317 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.50	n/a	0.0	0.2489	0.2489	n/a	n/a	0.166
X-X, +D+L	1.50	n/a	0.0	0.2835	0.2835	n/a	n/a	0.189
X-X, +D+0.750L	1.50	n/a	0.0	0.2749	0.2749	n/a	n/a	0.183
X-X, +0.60D	1.50	n/a	0.0	0.1493	0.1493	n/a	n/a	0.100
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.2489	0.2489	0.166
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	0.2835	0.2835	0.189
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	0.2749	0.2749	0.183
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.1493	0.1493	0.100

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.550	+Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +1.40D	0.550	-Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +1.20D+1.60L	0.6810	+Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +1.20D+1.60L	0.6810	-Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +1.20D+L	0.6024	+Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +1.20D+L	0.6024	-Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +1.20D	0.4714	+Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +1.20D	0.4714	-Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +0.90D	0.3536	+Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
X-X, +0.90D	0.3536	-Z	Bottom	0.2592	Min Temp %	0.2952	11.573	OK
Z-Z, +1.40D	0.5011	-X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +1.40D	0.5011	+X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +1.20D+1.60L	0.6205	-X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +1.20D+1.60L	0.6205	+X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +1.20D+L	0.5489	-X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +1.20D+L	0.5489	+X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK

General Footing

DESCRIPTION: ELEVATOR FTG

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.4295	-X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +1.20D	0.4295	+X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +0.90D	0.3222	-X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK
Z-Z, +0.90D	0.3222	+X	Bottom	0.2592	Min Temp %	0.2818	11.063	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.55 psi	2.55 psi	2.67 psi	2.67 psi	2.67 psi	82.16 psi	0.03	OK
+1.20D+1.60L	3.15 psi	3.15 psi	3.30 psi	3.30 psi	3.30 psi	82.16 psi	0.04	OK
+1.20D+L	2.79 psi	2.79 psi	2.92 psi	2.92 psi	2.92 psi	82.16 psi	0.04	OK
+1.20D	2.18 psi	2.18 psi	2.29 psi	2.29 psi	2.29 psi	82.16 psi	0.03	OK
+0.90D	1.64 psi	1.64 psi	1.71 psi	1.71 psi	1.71 psi	82.16 psi	0.02	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	12.71 psi	164.32 psi	0.07734	OK
+1.20D+1.60L	15.74 psi	164.32 psi	0.09576	OK
+1.20D+L	13.92 psi	164.32 psi	0.08471	OK
+1.20D	10.89 psi	164.32 psi	0.0663	OK
+0.90D	8.17 psi	164.32 psi	0.04972	OK