ANNÉE STRUCTURAL ENGINEERING, LLC

Structural Calculations

(Response to Review Corrections)

Project:

Mounger Residence

4006 E. Mercer Way
Mercer Island, WA 98040

For:

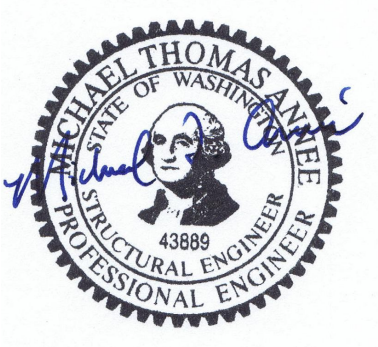
Sturman Architects
9 - 103rd Ave SE, Suite 203
Bellevue, WA 98004

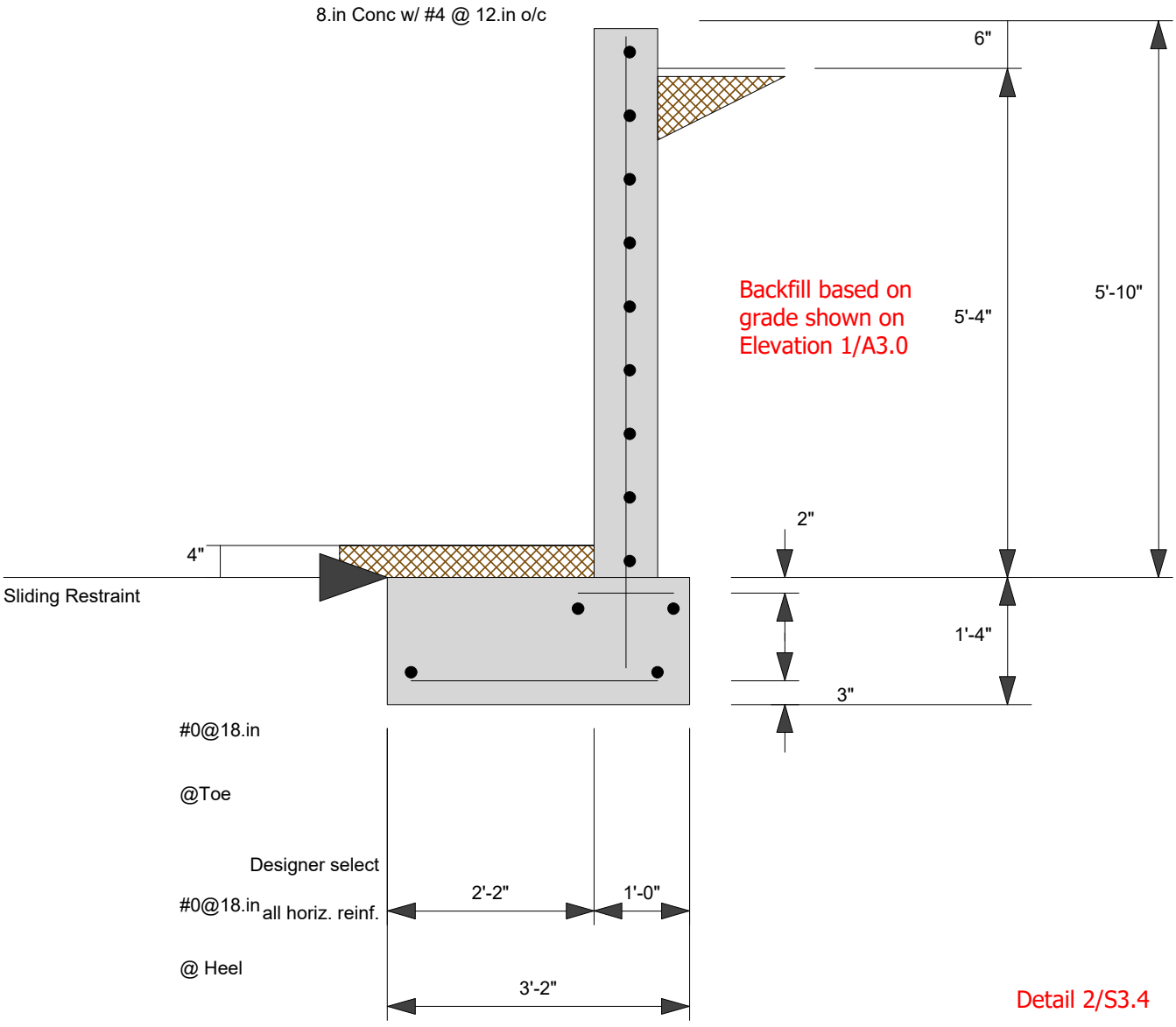
By:

Année Structural Engineering, LLC
1801 18th Ave S
Seattle, WA 98144

Date:

August 29, 2022

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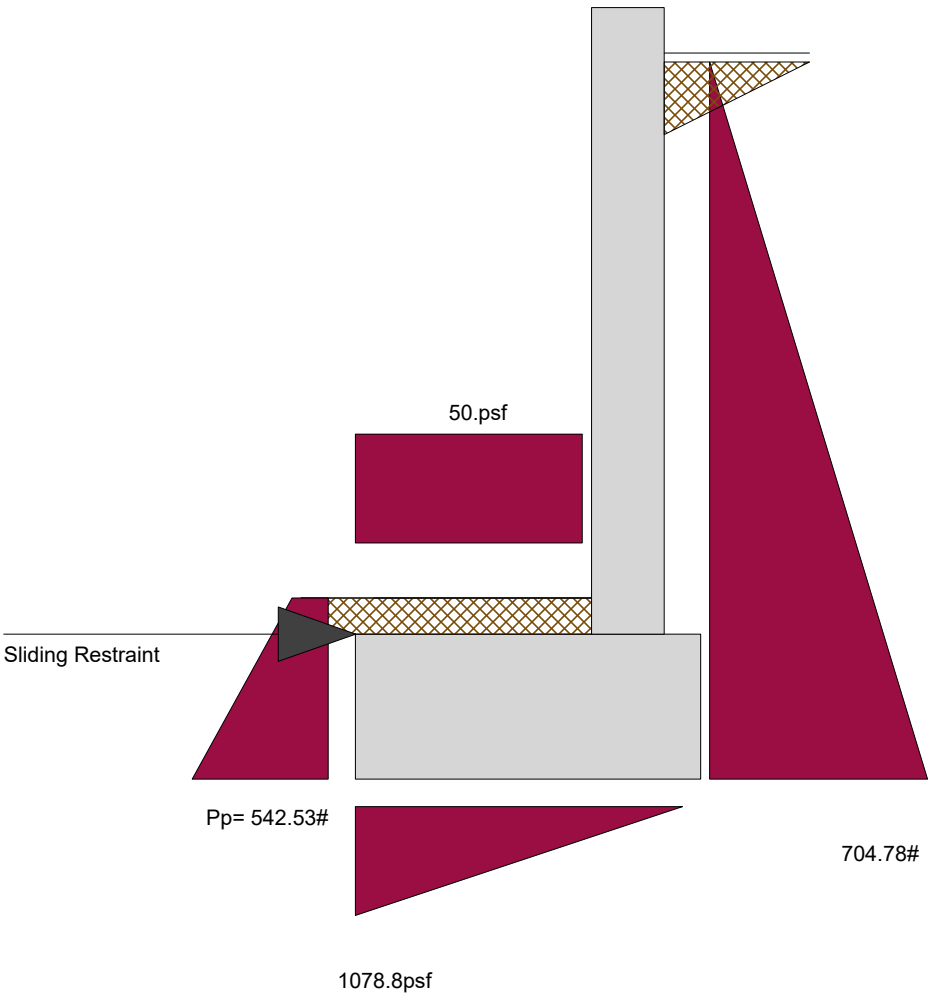
6"
Backfill based on grade shown on Elevation 1/A3.0
5'-4"
5'-10"
2"
4"
Sliding Restraint
1'-4"
3"
#0@18.in
@Toe
Designer select
#0@18.in all horiz. reinf.
@ Heel
2'-2"
1'-0"
3'-2"
Detail 2/S3.4


50.psf
Sliding Restraint
Pp= 542.53#
704.78#
1078.8psf

Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341
Licensee : Annee Structural Engineering LLC

Description : South basement entry wasll

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	5.33 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Vertical component of active
Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 plf
...Height to Top	=	5.33 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.97	OK
Sliding	=	1.58	OK
Slab Resists All Sliding !			
Total Bearing Load	=	1,625 lbs	
...resultant ecc.	=	6.95 in	
Soil Pressure @ Toe	=	1,079 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,295 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	5.0 psi	OK
Footing Shear @ Heel	=	2.1 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	704.8 lbs
less 100% Passive Force	= -	542.5 lbs
less 100% Friction Force	= -	568.8 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 =	12.00
Rebar Placed at	=	Center
Design Data		
fb/FB + fa/Fa	=	**0.417**
Total Force @ Section	lbs =	785.5
Moment....Actual	ft-l =	1,414.0
Moment.....Allowable	ft-l =	3,387.6
Shear.....Actual	psi =	16.4
Shear.....Allowable	psi =	75.0
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	4.00
Lap splice if above	in =	18.72
Lap splice if below	in =	8.40
Hook embed into footing	in =	8.40
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	

Cantilevered Retaining Wall

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ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341
Licensee : Annee Structural Engineering LLC

Description : South basement entry wasll

Footing Dimensions & Strengths

Toe Width	=	2.17 ft
Heel Width	=	1.00
Total Footing Width	=	3.17
Footing Thickness	=	16.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,295	0	psf
Mu' : Upward	=	0	0	ft-lb
Mu' : Downward	=	0	56	ft-lb
Mu: Design	=	1,414	56	ft-lb
Actual 1-Way Shear	=	5.02	2.07	psi
Allow 1-Way Shear	=	75.00	75.00	psi
Toe Reinforcing	=	None Spec'd		
Heel Reinforcing	=	None Spec'd		
Key Reinforcing	=	None Spec'd		

Other Acceptable Sizes & Spacings

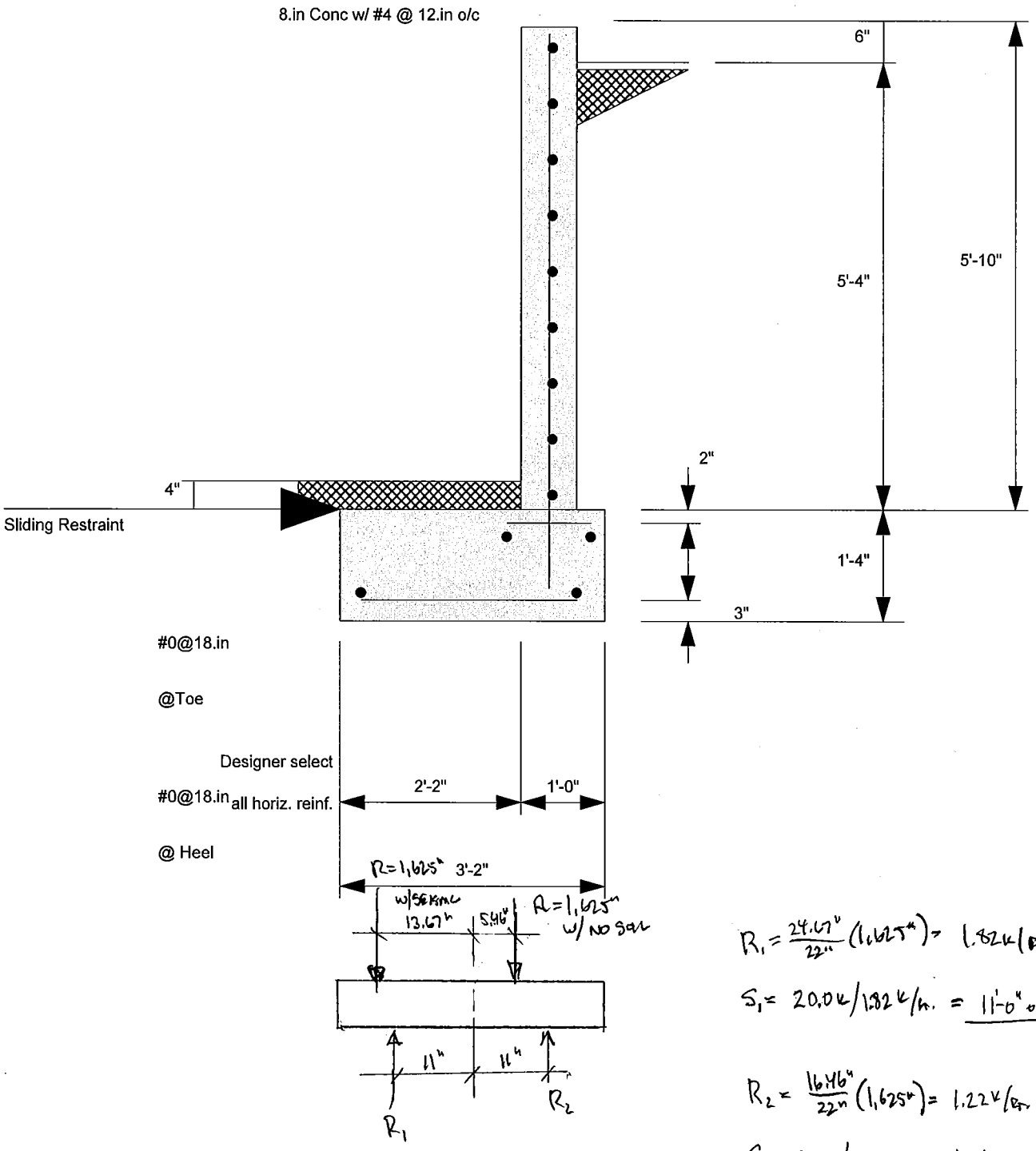
Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb			.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Item									
Heel Active Pressure	=	777.7	2.22	1,728.1	Soil Over Heel	=	213.3	3.00	640.0
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-48.6	0.56	-27.0	Surcharge Over Heel	=			
Surcharge Over Toe	=	-24.3	0.83	-20.3	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	=	86.7	1.08	93.9
					Surcharge Over Toe	=	108.4	1.08	117.4
					Stem Weight(s)	=	583.3	2.50	1,458.4
					Earth @ Stem Transitions	=			
					Footing Weight	=	633.4	1.58	1,003.0
					Key Weight	=			
					Vert. Component	=			
Total	=	704.8	**O.T.M.** =	1,680.9	**Total =**		1,625.1 lbs	**R.M. =**	3,312.8

Resisting/Overturning Ratio = **1.97**
Vertical Loads used for Soil Pressure = 1,625.1 lbs

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

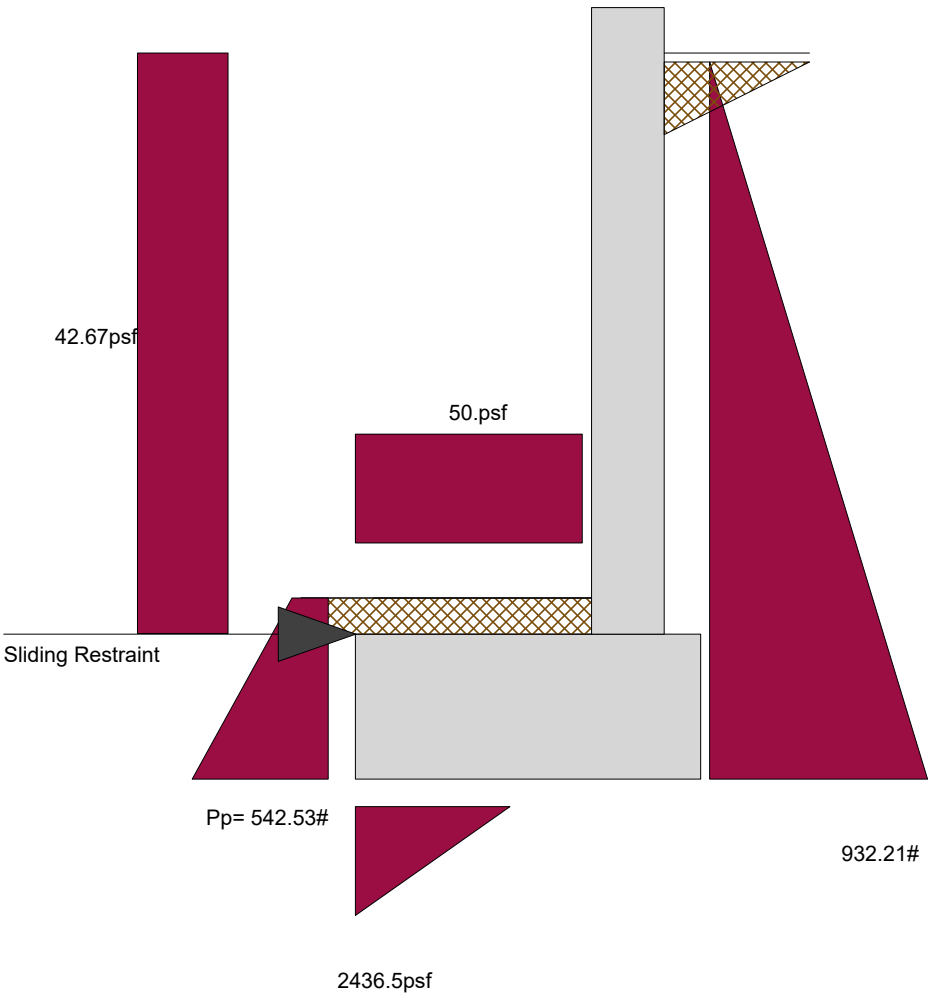


$R_1 = \frac{24.67"}{22"}(1{,}625\#) = 1.82 k/ft$

$S_1 = 20.0k / 1.82 k/ft. = \underline{11'-0" oc}$ (4" ϕ PILES)

$R_2 = \frac{16.46"}{22"}(1{,}625\#) = 1.22 k/ft.$

$S_2 = 20.0 / 1.22 = \underline{16'-5" oc}$ (4" ϕ PILES)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Project Title:
Engineer:
Project Descr:

Project ID:

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : South basement entry wasll

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	5.33 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Vertical component of active
Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	42.7 plf
...Height to Top	=	5.33 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.28	Ratio < 1.5!
Sliding	=	1.19	Ratio < 1.5!
Slab Resists All Sliding !			
Total Bearing Load	=	1,625 lbs	
...resultant ecc.	=	13.67 in	
Soil Pressure @ Toe	=	2,437 psf	NG
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Exceeds Allowable!			
ACI Factored @ Toe	=	2,924 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	9.8 psi	OK
Footing Shear @ Heel	=	2.1 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	932.2 lbs
less 100% Passive Force	= -	542.5 lbs
less 100% Friction Force	= -	568.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	287.0 lbs NG

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 =	12.00
Rebar Placed at	=	Center
Design Data		
fb/FB + fa/Fa	=	**0.596**
Total Force @ Section	lbs =	1,012.9
Moment....Actual	ft-l =	2,020.1
Moment.....Allowable	ft-l =	3,387.6
Shear.....Actual	psi =	21.1
Shear.....Allowable	psi =	75.0
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	4.00
Lap splice if above	in =	18.72
Lap splice if below	in =	8.40
Hook embed into footing	in =	8.40
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	

Factor of Safety for Seismic loading is 1.2 per geotech and soil bearing pressure has a 1/3 increase for seismic loads per geotech. This is typical at wall calculations.

Cantilevered Retaining Wall

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Lic. # : KW-06009341
Licensee : Annee Structural Engineering LLC

Description : South basement entry wasll

Footing Dimensions & Strengths

Toe Width	=	2.17 ft
Heel Width	=	1.00
Total Footing Width	=	3.17
Footing Thickness	=	16.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,924	0	psf
Mu' : Upward	=	0	0	ft-lb
Mu' : Downward	=	0	56	ft-lb
Mu: Design	=	2,020	56	ft-lb
Actual 1-Way Shear	=	9.80	2.07	psi
Allow 1-Way Shear	=	75.00	75.00	psi
Toe Reinforcing	=	None Spec'd		
Heel Reinforcing	=	None Spec'd		
Key Reinforcing	=	None Spec'd		

Other Acceptable Sizes & Spacings

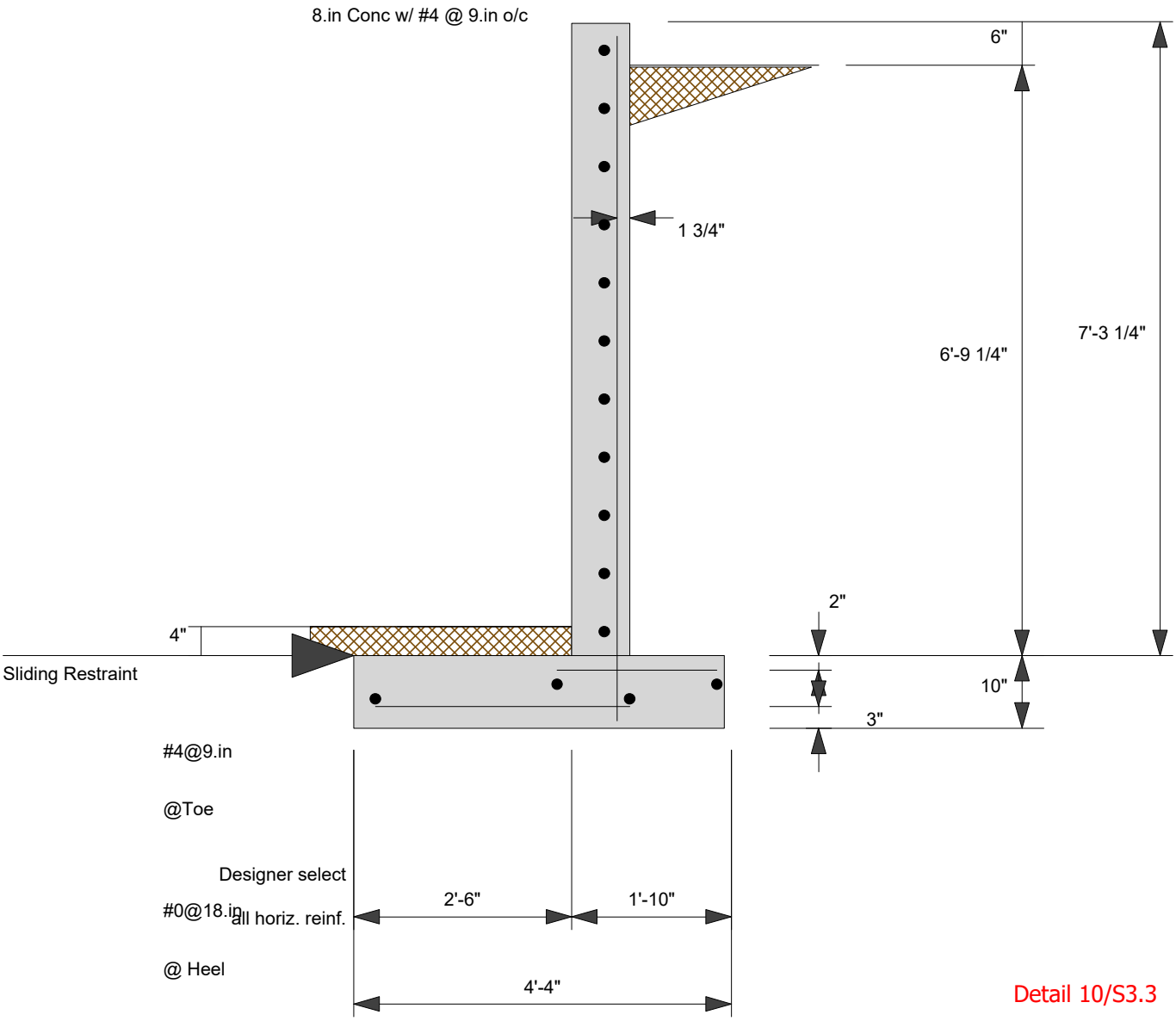
Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

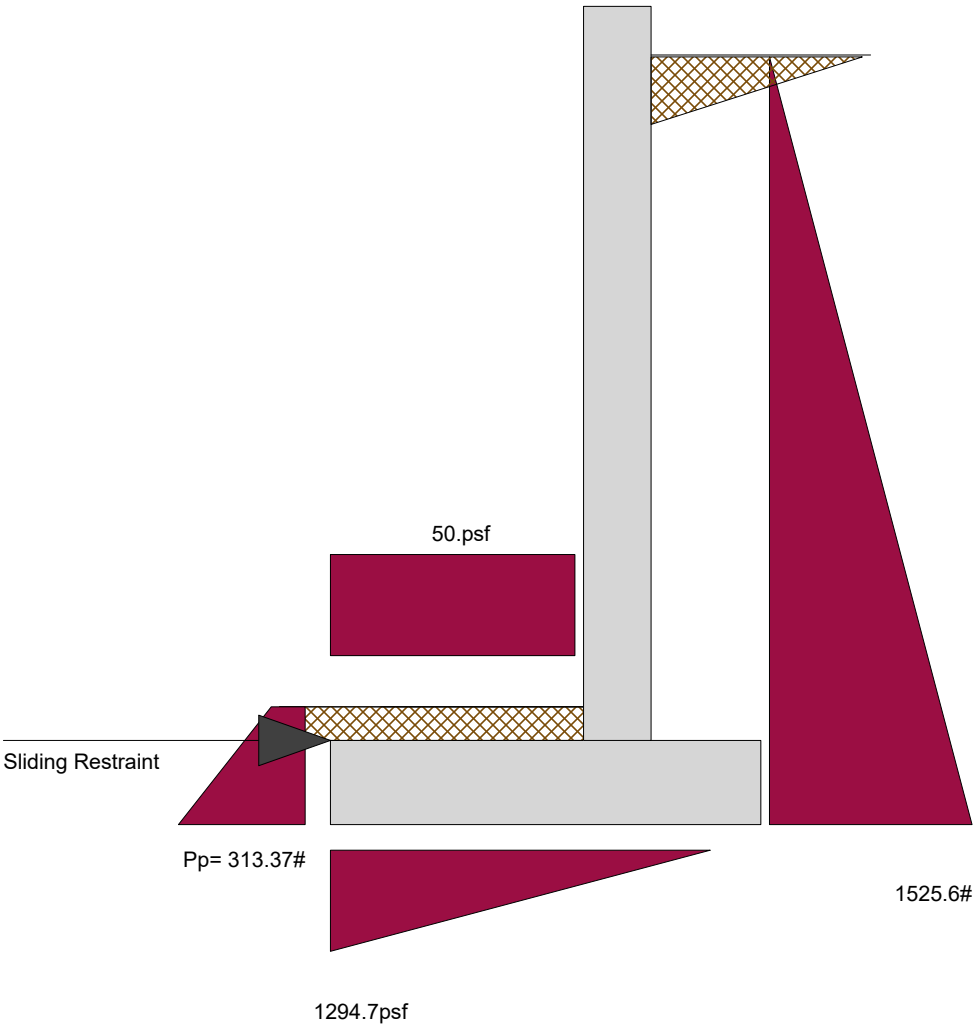
		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb			.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Item									
Heel Active Pressure	=	777.7	2.22	1,728.1	Soil Over Heel	=	213.3	3.00	640.0
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-48.6	0.56	-27.0	Surcharge Over Heel	=			
Surcharge Over Toe	=	-24.3	0.83	-20.3	Adjacent Footing Load	=			
Adjacent Footing Load	=				Axial Dead Load on Stem	=			
Added Lateral Load	=	227.4	4.00	909.3	* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=				Soil Over Toe	=	86.7	1.08	93.9
					Surcharge Over Toe	=	108.4	1.08	117.4
					Stem Weight(s)	=	583.3	2.50	1,458.4
					Earth @ Stem Transitions	=			
					Footing Weight	=	633.4	1.58	1,003.0
					Key Weight	=			
					Vert. Component	=			
Total	=	932.2	**O.T.M.** =	2,590.2	**Total =**		1,625.1 lbs	**R.M. =**	3,312.8

Resisting/Overturning Ratio = **1.28**
Vertical Loads used for Soil Pressure = 1,625.1 lbs

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



Detail 10/S3.3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Project Title:
Engineer:
Project Descr:

Project ID:

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 5' landscape wall - west of garage - 10/S3.3

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	6.77 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Vertical component of active
Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	55.0 psf/ft
Toe Active Pressure	=	55.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

55 pcf for this particular slope per geotech.

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 plf
...Height to Top	=	6.77 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.77	OK
Sliding	=	0.77	UNSTABLE!
Slab Resists All Sliding !			
Total Bearing Load	=	2,441 lbs	
...resultant ecc.	=	10.91 in	
Soil Pressure @ Toe	=	1,295 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,554 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	21.5 psi	OK
Footing Shear @ Heel	=	14.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	1,525.6 lbs	
less 100% Passive Force	= -	313.4 lbs	
less 100% Friction Force	= -	850.0 lbs	
Added Force Req'd	=	357.9 lbs	NG
....for 1.5 : 1 Stability	=	1,120.7 lbs	NG

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 =	9.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.639**
Total Force @ Section	lbs =	1,999.5
Moment....Actual	ft-l =	4,548.3
Moment.....Allowable	ft-l =	7,122.4
Shear.....Actual	psi =	26.7
Shear.....Allowable	psi =	75.0
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25
Lap splice if above	in =	18.72
Lap splice if below	in =	6.00
Hook embed into footing	in =	6.00
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	

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Title Block Line 6

Project Title:
Engineer:
Project Descr:

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ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 5' landscape wall - west of garage - 10/S3.3

Footing Dimensions & Strengths

Toe Width	=	2.50 ft
Heel Width	=	1.83
Total Footing Width	=	4.33
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,554	0	psf
Mu' : Upward	=	3,782	0	ft-lb
Mu' : Downward	=	869	765	ft-lb
Mu: Design	=	2,913	765	ft-lb
Actual 1-Way Shear	=	21.50	14.58	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

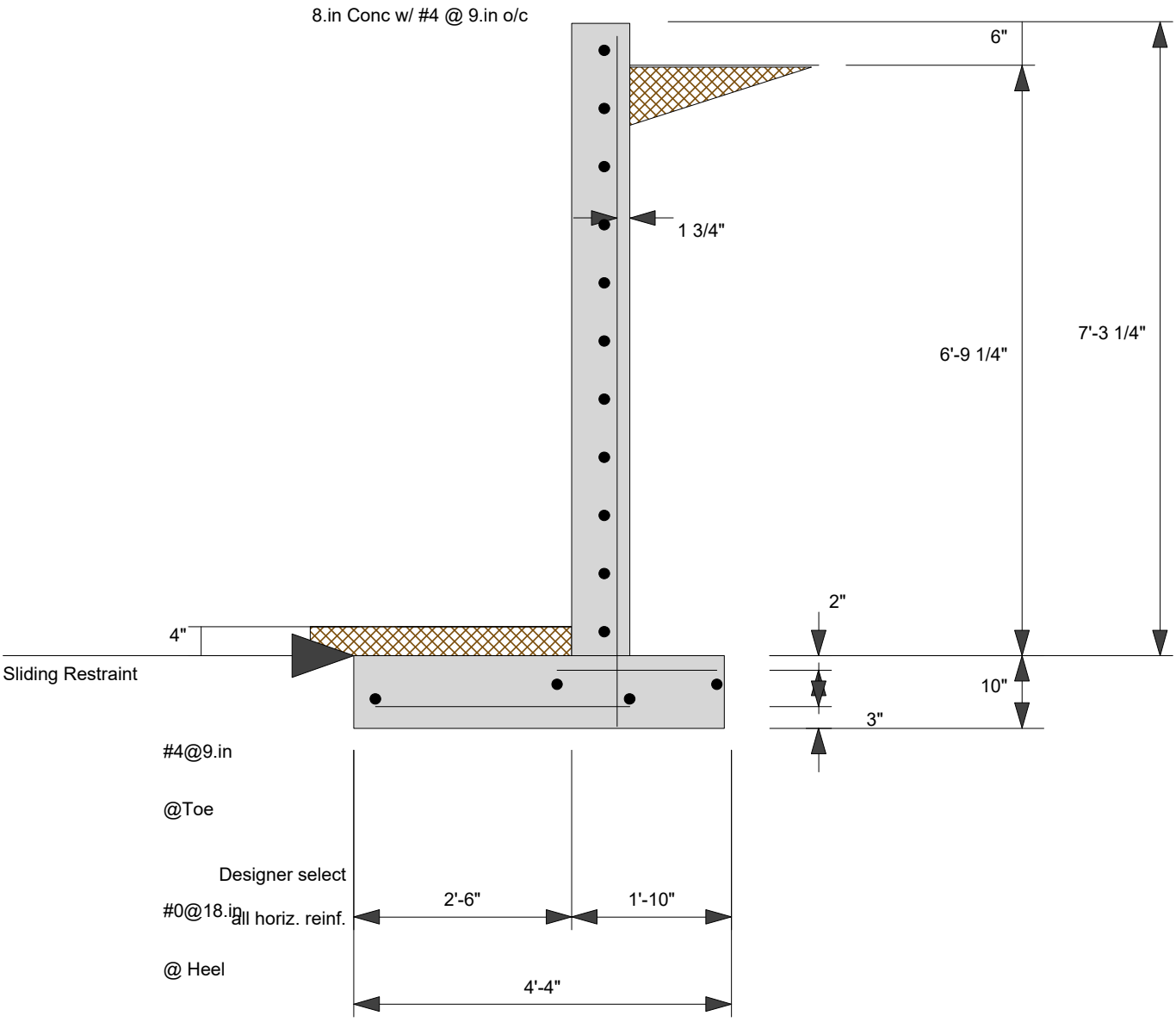
Toe: #4@ 17.25 in, #5@ 26.50 in, #6@ 37.75 in, #7@ 48.25 in, #8@ 48.25 in, #9@ 4
Heel: Not req'd, Mu < S * Fr
Key: No key defined

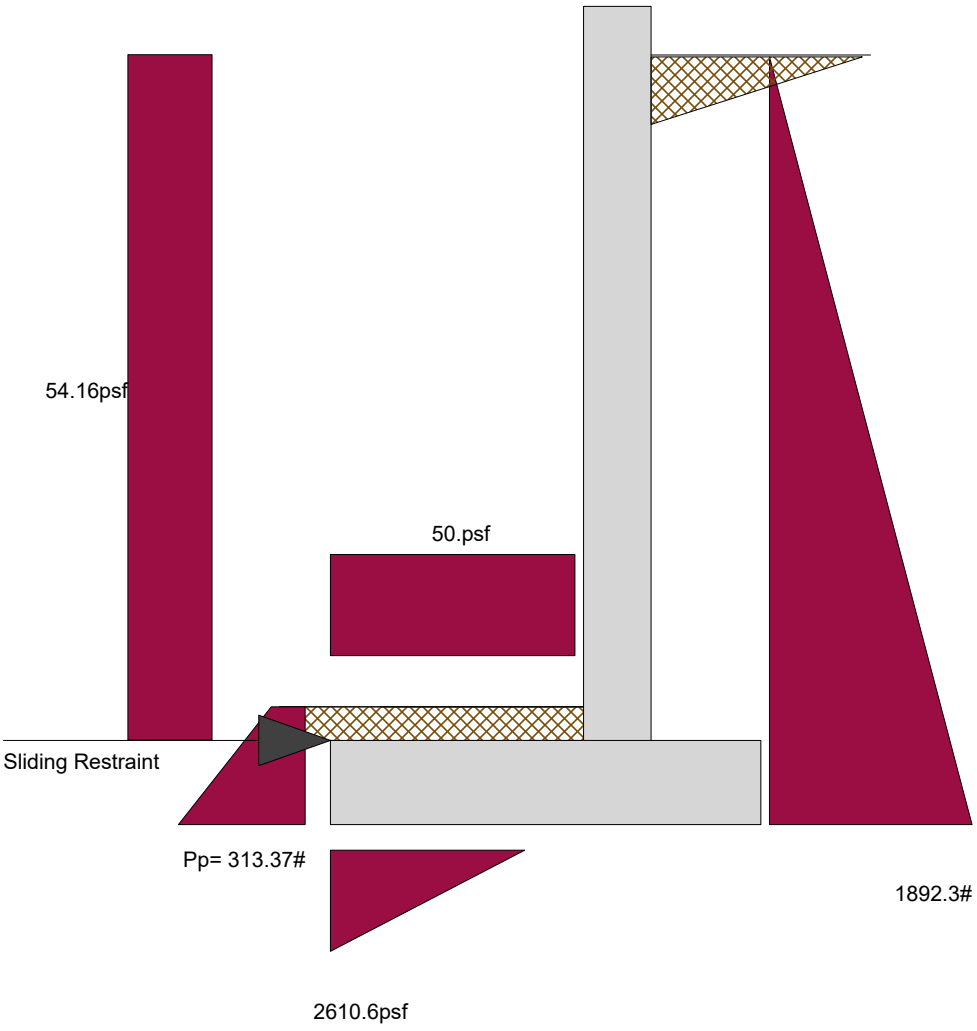
Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	1,589.8	2.53	4,029.2	Soil Over Heel	= 947.5	3.75	3,553.1
Surcharge over Heel	=				Sloped Soil Over Heel	=		
Toe Active Pressure	=	-37.4	0.39	-14.6	Surcharge Over Heel	=		
Surcharge Over Toe	=	-26.7	0.58	-15.6	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	= 100.0	1.25	125.0
					Surcharge Over Toe	= 125.0	1.25	156.3
					Stem Weight(s)	= 727.0	2.83	2,059.8
					Earth @ Stem Transitions	=		
					Footing Weight	= 541.6	2.17	1,173.4
					Key Weight	=		
					Vert. Component	=		
Total	=	1,525.6	**O.T.M.** =	3,999.1	**Total =**	2,441.2 lbs	**R.M. =**	7,067.6

Resisting/Overturning Ratio = **1.77**
Vertical Loads used for Soil Pressure = 2,441.2 lbs

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


8.in Conc w/ #4 @ 9.in o/c
6"
1 3/4"
7'-3 1/4"
6'-9 1/4"
2"
4"
Sliding Restraint
10"
3"
#4@9.in
@Toe
Designer select
#0@18.in
all horiz. reinf.
@ Heel
2'-6"
1'-10"
4'-4"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Project Title:
Engineer:
Project Descr:

Project ID:

Printed: 27 AUG 2022, 1:02PM

Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 5' landscape wall - west of garage - 10/S3.3

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	6.77 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Vertical component of active
Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	55.0 psf/ft
Toe Active Pressure	=	55.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	54.2 plf
...Height to Top	=	6.77 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.27	Ratio < 1.5!
Sliding	=	0.62	UNSTABLE!
Slab Resists All Sliding !			
Total Bearing Load	=	2,441 lbs	
...resultant ecc.	=	18.52 in	
Soil Pressure @ Toe	=	2,611 psf	NG
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Exceeds Allowable!			
ACI Factored @ Toe	=	3,133 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	30.2 psi	OK
Footing Shear @ Heel	=	14.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	1,892.3 lbs
less 100% Passive Force	= -	313.4 lbs
less 100% Friction Force	= -	850.0 lbs
Added Force Req'd	=	724.5 lbs NG
....for 1.5 : 1 Stability	=	1,670.7 lbs NG

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 =	9.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.813**
Total Force @ Section	lbs =	2,366.2
Moment....Actual	ft-l =	5,789.5
Moment.....Allowable	ft-l =	7,122.4
Shear.....Actual	psi =	31.5
Shear.....Allowable	psi =	75.0
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25
Lap splice if above	in =	18.72
Lap splice if below	in =	6.76
Hook embed into footing	in =	6.76
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	

Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341
Licensee : Annee Structural Engineering LLC

Description : 5' landscape wall - west of garage - 10/S3.3

Footing Dimensions & Strengths

Toe Width	=	2.50 ft
Heel Width	=	1.83
Total Footing Width	=	4.33
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	3,133	0	psf
Mu' : Upward	=	6,527	0	ft-lb
Mu' : Downward	=	869	765	ft-lb
Mu: Design	=	5,658	765	ft-lb
Actual 1-Way Shear	=	30.17	14.58	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

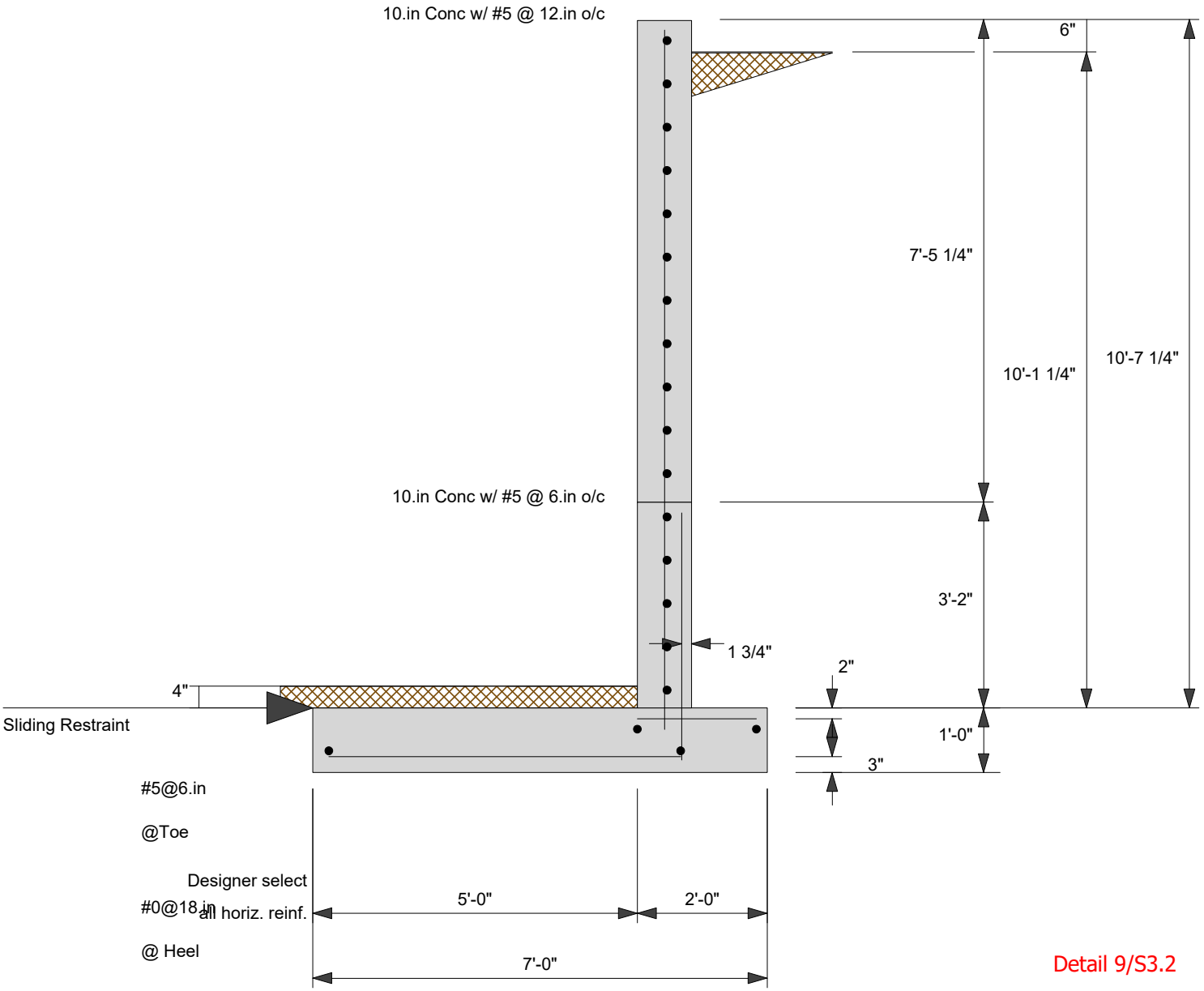
Toe: #4@ 9.25 in, #5@ 14.50 in, #6@ 20.50 in, #7@ 27.75 in, #8@ 36.50 in, #9@ 46
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		Force (lbs)	Distance (ft)	Moment (ft-lb)
.....OVERTURNING.....				
Heel Active Pressure	=	1,589.8	2.53	4,029.2
Surcharge over Heel	=			
Toe Active Pressure	=	-37.4	0.39	-14.6
Surcharge Over Toe	=	-26.7	0.58	-15.6
Adjacent Footing Load	=			
Added Lateral Load	=	366.7	4.22	1,546.7
Load @ Stem Above Soil	=			
Total	=	1,892.3	**O.T.M.** =	5,545.8
Resisting/Overturning Ratio			=	**1.27**
Vertical Loads used for Soil Pressure =			2,441.2 lbs	

Item		Force (lbs)	Distance (ft)	Moment (ft-lb)
.....RESISTING.....				
Soil Over Heel	=	947.5	3.75	3,553.1
Sloped Soil Over Heel	=			
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Stem	=			
* Axial Live Load on Stem	=			
Soil Over Toe	=	100.0	1.25	125.0
Surcharge Over Toe	=	125.0	1.25	156.3
Stem Weight(s)	=	727.0	2.83	2,059.8
Earth @ Stem Transitions	=			
Footing Weight	=	541.6	2.17	1,173.4
Key Weight	=			
Vert. Component	=			
Total =		2,441.2 lbs	**R.M. =**	7,067.6

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.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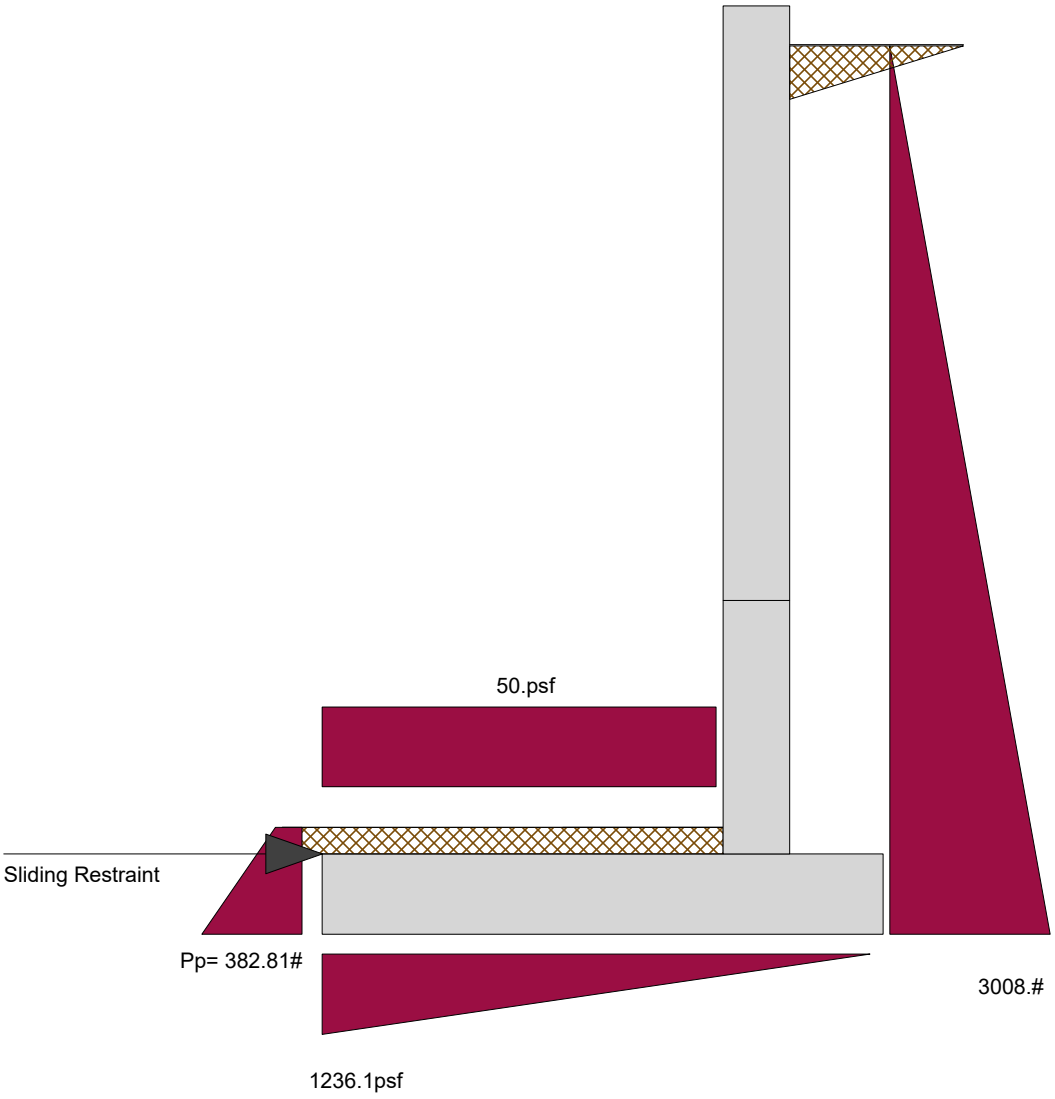
6"
7'-5 1/4"
10'-1 1/4"
10'-7 1/4"
10.in Conc w/ #5 @ 6.in o/c
3'-2"
1 3/4"
2"
4"
Sliding Restraint
1'-0"
3"
#5@6.in
@Toe
Designer select
#0@18.in
all horiz. reinf.
@ Heel
5'-0"
2'-0"
7'-0"

Detail 9/S3.2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Engineer:
Project Descr:

Project ID:

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 10' landscape wall - west of garage - 9/S3.2

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

maximum 2H:1V slope behind wall.

Criteria

Retained Height	=	10.10 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft
Vertical component of active Lateral soil pressure options:		
NOT USED for Soil Pressure.		
NOT USED for Sliding Resistance.		
NOT USED for Overturning Resistance.		

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	50.0 psf/ft
Toe Active Pressure	=	50.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 plf
...Height to Top	=	10.10 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.85 OK
Sliding	=	0.62 UNSTABLE!
Slab Resists All Sliding !		
Total Bearing Load	=	4,239 lbs
...resultant ecc.	=	14.56 in
Soil Pressure @ Toe	=	1,236 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,483 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	29.3 psi OK
Footing Shear @ Heel	=	16.7 psi OK
Allowable	=	75.0 psi

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	3,008.0 lbs
less 100% Passive Force	= -	382.8 lbs
less 100% Friction Force	= -	1,480.0 lbs
Added Force Req'd	=	1,141.6 lbs NG
....for 1.5 : 1 Stability	=	2,645.6 lbs NG

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	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	3.17	0.00
Wall Material Above "Ht"	=	Concrete	Concrete
Thickness	in =	10.00	10.00
Rebar Size	=	# 5	# 5
Rebar Spacing	in =	12.00	6.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	**0.686**	**0.660**
Total Force @ Section	lbs =	1,921.0	4,064.8
Moment....Actual	ft-l =	4,437.5	13,735.0
Moment.....Allowable	ft-l =	6,464.7	20,802.0
Shear.....Actual	psi =	32.0	41.4
Shear.....Allowable	psi =	75.0	75.0
Wall Weight	psf =	125.0	125.0
Rebar Depth 'd'	in =	5.00	8.19
Lap splice if above	in =	23.40	23.40
Lap splice if below	in =	23.40	4.02
Hook embed into footing	in =	23.40	4.02
Concrete Data			
f'c	psi =	2,500.0	2,500.0
Fy	psi =	20,000.0	20,000.0

Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341
Licensee : Annee Structural Engineering LLC

Description : 10' landscape wall - west of garage - 9/S3.2

Footing Dimensions & Strengths

Toe Width	=	5.00 ft
Heel Width	=	2.00
Total Footing Width	=	7.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,483	0	psf
Mu' : Upward	=	14,036	0	ft-lb
Mu' : Downward	=	3,850	1,112	ft-lb
Mu: Design	=	10,186	1,112	ft-lb
Actual 1-Way Shear	=	29.25	16.73	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 5 @ 6.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

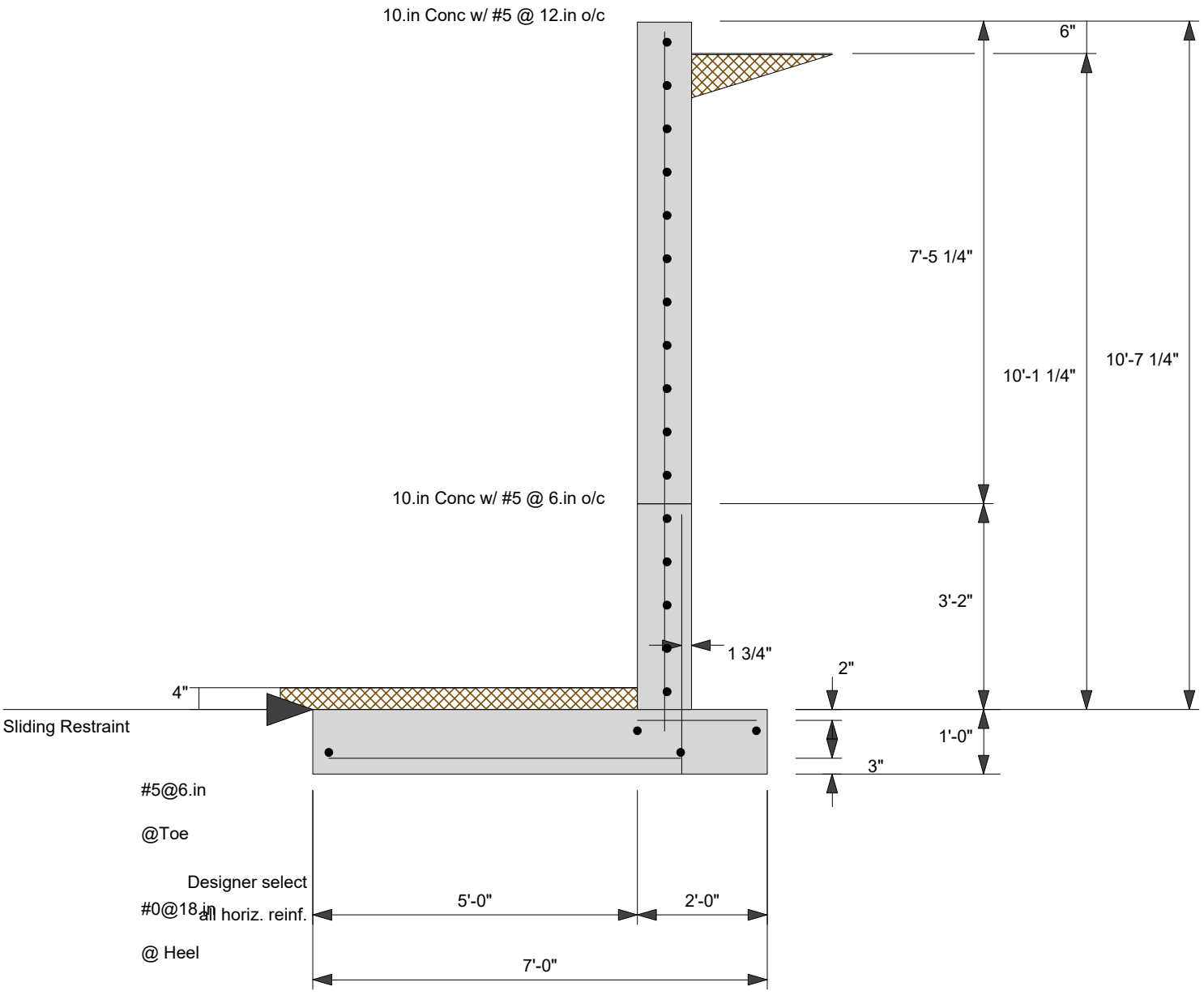
Toe: #4@ 7.25 in, #5@ 11.00 in, #6@ 15.75 in, #7@ 21.25 in, #8@ 28.00 in, #9@ 35
Heel: Not req'd, Mu < S * Fr
Key: No key defined

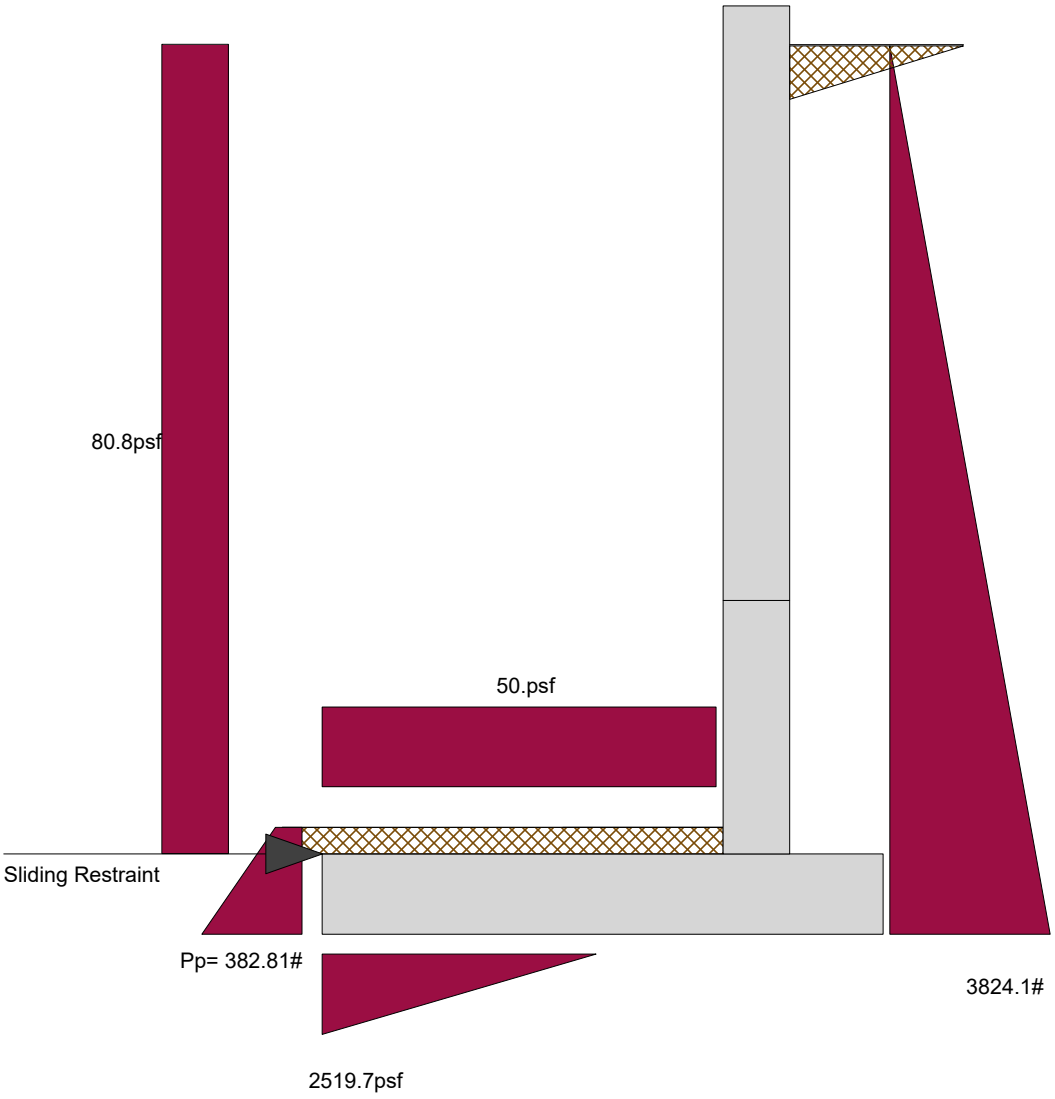
Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb			.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Item									
Heel Active Pressure	=	3,080.3	3.70	11,396.9	Soil Over Heel	=	1,414.0	6.42	9,073.2
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-44.4	0.44	-19.8	Surcharge Over Heel	=			
Surcharge Over Toe	=	-27.8	0.67	-18.5	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	=	200.0	2.50	500.0
					Surcharge Over Toe	=	250.0	2.50	625.0
					Stem Weight(s)	=	1,325.0	5.42	7,177.1
					Earth @ Stem Transitions	=			
					Footing Weight	=	1,050.0	3.50	3,675.0
					Key Weight	=			
					Vert. Component	=			
Total	=	3,008.0	**O.T.M.** =	11,358.7	**Total =**		4,239.0 lbs	**R.M. =**	21,050.3

Resisting/Overturning Ratio = **1.85**
Vertical Loads used for Soil Pressure = 4,239.0 lbs

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


10.in Conc w/ #5 @ 12.in o/c
6"
7'-5 1/4"
10'-1 1/4"
10'-7 1/4"
10.in Conc w/ #5 @ 6.in o/c
3'-2"
1 3/4"
2"
4"
Sliding Restraint
1'-0"
3"
#5@6.in
@Toe
Designer select
#0@18.in
all horiz. reinf.
@ Heel
5'-0"
2'-0"
7'-0"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Project Title:
Engineer:
Project Descr:

Project ID:

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 10' landscape wall - west of garage - 9/S3.2

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	10.10 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Vertical component of active
Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	50.0 psf/ft
Toe Active Pressure	=	50.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	80.8 plf
...Height to Top	=	10.10 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.29	Ratio < 1.5!
Sliding	=	0.49	UNSTABLE!
Slab Resists All Sliding !			
Total Bearing Load	=	4,239 lbs	
...resultant ecc.	=	28.54 in	
Soil Pressure @ Toe	=	2,520 psf	NG
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Exceeds Allowable!			
ACI Factored @ Toe	=	3,024 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	36.2 psi	OK
Footing Shear @ Heel	=	16.7 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs Slab Resists All Sliding !

Lateral Sliding Force	=	3,824.1 lbs
less 100% Passive Force	= -	382.8 lbs
less 100% Friction Force	= -	1,480.0 lbs
Added Force Req'd	=	1,957.6 lbs NG
....for 1.5 : 1 Stability	=	3,869.7 lbs NG

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	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	3.17	0.00
Wall Material Above "Ht"	=	Concrete	Concrete
Thickness	in =	10.00	10.00
Rebar Size	=	# 5	# 5
Rebar Spacing	in =	12.00	6.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	**0.987**	**0.858**
Total Force @ Section	lbs =	2,480.9	4,880.9
Moment....Actual	ft-l =	6,377.7	17,856.2
Moment.....Allowable	ft-l =	6,464.7	20,802.0
Shear.....Actual	psi =	46.9	54.7
Shear.....Allowable	psi =	75.0	75.0
Wall Weight	psf =	125.0	125.0
Rebar Depth 'd'	in =	5.00	8.19
Lap splice if above	in =	23.40	23.40
Lap splice if below	in =	23.40	5.33
Hook embed into footing	in =	23.40	5.33
Concrete Data			
f'c	psi =	2,500.0	2,500.0
Fy	psi =	20,000.0	20,000.0

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Project Title:
Engineer:
Project Descr:

Project ID:

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 10' landscape wall - west of garage - 9/S3.2

Footing Dimensions & Strengths

Toe Width	=	5.00 ft
Heel Width	=	2.00
Total Footing Width	=	7.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	3,024	0 psf
Mu' : Upward	=	0	0 ft-lb
Mu' : Downward	=	0	1,112 ft-lb
Mu: Design	=	17,856	1,112 ft-lb
Actual 1-Way Shear	=	36.24	16.73 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 6.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

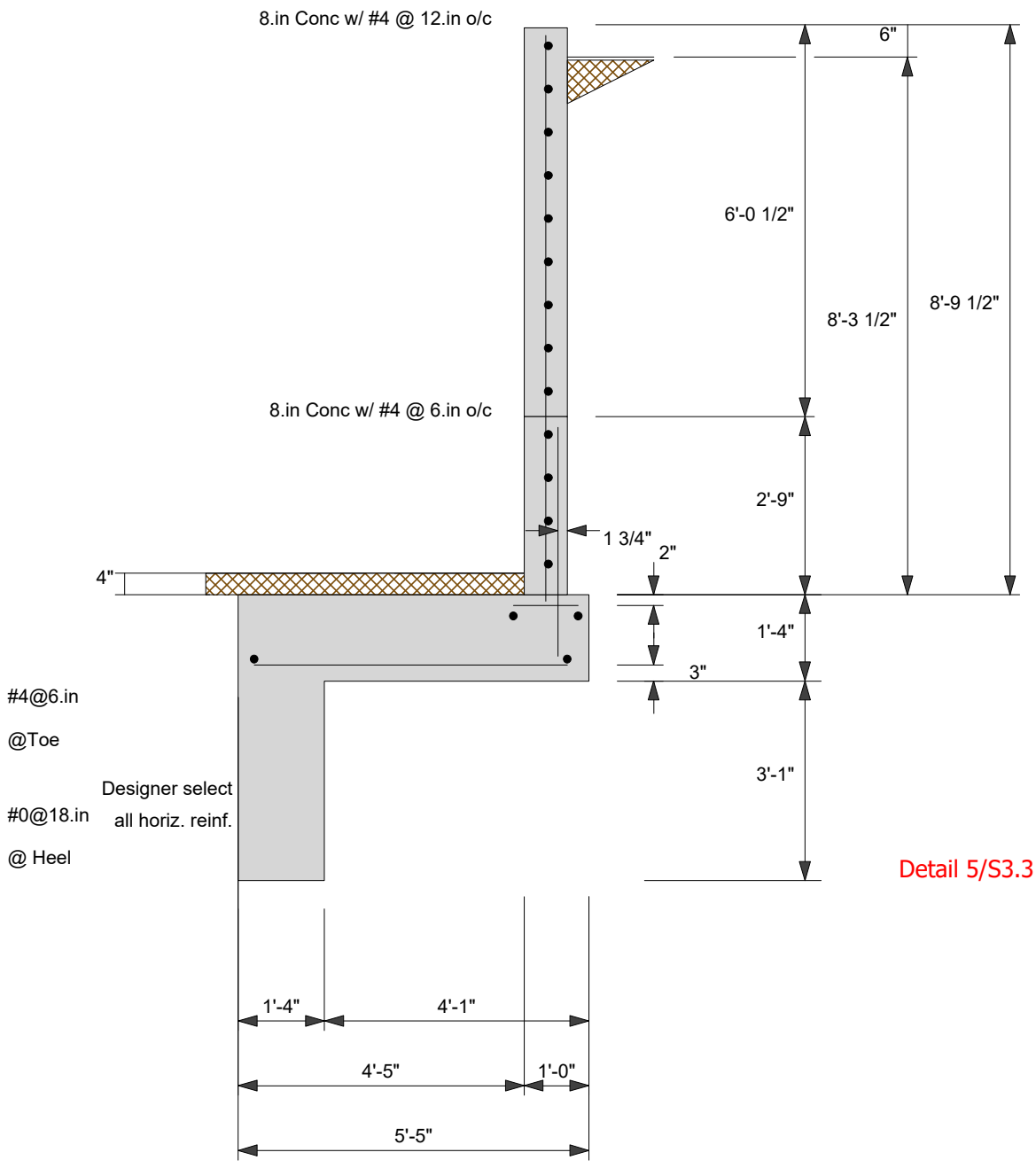
Toe: #4@ 5.00 in, #5@ 7.50 in, #6@ 10.75 in, #7@ 14.50 in, #8@ 19.00 in, #9@ 24.
Heel: Not req'd, Mu < S * Fr
Key: No key defined

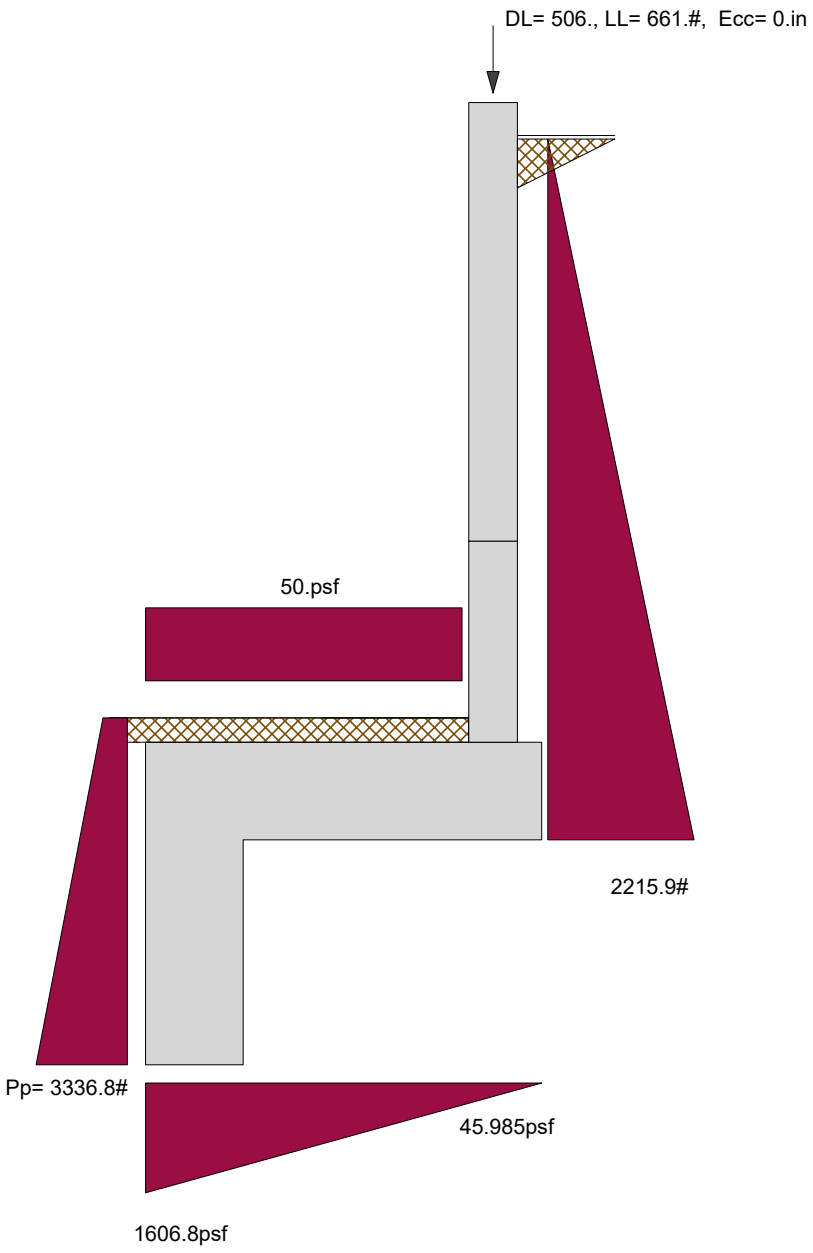
Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	3,080.3	3.70	11,396.9	Soil Over Heel	=	1,414.0	6.42	9,073.2
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-44.4	0.44	-19.8	Surcharge Over Heel	=			
Surcharge Over Toe	=	-27.8	0.67	-18.5	Adjacent Footing Load	=			
Adjacent Footing Load	=				Axial Dead Load on Stem	=			
Added Lateral Load	=	816.1	6.05	4,937.3	* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=				Soil Over Toe	=	200.0	2.50	500.0
					Surcharge Over Toe	=	250.0	2.50	625.0
					Stem Weight(s)	=	1,325.0	5.42	7,177.1
					Earth @ Stem Transitions	=			
					Footing Weight	=	1,050.0	3.50	3,675.0
					Key Weight	=			
					Vert. Component	=			
Total	=	3,824.1	**O.T.M.** =	16,295.9	**Total =**		4,239.0 lbs	**R.M. =**	21,050.3

Resisting/Overturning Ratio = **1.29**
Vertical Loads used for Soil Pressure = 4,239.0 lbs

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


8.in Conc w/ #4 @ 12.in o/c
6"
6'-0 1/2"
8'-3 1/2"
8'-9 1/2"
8.in Conc w/ #4 @ 6.in o/c
2'-9"
1 3/4"
2"
4"
1'-4"
3"
#4@6.in
@Toe
3'-1"
Designer select
all horiz. reinf.
#0@18.in
@ Heel
Detail 5/S3.3
1'-4"
4'-1"
4'-5"
1'-0"
5'-5"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Project Title:
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Project Descr:

Project ID:

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 8' retaining wall - grid 1 - 5/S3.3

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

maximum 2H:1V slope behind wall.

Criteria

Retained Height	=	8.30 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Vertical component of active Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	50.0 psf/ft
Toe Active Pressure	=	50.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 plf
...Height to Top	=	8.30 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	506.0 lbs
Axial Live Load	=	661.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.70	OK
Sliding	=	1.51	OK
Total Bearing Load	=	4,477 lbs	
...resultant ecc.	=	10.23 in	
Soil Pressure @ Toe	=	1,607 psf	OK
Soil Pressure @ Heel	=	46 psf	OK
Allowable	=	2,000 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	2,023 psf	
ACI Factored @ Heel	=	58 psf	
Footing Shear @ Toe	=	23.1 psi	OK
Footing Shear @ Heel	=	3.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	2,215.9 lbs	
less 100% Passive Force	= -	3,336.8 lbs	
less 0 % Friction Force	= -	0.0 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	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	2.75	0.00
Wall Material Above "Ht"	=	Concrete	Concrete
Thickness	in =	8.00	8.00
Rebar Size	=	# 4	# 4
Rebar Spacing	in =	12.00	6.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	**0.673**	**0.733**
Total Force @ Section	lbs =	1,232.1	2,740.0
Moment....Actual	ft-l =	2,279.4	7,621.5
Moment.....Allowable	ft-l =	3,387.6	10,400.4
Shear.....Actual	psi =	25.7	36.5
Shear.....Allowable	psi =	75.0	75.0
Wall Weight	psf =	100.0	100.0
Rebar Depth 'd'	in =	4.00	6.25
Lap splice if above	in =	18.72	18.72
Lap splice if below	in =	18.72	8.40
Hook embed into footing	in =	18.72	8.40
Concrete Data			
f'c	psi =	2,500.0	2,500.0
Fy	psi =	24,000.0	20,000.0

Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341
Licensee : Annee Structural Engineering LLC

Description : 8' retaining wall - grid 1 - 5/S3.3

Footing Dimensions & Strengths

Toe Width	=	4.42 ft
Heel Width	=	1.00
Total Footing Width	=	5.42
Footing Thickness	=	16.00 in
Key Width	=	16.00 in
Key Depth	=	37.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,023	58	psf
Mu' : Upward	=	0	0	ft-lb
Mu' : Downward	=	0	80	ft-lb
Mu: Design	=	7,621	80	ft-lb
Actual 1-Way Shear	=	23.11	2.95	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 6.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 8.00 in

Other Acceptable Sizes & Spacings

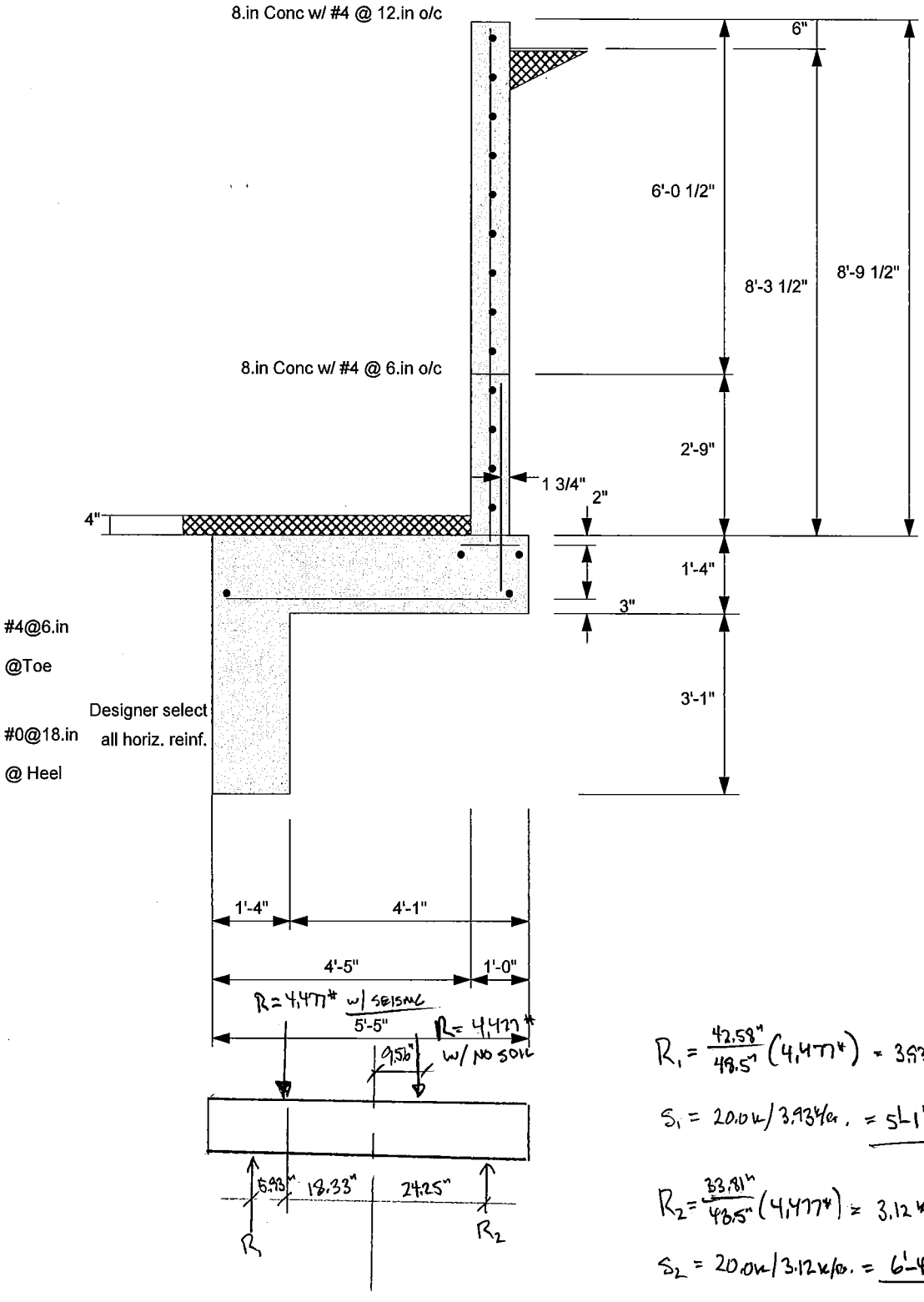
Toe: #4@ 9.00 in, #5@ 14.00 in, #6@ 19.75 in, #7@ 26.75 in, #8@ 35.25 in, #9@ 44
Heel: Not req'd, Mu < S * Fr
Key: #4@ 8.75 in, #5@ 13.25 in, #6@ 19.00 in, #7@ 25.75 in,

Summary of Overturning & Resisting Forces & Moments

	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Item							
Heel Active Pressure	2,320.0	3.21	7,449.9	Soil Over Heel	332.0	5.25	1,743.1
Surcharge over Heel				Sloped Soil Over Heel			
Toe Active Pressure	-69.4	0.56	-38.6	Surcharge Over Heel			
Surcharge Over Toe	-34.7	0.83	-28.9	Adjacent Footing Load			
Adjacent Footing Load				Axial Dead Load on Stem	506.0	4.75	2,403.7
Added Lateral Load				* Axial Live Load on Stem	661.0	4.75	3,140.0
Load @ Stem Above Soil				Soil Over Toe	176.7	2.21	390.2
				Surcharge Over Toe	220.9	2.21	487.7
				Stem Weight(s)	880.0	4.75	4,180.3
				Earth @ Stem Transitions			
				Footing Weight	1,083.4	2.71	2,934.4
				Key Weight	616.7	0.67	411.1
				Vert. Component			
Total	2,215.9	**O.T.M.**	7,382.4	**Total =**	3,815.6 lbs	**R.M. =**	12,550.5

Resisting/Overturning Ratio = **1.70**
Vertical Loads used for Soil Pressure = 4,476.6 lbs

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

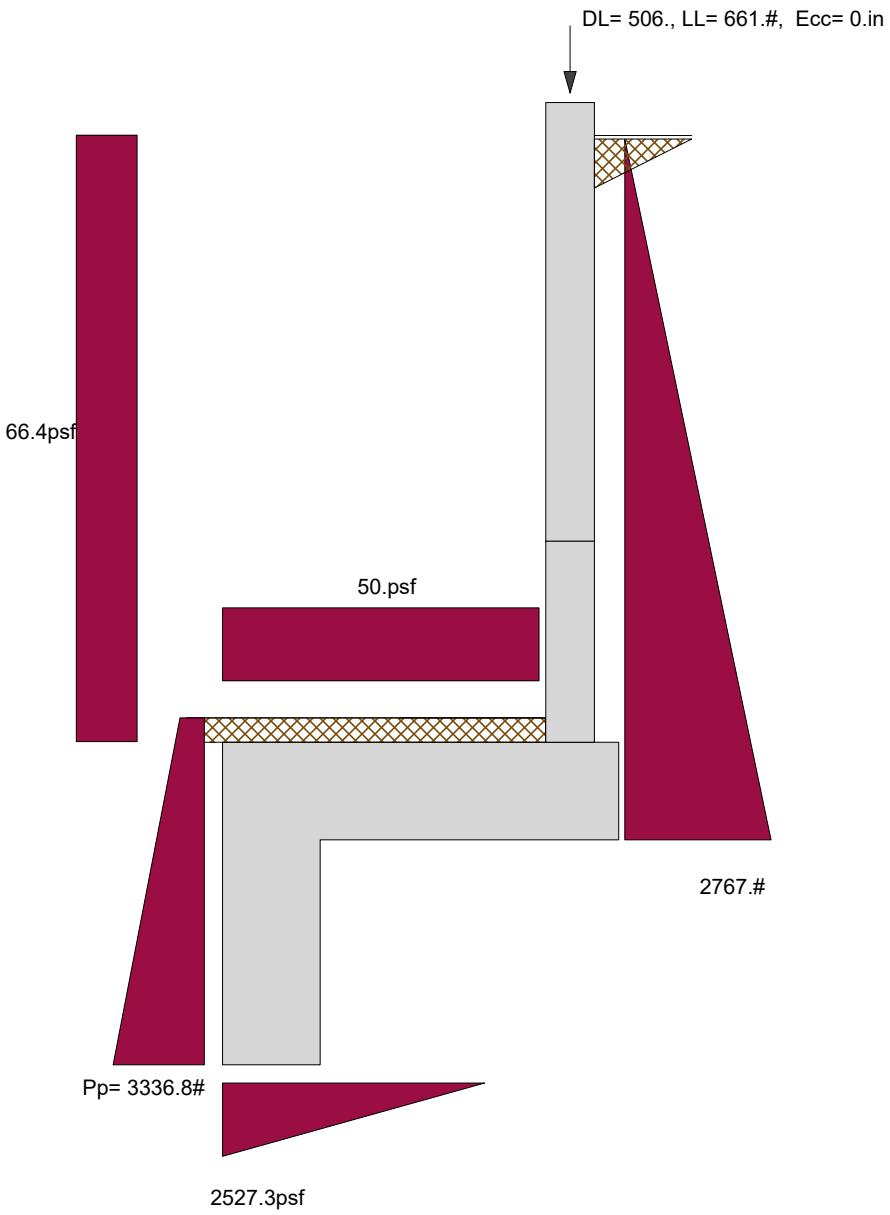


$R_1 = \frac{42.59"}{48.5"}(4,477^{\#}) = 3.93^{k}/_{ft}.$

$S_1 = 20.0^{k}/3.93^{k}/_{ft}. = \underline{5'-1"\,oc}$ (4" ϕ PILES)

$R_2 = \frac{33.91"}{48.5"}(4,477^{\#}) = 3.12^{k}/_{ft}.$

$S_2 = 20.0^{k}/3.12^{k}/_{ft}. = \underline{6'-4"\,oc}$ (4" ϕ PILES)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Project Title:
Engineer:
Project Descr:

Project ID:

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 8' retaining wall - grid 1 - 5/S3.3

Calculations per ACI 318-11, ACI 530-11, IBC 2012, CBC 2013, ASCE 7-10

Criteria

Retained Height	=	8.30 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Vertical component of active
Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	50.0 psf/ft
Toe Active Pressure	=	50.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	50.0 psf
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	66.4 plf
...Height to Top	=	8.30 ft
...Height to Bottom	=	0.00 ft
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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 at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	506.0 lbs
Axial Live Load	=	661.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.21	Ratio < 1.5!
Sliding	=	1.21	Ratio < 1.5!
Total Bearing Load	=	4,477 lbs	
...resultant ecc.	=	18.33 in	
Soil Pressure @ Toe	=	2,527 psf	NG
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	

Soil Pressure Exceeds Allowable!

ACI Factored @ Toe	=	3,182 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	28.9 psi	OK
Footing Shear @ Heel	=	3.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	2,767.0 lbs
less 100% Passive Force	= -	3,336.8 lbs
less 0 % Friction Force	= -	0.0 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	813.7 lbs NG

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	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	2.75	0.00
Wall Material Above "Ht"	=	Concrete	Concrete
Thickness	in =	8.00	8.00
Rebar Size	=	# 4	# 4
Rebar Spacing	in =	12.00	6.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	**0.975**	**0.953**
Total Force @ Section	lbs =	1,600.6	3,291.2
Moment....Actual	ft-l =	3,302.0	9,908.6
Moment.....Allowable	ft-l =	3,387.6	10,400.4
Shear.....Actual	psi =	38.0	48.3
Shear.....Allowable	psi =	75.0	75.0
Wall Weight	psf =	100.0	100.0
Rebar Depth 'd'	in =	4.00	6.25
Lap splice if above	in =	18.72	18.72
Lap splice if below	in =	18.72	8.40
Hook embed into footing	in =	18.72	8.40
Concrete Data			
f'c	psi =	2,500.0	2,500.0
Fy	psi =	24,000.0	20,000.0

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Cantilevered Retaining Wall

File = C:\ASE\Projects\MOUNGE~1\CALCUL~1\MOUNGE~1.EC6
ENERCALC, INC. 1983-2015, Build:6.15.7.30, Ver:6.15.12.31

Lic. # : KW-06009341 — **Licensee : Annee Structural Engineering LLC**

Description : 8' retaining wall - grid 1 - 5/S3.3

Footing Dimensions & Strengths

Toe Width	=	4.42 ft
Heel Width	=	1.00
Total Footing Width	=	5.42
Footing Thickness	=	16.00 in
Key Width	=	16.00 in
Key Depth	=	37.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	3,182	0	psf
Mu' : Upward	=	0	0	ft-lb
Mu' : Downward	=	0	80	ft-lb
Mu: Design	=	9,909	80	ft-lb
Actual 1-Way Shear	=	28.85	2.95	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 6.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 8.00 in

Other Acceptable Sizes & Spacings

Toe: #4@ 9.00 in, #5@ 14.00 in, #6@ 19.75 in, #7@ 26.75 in, #8@ 35.25 in, #9@ 44
Heel: Not req'd, Mu < S * Fr
Key: #4@ 8.75 in, #5@ 13.25 in, #6@ 19.00 in, #7@ 25.75 in,

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	=	2,320.0	3.21	7,449.9	Soil Over Heel	=	332.0	5.25	1,743.1
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Toe Active Pressure	=	-69.4	0.56	-38.6	Surcharge Over Heel	=			
Surcharge Over Toe	=	-34.7	0.83	-28.9	Adjacent Footing Load	=			
Adjacent Footing Load	=				Axial Dead Load on Stem	=	506.0	4.75	2,403.7
Added Lateral Load	=	551.1	5.48	3,022.0	* Axial Live Load on Stem	=	661.0	4.75	3,140.0
Load @ Stem Above Soil	=				Soil Over Toe	=	176.7	2.21	390.2
					Surcharge Over Toe	=	220.9	2.21	487.7
					Stem Weight(s)	=	880.0	4.75	4,180.3
					Earth @ Stem Transitions	=			
					Footing Weight	=	1,083.4	2.71	2,934.4
					Key Weight	=	616.7	0.67	411.1
					Vert. Component	=			
Total	=	2,767.0	**O.T.M.** =	10,404.3	**Total =**		3,815.6 lbs	**R.M. =**	12,550.5

Resisting/Overturning Ratio = **1.21**
Vertical Loads used for Soil Pressure = 4,476.6 lbs

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