

#25108

Structural Calculations For:

Sears Retaining Wall

AT

7414 76th AVE SE
Mercer Island, Washington 98040

Design Criteria: IBC 2021



12/16/2025

Project: SEAMS RETAINING WALL

Date: 12/11/25

Client: _____

Page Number: _____

PROJECT: CIP SITE RETAINING WALL.

7414 78TH AVE SE

MERIDOL ISLAND, WA 98040

CRITERIA: 2021 IBC

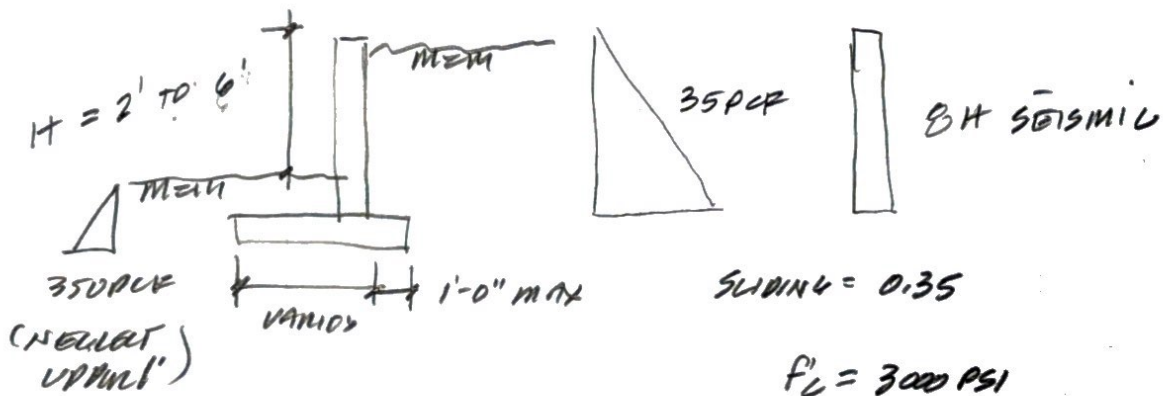
TAKA & ASSOCIATES REPORT NO. T-8832

DATE: DECEMBER 15, 2022

CT # 25108

RETAINING WALL IS "L" SHAPED IN PLAN AND ADJUTS
PRIVATE PROPERTY TO THE NORTH AND "TREE DRIP AREA"
TO THE EAST.

TYPICAL WALL SECTION:



Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - seismic 6' tall

Code Reference

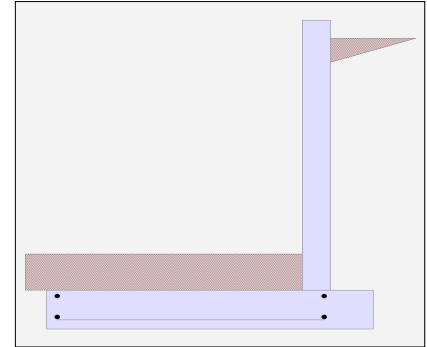
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Method	:	Uniform
Multiplier Used	=	8.000
(Multiplier used on soil density)		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

Uniform Seismic Force	=	64.667
Total Seismic Force	=	522.722

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	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

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Design Summary

Wall Stability Ratios

Overturning	=	3.73	OK
Sliding	=	1.18	Ratio < 1.5!
Global Stability	=	1.88	
Total Bearing Load = 3,426 lbs			
...resultant ecc.	=	2.34	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	515	psf OK
Soil Pressure @ Heel	=	379	psf OK
Allowable	=	2,500	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	721	psf
ACI Factored @ Heel	=	530	psf
Footing Shear @ Toe	=	13.0	psi OK
Footing Shear @ Heel	=	4.4	psi OK
Allowable	=	82.2	psi

Sliding Calcs

Lateral Sliding Force	=	1,509.4	lbs
less 100% Passive Force	-	584.5	lbs
less 100% Friction Force	= -	1,199.2	lbs
Added Force Req'd	=	0.0	lbs OK
....for 1.5 Stability	=	480.3	lbs NG

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

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

Stem Construction

Design Height Above Ftg

ft =	Stem OK	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa = 0.583

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	1,824.7

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	4,785.7

Moment.....Allowable = 8,206.3

Shear.....Actual

Service Level	psi =	
Strength Level	psi =	24.6

Shear.....Allowable psi = 82.2

Anet (Masonry) in2 =

Wall Weight psf = 100.0

Rebar Depth 'd' in = 6.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Bottom

SD SD

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Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.1812 in ² /ft		
(4/3) * As :	0.2416 in ² /ft	Min Stem T&S Reinf Area 1.440 in ²	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in ² /ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in ² /ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in ² /ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.2416 in ² /ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in ² /ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0059 in ² /ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	6.00 ft
Heel Width	=	1.67
Total Footing Width	=	7.67
Footing Thickness	=	13.00 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

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 721	530 psf	
Mu' : Upward	= 12,082	269 ft-#	
Mu' : Downward	= 5,886	560 ft-#	
Mu: Design	= 6,196 OK	290 ft-#	OK
phiMn	= 13,090	3,314 ft-#	
Actual 1-Way Shear	= 13.03	4.37 psi	
Allow 1-Way Shear	= 82.16	43.82 psi	
Toe Reinforcing	= # 5 @ 12.00 in		
Heel Reinforcing	= None Spec'd		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs	
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs	

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.54 in, #5@ 13.24 in, #6@ 18.80 in, #7@ 25.64 in, #8@ 33.76 in, #9@ 42.73 in, #10@ 54.27 in

Heel: phiMn = ph*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 2.15 in²
 Min footing T&S reinf Area per foot 0.28 in² /ft

If one layer of horizontal bars:

#4@ 8.55 in
 #5@ 13.25 in
 #6@ 18.80 in

If two layers of horizontal bars:

#4@ 17.09 in
 #5@ 26.50 in
 #6@ 37.61 in

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Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,143.5	2.69	3,081.0	Soil Over HL (ab. water tbl)	770.3	7.17	5,520.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		7.17	5,520.3
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Hee =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	660.0	3.00	1,980.0
Seismic Earth Load =	365.9	4.04	1,478.9	Surcharge Over Toe =			
=				Stem Weight(s) =	750.0	6.33	4,750.0
Total =	1,509.4	O.T.M. =	4,559.8	Earth @ Stem Transitions =			
				Footing Weight =	1,245.9	3.83	4,776.1
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio =			3.73	Total =	3,426.1 lbs	R.M.=	17,026.4
Vertical Loads used for Soil Pressure =		3,426.1 lbs					

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

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.014 in

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

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Engineer:
Project ID:
Project Descr:

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DESCRIPTION: sears retaining wall - seismic 6' tall

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.3a) =	21.36 in
Development length for #5 bar specified in this stem design segment =	16.43 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	9.59 in
As Provided =	0.3100 in ² /ft
As Required =	0.2416 in ² /ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

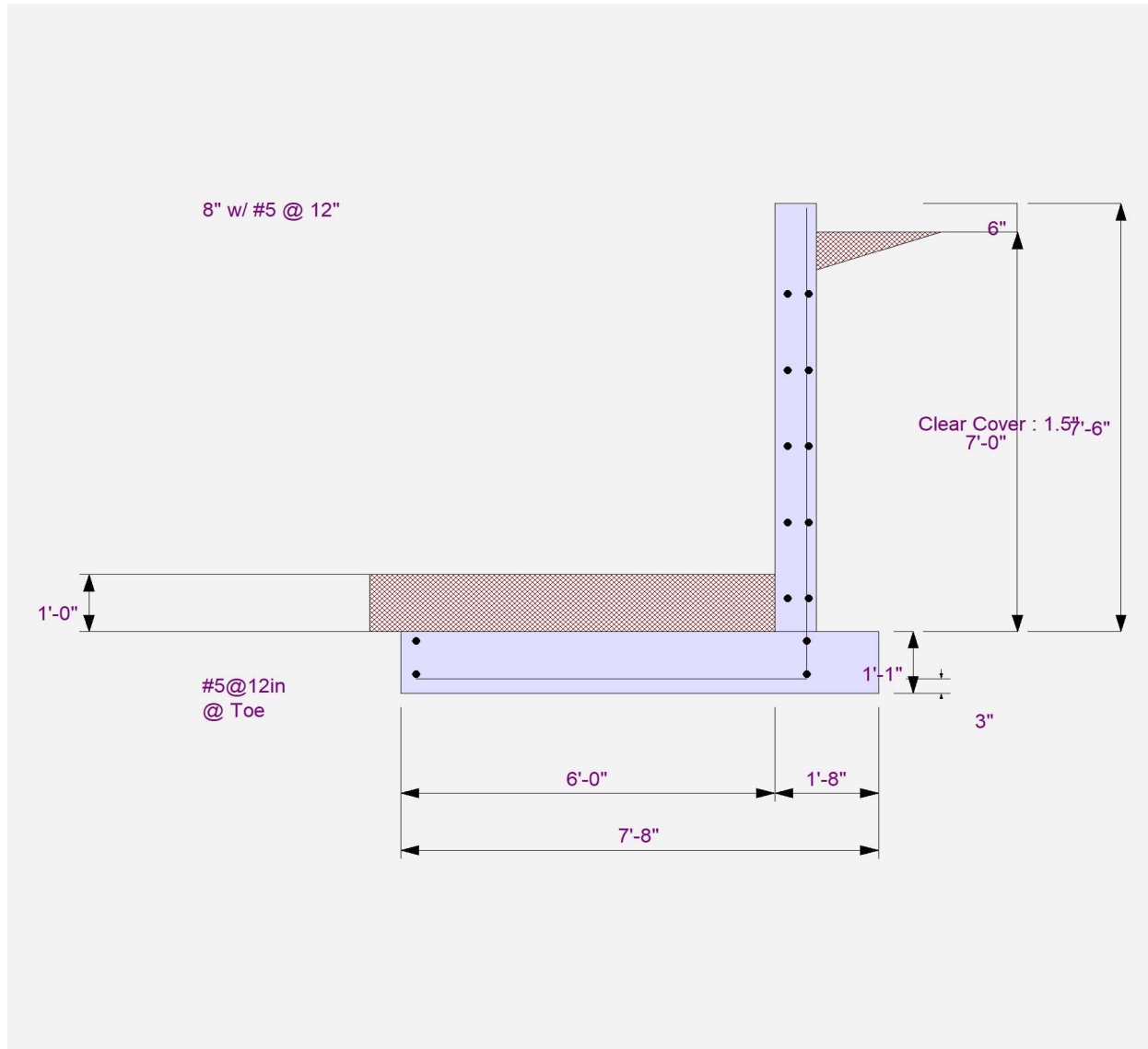
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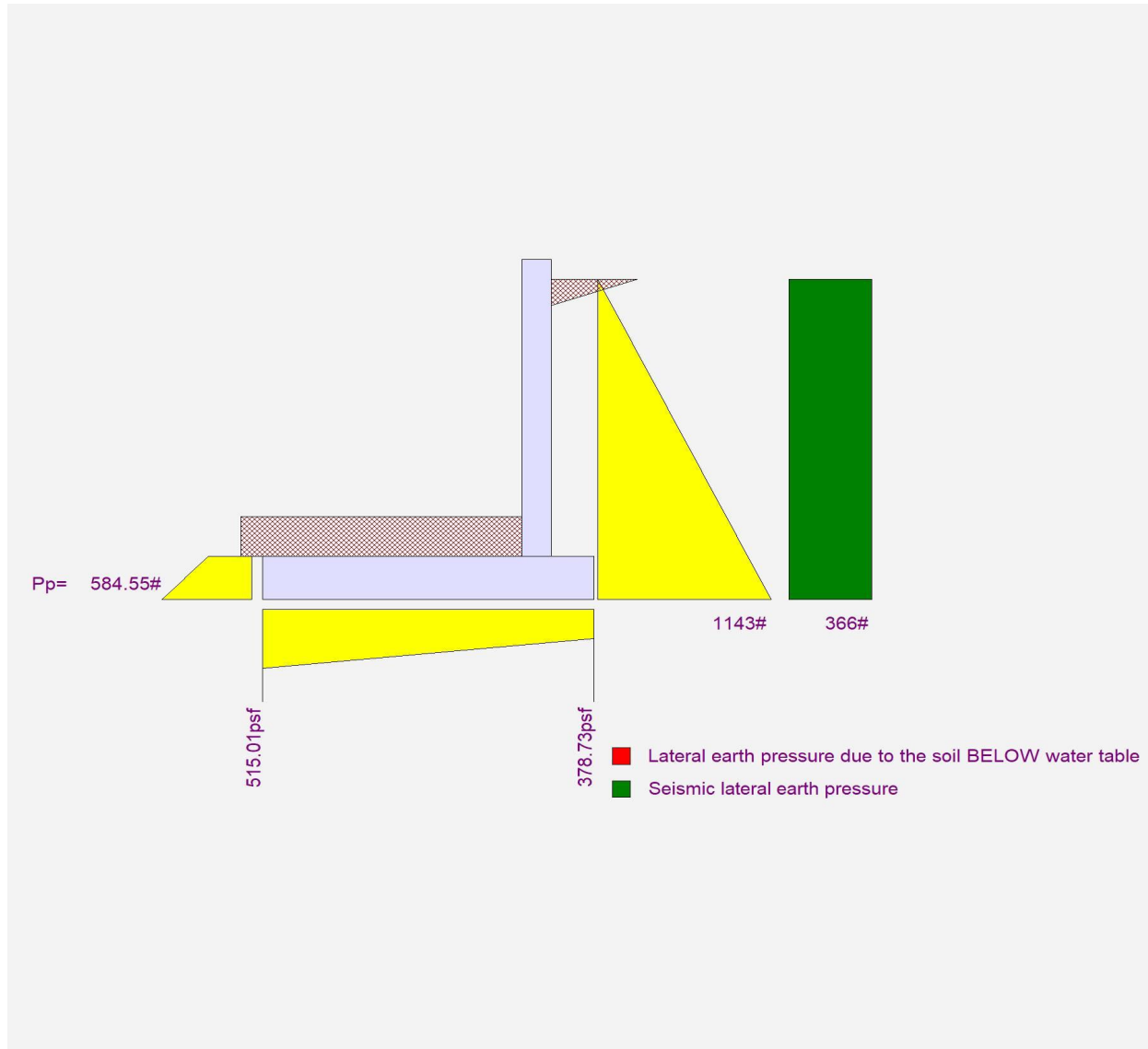
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C.T. ENGINEERING

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DESCRIPTION: sears retaining wall - no seismic 6' tall

Code Reference

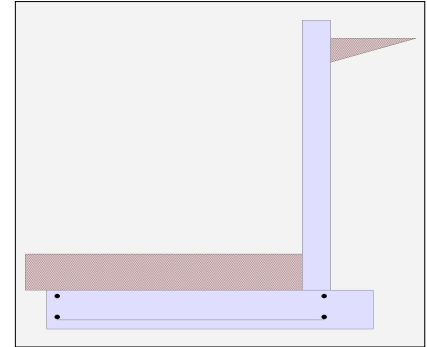
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

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	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

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Design Summary

Wall Stability Ratios

Overturning	=	5.53	OK
Sliding	=	1.56	OK
Global Stability	=	1.88	
Total Bearing Load	=	3,426	lbs
...resultant ecc.	=	2.84	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	364	psf OK
Soil Pressure @ Heel	=	530	psf OK
Allowable	=	2,500	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	510	psf
ACI Factored @ Heel	=	742	psf
Footing Shear @ Toe	=	9.9	psi OK
Footing Shear @ Heel	=	3.0	psi OK
Allowable	=	82.2	psi

Sliding Calcs

Lateral Sliding Force	=	1,143.5	lbs
less 100% Passive Force	-	584.5	lbs
less 100% Friction Force	= -	1,199.2	lbs
Added Force Req'd	=	0.0	lbs OK
....for 1.5 Stability	=	0.0	lbs OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

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

Stem Construction

Design Height Above Ftg

ft =	Stem OK	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa = 0.390

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	1,372.0

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	3,201.3

Moment.....Allowable = 8,206.3

Shear.....Actual

Service Level	psi =	
Strength Level	psi =	18.5

Shear.....Allowable psi = 82.2

Anet (Masonry) in2 =

Wall Weight psf = 100.0

Rebar Depth 'd' in = 6.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Bottom

SD SD SD

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Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.1212 in2/ft		
(4/3) * As :	0.1616 in2/ft	Min Stem T&S Reinf Area 1.440 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0059 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	6.00 ft
Heel Width	=	1.67
Total Footing Width	=	7.67
Footing Thickness	=	13.00 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

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 510	742 psf	
Mu' : Upward	= 10,263	416 ft-#	
Mu' : Downward	= 5,886	560 ft-#	
Mu: Design	= 4,377 OK	143 ft-#	OK
phiMn	= 13,090	3,314 ft-#	
Actual 1-Way Shear	= 9.93	2.98 psi	
Allow 1-Way Shear	= 82.16	43.82 psi	
Toe Reinforcing	= # 5 @ 12.00 in		
Heel Reinforcing	= None Spec'd		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs	
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs	

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.54 in, #5@ 13.24 in, #6@ 18.80 in, #7@ 25.64 in, #8@ 33.76 in, #9@ 42.73 in, #10@ 54.27 in

Heel: phiMn = ph*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 2.15 in2
 Min footing T&S reinf Area per foot 0.28 in2 /ft

If one layer of horizontal bars:

#4@ 8.55 in
 #5@ 13.25 in
 #6@ 18.80 in

If two layers of horizontal bars:

#4@ 17.09 in
 #5@ 26.50 in
 #6@ 37.61 in

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Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,143.5	2.69	3,081.0	Soil Over HL (ab. water tbl)	770.3	7.17	5,520.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		7.17	5,520.3
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	660.0	3.00	1,980.0
				Surcharge Over Toe =			
				Stem Weight(s) =	750.0	6.33	4,750.0
				Earth @ Stem Transitions =			
Total	= 1,143.5	O.T.M.	= 3,081.0	Footing Weight =	1,245.9	3.83	4,776.1
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio		=	5.53	Total =	3,426.1 lbs	R.M.=	17,026.4
Vertical Loads used for Soil Pressure =		3,426.1 lbs		* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.000 in

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

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Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.3a) =	21.36 in
Development length for #5 bar specified in this stem design segment =	16.43 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	9.59 in
As Provided =	0.3100 in ² /ft
As Required =	0.1728 in ² /ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

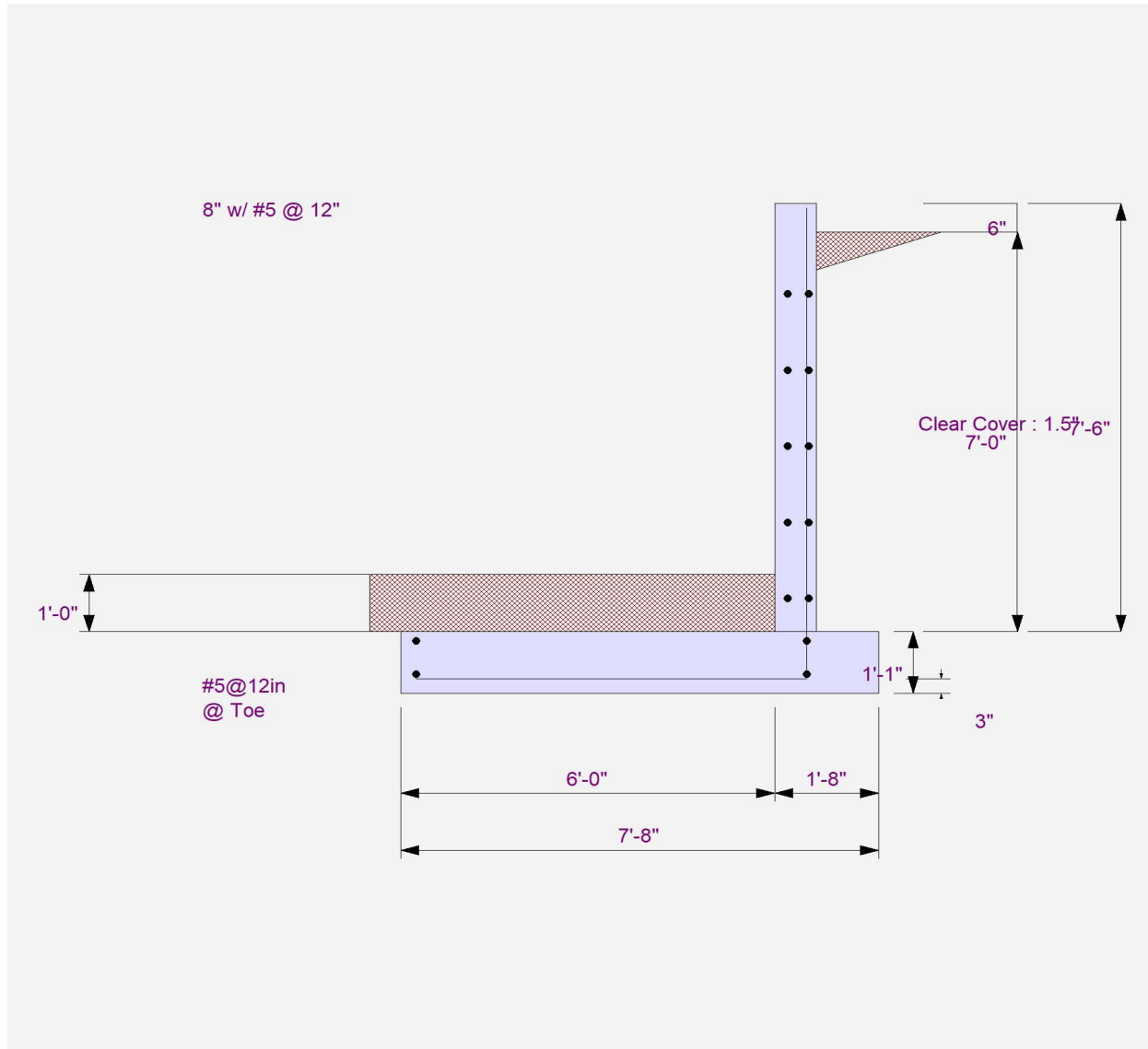
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Project Descr:

Cantilevered Retaining Wall

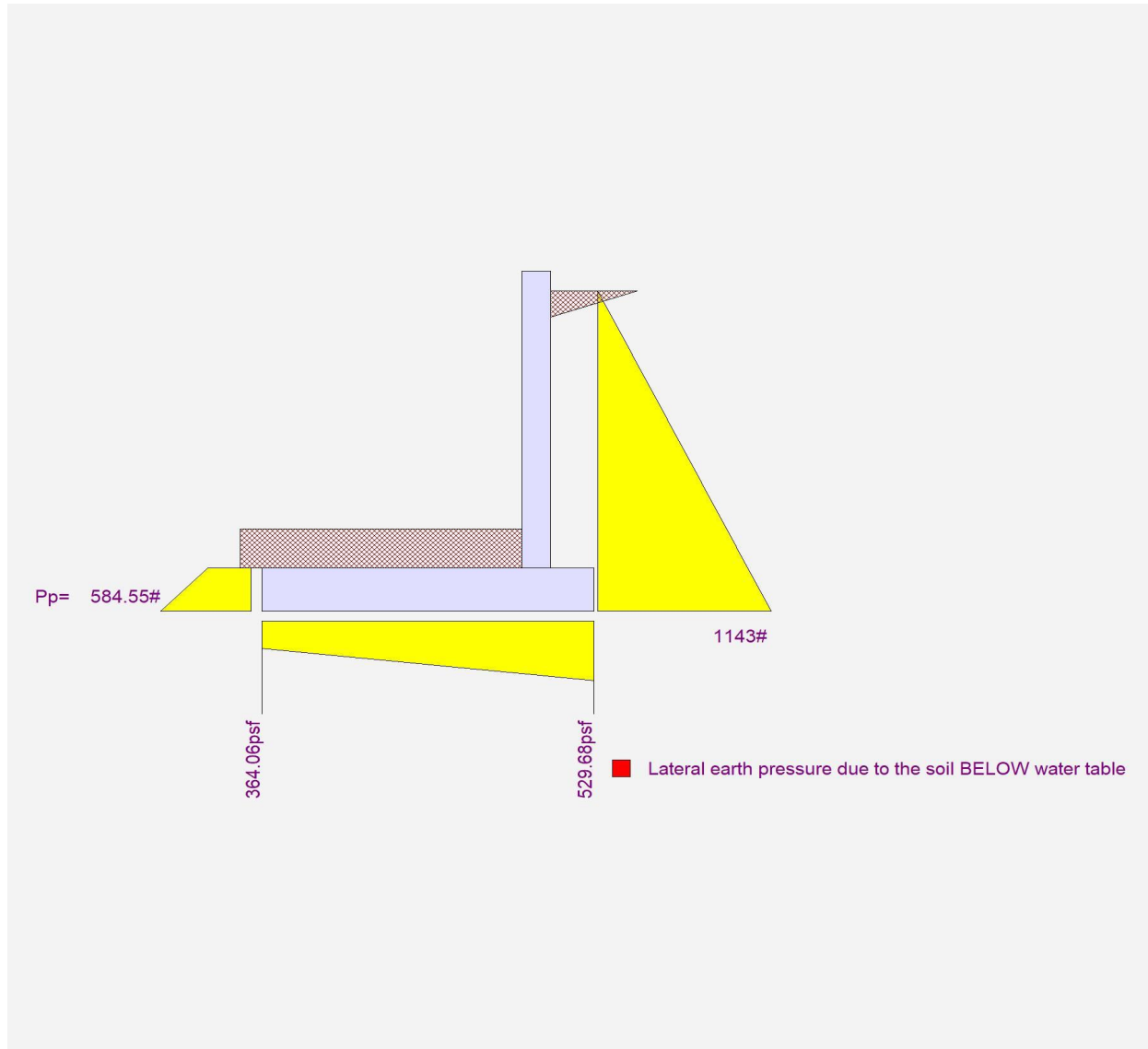
Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - no seismic 6' tall



Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - no seismic 4' tall

Code Reference

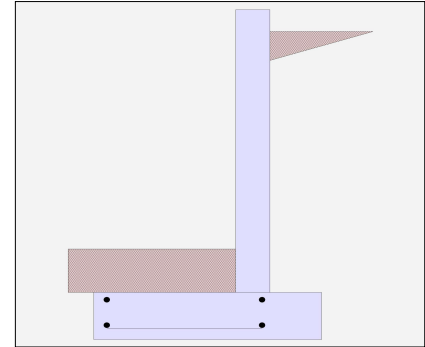
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Strength Level)

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	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

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DESCRIPTION: sears retaining wall - no seismic 4' tall

Design Summary

Wall Stability Ratios

Overturning	=	3.18	OK
Sliding	=	1.59	OK
Global Stability	=	2.17	
Total Bearing Load	=	2,330 lbs	
...resultant ecc.	=	3.24 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	721 psf	OK
Soil Pressure @ Heel	=	334 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,009 psf	
ACI Factored @ Heel	=	468 psf	
Footing Shear @ Toe	=	8.9 psi	OK
Footing Shear @ Heel	=	3.5 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	878.0 lbs	
less 100% Passive Force	=	584.5 lbs	
less 100% Friction Force	=	815.7 lbs	
Added Force Req'd	=	0.0 lbs	OK
...for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

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

Stem Construction

Design Height Above Ftg

ft =	Stem OK	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	18.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa = 0.362

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	1,008.0

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	2,016.0

Moment.....Allowable = 5,565.4

Shear.....Actual

Service Level	psi =	
Strength Level	psi =	13.6

Shear.....Allowable psi = 82.2

Anet (Masonry) in2 =

Wall Weight psf = 100.0

Rebar Depth 'd' in = 6.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - no seismic 4' tall

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.0763 in2/ft		
(4/3) * As :	0.1018 in2/ft	Min Stem T&S Reinf Area 1.248 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2067 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0059 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	2.75 ft
Heel Width	=	1.67
Total Footing Width	=	4.42
Footing Thickness	=	13.00 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

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 1,009	468 psf	
Mu' : Upward	= 3,392	255 ft-#	
Mu' : Downward	= 1,236	494 ft-#	
Mu: Design	= 2,155 OK	239 ft-#	OK
phiMn	= 13,090	3,314 ft-#	
Actual 1-Way Shear	= 8.90	3.47 psi	
Allow 1-Way Shear	= 82.16	43.82 psi	
Toe Reinforcing	= # 5 @ 12.00 in		
Heel Reinforcing	= None Spec'd		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs	
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs	

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.54 in, #5@ 13.24 in, #6@ 18.80 in, #7@ 25.64 in, #8@ 33.76 in, #9@ 42.73 in, #10@ 54.27 in

Heel: phiMn = ph*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 1.24 in2
 Min footing T&S reinf Area per foot 0.28 in2 /ft

If one layer of horizontal bars:

#4@ 8.55 in
 #5@ 13.25 in
 #6@ 18.80 in

If two layers of horizontal bars:

#4@ 17.09 in
 #5@ 26.50 in
 #6@ 37.61 in

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - no seismic 4' tall

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	878.0	2.36	2,073.1	Soil Over HL (ab. water tbl)	660.2	3.92	2,586.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.92	2,586.0
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Hee =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	302.5	1.38	415.9
				Surcharge Over Toe =			
				Stem Weight(s) =	650.0	3.08	2,004.2
				Earth @ Stem Transitions =			
				Footing Weight =	717.8	2.21	1,585.2
				Key Weight =			
				Vert. Component =			
Total	= 878.0	O.T.M.	= 2,073.1	Total	= 2,330.5 lbs	R.M.	= 6,591.3
Resisting/Overturning Ratio		=	3.18	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =		2,330.5 lbs					

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.029 in

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - no seismic 4' tall

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.3a) =	21.36 in
Development length for #5 bar specified in this stem design segment =	16.43 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	9.59 in
As Provided =	0.2067 in ² /ft
As Required =	0.1728 in ² /ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

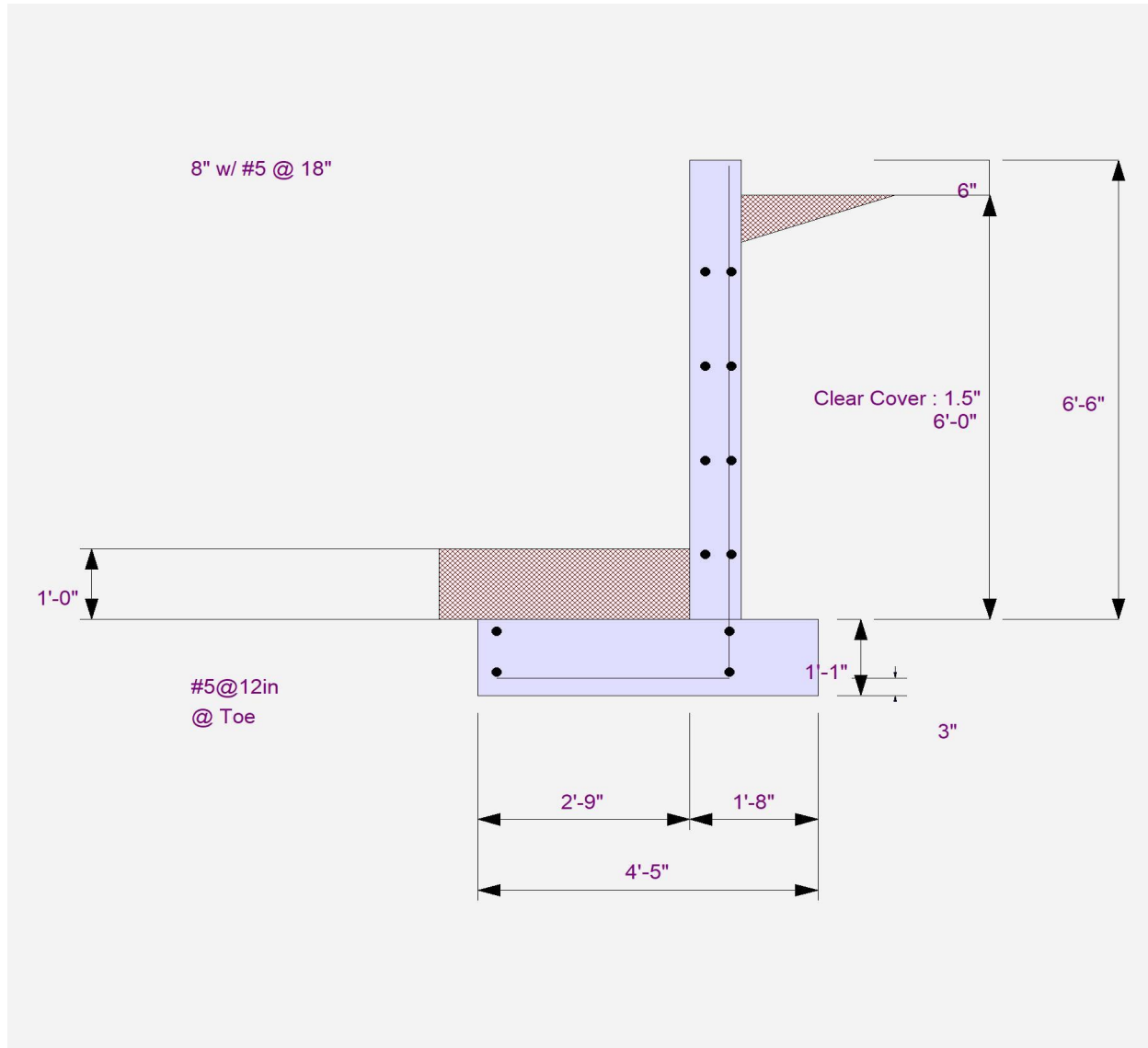
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LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

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DESCRIPTION: sears retaining wall - no seismic 4' tall



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

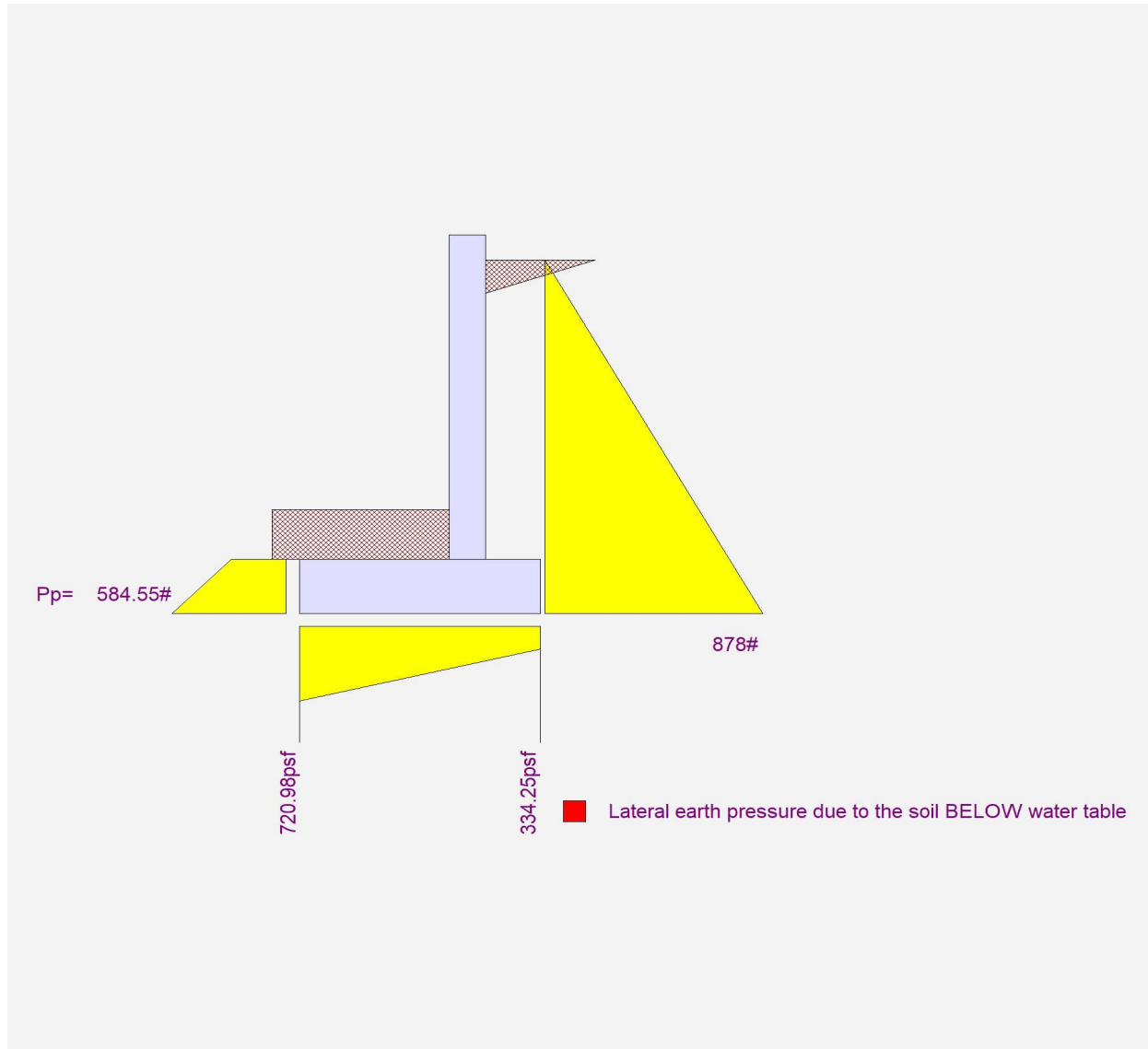
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LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - no seismic 4' tall



Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - w/seismic 4' tall

Code Reference

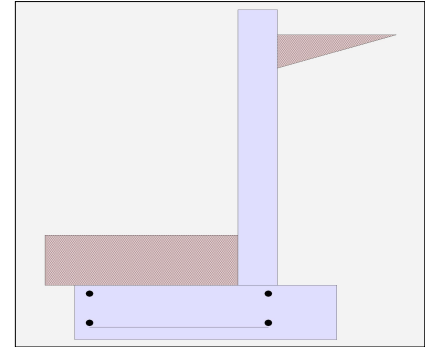
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Method	:	Uniform
Multiplier Used	=	8.000
(Multiplier used on soil density)		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf
(Strength Level)		

Uniform Seismic Force	=	48.667
Total Seismic Force	=	296.056

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	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - w/seismic 4' tall

Design Summary

Wall Stability Ratios

Overturning	=	3.01	OK
Sliding	=	1.55	OK
Global Stability	=	2.58	
Total Bearing Load	=	2,120 lbs	
...resultant ecc.	=	4.38 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	718 psf	OK
Soil Pressure @ Heel	=	242 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,006 psf	
ACI Factored @ Heel	=	339 psf	
Footing Shear @ Toe	=	8.4 psi	OK
Footing Shear @ Heel	=	3.3 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	854.9 lbs	
less 100% Passive Force	=	584.5 lbs	
less 100% Friction Force	=	742.2 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

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

Stem Construction

Design Height Above Ftg

ft =	Stem OK		
	0.00		
Wall Material Above "Ht"	=	Concrete	
Design Method	=	SD	SD SD
Thickness	=	8.00	
Rebar Size	=	# 5	
Rebar Spacing	=	18.00	
Rebar Placed at	=	Edge	

Design Data

fb/FB + fa/Fa = 0.318

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	943.3

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	1,775.0

Moment.....Allowable = 5,565.4

Shear.....Actual

Service Level	psi =	
Strength Level	psi =	12.7

Shear.....Allowable psi = 82.2

Anet (Masonry) in2 =

Wall Weight psf = 100.0

Rebar Depth 'd' in = 6.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - w/seismic 4' tall

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
Bottom Stem			
As (based on applied moment) :	0.0672 in2/ft		
(4/3) * As :	0.0896 in2/ft	Min Stem T&S Reinf Area 1.056 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2067 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0059 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	2.75 ft
Heel Width	=	1.67
Total Footing Width	=	4.42
Footing Thickness	=	13.00 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

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	= 1,006	339 psf	
Mu' : Upward	= 3,279	195 ft-#	
Mu' : Downward	= 1,236	428 ft-#	
Mu: Design	= 2,043 OK	233 ft-#	OK
phiMn	= 13,090	3,314 ft-#	
Actual 1-Way Shear	= 8.36	3.34 psi	
Allow 1-Way Shear	= 82.16	43.82 psi	
Toe Reinforcing	= # 5 @ 12.00 in		
Heel Reinforcing	= None Spec'd		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs	
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs	

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.54 in, #5@ 13.24 in, #6@ 18.80 in, #7@ 25.64 in, #8@ 33.76 in, #9@ 42.73 in, #10@ 54.27 in

Heel: phiMn = ph*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 1.24 in2
 Min footing T&S reinf Area per foot 0.28 in2 /ft

If one layer of horizontal bars:

#4@ 8.55 in
 #5@ 13.25 in
 #6@ 18.80 in

If two layers of horizontal bars:

#4@ 17.09 in
 #5@ 26.50 in
 #6@ 37.61 in

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - w/seismic 4' tall

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	647.6	2.03	1,313.2	Soil Over HL (ab. water tbl)	550.2	3.92	2,155.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.92	2,155.0
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Hee =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	302.5	1.38	415.9
Seismic Earth Load =	207.2	3.04	630.4	Surcharge Over Toe =			
=				Stem Weight(s) =	550.0	3.08	1,695.8
Total =	854.9	O.T.M. =	1,943.6	Earth @ Stem Transitions =			
				Footing Weight =	717.8	2.21	1,585.2
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio =			3.01	Total =	2,120.4 lbs	R.M.=	5,851.9
Vertical Loads used for Soil Pressure =		2,120.4 lbs					

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

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci

Horizontal Defl @ Top of Wall (approximate only) 0.025 in

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

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - w/seismic 4' tall

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.3a) =	21.36 in
Development length for #5 bar specified in this stem design segment =	16.43 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	9.59 in
As Provided =	0.2067 in ² /ft
As Required =	0.1728 in ² /ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

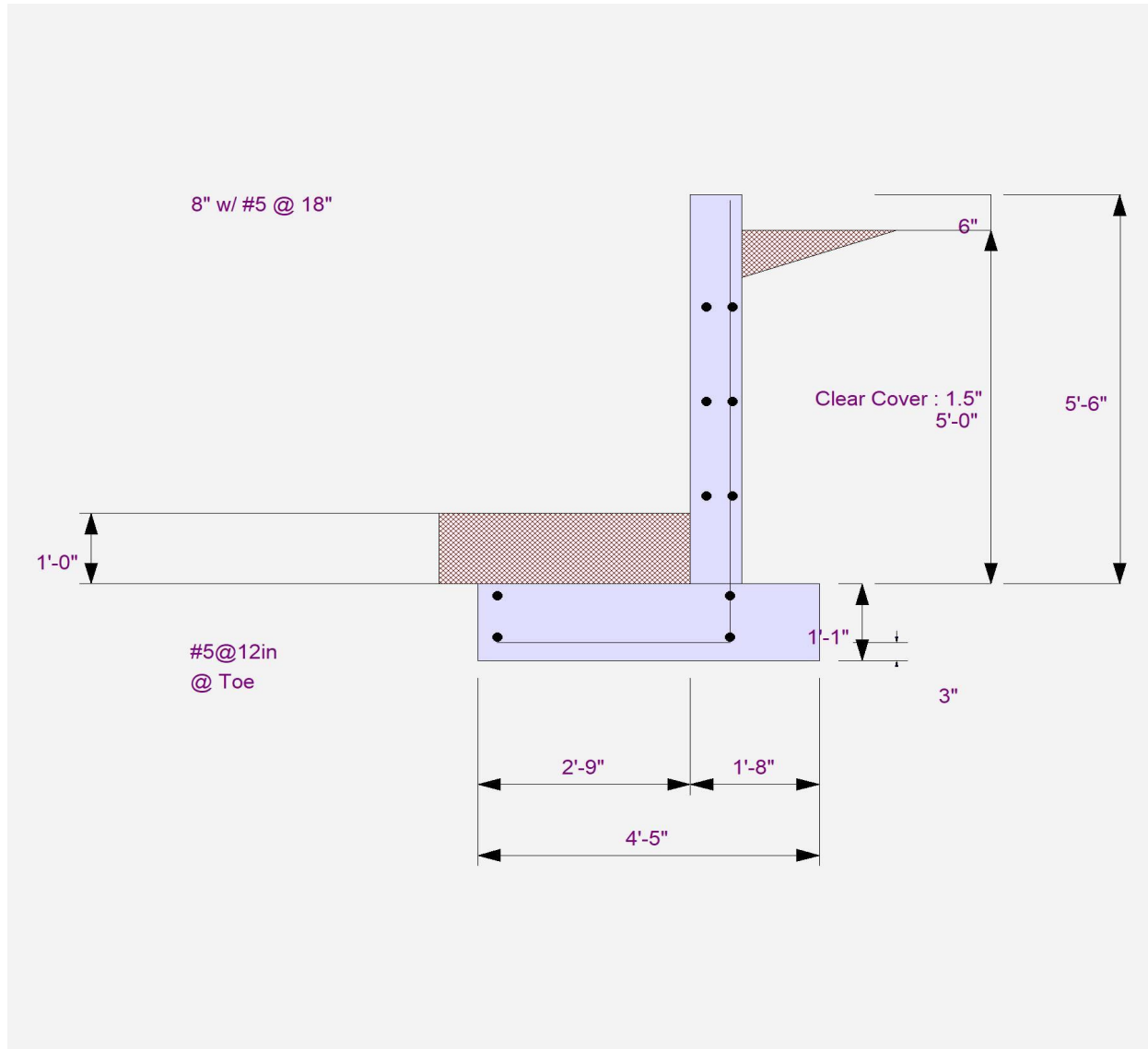
Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - w/seismic 4' tall



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: SEARS.ec6

LIC# : KW-06015571, Build:20.23.2.14

C.T. ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: sears retaining wall - w/seismic 4' tall

