19-205139 REV 01 RS

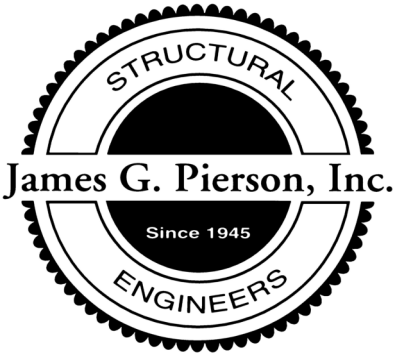
STRUCTURAL CALCULATIONS
REVISONS TO CONCRETE STRENGTH

PROJECT:

Kramer / Falk Remodel
4145 SW Agate Lane
Portland, OR 97239

for

Eric Butler Design
2400 SE Holgate Blvd
Portland, OR 97202



James G. Pierson, Inc.
Consulting Structural Engineers
610 S.W. ALDER SUITE 918 PORTLAND, OR. 97205
(503) 226-1286 FAX 226-3130

May 9, 2022

REMODEL / ADDITION

Project located in Portland, Oregon

GENERAL DESIGN LOADS:

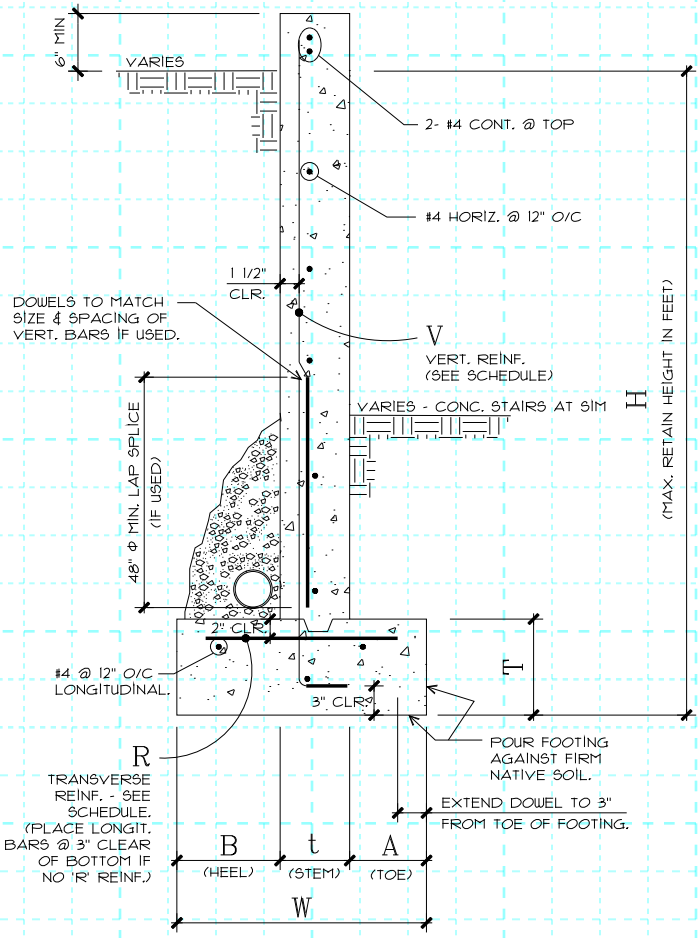
Project is designed in accord with requirements of the 2019 Oregon Structural Specialty Code. For this location the following design parameters apply:

Occupancy Category II
Seismic Site Class D, Design Category D
Roof Snow Load 25 PSF Roof Dead Load 15 PSF
Floor Live Load 40 PSF Floor Dead Load 12 PSF
Deck Live Load 60 PSF
Wind: 98 MPH EXP C (ASCE 7-16)
Allowable Soil Bearing Pressure = 2300 PSF (Per Strata Design dated 10/23/19)

Design Summary:

The following revised calculations are for the house remodel in Portland, Oregon. The design strength of the site retaining walls was changed from 3000 psi to 2500 psi concrete to eliminate the requirement for special inspection (that was not done when built). The 2nd item changed is detail 7/S4.1 for the epoxied dowels to tie the new foundation to existing, These dowels work with our without epoxy and the epoxy was not inspected when installed. As such, no special inspection would be required on project.

The techniques and principles of structural analysis used for these calculations conform to generally accepted standards of the engineering community. These design calculations have been prepared based upon architectural drawings furnished by client.



H	W	t	A	B	T	V	R
MAX. HT. IN FEET	TOTAL WIDTH IN INCHES	STEM WIDTH IN INCHES	TOE LENGTH IN INCHES	HEEL LENGTH IN INCHES	FOOTING THICKNESS IN INCHES	VERTICAL WALL REINFORCING	TRANSVERSE REINF. IN FOOTING
4'-0"	30"	6"	12"	12"	12"	#4 @ 18" O/C	NOT REQUIRED
6'-0"	48"	6"	18"	24"	12"	#4 @ 18" O/C	NOT REQUIRED
8'-0"	66"	8"	24"	34"	12"	#4 @ 12" O/C	#4 @ 18" O/C

NOTES:
RETAINING WALLS ARE DESIGNED FOR THE FOLLOWING PARAMETERS:
STUDWALL AXIAL LOAD CAN RANGE BETWEEN ZERO AND 1500 lb/ft VERTICAL LOAD
MAX. BEARING PRESSURE = 2300 psf
SOIL PASSIVE PRESSURE = 250 (h) pcf
SUBGRADE COEFFICIENT OF FRICTION = 0.40
CONCRETE TO BE f'c = 2500 psi MIN.
SOIL ACTIVE PRESSURE = 40 (h) pcf
REBAR TO BE ASTM A615 GRADE 40 MIN.

5 4

1
S4.2

DETAIL

1" = 1'-0"

James G. Pierson, Inc.

Consulting Structural Engineers

610 S.W.Alder, Suite 918 Portland, Oregon 97205

Tel: (503) 226-1286 Fax: (503) 226-3130

Project: Kramer/Falk Remodel	Job no.
Location: 4145 SW Agate	Date: 5/9/22
Client: Butler Design	Sheet no.: Page 3 of 27

James G. Pierson, Inc.
610 SW Alder #918
Portland, OR 97205
503-226-1286
www.jgpierson.com

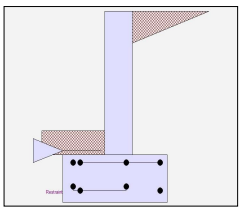
Project Name/Number : agate - retai
Title **4 ft** :
Dsgnr: **Golberg**
Description....
Site Retaining Wall sch.

Date: 7 JAN 2020

This Wall in File: X:\Residential Projects\Residential Projects 2019\4145 SW Agate - Butler Design\

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16



Criteria

Retained Height	=	3.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	2,300.0 psf	Soil Density, Heel	=	110.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	0.00 pcf
Active Heel Pressure	=	40.0 psf/ft	Footing||Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	250.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)

Wind on Exposed Stem

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs	Footing Type		Line Load
Footing Width	=	0.00 ft	Base Above/Below Soil		
Eccentricity	=	0.00 in	at Back of Wall	=	0.0 ft
Wall to Ftg CL Dist	=	0.00 ft	Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Triangular

Load at bottom of Triangular Distribution	=	112.000 psf	Total Strength-Level Seismic Load.	=	224.000 lbs
Strength-Level)			Total Service-Level Seismic Load.	=	156.800 lbs

Wall Design Summary

Stability Ratios

Overturning	=	2.27 OK
Slab Resists All Sliding !		

Soil Bearing

Total Bearing Load	=	950 lbs
...resultant ecc.	=	4.82 in
Soil Pressure @ Toe	=	746 psf OK
Soil Pressure @ Heel	=	14 psf OK
Allowable	=	2,300 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,045 psf
ACI Factored @ Heel	=	19 psf
Footing Shear @ Toe	=	2.1 psi OK
Footing Shear @ Heel	=	2.8 psi OK
Allowable	=	75.0 psi

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment
Soil Over Heel (above water table, if any)	275.0	lbs	2.08	ft	572.9ft-#
Soil Over Heel (below water table, if any)	0.0				
Water Table	0.0				
Soil Over Heel	275.0		2.08		572.9
Sloped Soil Over Heel	0.0				
Surcharge Over Heel	0.0				
Adjacent Footing Load	0.0				
Axial Dead Load on Stem	0.0				
Axial Live Load on Stem *	0.0				
Soil Over Toe	0.0		0.50		
Surcharge Over Toe	0.0				
Stem Weight(s)	300.0		1.33		400.0
Earth @ Stem Transitions	0.0				
Footing Weight	375.0		1.25		468.8
Key Weight	0.0		2.00		
Vert. Component	0.0				
Total Vertical Loads	950.0	lbs			
Resisting Moment					**1,441.7** ft-#
Eccentricity					**4.8** in

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

Overturning

Overturning Moments

Overturning Moments	Force	Distance	Moment
Heel Active Pressure (above water table, if any)	320.0 lbs	1.33 ft	426.7 ft-#
Heel Active Pressure (below water table, if any)	0.0		
Hydrostatic Force	0.0		
Buoyant Force	0.0		
Surcharge over Heel	0.0		
Adjacent Footing	0.0		
Surcharge Over Toe	0.0		
Load @ Stem Above Soil	0.0		
Added Lateral Load	0.0		
Seismic Load	156.8	1.33	209.1
Seismic-Self-weight	0.0		
Totals =	476.8 lbs		
	Overturning Moment		635.7 ft-#

Stem Design Summary

			Bottom
			Stem OK
Design Height Above Ftg	ft	=	0.00
Wall Material Above "Ht"		=	Concrete
Design Method		=	LRFD
Thickness		=	8.00
Rebar Size		=	# 4
Rebar Spacing		=	9.00
Rebar Placed at		=	Edge
Design Data			
fb/FB + fa/Fa		=	**0.057**
Total Force @ Section			
Service Level	lbs	=	
Strength Level	lbs	=	414.0
Moment....Actual			
Service Level	ft-#	=	
Strength Level	ft-#	=	414.0
Moment.....Allowable		=	7,122.4
Shear.....Actual			
Service Level	psi	=	
Strength Level	psi	=	5.5
Shear.....Allowable	psi	=	75.0
Anet	in2	=	
Rebar Depth 'd'	in	=	6.25
Masonry Data			
f'm	psi	=	
Fs	psi	=	
Solid Grouting		=	
Modular Ratio 'n'		=	
Wall Weight	psf	=	100.0
Short Term Factor		=	
Equiv. Solid Thick.		=	
Masonry Block Type		=	Medium Weight
Masonry Design Method		=	ASD
Concrete Data			
f'c	psi	=	2,500.0
Fy	psi	=	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0155 in2/ft		
(4/3) * As :	0.0207 in2/ft	Min Stem T&S Reinf Area 0.576 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2667 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.00 ft	f'c	=	2,500	psi
Heel Width	=	1.50	Fy	=	60,000	psi
Total Footing Width	=	2.50 ft	Footing Concrete Density	=	150.00	pcf
Footing Thickness	=	12.00 in	Min. As %	=	0.0018	
Key Width	=	0.00 in	Rebar Cover @ Top	=	2.00	in
Key Depth	=	0.00 in	@ Bottom	=	3.00	in
Key Distance from Toe	=	2.00 ft				

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,045	19	psf
Mu' : Upward	=	5,448	46	ft-#
Mu' : Downward	=	1,476	200	ft-#
Mu: Design	=	143	-15	ft-#
Actual 1-Way Shear	=	2.05	2.82	psi
Allow 1-Way Shear	=	75.00	75.00	psi

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.34 in, #6@ 20.36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46

Heel: #4@ 9.25 in, #5@ 14.34 in, #6@ 20.36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area	0.65	in2
Min footing T&S reinf Area per fo	0.26	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

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.

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.

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	8.40 in
As Provided =	0.2667 in2/ft
As Required =	0.1728 in2/ft

James G. Pierson, Inc.
610 SW Alder #918
Portland, OR 97205
503-226-1286
www.jgpierson.com

Project Name/Number : agate - retai
Title **6 ft** :
Dsgnr: **Golberg**
Description....
Site Retaining Wall sch.

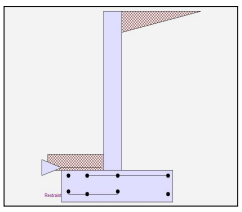
Date: 9 MAY 2022

This Wall in File: X:\Residential Projects\Residential Projects 2019\4145 SW Agate - Butler Design\

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria



Retained Height	=	5.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	2,300.0 psf	Soil Density, Heel	=	110.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	0.00 pcf
Active Heel Pressure	=	40.0 psf/ft	Footing||Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	250.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)

Wind on Exposed Stem

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs	Footing Type		Line Load
Footing Width	=	0.00 ft	Base Above/Below Soil		
Eccentricity	=	0.00 in	at Back of Wall	=	0.0 ft
Wall to Ftg CL Dist	=	0.00 ft	Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Triangular

Load at bottom of Triangular Distribution	=	175.000 psf	Total Strength-Level Seismic Load.	=	525.000 lbs
Strength-Level)			Total Service-Level Seismic Load.	=	367.500 lbs

Wall Design Summary

Stability Ratios

Overturning	=	2.40 OK
Slab Resists All Sliding !		

Soil Bearing

Total Bearing Load	=	2,108 lbs
...resultant ecc.	=	6.64 in
Soil Pressure @ Toe	=	964 psf OK
Soil Pressure @ Heel	=	90 psf OK
Allowable	=	2,300 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,350 psf
ACI Factored @ Heel	=	126 psf
Footing Shear @ Toe	=	7.5 psi OK
Footing Shear @ Heel	=	7.0 psi OK
Allowable	=	75.0 psi

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment
Soil Over Heel (above water table, if any)	1,008.3	lbs	3.08	ft	3,109.0ft-#
Soil Over Heel (below water table, if any)	0.0				
Water Table	0.0				
Soil Over Heel	1,008.3		3.08		3,109.0
Sloped Soil Over Heel	0.0				
Surcharge Over Heel	0.0				
Adjacent Footing Load	0.0				
Axial Dead Load on Stem	0.0				
Axial Live Load on Stem *	0.0				
Soil Over Toe	0.0		0.75		
Surcharge Over Toe	0.0				
Stem Weight(s)	500.0		1.83		916.7
Earth @ Stem Transitions	0.0				
Footing Weight	600.0		2.00		1,200.0
Key Weight	0.0		2.00		
Vert. Component	0.0				
Total Vertical Loads	2,108.3	lbs			
Resisting Moment					**5,225.7** ft-#
Eccentricity					**6.6** in

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

Overturning

Overturning Moments

Overturning Moments	Force	Distance	Moment
Heel Active Pressure (above water table, if any)	720.0 lbs	2.00 ft	1,440.0 ft-#
Heel Active Pressure (below water table, if any)	0.0		
Hydrostatic Force	0.0		
Buoyant Force	0.0		
Surcharge over Heel	0.0		
Adjacent Footing	0.0		
Surcharge Over Toe	0.0		
Load @ Stem Above Soil	0.0		
Added Lateral Load	0.0		
Seismic Load	367.5	2.00	735.0
Seismic-Self-weight	0.0		
Totals =	1,087.5 lbs		
	Overturning Moment		2,175.0 ft-#

Stem Design Summary

			Bottom
			Stem OK
Design Height Above Ftg	ft	=	0.00
Wall Material Above "Ht"		=	Concrete
Design Method		=	LRFD
Thickness		=	8.00
Rebar Size		=	# 4
Rebar Spacing		=	9.00
Rebar Placed at		=	Edge
Design Data			
fb/FB + fa/Fa		=	**0.272**
Total Force @ Section			
Service Level	lbs	=	
Strength Level	lbs	=	1,164.6
Moment....Actual			
Service Level	ft-#	=	
Strength Level	ft-#	=	1,941.0
Moment.....Allowable		=	7,122.4
Shear.....Actual			
Service Level	psi	=	
Strength Level	psi	=	15.5
Shear.....Allowable	psi	=	75.0
Anet	in2	=	
Rebar Depth 'd'	in	=	6.25
Masonry Data			
f'm	psi	=	
Fs	psi	=	
Solid Grouting		=	
Modular Ratio 'n'		=	
Wall Weight	psf	=	100.0
Short Term Factor		=	
Equiv. Solid Thick.		=	
Masonry Block Type		=	Medium Weight
Masonry Design Method		=	ASD
Concrete Data			
f'c	psi	=	2,500.0
Fy	psi	=	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0727 in2/ft		
(4/3) * As :	0.097 in2/ft	Min Stem T&S Reinf Area 0.960 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2667 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.50 ft	f'c		=	2,500	psi
Heel Width	=	2.50	Fy		=	60,000	psi
Total Footing Width	=	4.00 ft	Footing Concrete Density		=	150.00	pcf
Footing Thickness	=	12.00 in	Min. As %		=	0.0018	
Key Width	=	0.00 in	Rebar Cover	@ Top	=	2.00	in
Key Depth	=	0.00 in		@ Bottom	=	3.00	in
Key Distance from Toe	=	2.00 ft					

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,350	126	psf
Mu' : Upward	=	16,160	526	ft-#
Mu' : Downward	=	3,321	1,412	ft-#
Mu: Design	=	553	-172	ft-#
Actual 1-Way Shear	=	7.46	6.97	psi
Allow 1-Way Shear	=	75.00	75.00	psi

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.34 in, #6@ 20.36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46

Heel: #4@ 9.25 in, #5@ 14.34 in, #6@ 20.36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area	1.04	in2
Min footing T&S reinf Area per fo	0.26	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

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.

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)	0.033	in

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

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	8.40 in
As Provided =	0.2667 in2/ft
As Required =	0.1728 in2/ft

James G. Pierson, Inc.
610 SW Alder #918
Portland, OR 97205
503-226-1286
www.jgpierson.com

Project Name/Number : agate - retai
Title **8 ft** :
Dsgnr: **Golberg**
Description....
Site Retaining Wall sch.

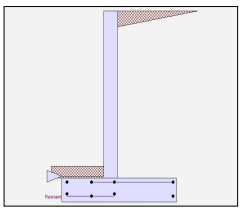
Date: 9 MAY 2022

This Wall in File: X:\Residential Projects\Residential Projects 2019\4145 SW Agate - Butler Design\

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria



Retained Height	=	7.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	2,300.0 psf	Soil Density, Heel	=	110.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	0.00 pcf
Active Heel Pressure	=	40.0 psf/ft	Footing||Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	250.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)

Wind on Exposed Stem

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs	Footing Type		Line Load
Footing Width	=	0.00 ft	Base Above/Below Soil		
Eccentricity	=	0.00 in	at Back of Wall	=	0.0 ft
Wall to Ftg CL Dist	=	0.00 ft	Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Triangular

Load at bottom of Triangular Distribution	=	343.000 psf	Total Strength-Level Seismic Load.	=	1,372.000 lbs
Strength-Level)			Total Service-Level Seismic Load.	=	960.400 lbs

Wall Design Summary

Stability Ratios

Overturning	=	2.14 OK
Slab Resists All Sliding !		

Soil Bearing

Total Bearing Load	=	3,707 lbs
...resultant ecc.	=	10.87 in
Soil Pressure @ Toe	=	1,340 psf OK
Soil Pressure @ Heel	=	8 psf OK
Allowable	=	2,300 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,876 psf
ACI Factored @ Heel	=	11 psf
Footing Shear @ Toe	=	17.6 psi OK
Footing Shear @ Heel	=	15.2 psi OK
Allowable	=	75.0 psi

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment
Soil Over Heel (above water table, if any)	2,181.7	lbs	4.08	ft	8,908.5ft-#
Soil Over Heel (below water table, if any)	0.0				
Water Table	0.0				
Soil Over Heel	2,181.7		4.08		8,908.5
Sloped Soil Over Heel	0.0				
Surcharge Over Heel	0.0				
Adjacent Footing Load	0.0				
Axial Dead Load on Stem	0.0				
Axial Live Load on Stem *	0.0				
Soil Over Toe	0.0		1.00		
Surcharge Over Toe	0.0				
Stem Weight(s)	700.0		2.33		1,633.3
Earth @ Stem Transitions	0.0				
Footing Weight	825.0		2.75		2,268.8
Key Weight	0.0		2.00		
Vert. Component	0.0				
Total Vertical Loads	3,706.7	lbs			
Resisting Moment					**12,810.6** ft-#
Eccentricity					**10.9** in

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

Overturning

Overturning Moments

Overturning Moments	Force	Distance	Moment
Heel Active Pressure (above water table, if any)	1,280.0 lbs	2.67 ft	3,413.3 ft-#
Heel Active Pressure (below water table, if any)	0.0		
Hydrostatic Force	0.0		
Buoyant Force	0.0		
Surcharge over Heel	0.0		
Adjacent Footing	0.0		
Surcharge Over Toe	0.0		
Load @ Stem Above Soil	0.0		
Added Lateral Load	0.0		
Seismic Load	960.4	2.67	2,561.1
Seismic-Self-weight	0.0		
Totals =	2,240.4 lbs		
	Overturning Moment		5,974.4 ft-#

Stem Design Summary

			Bottom
			Stem OK
Design Height Above Ftg	ft	=	0.00
Wall Material Above "Ht"		=	Concrete
Design Method		=	LRFD
Thickness		=	8.00
Rebar Size		=	# 4
Rebar Spacing		=	9.00
Rebar Placed at		=	Edge
Design Data			
fb/FB + fa/Fa		=	**0.857**
Total Force @ Section			
Service Level	lbs	=	
Strength Level	lbs	=	2,618.4
Moment....Actual			
Service Level	ft-#	=	
Strength Level	ft-#	=	6,109.7
Moment.....Allowable		=	7,122.4
Shear.....Actual			
Service Level	psi	=	
Strength Level	psi	=	34.9
Shear.....Allowable	psi	=	75.0
Anet	in2	=	
Rebar Depth 'd'	in	=	6.25
Masonry Data			
f'm	psi	=	
Fs	psi	=	
Solid Grouting		=	
Modular Ratio 'n'		=	
Wall Weight	psf	=	100.0
Short Term Factor		=	
Equiv. Solid Thick.		=	
Masonry Block Type		=	Medium Weight
Masonry Design Method		=	ASD
Concrete Data			
f'c	psi	=	2,500.0
Fy	psi	=	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2289 in2/ft		
(4/3) * As :	0.3052 in2/ft	Min Stem T&S Reinf Area 1.344 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.25 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2667 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	2.00 ft	f'c		=	2,500	psi
Heel Width	=	3.50	Fy		=	60,000	psi
Total Footing Width	=	5.50 ft	Footing Concrete Density		=	150.00	pcf
Footing Thickness	=	12.00 in	Min. As %		=	0.0018	
Key Width	=	0.00 in	Rebar Cover	@ Top	=	2.00	in
Key Depth	=	0.00 in		@ Bottom	=	3.00	in
Key Distance from Toe	=	2.00 ft					

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,876	11	psf
Mu' : Upward	=	39,594	1,330	ft-#
Mu' : Downward	=	5,904	4,431	ft-#
Mu: Design	=	1,395	-644	ft-#
Actual 1-Way Shear	=	17.59	15.22	psi
Allow 1-Way Shear	=	75.00	75.00	psi

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.34 in, #6@ 20.36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46

Heel: #4@ 9.25 in, #5@ 14.34 in, #6@ 20.36 in, #7@ 27.77 in, #8@ 36.56 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area	1.43	in2
Min footing T&S reinf Area per fo	0.26	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

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.

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)	0.047	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.

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	8.40 in
As Provided =	0.2667 in2/ft
As Required =	0.2500 in2/ft