Hodge engineering inc.

7/6/2022
Report # 220302A

THE APPROVED CONSTRUCTION ENGINEERING DOCUMENTS MUST BE POSTED ON THE JOB AT ALL INSPECTIONS IN A VISIBLE AND READILY ACCESSIBLE LOCATION.

RE: 1522 5th Street SW Puyallup, WA
Jason Davis Landscaping Walls
Unrestrained Retaining Wall

To Whom It May Concern:

I have reviewed the Exhibit Map dated 4/1/2022 by Azure Green Consultants for the Jason Davis Landscaping Walls, located at 1522 5th Street SW Puyallup.

Engineering Requested: At the request of the builder, I have provided an up to 12' tall unrestrained reinforced concrete wall for the south side of the site.

Background: The south block wall circled below is to be a reinforced concrete wall per the builder.

Reviewed 8/04/2022 DLSubject to field inspectors approvals.

City of Puyallup
Development & Permitting Services
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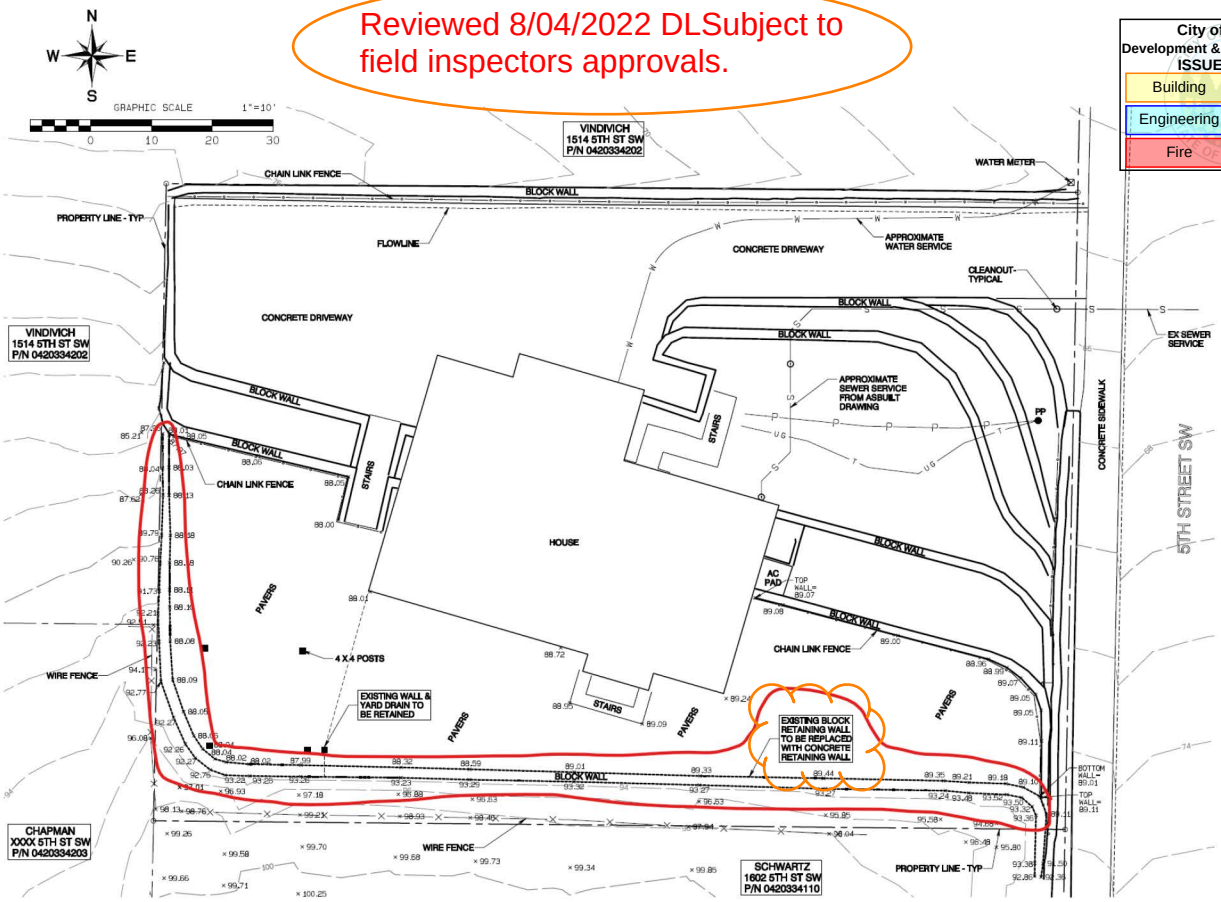
Building | Planning
Engineering | Public Works
Fire | Traffic



Azure Green Consultants Site Plan

B-21-0929

Hodge Engineering, Inc.
John E. Hodge P. E.
3733 Rosedale St NW, Suite 200, Gig Harbor, WA 98335
(253) 857-7055

Hodge engineering inc.

7/6/2022
Report # 220302A

City of Puyallup
Development & Permitting Services
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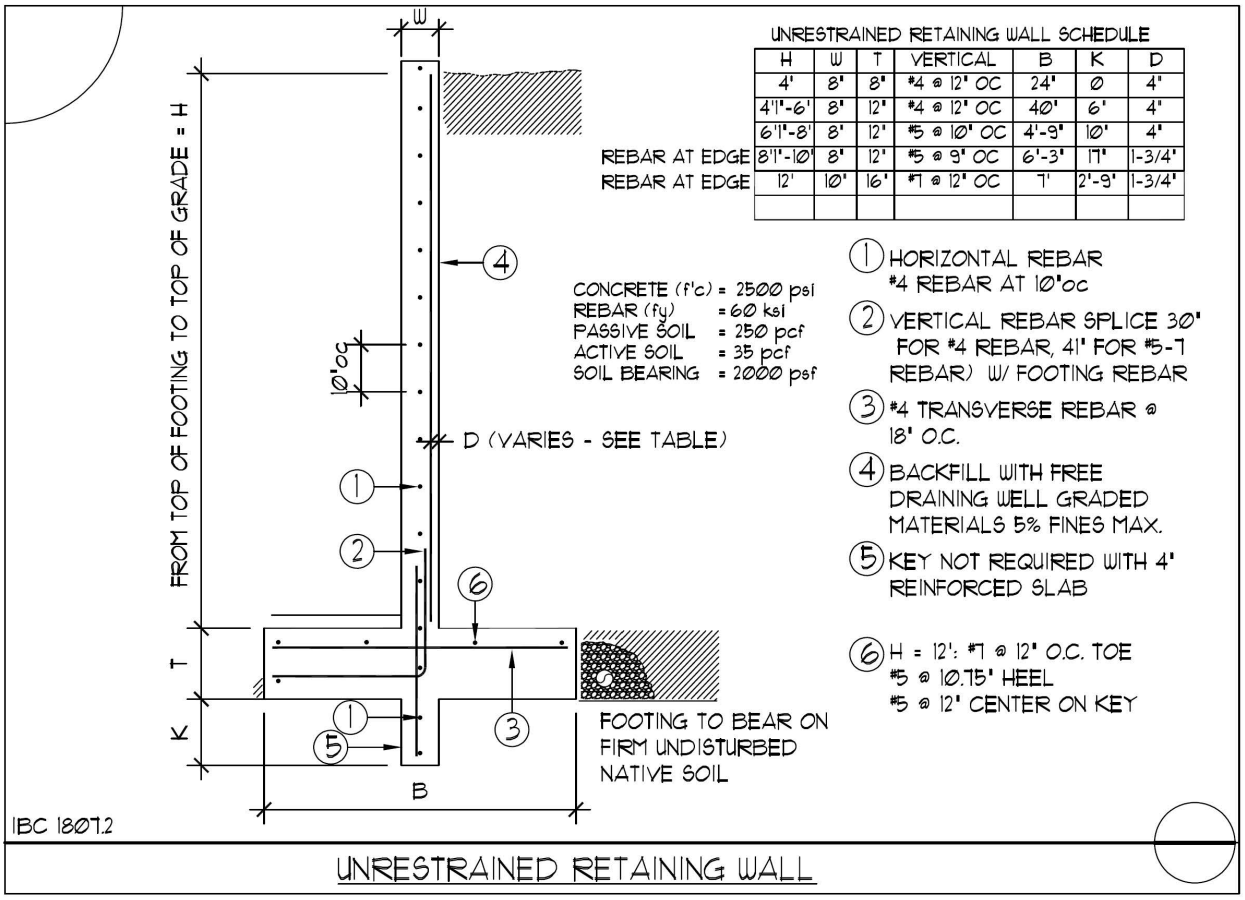
RE: 1522 5th Street SW Puyallup, WA
Jason Davis Landscaping Walls
Unrestrained Retaining Wall

Retaining Wall: The retaining wall detail below can be used in lieu of the south block wall at this site.

Drainage: Exterior grades adjacent to the walls are to be sloped away from the retaining wall. 4" minimum subsurface drains at or below the footing elevation are to be used. Drains are to consist of rigid perforated 4" PVC pipe surrounded by washed pea-gravel or granular fill with less than 5% fines. Place a nonwoven-geotextile filter fabric between the drainage material and the remaining backfill to reduce silt migration into the drainage zone. Please the filter fabric such that it fully separates the drainage material and the backfill and extends over the top of the drainage zone.

The level of the perforations in the pipe are to be at the bottom of the footings and the drains are to be constructed with sufficient gradient to allow gravity discharge.



H	W	T	VERTICAL	B	K	D
4'	8"	8"	#4 @ 12" OC	24"	Ø	4"
4'1"-6'	8"	12"	#4 @ 12" OC	40"	6"	4"
6'1"-8'	8"	12"	#5 @ 10" OC	4'-9"	10"	4"
8'1"-10'	8"	12"	#5 @ 9" OC	6'-3"	17"	1-3/4"
12'	10"	16"	#7 @ 12" OC	7'	2'-9"	1-3/4"

UNRESTRAINED RETAINING WALL

B-21-0929

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RE: 1522 5th Street SW Puyallup, WA
Jason Davis Landscaping Walls
Unrestrained Retaining Wall

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
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Fire	Traffic

General Concrete Structural Notes

4. CONCRETE

CONCRETE WALLS EXCEEDING 8' IN HEIGHT MUST BE DESIGNED AND STAMPED BY A LICENSED PROFESSIONAL ENGINEER. IF CONCRETE WALLS OVER 8' HAVE BEEN DESIGNED FOR THIS PROJECT THEY WILL BE SPECIFIED ON THE PLAN AND SHOWN IN THE DETAILS.

WOOD SHALL NOT BE USED TO SUPPORT MASONRY UNLESS SPECIFICALLY NOTED OTHERWISE ON THE S-SHEETS (IBC 2304.12).

ALL BASEMENT WALLS BELOW FINISHED GRADE SHALL BE WATER PROOFED OUTSIDE BY APPROVED METHODS AND MATERIALS.

CONCRETE: SHALL BE MADE WITH PORTLAND CEMENT ASTM C-150 TYPE II OR TYPE I AND SHALL BE READY MIXED PER ASTM C-94.

MIX DESIGNS: THE CONTRACTOR SHALL DESIGN CONCRETE MIXES THAT MEET OR EXCEED THE REQUIREMENTS OF THE CONCRETE MIX TABLE FOR THE BEARING STRENGTH SPECIFIED. THE MIX DESIGNS SHALL FACILITATE ANTICIPATED PLACEMENT METHODS, WEATHER, TEMPERATURE, REBAR CONGESTION, AND ALL OTHER FACTORS REQUIRED TO PROVIDE A STRUCTURALLY SOUND AND ACCEPTABLE FINISHED PRODUCT. WATER REDUCING ADMIXTURES MAY BE USED TO MEET THESE REQUIREMENTS. MAXIMUM SLUMP SHALL BE 5".

ADMIXTURES: ADMIXTURES SHALL BE BY MASTER BUILDERS, W.R. GRACE, OR PRE-APPROVED EQUAL. ALL MANUFACTURER'S RECOMMENDATIONS SHALL BE FOLLOWED.

WATER: SHALL BE CLEAN AND POTABLE

ITEM	DESIGN f'c (PSI)	MAX. W/C RATIO	MIN. (2) FLYASH (PCY)	MAX. AGGREGATE SIZE (IN)	NOTES	MIN. CEMENTITOUS (1) MATERIAL (SACKS/YARD)
FOUNDATIONS	2500 @ 28 DAYS	0.45	--	3/4	--	5-1/2
STEMWALLS	3000 @ 28 DAYS	0.45	100	3/4	--	5-1/2
SLAB ON GRADE	3000 @ 28 DAYS	0.45	100	3/4		5-1/2
CONCRETE FRAME	2500 @ 28 DAYS	0.45	100	3/4	--	5-1/2

PROVIDE 3000 PSI @ 28 DAYS MINIMUM FOR DURABILITY AT BASEMENT WALLS, FOUNDATION WALLS, EXTERIOR WALLS, PORCHES, CARPORT SLABS AND STEPS EXPOSED TO THE WEATHER AND FOR ALL GARAGE FLOOR SLABS. CONCRETE SHALL BE AIR ENTRAINED. TOTAL AIR CONTENT (PERCENT BY VOLUME OF CONCRETE) SHALL BE NO LESS THAN 5 PERCENT OR MORE THAN 7 PERCENT. NO SPECIAL INSPECTION FOR 3000 PSI CONCRETE - DURABILITY ONLY.

REINFORCING STEEL: SHALL CONFORM TO ASTM A-615, GRADE 60. PLACE PER ACI 315 AND ACI 318. VERTICAL AND HORIZONTAL REINFORCEMENT SHALL BE THE LONGEST LENGTHS PRACTICAL. WHERE SPLICES ARE NECESSARY THE LENGTH OF LAP SPLICE SHALL BE A MINIMUM OF 30 INCHES FOR #4, 38 INCHES FOR #5, AND 45 INCHES FOR #6. THE MAXIMUM GAP BETWEEN NON-CONTACT PARALLEL BARS AT A LAP SPLICE SHALL NOT EXCEED 5 INCHES.

CRACKS: UN-REINFORCED CONCRETE WILL CRACK. SLAB CRACK CONTROL IS RECOMMENDED IF CRACKS ARE UNDESIRABLE AND IS AS DIRECTED BY THE OWNER. OWNER IS TO DETERMINE THE ACCEPTABLE AMOUNT OF SLAB CRACKING PRIOR TO CONSTRUCTION AND REQUEST APPROPRIATE CRACK CONTROL.

CONCRETE MINIMUM COVER OVER REINFORCEMENT
CONCRETE CAST AGAINST EARTH = 3" EXPOSED TO WEATHER OR EARTH = 2"
WALLS AND SLABS NOT EXPOSED TO WEATHER = 3/4"

Engineering calculations and detail attached.

7/6/2022
Report #220302A

JOHN E. HODGE — STATE OF WASHINGTON — 27886 — REGISTERED PROFESSIONAL ENGINEER

John Hodge P.E.

B-21-0929

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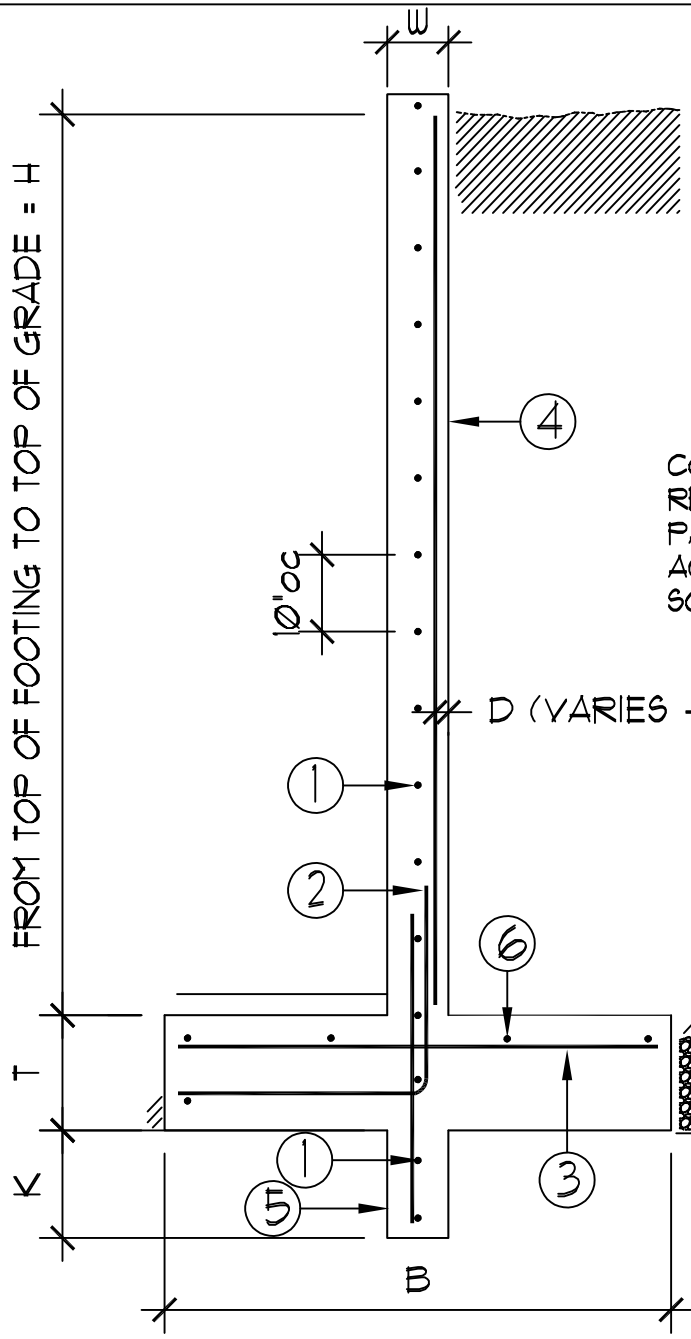

UNRESTRAINED RETAINING WALL SCHEDULE

	H	W	T	VERTICAL	B	K	D
	4'	8"	8"	#4 @ 12" OC	24"	Ø	4"
	4'1"-6'	8"	12"	#4 @ 12" OC	40"	6"	4"
	6'1"-8'	8"	12"	#5 @ 10" OC	4'-9"	10"	4"
REBAR AT EDGE	8'1"-10'	8"	12"	#5 @ 9" OC	6'-3"	17"	1-3/4"
REBAR AT EDGE	12'	10"	16"	#7 @ 12" OC	7'	2'-9"	1-3/4"

CONCRETE (f'c) = 2500 psi
REBAR (fy) = 60 ksi
PASSIVE SOIL = 250 pcf
ACTIVE SOIL = 35 pcf
SOIL BEARING = 2000 psf

1. HORIZONTAL REBAR #4 REBAR AT 10"oc
2. VERTICAL REBAR SPLICE 30" FOR #4 REBAR, 41" FOR #5-7 REBAR) W/ FOOTING REBAR
3. #4 TRANSVERSE REBAR @ 18" O.C.
4. BACKFILL WITH FREE DRAINING WELL GRADED MATERIALS 5% FINES MAX.
5. KEY NOT REQUIRED WITH 4" REINFORCED SLAB
6. H = 12': #7 @ 12" O.C. TOE
   #5 @ 10.75" HEEL
   #5 @ 12" CENTER ON KEY

FOOTING TO BEAR ON FIRM UNDISTURBED NATIVE SOIL

IBC 1807.2

City of Puyallup
Development & Permitting Services
ISSUED PERMIT
Building | Planning
Engineering | Public Works
Fire | Traffic

UNRESTRAINED RETAINING WALL

B-21-0929

Hodge Engineering, Inc.
3733 Rosedale St. Ste. 200
Gig Harbor, WA. 98335

Project Name/Number : unrestrained
Title **6' Unrestrained 40 psf Surcharge**
Dsgnr: **JEH**
Description....
6' Unrestrained wall

This Wall in File: C:\Users\johnhodge\Documents\RetainPro 10 Project Files\unrestrained walls 2.RPX

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License : KW-06053958
License To : HODGE ENGINEERING

Cantilevered Retaining Wall

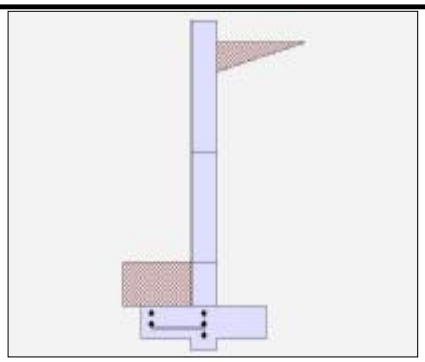
Code: IBC 2018,ACI 318-14,TMS 402-16

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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 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	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

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 (Service Level)	=	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	=	100.0 lbs
Axial Live Load	=	200.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	2.07	OK
Sliding	=	1.55	OK
Total Bearing Load	=	2,391 lbs	
...resultant ecc.	=	6.69 in	
Soil Pressure @ Toe	=	1,488 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,083 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	19.0 psi	OK
Footing Shear @ Heel	=	9.2 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	883.3 lbs	
less 100% Passive Force	= -	600.0 lbs	
less 100% Friction Force	= -	766.8 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	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	3.50	1.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	8.00	8.00	8.00
Rebar Size	=	# 4	# 4	# 4
Rebar Spacing	=	12.00	12.00	12.00
Rebar Placed at	=	Center	Center	Center
Design Data				
fb/FB + fa/Fa	=	**0.061**	**0.419**	**0.703**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	225.9	801.8	1,130.2
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	209.5	1,421.2	2,382.5
Moment.....Allowable	ft-# =	3,387.6	3,387.6	3,387.6
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	4.7	16.7	23.5
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	4.00	4.00	4.00
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	100.0	100.0	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	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0126 in2/ft		
(4/3) * As :	0.0169 in2/ft	Min Stem T&S Reinf Area 0.576 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 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 :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0858 in2/ft		
(4/3) * As :	0.1144 in2/ft	Min Stem T&S Reinf Area 0.480 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 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 :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1438 in2/ft		
(4/3) * As :	0.1918 in2/ft	Min Stem T&S Reinf Area 0.192 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 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 :	0.16 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.30 ft
Heel Width	=	1.96
Total Footing Width	=	3.26
Footing Thickness	=	9.00 in
Key Width	=	8.00 in
Key Depth	=	3.00 in
Key Distance from Toe	=	1.30 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	=	2,083	0	psf
Mu' : Upward	=	18,171	211	ft-#
Mu' : Downward	=	2,691	831	ft-#
Mu: Design	=	1,290	620	ft-#
Actual 1-Way Shear	=	19.05	9.24	psi
Allow 1-Way Shear	=	75.00	40.00	psi

Toe Reinforcing = # 4 @ 12.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = # 4 @ 13.89 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.

Other Acceptable Sizes & Spacings

Toe: #4@ 12.34 in, #5@ 19.13 in, #6@ 27.16 in, #7@ 37.03 in, #8@ 48.76 in, #9@ 6
Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm
Key: phiMn = phi'5'lambda'sqrt(fc)'Sm

Min footing T&S reinf Area 0.63 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Hodge Engineering, Inc.
3733 Rosedale St. Ste. 200
Gig Harbor, WA. 98335

Project Name/Number : unrestrained
Title **8' Unrestrained 40 psf Surcharge**
Dsgnr: **JEH**
Description....
8' Unrestrained wall 40 psf surcharge

This Wall in File: C:\Users\johnhodge\Documents\RetainPro 10 Project Files\unrestrained walls 2.RPX

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Cantilevered Retaining Wall

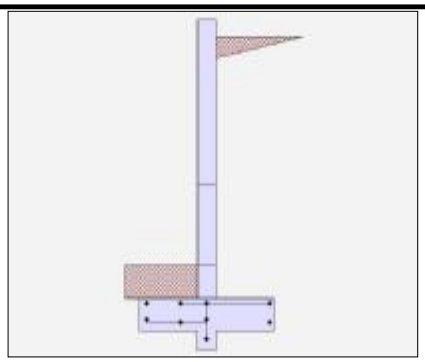
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	8.00 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	=	1,515.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 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	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

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 (Service Level)	=	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	=	100.0 lbs
Axial Live Load	=	200.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	2.38	OK
Sliding	=	1.53	OK
Total Bearing Load	=	4,030 lbs	
...resultant ecc.	=	7.50 in	
Soil Pressure @ Toe	=	1,514 psf	OK
Soil Pressure @ Heel	=	179 psf	OK
Allowable	=	1,515 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,120 psf	
ACI Factored @ Heel	=	251 psf	
Footing Shear @ Toe	=	19.7 psi	OK
Footing Shear @ Heel	=	11.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,532.0 lbs	
less 100% Passive Force	= -	1,001.0 lbs	
less 100% Friction Force	= -	1,340.3 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	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	3.50	1.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	8.00	8.00	8.00
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	12.00	12.00	10.75
Rebar Placed at	=	Center	Center	Center
Design Data				
fb/FB + fa/Fa	=	**0.208**	**0.729**	**0.970**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	658.6	1,514.5	1,954.9
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,056.7	3,700.2	5,430.3
Moment.....Allowable	ft-# =	5,069.7	5,069.7	5,593.0
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	13.7	31.6	40.7
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	4.00	4.00	4.00
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	100.0	100.0	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	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

City of Puyallup
Development & Permitting Services
ISSUED PERMIT
Building | Planning
Engineering | Public Works
Fire | Traffic

B-21-0929

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0638 in2/ft		
(4/3) * As :	0.0851 in2/ft	Min Stem T&S Reinf Area 0.960 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 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 :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2234 in2/ft		
(4/3) * As :	0.2978 in2/ft	Min Stem T&S Reinf Area 0.480 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 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 :	0.2234 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 :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3278 in2/ft		
(4/3) * As :	0.4371 in2/ft	Min Stem T&S Reinf Area 0.192 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 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 :	0.3278 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.346 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	2.05 ft
Heel Width	=	2.71
Total Footing Width	=	4.76
Footing Thickness	=	12.00 in
Key Width	=	8.00 in
Key Depth	=	7.00 in
Key Distance from Toe	=	2.05 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	=	2,120	251	psf
Mu' : Upward	=	46,526	1,086	ft-#
Mu' : Downward	=	7,837	2,721	ft-#
Mu: Design	=	3,224	1,635	ft-#
Actual 1-Way Shear	=	19.69	11.62	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 9.26 in
Heel Reinforcing = # 4 @ 18.00 in
Key Reinforcing = # 4 @ 13.89 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.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Key: #4@ 13.88 in, #5@ 18 in, #6@ 18 in, #7@ 18 in, #8@ 18 i

Min footing T&S reinf Area 1.23 in2
Min footing T&S reinf Area per foot 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

Hodge Engineering, Inc.
3733 Rosedale St. Ste. 200
Gig Harbor, WA. 98335

Project Name/Number : unrestrained
Title **10' Unrestrained 40 psf Surcharge**
Dsgnr: **JEH**
Description....
10' Unrestrained wall with 40 psf surcharge

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Cantilevered Retaining Wall

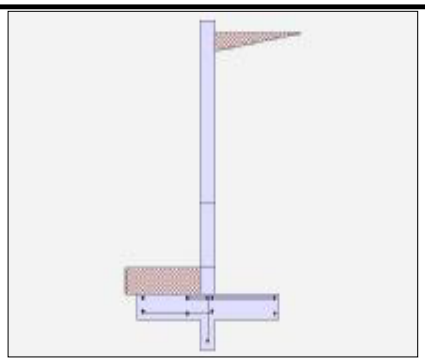
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	10.00 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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 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	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

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 (Service Level)	=	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	=	2.64	OK
Sliding	=	1.53	OK
Total Bearing Load	=	5,600 lbs	
...resultant ecc.	=	7.60 in	
Soil Pressure @ Toe	=	1,438 psf	OK
Soil Pressure @ Heel	=	351 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,014 psf	
ACI Factored @ Heel	=	492 psf	
Footing Shear @ Toe	=	28.7 psi	OK
Footing Shear @ Heel	=	18.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,257.5 lbs	
less 100% Passive Force	= -	1,504.2 lbs	
less 100% Friction Force	= -	1,960.1 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	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	3.50	1.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	8.00	8.00	8.00
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	9.00	9.00	9.00
Rebar Placed at	=	6.25 i	6.25 i	6.25 i
Design Data				
fb/FB + fa/Fa	=	**0.279**	**0.711**	**0.965**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,315.4	2,451.3	3,003.6
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	2,993.3	7,628.7	10,351.5
Moment.....Allowable	ft-# =	10,717.8	10,717.8	10,717.8
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	17.5	32.7	40.0
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	6.25	6.25	6.25
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	100.0	100.0	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	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

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B-21-0929

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1121 in2/ft		
(4/3) * As :	0.1495 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 :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.4133 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2858 in2/ft		
(4/3) * As :	0.3811 in2/ft	Min Stem T&S Reinf Area 0.480 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 :	0.2858 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.4133 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3878 in2/ft		
(4/3) * As :	0.5171 in2/ft	Min Stem T&S Reinf Area 0.192 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 :	0.3878 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.4133 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	=	2.80 ft
Heel Width	=	3.46
Total Footing Width	=	6.26
Footing Thickness	=	12.00 in
Key Width	=	8.00 in
Key Depth	=	14.00 in
Key Distance from Toe	=	2.80 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	=	2,014	492	psf
Mu' : Upward	=	83,819	2,808	ft-#
Mu' : Downward	=	14,633	6,113	ft-#
Mu: Design	=	5,766	3,305	ft-#
Actual 1-Way Shear	=	28.73	17.96	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 4 @ 9.25 in
Heel Reinforcing = # 4 @ 9.26 in
Key Reinforcing = # 4 @ 13.88 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.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Key: #4@ 13.88 in, #5@ 18 in, #6@ 18 in, #7@ 18 in, #8@ 18 i

Min footing T&S reinf Area 1.62 in2
Min footing T&S reinf Area per foot 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

Hodge Engineering Inc.
3733 Rosedale Street
Suite 100
Gig Harbor, WA 98335

Project Name/Number : unrestrained
Title **12' Unrestrained 40 psf Surcharge**
Dsgnr: **JEH**
Description....
12' Unrestrained wall with 40 psf surcharge

Date: 6 JUL 2022

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Cantilevered Retaining Wall

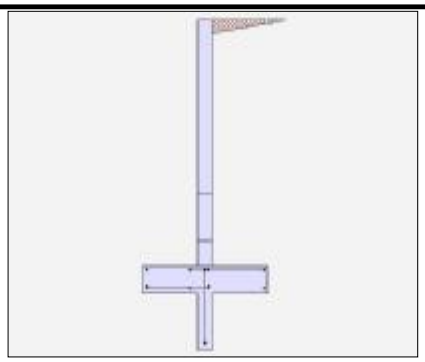
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

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

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 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	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

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 (Service Level)	=	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	=	100.0 lbs
Axial Live Load	=	250.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	2.32	OK
Sliding	=	1.57	OK
Total Bearing Load	=	7,795 lbs	
...resultant ecc.	=	10.35 in	
Soil Pressure @ Toe	=	1,934 psf	OK
Soil Pressure @ Heel	=	291 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,707 psf	
ACI Factored @ Heel	=	407 psf	
Footing Shear @ Toe	=	29.1 psi	OK
Footing Shear @ Heel	=	18.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	3,280.8 lbs	
less 100% Passive Force	= -	2,501.0 lbs	
less 100% Friction Force	= -	2,640.7 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	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	3.50	1.25	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	10.00	10.00	10.00
Rebar Size	=	# 7	# 7	# 7
Rebar Spacing	=	12.00	12.00	12.00
Rebar Placed at	=	Edge	Edge	Edge
Design Data				
fb/FB + fa/Fa	=	**0.349**	**0.690**	**0.950**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	2,196.1	3,454.7	4,276.4
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	6,467.5	12,771.4	17,594.2
Moment.....Allowable	ft-# =	18,507.2	18,507.2	18,507.2
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	24.2	38.1	47.1
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	7.56	7.56	7.56
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	125.0	125.0	125.0
Short Term Factor	=			
Equiv. Solid Thick.	=			
Masonry Block Type	=	Medium Weight		
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =	2,500.0	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

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B-21-0929

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1984 in2/ft		
(4/3) * As :	0.2645 in2/ft	Min Stem T&S Reinf Area 2.040 in2	
200bd/fy : 200(12)(7.5625)/60000 :	0.3025 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2645 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.6 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.0245 in2/ft	#6@ 22.00 in	#6@ 44.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3918 in2/ft		
(4/3) * As :	0.5224 in2/ft	Min Stem T&S Reinf Area 0.540 in2	
200bd/fy : 200(12)(7.5625)/60000 :	0.3025 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3918 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.6 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.0245 in2/ft	#6@ 22.00 in	#6@ 44.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.5398 in2/ft		
(4/3) * As :	0.7197 in2/ft	Min Stem T&S Reinf Area 0.300 in2	
200bd/fy : 200(12)(7.5625)/60000 :	0.3025 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.5398 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.6 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.0245 in2/ft	#6@ 22.00 in	#6@ 44.00 in

Footing Data

Toe Width	=	3.09 ft
Heel Width	=	3.92
Total Footing Width	=	7.01
Footing Thickness	=	16.00 in
Key Width	=	10.00 in
Key Depth	=	33.00 in
Key Distance from Toe	=	3.09 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	=	2,707	407	psf
Mu' : Upward	=	135,535	3,550	ft-#
Mu' : Downward	=	13,729	9,000	ft-#
Mu: Design	=	10,150	5,450	ft-#
Actual 1-Way Shear	=	29.07	18.57	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 7 @ 12.00 in
Heel Reinforcing = # 5 @ 10.75 in
Key Reinforcing = # 5 @ 12.00 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.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.94 in, #5@ 10.76 in, #6@ 15.27 in, #7@ 20.83 in, #8@ 27.43 in, #9@ 34
Heel: #4@ 6.94 in, #5@ 10.76 in, #6@ 15.27 in, #7@ 20.83 in, #8@ 27.43 in, #9@ 34
Key: #4@ 7.97 in, #5@ 12.35 in, #6@ 17.53 in, #7@ 18 in, #8@

Min footing T&S reinf Area 2.42 in2
Min footing T&S reinf Area per foot 0.35 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.94 in	#4@ 13.89 in
#5@ 10.76 in	#5@ 21.53 in
#6@ 15.28 in	#6@ 30.56 in

B-21-0929

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Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		3,111.1	4.44	13,827.2	Soil Over HL (ab. water tbl)	4,075.8	5.46	22,274.2
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		5.46	22,274.2
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=	169.7	6.67	1,131.3	Surcharge Over Heel	= 123.5	5.46	675.0
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	= 350.0	3.50	350.4
Added Lateral Load	=				* Axial Live Load on Stem	= 250.0	3.50	876.1
Load @ Stem Above Soil	=				Soil Over Toe	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	= 1,500.0	3.50	5,256.6
					Earth @ Stem Transitions	=		
					Footing Weight	= 1,401.8	3.50	4,912.4
					Key Weight	= 343.8	3.50	1,204.6
					Vert. Component	=		
Total	=	3,280.8	**O.T.M.** =	14,958.5	**Total =**	7,544.9 lbs	**R.M.=**	34,673.3

Resisting/Overturning Ratio = **2.32**
Vertical Loads used for Soil Pressure = 7,794.9 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)	0.092	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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