

October 13, 2021

Nate Brusik Lighthouse Homes PO Box 525 Riverton, Utah 84065 <u>Natebrusik1@gmail.com</u> Cc: <u>ryan@pepg.net</u> ryan.dummer@pepg.net

RE: Lighthouse Heights Subdivision - Site Retaining Wall (LEI #2021-2576)

To Whom It May Concern:

Our services have been requested to design the site retaining wall to be installed along the north side of the storm water retention basin in the Lighthouse Heights Subdivision in Elk Ridge, Utah. See the attached plan, details, and calculations for our recommendations.

All site and soil design (e.g. grading, drainage, etc.) is by others and LEI Engineers & Surveyors, Inc. assumes liability for the structural design of the aforementioned site retaining wall only. Information provided in the CMT Engineering Laboratories Geotechnical Engineering Study (project #15559 dated 11/24/2020) and the PEPG Consulting Lighthouse Heights Subdivision Grading & Drainage Plan (sheet C4.0 dated 8/11/2021) were used for the design of the site retaining wall.

Please call if you have any questions or concerns. Thank you.

Sincerely,

-Inden M. West

Jordan M. West, E.I.T. LEI Consulting Engineers & Surveyors, Inc.

Attachments

Reviewed by:



 Civil Engineering

- Structural
 Engineering
- Surveying

Land Planning
Landscape

Architecture















LBI	PROJECT:	JOB #:
ENGINEERS	SUBJECT:	DATE:
	DESIGNER:	SHEET: OF:

PLANNERS

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Project Name/Number : 2021-2576 Title 5'-0" :RETAINING WALL Dsgnr: JMW Description FT1 FW5

vail in Prie. T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

1

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06060294 License To : LEI Engineers and Surveyors

Cantilevered Retaining Wall

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

Criteria **Retained Height** = 5.00 ft Wall height above soil = 6.50 ft Slope Behind Wall = 0.00 Height of Soil over Toe = 18.00 in Water height over heel = 0.0 ft

Surcha	rge	Load	S
--------	-----	------	---

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding	& Ov	rerturning
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Ove	rturnii	ng

Axial Load Applied to Stem

Total Load Tipplied	.0.	010			
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =			0.0 lbs 0.0 lbs 0.0 in		
Design Summary					
Wall Stability Ratios Overturning Sliding	=		2.32 2.64		
Total Bearing Loadresultant ecc.	= =		1,895 9.61		
Soil Pressure @ Toe Soil Pressure @ Heel	=			psf	
Allowable Soil Pressure Less		n A		Э	
ACI Factored @ Toe ACI Factored @ Heel	=		2,262 0	pst psf	
Footing Shear @ Toe Footing Shear @ Heel	=			psi psi	
Allowable Sliding Calcs	=		75.0	psi	
Lateral Sliding Force less 100% Passive Force less 100% Friction Force			718.1 1,328.1 568.6	lbs	
Added Force Req'd for 1.5 Stability	= =		0.0	lbs Ibs	

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

Soil Data				
Allow Soil Bearing		=	2,000.0	psf
Equivalent Fluid Pressu	re N	leth		
Active Heel Pressure		=	35.0	psf/ft
		=		
Passive Pressure		=	425.0	psf/ft
Soil Density, Heel		=	110.00	pcf
Soil Density, Toe		=	0.00	pcf
Footing Soil Friction		=	0.300	
Soil height to ignore				
for passive pressure		=	0.00	in
Lateral Load App	liec	d to	o Stem	
Lateral Load	=	100.00	0.0 #/	ft
Height to Top	=		0.00 ft	
Height to Bottom	=		0.00 ft	
Load Type	=	W	ind (W)	
		(S	ervice Le	evel)
Wind on Exposed Sten (Strength Level)	n =		22.6 ps	sf

·		
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

Stem Construction		2nd	Bottom	
Design Height Above Ftg	ft =	5.50	Stem OK 0.00	STATE OF 6794
Wall Material Above "Ht"	0.0	Fence	Concrete	1200 14
Design Method	=		LRFD	LRFD * JARED R. *
Thickness	=		10.00	
Rebar Size	=		# 5	B No 7942895-
Rebar Spacing	=		12.00	10. 1942030- E
Rebar Placed at	=		Edge	PALFREYMAN No. 7942895- 2202 10-13-21 RD PROFESSIONAL
Design Data				
fb/FB + fa/Fa	=		0.217	PROFESSIONA
Total Force @ Section				
Service Level	lbs =	81.4		
Strength Level	lbs =		846.9	
MomentActual				
Service Level	ft-# =	244.1		
Strength Level	ft-# =		2,378.6	
MomentAllowable	ft-# =		10,911.3	
ShearActual				
Service Level	psi =			
Strength Level	psi =		8.6	
ShearAllowable	' =		75.0	
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =		8.19	
Masonry Data				
fm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf=		125.0	
Short Term Factor	=			
Equiv. Solid Thick.	=			
Masonry Block Type	=	Medium W	eight	
Masonry Design Method	=	ASD	22	
Concrete Data				
f'c	psi =		2,500.0	

Fy

Project Name/Number : 2021-2576 5'-0" RETAINING WALL Title LEI Engineers and Surveyors, Inc Dsgnr: JMW Description FT1 FW5 Spanish Fork, UT 84660

Jared Palfreyman

3302 N. Main St

801-798-0555

Page: 2 Date: 20 SEP 2021

Structural\2021 Structural Jobs\2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31 Cantilevered Retaining Wall Code: IBC 2018, ACI 318-14, TMS 402-16 License : KW-06060294 License To : LEI Engineers and Surveyors **Concrete Stem Rebar Area Details** Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.0672 in2/ft (4/3) * As : 0.0896 in2/ft Min Stem T&S Reinf Area 1.320 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 in2/ft Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft Horizontal Reinforcing Options : 0.0018bh: 0.0018(12)(10): 0.216 in2/ft STATE OF SPAH ================= One layer of : Two layers of : Required Area : 0.216 in2/ft #4@ 10.00 in #4@ 20.00 in 0 Provided Area : 0.31 in2/ft #5@ 15.50 in #5@ 31.00 in JARED R. Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in RECISIONAL CN CINEER **Footing Data Footing Design Results** 1.00 ft Toe Width -Toe Heel Heel Width = 2.17 Factored Pressure 2,262 0 psf \equiv Total Footing Width = 3.17 Mu': Upward = 11,642 22 ft-# Mu' : Downward = 2,268 746 ft-# Footing Thickness = 12.00 in Mu: Design 724 ft-# 781 = Key Width 0.00 in = Actual 1-Way Shear = 4.80 8.27 psi Key Depth 0.00 in = Allow 1-Way Shear = 75.00 40.00 psi Key Distance from Toe = 0.00 ft Toe Reinforcing = # 5 @ 12.00 in Heel Reinforcing = None Spec'd 60,000 psi f'c = 2,500 psi Fy = Footing Concrete Density = 150.00 pcf Key Reinforcing = None Spec'd Min. As % 0.0018 Footing Torsion, Tu = 0.00 ft-lbs = 2.00 Cover @ Top @ Btm .= 3.00 in 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: phiMn = phi'5'lambda'sqrt(fc)'Sm Key: No key defined Min footing T&S reinf Area 0.82 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

#6@ 20.37 in

#5@ 28.70 in

#6@ 40.74 in



Project Name/Number : 2021-2576 Title 5'-0":RETAINING WALL Dsgnr: JMW Description.... FT1 FW5

Page: 3 Date: 20 SEP 2021

This Wall in File. T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

License : KW-06060294 License To : LEI Engineers and Surveyors Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

		VERTURNING		namen kan ng mapanang ti bagi sala si magi pada si na dina managi na mila sa si na sa si na sa si na sa sa si n		SISTING	
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	630.0	2.00	1,260.0	Soil Over HL (ab. water tbl)	733.0	2.50	1,832.2
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)	F	2.50	1,832.2
Hydrostatic Force				Watre Table			
Buoyant Force	=			Sloped Soil Over Heel =			
Surcharge over Heel	=			Surcharge Over Heel =			
	=			Adjacent Footing Load =			
	=			Axial Dead Load on Stem =			
	=			* Axial Live Load on Stem =			
Load @ Stem Above Soil	= 88.1	9.25	815,3	Soil Over Toe =		0.50	
Ū.	=			Surcharge Over Toe =			
				Stem Weight(s) =	687.5	1.42	974.0
	740.4		0.075.0	Earth @ Stem Transitions =			
Total	= 718.1	O.T.M. =	2,075.3	Footing Weight =	474.9	1.58	751.8
				Key Weight =			
Resisting/Overturning			2.32	Vert. Component =			
Vertical Loads used for	Soil Pressure	e = 1,895.4	1 lbs	Total =	1,895.4	lbs R.M.=	4,805.8
				* Axial live load NOT included	in total display	ed or used fo	r overturning

250.0 pci

^{*} 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

Horizontal Defl @ Top of Wall (approximate only) 0.163 in





Jared Palfreyman

 Jared Pattreyman
 Title
 5-0. KETAINING W.

 LEI Engineers and Surveyors, Inc
 Dsgnr: JMW

 3302 N. Main St
 Description....

 Spanish Fork, UT 84660
 FT1 FW5 - SEISMIC

 all in File. T. Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

Project Name/Number : 2021-2576 Title 5'-0" RETAINING WALL Dsgnr: JMW Description.... FT1 FW5 - SEISMIC

tainPro (c) 1987-2019, Build ense : KW-06060294 cense To : LEI Engineers		Cantilevered Retaini	ng Wa	Code: IBC 2018,ACI 318-14,TMS 402-1
Criteria		Soil Data		
Wall height above soil	= 5.00 ft = 6.50 ft = 0.00	Allow Soil Bearing = 2 Equivalent Fluid Pressure Method Active Heel Pressure =	,667.0 ps d 35.0 ps	
	= 18.00 in = 0.0 ft	= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	925.0 ps 110.00 pc 0.00 pc 0.300 0.00 in	of of
Surcharge Loads		Lateral Load Applied to		Adjacent Footing Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied Axial Dead Load	= 0.0 psf turning = 0.0 lbs = 0.0 lbs	Lateral Load = Height to Top = Height to Bottom = Load Type = Wind	0.0 #/ft 0.00 ft 0.00 ft	Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine Load
Earth Pressure Se Method : Uniform Multiplier Used (Multiplier used on soil de	= 15.670	Total Seismic Force = 564	.020	* JARED R. PALFREYMAN
Design Summary		Stem Construction		2nd Bottom 6 No. 7942895-
Wall Stability Ratios Overturning Sliding	= 1.97 OK = 3.38 OK	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = = = =	2ndBottomPALFREYMAN PALFREYMAN No. 7942895–Stem OK22025.500.00FenceConcrete LRFD 10.00
Total Bearing Loadresultant ecc.	= 1,895 lbs = 11.95 in	Rebar Size Rebar Spacing Rebar Placed at	= = =	# 5 12.00 Edge
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 2,151 psf O = 0 psf O = 2,667 psf	Total Force @ Section	=	0.214
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	Than Allowable = 3,012 psf = 0 psf	Service Level Strength Level MomentActual	lbs = lbs =	1,170.1
Footing Shear @ Toe Footing Shear @ Heel Allowable	= 6.6 psi Ol = 9.3 psi Ol = 75.0 psi		ft-# = ft-# = ft-# =	2,341.9 10,911.3
Iding Calcs Lateral Sliding Force less 100% Passive Forc less 100% Friction Force		ShearActual Service Level Strength Level ShearAllowable	psi = psi = =	11.9 75.0
Added Force Req'd for 1.5 Stability	= 0.0 lbs Ol = 0.0 lbs O	 Anet (Masonry) Rebar Depth 'd' Masonry Data 	in2 = in =	8.19
rtical component of activ T considered in the calc		f'm Fs S Solid Grouting Modular Ratio 'n' Wall Weight	psi = psi = = psf =	125.0
oad Factors Building Code Dead Load Live Load	IBC 2018,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	=	ledium Weight

Concrete Data

psi =

psi =

2,500.0

60,000.0

fc

Fy

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



Project Name/Number : 2021-2576 Title 5'-0" RETAINING WALL Dsgnr: JMW Description.... FT1 FW5 - SEISMIC

mis wairin File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06060294 License To : LEI Engineers and Surveyors

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

Concrete Stem Rebar Area Details Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.0661 in2/ft (4/3) * As : 0.0882 in2/ft Min Stem T&S Reinf Area 1.320 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 : STATE OF SPAH Required Area : 0.216 in2/ft #4@ 10.00 in #4@ 20.00 in 0 Provided Area : 0.31 in2/ft #5@ 31.00 in #5@ 15.50 in JARED R. Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in RECISIONAL ENGINEER **Footing Data Footing Design Results** Toe Width 1.00 ft Toe Heel = Heel Width = 2.17 Factored Pressure 3,012 = 0 psf Total Footing Width = 3.17 Mu' : Upward = 14,652 0 ft-# Mu' : Downward 746 ft-# **Footing Thickness** = 12.00 in = 2.268 Mu: Design = 1,032 746 ft-# Key Width 0.00 in = Actual 1-Way Shear = 6.63 9.33 psi Key Depth =0.00 in Allow 1-Way Shear 75.00 40.00 psi Ξ Key Distance from Toe 0.00 ft = Toe Reinforcing = #5@12.00 in 60,000 psi f'c = 2,500 psi Fy = Heel Reinforcing = None Spec'd Footing Concrete Density Key Reinforcing 150.00 pcf = None Spec'd = Min. As % = 0.0018 Footing Torsion, Tu 0.00 ft-lbs Cover @ Top 2.00 @ Btm .= 3.00 in 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: phiMn = phi'5'lambda'sqrt(fc)'Sm Key: No key defined Min footing T&S reinf Area 0.82 in2 Min footing T&S reinf Area per foot in2 /ft 0.26 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



Project Name/Number : 2021-2576 Title 5'-0" RETAINING WALL Dsgnr: JMW Description.... FT1 FW5 - SEISMIC

This Wall in File: T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

License : KŴ-06060294 License To : LEI Engineers and Surveyors

Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

			ERTURNING	
Item		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		630.0	2.00	1,260.0
Buoyant Force	=			
Surcharge over Heel	=			
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=			
Seismic Earth Load	=	394.9	3.00	1,184.7
	=			
Total	=	1,024.9	O.T.M. =	2,444.7
Resisting/Overturning Vertical Loads used fo			= = 1,895.4	1.97 1 lbs

		RE	RESISTING		
		Force Ibs	Distance ft	Moment ft-#	
Soil Over HL (ab. water t	bl)	733.0	2.50	1,832.2	
Soil Over HL (bel. water Watre Table	tbl)		2.50	1,832.2	
Sloped Soil Over Heel	=				
Surcharge Over Heel	=				
Adjacent Footing Load	=				
Axial Dead Load on Stem	า =				
* Axial Live Load on Stem	=				
Soil Over Toe	=		0.50		
Surcharge Over Toe	=				
Stem Weight(s)	=	687.5	1.42	974.0	
Earth @ Stem Transition	s =				
Footing Weight	=	474.9	1.58	751.8	
Key Weight	=				
Vert. Component	=				
Tota Axial live load NOT inclue resistance, but is include	ded i	n total display		4,805.8 r overturning	

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) 0.217 in





Project Name/Number : 2021-2576 Title 8'-0" RETAINING WALL Dsgnr: JMW Description FT3 FW8

all in File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

Soil Data

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06060294 License To : LEI Engineers and Surveyors

Cantilevered Retaining Wall

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

Π

Criteria = **Retained Height** 8.00 ft Wall height above soil 6.50 ft = Slope Behind Wall = 0.00 Height of Soil over Toe = 18.00 in Water height over heel = 0.0 ft

Surcharge I	Load	S
-------------	------	---

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding	& OV	returning
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Ove	rturnii	ng

Axial Load Applied to Stem

. and a source of prices		-			4
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =			0.0 lbs 0.0 lbs 0.0 in		•
Design Summary					
	No. of Concession, Name	a la		and the second se	
Wall Stability Ratios Overturning Sliding	=		3.52 1.67	OK OK	
Total Bearing Loadresultant ecc.	=		3,962 10.81		
Soil Pressure @ Toe Soil Pressure @ Heel	=			psf	
Allowable Soil Pressure Less	= Th	an	2,000 Allowabl	psf e	
ACI Factored @ Toe ACI Factored @ Heel	=		2,582 0	psf psf	
Footing Shear @ Toe	=		11.9	psi	OK
Footing Shear @ Heel	=		15.1	psi	OK
Allowable	=		75.0	psi	
Sliding Calcs					
Lateral Sliding Force less 100% Passive Force less 100% Friction Force		-	1,505.6 1,328.1 1,188.6	lbs	
Added Force Req'd for 1.5 Stability	=			lbs Ibs	

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

IBC 2018,ACI
1.200
1.600
1.600
1.000
1.000

	And in case	and a lot of	Contraction of the local division of the loc	or other the local division of the
Allow Soil Bearing		=	2,000.0	psf
Equivalent Fluid Pressure	e M	leth	lod	5-0 -
Active Heel Pressure		=	35.0	psf/ft
		=		
Passive Pressure		=	425.0	psf/ft
Soil Density, Heel		=	110.00	pcf
Soil Density, Toe		=	0.00	pcf
Footing Soil Friction		=	0.300	
Soil height to ignore				
for passive pressure		=	0.00	in
Lateral Load Appli	ec	l to	Stem	
的制度的现在分词 化化合金属 化合金属	0.000			
Lateral Load	=		0.0 #/	′ft
Height to Top	=		0.00 ft	
Height to Bottom	Ξ		0.00 ft	
Load Type	=	W	ind (W)	
1993 -		(S	ervice Le	evel)
Wind on Exposed Stem (Strength Level)	=		22.6 p	sf

8. A. A. A.			
S. Lanar	-	-	

0.0 lbs
00 ft
.00 in
.00 ft
Load
0.0 ft
00
(

Stem Construction		2nd	Bottom	
Design Height Above F	tc ft=	8.50	Stem OK 0.00	
Wall Material Above "H	lt" =	Fence	Concrete	
Design Method	=		LRFD	LRFD
Thickness	=		10.00	
Rebar Size	=		# 5	
Rebar Spacing	=		12.00	TE OF LTD
Rebar Placed at	=		Edge	STATE OF STAT
Design Data			0.589	A FOR THE
fb/FB + fa/Fa	=		0.589	$//$ // JARED R. $\langle \rangle$
Total Force @ Section		04.4		PALFREYMAN
Service Level	lbs =	81.4	4 000 0	資 No. 7942895- 夏
Strength Level MomentActual	lbs =		1,938.9	ST 2202
Service Level	ft-# =	244.1		(10-13-21) (ST
Strength Level	ft-# =	244.1	6,431.3	PALFREYMAN No. 7942895- 2202 10-13-21 FRED PROFESSIONAL
			1990 - 1990 - 1997 -	101-E201
MomentAllowable	ft-# =		10,911.3	
ShearActual				
Service Level	psi =			
Strength Level	psi =		19.7	
ShearAllowable	=		75.0	
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =		8.19	
Masonry Data	0			8
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'			105.0	
Wall Weight	psf=		125.0	
Short Term Factor	=			
Equiv. Solid Thick. Masonry Block Type	=	Medium W	loight	
Masonry Design Metho		ASD	ogni	
Concrete Data	- uu	AUU		
fc	psi =		2,500.0	
Fy	psi =		60,000.0	



Jared Palfreyman LEI Engineers and Surveyors, Inc

 3302 N. Main St
 Description....

 Spanish Fork, UT 84660
 FT3 FW8

 801-798-0555
 Wall in File. T.\Structural\2021 Structural Jobs\2021-2576_LHH Lighthouse Heights Retaining Wal

Project Name/Number : 2021-2576 Title 8'-0" RETAINING WALL Dsgnr: JMW Description.... FT3 FW8

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06060294 License To : LEI Engineers and Surveyors **Cantilevered Retaining Wall**

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

Concrete Stem Rebar Area	Details	
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1816 in2/ft	
(4/3) * As :	0.2422 in2/ft	Min Stem T&S Reinf Area 2.040 in2
200bd/fy: 200(12)(8.1875)/60000:	0.3275 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 : #4@ 10.00 in #4@ 20.00 in 55 PTE OF 57 PTE
Required Area :	0.2422 in2/ft	One layer of : Two layers of : #4@ 10.00 in #4@ 20.00 in 55 ATE OF 27
Provided Area :	0.31 in2/ft	#5@ 15.50 in #5@ 31.00 in
Maximum Area :	1.1092 in2/ft	#6@ 22.00 in #6@ 44.00 in JARED R.
Footing Data	Footir	g Design Results
Footing Concrete Density = Min. As % =	If torsi supple Other Acc Toe: #4 Heel: #4	rd = 24,682 968 ft-# ward = 4,030 3,861 ft-# ay Shear = 11.94 15.14 psi y Shear = 75.00 75.00 psi rcing = # 5 @ 12.00 in rcing = None Spec'd

Min footing T&S reinf Area	1.21	in2
Min footing T&S reinf Area per foot	0.26	in2 <i>I</i> ft
If one layer of horizontal bars:	If two lay	ers of horizontal bars:
#4@ 9.26 in	#4@ 1	8.52 in
#5@ 14.35 in	#5@ 2	8.70 in
#6@ 20.37 in	#6@ 4	0.74 in



Project Name/Number : 2021-2576 Title 8'-0" :RETAINING WALL Dsgnr: JMW Description.... FT3 FW8

This Wall in File. T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

License : KW-06060294 License To : LEI Engineers and Surveyors Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

Real and a survey of the second s			ERTURNING					SISTING	
Item		Force lbs	Distance ft	Moment ft-#	_		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,417.5	3.00	4,252.5	Soil Over HL (ab. water	tbl)	2,199.7	3.42	7,514.6
HL Act Pres (be water tbl) Hydrostatic Force				,	Soil Over HL (bel. wate Watre Table	r tbl)		3.42	7,514.6
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 Ste	m =			
Added Lateral Load	=				* Axial Live Load on Sten	n =			
Load @ Stem Above Soil	=	88,1	12,25	1,079,7	Soil Over Toe	=		0.67	
0	=				Surcharge Over Toe	=			
					Stem Weight(s)	=	1,062.5	1.75	1,859.0
are the e	(Earth @ Stem Transitio	ns=			
Total	=	1,505.6	O.T.M. =	5,332.2	Footing Weight	=	699.9	2.33	1,632.9
					Key Weight	=			
Resisting/Overturning			=	3.52	Vert. Component	=			
Vertical Loads used for	r Soi	Pressure	= 3,962.	1 lbs	То	tal =	3,962,1	bs R.M.=	18,776,9
• • •					14 (sec.)	tal =			

250.0 pci

 Total =
 3,962.1
 Ibs
 R.M.=
 18,776.9

 * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.
 18,776.9

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

Horizontal Defl @ Top of Wall (approximate only) 0.159 in





Project Name/Number : 2021-2576 Title 8'-0";RETAINING WALL Dsgnr: JMW Description.... FT3 FW8 - SEISMIC

801-798-0555 Structural\2021 Structural Jobs\2021-2576_LHH Lighthouse Heights Retaining Wal

 Criteria

 Criteria

 Soil Data

 Retained Height
 =
 8.00 ft

 Wall height above soil
 =
 6.50 ft

Wall height above soil	=	6.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	18.00 in
Water height over heel	=	0.0 ft

Surcharge Loads					
Surcharge Over Heel	=	0.0 psf			
Used To Resist Sliding	& O	verturning			

Avial Load Applia	dto	Stom
Used for Sliding & Ove	erturni	ng
Surcharge Over Toe	=	0.0 psf
Used to Resist Sliding	Jaur	renuming

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 = 10.450 (Multiplier used on soil density)

Design Summary

Wall Stability Ratios Overturning Sliding	=		2.71 2.03		
Total Bearing Loadresultant ecc.	= =		3,962 15.62		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= = Th: = =		2,667 Allowable 3,584	psf psf	
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =		17.0 22.7 75.0	psi psi	
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force Added Force Req'd for 1.5 Stability		-		lbs Ibs Ibs	

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

		Ŭ	
Soil Data			
Allow Soil Bearing	-	2,667.0	psf
Equivalent Fluid Pressu	re Me	ethod	
Active Heel Pressure	=	35.0	psf/ft
	=	:	
Passive Pressure	=	925.0	psf/ft
Soil Density, Heel	=	= 110.00	pcf
Soil Density, Toe	1	= 0.00	pcf
Footing Soil Friction	=	0.300	
Soil height to ignore for passive pressure	=	= 0.00	in
Lateral Load App	lied	to Stem	12
	ALCONO		
Lateral Load	=	0.0 #/	ft
Height to Top	=	0.00 ft	
Height to Bottom	=	0.00 ft	
Load Type	=	Wind (W)	



Uniform Seismic Force	=	94.050
Total Seismic Force	=	846.450

		_			LRFD PALFRE
Ste	em Construction		2nd	Bottom	吕 No. 794
the second second	Design Height Above Ftg	ft =	8.50	Stem OK 0.00	220
	Wall Material Above "Ht"	=	Fence	Concrete	10-13
	Design Method	=		LRFD	LRFD
	Thickness	=		10.00	
	Rebar Size	=		# 5	
	Rebar Spacing	=		12.00	
	Rebar Placed at	=		Edge	
	besign Data fb/FB + fa/Fa	=		0.713	
	Total Force @ Section	-		0.715	
	Service Level	lle e			
	2.3 (3.5 (2.5) (2.	lbs =		0.544.4	
	Strength Level MomentActual	lbs =		2,544.4	
	Service Level	ft-# =			
	Strength Level	ft-# =		7,788.3	
	0				
	MomentAllowable	ft-# =		10,911.3	
	ShearActual	110000-000			
	Service Level	psi =			
	Strength Level	psi =		25.9	
	ShearAllowable	=		75.0	
	Anet (Masonry)	in2 =			
	Rebar Depth 'd'	in =		8.19	
	Masonry Data				
	f'm	psi =			
	Fs	psi =			
	Solid Grouting	=			
	Modular Ratio 'n'	=			
	Wall Weight	psf=		125.0	
	Short Term Factor	=			
	Equiv. Solid Thick.	=			
	Masonry Block Type	=	Medium W	eight	
	Masonry Design Method	=	ASD		
	Concrete Data	psi =		2,500.0	
	Fy	psi =		60,000.0	
		Por		00,000.0	



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

Adjacent Footing Load

Adjacent Footing Load	Ξ	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





Bottom Stem

(4/3) * As :

Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660 801-798-0555

Project Name/Number : 2021-2576 8'-0" RETAINING WALL Title Dsgnr: JMW Description.. FT3 FW8 - SEISMIC

In File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

Vertical Reinforcing

0.2199 in2/ft

0.2933 in2/ft

0.3275 in2/ft

0.2933 in2/ft

1.1092 in2/ft

0.31 in2/ft

0.216 in2/ft

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As (based on applied moment) :

0.0018bh: 0.0018(12)(10):

200bd/fy: 200(12)(8.1875)/60000:

Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

Horizontal Reinforcing

Min Stem T&S Reinf Area 2.040 in2 Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft Horizontal Reinforcing Options : One layer of : Two layers of : #4@ 20.00 in #4@ 10.00 in #5@ 15.50 in #5@ 31.00 in #6@ 44.00 in #6@ 22.00 in

Footing Data

Required Area :

Provided Area :

Maximum Area :

and the second		
Toe Width	=	1.33 ft
Heel Width	=	3.33
Total Footing Width	= -	4.67
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc = 2,500 psi Footing Concrete Densit Min. As % Cover @ Top 2.00	=	75,000 psi 150.00 pcf 0.0018 3tm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	3,584	0 psf
Mu' : Upward	=	32,728	155 ft-#
Mu' : Downward	=	4,030	3,861 ft-#
Mu: Design	=	2,392	3,707 ft-#
Actual 1-Way Shear	=	17.02	22.72 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 5 @ 12.00 in	
Heel Reinforcing	=	# 5 @ 12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	ohi 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: No key defined

Min footing T&S reinf Area	1.21	in2
Min footing T&S reinf Area per foot	0.26	in2 /ft
If one layer of horizontal bars:	If two lay	ers of horizontal bars:
#4@ 9.26 in	#4@ 1	8.52 in
#5@ 14.35 in	#5@ 2	28.70 in
#6@ 20.37 in	#6@ 4	0.74 in



Project Name/Number : 2021-2576 Title 8'-0";RETAINING WALL Dsgnr: JMW Description.... FT3 FW8 - SEISMIC

his Wall in File: 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

			ERTURNING	
Item		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl) HL Act Pres (be water tbl) Hydrostatic Force		1,417.5	3.00	4,252.5
Buoyant Force	=			
Surcharge over Heel	=			
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=			
Seismic Earth Load	=	592.5	4.50	2,666.3
	=			
Total	=	2,010.0	O.T.M. =	6,918.8
Resisting/Overturning Vertical Loads used for				2.71

	RI		
	Force Ibs	Distance ft	Moment ft-#
Soil Over HL (ab. water tbl)	2,199.7	3.42	7,514.6
Soil Over HL (bel. water tbl) Watre Table		3.42	7,514.6
Sloped Soil Over Heel =			
Surcharge Over Heel =			
Adjacent Footing Load =			
Axial Dead Load on Stem =			
* Axial Live Load on Stem =			
Soil Over Toe =		0.67	
Surcharge Over Toe =			
Stem Weight(s) =	1,062.5	1.75	1,859.0
Earth @ Stem Transitions =			
Footing Weight =	699.9	2.33	1,632.9
Key Weight =			
Vert. Component =			
Total =	3,962.1	lbs R.M.=	18,776.9

* 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) 0.221 in





Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660

Project Name/Number : 2021-2576 Title 11'-0" RETAINING WALL Dsgnr: JMW Description.... FT5 FW11

801-798-0555 his Wall in File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

License : KW-06060294 License To : LEI Engineer	s and	Surveyors	Cantilevered Retain	ing w	all	Code: IB	C 2018,AC	CI 318-14,TMS 402-16
Criteria			Soil Data					
Wall height above soil Slope Behind Wall Height of Soil over Toe	=	11.00 ft 6.50 ft 0.00 18.00 in 0.0 ft	Allow Soil Bearing = Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure = Soil Density, Heel =		psf/ft psf/ft			
			Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	0.00 0.300 0.00	pcf			
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent I	ooting L	.oad
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied	= turning	0.0 psf g	Contraction Section Section	0.0 #/ 0.00 ft 0.00 ft nd (W) ervice Le		Adjacent Foo Footing Width Eccentricity Wall to Ftg C Footing Type	L Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
Axial Dead Load Axial Live Load Axial Load Eccentricity	=	0.0 lbs 0.0 lbs 0.0 in	Wind on Exposed Stem = (Service Level)	22.6 pt		Base Above/I at Back of Poisson's Ra	Wall	= 0.0 ft = 0.300
Design Summary			Stem Construction		3rd	2nd Stem OK	Bottom Stem OK	STATE OF 5THA
Wall Stability Ratios			Design Height Above Ft Wall Material Above "Ht		11.50 Fence		0.00 Concrete	* JARED R. *
Overturning	=	3.95 OK	Design Method	_	I ence	LRFD	LRFD	PALFREYMAN C
Sliding	=	1.52 OK	Thickness	=		10.00	10.00	日 No. 7942895- 日
			Rebar Size	=		# 5	# 5	2202
Total Bearing Load resultant ecc.	=	9,065 lbs 9.12 in	Rebar Spacing Rebar Placed at	=		12.00 Edge	6.00 Edge	RECIEVAL PALFREYMAN No. 7942895- 2202 10-13-21 Rep PROFESSIONAL
Soil Pressure @ Toe	=	1,832 psf Ok	fb/FB + fa/Fa	=		0.589	0.697	* ROFESSIOL*
Soil Pressure @ Heel	=	483 psf Ok	Total Force @ Section			0.305	0.037	
Allowable	=	2,000 psf	Service Level	lbs =	135.6	5		
Soil Pressure Less ACI Factored @ Toe	s Thar =	2,564 psf	Strength Level	lbs =	10010	1,938.9	3,534.9	
ACI Factored @ Heel	=	677 psf	MomentActual			.,	-,	
Footing Shear @ Toe	=	18.8 psi Ok	C Service Level	ft-# =	406.8	3		
Footing Shear @ Heel	=	14.6 psi Ok		ft-# =		6,431.3	14,516.0	
Allowable	=	75.0 psi	MomentAllowable	ft-# =		10,911.3	20,802.0	
Sliding Calcs			ShearActual					
Lateral Sliding Force	=	2,666.9 lbs	Service Level	psi =				
less 100% Passive Ford			Strength Level	psi =		19.7	36.0	
less 100% Friction Forc			ShearAllowable	=		75.0	75.0	
Added Force Req'd for 1.5 Stability	=	0.0 lbs Ok 0.0 lbs Ok		in2 =		0.40	0.40	
Ior 1.5 Stability	-	0.0 IDS Or	Masonry Data	in =		8.19	8.19	
			f'm Fa	psi =				
Vertical component of activ	o lata	ral soil proceure l	Fs S Solid Grouting	psi = =				
NOT considered in the calc			Modular Ratio 'n'	=				
Load Factors			Wall Weight	psf =		125.0	125.0	
Building Code	IB	3C 2018,ACI	Short Term Factor Equiv, Solid Thick,	=				
Dead Load	8	1.200	Masonry Block Type		Medium \	Weiaht		
Live Load		1.600	Masonry Design Metho		ASD			
Earth, H		1.600	Concrete Data					
Wind, W		1.000	fc	psi =		2,500.0	2,500.0	
Seismic, E		1.000	Fy	psi =		60,000.0	60,000.0	



Project Name/Number : 2021-2576 11'-0" RETAINING WALL Title Dsgnr: JMW Description.... **FT5 FW11**

Structural\2021 Structural Jobs\2021-2576_LHH Lighthouse Heights Retaining Wal

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200bd/fy: 200(12)(8.1875)/60000:

0.0018bh: 0.0018(12)(10):

Required Area :

Provided Area :

Maximum Area :

Toe Width

Heel Width

Key Width

Key Depth

Min. As %

Cover @ Top

fc =

Footing Data

Total Footing Width

Key Distance from Toe

Footing Concrete Density

2,500 psi

2.00

Footing Thickness

Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details 2nd Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.1816 in2/ft (4/3) * As : 0.2422 in2/ft Min Stem T&S Reinf Area 2.040 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 : 0.2422 in2/ft #4@ 10.00 in #4@ 20.00 in Provided Area : 0.31 in2/ft #5@ 15.50 in #5@ 31.00 in Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@, 44.00 in Horizontal Reinforcing Bottom Stem Vertical Reinforcing As (based on applied moment) : 0.4099 in2/ft (4/3) * As : 0.5466 in2/ft

0.3275 in2/ft

0.4099 in2/ft

1.1092 in2/ft

0.62 in2/ft

1.67 ft

6.17

7.83

12.00 in

0.00 in

0.00 in

0.00 ft

60,000 psi

150.00 pcf

0.0018

@ Btm.= 3.00 in

=

=

=

=

=

=

=

Fy =

=

-

0.216 in2/ft

Min Stem T&S Reinf Area 0.720 in2 Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft

Horizontal Reinforcing Options : One layer of : Two layers of : #4@ 10.00 in #4@ 20.00 in #5@ 15.50 in #5@ 31.00 in #6@ 22.00 in

#6@ 44.00 in

Footing Design Results

Link working the second s		Toe	Heel
Factored Pressure	\equiv	2,564	677 psf
Mu': Upward	\equiv	40,473	15,711 ft-#
Mu': Downward	=	6,295	23,205 ft-#
Mu: Design	=	2,848	7,494 ft-#
Actual 1-Way Shear	=	18.82	14.63 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 5 @ 12.00 ir	1
Heel Reinforcing	=	# 4 @ 6.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	ohi 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: No key defined

Min footing T&S reinf Area	2.03	in2
Min footing T&S reinf Area per foot	0.26	in2 /ft
If one layer of horizontal bars:	If two lay	ers of horizontal bars:
#4@ 9.26 in	#4@ 1	8.52 in
#5@ 14.35 in	#5@ 2	8.70 in
#6@ 20.37 in	#6@ 4	0.74 in



Project Name/Number : 2021-2576 Title 11'-0" RETAINING WALL Dsgnr: JMW Description.... FT5 FW11

nis Wail in File: T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
2,520.0	4.00	10,080.0	Soil Over HL (ab. water tbl)	6,452.5	5.17	33,331.6
			Soil Over HL (bel. water tbl) Watre Table		5.17	33,331.6
			Surcharge Over Heel =			
			Adjacent Footing Load =			
			Axial Dead Load on Stem =			
			* Axial Live Load on Stem =			
146.9	15.25	2,240.2	Soil Over Toe =		0.83	
			Surcharge Over Toe =			
			0 ()	1,437.5	2.08	2,993.8
2 666 0	0.T.M -	12 220 2	\mathbf{Q}			
2,000.9	0.1.IVI. =	12,320.2	Footing Weight =	1,174.8	3.92	4,600.5
			Key Weight =			
	=		Vert. Component =			
I Pressure	= 9,064.8	3 lbs	Total =	9.064.8	bs R.M.=	48.696.4
	Force Ibs 2,520.0 146.9 2,666.9 io	Force Distance 1bs ft 2,520.0 4.00 146.9 15.25 2,666.9 O.T.M. = io =	lbs ft ft-# 2,520.0 4.00 10,080.0 146.9 15.25 2,240.2 2,666.9 O.T.M. = 12,320.2 io = 3.95	Force lbsDistance ftMoment ft-#2,520.04.0010,080.0Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table Sloped Soil Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem = * Axial Live Load on Stem = Soil Over Toe = Stem Weight(s) = Earth @ Stem Transitions= Footing Weight = Key Weight = Vert. Component =	Force IbsDistance ftMoment ft-#Force Ibs2,520.04.0010,080.0Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl) Watre Table6,452.5 Soil Over HL (bel. water tbl) Watre Table2,520.04.0010,080.0Soil Over HL (ab. water tbl) Watre Table6,452.5 Soil Over Heel = Adjacent Footing Load = Axial Dead Load on Stem = * Axial Live Load on Stem = Stem Weight(s) = Stem Weight(s) = Tooting Weight = Footing Weight = Nutre Table146.915.252,240.2Soil Over Toe = Stem Weight(s) = Footing Weight = Footing Weight = Vert. Component =2,666.90.T.M. =12,320.2Tooting Weight = Vert. Component =	Force IbsDistance ftMoment ft-#2,520.04.0010,080.0Soil Over HL (ab. water tbl) Soil Over HL (bel. water tbl)6,452.55.172,520.04.0010,080.0Soil Over HL (bel. water tbl) Watre Table6,452.55.17Sloped Soil Over Heel= Surcharge Over Heel= Adjacent Footing Load= Axial Dead Load on Stem = * Axial Live Load on Stem = Stem Weight(s)= 1,437.50.83146.915.252,240.2Soil Over Toe= Stem Weight(s)= 1,437.50.832,666.90.T.M. =12,320.2Earth @ Stem Transitions = Footing Weight= 1,174.83.92io= 9,064.8hsVert. Component=

* 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) 0.114 in





0.0 lbs

0.0 lbs

0.0 in

7.840

Project Name/Number : 2021-2576 Title 11'-0" RETAINING WALL Dsgnr: JMW Description.... FT5 FW11 - SEISMIC

2,667.0 psf

35.0 psf/ft

927.0 psf/ft

0.00 pcf

110.00 pcf

0.00 in

0.0 #/ft

0.300

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JARED R.

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Structural 2021 Structural Jobs 2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

Criteria

the second se		
Retained Height	=	11.00 ft
Wall height above soil	=	6.50 ft
Slope Behind Wall	$\sim 10^{-10}$	0.00
Height of Soil over Toe	$\sim = 1$	18.00 in
Water height over heel	=	0.0 ft

Soil Density, Heel Soil Density, Toe Footing||Soil Friction Soil height to ignore for passive pressure Lateral Load Applied to Stem 0.0 psf Lateral Load = Used To Resist Sliding & Overturning 0.0 psf

Soil Data

Allow Soil Bearing

Passive Pressure

Active Heel Pressure

Equivalent Fluid Pressure Method

Height to Top	=	0.00 ft
Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem		0.0 psf
(Service Level)	=	0.0 psi



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

Uniform Seismic Force = 94.080 **Total Seismic Force** = 1,128.960

Stem Construction		3rd	2nd	Bottom	PALFREYMAN No. 7942895- 2202 10-13-21 PROFESSIONAL
			Stem OK	Stem OK	12 2202
Design Height Above Ftg	ft =	11.50	3.00	0.00	10-13-21
Wall Material Above "Ht"	=	Fence	Concrete	Concrete	AREA TOTAL
Design Method	=		LRFD	LRFD	PROFESSIONAL
Thickness	=		10.00	10.00	- DDD-
Rebar Size	=		# 5	# 5	
Rebar Spacing	=		12.00		
Rebar Placed at Design Data	=		Edge	Edge	
fb/FB + fa/Fa	=		0.713	0.870	
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =		2,544.6	4,422.9	
MomentActual					
Service Level	ft-# =				
Strength Level	ft-# =		7,789.2	18,114.5	
MomentAllowable	ft-# =		10,911.3	20,802.0	
ShearActual					
Service Level	psi =				
Strength Level	psi =		25.9	45.0	
ShearAllowable	=		75.0	75.0	
Anet (Masonry)	in2 =				
Rebar Depth 'd'	in =	<u>80</u>	8.19	8.19	
Masonry Data					
f'm	psi =				
Fs	psi =				
Solid Grouting	=				
Modular Ratio 'n'	=				
Wall Weight	psf=		125.0	125.0	
Short Term Factor	=				
Equiv. Solid Thick.	=				
Masonry Block Type	=	Medium W	eight		
Masonry Design Method	=	ASD			
Concrete Data					
fc	psi =		2,500.0	2,500.0	
Fy	psi =		60,000.0	60,000.0	

Design Summary

(Multiplier used on soil density)

Surcharge Loads

Surcharge Over Heel

Surcharge Over Toe

Axial Dead Load

Method : Uniform

Multiplier Used

Axial Live Load

Used for Sliding & Overturning

Axial Load Eccentricity =

Axial Load Applied to Stem

Earth Pressure Seismic Load

=

=

Wall Stability Ratios Overturning Sliding			3.29 OK 1.70 OK
Total Bearing Load resultant ecc.	= =		9,065 lbs 12.44 in
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= = Th: =	an	2,076 psf OK 239 psf OK 2,667 psf Allowable 2,907 psf 334 psf
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= =		21.6 psi OK 19.7 psi OK 75.0 psi
Lateral Sliding Force less 100% Passive Force less 100% Friction Force Added Force Req'd for 1.5 Stability		-	

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

Project Name/Number : 2021-2576 11'-0" RETAINING WALL Title Dsgnr: JMW Description... FT5 FW11 - SEISMIC

Page: 2 Date: 20 SEP 2021

Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

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Jared Palfreyman

3302 N. Main St

801-798-0555

Spanish Fork, UT 84660

LEI Engineers and Surveyors, Inc

Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details 2nd Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.22 in2/ft (4/3) * As : 0.2933 in2/ft Min Stem T&S Reinf Area 2.040 in2 200bd/fy: 200(12)(8.1875)/60000: Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft 0.3275 in2/ft 0.0018bh : 0.0018(12)(10) : 0.216 in2/ft Horizontal Reinforcing Options : ============== One layer of : Two layers of : Required Area : 0.2933 in2/ft #4@ 10.00 in #4@ 20.00 in Provided Area : 0.31 in2/ft #5@ 15.50 in #5@ 31.00 in Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.5116 in2/ft (4/3) * As : 0.6821 in2/ft Min Stem T&S Reinf Area 0.720 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 : OF STAH STATE ================ One layer of : Two layers of : Required Area : 0.5116 in2/ft #4@ 10.00 in #4@ 20.00 in Provided Area : 0.62 in2/ft #5@ 15.50 in #5@ 31.00 in JARED R. Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in RECISIONAL No. 7. 2202 10-13-21 PROFESSIONAL CUCINEER. **Footing Data Footing Design Results** 1.67 ft Toe Width \equiv Toe Heel Heel Width = 6.17 Factored Pressure = 2,907 334 psf **Total Footing Width** 7.83 = Mu': Upward 45,369 13,052 ft-# = **Footing Thickness** Mu': Downward = 6,295 23,205 ft-# = 12.00 in Mu: Design = 3,256 10,153 ft-# Key Width 0.00 in = Actual 1-Way Shear = 21.65 19.75 psi Key Depth = 0.00 in Allow 1-Way Shear = 75.00 75.00 psi Key Distance from Toe 0.00 ft = Toe Reinforcing = #5@12.00 in 60,000 psi fc =2,500 psi Heel Reinforcing = #4 @ 6.00 in Fy = Footing Concrete Density Key Reinforcing = None Spec'd = 150.00 pcf Min. As % 0.0018 Footing Torsion, Tu 0.00 ft-lbs = Cover @ Top 2.00 @ Btm .= 3.00 in 0.00 ft-lbs

Footing Allow. Torsion, phi Tu =

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@ 7.32 in, #5@ 11.35 in, #6@ 16.11 in, #7@ 21.97 in, #8@ 28.93 in, #9@ 36 Key: No key defined

Min footing T&S reinf Area	2.03 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

Project Name/Number : 2021-2576 Title 11'-0" RETAINING WALL Dsgnr: JMW Description.... FT5 FW11 - SEISMIC

Page: 3 Date: 20 SEP 2021

This Wall in Priet T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

Jared Palfreyman

Spanish Fork, UT 84660

3302 N. Main St

801-798-0555

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

Summary of Overturning & Resisting Forces & Moments

LEI Engineers and Surveyors, Inc

			ERTURNING					SISTING	
Item		Force lbs	Distance ft	Moment ft-#	_		Force Ibs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl))	2,520.0	4.00	10,080.0	Soil Over HL (ab. wate	r tbl)	6,452.5	5.17	33,331.6
HL Act Pres (be water tbl))				Soil Over HL (bel. wate Watre Table	er tbl)		5.17	33,331.6
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 Ste	em =			
dded Lateral Load	=				* Axial Live Load on Ster	n =			
oad @ Stem Above Soil.	=				Soil Over Toe	=		0.83	
Seismic Earth Load	=	790.3	6.00	4,741.6	Surcharge Over Toe	=			
	=			2007 (2017) 2017 (2017)	Stem Weight(s)	=	1,437.5	2.08	2,993.8
T . 4 . 1		0.040.0		44.004.0	Earth @ Stem Transition	ns=			
Total	=	3,310.3	O.T.M. =	14,821.6	Footing Weight	=	1,174.8	3.92	4,600.5
					Key Weight	=			
Resisting/Overturning			=	3.29	Vert. Component	=			
Vertical Loads used for	or So	il Pressure	= 9,064.	8 lbs	То	tal =	9.064.8	bs R.M.=	48,696,4

250.0 pci

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

Horizontal Defl @ Top of Wall (approximate only) 0.129 in





10.00 ft

Project Name/Number : 2021-2576 Title 10'-0" RETAINING WALL Dsgnr: JMW Description **FT6 FW10**

valinn File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

(Strength Level)

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Cantilevered Retaining Wall

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

Criteria = **Retained Height**

Wall height above soil	=	6.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	18.00 in
Water height over heel	=	11.0 ft

Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding	& Ov	rerturning
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Ove	rturnir	ng

Axial Load Applied to Stem

. and mena . debuea		-			
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =			0.0 lbs 0.0 lbs 0.0 in		
Design Summary					[
Wall Stability Ratios Overturning Sliding	=		2.63 1.51	OK OK	
0					
Total Bearing Load resultant ecc.	=		9,424 19.68		
Soil Pressure @ Toe Soil Pressure @ Heel	=		1,968 0	psf psf	
Allowable Soil Pressure Less	= Th	an	2,000 Allowabl		
ACI Factored @ Toe ACI Factored @ Heel	=		2,464 0	psf psf	
Footing Shear @ Toe	=		51.5		
Footing Shear @ Heel Allowable	=		38.2 75.0	18	OK
Sliding Calcs					
Lateral Sliding Force less 100% Passive Force less 100% Friction Force				lbs	
Added Force Req'd for 1.5 Stability	=		0.0	lbs Ibs	

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

Soil Data				
Allow Soil Bearing		=	2,000.0	psf
Equivalent Fluid Pressur Active Heel Pressure	ew			psf/ft
			00.0	point
		=		
Passive Pressure		=	425.0	psf/ft
Soil Density, Heel		=	110.00	pcf
Soil Density, Toe		=	0.00	pcf
Footing Soil Friction		=	0.300	
Soil height to ignore for passive pressure		=	0.00	in
Lateral Load Appl	iec	l to	o Stem	
Lateral Load Height to Top Height to Bottom	= = =		0.0 #/ 0.00 ft 0.00 ft	ft
Load Type	=		'ind (W) Strength L	evel)
Wind on Exposed Stem	ן ב		22.6 ps	sf

1	Homeson .	

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

Ste	em Construction		3rd	2nd	Bottom	
No. of Concession, Name	Design Height Above Ftg	ft =	10.50	Stem OK 4.17	Stem OK	STATE OF 5 DA
	Wall Material Above "Ht"	=	Fence	4.17 Concrete	0.00 . Concrete	Signation
	Design Method	=	1 crice	LRFD	LRFD	* JARED R. *
	Thickness	=		10.00	10.00	PALFREYMAN
	Rebar Size	=		# 5	# 5	日本 No. 7942895- 日日
	Rebar Spacing	=		12.00	3.00	10. 1942090- E
	Rebar Placed at	=		Edge	Edge	10-12-21
	Design Data			9-	g-	PALFREYMAN PALFREYMAN No. 7942895- 2202 10-13-21 PROFESSIONAL
	fb/FB + fa/Fa	=		0.682	0.716	PROFESSIONA
	Total Force @ Section					
	Service Level	lbs =	81.4			
	Strength Level	lbs =		2,970.1	7,801.4	
	MomentActual					
	Service Level	ft-# =	244.1			
	Strength Level	ft-# =		7,444.2	29,079.7	
	MomentAllowable	ft-# =		10,911.3	40,583.3	
	ShearActual					
	Service Level	psi =				
	Strength Level	psi =		30.2	79.4	
	ShearAllowable	=		75.0	94.9	
	Anet (Masonry)	in2 =		75.0	54.5	
	Rebar Depth 'd'	in =		8.19	8.19	
	Masonry Data	111 -		0.10	0.15	
	fm	psi =				
	Fs	psi=				
S	Solid Grouting	=				
	Modular Ratio 'n'	=				
	Wall Weight	psf =		125.0	125.0	
	Short Term Factor	=				
	Equiv. Solid Thick.	=				
	Masonry Block Type	=	Medium W	eight		
	Masonry Design Method	=	ASD			
	Concrete Data					
	f'c	psi =		2,500.0	4,000.0	
	Fy	psi =		60,000.0	60,000.0	



Required Area :

Required Area :

Provided Area :

Maximum Area :

Toe Width

Heel Width

Key Width

Key Depth

Min. As %

Cover @ Top

f'c =

Footing Data

Total Footing Width

Key Distance from Toe

Footing Concrete Density

2,500 psi

2.00

Footing Thickness

Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660 801-798-0555

Project Name/Number : 2021-2576 Title 10'-0" RETAINING WALL Dsgnr: JMW Description.... **FT6 FW10**

Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details 2nd Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.2102 in2/ft (4/3) * As : 0.2803 in2/ft Min Stem T&S Reinf Area 1.519 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 :

0.8212 in2/ft

1.7746 in2/ft

1.24 in2/ft

4.00 ft

5.67

9.67

12.00 in

12.00 in

28.00 in

4.00 ft

60,000 psi 150.00 pcf

0.0018

@ Btm .= 3.00 in

Provided Area : 0.31 in2/ft Maximum Area : 1.1092 in2/ft Bottom Stem As (based on applied moment) : (4/3) * As : 1.095 in2/ft 200bd/fy: 200(12)(8.1875)/60000: 0.0018bh: 0.0018(12)(10): 0.216 in2/ft

=

=

=

=

=

=

=

Fv =

=

=

0.2803 in2/ft #4@ 10.00 in #5@ 15.50 in #6@ 22.00 in Horizontal Reinforcing Vertical Reinforcing 0.8212 in2/ft 0.3275 in2/ft

Min Stem T&S Reinf Area 1.001 in2 Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft Horizontal Reinforcing Options :

Two layers of :

#4@ 20.00 in

#5@ 31.00 in

#6@ 44.00 in

One layer of : Two layers of : #4@ 10.00 in #4@ 20.00 in #5@ 15.50 in #5@ 31.00 in #6@ 22.00 in

#6@ 44.00 in

Footing Design Results

In the second seco	COLUMN 2	THE R. LEWIS CO., LANSING MICH.	CONTRACTOR OF THE OWNER O
		Toe	Heel
Factored Pressure	=	2,464	0 psf
Mu' : Upward	=	203,588	4,582 ft-#
Mu': Downward	=	36,288	17,516 ft-#
Mu: Design	=	13,942	12,934 ft-#
Actual 1-Way Shear	=	51.52	38.18 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 5 @ 6.00 in	
Heel Reinforcing	=	# 4 @ 6.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	ohi Tu 😑	0.00 ft-lbs



If torsion exceeds allowable, provide

supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.33 in, #5@ 9.82 in, #6@ 13.94 in, #7@ 19.01 in, #8@ 25.03 in, #9@ 31. Heel: #4@ 6.31 in, #5@ 9.78 in, #6@ 13.89 in, #7@ 18.94 in, #8@ 24.94 in, #9@ 31. Key: phiMn = phi'5'lambda'sqrt(fc)'Sm

Min footing T&S reinf Area 2.51 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@ 28.70 in #5@ 14.35 in #6@ 20.37 in #6@ 40.74 in



Project Name/Number : 2021-2576 Title 10'-0" RETAINING WALL Dsgnr: JMW Description **FT6 FW10**

all in File: 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

.....RESISTING.....

Summary of Overturning & Resisting Forces & Moments

		OVERTURNING						
Item		Force lbs	Distance ft	Moment ft-#				
HL Act Pres (ab water	tbl)			20,017.3				
HL Act Pres (be water	tbl)	1,312.9	3.67	4,813.8				
-lydrostatic Force		3,775.2	3.67					
Buoyant Force	=	603.2	4.83					
Surcharge over Heel	=							
Surcharge Over Toe	=							
Adjacent Footing Load	=							
Added Lateral Load	=							
oad @ Stem Above S	Soil =	88.1	14.25	1,256.0				
	=							
Total	=	5,779.3	O.T.M. =	22,827.2				

			LOIOTINO				
		Force lbs	Distance ft	Moment ft-#			
Soil Over HL (ab. water th	bl)						
Soil Over HL (bel. water t	bl)	3,295.9					
Watre Table		3,015.6	7.25	23,894.0			
Sloped Soil Over Heel	=						
Surcharge Over Heel	=						
Adjacent Footing Load	=						
Axial Dead Load on Stem	=						
* Axial Live Load on Stem	=						
Soil Over Toe	=		2.00				
Surcharge Over Toe	=						
Stem Weight(s)	=	1,312.5	4.42	5,796.9			
Earth @ Stem Transitions	3 =						
Footing Weight	=	1,449.9	4.83	7,007.4			
Key Weight	=	350.0	4.50	1,575.0			
Vert. Component	=						
Tota	=	9,423.9	lbs R.M.=	60,135.2			

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

*Includes water table effect

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) 0.093 in





Project Name/Number : 2021-2576 Title 10'-0" RETAINING WALL Dsgnr: JMW Description.... FT6 FW10 - SEISMIC

tainPro (c) 1987-2019, Build ense : KW-06060294 :ense To : LEI Engineers			rs		Cantilevered Retaini	ng W	/all	Code: IBC 2018,ACI 318-14,TMS 402-16			
Criteria	- and	- 4. 7090		5	Soil Data						
Retained Height = Vall height above soil = Slope Behind Wall = Height of Soil over Toe = Vater height over heel =	= = =	10.00 ft 6.50 ft 0.00 18.00 in 11.0 ft		E A	llow Soil Bearing = 2 quivalent Fluid Pressure Methor ctive Heel Pressure = = assive Pressure =		psf/ft				
		11.0 1		S F	oil Density, Heel=oil Density, Toe=ooting Soil Friction=oil height to ignore=for passive pressure=	0.00 0.300 0.00	pcf	L.			
Surcharge Loads				l	ateral Load Applied to	Stem		Adjacent F	ooting L	oad	
Used To Resist Sliding &	= urning	0.0 psf		 	.Height to Bottom = oad Type = Win	0.0 #/ 0.00 ft 0.00 ft d (W) ength L		Adjacent Fool Footing Width Eccentricity Wall to Ftg Cl Footing Type Base Above/B	L Dist	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load	
	= = =	0.0 lbs 0.0 lbs 0.0 in			Wind on Exposed Stem ₌ (Strength Level)	0.0 ps	sf	at Back of V Poisson's Rat	Nall	= 0.0 ft = 0.300	
Method:Uniform Multiplier Used (Multiplier used on soil de		8.550		1.00	Iniform Seismic Force=94Total Seismic Force=1,034	.050 .550				JARED R.	
Design Summary					Stem Construction		3rd	2nd Stem OK	Bottom Stem OK	PALFREYMAN No. 7942895- 2202 10-13-21	
Wall Stability Ratios Overturning	=		OK		Design Height Above Ftg Wall Material Above "Ht" Design Method	ft = = =	10. Fen	50 4.17	0.00 Concrete LRFD	10 2202 10-13-21 PROFESSIONAL	
Sliding	=		OK		Thickness Rebar Size	=		10.00 # 5	10.00 # 5		
Total Bearing Load resultant ecc.	=	9,299 23.41			Rebar Spacing Rebar Placed at	=		12.00 Edge	3.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	2,151 0 2,667	psf C		Design Data fb/FB + fa/Fa Total Force @ Section	=		0.706	0.784		
Soil Pressure Less		Allowable 2,689	е		Service Level Strength Level MomentActual	lbs = Ibs =		3,371.6	8,595.0		
Footing Shear @ Toe Footing Shear @ Heel	=	55.9	psi C psi C		Service Level Strength Level	ft-# = ft-# =		7,708.7	31,835.7		
Allowable liding Calcs	=	75.0	psi		MomentAllowable ShearActual	ft-# =		10,911.3	40,583.3		
Lateral Sliding Force less 100% Passive Force less 100% Friction Force			lbs		Service Level Strength Level ShearAllowable	psi = psi = =		34.3 75.0	87.5 94.9		
Added Force Req'd for 1.5 Stability	= =		lbs C lbs C		Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =		8.19	8.19)	
					f'm Fs	psi = psi =					
rtical component of active T considered in the calcu		6.48			Solid Grouting Modular Ratio 'n' Wall Weight	= = psf =		125.0	125.0		
oad Factors					- Short Torm Easter	h21 -		125.0	125.0		

Short Term Factor

Equiv. Solid Thick.

Concrete Data

fc

Fy

Masonry Block Type

Masonry Design Method

=

÷

psi=

psi =

= ASD

= Medium Weight

2,500.0

60,000.0

4,000.0

60,000.0

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



If torsion exceeds allowable, provide

supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 5.82 in, #5@ 9.02 in, #6@ 12.81 in, #7@ 17.47 in, #8@ 23.00 in, #9@ 29. Heel: #4@ 6.31 in, #5@ 9.78 in, #6@ 13.89 in, #7@ 18.94 in, #8@ 24.94 in, #9@ 31. Key: phiMn = phi'5'lambda'sqrt(fc)'Sm

Min footing T&S reinf Area	2.51	in2
Min footing T&S reinf Area per foot	0.26	in2 /ft
If one layer of horizontal bars:	If two lay	ers of horizontal bars:
#4@ 9.26 in	#4@ 1	8.52 in
#5@ 14.35 in	#5@ 2	8.70 in
#6@ 20.37 in	#6@ 4	0.74 in



Project Name/Number : 2021-2576 Title 10'-0"; RETAINING WALL Dsgnr: JMW Description.... FT6 FW10 - SEISMIC

This Wair in File. 1. Structural\2021 Structural Jobs\2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

RESISTING

Summary of Overturning & Resisting Forces & Moments

			OVERTURNING					
Item		Force lbs	Distance ft	Moment ft-#				
HL Act Pres (ab water tbl)				20,017.3				
HL Act Pres (be water tbl)		1,312.9	3.67	4,813.8				
Hydrostatic Force		3,775.2	3.67					
Buoyant Force	=	603.2	4.83					
Surcharge over Heel	=							
Surcharge Over Toe	=							
Adjacent Footing Load	=							
Added Lateral Load	=							
Load @ Stem Above Soil	=							
Seismic Earth Load	=	724.2	5.50	3,983.0				
	=							
Total	=	6,415.4	O.T.M. =	25,554.3				
Resisting/Overturning	Rat	tio	=	2.33				
Vertical Loads used for	r Sc	il Pressure	= 9,298.9) Ibs				

Force lbs	Dis	stance	Moment
		ft	ft-#
3,295.9			
3,015.6		7.25	23,894.0
		2.00	
1,312.5		4.42	5,796.9
1,449.9		4.83	7,007.4
225.0		4.50	1,012.5
9,298.9	lbs F	R.M.=	59,572.7
	3,295.9 3,015.6 1,312.5 1,449.9 225.0	3,295.9 3,015.6 1,312.5 1,449.9 225.0	3,295.9 3,015.6 7.25 2.00 1,312.5 4.42 1,449.9 225.0 4.50

* Axial live load NOT included in total displayed, or used for overturning

Maniseric is in the state of the other of the state of th

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 0.102 in

Horizontal Defl @ Top of Wall (approximate only) 0.102





Project Name/Number : 2021-2576 Title 10'-0", RETAINING WALL Dsgnr: JMW Description.... FT6 FW10

This Wair in File. T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

Soil Data

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Cantilevered Retaining Wall

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

Criteria

and the second		
Retained Height	=	10.00 ft
Wall height above soil	=	6.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	18.00 in
Water height over heel	=	11.0 ft

Surcharge Loads

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

Axial Load Applied to Stem

Axial Load Applied	110	5	CIII	Contraction of the	
Axial Dead Load Axial Live Load Axial Load Eccentricity	= =		0.0 lbs 0.0 lbs 0.0 in		
Design Summary					
Wall Stability Ratios	=				
Overturning Sliding	=		2.63 1.51		
Total Bearing Loadresultant ecc.	=		9,424 19.68		
Soil Pressure @ Toe Soil Pressure @ Heel	=			psf	
Allowable Soil Pressure Les	= s Tha	an	2,000 Allowable	psf e	
ACI Factored @ Toe ACI Factored @ Heel	=		2,464 0	psf psf	
Footing Shear @ Toe Footing Shear @ Heel	=		51.5 38.2		
Allowable	=		75.0	· · · · · · · ·	e
Sliding Calcs Lateral Sliding Force less 100% Passive Forc less 100% Friction Forc		-	5,176.2 4,964.2 2,827.2	lbs	
Added Force Req'd for 1.5 Stability	=			lbs Ibs	

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

Allow Soil Bearing	=	= 2,000.0	psf
Equivalent Fluid Pressu	e Me	ethod	
Active Heel Pressure	=	= 35.0	psf/ft
	=		
Passive Pressure	=	= 425.0	psf/ft
Soil Density, Heel	2	= 110.00	pcf
Soil Density, Toe		= 0.00	pcf
Footing Soil Friction	÷	= 0.300	
Soil height to ignore for passive pressure	-	= 0.00	in
Lateral Load App	lied	to Stem	
Lateral Load	=	0.0 #/	'ft
Height to Top	=	0.00 ft	
Height to Bottom	=	0.00 ft	
Load Type		Wind (W) (Strength L	evel)

Wind on Exposed Stem ₌ 22.6 psf (Strength Level)

1.1.1.1.1				
		8		
			-	
al and	<u>L</u>			
The state of the				

1

Aujacentrooting	LUa	J
Adjacent Footing Load	=	0.0 lb
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

	Stem Construction		3rd	2nd	Bottom	STATE OF SPA
	Design Height Above Ftg	ft =	10.50	Stem OK 4.17	Stem OK 0.00	STA
	Wall Material Above "Ht"	=	Fence	Concrete	Concrete	
	Design Method	=	1 choc	LRFD	LRFD	// // JARED R. \\ \\
	Thickness	=		10.00	10.00	PALFREYMAN
	Rebar Size	=		# 5	# 7	ĝ No. 7942895− ₽
	Rebar Spacing	=		12.00	6.00	102 2202 E
	Rebar Placed at	=		Edge	Edge	PALFREYMAN No. 7942895- 2202 10-13-21 FROM PROFESSIONAL
ŧ.	Design Data ———					PROFIESSIONAL
	fb/FB + fa/Fa	=		0.682	0.806	.OI.FODI
	Total Force @ Section					
	Service Level	lbs =	81.4			
	Strength Level	lbs =		2,970.1	7,801.4	
	MomentActual					
	Service Level	ft-#=	244.1			
	Strength Level	ft-# =		7,444.2	29,079.7	
	MomentAllowable	ft-#=		10,911.3	36,058.5	
	ShearActual					
	Service Level	psi =				
	Strength Level	psi =		30.2	86.0	
	ShearAllowable	=		75.0	94.9	
	Anet (Masonry)	in2 =		10.0	01.0	
(Rebar Depth 'd'	in =		8.19	7.56	
	Masonry Data				1.00	
	f'm	psi =				
	Fs	, psi =				
S	Solid Grouting	=				
	Modular Ratio 'n'	=				
	Wall Weight	psf=		125.0	125.0	
	Short Term Factor	=				
	Equiv. Solid Thick.	=				
	Masonry Block Type	=	Medium W	eight		
	Masonry Design Method	=	ASD			
	Concrete Data				12022202000	
	f'c	psi =		2,500.0	4,000.0	
	Fy	psi =		60,000.0	60,000.0	

Project Name/Number : 2021-2576 Title 10'-0" RETAINING WALL Dsgnr: JMW Description **FT6 FW10**

Valinin File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

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1.0

Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

Jared Palfreyman

Spanish Fork, UT 84660

3302 N. Main St

LEI Engineers and Surveyors, Inc

.....

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing			
As (based on applied moment) :	0.2102 in2/ft				
(4/3) * As :	0.2803 in2/ft	Min Stem T&S Reinf Area 1.519 in2			
200bd/fy: 200(12)(8.1875)/60000:	0.3275 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 :	0.2803 in2/ft	#4@ 10.00 in #4@ 20.00 in			
Provided Area :	0.31 in2/ft	#5@ 15.50 in #5@ 31.00 in			
Maximum Area :	1.1092 in2/ft	#6@ 22.00 in #6@ 44.00 in			
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing			
As (based on applied moment) :	0.8921 in2/ft				
(4/3) * As :	1.1895 in2/ft	Min Stem T&S Reinf Area 1.001 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 :	0.8921 in2/ft	#4@ 10.00 in #4@ 20.00 in			
Provided Area :	1.2 in2/ft	#5@ 15.50 in #5@ 31.00 in			
Maximum Area :	1.6392 in2/ft	#6@ 22.00 in #6@ 44.00 in * JARED R. *			
Footing Data	Footing De	Toe Heel PALFREYMAN ure 2,464 0 psf $=$ 203,588 4,582 ft.# d $=$ 36,288 17,516 ft.# $=$ 13,942 12,934 ft.#			
Toe Width =	4.00 ft	Toe Heel 资 No. 7942895-			
Heel Width =	5.67 Factored Pressu	ure = 2,464 0 psf			
Total Footing Width =	9.67 Mu': Upward	= 203,588 4,582 ft.#			
Footing Thickness =	12.00 in Mu' : Downward Mu: Design	d = 36,288 17,516 ft.# = 13,942 12,934 ft.#			
	12.00 in Actual 1-Way St				
	28.00 in Allow 1-Way She				
Key Distance from Toe =	4.00 ft Toe Reinforcing	g = #5@,6.00 in			
	0,000 psi Heel Reinforcing	g = #4 @ 6.00 in			
	50.00 pcf Key Reinforcing				
	0018 Footing Torsion,				
Cover @ Top 2.00 @ Btm.	= 3.00 in Footing Allow. To	Forsion, phi Tu = 0.00 ft-lbs			

Footing Allow. Torsion, phi Tu =

If torsion exceeds allowable, provide

supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.33 in, #5@ 9.82 in, #6@ 13.94 in, #7@ 19.01 in, #8@ 25.03 in, #9@ 31. Heel: #4@ 6.31 in, #5@ 9.78 in, #6@ 13.89 in, #7@ 18.94 in, #8@ 24.94 in, #9@ 31. Key: phiMn = phi'5'lambda'sqrt(fc)'Sm

2.51 in2
0.26 in2 /ft
wo layers of horizontal bars:
#4@ 18.52 in
#5@ 28.70 in
#6@ 40.74 in



Project Name/Number : 2021-2576 Title 10'-0", RETAINING WALL Dsgnr: JMW Description.... FT6 FW10

this Wall in File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

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

.....RESISTING

Summary of Overturning & Resisting Forces & Moments

		OVERTURNING			
Item		Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)				20,017.3	
HL Act Pres (be water tbl)		1,312.9	3.67	4,813.8	
Hydrostatic Force		3,775.2	3.67		
Buoyant Force	=	603.2	4.83		
Surcharge over Heel	=				
Surcharge Over Toe	=				
Adjacent Footing Load	=				
Added Lateral Load	=				
Load @ Stem Above Soil	=	88.1	14.25	1,256.0	
	=				
Total	=	5,779.3	O.T.M. =	22,827.2	
Resisting/Overturning Vertical Loads used fo			= = 9.423.9	2.63 9 lbs	

	Force lbs	Distance ft	Moment ft-#
Soil Over HL (ab. water tbl)		
Soil Over HL (bel. water tb	I) 3,295.9		
Watre Table	3,015.6	7.25	23,894.0
Sloped Soil Over Heel =			
Surcharge Over Heel =	:		
Adjacent Footing Load =	ŧ		
Axial Dead Load on Stem =	5		
* Axial Live Load on Stem =	-		
Soil Over Toe =	ŧ.	2.00	
Surcharge Over Toe =	=		
Stem Weight(s) =	= 1,312.5	4.42	5,796.9
Earth @ Stem Transitions =	=		
Footing Weight =	= 1,449.9	4.83	7,007.4
Key Weight =	= 350.0	4.50	1,575.0
Vert. Component	ŧ		
Total	= 9,423.9	lbs R.M.=	60,135.2

* Axial live load NOT included in total displayed, or used for overturning

resistance, but is included for soil pressure calculation.

*Includes water table effect

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) 0.093 in




Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660 801-798-0555 Structured 19001 Structured Jobe/2001 0

Project Name/Number : 2021-2576 Title 10'-0" RETAINING WALL Dsgnr: JMW Description.... FT6 FW10 - SEISMIC

Critoria		Soil Data	
RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06060294 License To : LEI Engineers and Surveyors		Cantilevered Retaining Wall	
This Wall in File. T.\Structural\2021 Structural Jo	obs	2021-2576_LHH Lighthouse Heights Retaining Wal	

	7 98-0555 Iral\2021 Str	uctural Jobs\2	021-2576_LHH Lighthouse Hei	ights Re	taining Wa	al l		
RetainPro (c) 1987-2019, Bui License : KW-06060294 License To : LEI Enginee			Cantilevered Retain	ing W	/all	Code: IB0	C 2018,AC	I 318-14,TMS 402-16
Criteria			Soil Data			Sector Sector		
Retained Height Wall height above soil Slope Behind Wall Height of Soil over Toe Water height over heel	= 10.00 = 6.50 = 0.00 = 18.00 = 11.0	D ft F D ft F D in F D ft F S S	Allow Soil Bearing = Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	35.0	psf/ft psf/ft pcf pcf			
Surcharge Loads			Lateral Load Applied to	Stem		Adjacent F	ooting L	oad
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applie Axial Dead Load Axial Live Load Axial Load Eccentricity	g & Overturn = 0.0 rturning d to Stem = 0.0 = 0.0	ing D psf	•.	0.0 #/ 0.00 ft 0.00 ft nd (W) rength L 0.0 ps	ft .evel)	Adjacent Fool Footing Width Eccentricity Wall to Ftg Cl Footing Type Base Above/E at Back of N Poisson's Rat	Load Dist Below Soil Wall	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load = 0.0 ft = 0.300
Earth Pressure S								
Method : Uniform Multiplier Used (Multiplier used on soil	= 8.550		Uniform Seismic Force = 9 Total Seismic Force = 1,03	4.050			2	JARED R. PALFREYMAN
Design Summary			Stem Construction		3rd	2nd	Bottom	PALFREYMAN CC No. 7942895-
Wall Stability Ratios Overturning Sliding	= = = 9	2.33 OK 1.75 OK ,299 lbs	Design Height Above Ft Wall Material Above "Ht Design Method Thickness Rebar Size	" = = =	10.50 Fence	Concrete LRFD 10.00 # 5	# /	PALFREYMAN No. 7942895- 2202 10-13-21 PROFESSIONAL
Total Bearing Load resultant ecc.		3.41 in	Rebar Spacing Rebar Placed at	=		12.00 Edge	6.00 Edge	
Soil Pressure @ Toe Soil Pressure @ Heel	= 2 =	,151 psf OK 0 psf OK	fb/FB + fa/Fa	=		0.706	0.882	
Allowable Soil Pressure Les ACI Factored @ Toe	s Than Allo	,689 psf	Total Force @ Section Service Level Strength Level	lbs = lbs =		3,371.6	8,595.0	
ACI Factored @ Heel Footing Shear @ Toe Footing Shear @ Heel		0 psf 55.9 psi OK 43.8 psi OK	MomentActual Service Level Strength Level	ft-# = ft-# =		7,708.7	31,835.7	
Allowable Sliding Calcs		75.0 psi	MomentAllowable ShearActual	ft-# =		10,911.3	36,058.5	
Lateral Sliding Force less 100% Passive For less 100% Friction For	ce = - 7,4	12.2 lbs 00.0 lbs 89.7 lbs	Service Level Strength Level ShearAllowable	psi = psi = =		34.3 75.0	94.7 94.9	
Added Force Req'd for 1.5 Stability	=	0.0 lbs OK 0.0 lbs OK	Anet (Masonry) Rebar Depth 'd' Masonry Data	in2 = in =		8.19	7.56	
Vertical component of acti NOT considered in the cal			f'm Fs	psi = psi = = psf =		125.0	125.0	
Load Factors Building Code Dead Load	IBC 20	18,ACI 1.200	Short Term Factor Equiv. Solid Thick. Masonry Block Type	=	Medium \			

psi =

psi =

= ASD

= Medium Weight

2,500.0

60,000.0

4,000.0

60,000.0

Masonry Block Type

Concrete Data

f'c Fy

Masonry Design Method

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



Min. As %

Cover @ Top

-

2.00

0.0018

@ Btm = 3.00 in

Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660 801-798-0555 Project Name/Number : 2021-2576 Title 10'-0": RETAINING WALL Dsgnr: JMW Description.... FT6 FW10 - SEISMIC

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This Wall In File. 1. Structural 202	Structural Jobs\2021-2576	LHH Lighthouse Heights Retaining Wal
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Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details 2nd Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.2177 in2/ft (4/3) * As : 0.2903 in2/ft Min Stem T&S Reinf Area 1.519 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 in2/ft Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft 0.0018bh: 0.0018(12)(10): Horizontal Reinforcing Options : 0.216 in2/ft ========= One layer of : Two layers of : Required Area : 0.2903 in2/ft #4@ 10.00 in #4@ 20.00 in Provided Area : 0.31 in2/ft #5@ 15.50 in #5@ 31.00 in Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in Bottom Stem Horizontal Reinforcing Vertical Reinforcing As (based on applied moment) : 0.9767 in2/ft 1.3022 in2/ft (4/3) * As : Min Stem T&S Reinf Area 1.001 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 : STATE OF SPAH Required Area : 0.9767 in2/ft #4@ 10.00 in #4@ 20.00 in Provided Area : #5@ 31.00 in 1.2 in2/ft #5@ 15.50 in Maximum Area : 1.6392 in2/ft #6@ 22.00 in #6@ 44.00 in JARED R. RECTING TO AROFESSIONAL **Footing Data TEER** Footing Design Results 4.00 ft Toe Width = Heel Toe Heel Width 5.67 = Factored Pressure = 2,689 0 psf 5 **Total Footing Width** = 9.67 Mu': Upward 2.874 ft-# = 218,324 Mu': Downward = 17,516 ft-# 36,288 Footing Thickness Ξ 12.00 in Mu: Design = 15,170 14,642 ft-# Key Width = 12.00 in Actual 1-Way Shear = 55.93 43.76 psi Key Depth = 18.00 in Allow 1-Way Shear = 75.00 75.00 psi Key Distance from Toe = 4.00 ft Toe Reinforcing = #5@6.00 in fc = 2,500 psi Fy = 60.000 psi Heel Reinforcing = #4 @ 6.00 in Footing Concrete Density 150.00 pcf Key Reinforcing = None Spec'd =

If torsion exceeds allowable, provide

supplemental design for footing torsion.

=

÷ =

Other Acceptable Sizes & Spacings

Footing Torsion, Tu

Footing Allow. Torsion, phi Tu

Toe: #4@ 5.82 in, #5@ 9.02 in, #6@ 12.81 in, #7@ 17.47 in, #8@ 23.00 in, #9@ 29. Heel: #4@ 6.31 in, #5@ 9.78 in, #6@ 13.89 in, #7@ 18.94 in, #8@ 24.94 in, #9@ 31. Key: phiMn = phi'5'lambda'sqrt(fc)'Sm

0.00 ft-lbs

0.00 ft-lbs

Min footing T&S reinf Area	2.51 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



Project Name/Number : 2021-2576 Title 10'-0", RETAINING WALL Dsgnr: JMW Description.... FT6 FW10 - SEISMIC

rnis wair in File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

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Cantilevered Retaining Wall

pci

0.102 in

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

.....RESISTING

Summary of Overturning & Resisting Forces & Moments

Brancesco (international description of the second s			ERTURNING	
Item	_	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)				20,017.3
HL Act Pres (be water tbl)		1,312.9	3.67	4,813.8
Hydrostatic Force		3,775.2	3.67	
Buoyant Force	=	603.2	4.83	
Surcharge over Heel	=			
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=			
Seismic Earth Load	=	724.2	5.50	3,983.0
	=			
Total	=	6,415.4	O.T.M. =	25,554.3
Resisting/Overturning Vertical Loads used fo				2.33 Ibs

	Force lbs	Distance ft	Moment ft-#
Soil Over HL (ab. water tbl))		
Soil Over HL (bel. water tbl) 3,295.9		
Watre Table	3,015.6	7.25	23,894.0
Sloped Soil Over Heel =			
Surcharge Over Heel =			
Adjacent Footing Load =			
Axial Dead Load on Stem =			
* Axial Live Load on Stem =			
Soil Over Toe =		2.00	
Surcharge Over Toe =			
Stem Weight(s) =	1,312.5	4.42	5,796.9
Earth @ Stem Transitions =			
Footing Weight =	1,449.9	4.83	7,007.4
Key Weight =	225.0	4.50	1,012.5
Vert. Component =	:		
Total -	- 0.200.0	Ibo DM =	E0 E70 7

Total = 9,298.9 lbs **R.M.=** 59,572.7 * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

* ត្រឹត្តឲ្យតូឆ្នាំទូ ត្រូវជាឲ្យស្ត្រឲ្យ (theta 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)

Horizontal Defl @ Top of Wall (approximate only)

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.





7.00 ft

Project Name/Number : 2021-2576 Title 7'-0" :RETAINING WALL Dsgnr: JMW Description.... FT4 FW7

801-798-0555 This Wall in File. T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

(Strength Level)

Soil Data

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Cantilevered Retaining Wall

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

Criteria Retained Height = Wall height above soil =

Wall height above soil	=	6.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	18.00 in
Water height over heel	=	8.0 ft

Surcharge Loads

	=	0.0 psf
Used To Resist Sliding	& Ov	erturning
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Ove	rturnir	Ig

Axial Load Applied to Stem

	-		and the second second		
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =			0.0 lbs 0.0 lbs 0.0 in		
Design Summary					[
Wall Stability Ratios Overturning Sliding	= =		2.38 1.51		
Total Bearing Loadresultant ecc.	=		5,312 16.69		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable			1,748 0 2,000	psf	
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel		an /	Allowable 2,215	e	
Footing Shear @ Toe Footing Shear @ Heel Allowable			25.4 21.9 75.0	psi	
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force	=		1,593.6	lbs Ibs	
Added Force Req'd for 1.5 Stability	=			lbs lbs	

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

Call State Street Street State Sta	12 martin		and the second second	COLUMN TWO IS NOT
Allow Soil Bearing		=	2,000.0	psf
Equivalent Fluid Pressur	e N	leth	lod	
Active Heel Pressure		=	35.0	psf/ft
		1337		
Dessities Dressure		=	405.0	
Passive Pressure		=	425.0	
Soil Density, Heel		=	110.00	pcf
Soil Density, Toe		=	0.00	pcf
Footing Soil Friction		=	0.300	
Soil height to ignore				
for passive pressure		=	0.00	in
Lateral Load Appl	iec	t to	Stem	
Lateral Load	=		0.0 #/	ft
Height to Top	=		0.00 ft	
Height to Bottom	=		0.00 ft	
Load Type	=	W	ind (W)	
<i></i>		(S	trength L	evel)
Wind on Exposed Stem	=		22.6 ps	sf



Adjacent Footing I	_oad	
Adjacent Footing Load	=	0.0 lb:
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

Stem Construction		3rd	2nd	Bottom	STRIE OF STA
Design Height Above Ftg	ft =	7.50	Stem OK 2.00	Stem OK 0.00	STATISTY
Wall Material Above "Ht"	=	Fence	Concrete	Concrete	* JARED R. *
Design Method	=		LRFD	LRFD	PALFREYMAN C
Thickness	=		10.00	10.00	E No 2042905
Rebar Size	=		# 5	# 5	1942095- E
Rebar Spacing	=		12.00	6.00	101221 5
Rebar Placed at	=		Edge	Edge	PALFREYMAN No. 7942895- 2202 10-13-21
Design Data			0.482	0.555	PROFESSIONAL
fb/FB + fa/Fa	=		0.482	0.555	
Total Force @ Section					
Service Level	lbs =	81.4			
Strength Level	lbs =		2,291.2	4,086.6	
MomentActual					
Service Level	ft-# =	244.1			
Strength Level	ft-# =		5,267.2	11,554.2	
MomentAllowable	ft-# =		10,911.3	20,802.0	
ShearActual					
Service Level	psi =				
Strength Level	psi=		23.3	41.6	
ShearAllowable			75.0	75.0	
Anet (Masonry)	in2 =				
Rebar Depth 'd'	in =		8.19	8.19	
Masonry Data					
fm	psi =				
Fs	psi =				
Solid Grouting	=				
Modular Ratio 'n'	=				
Wall Weight	psf =		125.0	125.0	
Short Term Factor	=				
Equiv. Solid Thick.	=				
Masonry Block Type	=	Medium W	eight		
Masonry Design Method	=	ASD			
Concrete Data					
fc	psi =		2,500.0	2,500.0	
Fy	psi =		60,000.0	60,000.0	



Key Width

Key Depth

Min. As %

Cover @ Top

fc =

Key Distance from Toe

Footing Concrete Density

2,500 psi

2.00

=

=

=

Fy =

=

=

12.00 in

12.00 in

2.50 ft

75,000 psi

150.00 pcf

0.0018

@ Btm.= 3.00 in

Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660 801-798-0555

Project Name/Number : 2021-2576 7'-0" RETAINING WALL Title Dsgnr: JMW Description FT4 FW7

Page: 2 20 SEP 2021 Date:

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

Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

RetainPro (c) 1987-2019, Build 11.20.03.31 **Cantilevered Retaining Wall** License : KW-06060294 License To : LEI Engineers and Surveyors **Concrete Stem Rebar Area Details**

2nd Stem Vertical Reinforcing Horizontal Reinforcing 0.1488 in2/ft As (based on applied moment) : (4/3) * As : 0.1983 in2/ft Min Stem T&S Reinf Area 1.320 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 : 0.216 in2/ft #4@ 10.00 in #4@ 20.00 in Provided Area : 0.31 in2/ft #5@ 15.50 in #5@ 31.00 in Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.3263 in2/ft (4/3) * As : 0.4351 in2/ft Min Stem T&S Reinf Area 0.480 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 : STATE OF GRAN Required Area : #4@ 20.00 in 0.3275 in2/ft #4@ 10.00 in Provided Area : 0.62 in2/ft #5@ 15.50 in #5@ 31.00 in JARED R. Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in RECISTENED PROFESSIONA VGINEER **Footing Data Footing Design Results** Toe Width 2.50 ft = Heel Width = 4.33 ŝ **Total Footing Width** = 6.83 Footing Thickness = 12.00 in

	Contraction of the	to have a set of the set of the set of the	dis.
		Toe	Heel
Factored Pressure	$\equiv 1$	2,215	0 psf
Mu' : Upward	$\equiv 0$	71,675	1,254 ft-#
Mu': Downward	\equiv	14,175	6,761 ft-#
Mu: Design	\equiv	4,792	5,507 ft-#
Actual 1-Way Shear	=	25.37	21.86 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 5 @ 12.00 in	
Heel Reinforcing	=	# 5 @ 12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hi 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: phiMn = phi'5'lambda'sqrt(fc)'Sm

Min footing T&S reinf Area	1.77	in2
Min footing T&S reinf Area per foot	0.26	in2 /ft
If one layer of horizontal bars:	If two lay	ers of horizontal bars:
#4@ 9.26 in	#4@ 1	8.52 in
#5@ 14.35 in	#5@ 2	8.70 in
#6@ 20.37 in	#6@ 4	0.74 in



Project Name/Number : 2021-2576 Title 7'-0" RETAINING WALL Dsgnr: JMW Description.... FT4 FW7

This Wall in File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

License : KW-06060294 License To : LEI Engineers and Surveyors Cantilevered Retaining Wall

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

.....RESISTING

Summary of Overturning & Resisting Forces & Moments

			ERTURNING		
Item	_	Force Ibs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl) HL Act Pres (be water tbl)		694.4	2.67	8,155.9 1,851.7	Soil Over HL(Soil Over HL(Watre Table
Hydrostatic Force Buoyant Force	=	1,996.8 426.4	2.67 3.42		Sloped Soil Ove
Surcharge over Heel Surcharge Over Toe Adjacent Footing Load	=				Surcharge Ove Adjacent Footir Axial Dead Loa
Added Lateral Load Load @ Stem Above Soil	=	88.1	11.25	991.6	* Axial Live Load Soil Over Toe Surcharge Ove
Total	=	3,205.7	O.T.M. =	9,624.8	Stem Weight(s Earth @ Stem Footing Weight
Resisting/Overturning Vertical Loads used for			= = 5,311,	2.38 8 lbs	Key Weight Vert. Compone

	Force lbs	Distance ft	Moment ft-#
Soil Over HL (ab. water tbl))		
Soil Over HL (bel. water tbl) 1,670.7		
Watre Table	1,528.7	5.08	8,492.7
Sloped Soil Over Heel =			
Surcharge Over Heel =			
Adjacent Footing Load =			
Axial Dead Load on Stem =			
* Axial Live Load on Stem =			
Soil Over Toe =		1.25	
Surcharge Over Toe =			
Stem Weight(s) =	937.5	2.92	2,734.4
Earth @ Stem Transitions =	8		
Footing Weight =	1,025.0	3.42	3,501.7
Key Weight =	150.0	3.00	450.0
Vert. Component _=	(2	
	50110		00 0 10 0

Total = 5,311.8 lbs **R.M.=** 22,949.2 * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

*Includes water table effect

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

Horizontal Defl @ Top of Wall (approximate only) 0.096 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.

250.0 pci





Jared Palfreyman LEI Engineers and Surveyors, Inc Project Name/Number : 2021-2576 7'-0" RETAINING WALL Title Dsgnr: JMW Description.

/EER

ENGIN'

Date: 3302 N. Main St FT4 FW7 - SEISMIC Spanish Fork, UT 84660 801-798-0555 Structural\2021 Structural Jobs\2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31 Cantilevered Retaining Wall Code: IBC 2018, ACI 318-14, TMS 402-16 License : KW-06060294 License To : LEI Engineers and Surveyors Soil Data Criteria Allow Soil Bearing 2,667.0 psf = **Retained Height** 7.00 ft Equivalent Fluid Pressure Method Wall height above soil 6.50 ft = Active Heel Pressure 35.0 psf/ft = Slope Behind Wall 0.00 = \equiv Height of Soil over Toe = 18.00 in Passive Pressure = 925.0 psf/ft Water height over heel = 8.0 ft Soil Density, Heel = 110.00 pcf 0.00 pcf Soil Density, Toe = Footing||Soil Friction = 0.300 Soil height to ignore for passive pressure = 0.00 in Surcharge Loads Lateral Load Applied to Stem Adjacent Footing Load Surcharge Over Heel Adjacent Footing Load 0.0 lbs 0.0 psf = Lateral Load 0.0 #/ft Used To Resist Sliding & Overturning ...Height to Top Footing Width 0.00 ft = 0.00 ft = Surcharge Over Toe 0.0 psf Eccentricity 0.00 in ...Height to Bottom = 0.00 ft Used for Sliding & Overturning Wall to Ftg CL Dist 0.00 ft = Load Type = Wind (W) Footing Type Line Load Axial Load Applied to Stem (Strength Level) Base Above/Below Soil 0.0 ft Axial Dead Load 0.0 lbsWind on Exposed Stem _ 0.0 psf at Back of Wall Axial Live Load 0.0 lbs (Strength Level) Poisson's Ratio 0.300 = Axial Load Eccentricity 0.0 in = Earth Pressure Seismic Load STATE OF STAR Method : Uniform Uniform Seismic Force = 94,000 D Multiplier Used = 11.750 **Total Seismic Force** 752.000 JARED R. (Multiplier used on soil density) R I. ROUND IN 220% 10-13-21 PROFESSIONAL Stem Construction 3rd 2nd Bottom **Design Summary** Stem OK Stem OK 0.00 **Design Height Above Ftg** 7.50 ft = 2.00 Wall Stability Ratios Wall Material Above "Ht" = Fence Concrete Concrete Overturning = 2.14 OK Design Method = LRFD LRFD 2.26 OK Sliding = Thickness 10.00 = 10.00 # 5 Rebar Size = # 5 Total Bearing Load = 5.312 lbs Rebar Spacing = 12.00 6.00 ...resultant ecc. = 19.21 in Rebar Placed at = Edge Edge **Design Data** Soil Pressure @ Toe 1,950 psf OK = fb/FB + fa/Fa 0.479 0.593 = Soil Pressure @ Heel = 0 psf OK Total Force @ Section 2,667 psf Allowable = Service Level lbs = Soil Pressure Less Than Allowable Strength Level 4.597.7 lbs = 2,614.3 ACI Factored @ Toe 2,471 psf = Moment....Actual ACI Factored @ Heel = 0 psf ft-# = Service Level Footing Shear @ Toe = 28.5 psi OK Strength Level ft-# = 5,230.3 12,351.5 Moment.....Allowable ft-# = 10,911.3 20.802.0 Shear Actual

Service Level

Strength Level

Shear.....Allowable

Anet (Masonry)

Rebar Depth 'd'

Masonry Data

Solid Grouting

Modular Ratio 'n' Wall Weight

Short Term Factor

Equiv. Solid Thick. Masonry Block Type

Concrete Data

fc Fy

Masonry Design Method

fm Fs

psi=

psi =

in2 =

in =

psi=

psi=

psf=

psi=

psi=

= =

=

= ASD

= Medium Weight

=

26.6

75.0

8.19

125.0

2,500.0

60.000.0

46.8

75.0

8.19

125.0

2,500.0

60,000.0

Footing Shear @ Heel	=		25.0 psi	OK
Allowable	=		75.0 psi	
Sliding Calcs				
Lateral Sliding Force	=		3,217.6 lbs	
less 100% Passive Force	=	-	5,665.6 lbs	
less 100% Friction Force	=	-	1,593.6 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



Footing Allow, Torsion, phi Tu =

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: phiMn = phi'5'lambda'sqrt(fc)'Sm

Min footing T&S reinf Area Min footing T&S reinf Area per foot	1.77 0.26	in2 in2 <i>I</i> ft
If one layer of horizontal bars:	If two lay	ers of horizontal bars:
#4@ 9.26 in	#4@ 1	8.52 in
#5@ 14.35 in	#5@ 2	8.70 in
#6@ 20.37 in	#6@ 4	0.74 in



Project Name/Number : 2021-2576 Title 7'-0" RETAINING WALL Dsgnr: JMW Description.... FT4 FW7 - SEISMIC

This Wall in File: T. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

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Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

			ERTURNING.	
Item		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)				8,155.9
HL Act Pres (be water tbl)		694.4	2.67	1,851.7
Hydrostatic Force		1,996.8	2.67	
Buoyant Force	=	426.4	3.42	
Surcharge over Heel	=			
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=			
Seismic Earth Load	=	526.4	4.00	2,105.6
	=			
Total	=	3,644.0	O.T.M. =	10,738.9
Resisting/Overturning	Raf	tio	=	2.14
Vertical Loads used fo			= 5,311.8	lbs

			RESISTING			
		Force lbs	Distance ft	Moment ft-#		
Soil Over HL (ab. water t	tbl)					
Soil Over HL (bel. water	tbl)	1,670.7				
Watre Table		1,528.7	5.08	8,492.7		
Sloped Soil Over Heel	=					
Surcharge Over Heel	=					
Adjacent Footing Load	=					
Axial Dead Load on Sten	า =					
* Axial Live Load on Stem	=					
Soil Over Toe	=		1.25			
Surcharge Over Toe	=					
Stem Weight(s)	=	937.5	2.92	2,734.4		
Earth @ Stem Transition	s =					
Footing Weight	=	1,025.0	3.42	3,501.7		
Key Weight	=	150.0	3.00	450.0		
Vert. Component	=					
Tota		53118	lbs RM =	22 9/9 2		

Total = 5,311.8 lbs **R.M.=** 22,949.2 * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

*// cost is in the 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) 0.107 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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Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St

Project Name/Number : 2021-2576 Title 4'-0" RETAINING WALL Dsgnr: JMW Description.... FT2 FW4

 Spanish Fork, UT 84660
 FT2 FW4

 801-798-0555
 Structural V2021 Structural Jobs V2021-2576_LHH Lighthouse Heights Retaining Wal

RetainPro (c) 1987-2019,	Build 11.20.03.31
License : KW-06060294	

aining Wall

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

RetainPro (c) 1987-2019, Build License : KW-06060294 License To : LEI Engineers			rs		Cantilevered Reta
Criteria					Soil Data
Retained Height = Wall height above soil = Slope Behind Wall =		4.00 ft 6.50 ft 0.00		E	Allow Soil Bearing = Equivalent Fluid Pressure Me Active Heel Pressure =
Height of Soil over Toe = Water height over heel =		8.00 in 5.0 ft		s S	Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =
Surcharge Loads					Lateral Load Applied
Surcharge Over Heel = Used To Resist Sliding & Surcharge Over Toe = Used for Sliding & Overtu	Over	0.0 psf turning 0.0 psf			Lateral Load = Height to Top = Height to Bottom = Load Type = \
Axial Load Applied	to St	em			(
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =		0.0 lbs 0.0 lbs 0.0 in			Wind on Exposed Stem = (Strength Level)
Design Summary	and the second	100 - 200 - 100			Stem Construction
Wall Stability Ratios Overturning Sliding Total Bearing Load resultant ecc.	= = =	1.60 1.69 2,008 14.94	OK Ibs		Design Height Above Wall Material Above ' Design Method Thickness Rebar Size Rebar Spacing
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= = Than	1,994 0 2,000	psf psf psf		Rebar Placed at Design Data fb/FB + fa/Fa Total Force @ Secti Service Level
ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= = = =	10.7 9.8 75.0	psf psi psi psi		Strength Level MomentActual Service Level Strength Level MomentAllowable ShearActual Service Level
Lateral Sliding Force less 100% Passive Force less 100% Friction Force Added Force Req'd for 1.5 Stability			lbs		Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'

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

and the second se		and the second second	and the second s	and the second se
Soil Data				
Allow Soil Bearing		=	2,000.0	psf
Equivalent Fluid Pressure	əМ	leth	lod	
Active Heel Pressure		=	35.0	psf/ft
		=		
Passive Pressure		=	425.0	psf/ft
Soil Density, Heel		=	110.00	pcf
Soil Density, Toe		=	0.00	pcf
Footing Soil Friction		=	0.300	
Soil height to ignore				
for passive pressure		=	0.00	in
Lateral Load Appl	iec	t	o Stem	
	Contraction of the			and the second se
Lateral Load	=		0.0 #/	ft
Height to Top	=		0.00 ft	
Height to Bottom	=		0.00 ft	
Load Type	=	W	ind (W)	
		(S	trength L	evel)
Wind on Exposed Stem	=		22.6 ps	sf

		1 Mari
	88800m	
		10.1
60000000		

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

Stem Construction		2nd	Bottom	
Design Height Above Ftg	ft =	4.50	Stem OK	
Wall Material Above "Ht"	n = =	4.50	0.00	
	=	Fence	Concrete	
Design Method Thickness	=		LRFD 10.00	LRFD
Rebar Size	_		# 5	
Rebar Spacing	-		12.00	
Rebar Placed at	=		Edge	
Design Data			Luge	11*
fb/FB + fa/Fa	=		0.305	//
Total Force @ Section				E
Service Level	lbs =	81.4		11 53
Strength Level	lbs =		1,597.9	1 E
MomentActual			.,	1
Service Level	ft-# =	244.1		
Strength Level	ft-# =		3,334.0	
MomentAllowable	ft-# =		10,911.3	
ShearActual				
Service Level	psi =			
Strength Level	psi =		16.3	
ShearAllowable	=		75.0	
Anet (Masonry)	in2 =		70.0	
Rebar Depth 'd'	in =		8.19	
Masonry Data	II 10.000		0.10	
fm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf=		125.0	
Short Term Factor	. =			
Equiv. Solid Thick,	=			
Masonry Block Type	=	Medium W	eight	
Masonry Design Method	=	ASD	e-can tilladdi	
Concrete Data				
f'c	psi =		2,500.0	
Fy	psi =		60,000.0	





RetainPro (c) 1987-2019, Build 11.20.03.31

Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660 801-798-0555 Project Name/Number : 2021-2576 Title 4'-0" :RETAINING WALL Dsgnr: JMW Description.... FT2 FW4

wall in File. 1. Structural 2021 Structural Jobs 2021-2576_LHH Lighthouse Heights Retaining Wal

Cantilevered Retaining Wall License : KŴ-06060294 License To : LEI Engineers and Surveyors Code: IBC 2018, ACI 318-14, TMS 402-16 **Concrete Stem Rebar Area Details** Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.0942 in2/ft (4/3) * As : 0.1255 in2/ft Min Stem T&S Reinf Area 1.080 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 : STATE OF OTAH 0.216 in2/ft #4@ 10.00 in #4@ 20.00 in Required Area : Provided Area : #5@ 15.50 in 0 0.31 in2/ft #5@ 31.00 in Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in JARED R. RECISIONAL VGINEER **Footing Data** Footing Design Results Toe Width 1.33 ft = Heel Toe Heel Width = Factored Pressure 2.50 2,601 = 0 psf \$ **Total Footing Width** 3.83 = Mu': Upward = 21,610 0 ft-# Mu' : Downward = 4,030 983 ft-# **Footing Thickness** = 12.00 in Mu: Design = 1,465 983 ft-# Key Width 0.00 in = Actual 1-Way Shear = 10.74 9.83 psi Key Depth = 0.00 in Allow 1-Way Shear 40.00 psi = 75.00 Key Distance from Toe 0.00 ft = Toe Reinforcing = #5@12.00 in 60,000 psi Heel Reinforcing = None Spec'd 2,500 psi Fy = fc =Footing Concrete Density = 150.00 pcf Key Reinforcing = None Spec'd Min. As % 0.0018 Footing Torsion, Tu 0.00 ft-lbs 2.00 Cover @ Top @ Btm .= 3.00 in 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: phiMn = phi'5'lambda'sqrt(fc)'Sm Key: No key defined

Min footing T&S reinf Area0.99in2Min footing T&S reinf Area per foot0.26in2/ftIf one layer of horizontal bars:If two layers of horiz#4@18.52 in

#5@ 14.35 in #6@ 20.37 in 0.26 in2 /ft If two layers of horizontal bars: #4@ 18.52 in #5@ 28.70 in #6@ 40.74 in



Project Name/Number : 2021-2576 4'-0" RETAINING WALL Title Dsgnr: JMW Description.... FT2 FW4

Page: 3 Date: 20 SEP 2021

e. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31

License : KW-06060294 License To : LEI Engineers and Surveyors

Cantilevered Retaining Wall

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

Summary of Overturning & Resisting Forces & Moments

		OV Force	ERTURNIN Distance	G Moment	
Item		lbs	ft	ft-#	
HL Act Pres (ab water tbl))			2,260.8	Soil Over HL
HL Act Pres (be water tbl))	271.3	1.67	452.1	Soil Over HL
Hydrostatic Force		780.0	1.67		Watre Table
Buoyant Force	=	239.2	1.92		Sloped Soil O
Surcharge over Heel	=				Surcharge Ov
Surcharge Over Toe	=				Adjacent Fool
Adjacent Footing Load	=				Axial Dead Lo
Added Lateral Load	=				* Axial Live Loa
Load @ Stem Above Soil	=	88.1	8.25	727.2	Soil Over Toe
	=				Surcharge Ov
					Stem Weight(
Total	=	1,378.6	O.T.M. =	2,937.6	Earth @ Sten Footing Weig
					Key Weight
Resisting/Overturning Vertical Loads used for			= = 2,008	1.60 .1 lbs	Vert. Compor

		R		
		Force Ibs	Distance ft	Moment ft-#
Soil Over HL (ab. water t	bl)			
Soil Over HL (bel. water	tbl)	454.7		
Watre Table		416.0	3.00	1,363.8
Sloped Soil Over Heel	=			
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Stem	ו =			
* Axial Live Load on Stem	=			
Soil Over Toe	=		0.67	
Surcharge Over Toe	=			
Stem Weight(s)	=	562.5	1.75	984.2
Earth @ Stem Transitions	s =			
Footing Weight	=	575.0	1.92	1,101.9
Key Weight	=			
Vert. Component	=			
Tota	1 =	2 008 1	lbs R.M =	4 697 8

Ibs R.M. 4,697.8 * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

*Includes water table effect

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) 0.152 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.





Jared Palfreyman LEI Engineers and Surveyors, Inc 3302 N. Main St Spanish Fork, UT 84660 801-798-0555 Structural Joba 2021 2

Project Name/Number : 2021-2576 Title 4'-0" RETAINING WALL Dsgnr: JMW Description.... FT2 FW4 - SEISMIC

2018,ACI 318-14,TMS 402-16

etainPro (c) 1987-2019, Buil cense : KW-06060294 cense To : LEI Engineer				Cantilevered Retain	ing W	all	Code: IBC 20
Criteria				Soil Data			
Retained Height Wall height above soil Slope Behind Wall	= =	4.00 ft 6.50 ft 0.00		Allow Soil Bearing = 2 Equivalent Fluid Pressure Metho Active Heel Pressure =		psf psf/ft	
Height of Soil over Toe Nater height over heel	=	18.00 in 5.0 ft		= Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	925.0 110.00 0.00 0.300 0.00	pcf pcf	
Surcharge Loads				Lateral Load Applied to	Stem		Adjacent Fool
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over	= turnin	0.0 psf g		Lateral Load = Height to Top = Height to Bottom = Load Type = Wir	0.0 #/ 0.00 ft 0.00 ft d (W)		Adjacent Footing I Footing Width Eccentricity Wall to Ftg CL Dis
Axial Load Applied	to S	item	and the second se	(Str	ength L	even	Footing Type Base Above/Belov
Axial Dead Load Axial Live Load Axial Load Eccentricity	= = =	0.0 lbs 0.0 lbs 0.0 in		Wind on Exposed Stem ₌ (Strength Level)	0.0 ps	f	at Back of Wall Poisson's Ratio
Earth Pressure Se	ismi	c Load					
Method:Uniform Multiplier Used (Multiplier used on soil d		8.800)		Total Seismic Force = 47	4.000 0.000		
Design Summary				Stem Construction		2nd	Stem OK
Wall Stability Ratios Overturning Sliding	=	1.55 O 2.53 O		Design Height Above Ft Wall Material Above "Ht Design Method Thickness Rebar Size		4.50 Fence	0.00
Total Bearing Load resultant ecc.	=	2,008 lbs 15.51 in		Rebar Spacing Rebar Placed at	=		12.00 Edge
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= = =	2,146 ps 0 ps 2,667 ps	OK	Total Force @ Section	=		0.276
Soil Pressure Les	s Thar	Allowable		Service Level	lbs =		1.827.0
ACI Factored @ Toe ACI Factored @ Heel	=	2,799 ps 0 ps		Strength Level MomentActual Service Level	lbs = ft-# =		1,027.0
Footing Shear @ Toe	=	11.6 ps		Strength Level	ft-# =		3,021.0
Footing Shear @ Heel Allowable	=	9.8 psi 75.0 psi		MomentAllowable	ft-# =		10,911.3
Sliding Calcs Lateral Sliding Force	=	1,380.3 lbs		ShearActual Service Level	psi =		
less 100% Passive Ford less 100% Friction Ford	e = -	2,890.6 lbs		Strength Level ShearAllowable	psi = =		18.6 75.0
1622 100 % LUCION LOIC							
Added Force Req'd for 1.5 Stability	=	0.0 lbs 0.0 lbs		())	in2 = in =		8.19

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

oting l	oad	
Load	=	0.0 lbs
	=	0.00 ft
	=	0.00 in
list	=	0.00 ft
		Line Load
ow Soil II	=	0.0 ft
	=	0.300
1		JARED R.

					1	RA A	LFREYMA
Stem Cons	struction		2nd	Bottom		B No.	7942895
Design H	eight Above Ftg	ft =	4.50	Stem OK 0.00	(ISTE	LFREYMA 7942895 2202 10-13-21 ROFESSION
Wall Ma	terial Above "Ht"	=	Fence	Concrete		1 Set	
Design I	Method	=		LRFD	LRFI		ROFFSSION
Thickne		=		10.00			- HOD
Rebar S		=		# 5			
Rebar S		=		12.00			
	laced at	=		Edge			
Design D				0.070			
fb/FB +		=		0.276			
	orce @ Section						
	ce Level	lbs =					
	gth Level	lbs =		1,827.0			
	tActual	e. 11					
	ce Level	ft-# =					
	igth Level	ft-# =		3,021.0			
Moment	Allowable	ft-# =		10,911.3			
Shear	Actual						
Servi	ice Level	psi =					
Strer	ngth Level	psi =		18.6			
Shear	Allowable	=		75.0			
Anet (M	asonrv)	in2 =					
Rebar D		in =		8.19			
Masonry	이 것은 것이 있는 것이 있는 것이 없다.						
fm		psi =					
Fs		psi =					
Solid Gr	outing	=					
Modular	Ratio 'n'	=					
Wall We	eight	psf=		125.0			
Short Te	erm Factor	=					
Equiv. S	olid Thick.	=					
Masonry	/ Block Type	=	Medium W	eight			
Masonry	/ Design Method	=	ASD				
Concrete	Data						
f'c		psi =		2,500.0			
Fy		psi =		60,000.0			

Project Name/Number : 2021-2576 Jared Palfreyman Title 4'-0" RETAINING WALL Page: 2 LEI Engineers and Surveyors, Inc Dsgnr: JMW Date: 20 SEP 2021 3302 N. Main St Description... FT2 FW4 - SEISMIC Spanish Fork, UT 84660 801-798-0555 vail in File. 1. Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal RetainPro (c) 1987-2019, Build 11.20.03.31 Cantilevered Retaining Wall License : KŴ-06060294 License To : LEI Engineers and Surveyors Code: IBC 2018, ACI 318-14, TMS 402-16 **Concrete Stem Rebar Area Details** Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.0853 in2/ft (4/3) * As : 0.1138 in2/ft Min Stem T&S Reinf Area 1,080 in2 200bd/fy: 200(12)(8.1875)/60000: 0.3275 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 : STATE OF 67 ______ One layer of : Two layers of : AH Required Area : 0.216 in2/ft #4@ 10.00 in #4@ 20.00 in Provided Area : #5@ 15.50 in #5@ 31.00 in 0.31 in2/ft JARED R. Maximum Area : 1.1092 in2/ft #6@ 22.00 in #6@ 44.00 in RECISIONAL No. 7. 2202 10-13-21 **Footing Design Results** 日日日 **Footing Data** &NGIN-Toe Width 1.33 ft = Heel Toe Heel Width = 2.50 **Factored Pressure** = 2,799 0 psf Total Footing Width = 3.83 Mu': Upward = 22,754 0 ft-# Mu': Downward = 4,030 983 ft-# Footing Thickness = 12.00 in = Mu: Design 1,560 983 ft-# Key Width = 0.00 in Actual 1-Way Shear 9.83 psi = 11.56 Key Depth 0.00 in = Allow 1-Way Shear = 75.00 40.00 psi Key Distance from Toe = 0.00 ft Toe Reinforcing = #5@12.00 in Heel Reinforcing = None Spec'd f'c = 2,500 psi Fy = 60,000 psi Footing Concrete Density 150.00 pcf Key Reinforcing = None Spec'd Min. As % Footing Torsion, Tu 0.0018 = = 0.00 ft-lbs Cover @ Top 2.00 @ Btm .= 3.00 in 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: phiMn = phi'5'lambda'sqrt(fc)'Sm Key: No key defined

Min footing T&S reinf Area	0.99 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	



Project Name/Number : 2021-2576 Title 4'-0" RETAINING WALL Dsgnr: JMW Description.... FT2 FW4 - SEISMIC

Structural/2021 Structural Jobs/2021-2576_LHH Lighthouse Heights Retaining Wal

RetainPro (c) 1987-2019, Build 11.20.03.31 License : KW-06060294 License To : LEI Engineers and Surveyors

Cantilevered Retaining Wall

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

RESISTING

Summary of Overturning & Resisting Forces & Moments

	OVERTURNING Force Distance Mom			
Item	_	lbs	ft	ft-#
HL Act Pres (ab water tbl)				2,260.8
HL Act Pres (be water tbl)		271.3	1.67	452.1
Hydrostatic Force		780.0	1.67	
Buoyant Force =		239.2	1.92	
Surcharge over Heel	=			
Surcharge Over Toe =				
Adjacent Footing Load =				
Added Lateral Load =				
Load @ Stem Above Soil	=			
Seismic Earth Load =		329.0	2.50	822.5
	=			
Total	=	1,619.4	O.T.M. =	3,033.0
Resisting/Overturning Vertical Loads used fo			= = 2,008.1	1.55 I lbs

			EOIC	DIING	
		Force lbs	D	ft ft	Moment ft-#
Soil Over HL (ab. water tb	ol)				
Soil Over HL (bel. water th	ol)	454.7			
Watre Table		416.0		3.00	1,363.8
Sloped Soil Over Heel	=				
Surcharge Over Heel	=				
Adjacent Footing Load	=				
Axial Dead Load on Stem	=				
* Axial Live Load on Stem	=				
Soil Over Toe	=			0.67	
Surcharge Over Toe	=				
Stem Weight(s)	=	562.5		1.75	984.2
Earth @ Stem Transitions	=				
Footing Weight	=	575.0		1.92	1,101.9
Key Weight	=				
Vert. Component	=				
Total	=	2.008.1	lbs	R.M.=	4 697 8

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



*In a 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) 0.163 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.