



Structural Calculations for:

Mercer Residence Shoring

6950 SE Maker St, Mercer Island, WA

Client: Dorothy Strand

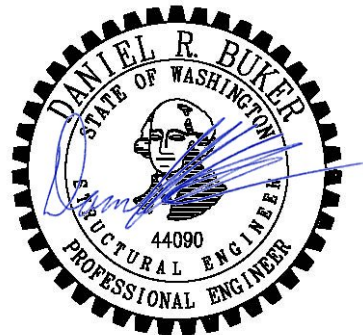
Code: 2018 International Building Code

Table of Contents

- SH1-SH8 – Soldier Pile and Permanent Concrete Wall Calculations
- SH9-SH11 - West Site Stabilization Wall Calculations

Scope: Structural Design of Temporary Soldier Pile wall to provide temporary site shoring during construction of an adjacent residence.

May 17, 2023



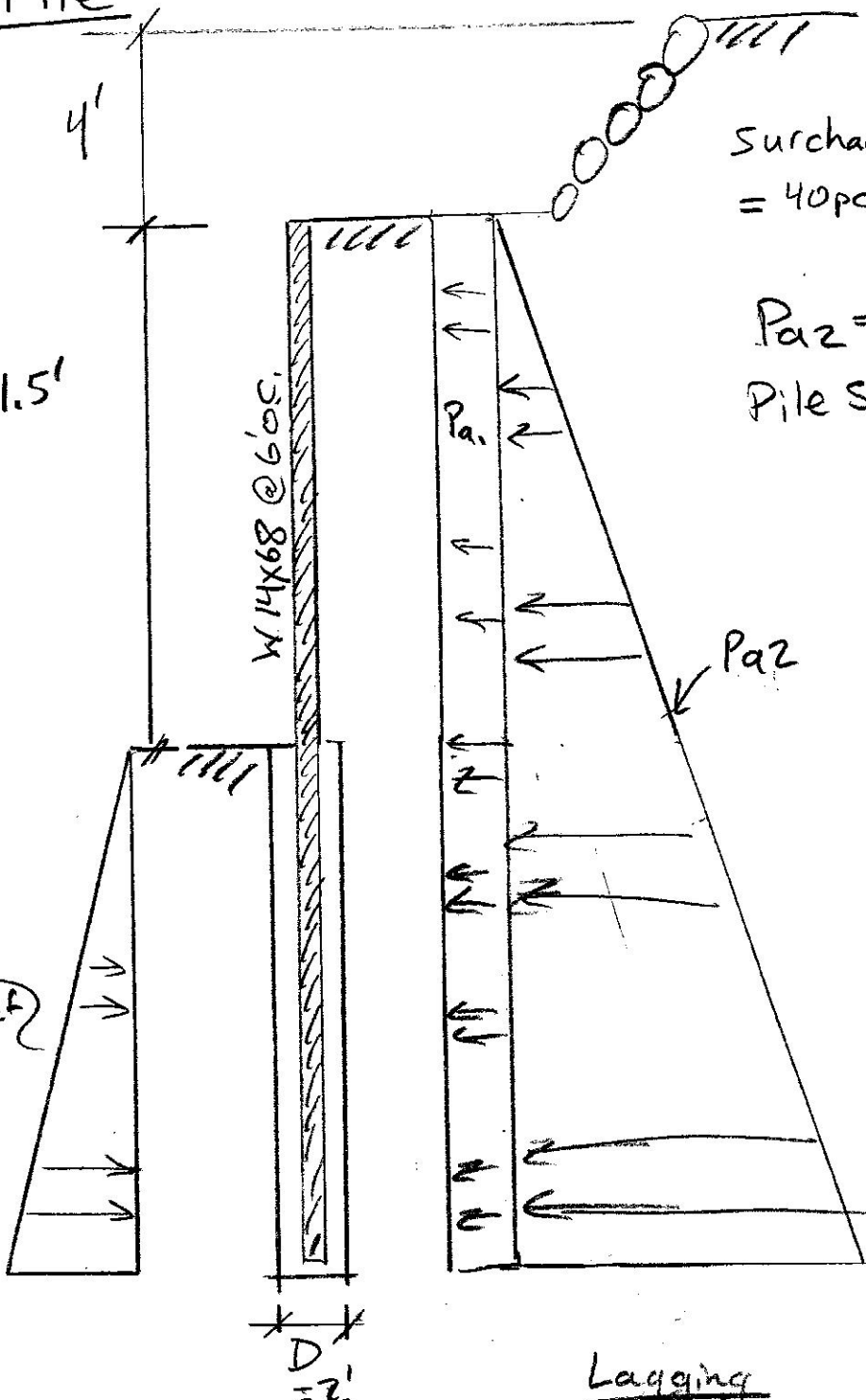
Typ. Pile

4'

H = 11.5'

W 14 X 68 @ 6' o.c.

$P_p = 450 \text{ psf}$



Surcharge (P_{a1})
 $= 40 \text{ psf} (4\frac{1}{2}) = 80 \text{ psf}$

$P_{a2} = 40 \text{ psf}$

Pile Spacing = 6' o.c.

D = 2'

Lagging

P.T. 4 X 10

$l = 6'$, $w = 0.3 (40 (11.5) + 80)$
 $= 162 \text{ psf}$

\Rightarrow for 4 X 10 = 125 plf

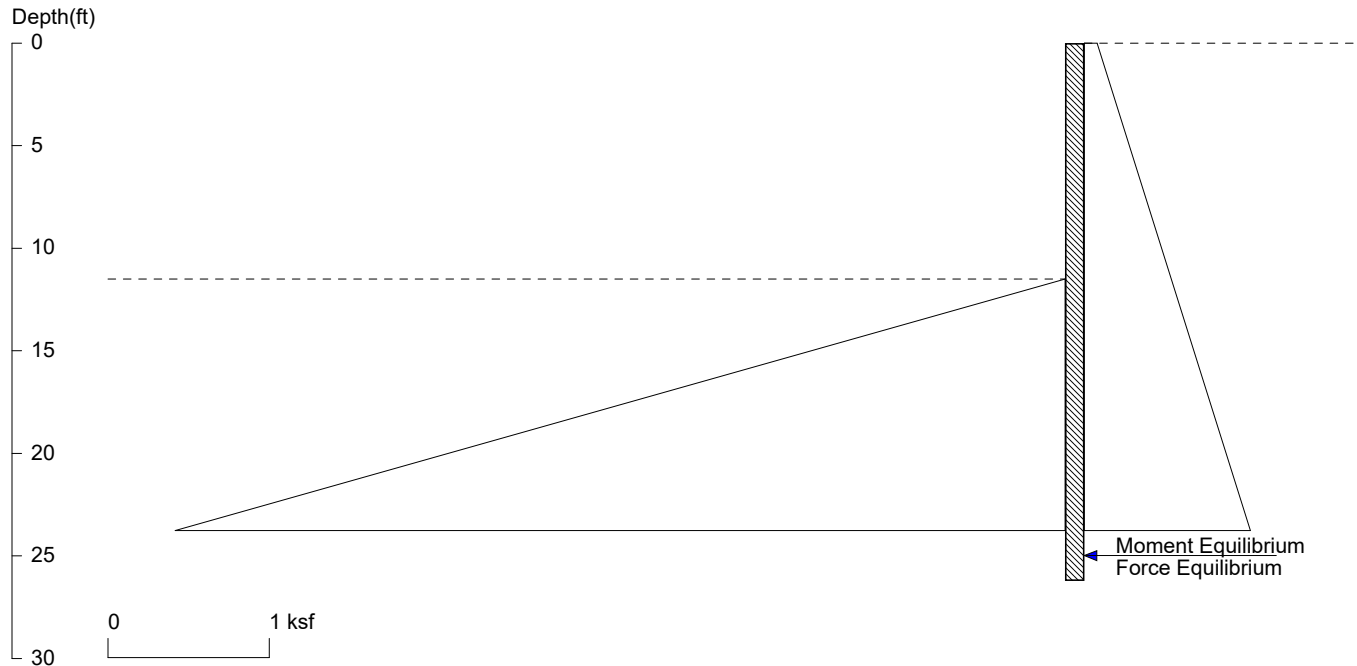
$M = 563 \text{ ft-lb}$, $f_b = 357 \text{ psi}$

$R = 357 \#$, $f_v = 17 \text{ psi}$

$\Delta T L = 0.08'' = \frac{1}{849}$

Mercer Res. Shoring

Mercer Residence 11.5ft Pile w/ 6' spacing



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to 4324324234 3424343

Date: 12/13/2022

File: H:\Projects\2022\Mercer Residence Shoring\Calculations\Pile_11_5.sh8

Wall Height=11.5 Pile Diameter=2.0 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.71 Min. Pile Length=26.21

MOMENT IN PILE: Max. Moment=189.59 per Pile Spacing=6.0 at Depth=17.79

PILE SELECTION:

Request Min. Section Modulus = 68.9 in³/pile=1129.73 cm³/pile, F_y= 50 ksi = 345 MPa, F_b/F_y=0.66

W14X68 has Section Modulus = 103.0 in³/pile=1687.86 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 1.01(in) based on E (ksi)=29000.00 and I (in⁴)/pile=722.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	.08	50	2.080	.04

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
11.5	0	50	17.325	.45

ACTIVE SPACING:

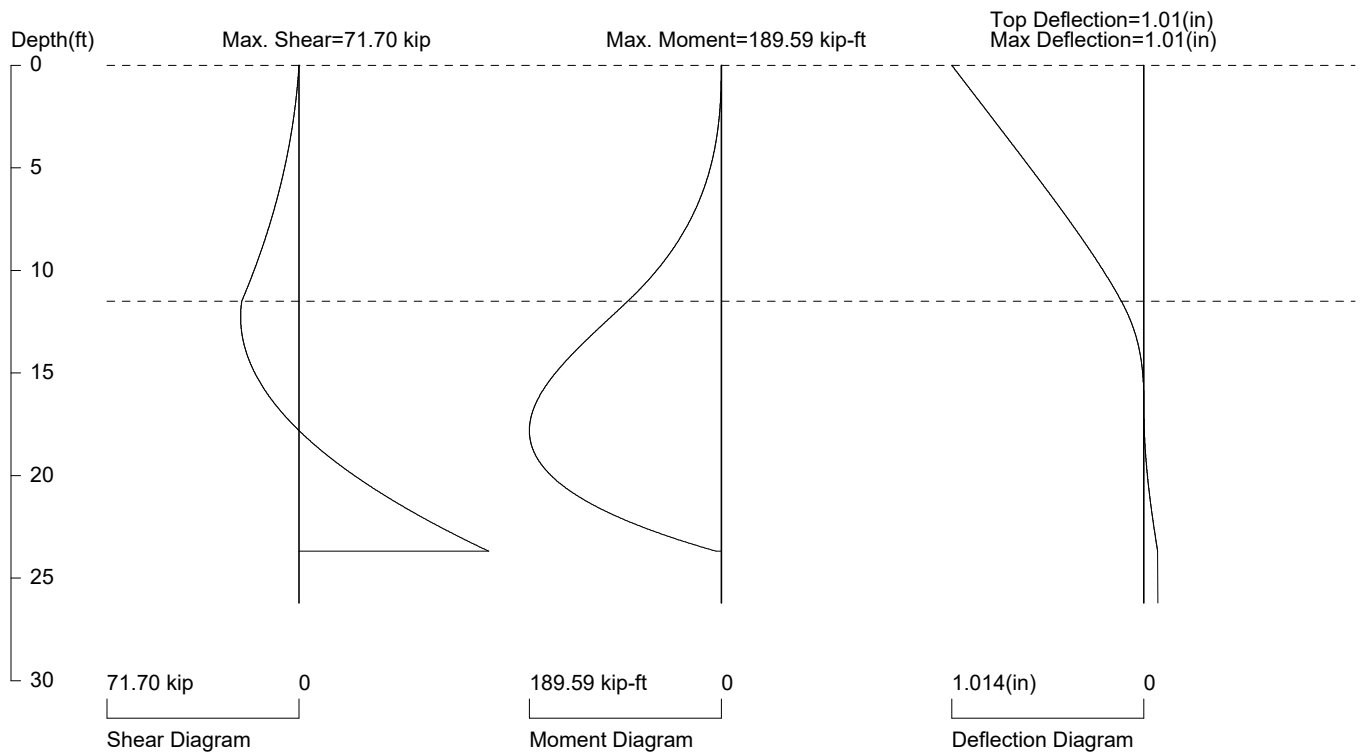
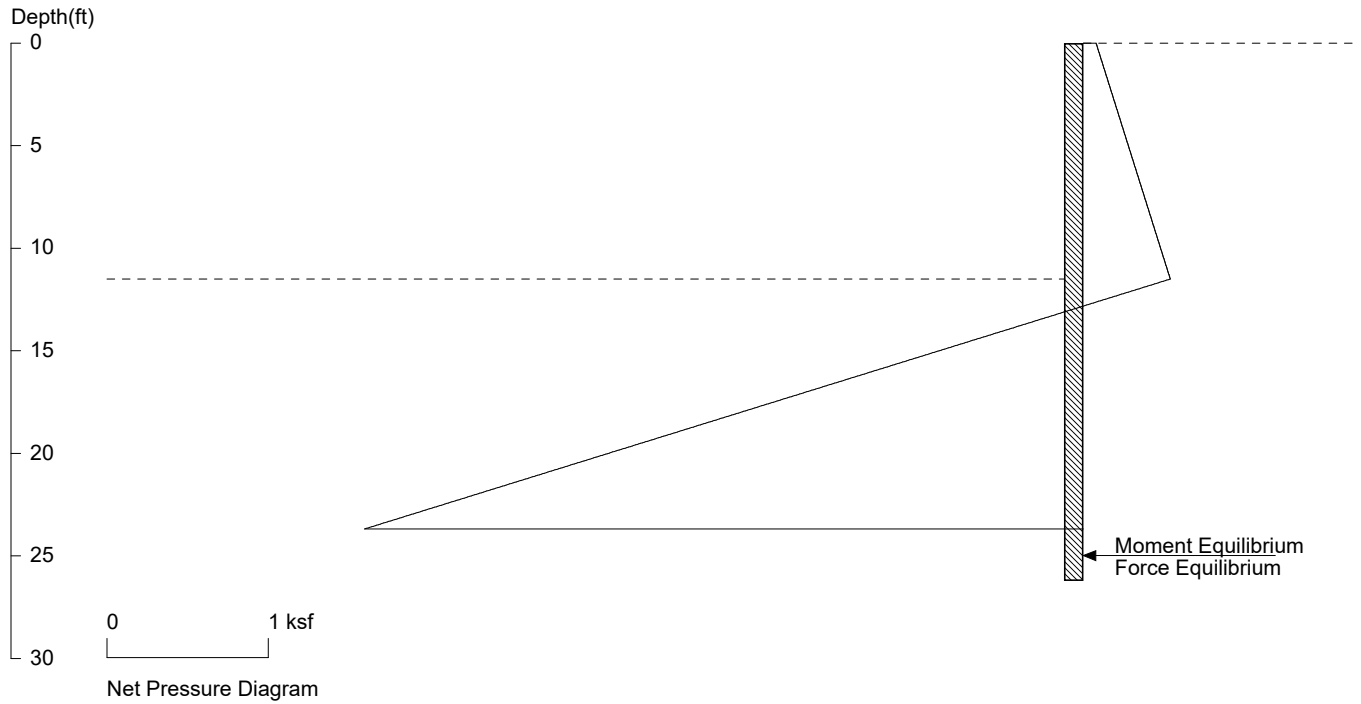
No.	Z depth	Spacing
1	0.00	6.00
2	11.50	2.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	11.50	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Mercer Residence 11.5ft Pile w/ 6' spacing



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W14X68: E (ksi)=29000.0, I (in⁴)/pile=722.0

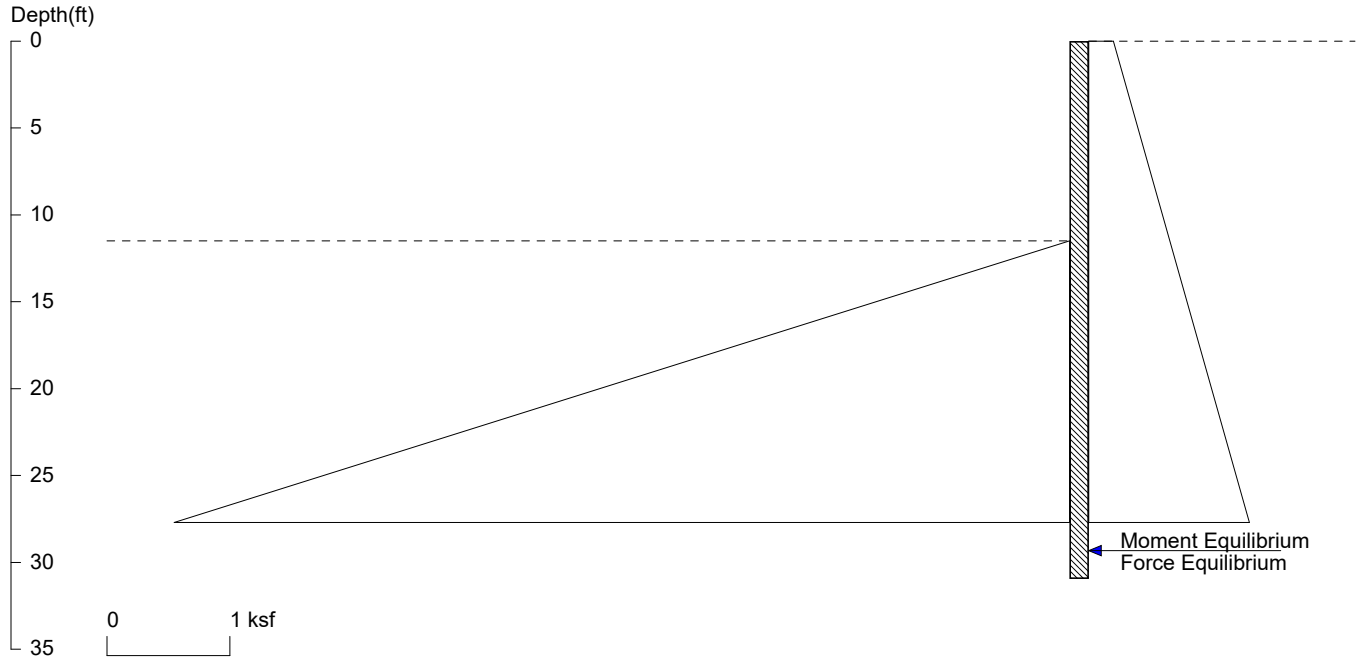
File: H:\Projects\2022\Mercer Residence Shoring\Calculations\Pile_11_5.sh8

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to 4324324234 3424343

SH3

Mercer Residence Shoring Permanent 11.5' w/ 200psf surcharge



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to 4324324234 3424343

Date: 1/29/2023

File: H:\Projects\2022\Mercer Residence Shoring\Calculations\Pile_11_5_permanent.sh8

Wall Height=11.5 Pile Diameter=2.0 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=19.45 Min. Pile Length=30.95

MOMENT IN PILE: Max. Moment=325.44 per Pile Spacing=6.0 at Depth=20.07

PILE SELECTION:

Request Min. Section Modulus = 164.4 in³/pile=2693.42 cm³/pile, F_y= 36 ksi = 248 MPa, F_b/F_y=0.66

W16X100 has Section Modulus = 175.0 in³/pile=2867.73 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 1.05(in) based on E (ksi)=29000.00 and I (in⁴)/pile=1490.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	.2	50	2.200	.04

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
11.5	0	50	17.325	.45

ACTIVE SPACING:

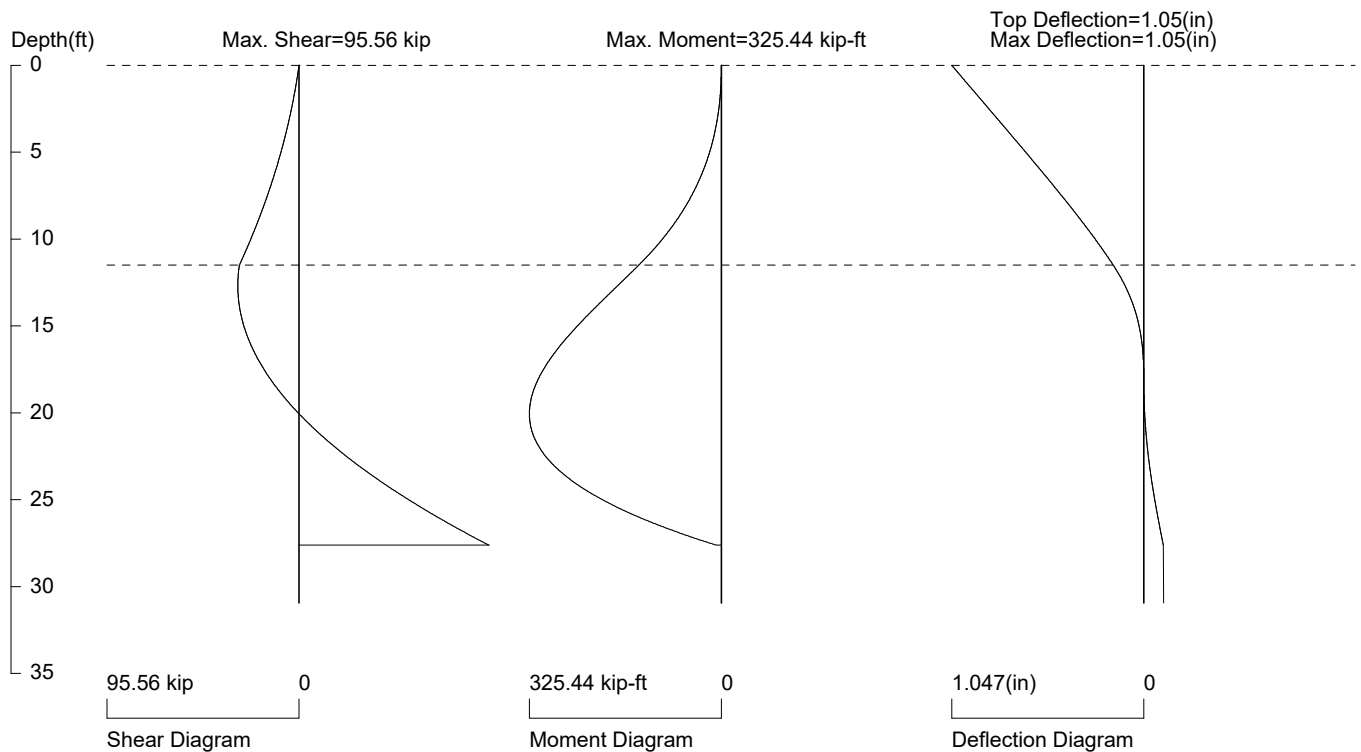
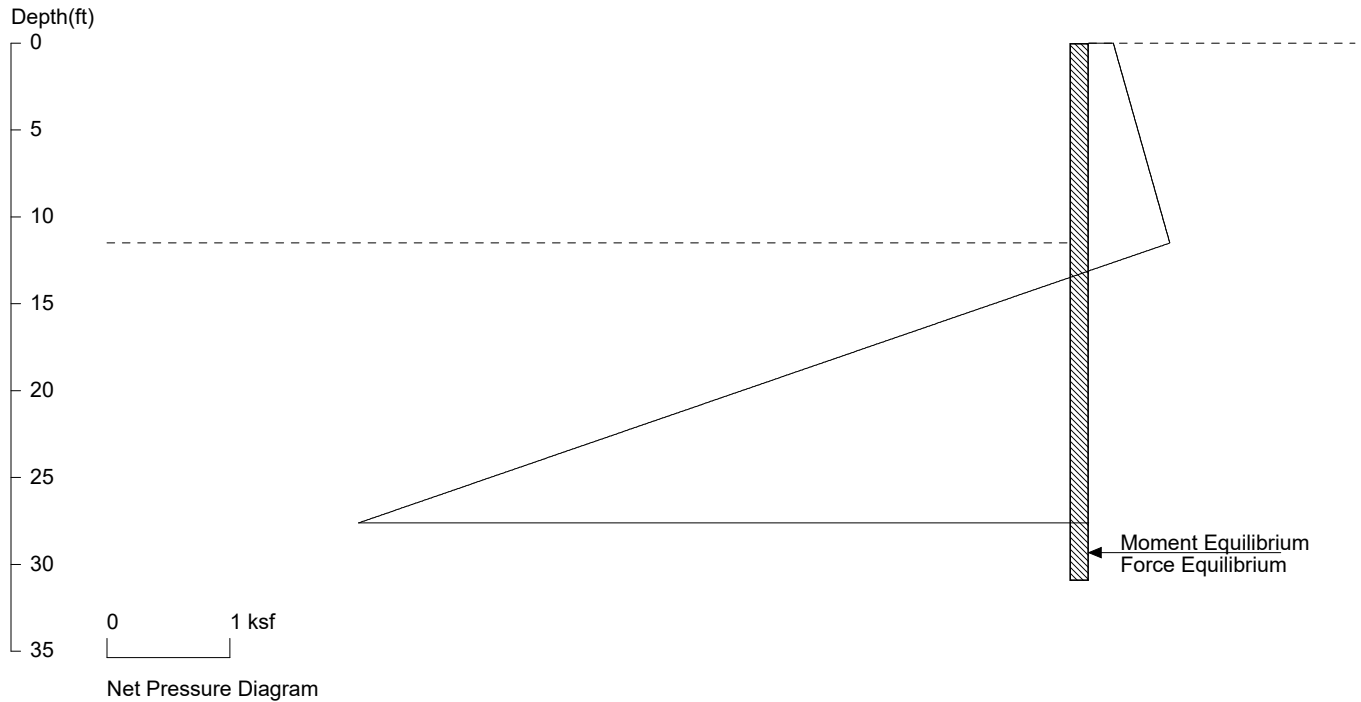
No.	Z depth	Spacing
1	0.00	6.00
2	11.50	2.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	11.50	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Mercer Residence Shoring Permanent 11.5' w/ 200psf surcharge



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X100: E (ksi)=29000.0, I (in⁴)/pile=1490.0

File: H:\Projects\2022\Mercer Residence Shoring\Calculations\Pile_11_5_permanent.sh8

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

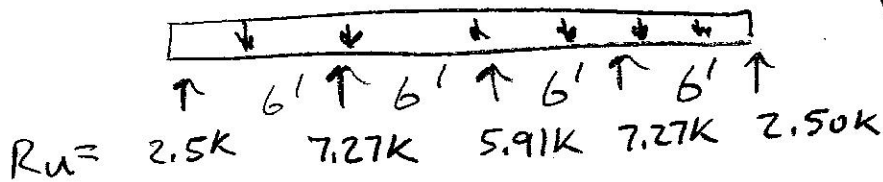
Licensed to 4324324234 3424343

SH5

- Permanent Concrete Wall supported by Piles

$$W = 40(11.5') + 200 = 660 \text{ plf}$$

$$w_u = 1.6(660) = 1.06 \text{ klf}$$



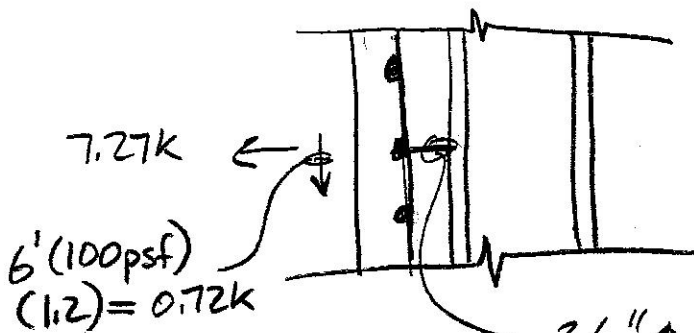
$$M_u = 2.93 \text{ k-ft} / -4.09 \text{ k-ft}$$

$$35.1 \text{ k-in} / -49.08 \text{ k-in}$$

for 8" wall w/ #5 @ 12" o.c. centered $f'_c = 2.5 \text{ ksi}$
 $f_y = 60 \text{ ksi}$

$$b = 12", d = 3.5", A_s = 0.31", \phi M_n = 52.5 \text{ k-ft}$$

Anchor



$3/4" \phi$ S3L Nelson Stud $\times 5 3/8"$
 @ 12" o.c.

Mercer Residence Shoring

www.hilti.us

Company: Buker Engineering, llc
 Specifier: Daniel Buker
 Address: 4303 Stone Way N., Seattle, WA 98103
 Phone | Fax: 206.258.6333 |
 E-Mail:

Page: 1
 Project: Mercer Residence Shor
 Sub-Project I Pos. No.:
 Date: 1/29/2023

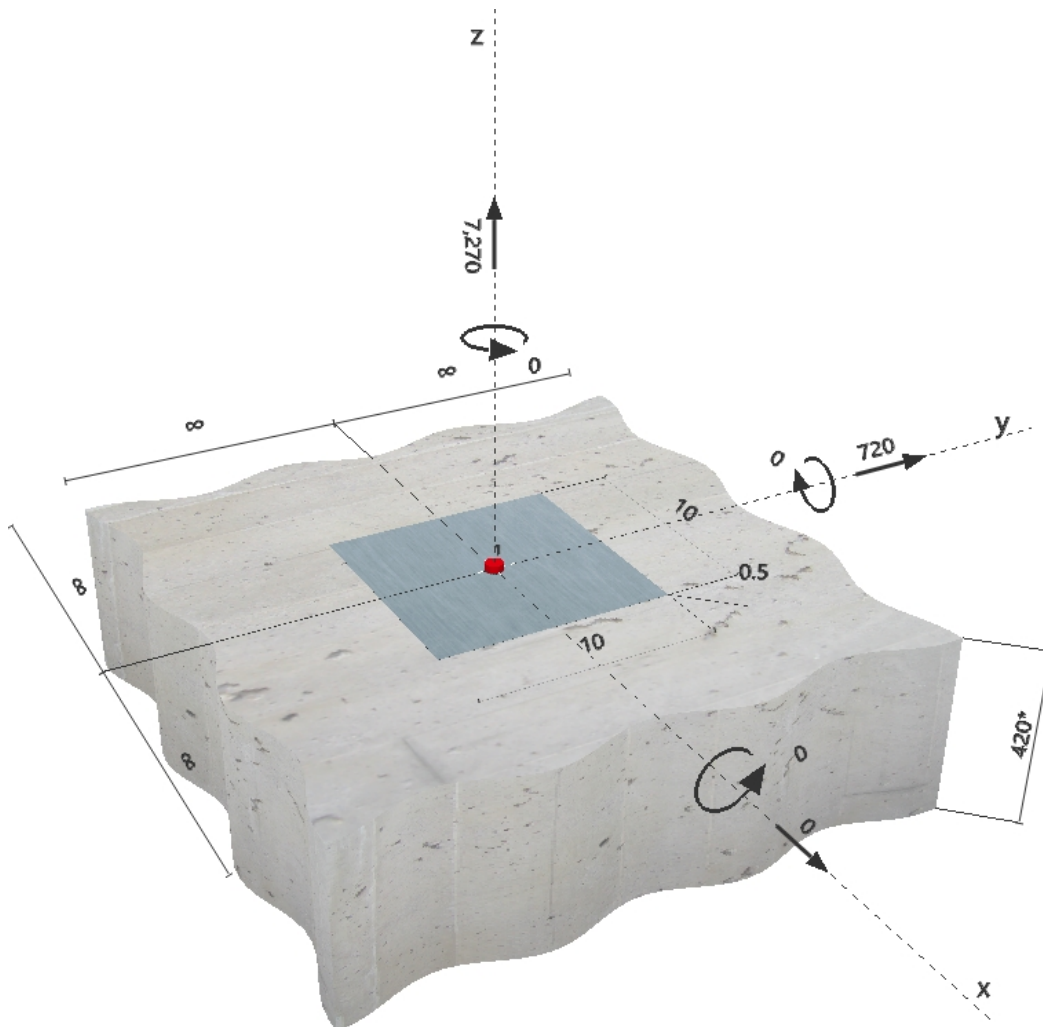
Specifier's comments: WHS connecting Concrete wall to soldier pile

1 Input data

Anchor type and diameter:	AWS D1.1 GR. B 3/4
Effective embedment depth:	$h_{ef} = 5.000$ in.
Material:	
Proof:	Design method ACI 318-08 / CIP
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.
Anchor plate:	$l_x \times l_y \times t = 10.000$ in. \times 10.000 in. \times 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 2500, $f'_c = 2500$ psi; $h = 420.000$ in.
Reinforcement:	tension: condition B, shear: condition B; edge reinforcement: none or $<$ No. 4 bar
Seismic loads (cat. C, D, E, or F)	no



Geometry [in.] & Loading [lb, in.lb]



www.hilti.us

Company:	Buker Engineering, llc	Page:	2
Specifier:	Daniel Buker	Project:	Mercer Residence Shor
Address:	4303 Stone Way N., Seattle, WA 98103	Sub-Project I Pos. No.:	
Phone Fax:	206.258.6333	Date:	1/29/2023
E-Mail:			

2 Proof I Utilization (Governing Cases)

Loading	Proof	Design values [lb]		Utilization	Status
		Load	Capacity	β_N / β_V [%]	
Tension	Concrete Breakout Strength	7270	9391	78 / -	OK
Shear	Pryout Strength	720	18783	- / 4	OK

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	0.774	0.039	5/3	66	OK

3 Warnings

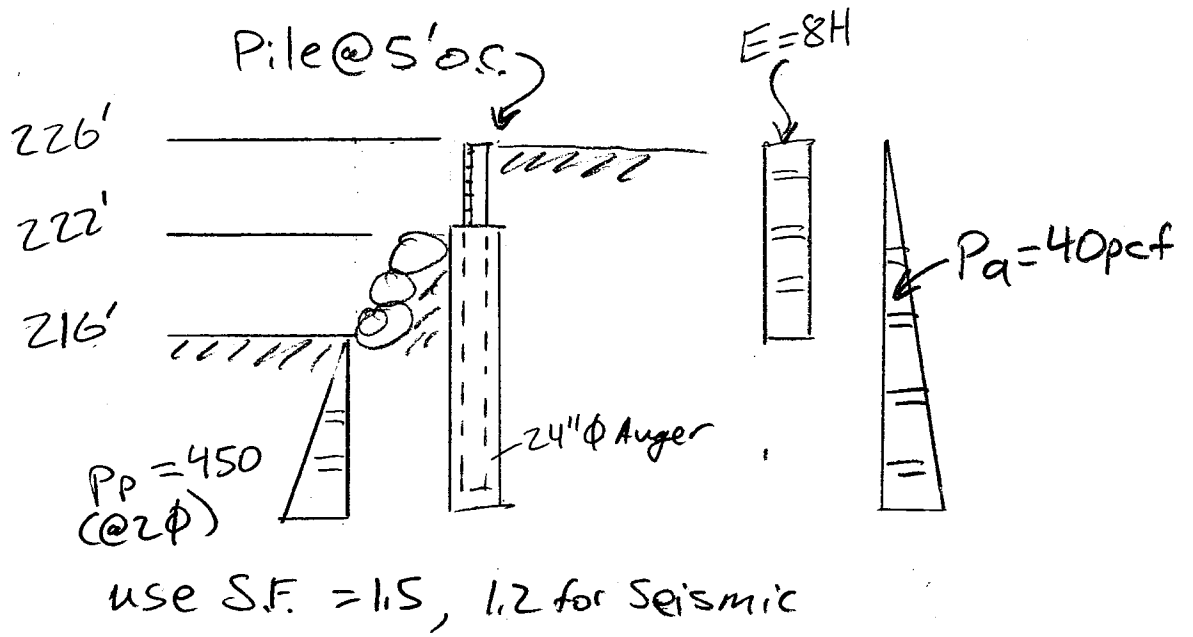
- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

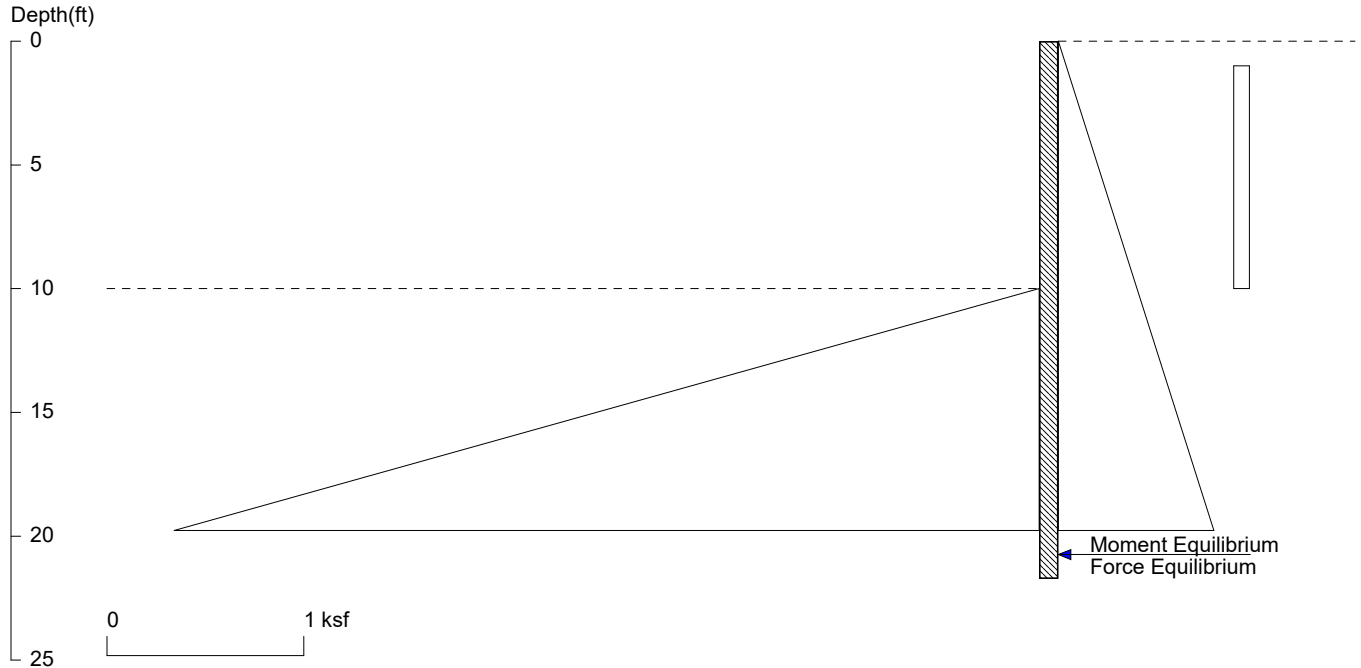
- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

West Soldier Pile Wall



Mercer Residence Shoring

Strand West Wall 10' w/ Seismic



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to 4324324234 3424343

Date: 5/16/2023

File: H:\Projects\2022\Mercer Residence Shoring\Calculations\West Wall - Calc 1.sh8

Wall Height=10.0 Pile Diameter=2.0 Pile Spacing=5.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=11.72 Min. Pile Length=21.72

MOMENT IN PILE: Max. Moment=97.95 per Pile Spacing=5.0 at Depth=14.98

PILE SELECTION:

Request Min. Section Modulus = 49.5 in³/pile=810.67 cm³/pile, F_y= 36 ksi = 248 MPa, F_b/F_y=0.66

W12X40 has Section Modulus = 51.5 in³/pile=843.93 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.88(in) based on E (ksi)=29000.00 and I (in⁴)/pile=307.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.000	.04
1	.08	10	0.080	

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
10	0	50	18.00	.45

ACTIVE SPACING:

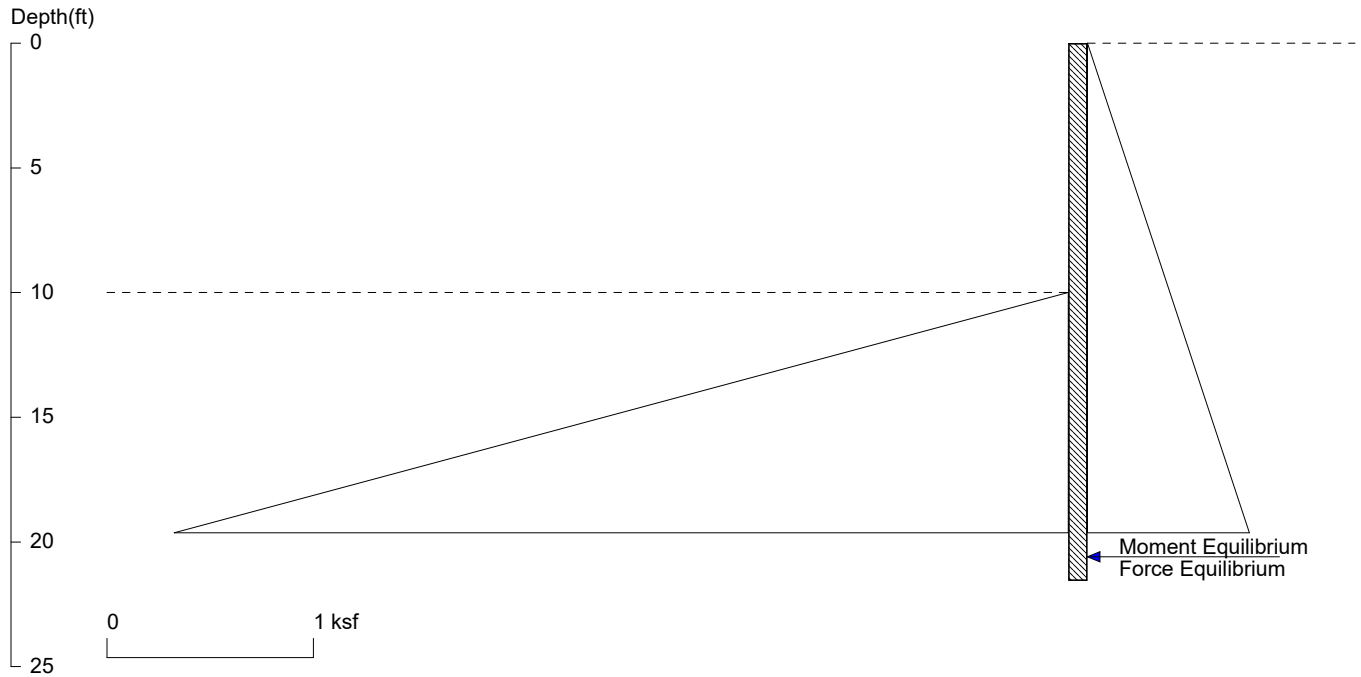
No.	Z depth	Spacing
1	0.00	5.00
2	10.00	2.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	10.00	4.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Strand West Wall 10' w/ Seismic



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

Licensed to 4324324234 3424343

Date: 5/16/2023

File: H:\Projects\2022\Mercer Residence Shoring\Calculations\West Wall - Calc 2.sh8

Wall Height=10.0 Pile Diameter=2.0 Pile Spacing=5.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=11.56 Min. Pile Length=21.56

MOMENT IN PILE: Max. Moment=70.00 per Pile Spacing=5.0 at Depth=15.01

PILE SELECTION:

Request Min. Section Modulus = 35.4 in³/pile=579.34 cm³/pile, F_y= 36 ksi = 248 MPa, F_b/F_y=0.66

W12X40 has Section Modulus = 51.5 in³/pile=843.93 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.60(in) based on E (ksi)=29000.00 and I (in⁴)/pile=307.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.000	.04

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
10	0	50	18.00	.45

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	5.00
2	10.00	2.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	10.00	4.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in