



Structural Calculations for:

## **Mercer Residence Shoring**

6950 SE Maker St, Mercer Island, WA

Client: Dorothy Strand

Code: 2018 International Building Code

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- SH1-SH8 – Soldier Pile and Permanent Concrete Wall Calculations

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

January 30, 2023



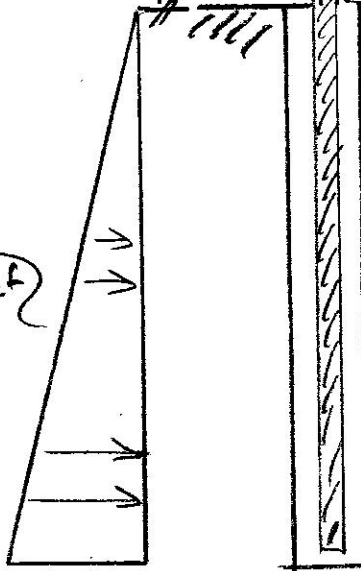
Typ. Pile

4'

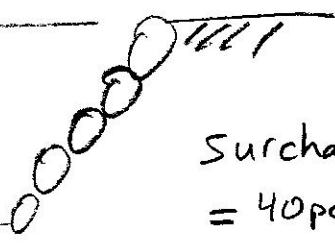
H=11.5'

W14X68 @ 6'oc.

$P_p = 450 \text{ psf}$



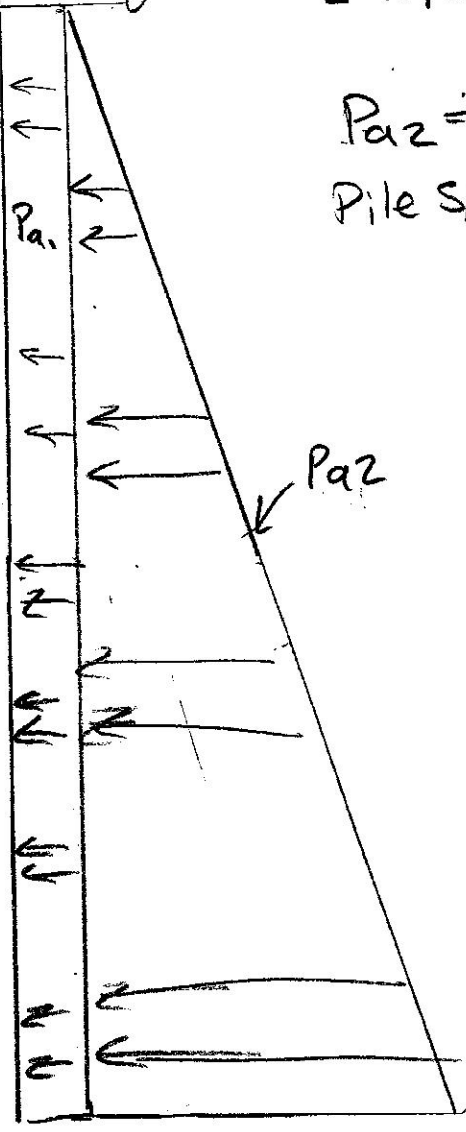
D = 2'



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

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

Pile Spacing = 6' oc.



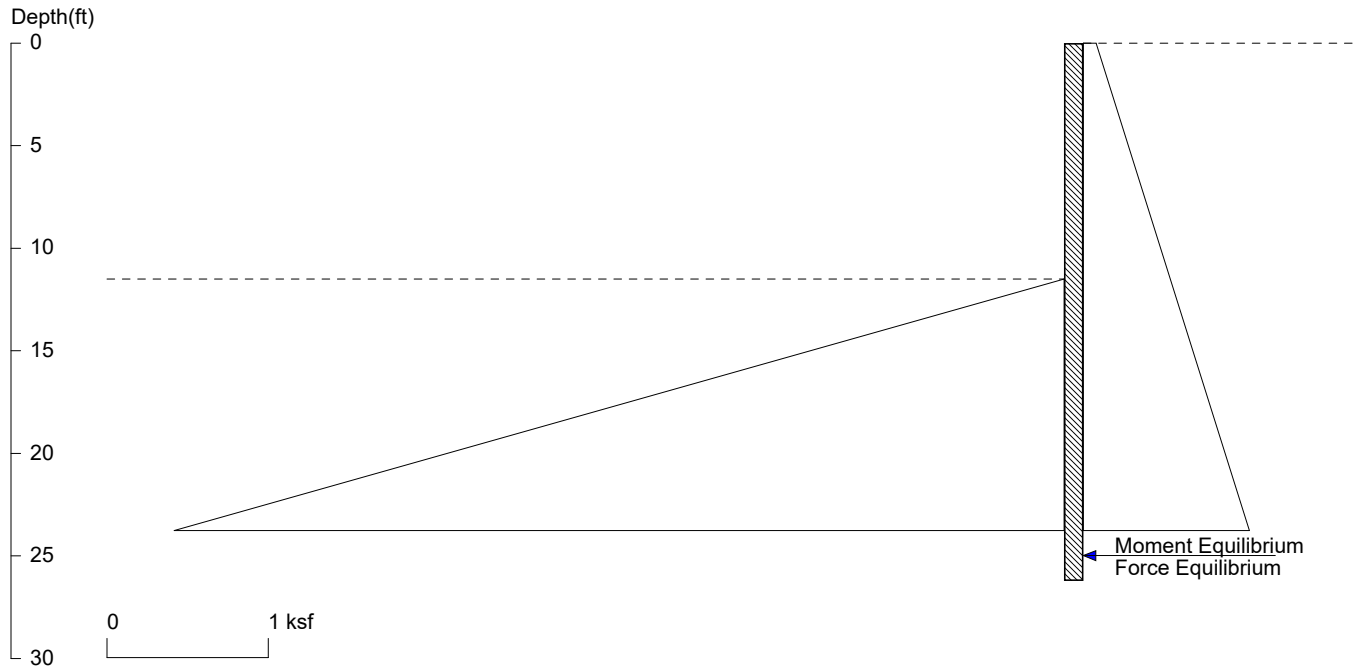
Lagging

P.T. 4X10

$l = 6'$ ,  $w = 0.3 (40 (11.5) + 80) = 162 \text{ psf}$   
 $\Rightarrow$  for 4X10 = 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



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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 in<sup>3</sup>/pile=1129.73 cm<sup>3</sup>/pile, F<sub>y</sub>= 50 ksi = 345 MPa, F<sub>b</sub>/F<sub>y</sub>=0.66

W14X68 has Section Modulus = 103.0 in<sup>3</sup>/pile=1687.86 cm<sup>3</sup>/pile. It is greater than Min. Requirements!

Top Deflection = 1.01(in) based on E (ksi)=29000.00 and I (in<sup>4</sup>)/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:

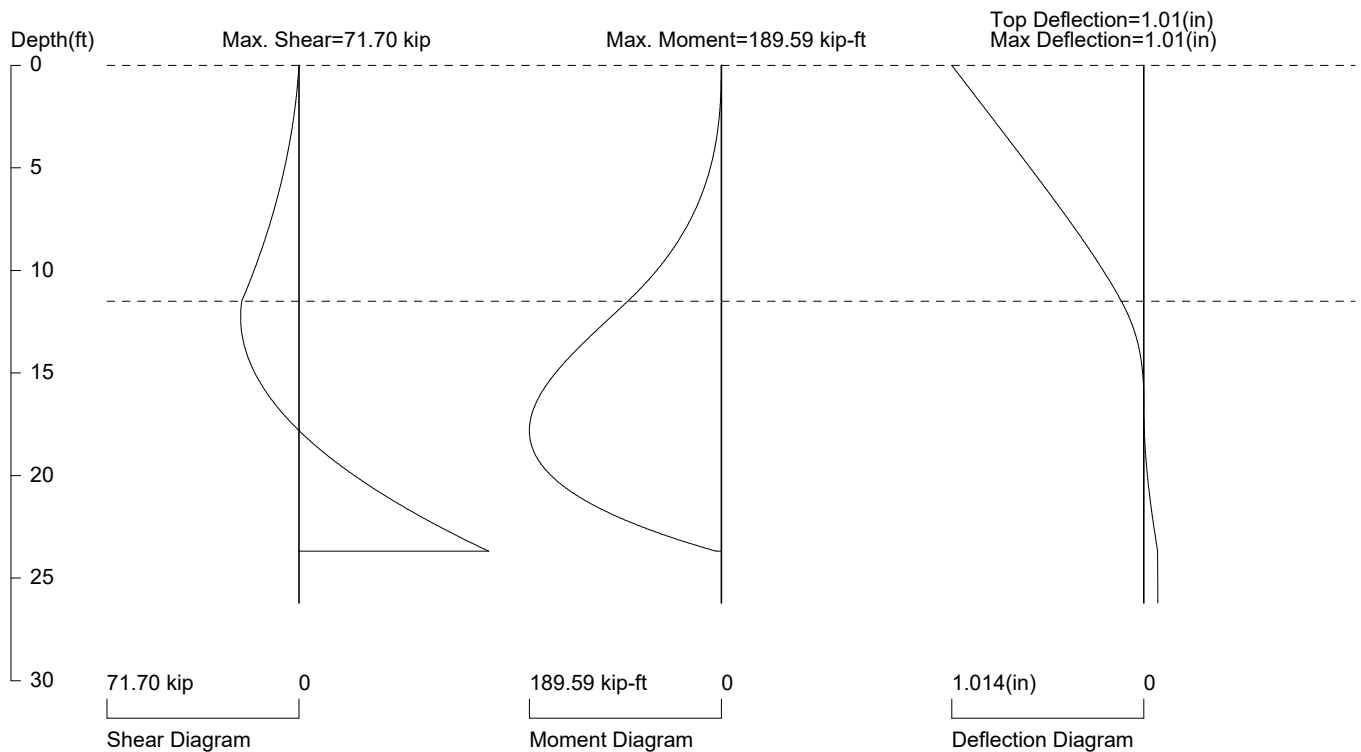
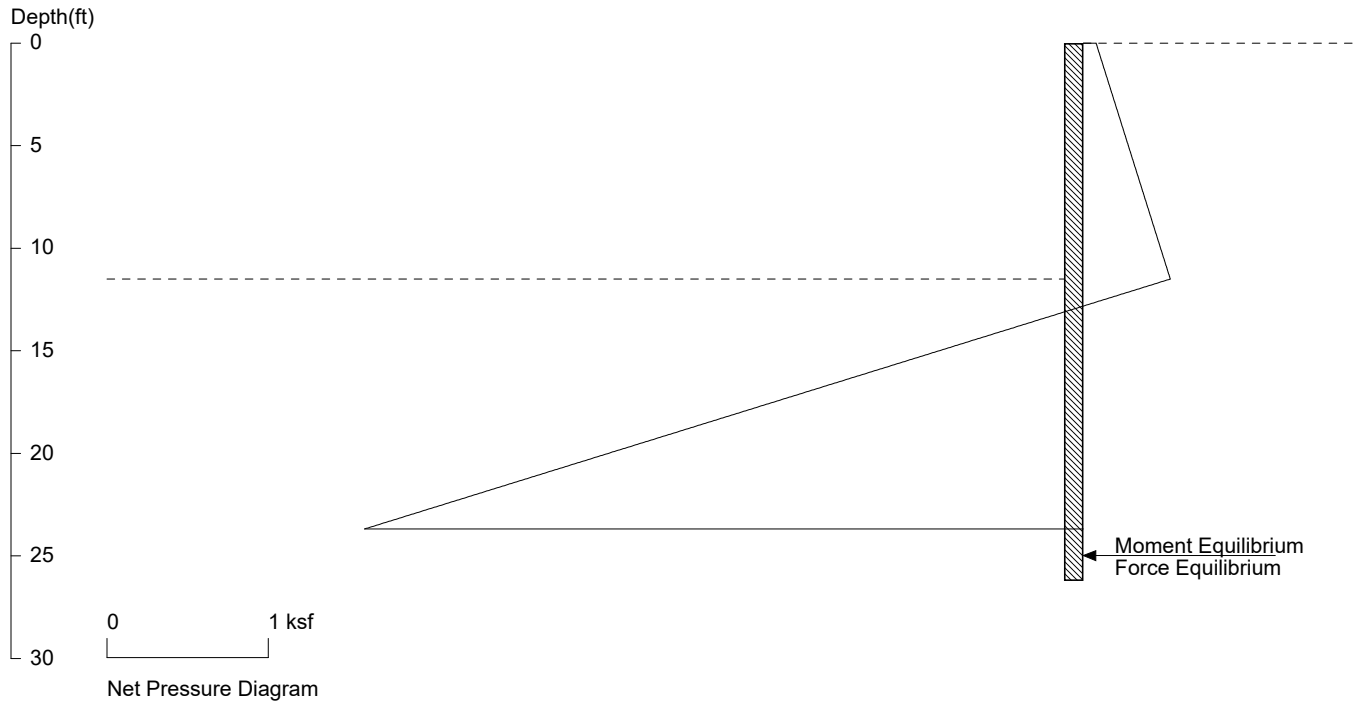
No.	Z depth	Spacing
1	0.00	6.00
2	11.50	2.00

## 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/ft<sup>3</sup>; 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 (in<sup>4</sup>)/pile=722.0

File: H:\Projects\2022\Mercer Residence Shoring\Calculations\Pile\_11\_5.sh8

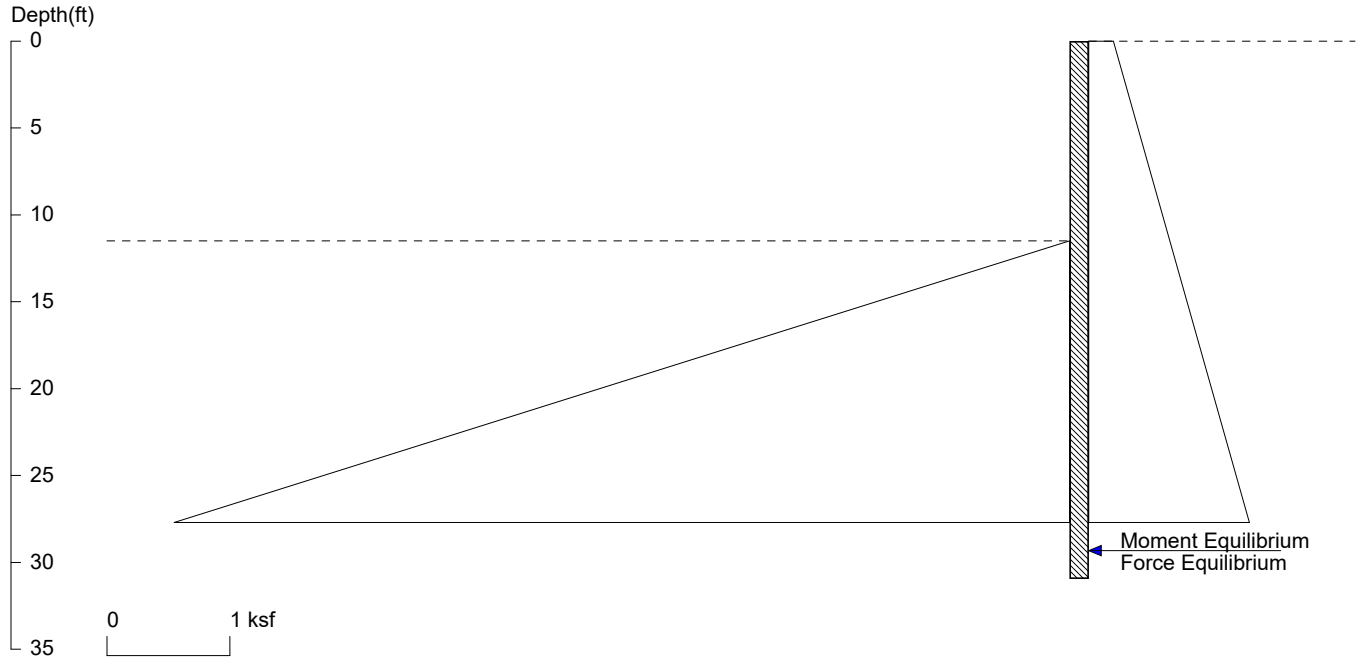
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SH3

# Mercer Residence Shoring Permanent 11.5' w/ 200psf surcharge



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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 in<sup>3</sup>/pile=2693.42 cm<sup>3</sup>/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66

W16X100 has Section Modulus = 175.0 in<sup>3</sup>/pile=2867.73 cm<sup>3</sup>/pile. It is greater than Min. Requirements!

Top Deflection = 1.05(in) based on E (ksi)=29000.00 and I (in<sup>4</sup>)/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:**

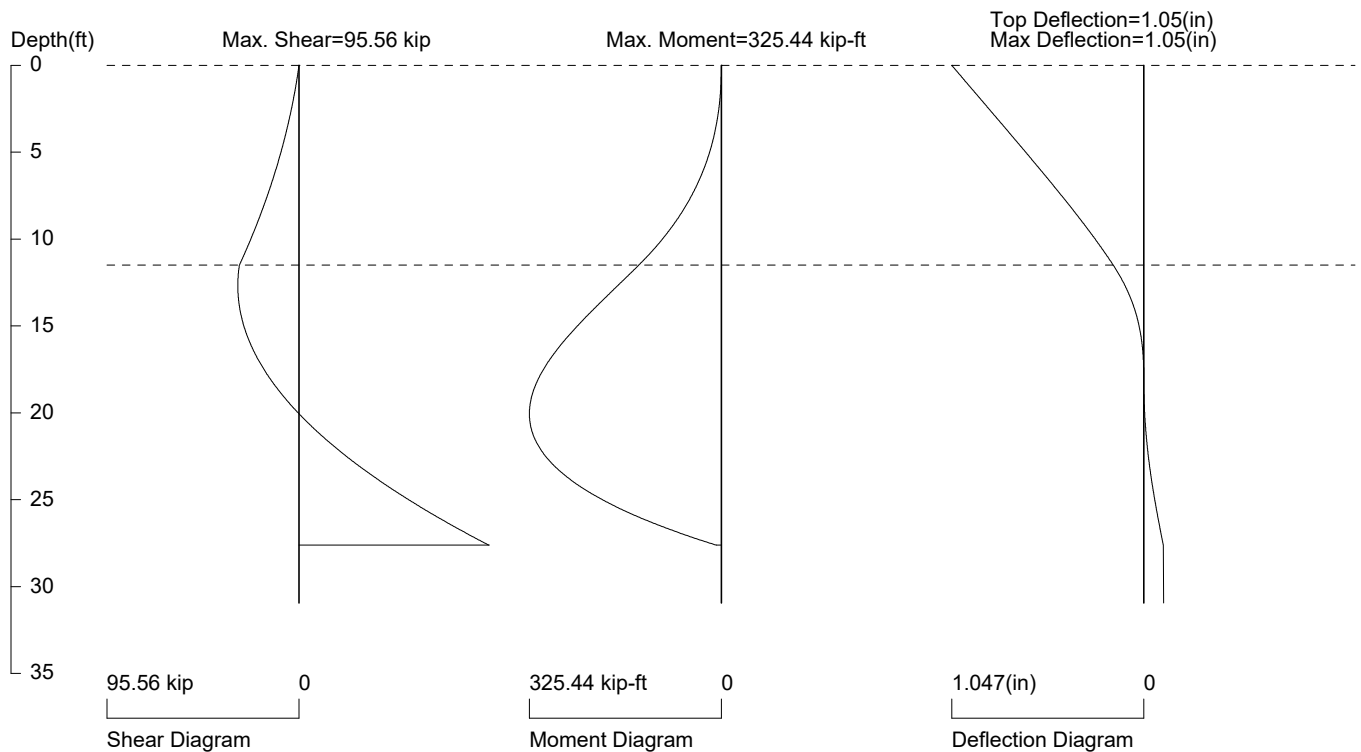
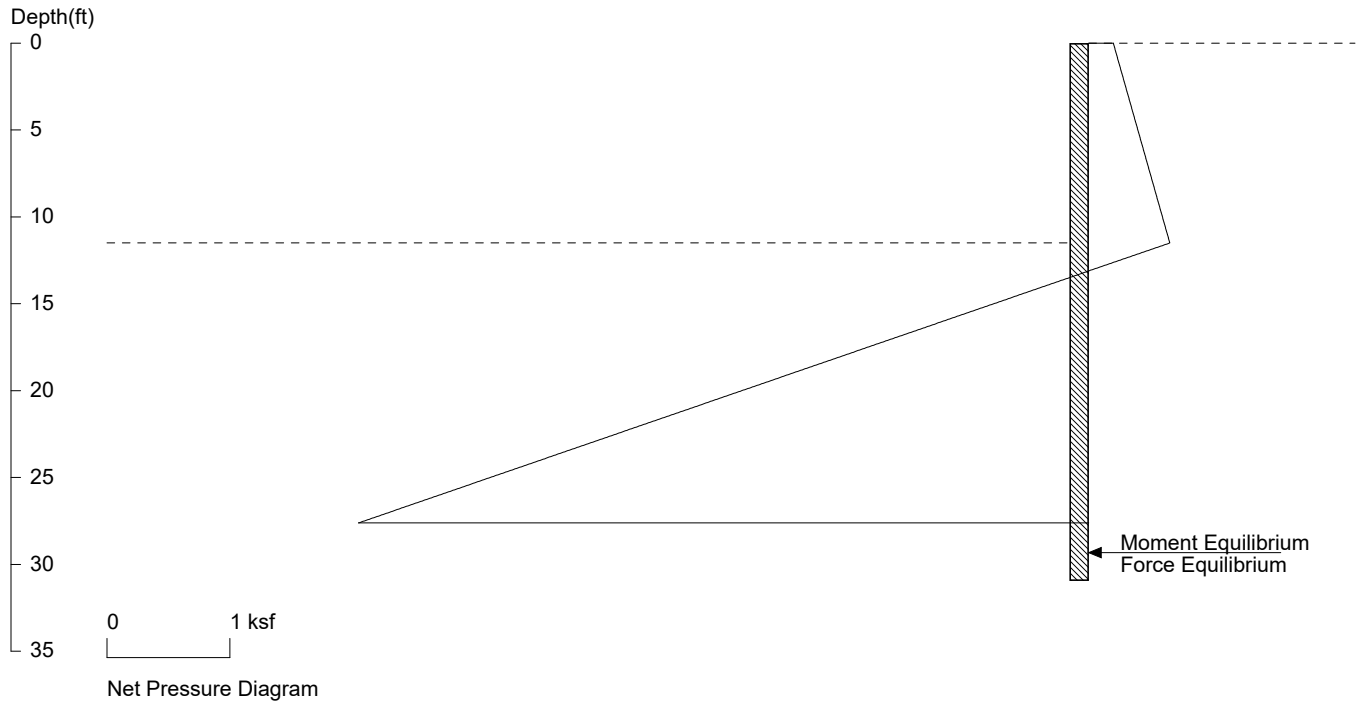
No.	Z depth	Spacing
1	0.00	6.00
2	11.50	2.00

**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/ft<sup>3</sup>; 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

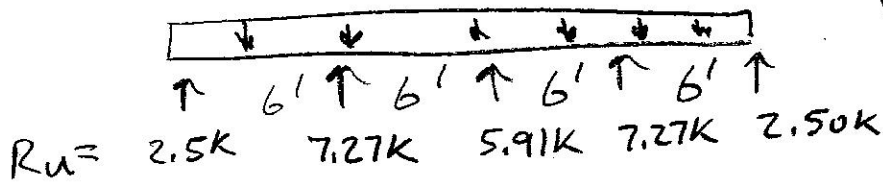
User Input Pile, W16X100: E (ksi)=29000.0, I (in<sup>4</sup>)/pile=1490.0

File: H:\Projects\2022\Mercer Residence Shoring\Calculations\Pile\_11\_5\_permanent.sh8

- Permanent Concrete Wall supported by Piles

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

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



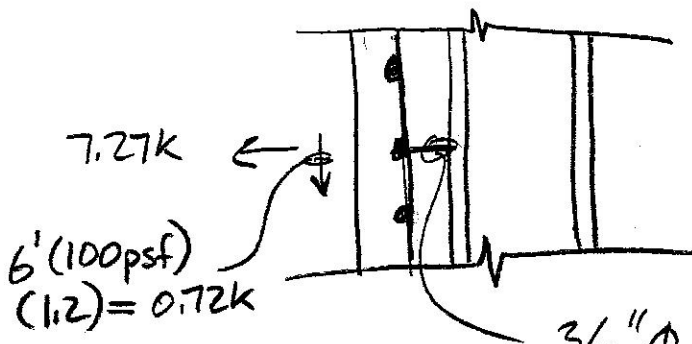
$$M_u = 2.93 \text{ k-ft} / -4.09 \text{ k-ft}$$

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

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](http://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

1  
 Mercer Residence Shor  
 1/29/2023

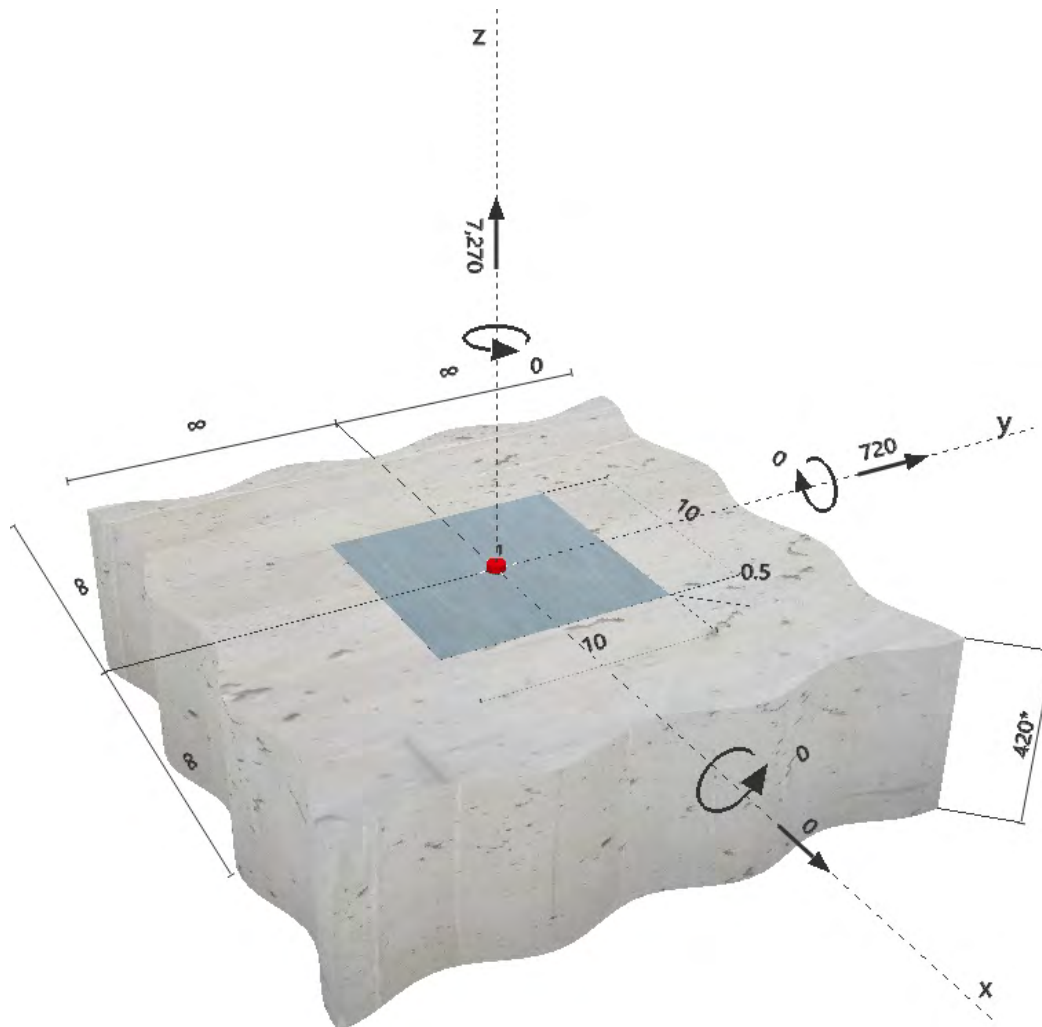
**Specifier's comments:** WHS connecting Concrete wall to soldier pile

## 1 Input data

<b>Anchor type and diameter:</b>	<b>AWS D1.1 GR. B 3/4</b>
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]





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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	$\beta_N / \beta_V$ [%]	
Tension	Concrete Breakout Strength	7270	9391	78 / -	OK
Shear	Pryout Strength	720	18783	- / 4	OK

Loading	$\beta_N$	$\beta_V$	$\zeta$	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

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