STRUCTURAL CALCULATIONS

FOR

ALTMAN WEST LOT SHORING
9167 SE 64TH STREET
MERCER ISLAND, WA

SITE SPECIFIC
LATERAL AND VERTICAL
ANALYSIS AND DESIGN
(DO NOT REUSE)

FOR
BENJAMIN ALTMAN

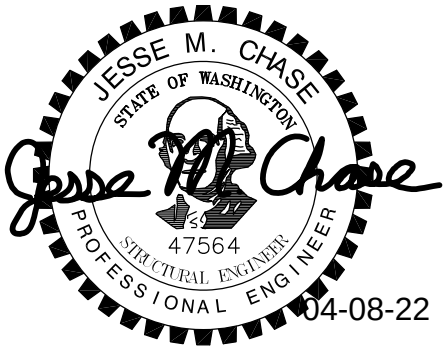
PROJECT #2022-0033.0

BY
MC SQUARED, INC.

JACOB A GUSTAFSON, EIT

REVIEWED BY

JESSE M CHASE, PE, SE



MC SQUARED
INCORPORATED
STRUCTURAL & CIVIL ENGINEERS

STRUCTURAL & FOUNDATION ENGINEERS

1235 EAST 4TH AVE.
SUITE 101
OLYMPIA, WA, 98506
(360) 754-9339

STRUCTURAL NOTES

General Notes:

These structural notes supplement the drawings. Any discrepancy found among the drawings, these notes, and the site conditions shall be reported to the Engineer, who shall correct such discrepancy in writing. Any work done by the Contractor after discovery of such discrepancy shall be done at the Contractor's risk. **The Contractor shall verify and coordinate the dimensions among all drawings prior to proceeding with any work or fabrication.** The Contractor is responsible for all bracing and shoring during construction.

All construction shall conform to the applicable portions of the latest edition of the International Building Code except where noted.

Design Criteria:

1. Live Load = 2' Soil Surcharge @ Parking Area Above

2. Soil Loads per PanGEO report No. 19-062, Dated Dec. 28, 2021
   = 35 to 45 PCF Active Pressure, based on slope of ground
   = 400 PCF, Passive Pressure

Steel:

1. All steel piles shall be ASTM A992, Fy=50 Ksi, except as noted.
2. Welding shall be by AWS certified welders with E70 electrodes in accordance with AWS D1.1-75.
3. All steel members and parts shall be shop painted with two coats of red oxide primer after fabrication.
4. Anchor rods shall have Fy= 55 Ksi. Anchorages shall provide full load transfer to soldier piling by the use of A36 bevel plates.

Carpentry:

1. Lagging shall be ground contact pressure treated #2 Hem-Fir material.

Soldier Pile Installation Sequence

1. Drill holes for soldier pile.
2. Place soldier piles in hole properly aligned and spaced.
3. Excavate and chip out concrete adjacent to steel soldier pile to allow for placement of timber lagging.
4. Place timber lagging and attach to steel piles.
5. Continue with excavation, chipping, and lagging placement.

Soldier Pile With Tie-Backs Installation Sequence

1. Drill holes for soldier pile.
2. Place soldier piles in hole properly aligned and spaced.
3. Excavate and chip out concrete adjacent to steel soldier pile to allow for placement of timber lagging.
4. Place timber lagging and attach to steel piles.
5. Drill anchor rods to the required slope and length.
6. Test anchors by tensioning the anchor to 150% of design load and hold for 24 hours. SR-3 anchor design load is 41,000#, SR-1 design load is 20,000#.
7. Continue with excavation, chipping, and lagging placement.

CAUTION

CONTRACTOR TO FIELD VERIFY ALL CONDITIONS AND ALL ELEVATIONS.

MC SQUARED, INC.
OLYMPIA, WASHINGTON 98506
(360) 754-9339
FAX (360) 352-2044

Job:_____

Date:_____ By:_____

Sheet:_____ Page_____ of_____

SOLDIER PILE RETAINING WALL - WEST LOT

$H_{MAX} = 20' - 0"$

$\Delta_{MAX} = \frac{H \times 12}{100} = 2.4"$

SURCHARGE = $q = 250$ PSF → TRAFFIC SURCHARGE DUE TO DRIVEWAY ABOVE

$S = 4'$

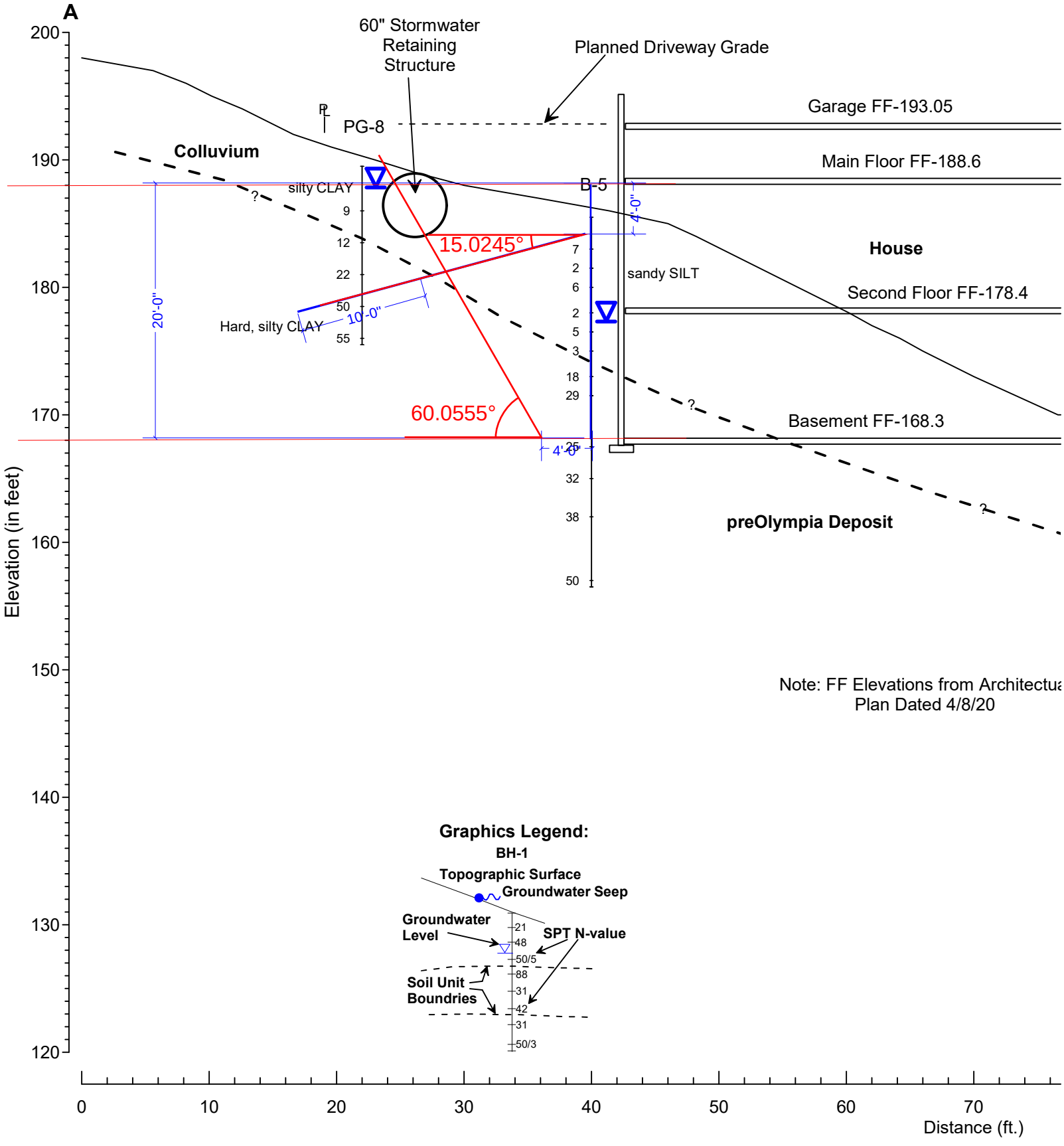
$P_A = 35$ PCF (LEVEL BACKSLOPE)

$P_P = 400$ PCF

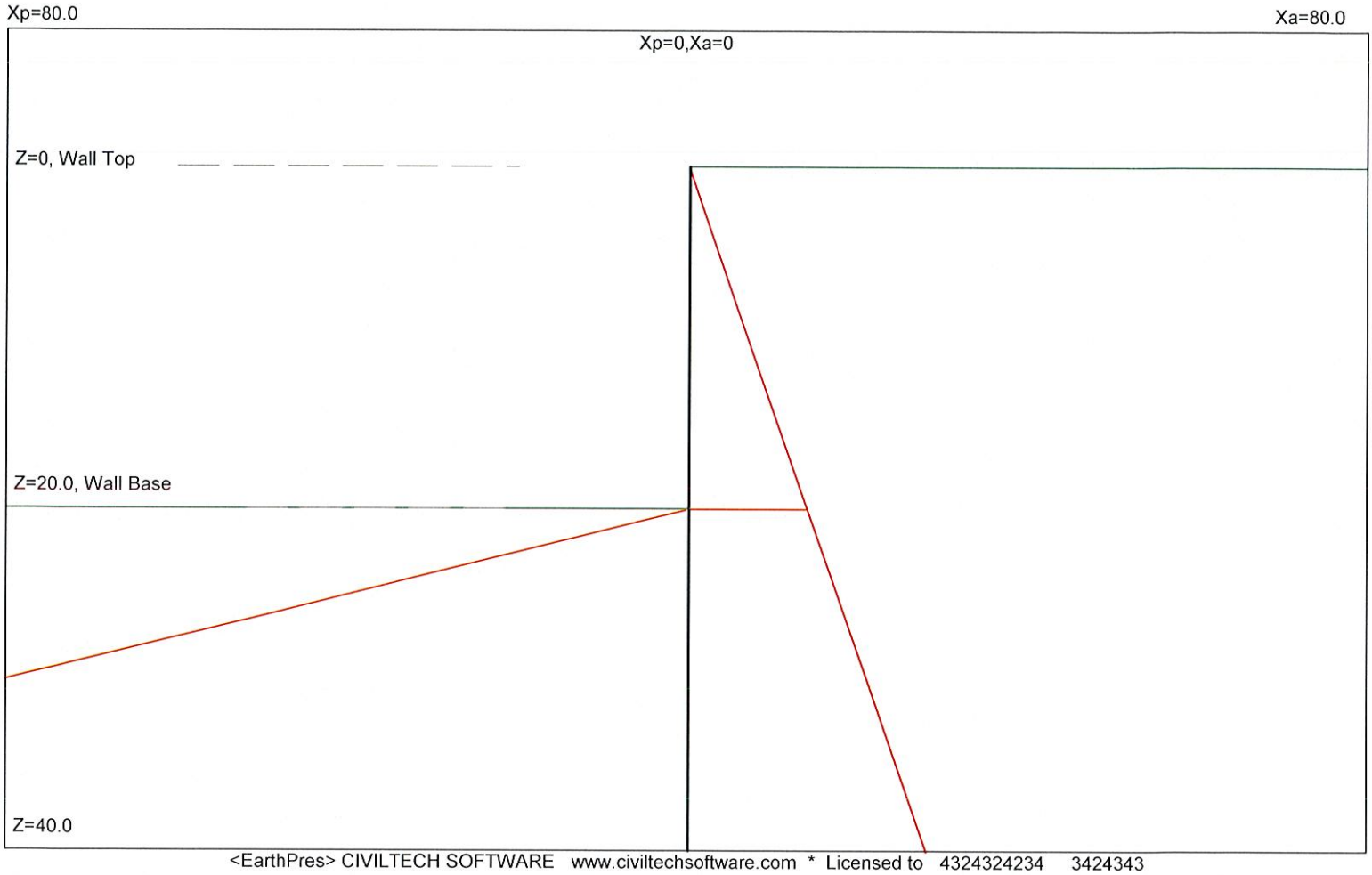
MIN. EMBED = 10'-0" PER PAN-GEO

LAGGING → DESIGN VARIES BY DEPTH, P = 35*D

SOIL AND ANCHORING CONDITIONS



WESTERN WALL PRESSURES



<EarthPres> CIVILTECH SOFTWARE www.civiltechsoftware.com * Licensed to 4324324234 3424343
UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf
Date: 3/8/2022 File: M:\PROJECTS\Altman, Benjamin\2022-0033 - Altman West Soldier Pile Wall (Mercer Island)\Documents\SOIL LOADING.ep8

* INPUT DATA *

Wall Height=20.0 Total Soil Types= 2

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	114.0	126.0	32.0	0.0	4	3	Sandy Silt
2	128.0	141.0	31.0	0.0	14	1	Hard Silty Clay

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sandy Silt
2	50.0	0.0	50.0	800.0	2	Hard Silty Clay

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	20.0	0.0	20.0	800.0	2	Hard Silty Clay

Wall Friction Options: 1.* No wall friction
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*
Water Density = 62.4
Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Eae (Total Force above Base)= 7.01 per one linear foot (or meter) width along wall height
Ea (Total Static Force above Base)= 7.01

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
0.00	0.00	20.00	0.70	0.0350	0.3073

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
20.00	0.70	40.00	1.40	0.0350	0.3073

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
20.00	0.00	40.00	8.00	0.400	3.1247

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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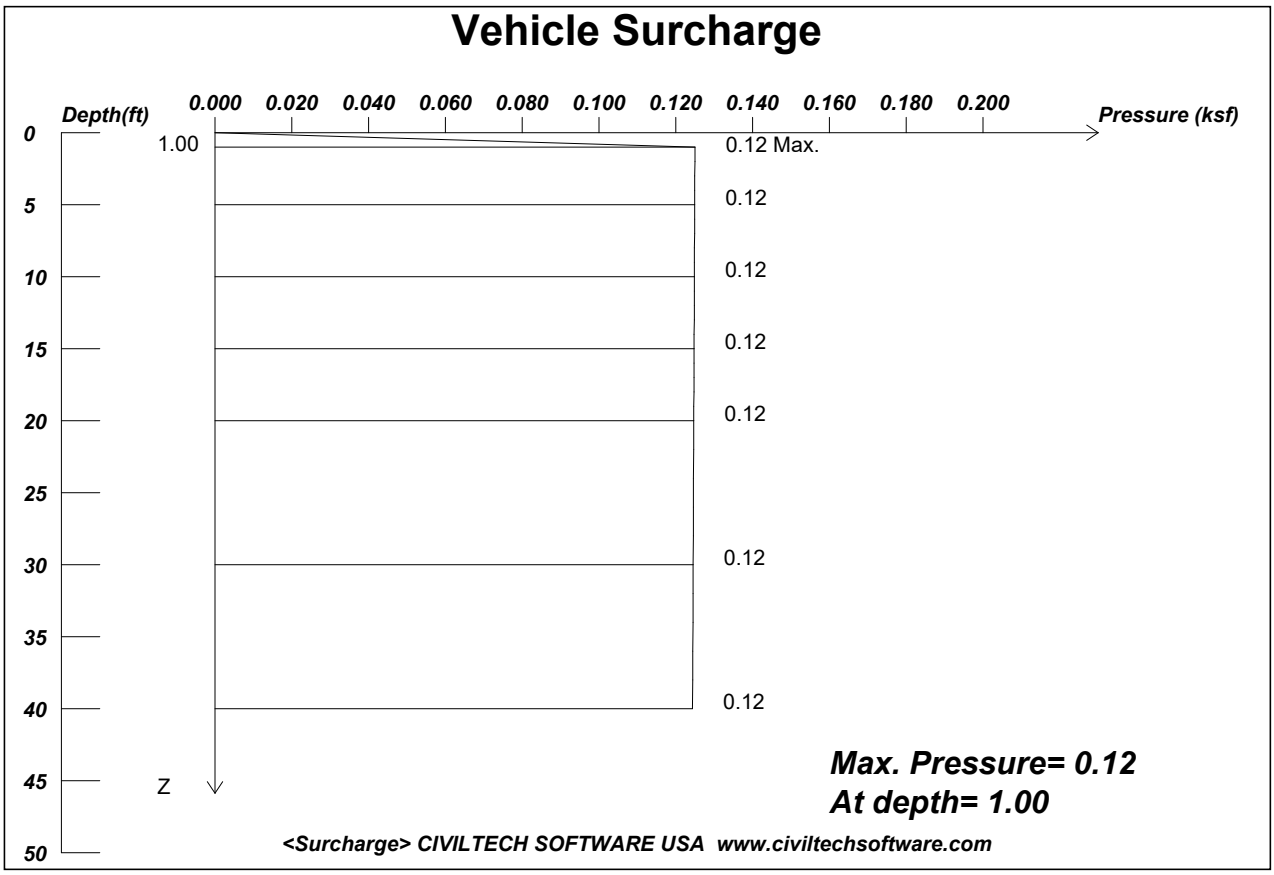

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Wall Height, H= 20 Load Depth at Surface, D= 0

Load Factor of Surcharge Loading = 1

Flexible Wall Condition -- Movement or deflection are allowed.

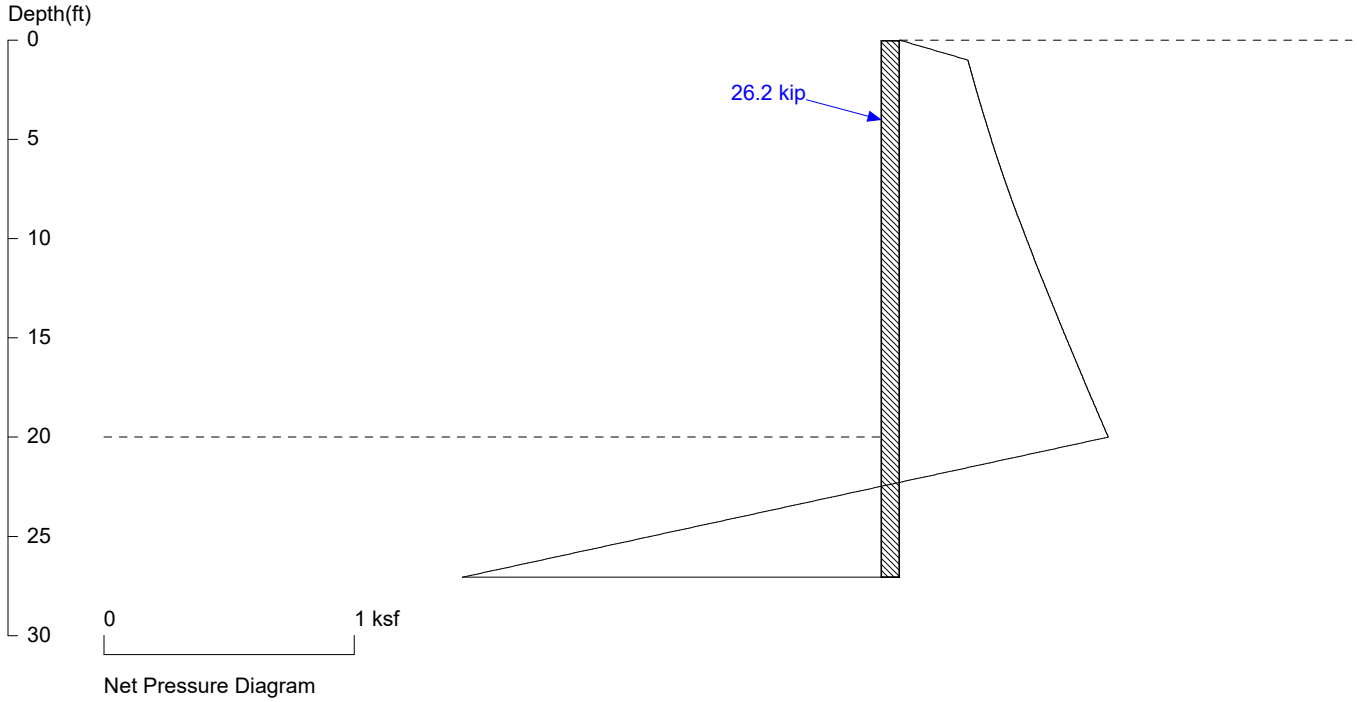
Max. Pressure = 0.125 at depth = 1.00

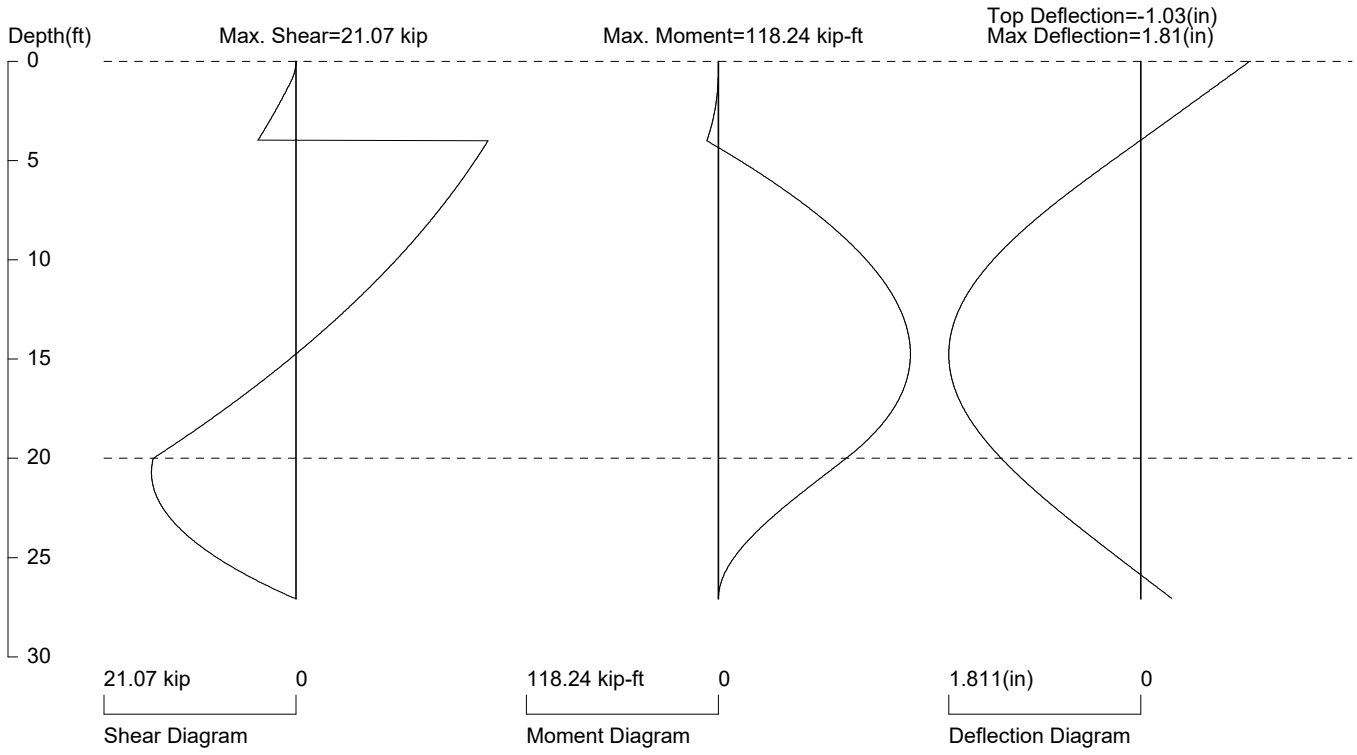
X	Width	Strip Load
.0	.0	.00

Infinite Surcharge, Q=.25 Wayne-Teng Equation (Modified Boussinesq)

UNITS: LENGTH/DEPTH: ft, Qpoint: kip, Qline: kip/ft, Qstrip/Qarea/PRESSURE: ksf

WESTERN WALL PRESSURES
4' SPACING





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 4.0 foot or meter

User Input Pile, W8X48: E (ksi)=29000.0, I (in4)/pile=184.0

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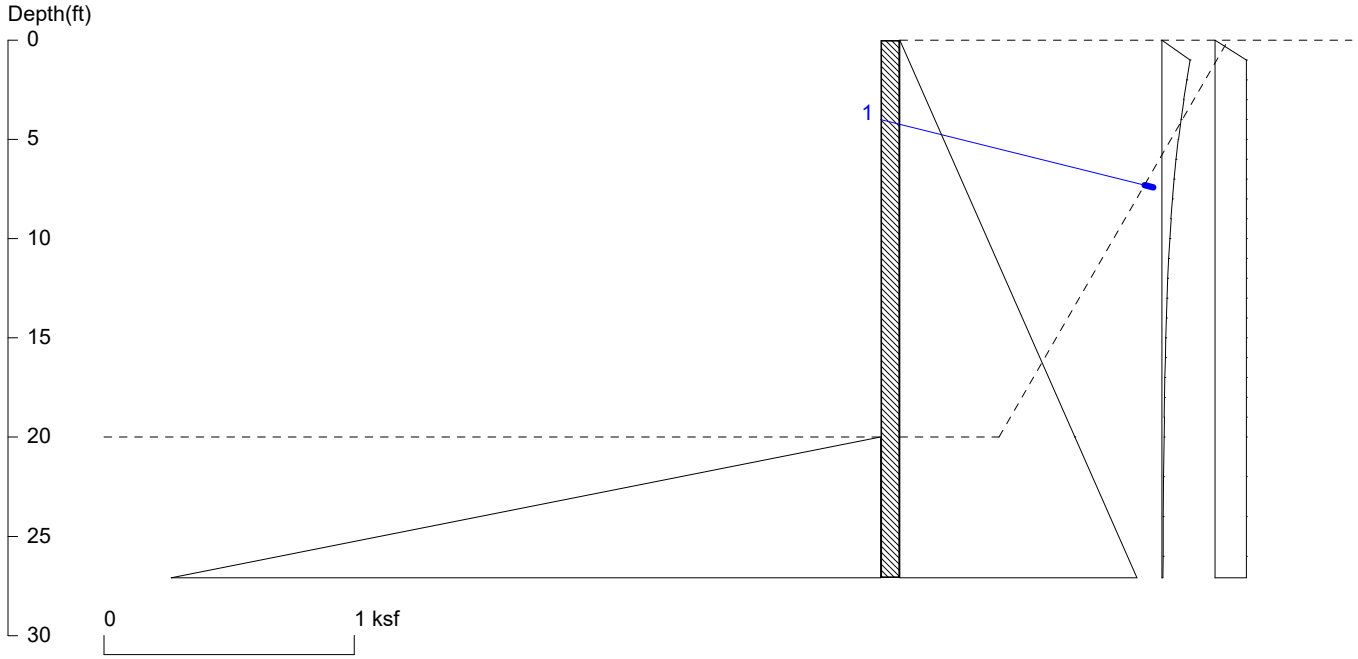
WESTERN WALL PRESSURES
4' SPACING



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File: M:\PROJECTS\Altman, Benjamin\2022-0033 - Altman West Soldier Pile Wall (Mercer Island)\Documents\SHORING WE

Wall Height=20.0 Pile Diameter=0.7 Pile Spacing=4.0 Wall Type: 3. Soldier Pile, Driving

PILE LENGTH: Min. Embedment=7.09 (8~10ft is recommended!!!) Min. Pile Length=27.09
MOMENT IN PILE: Max. Moment=118.24 per Pile Spacing=4.0 at Depth=14.75

PILE SELECTION:
Request Min. Section Modulus = 43.0 in3/pile=704.59 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W8X48 has Section Modulus = 43.2 in3/pile=707.92 cm3/pile. It is greater than Min. Requirements!
Top Deflection = -1.03(in) based on E (ksi)=29000.00 and I (in4)/pile=184.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	4.0	15.0	4.0	26.2	25.3	6.8	12.8	0.5

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	20.00	.7	0.035000
*	Below	Base		
20.00	.7	50.00	1.75	0.035000
*	Sur-	charg		
0.000	0.000	1.000	0.112	0.111798
1.000	0.112	2.000	0.099	-0.01284
2.000	0.099	3.000	0.087	-0.01217
3.000	0.087	4.000	0.076	-0.01125
4.000	0.076	5.000	0.065	-0.01019
5.000	0.065	6.000	0.056	-0.00905
6.000	0.056	7.000	0.048	-0.00793
7.000	0.048	8.000	0.041	-0.00686

8.000	0.041	9.000	0.036	-0.00588
9.000	0.036	10.00	0.031	-0.00501
10.00	0.031	11.00	0.026	-0.00425
11.00	0.026	12.00	0.023	-0.00360
12.00	0.023	13.00	0.020	-0.00305
13.00	0.020	14.00	0.017	-0.00258
14.00	0.017	15.00	0.015	-0.00219
15.00	0.015	16.00	0.013	-0.00186
16.00	0.013	17.00	0.011	-0.00158
17.00	0.011	18.00	0.010	-0.00135
18.00	0.010	19.00	0.009	-0.00116
19.00	0.009	20.00	0.008	-0.00100
20.00	0.008	22.00	0.006	-0.00080
22.00	0.006	24.00	0.005	-0.00060
24.00	0.005	26.00	0.004	-0.00046
26.00	0.004	28.00	0.003	-0.00036
*	Sur-	charg		
0.000	0.000	1.000	0.125	0.124984
1.000	0.125	2.000	0.125	-0.00001
2.000	0.125	3.000	0.125	-0.00001
3.000	0.125	4.000	0.125	-0.00001
4.000	0.125	5.000	0.125	-0.00001
5.000	0.125	6.000	0.125	-0.00001
6.000	0.125	7.000	0.125	-0.00001
7.000	0.125	8.000	0.125	-0.00001
8.000	0.125	9.000	0.125	-0.00001
9.000	0.125	10.00	0.125	-0.00001
10.00	0.125	11.00	0.125	-0.00001
11.00	0.125	12.00	0.125	-0.00001
12.00	0.125	13.00	0.125	-0.00001
13.00	0.125	14.00	0.125	-0.00001
14.00	0.125	15.00	0.125	-0.00001
15.00	0.125	16.00	0.125	-0.00001
16.00	0.125	17.00	0.125	-0.00001
17.00	0.125	18.00	0.125	-0.00001
18.00	0.125	19.00	0.125	-0.00001
19.00	0.125	20.00	0.125	-0.00001
20.00	0.125	22.00	0.125	-0.00001
22.00	0.125	24.00	0.125	-0.00001
24.00	0.125	26.00	0.125	-0.00001
26.00	0.125	28.00	0.125	-0.00001

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
20.0	0.00	200.0	72.00	0.400

ACTIVE SPACING:

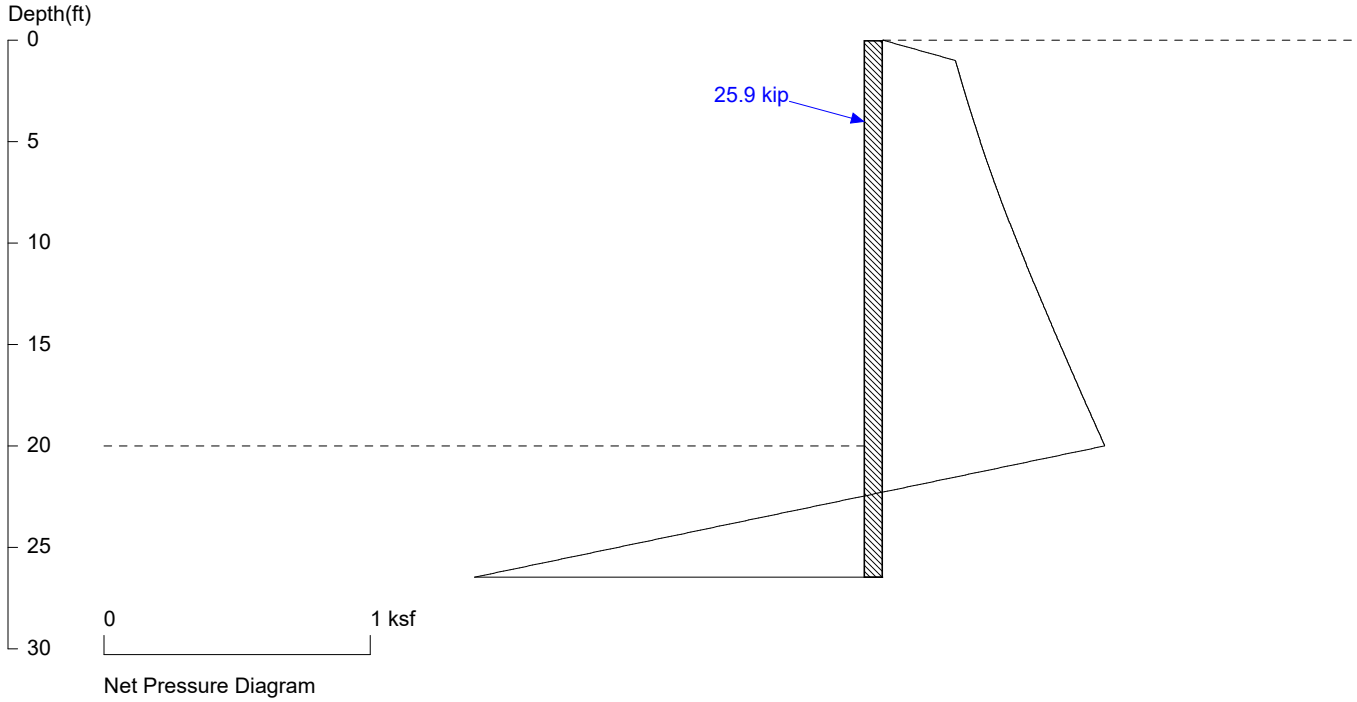
No.	Z depth	Spacing
1	0.00	4.00
2	20.00	0.67

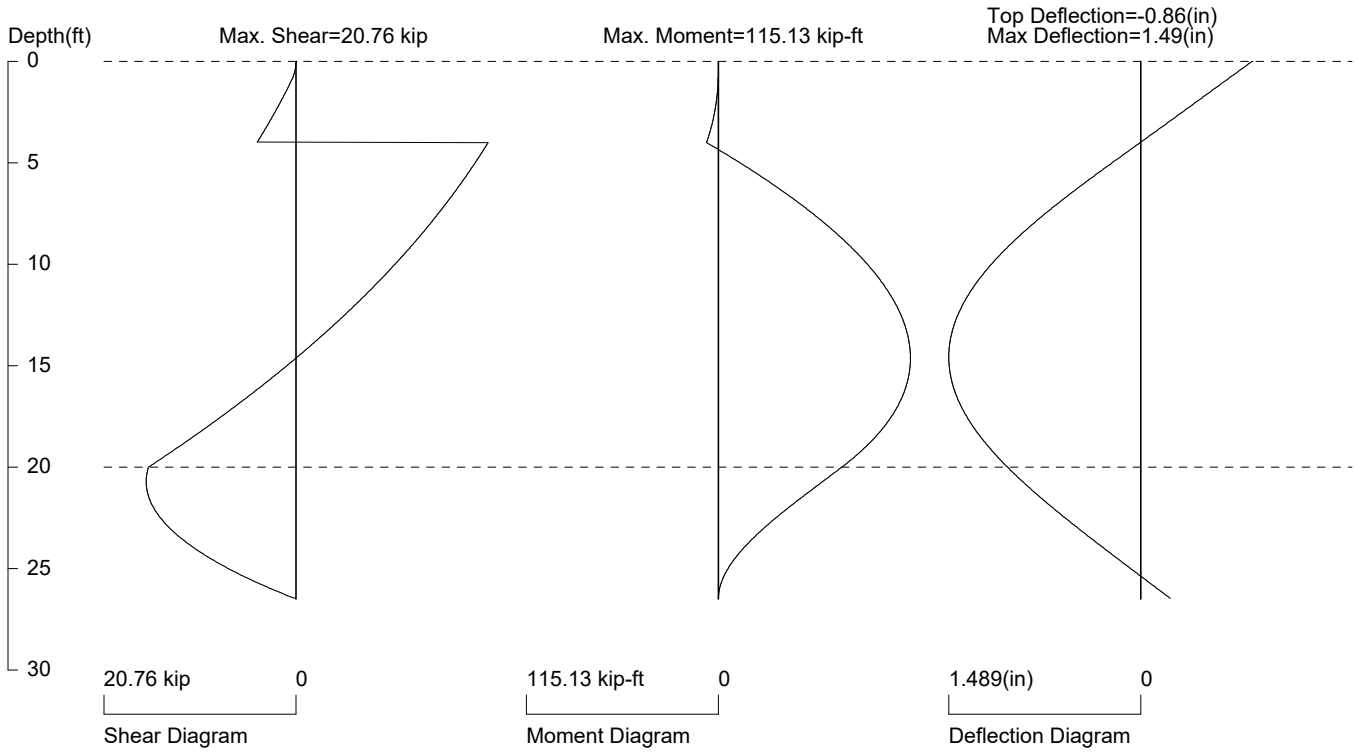
PASSIVE SPACING:

No.	Z depth	Spacing
1	20.00	2.01

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

WESTERN WALL PRESSURES
4' SPACING





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 4.0 foot or meter

User Input Pile, W10X39: E (ksi)=29000.0, I (in4)/pile=209.0

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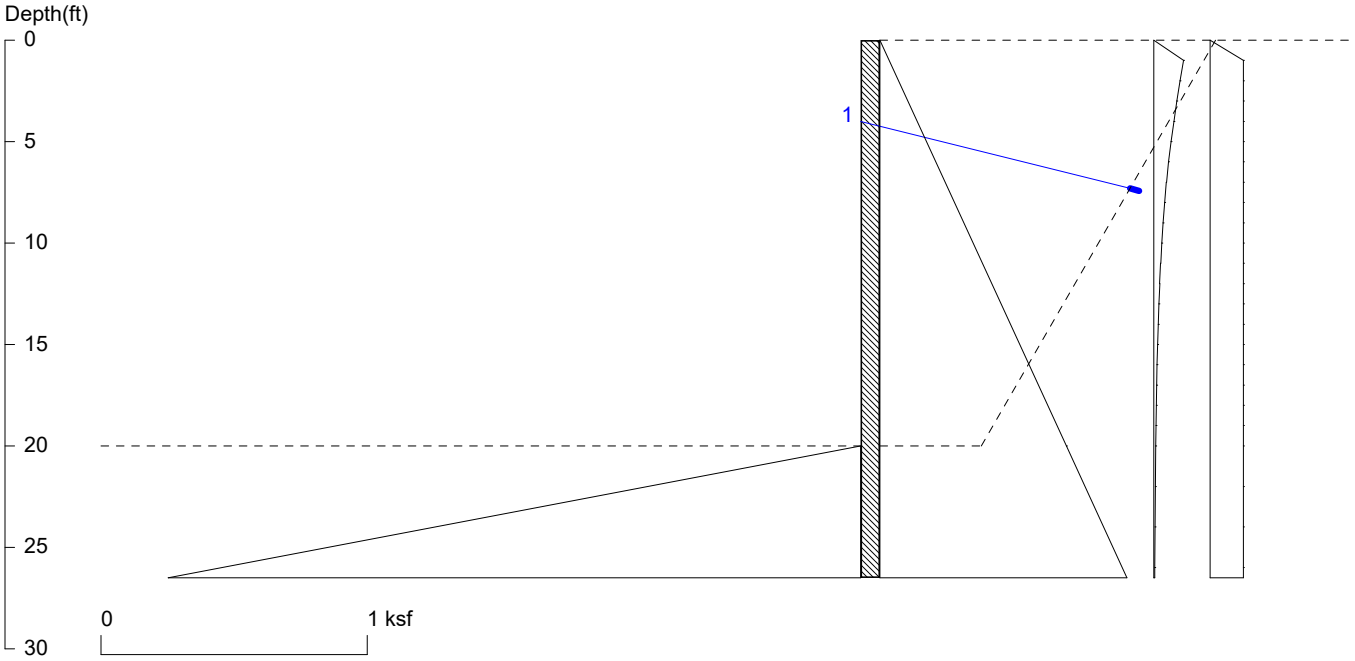
WESTERN WALL PRESSURES
4' SPACING



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Wall Height=20.0 Pile Diameter=0.8 Pile Spacing=4.0 Wall Type: 3. Soldier Pile, Driving

PILE LENGTH: Min. Embedment=6.50 (8~10ft is recommended!!!) Min. Pile Length=26.50
MOMENT IN PILE: Max. Moment=115.13 per Pile Spacing=4.0 at Depth=14.63

PILE SELECTION:
Request Min. Section Modulus = 41.9 in3/pile=686.05 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W10X39 has Section Modulus = 42.1 in3/pile=689.89 cm3/pile. It is greater than Min. Requirements!
Top Deflection = -0.86(in) based on E (ksi)=29000.00 and I (in4)/pile=209.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	4.0	15.0	4.0	25.9	25.0	6.7	12.8	0.5

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	20.00	.7	0.035000
*	Below	Base		
20.00	.7	50.00	1.75	0.035000
*	Sur-	charg		
0.000	0.000	1.000	0.112	0.111798
1.000	0.112	2.000	0.099	-0.01284
2.000	0.099	3.000	0.087	-0.01217
3.000	0.087	4.000	0.076	-0.01125
4.000	0.076	5.000	0.065	-0.01019
5.000	0.065	6.000	0.056	-0.00905
6.000	0.056	7.000	0.048	-0.00793
7.000	0.048	8.000	0.041	-0.00686

8.000	0.041	9.000	0.036	-0.00588
9.000	0.036	10.00	0.031	-0.00501
10.00	0.031	11.00	0.026	-0.00425
11.00	0.026	12.00	0.023	-0.00360
12.00	0.023	13.00	0.020	-0.00305
13.00	0.020	14.00	0.017	-0.00258
14.00	0.017	15.00	0.015	-0.00219
15.00	0.015	16.00	0.013	-0.00186
16.00	0.013	17.00	0.011	-0.00158
17.00	0.011	18.00	0.010	-0.00135
18.00	0.010	19.00	0.009	-0.00116
19.00	0.009	20.00	0.008	-0.00100
20.00	0.008	22.00	0.006	-0.00080
22.00	0.006	24.00	0.005	-0.00060
24.00	0.005	26.00	0.004	-0.00046
26.00	0.004	28.00	0.003	-0.00036
*	Sur-	charg		
0.000	0.000	1.000	0.125	0.124984
1.000	0.125	2.000	0.125	-0.00001
2.000	0.125	3.000	0.125	-0.00001
3.000	0.125	4.000	0.125	-0.00001
4.000	0.125	5.000	0.125	-0.00001
5.000	0.125	6.000	0.125	-0.00001
6.000	0.125	7.000	0.125	-0.00001
7.000	0.125	8.000	0.125	-0.00001
8.000	0.125	9.000	0.125	-0.00001
9.000	0.125	10.00	0.125	-0.00001
10.00	0.125	11.00	0.125	-0.00001
11.00	0.125	12.00	0.125	-0.00001
12.00	0.125	13.00	0.125	-0.00001
13.00	0.125	14.00	0.125	-0.00001
14.00	0.125	15.00	0.125	-0.00001
15.00	0.125	16.00	0.125	-0.00001
16.00	0.125	17.00	0.125	-0.00001
17.00	0.125	18.00	0.125	-0.00001
18.00	0.125	19.00	0.125	-0.00001
19.00	0.125	20.00	0.125	-0.00001
20.00	0.125	22.00	0.125	-0.00001
22.00	0.125	24.00	0.125	-0.00001
24.00	0.125	26.00	0.125	-0.00001
26.00	0.125	28.00	0.125	-0.00001

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
20.0	0.00	200.0	72.00	0.400

ACTIVE SPACING:

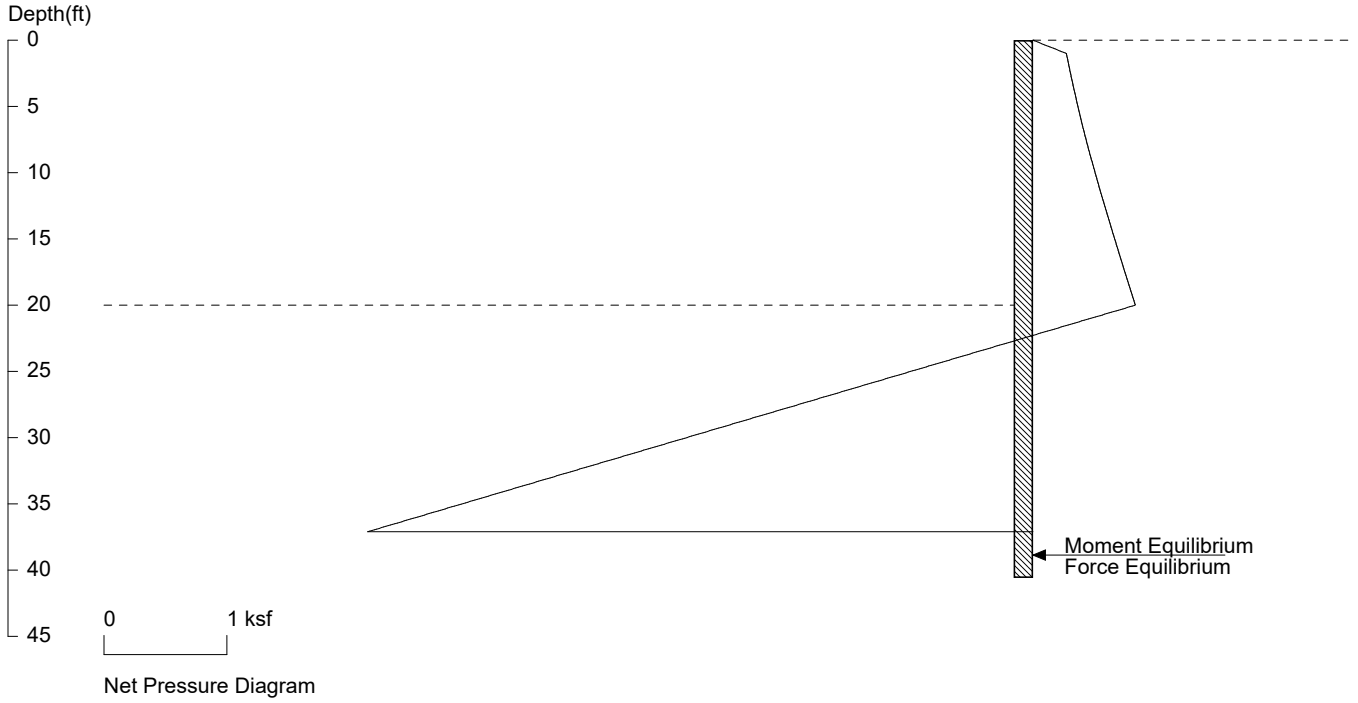
No.	Z depth	Spacing
1	0.00	4.00
2	20.00	0.83

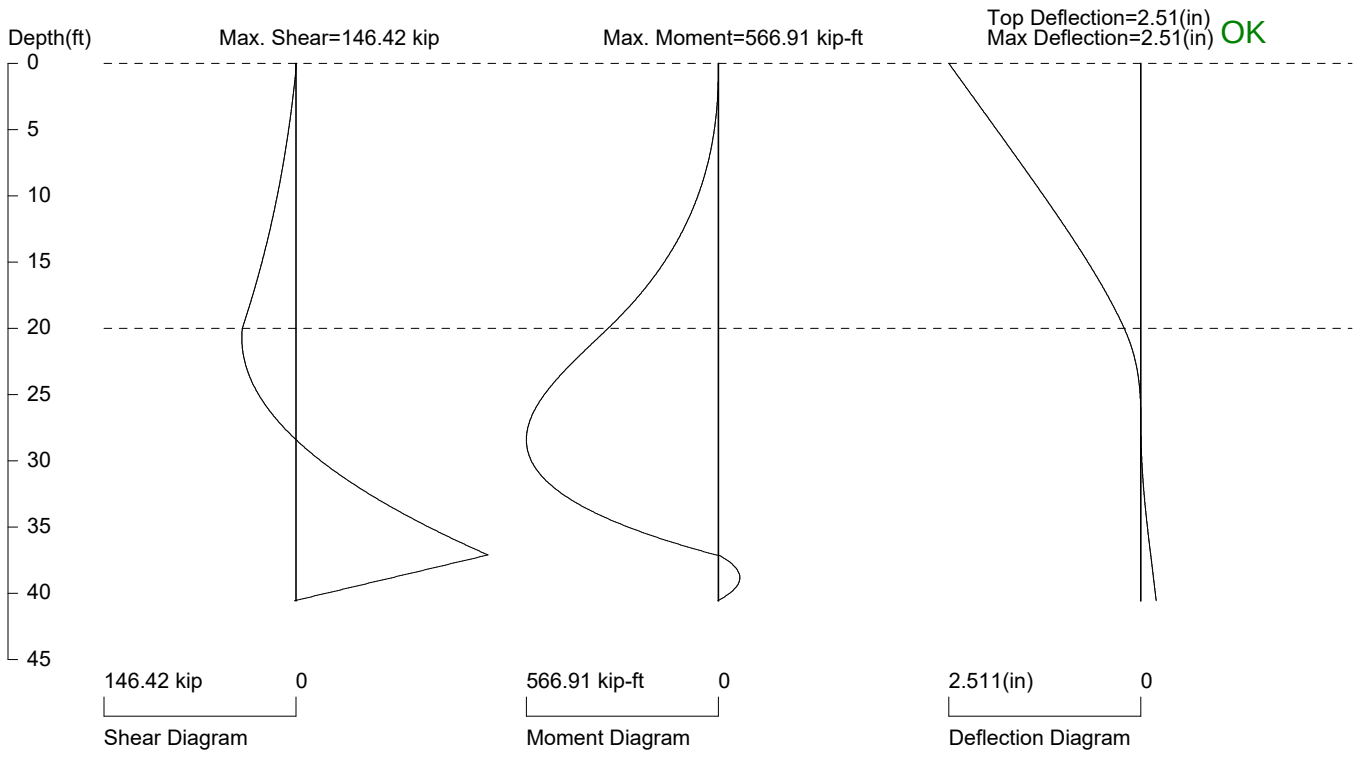
PASSIVE SPACING:

No.	Z depth	Spacing
1	20.00	2.49

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

WESTERN WALL PRESSURES
4' SPACING - W/O TIEBACKS





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 4.0 foot or meter

User Input Pile, W14X193: E (ksi)=29000.0, I (in4)/pile=2400.0

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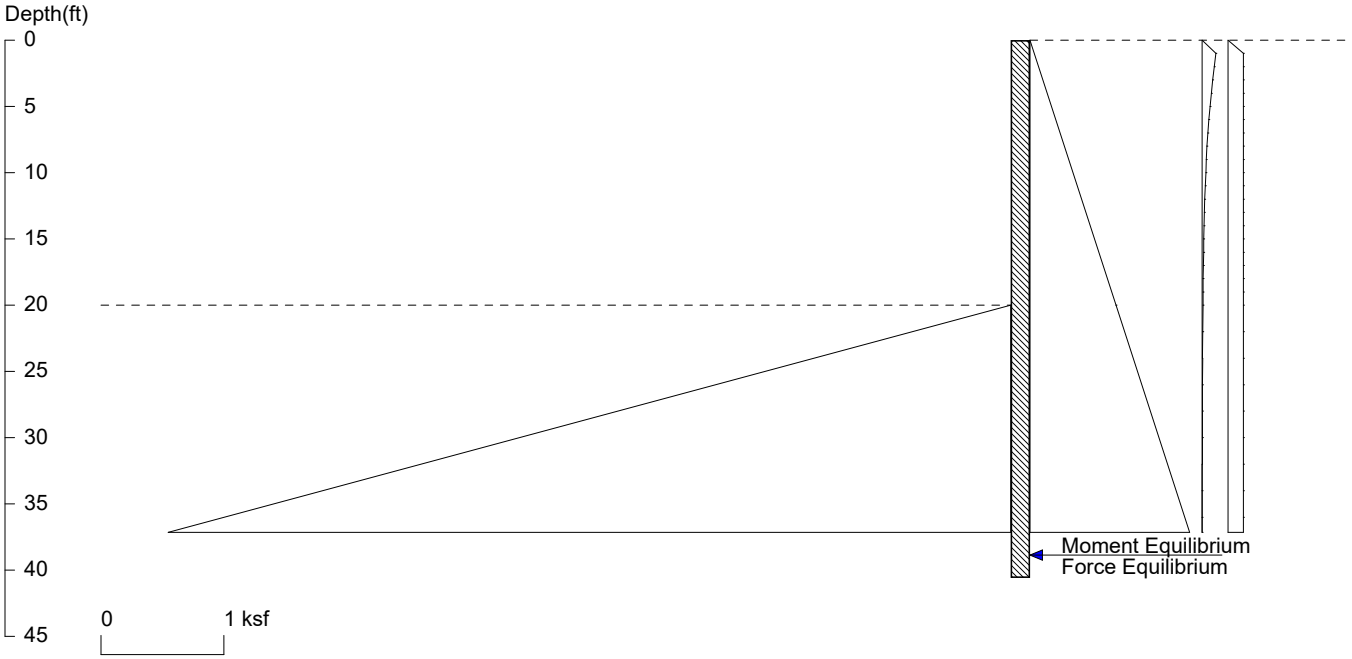
WESTERN WALL PRESSURES
4' SPACING - W/O TIEBACKS



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Wall Height=20.0 Pile Diameter=1.2 Pile Spacing=4.0 Wall Type: 3. Soldier Pile, Driving

PILE LENGTH: Min. Embedment=20.57 Min. Pile Length=40.57
MOMENT IN PILE: Max. Moment=566.91 per Pile Spacing=4.0 at Depth=28.41

PILE SELECTION:
Request Min. Section Modulus = 206.1 in3/pile=3378.17 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W14X193 has Section Modulus = 310.0 in3/pile=5079.97 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 2.51(in) based on E (ksi)=29000.00 and I (in4)/pile=2400.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	20.00	.7	0.035000
*	Below	Base		
20.00	.7	50.00	1.75	0.035000
*	Sur-	charg		
0.000	0.000	1.000	0.112	0.111798
1.000	0.112	2.000	0.099	-0.01284
2.000	0.099	3.000	0.087	-0.01217
3.000	0.087	4.000	0.076	-0.01125
4.000	0.076	5.000	0.065	-0.01019
5.000	0.065	6.000	0.056	-0.00905
6.000	0.056	7.000	0.048	-0.00793
7.000	0.048	8.000	0.041	-0.00686
8.000	0.041	9.000	0.036	-0.00588
9.000	0.036	10.00	0.031	-0.00501
10.00	0.031	11.00	0.026	-0.00425
11.00	0.026	12.00	0.023	-0.00360
12.00	0.023	13.00	0.020	-0.00305

13.00	0.020	14.00	0.017	-0.00258
14.00	0.017	15.00	0.015	-0.00219
15.00	0.015	16.00	0.013	-0.00186
16.00	0.013	17.00	0.011	-0.00158
17.00	0.011	18.00	0.010	-0.00135
18.00	0.010	19.00	0.009	-0.00116
19.00	0.009	20.00	0.008	-0.00100
20.00	0.008	22.00	0.006	-0.00080
22.00	0.006	24.00	0.005	-0.00060
24.00	0.005	26.00	0.004	-0.00046
26.00	0.004	28.00	0.003	-0.00036
28.00	0.003	30.00	0.003	-0.00028
30.00	0.003	32.00	0.002	-0.00022
32.00	0.002	34.00	0.002	-0.00018
34.00	0.002	36.00	0.002	-0.00014
36.00	0.002	38.00	0.001	-0.00012
38.00	0.001	40.00	0.001	-0.00009
40.00	0.001	44.00	0.001	-0.00007
*	Sur-	charg		
0.000	0.000	1.000	0.125	0.124984
1.000	0.125	2.000	0.125	-0.00001
2.000	0.125	3.000	0.125	-0.00001
3.000	0.125	4.000	0.125	-0.00001
4.000	0.125	5.000	0.125	-0.00001
5.000	0.125	6.000	0.125	-0.00001
6.000	0.125	7.000	0.125	-0.00001
7.000	0.125	8.000	0.125	-0.00001
8.000	0.125	9.000	0.125	-0.00001
9.000	0.125	10.00	0.125	-0.00001
10.00	0.125	11.00	0.125	-0.00001
11.00	0.125	12.00	0.125	-0.00001
12.00	0.125	13.00	0.125	-0.00001
13.00	0.125	14.00	0.125	-0.00001
14.00	0.125	15.00	0.125	-0.00001
15.00	0.125	16.00	0.125	-0.00001
16.00	0.125	17.00	0.125	-0.00001
17.00	0.125	18.00	0.125	-0.00001
18.00	0.125	19.00	0.125	-0.00001
19.00	0.125	20.00	0.125	-0.00001
20.00	0.125	22.00	0.125	-0.00001
22.00	0.125	24.00	0.125	-0.00001
24.00	0.125	26.00	0.125	-0.00001
26.00	0.125	28.00	0.125	-0.00001
28.00	0.125	30.00	0.125	-0.00001
30.00	0.125	32.00	0.124	-0.00001
32.00	0.124	34.00	0.124	-0.00001
34.00	0.124	36.00	0.124	-0.00001
36.00	0.124	38.00	0.124	-0.00001
38.00	0.124	40.00	0.124	-0.00001
40.00	0.124	44.00	0.124	-0.00001

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
20.0	0.00	200.0	72.00	0.400

ACTIVE SPACING:

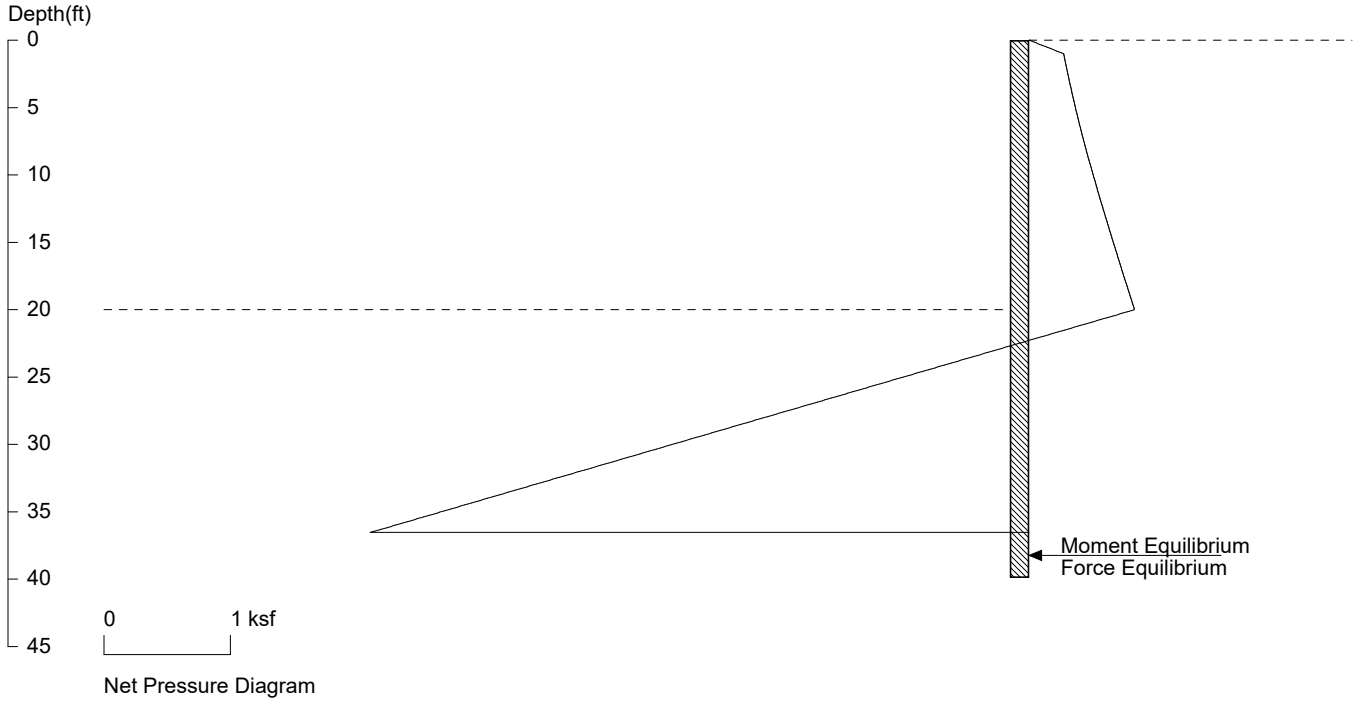
No.	Z depth	Spacing
1	0.00	4.00
2	20.00	1.20

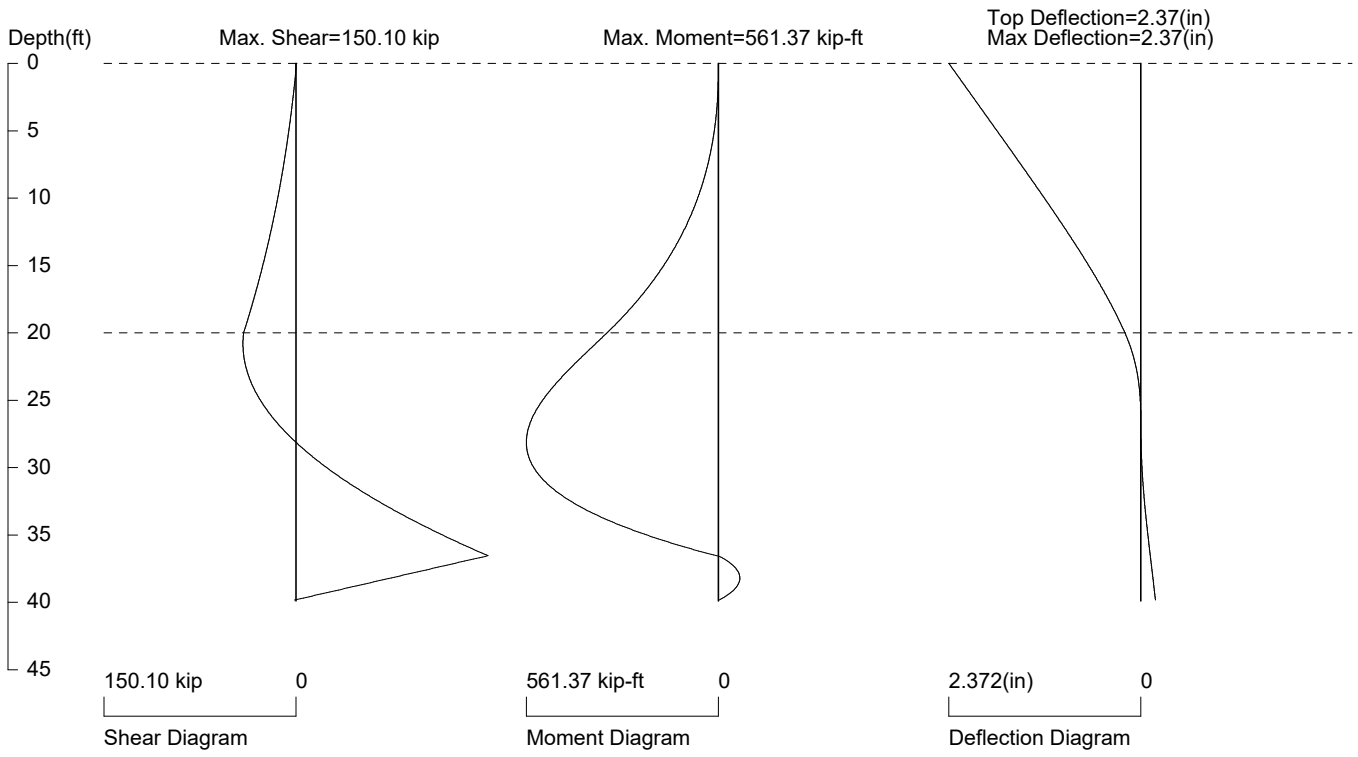
PASSIVE SPACING:

No.	Z depth	Spacing
1	20.00	3.60

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

WESTERN WALL PRESSURES
4' SPACING - W/O TIEBACKS





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 4.0 foot or meter

User Input Pile, W18X130: E (ksi)=29000.0, I (in4)/pile=2460.0

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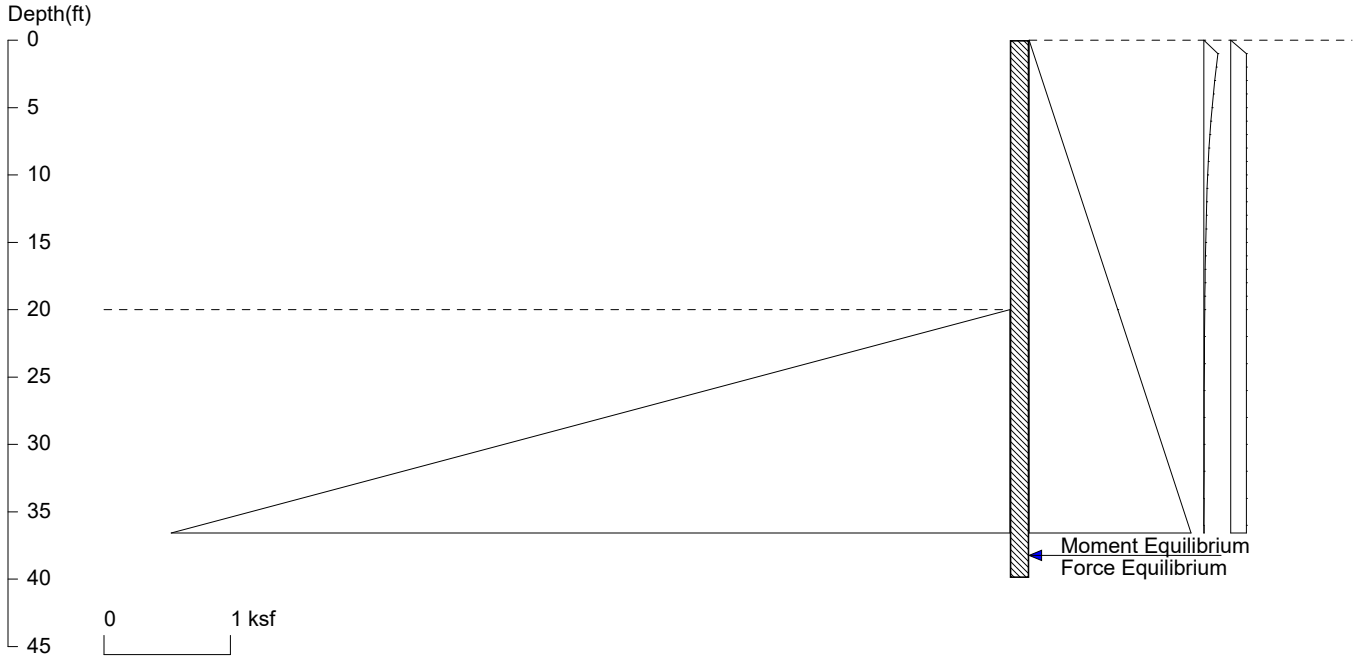
WESTERN WALL PRESSURES
4' SPACING - W/O TIEBACKS



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Wall Height=20.0 Pile Diameter=1.5 Pile Spacing=4.0 Wall Type: 3. Soldier Pile, Driving

PILE LENGTH: Min. Embedment=19.90 Min. Pile Length=39.90
MOMENT IN PILE: Max. Moment=561.37 per Pile Spacing=4.0 at Depth=28.10

PILE SELECTION:
Request Min. Section Modulus = 204.1 in3/pile=3345.17 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W18X130 has Section Modulus = 256.0 in3/pile=4195.07 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 2.37(in) based on E (ksi)=29000.00 and I (in4)/pile=2460.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	20.00	.7	0.035000
*	Below	Base		
20.00	.7	50.00	1.75	0.035000
*	Sur-	charg		
0.000	0.000	1.000	0.112	0.111798
1.000	0.112	2.000	0.099	-0.01284
2.000	0.099	3.000	0.087	-0.01217
3.000	0.087	4.000	0.076	-0.01125
4.000	0.076	5.000	0.065	-0.01019
5.000	0.065	6.000	0.056	-0.00905
6.000	0.056	7.000	0.048	-0.00793
7.000	0.048	8.000	0.041	-0.00686
8.000	0.041	9.000	0.036	-0.00588
9.000	0.036	10.00	0.031	-0.00501
10.00	0.031	11.00	0.026	-0.00425
11.00	0.026	12.00	0.023	-0.00360
12.00	0.023	13.00	0.020	-0.00305

13.00	0.020	14.00	0.017	-0.00258
14.00	0.017	15.00	0.015	-0.00219
15.00	0.015	16.00	0.013	-0.00186
16.00	0.013	17.00	0.011	-0.00158
17.00	0.011	18.00	0.010	-0.00135
18.00	0.010	19.00	0.009	-0.00116
19.00	0.009	20.00	0.008	-0.00100
20.00	0.008	22.00	0.006	-0.00080
22.00	0.006	24.00	0.005	-0.00060
24.00	0.005	26.00	0.004	-0.00046
26.00	0.004	28.00	0.003	-0.00036
28.00	0.003	30.00	0.003	-0.00028
30.00	0.003	32.00	0.002	-0.00022
32.00	0.002	34.00	0.002	-0.00018
34.00	0.002	36.00	0.002	-0.00014
36.00	0.002	38.00	0.001	-0.00012
38.00	0.001	40.00	0.001	-0.00009
*	Sur-	charg		
0.000	0.000	1.000	0.125	0.124984
1.000	0.125	2.000	0.125	-0.00001
2.000	0.125	3.000	0.125	-0.00001
3.000	0.125	4.000	0.125	-0.00001
4.000	0.125	5.000	0.125	-0.00001
5.000	0.125	6.000	0.125	-0.00001
6.000	0.125	7.000	0.125	-0.00001
7.000	0.125	8.000	0.125	-0.00001
8.000	0.125	9.000	0.125	-0.00001
9.000	0.125	10.00	0.125	-0.00001
10.00	0.125	11.00	0.125	-0.00001
11.00	0.125	12.00	0.125	-0.00001
12.00	0.125	13.00	0.125	-0.00001
13.00	0.125	14.00	0.125	-0.00001
14.00	0.125	15.00	0.125	-0.00001
15.00	0.125	16.00	0.125	-0.00001
16.00	0.125	17.00	0.125	-0.00001
17.00	0.125	18.00	0.125	-0.00001
18.00	0.125	19.00	0.125	-0.00001
19.00	0.125	20.00	0.125	-0.00001
20.00	0.125	22.00	0.125	-0.00001
22.00	0.125	24.00	0.125	-0.00001
24.00	0.125	26.00	0.125	-0.00001
26.00	0.125	28.00	0.125	-0.00001
28.00	0.125	30.00	0.125	-0.00001
30.00	0.125	32.00	0.124	-0.00001
32.00	0.124	34.00	0.124	-0.00001
34.00	0.124	36.00	0.124	-0.00001
36.00	0.124	38.00	0.124	-0.00001
38.00	0.124	40.00	0.124	-0.00001

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
20.0	0.00	200.0	72.00	0.400

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	4.00
2	20.00	1.50

PASSIVE SPACING:

No.	Z depth	Spacing
1	20.00	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

Multiple Simple Beam

Description : SOLDIER PILE WALL LAGGING

Wood Beam Design : 4' LAGGING @ BASE

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **11.250 X 3.50, Sawn, Fully Unbraced**
Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
Wood Species : Hem-Fir
Wood Grade : No.2

Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

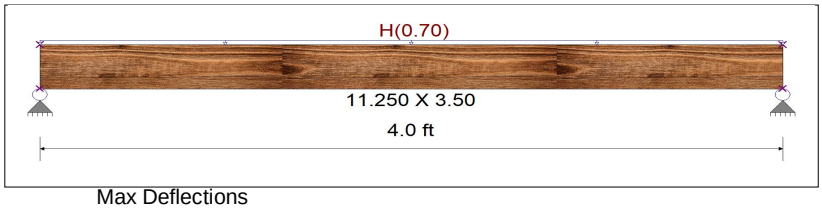
Unif Load: H = 0.70 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.956** : 1
fb : Actual : 731.43 psi at 2.000 ft in Span # 1
Fb : Allowable : 765.00 psi
Load Comb : +D+H

Max fv/FvRatio = **0.425** : 1
fv : Actual : 45.87 psi at 0.000 ft in Span # 1
Fv : Allowable : 108.00 psi
Load Comb : +D+H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support							1.40
Right Support							1.40



Max Deflections

Transient Downward	0.078 in	Total Downward	0.078 in
Ratio	618	Ratio	618
	LC: H Only		LC: +D+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : 4' LAGGING @ 10'

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **11.250 X 3.50, Sawn, Fully Unbraced**
Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
Wood Species : Hem-Fir
Wood Grade : No.2

Fb - Tension	675.0 psi	Fc - Prll	500.0 psi	Fv	140.0 psi	Ebend- xx	1,100.0 ksi	Density	26.840 pcf
Fb - Compr	675.0 psi	Fc - Perp	405.0 psi	Ft	350.0 psi	Eminbend - xx	400.0 ksi		

Applied Loads

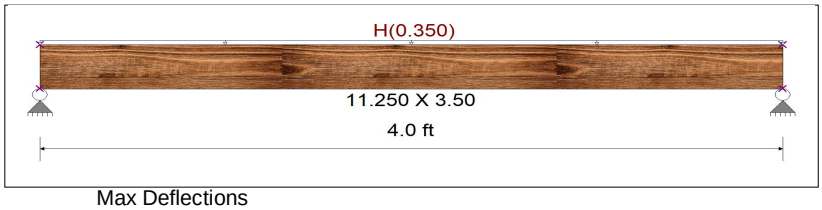
Unif Load: H = 0.350 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.602** : 1
fb : Actual : 365.71 psi at 2.000 ft in Span # 1
Fb : Allowable : 607.50 psi
Load Comb : +D+H

Max fv/FvRatio = **0.228** : 1
fv : Actual : 22.93 psi at 0.000 ft in Span # 1
Fv : Allowable : 100.80 psi
Load Comb : +D+H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support							0.70
Right Support							0.70



Max Deflections

Transient Downward	0.046 in	Total Downward	0.046 in
Ratio	1047	Ratio	1047
	LC: H Only		LC: +D+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

MC SQUARED, INC.
OLYMPIA, WASHINGTON 98506
(360) 754-9339
FAX (360) 352-2044

Job:_____

Date:_____ By:_____

Sheet:_____ Page_____ of_____

ANCHORAGE DESIGN

- A153 GALVENIZING
- F1554 - GR 55 RODS
- SR ANCHORS ACCEPT 1" - 1.5"
- MANUFACTURER RECCOMENDED F.S. = 2.00

ANCHOR:

$P = 25.9$ K PER SHORINGPRO CALC

SR-3 CAP = 48K CN = 14

$F.S. = \frac{48}{25.9} = 1.85$ ∴ ACCEPTABLE FOR TEMPORARY CONDITIONS

ROD:

$P_{DESIGN} = 25.9$ KIPS

$A_{MIN} = \frac{25.9}{.6 \times 55} = 0.78\ in^2$

$\phi = \sqrt{\frac{4 \times A}{\pi}} = 1.001$ ∴ USE 1 1/8" ϕ ROD

7) TECHNICAL PERFORMANCE ISSUES

Manta Ray and Stingray anchors are tensile anchors designed to work well in soils with SPT blow counts (N) from 7 to 50. The smaller anchor models are used in harder soils or where lowers loads are required. Larger anchors are used in softer soils. In harder soils, the installed capacity is limited by the ultimate strength of the anchor. In softer soils, it is limited by the soil strength. Soils with blow counts of 35 to 50 and higher, often require the installer to drill a 4-inch diameter pilot hole for Manta Ray or a 6-inch pilot hole for Stingray prior to installation in order to achieve an efficient installation time.
Although they are not intended for installation in rock, some models can be successfully installed into rock formations with low Rock Quality Designation (RQD). Typically, a pilot hole is required for these installations, but sometimes anchors can be simply driven into weathered, layered, decomposing rock.

Manta Ray and Stingray anchors are designed to react tensile loads along the axis of the anchor rod. They are not designed to react compressive, lateral, or shear loads, however, they can be made to do so by the addition of grout, which will increase the holding capacity, sometimes very significantly.

The increase is dependant upon the grout length and soil type. Both the CTB and SCR exceed the deformation characteristics of ASTM 615 rebar.

For retaining structures, Manta Ray anchors should be installed a minimum of 6 feet behind the failure place after proof testing. Stingray anchors should be installed a minimum of 10 feet behind the failure plane after proof testing. A minimum overburden of 4 feet must be maintained for Manta Ray anchors and 7 feet for Stingray anchors.
Manta Ray and Stingray anchors can be proof tested up to 90% of yield strength. Working loads are typically between 50% and 90% of the proof test value.

8) TECHNICAL SERVICES

Limited technical services are available to help select anchors and anchoring methods, installation training, and support. Soil boring logs with USCS soil classification and SPT blow counts are required to predict anchor performance. Please contact your Manta Ray distributor or Foresight Products directly. Per diem and other charges for on-site services may apply.

9) ULTIMATE HOLDING CAPACITY CHART

Soil Description	Blow Count	Stingray SR-3	Stingray SR-2	Stingray SR-1	Manta Ray MR-SR	Manta Ray MR-1	Manta Ray MR-2	Manta Ray MR-3
Dense fine compact sands, very hard silts or clays	45-60	100 (2,3)	79-89 (2,4)	58-65 (2,4)	40 (1,3)	36-40 (1,3,4)	21-28 (2,4)	17-20 (2,3,4)
Dense clays, sands and gravels, hard silts and clays	35-50	85-100 (2,3,4)	62-79 (4)	39-58 (4)	32-40 (2,3,4)	24-36 (2,4)	15-22 (2,4)	12-18 (2,4)
Medium dense sandy gravel stiff to hard silts and clays	24-40	63-90 (4)	46-66 (4)	29-41 (4)	24-34 (2,4)	18-20 2,4)	12-18 (4)	9-14 (4)
Medium Dense Coarse sand and gravel, Stiff to Very stiff silts and clays	14-25	48-63 (4)	31-48 (4)	24-32 (4)	18-24 (4)	15-20 (4)	9-12 (4)	7-9 (4)
Loose to Medium Dense Fine to Coarse sand; Firm to Stiff clays and silts	7-14	37-48 (4)	27-36 (4)	16-24 (4)	14-18 (4)	10-15 (4)	7-10 (4)	5-8 (4)

Notes:
1) Drilled pilot hole required for efficient installation.
2) Ease of installation may be improved by drilling a pilot hole.
3) Holding capacity limited by ultimate strength of anchors.
4) Holding capacity limited by soil failure.
5) Not recommended in these soils.