

SHORING CALCCS

New Single Family Residence
5818 W Mercer Way
Mercer Island, WA



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Project: 5818 W Mercer Way

By: JDA

Proj No: 269-2024

Date: 07/25/25

Summary

Update shoring calculations for soil pressure figure when using two rows of tiebacks, as provided by Cobalt Geosciences (see page 2, marked up for a sample 20' tall soldier pile). Note that AT-REST pressure of 55 pcf, plus an additional 0.75psf x backslope angle was used in design.

See pages 3-19 for E1-E10 showing pile designs (moment equilibrium, shear, moment, deflection), free body diagrams (soil pressures used), wall height, pile diameter, pile spacing, wall type, and minimum embedment. Note that tieback lengths were derived using a 3 KLF tieback resistance; lengths of tiebacks was derived outside of program due to unique no-load zone and can be seen in each pile design.

Piles E11 - E14 have been re-designed using decreased passive resistance as provided by Cobalt Geosciences. See pages 20 - 24 for cantilevered shoring designs.



Subject: Shoring Calculation Overview

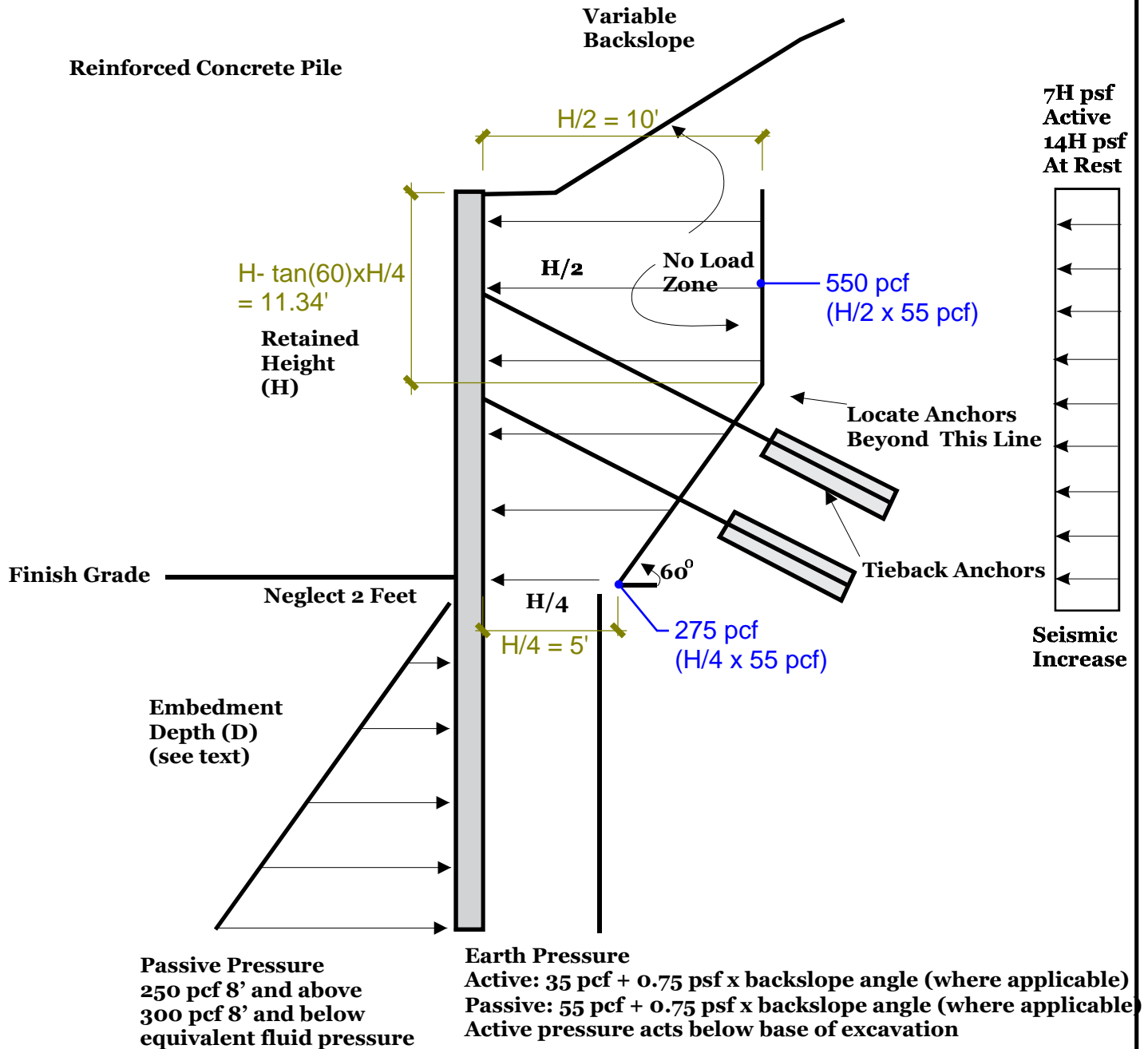
Project: 5818 W Mercer Way

Client: CenterLine

Project No.: 269-2024

Date: 07/25/25

Reinforced Concrete Pile



Notes:

See report for additional specific information

Soil pressures act over the pile spacing

Passive pressures act over twice the grouted pile diameter on the pile spacing, whichever is smaller

Assumed no hydrostatic pressures act on the back of the walls

At least 2 anchors (3 percent) to be tested to 200 percent of the design load

Preliminary adhesion of 3 kips per lineal foot (pressure grouted with post grouting)

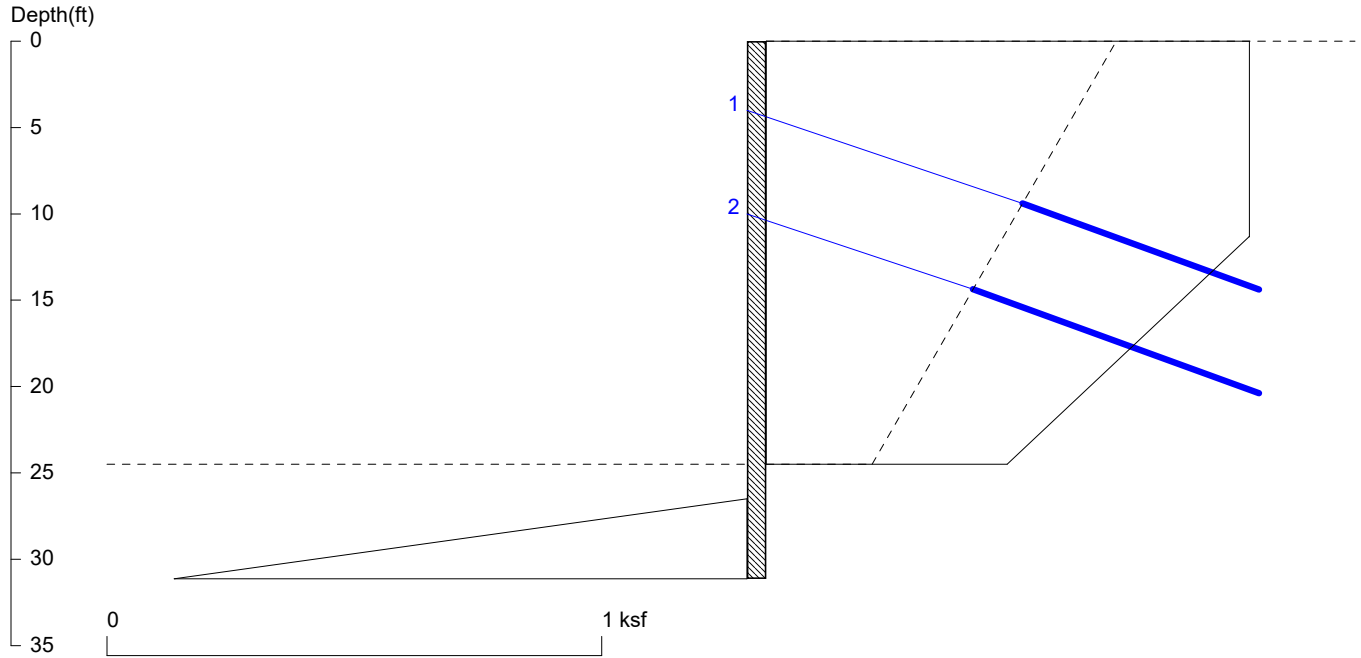


Proposed Residence
5818 W. Mercer Way
Mercer Island, Washington

**Soldier Pile
Wall with
Tiebacks**

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

E1 (24.5 ft @ 6 ft oc) Corner Pile Case



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Date: 7/25/2025

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E1_2

Wall Height=24.5

Pile Diameter=2.0

Pile Spacing=6.0

Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=6.63 Min. Pile Length=31.13

MOMENT IN PILE: Max. Moment=71.38 per Pile Spacing=6.0 at Depth=19.19

PILE SELECTION:

Request Min. Section Modulus = 26.0 in³/pile=425.37 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W16X26 has Section Modulus = 38.4 in³/pile=629.26 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.03(in) based on E (ksi)=29000.00 and I (in⁴)/pile=301.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	Free Length	Fixed Length
1. Tieback	4.0	20.0	6.0	29.9*	28.1	10.2	1.8	1.0
2. Tieback	10.0	20.0	6.0	28.7	27.0	9.8	2.7	3.3

* Top Brace increased by 15% (DM7.2-103)

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
0	.9769	11.33	0.976	0.000000
11.33	0.976	24.5	.4884	-0.03711

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
26.5	0	34.5	2.000	.25

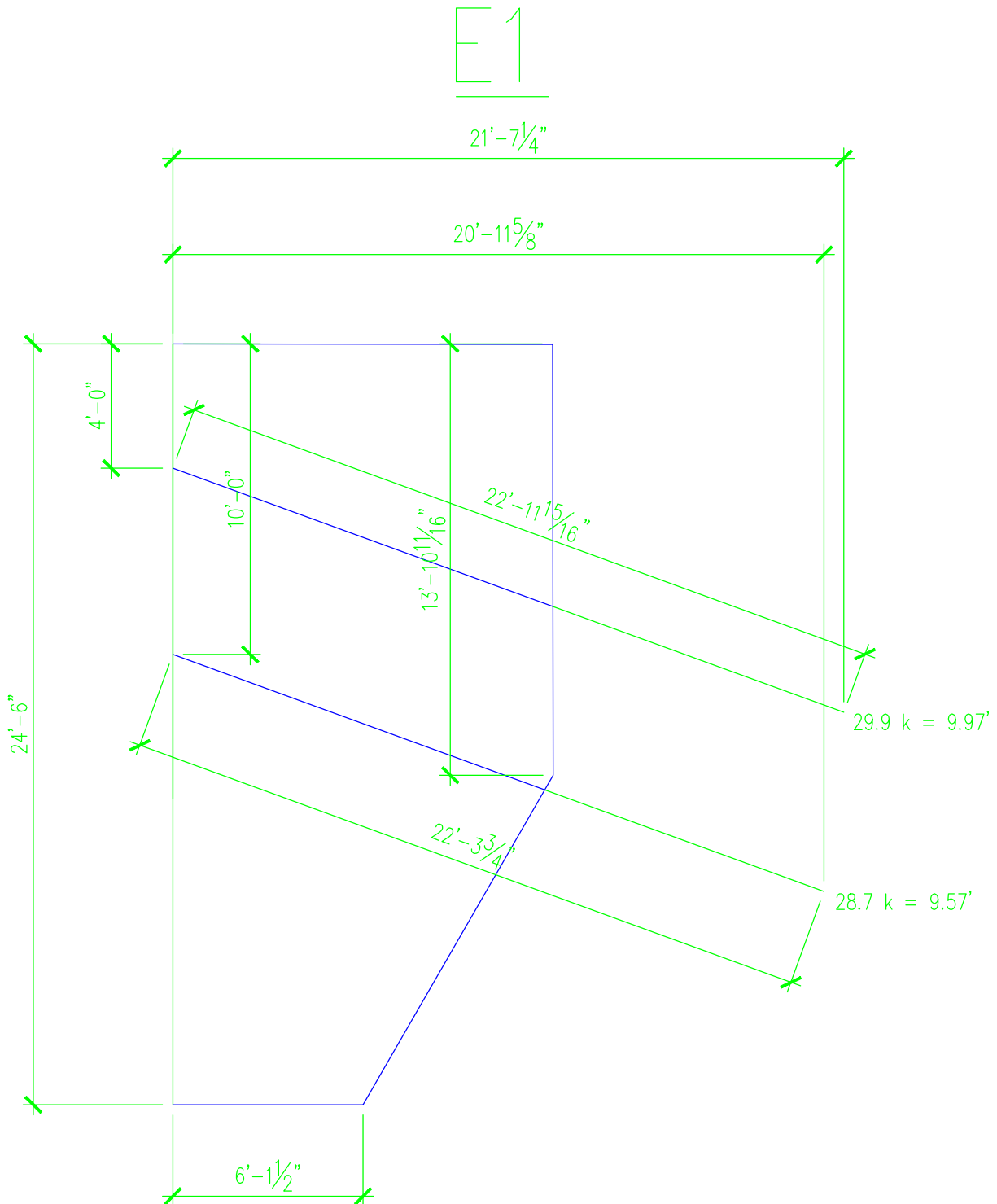
ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	3.00
2	24.50	2.00

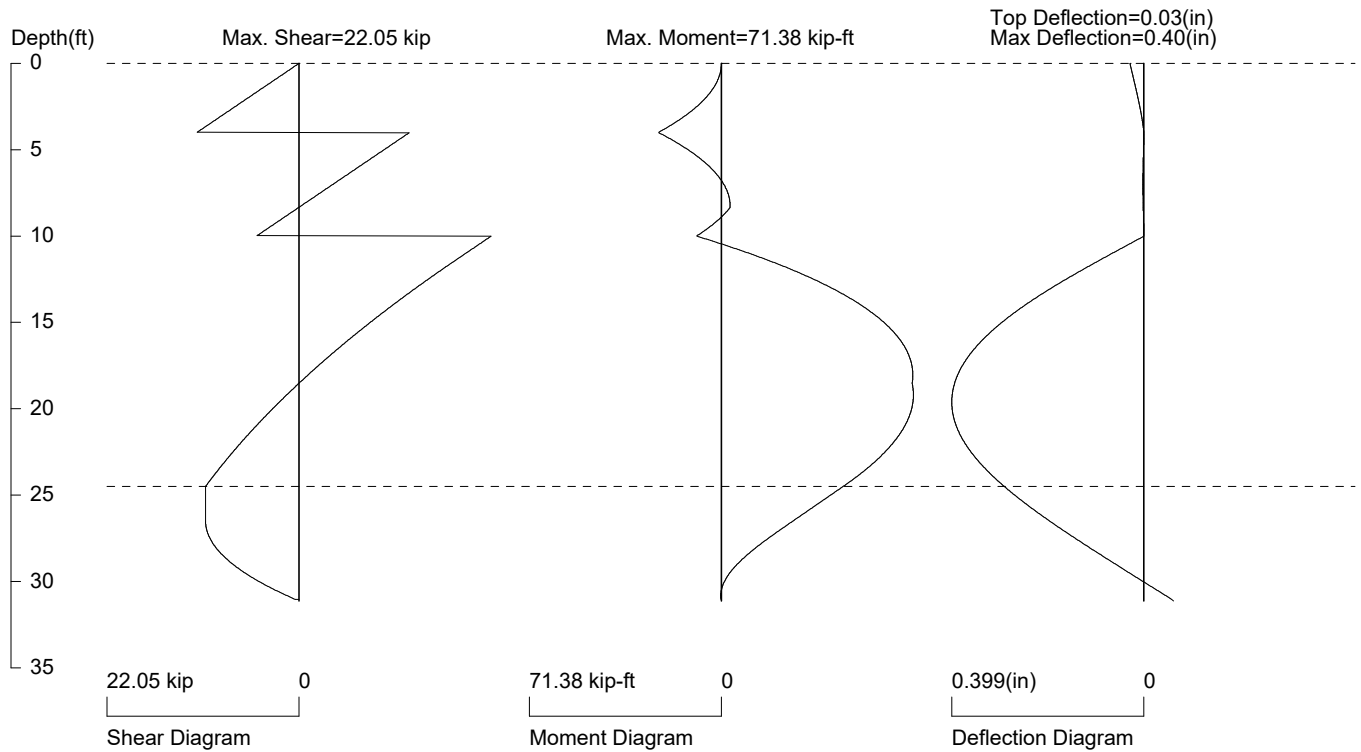
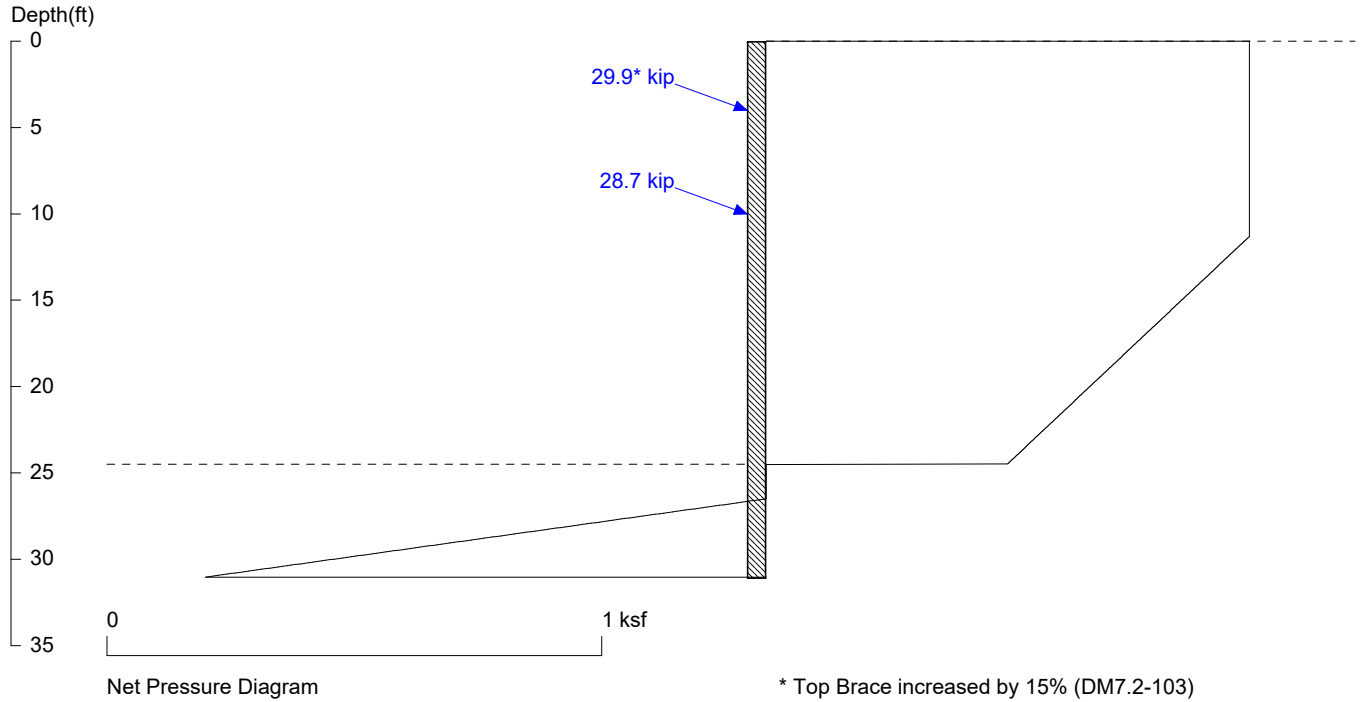
PASSIVE SPACING:

No.	Z depth	Spacing
1	24.50	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



E1 (24.5 ft @ 6 ft oc) Corner Pile Case



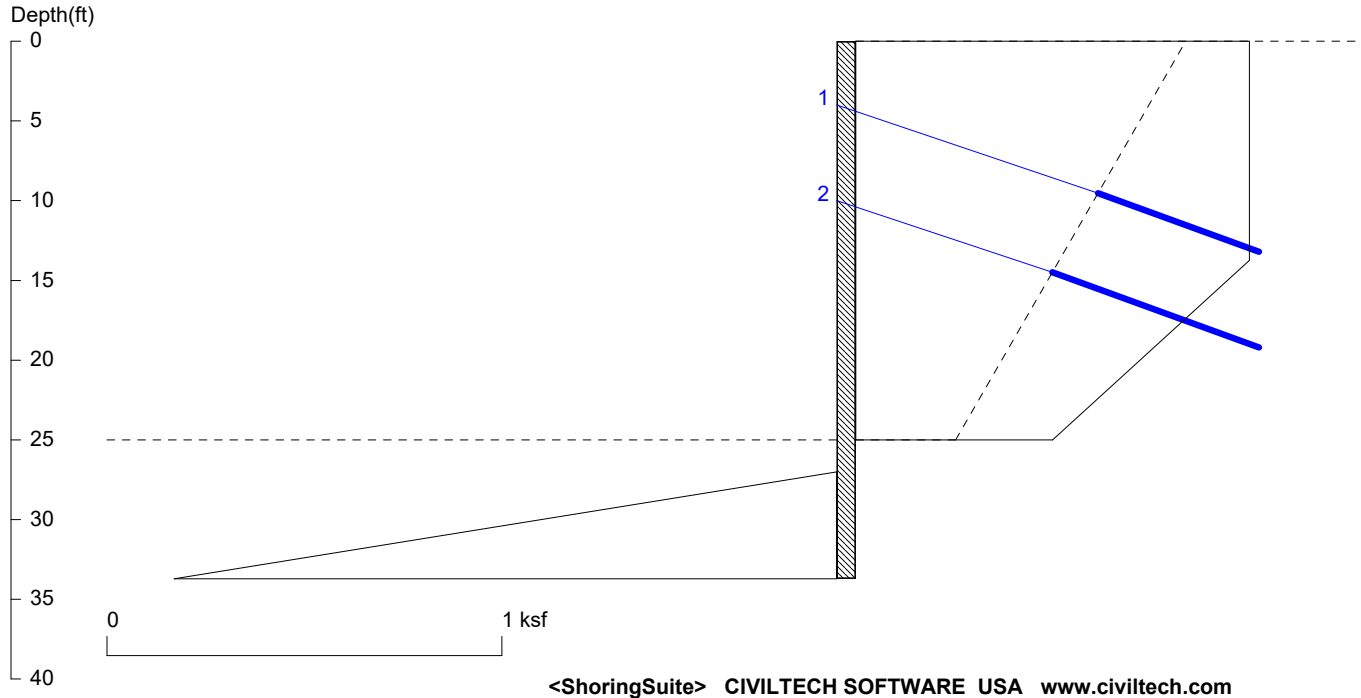
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X26: E (ksi)=29000.0, I (in⁴)/pile=301.0

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E1_24.5 ft @ 6 ft oc (Corner Tieback).SH8

E2, E4-E7 (25 ft @ 6 ft oc)



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Date: 7/25/2025

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E2,E4-E7

Wall Height=25.0

Pile Diameter=2.0

Pile Spacing=6.0

Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=8.71 Min. Pile Length=33.71

MOMENT IN PILE: Max. Moment=174.92 per Pile Spacing=6.0 at Depth=19.69

PILE SELECTION:

Request Min. Section Modulus = 63.6 in³/pile=1042.34 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W16X57 has Section Modulus = 92.2 in³/pile=1510.88 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.02(in) based on E (ksi)=29000.00 and I (in⁴)/pile=758.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	Free Length	Fixed Length
1. Tieback	4.0	20.0	6.0	61.0*	57.3	20.9	6.2	3.0
2. Tieback	10.0	20.0	6.0	64.2	60.3	22.0	8.1	4.0

* Top Brace increased by 15% (DM7.2-103)

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
0	.9968	13.74	.9968	0.000000
13.74	.9968	25	.4984	-0.04426

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
27	0	35	2.000	.25

ACTIVE SPACING:

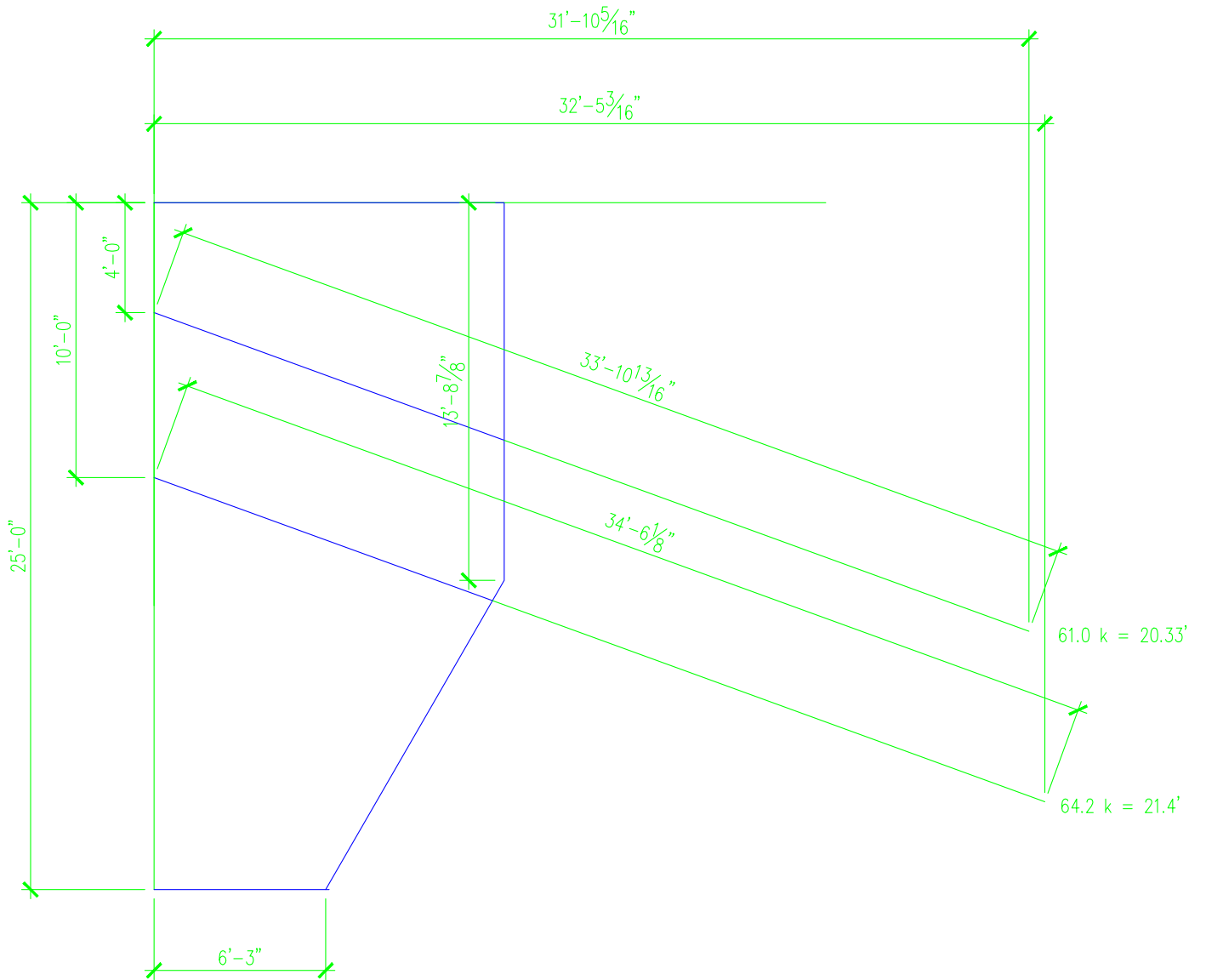
No.	Z depth	Spacing
1	0.00	6.00
2	25.00	2.00

PASSIVE SPACING:

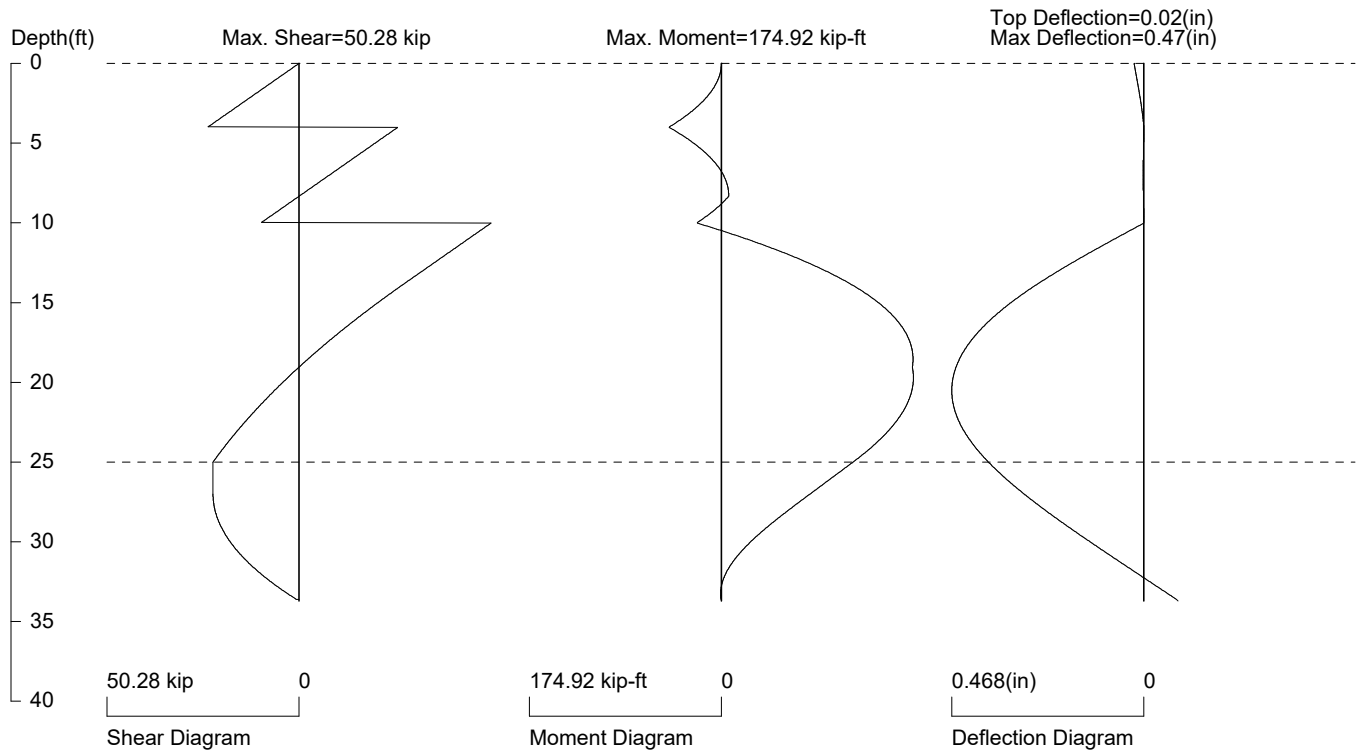
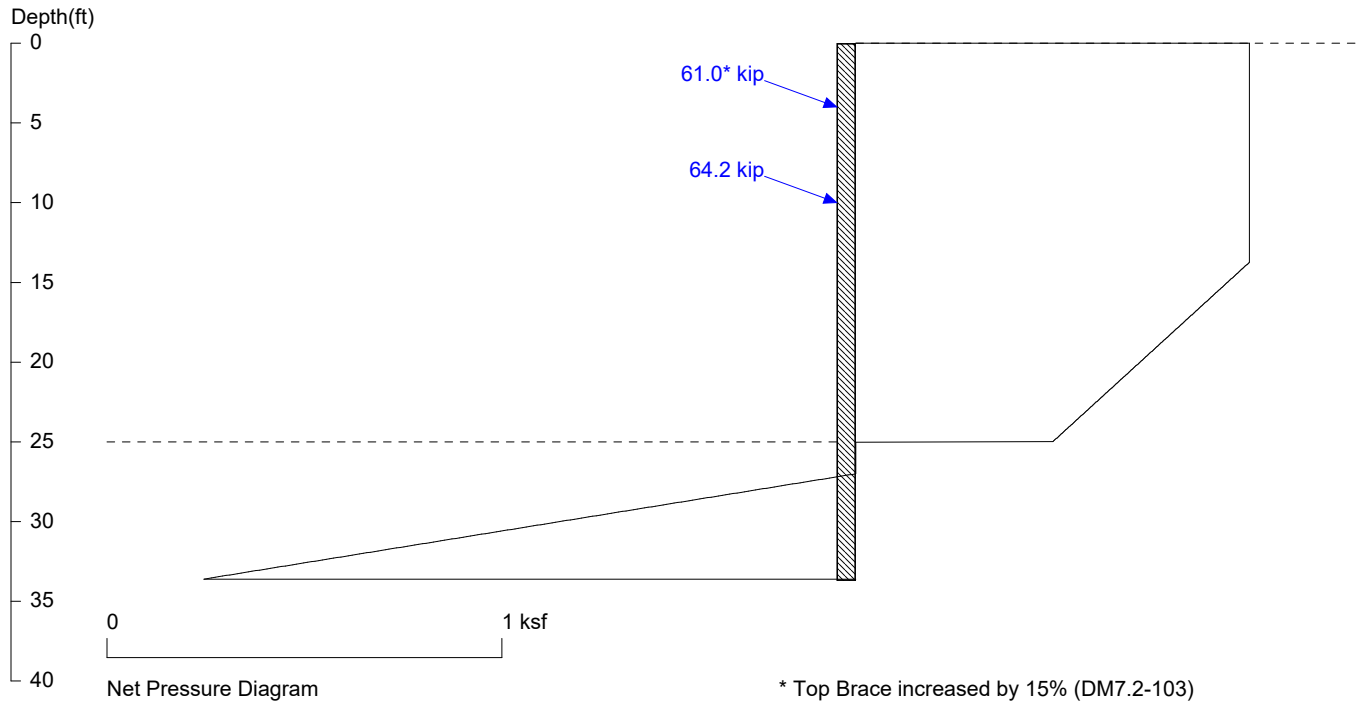
No.	Z depth	Spacing
1	25.00	4.00

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

E2, E4-E7



E2, E4-E7 (25 ft @ 6 ft oc)



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

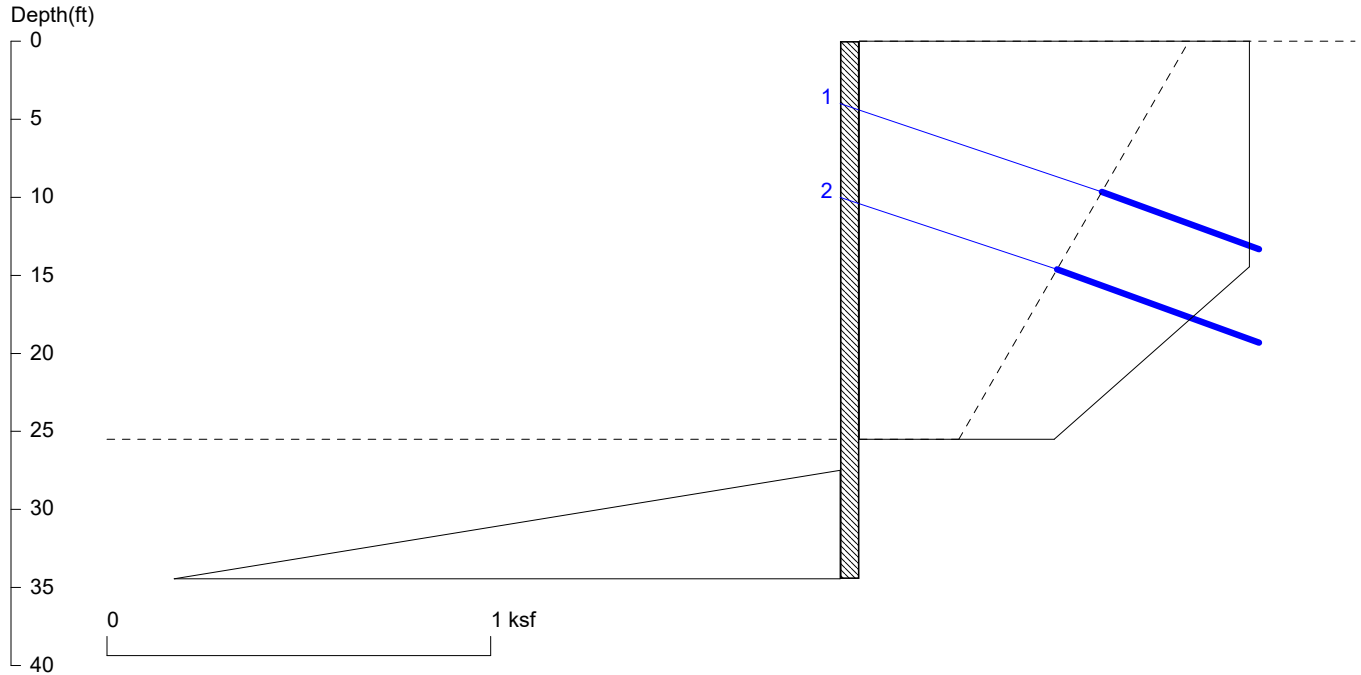
User Input Pile, W16X57: E (ksi)=29000.0, I (in4)/pile=758.0

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E2,E4--E7_25 ft @ 6 ft oc (Tieback).SH8

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E3 (25.5 ft @ 6 ft oc)



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Date: 7/25/2025

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E3_2

Wall Height=25.5

Pile Diameter=2.0

Pile Spacing=6.0

Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=8.94 Min. Pile Length=34.44

MOMENT IN PILE: Max. Moment=192.79 per Pile Spacing=6.0 at Depth=20.00

PILE SELECTION:

Request Min. Section Modulus = 97.4 in³/pile=1595.58 cm³/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66

W16X67 has Section Modulus = 117.0 in³/pile=1917.28 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.02(in) based on E (ksi)=29000.00 and I (in⁴)/pile=954.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	Free Length	Fixed Length
1. Tieback	4.0	20.0	6.0	62.2*	58.4	21.3	17.5	3.6
2. Tieback	10.0	20.0	6.0	67.8	63.7	23.2	13.5	3.2

* Top Brace increased by 15% (DM7.2-103)

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
0	1.016	14.46	1.016	0.000000
14.46	1.016	25.5	.5084	-0.04605

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
27.5	0	35.5	2.000	.25

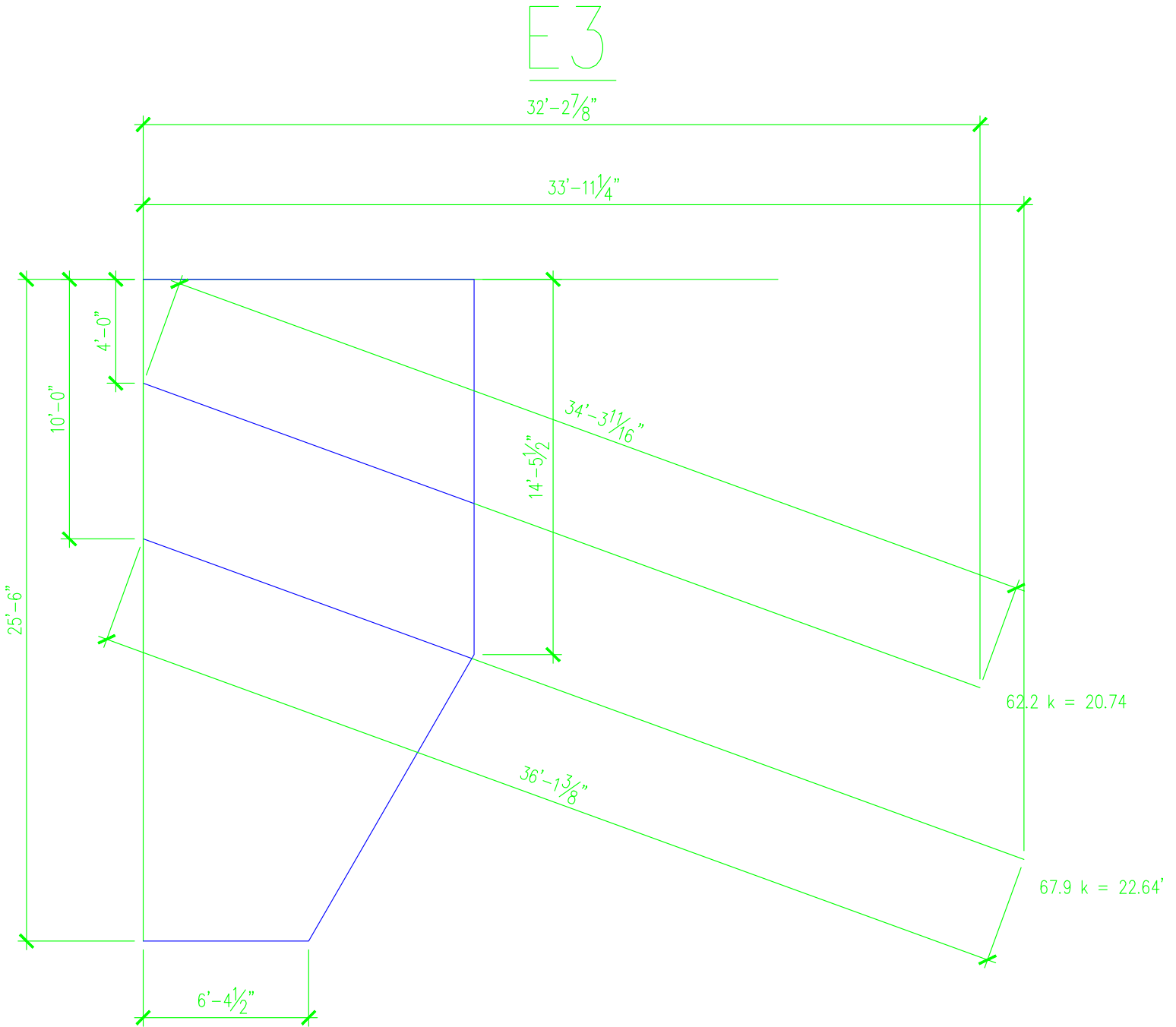
ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	6.00
2	25.50	2.00

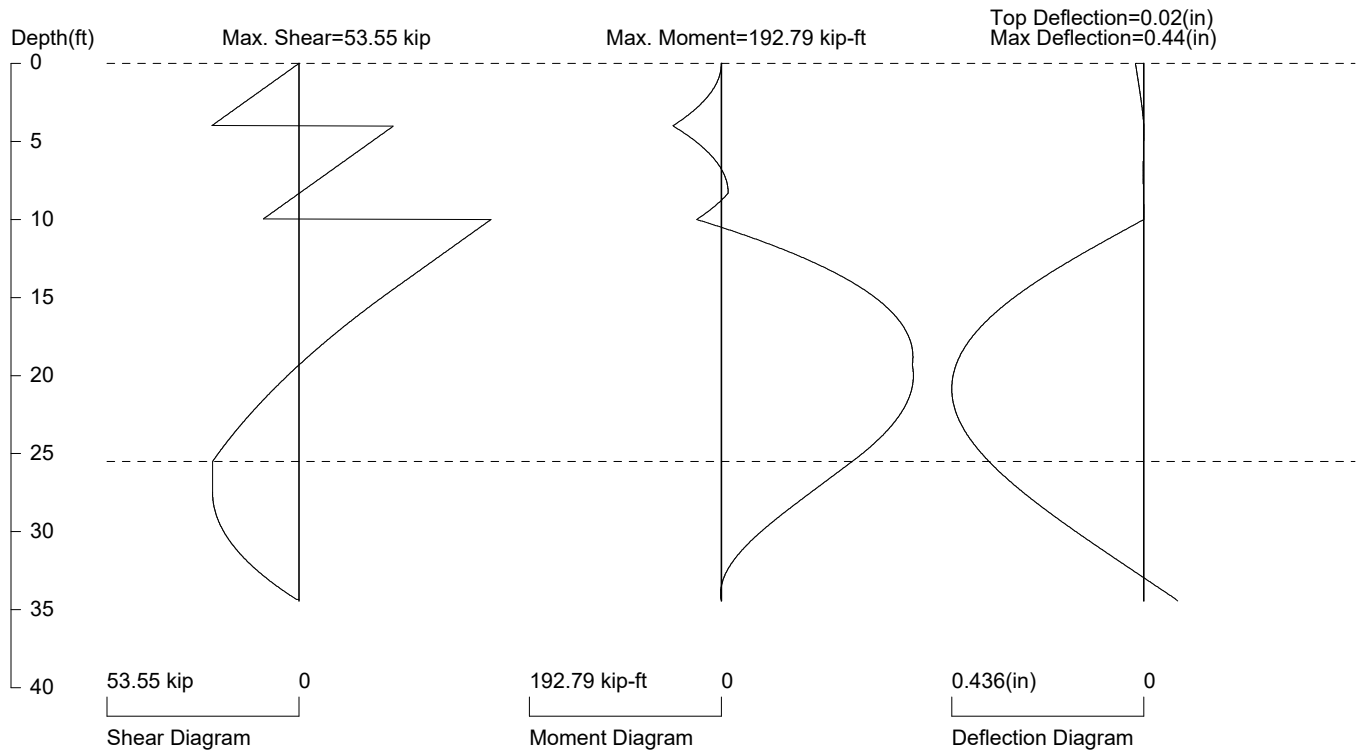
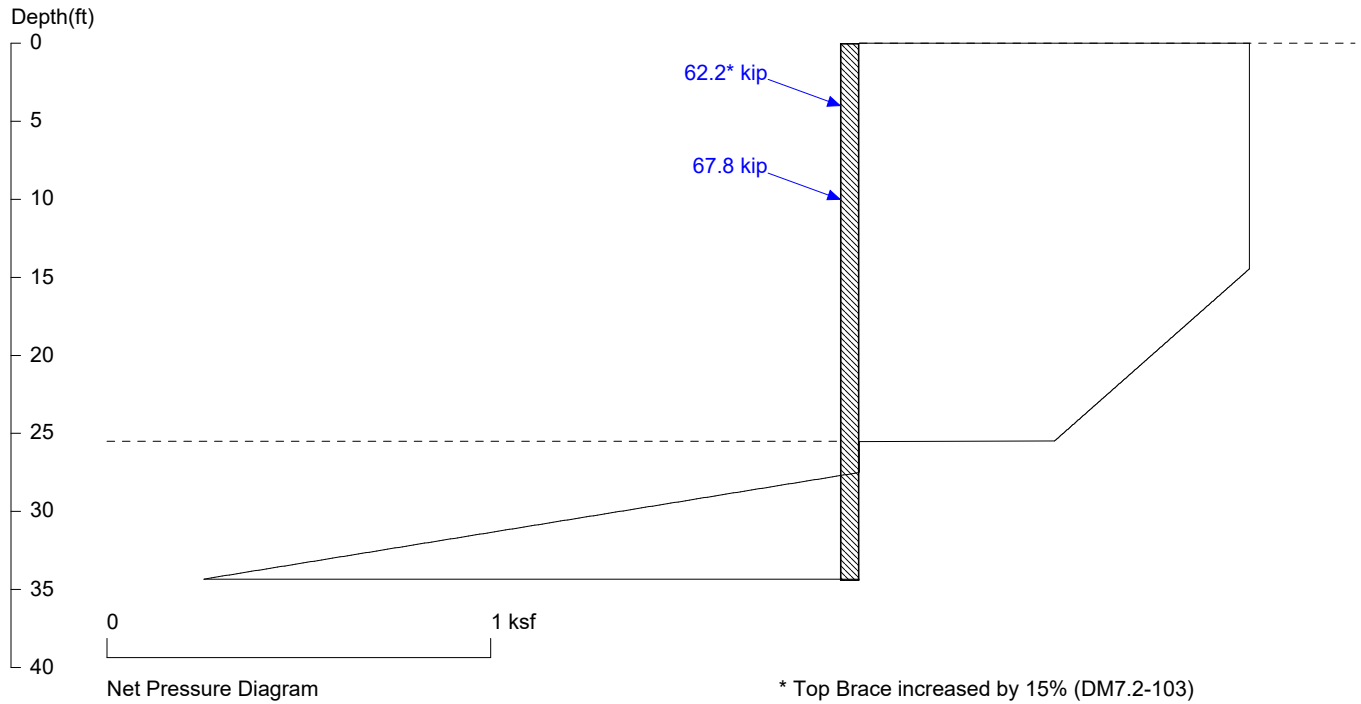
PASSIVE SPACING:

No.	Z depth	Spacing
1	25.50	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



E3 (25.5 ft @ 6 ft oc)



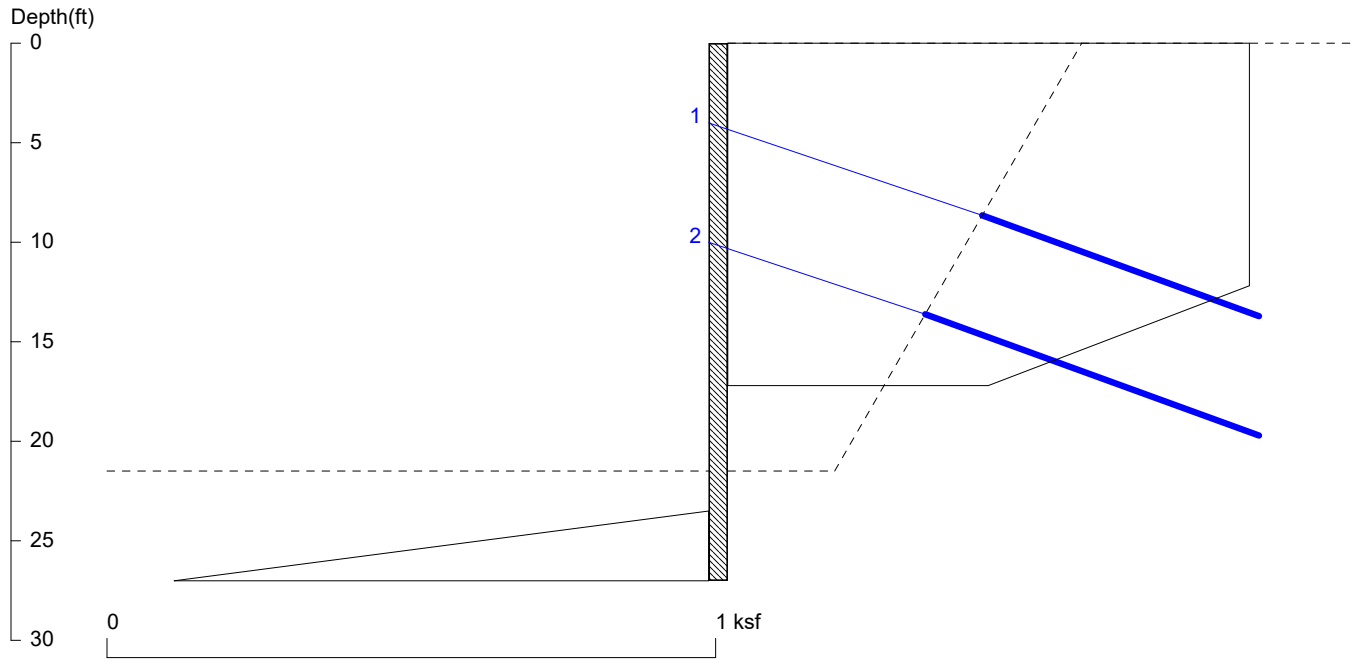
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X67: E (ksi)=29000.0, I (in⁴)/pile=954.0

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E3_25.5 ft @ 6 ft oc (Tieback).SH8

E8 (21.5 ft @ 6 ft oc)



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File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E8_2

Wall Height=21.5

Pile Diameter=2.0

Pile Spacing=6.0

Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=5.51 Min. Pile Length=27.01

MOMENT IN PILE: Max. Moment=47.97 per Pile Spacing=6.0 at Depth=14.94

PILE SELECTION:

Request Min. Section Modulus = 17.4 in³/pile=285.88 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W16X26 has Section Modulus = 38.4 in³/pile=629.26 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.05(in) based on E (ksi)=29000.00 and I (in⁴)/pile=301.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	Free	Fixed Length
1. Tieback	4.0	20.0	6.0	52.5*	49.3	17.9	1.6	3.4
2. Tieback	10.0	20.0	6.0	35.1	33.0	12.0	10.3	2.7

* Top Brace increased by 15% (DM7.2-103)

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
0	.8573	12.19	.8573	0.000000
12.19	.8573	17.2	.4286	-0.08561

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
23.5	0	31.5	2.000	.25

ACTIVE SPACING:

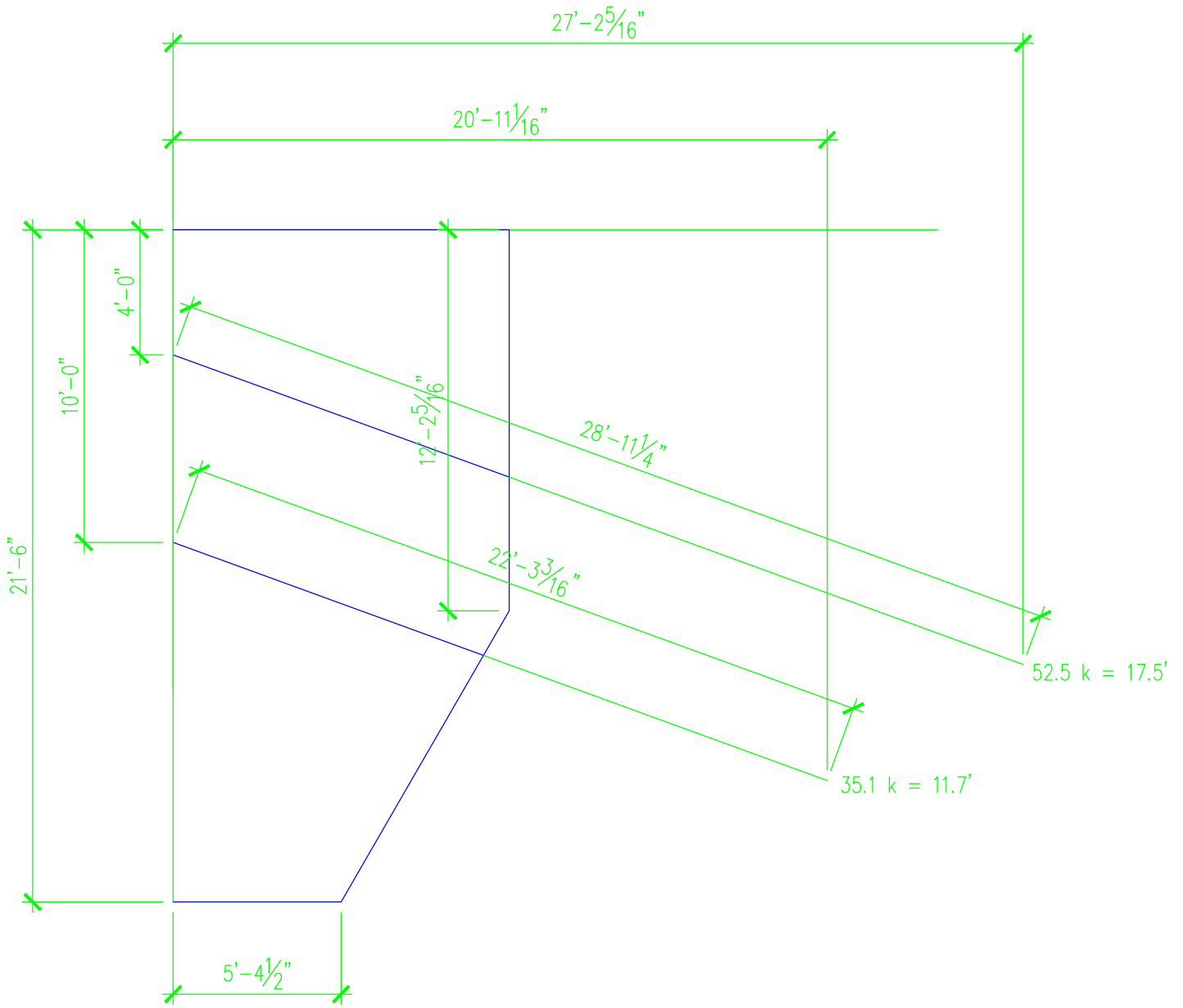
No.	Z depth	Spacing
1	0.00	6.00
2	21.50	2.00

PASSIVE SPACING:

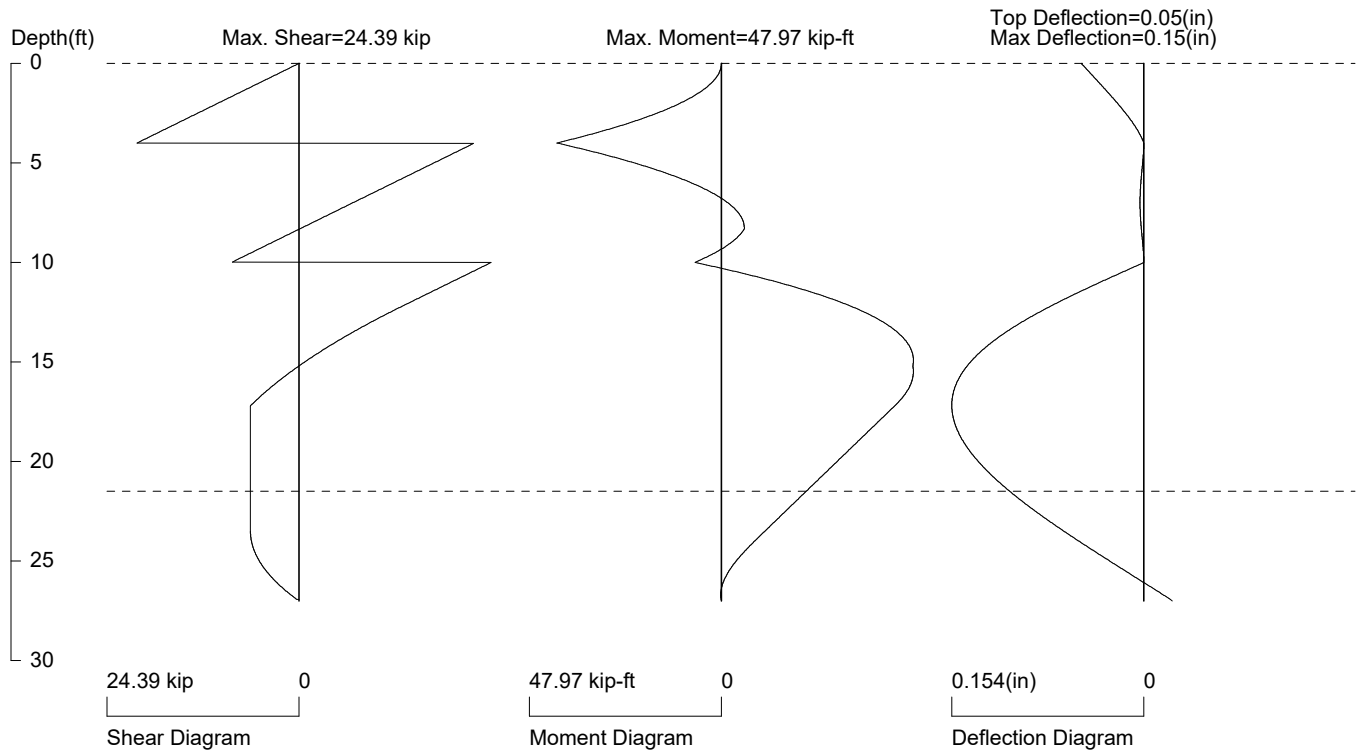
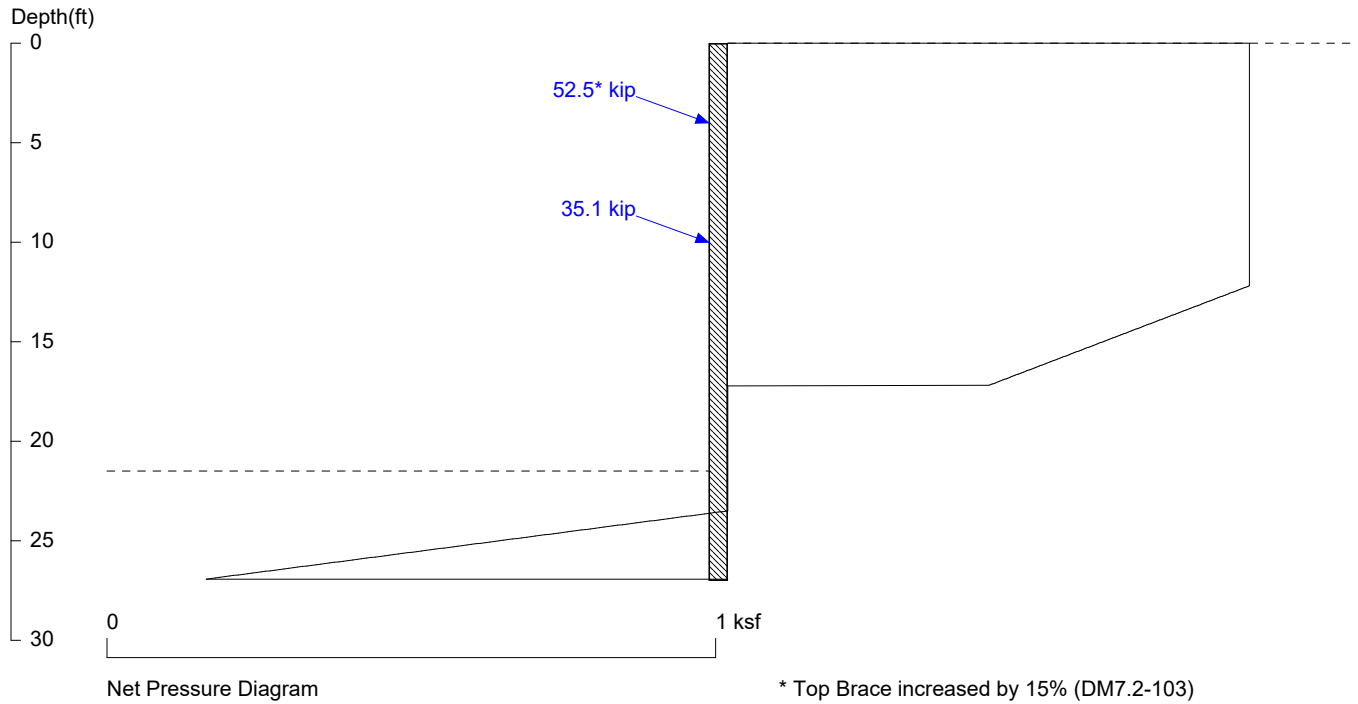
No.	Z depth	Spacing
1	21.50	4.00

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

E8



E8 (21.5 ft @ 6 ft oc)



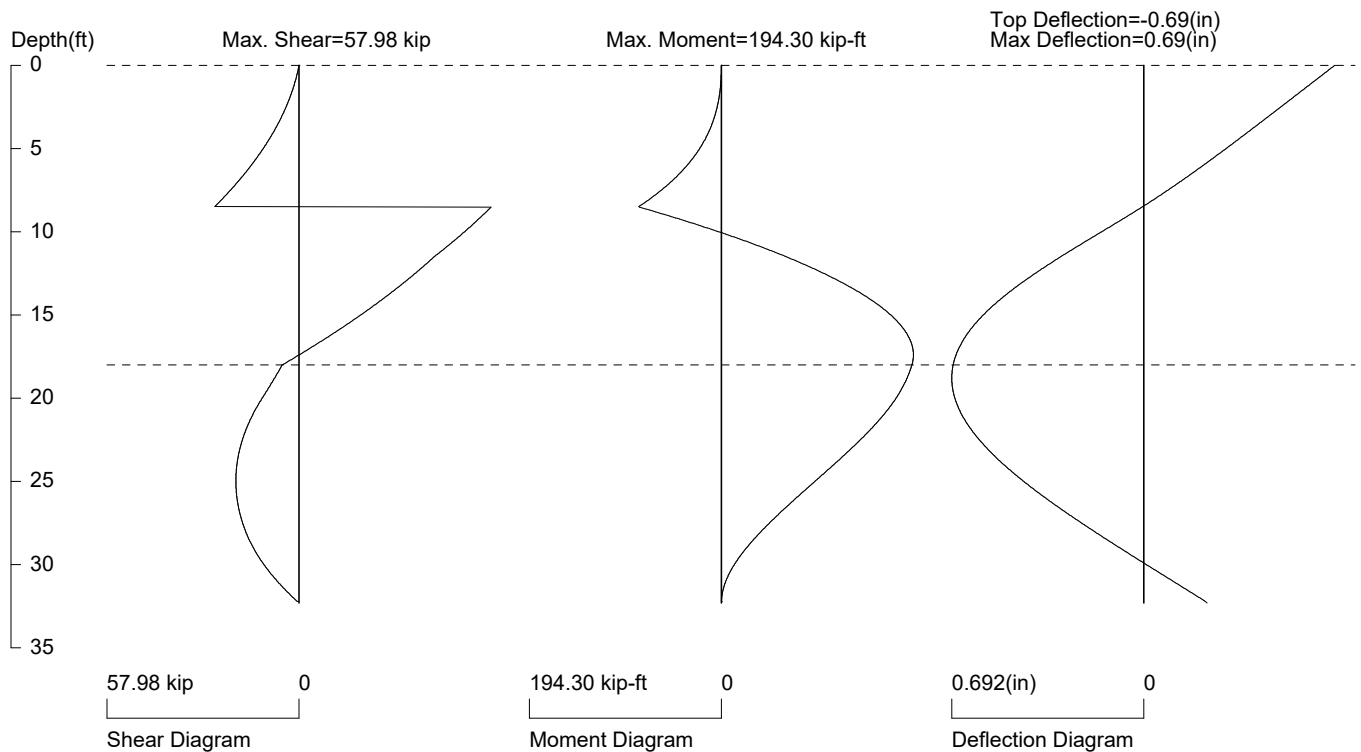
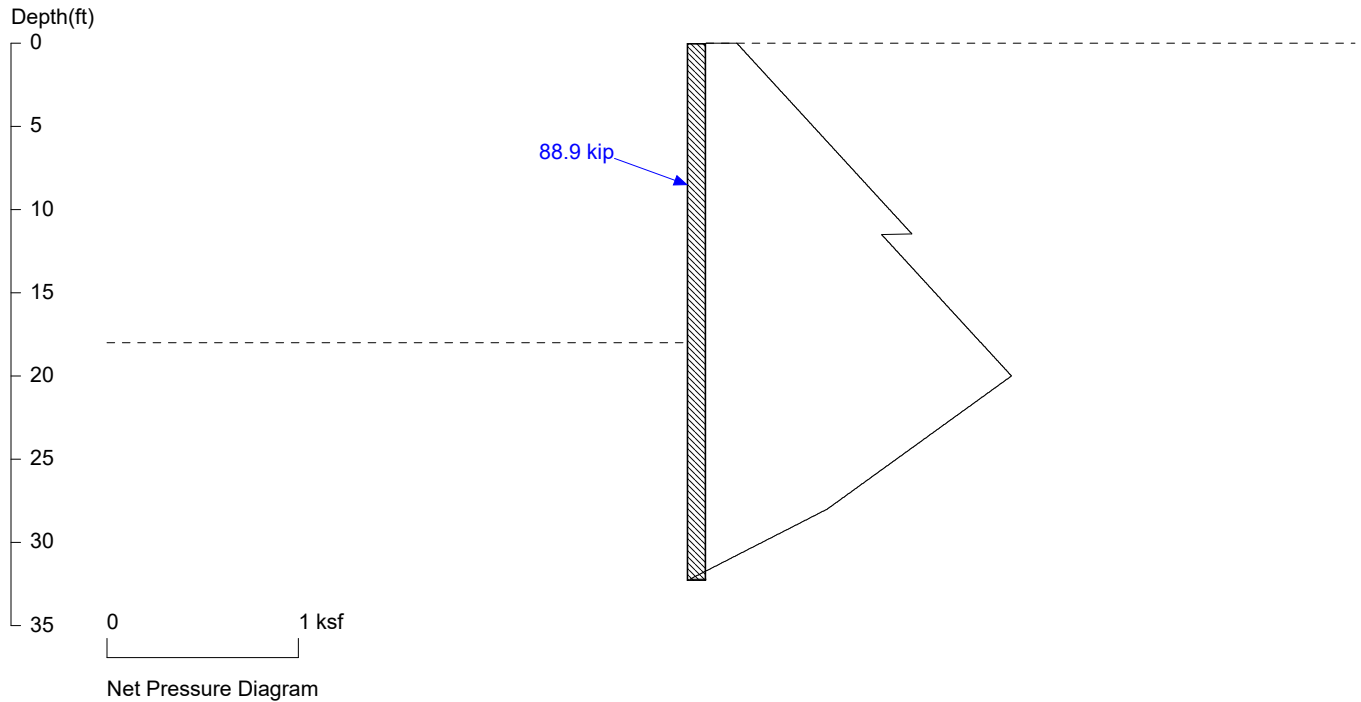
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X26: E (ksi)=29000.0, I (in⁴)/pile=301.0

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\Updated Double Tie-Back\E8_21.5 ft @ 6 ft oc (Tieback).SH8

E9 (18 ft @ 6 ft oc)



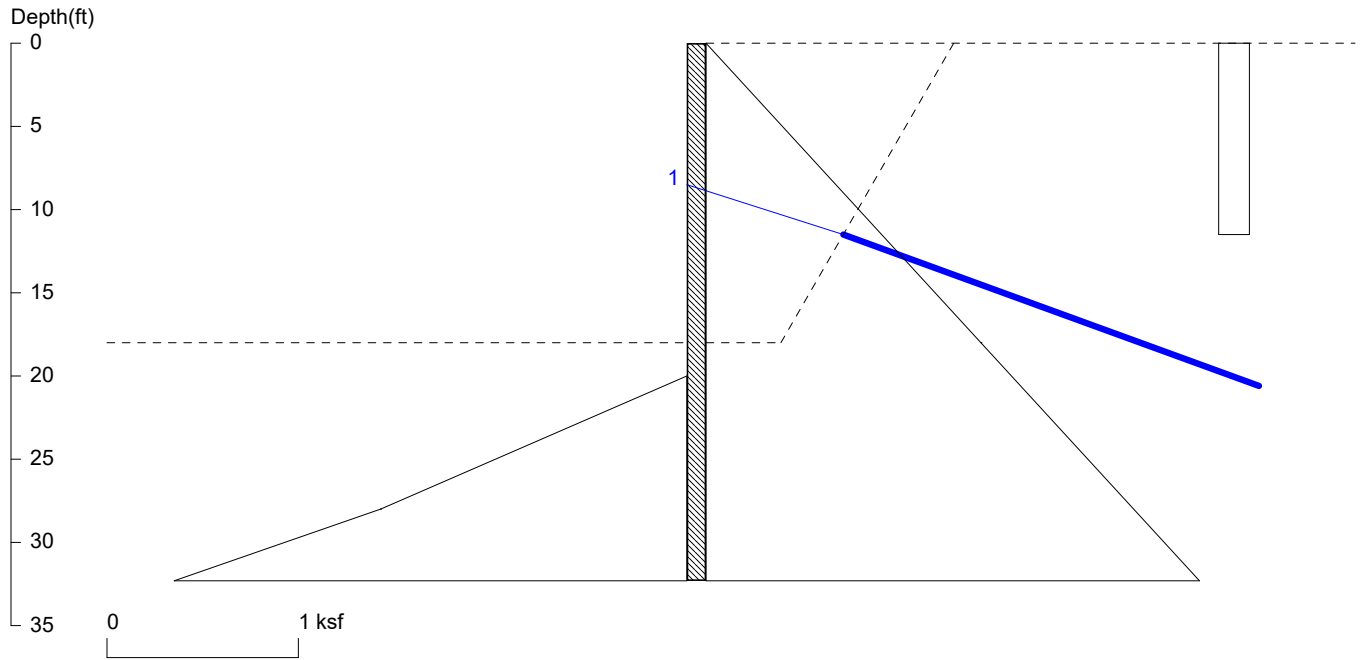
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

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

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\E9_18 ft @ 6 ft oc (Tieback).SH8

E9 (18 ft @ 6 ft oc)



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File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\E9_18 ft @ 6 ft oc (Tieback).SH

Wall Height=18.0 Pile Diameter=2.0 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.31 Min. Pile Length=32.31

MOMENT IN PILE: Max. Moment=194.30 per Pile Spacing=6.0 at Depth=17.40

PILE SELECTION:

Request Min. Section Modulus = 98.1 in³/pile=1608.08 cm³/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66

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

Top Deflection = -0.69(in) based on E (ksi)=29000.00 and I (in⁴)/pile=722.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	Free	Fixed Length
1. Tieback	8.5	20.0	6.0	88.9	83.6	30.4	X	X

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
0	0	18	1.436	0.07975
*	Below	Base		
18	1.436	100	7.976	.07975
0	.161	11.5	0.161	0

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
20	0	28	1.600	.20
28	1.600	200	44.600	0.25

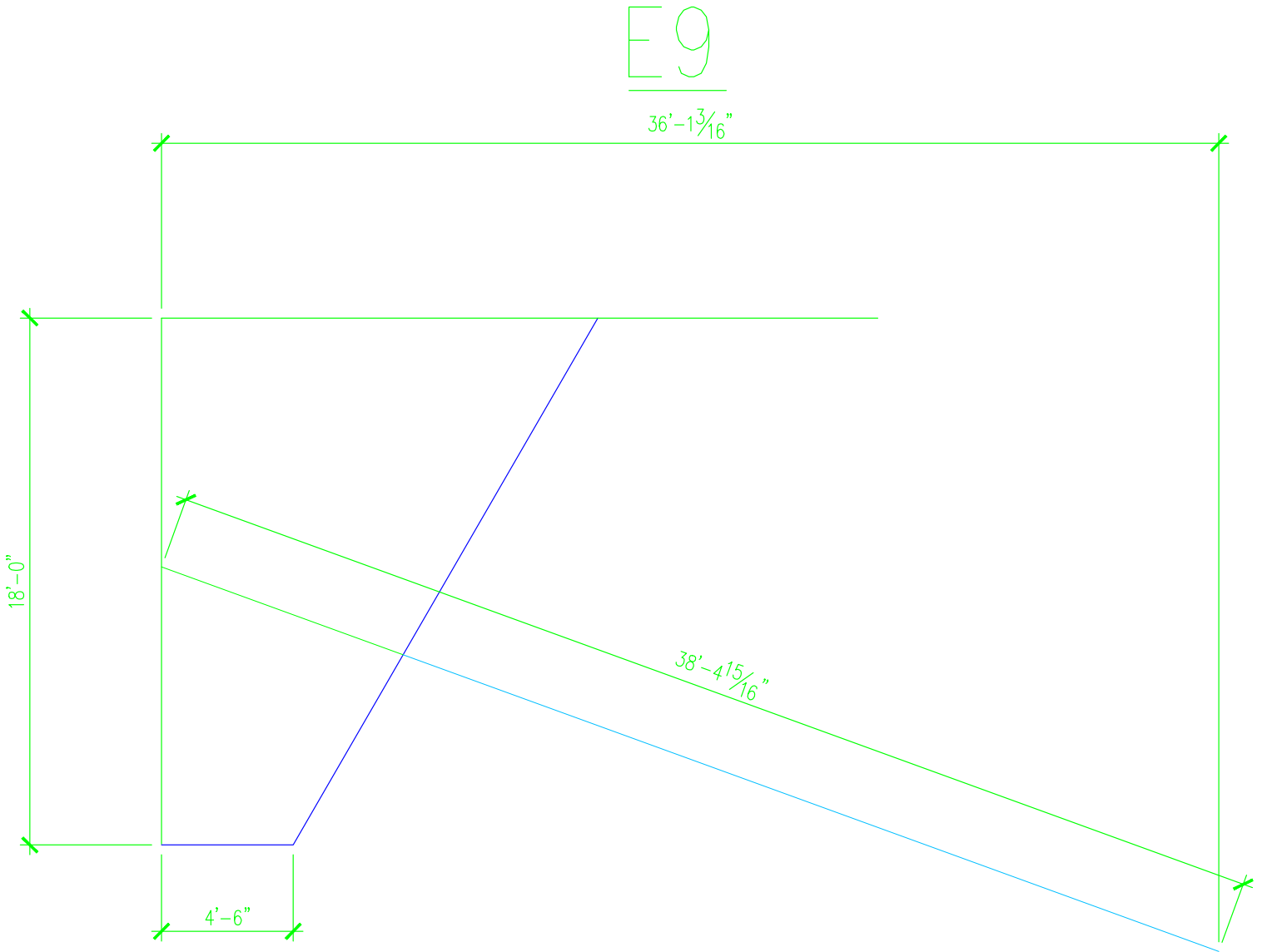
ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	6.00
2	18.00	2.00

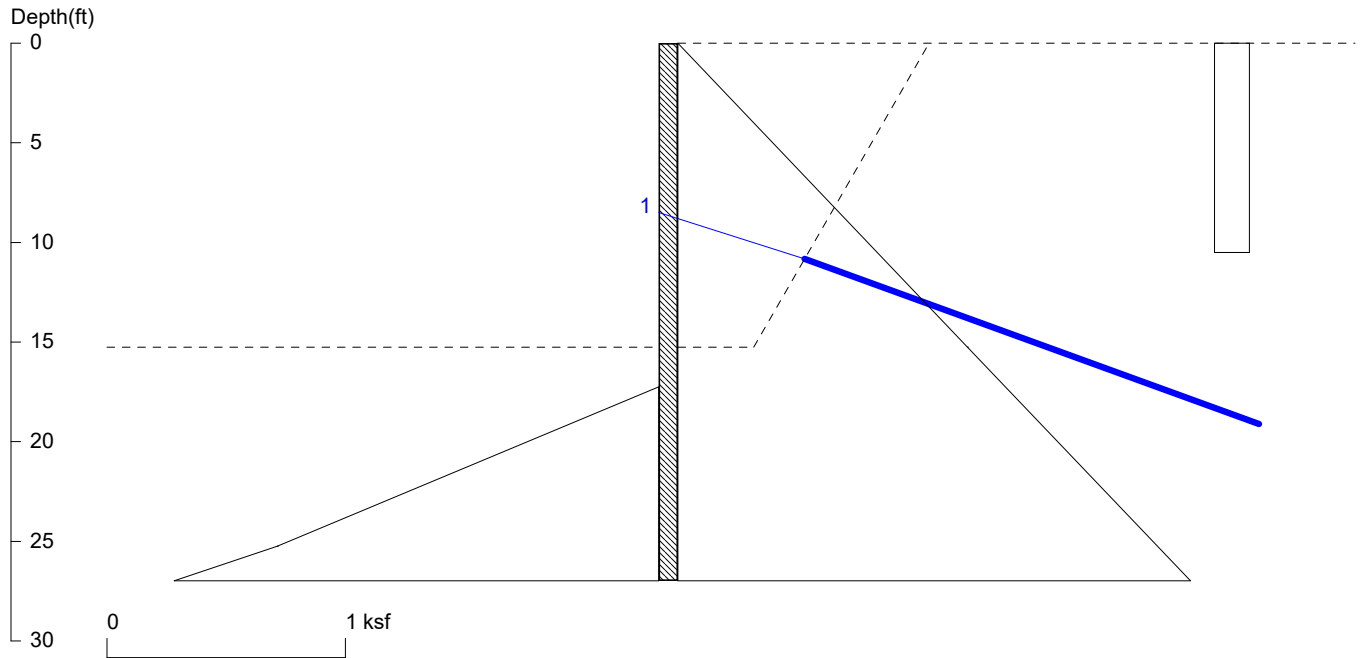
PASSIVE SPACING:

No.	Z depth	Spacing
1	18.00	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



E10 (15.25 ft @ 6 ft oc)



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File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\E10_15.25 ft @ 6 ft oc (Tieback

Wall Height=15.3

Pile Diameter=2.0

Pile Spacing=6.0

Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=11.73 Min. Pile Length=26.98

MOMENT IN PILE: Max. Moment=80.71 per Pile Spacing=6.0 at Depth=8.49

PILE SELECTION:

Request Min. Section Modulus = 29.3 in³/pile=480.94 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W16X26 has Section Modulus = 38.4 in³/pile=629.26 cm³/pile. It is greater than Min. Requirements!

Top Deflection = -0.13(in) based on E (ksi)=29000.00 and I (in⁴)/pile=301.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	Free	Fixed Length
1. Tieback	8.5	20.0	6.0	70.5	66.2	24.1	X	X

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
0	0	15.25	1.216	0.07975
*	Below	Base		
15.25	1.216	100	7.975	.07975
0	.147	10.5	0.147	0

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
17.25	0	25.25	1.600	.2
25.25	1.600	200	45.287	.25

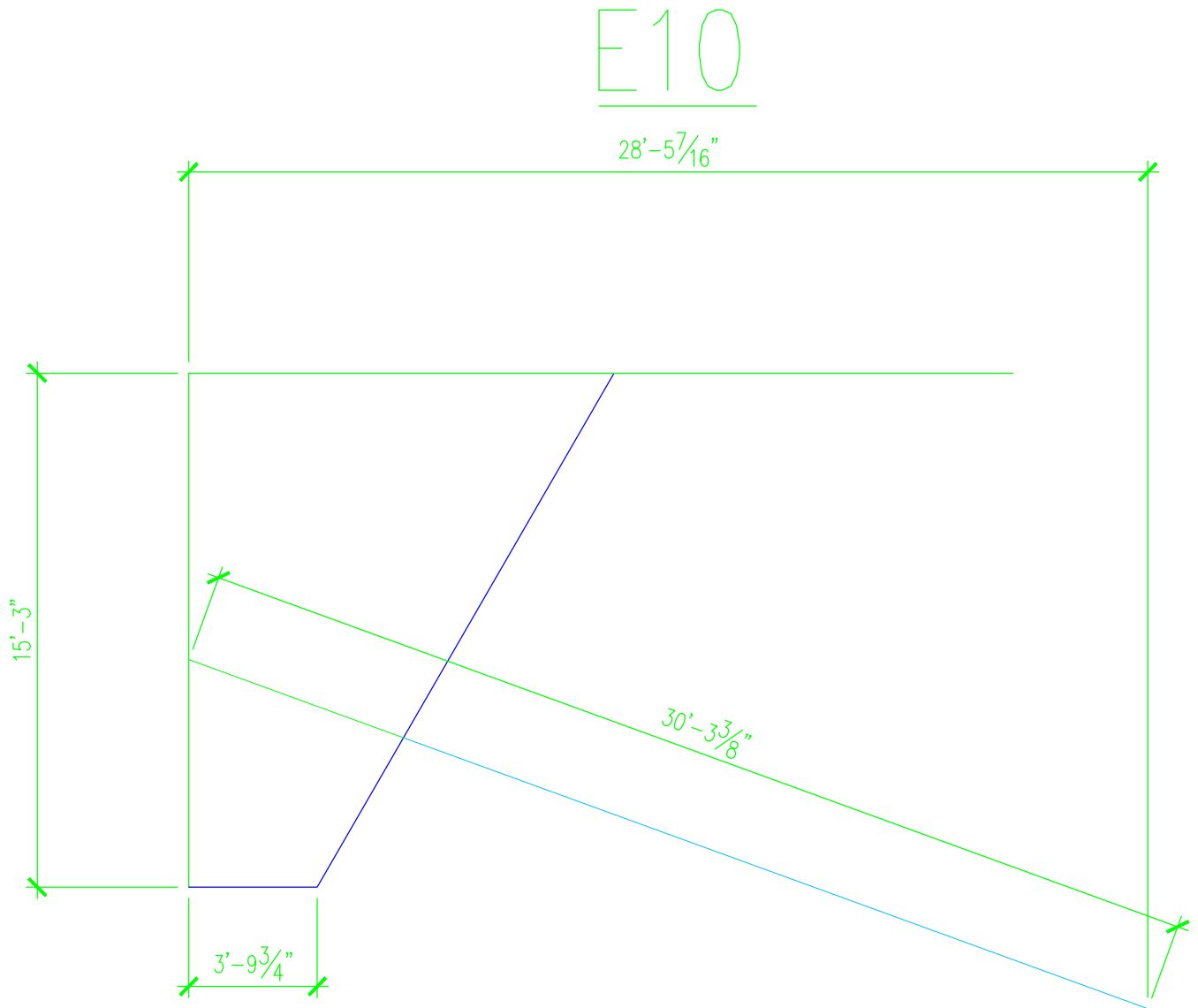
ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	6.00
2	15.25	2.00

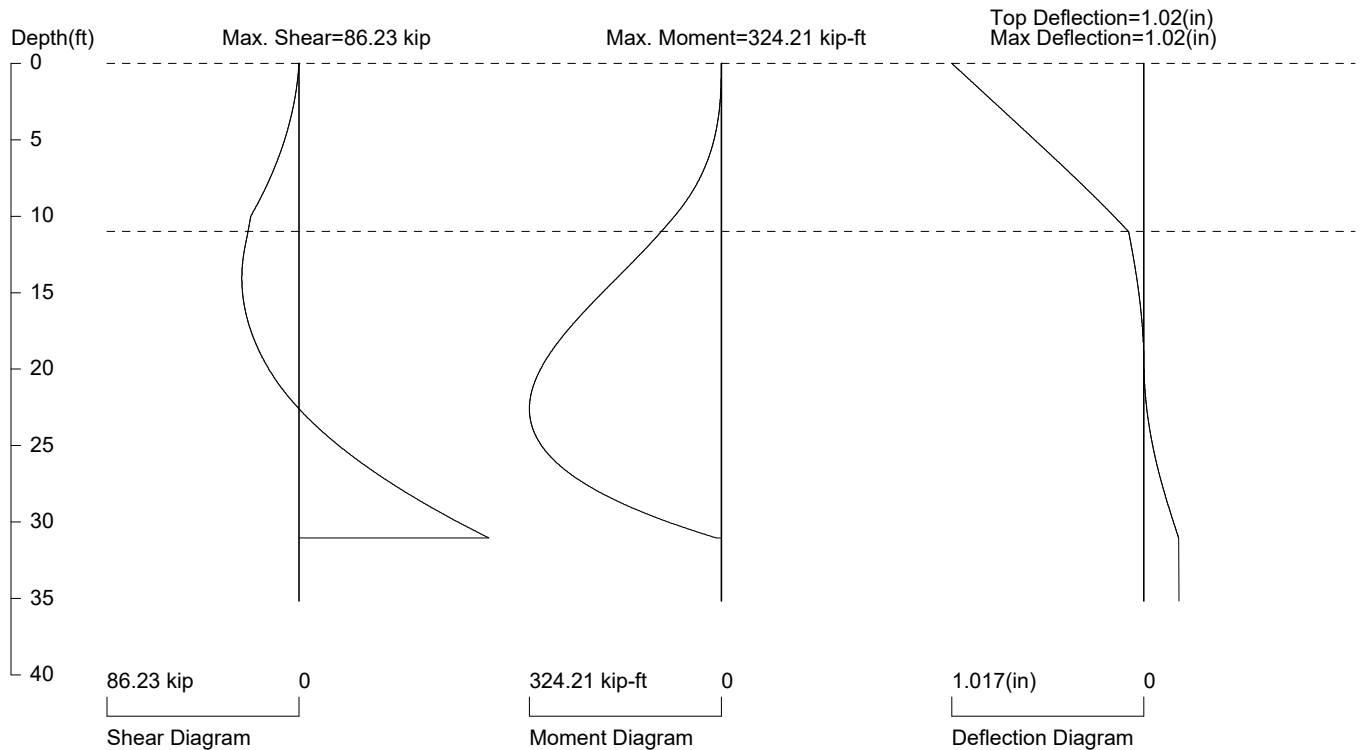
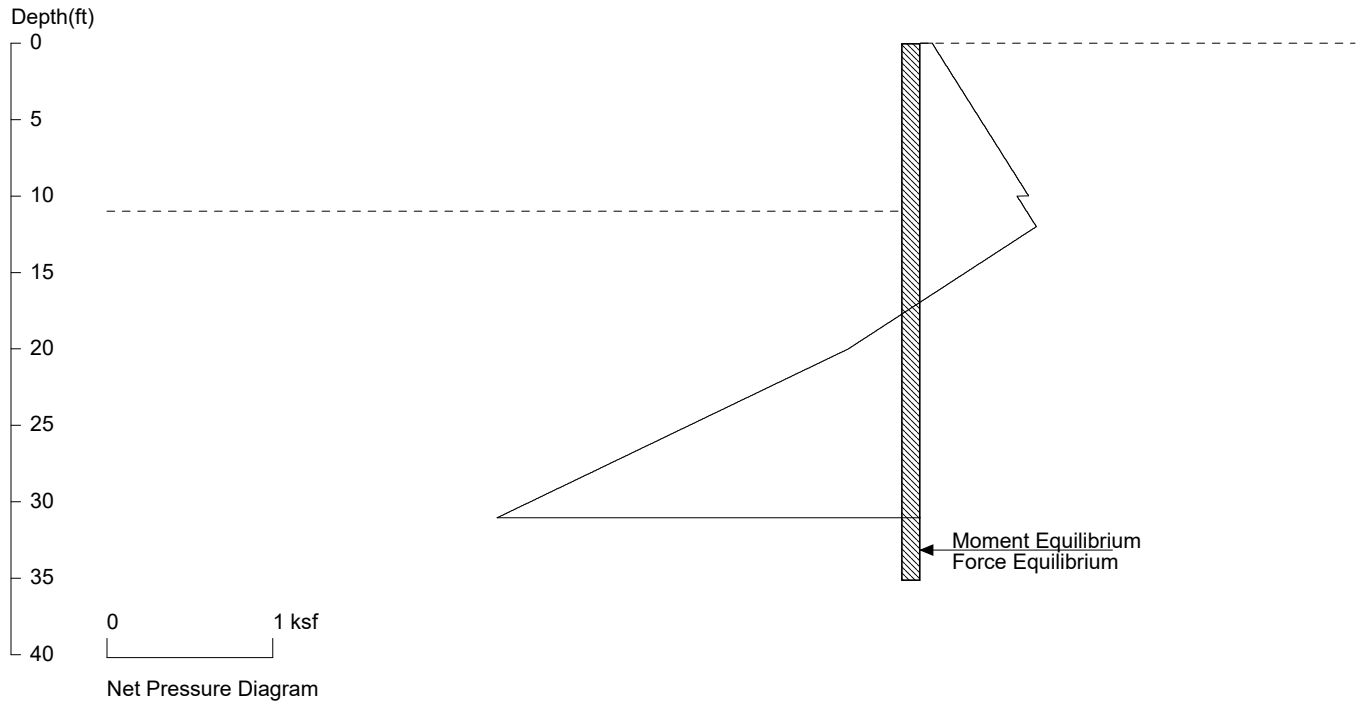
PASSIVE SPACING:

No.	Z depth	Spacing
1	15.25	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



E11-E12 (11 ft @ 6 ft oc)



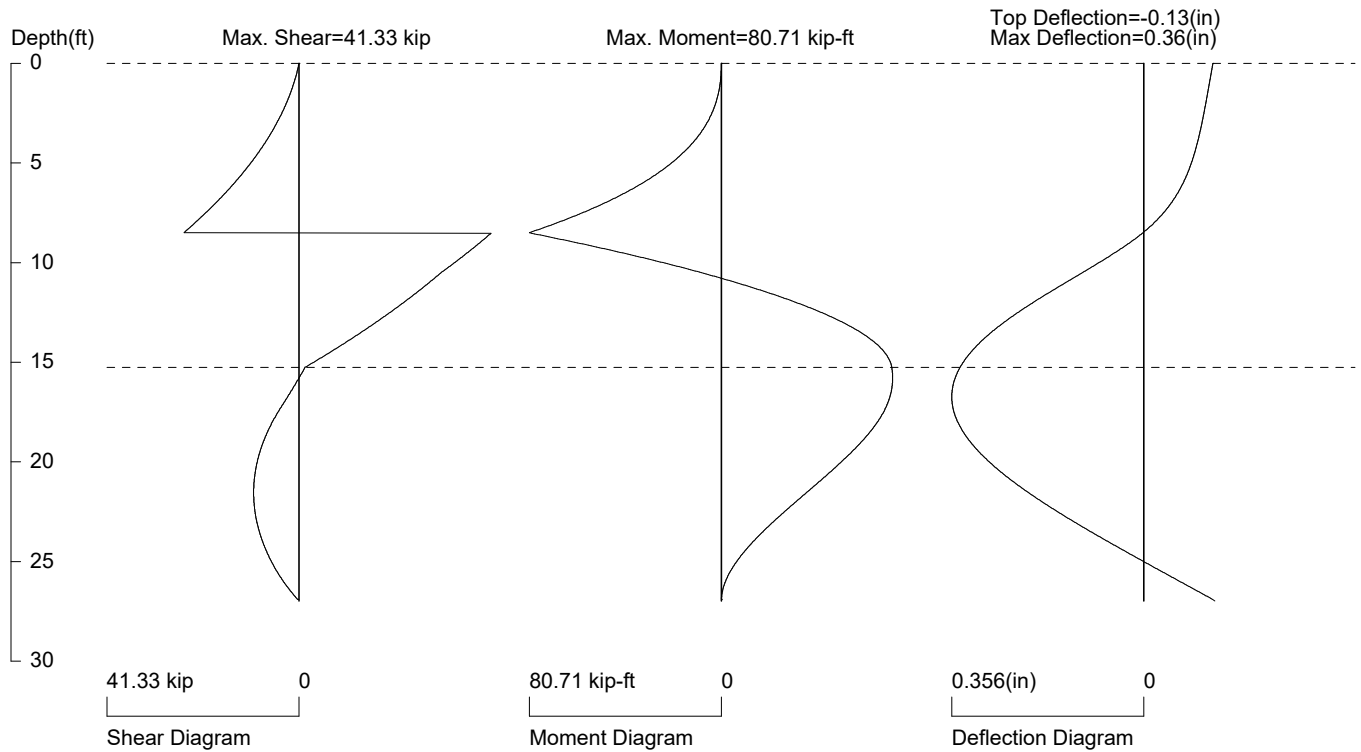
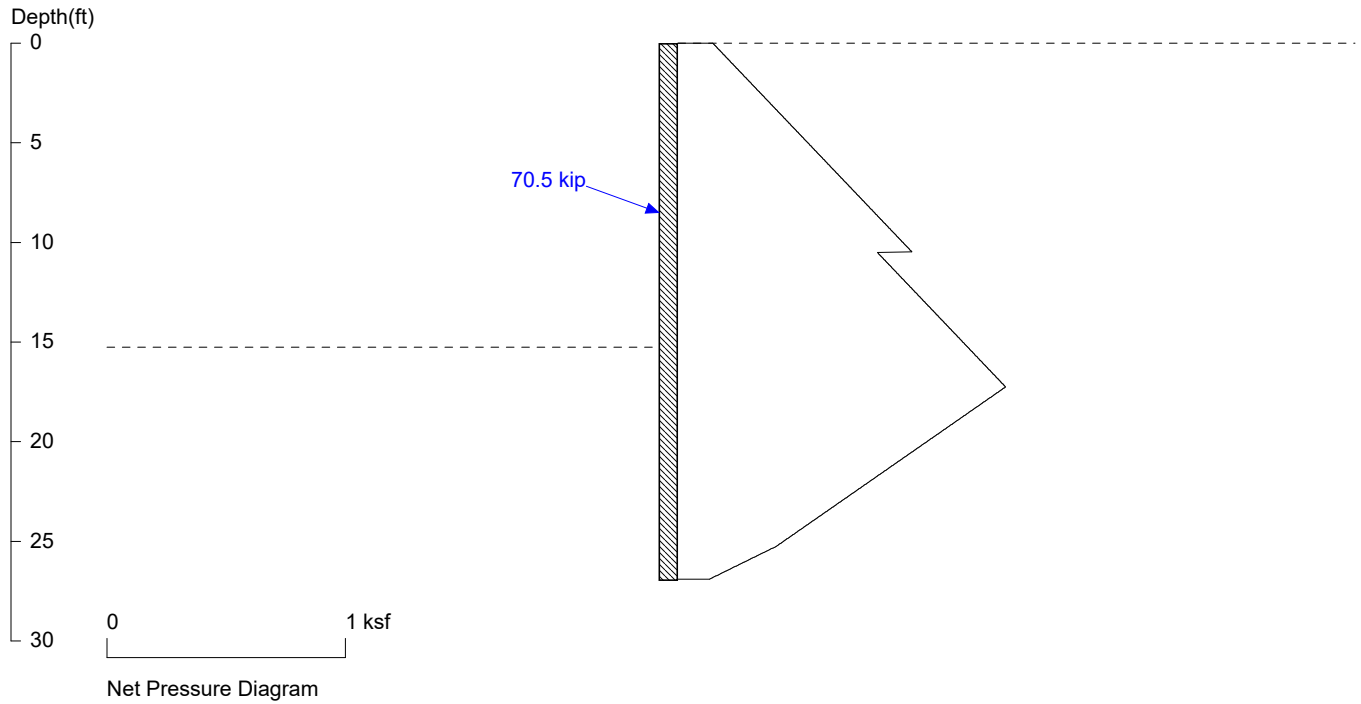
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W18X76: E (ksi)=29000.0, I (in⁴)/pile=1330.0

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\E11,E12_10 ft @ 6 ft oc (Cant).SH8

E10 (15.25 ft @ 6 ft oc)



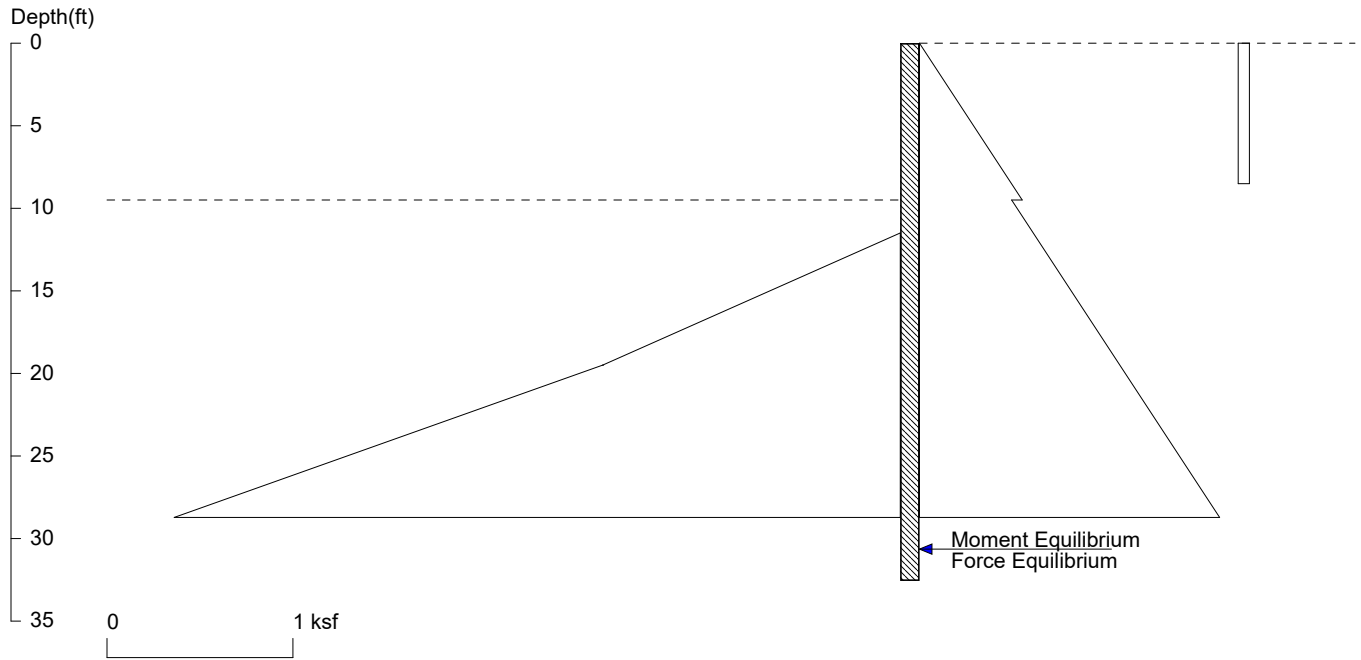
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X26: E (ksi)=29000.0, I (in⁴)/pile=301.0

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\E10_15.25 ft @ 6 ft oc (Tieback).SH8

E13-E14 (9.5 ft @ 6 ft oc)



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Date: 7/25/2025

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\E13_8.5 ft @ 6 ft oc (Cant).SH8

Wall Height=9.5

Pile Diameter=2.0

Pile Spacing=6.0

Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=23.06 Min. Pile Length=32.56

MOMENT IN PILE: Max. Moment=237.78 per Pile Spacing=6.0 at Depth=20.90

PILE SELECTION:

Request Min. Section Modulus = 86.5 in³/pile=1416.90 cm³/pile, F_y= 50 ksi = 345 MPa, F_b/F_y=0.66

W16X57 has Section Modulus = 92.2 in³/pile=1510.88 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 1.01(in) based on E (ksi)=29000.00 and I (in⁴)/pile=758.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	9.5	0.553	0.05825
*	Below	Base		
9.5	.495	100	5.767	.05825
0	.0595	8.5	0.060	

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
11.5	0	19.5	1.600	.2
19.5	1.600	200	46.725	.25

ACTIVE SPACING:

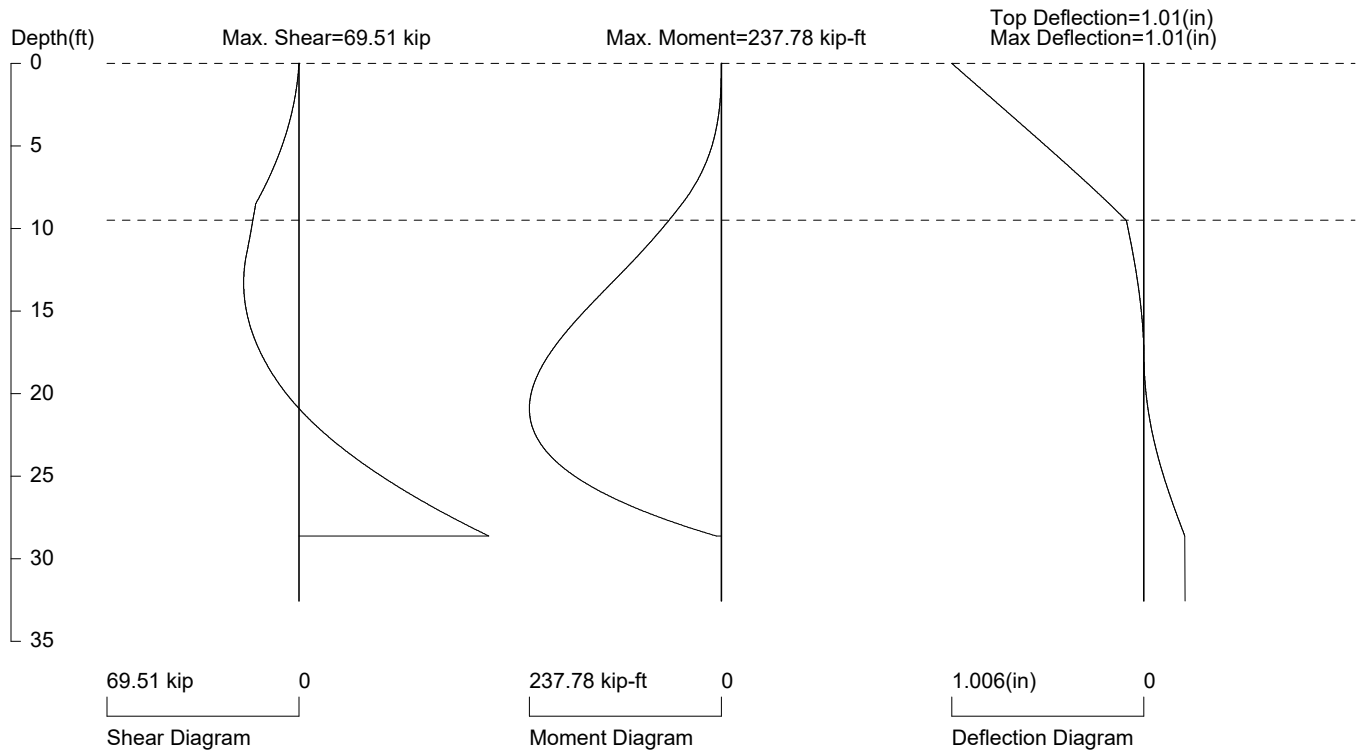
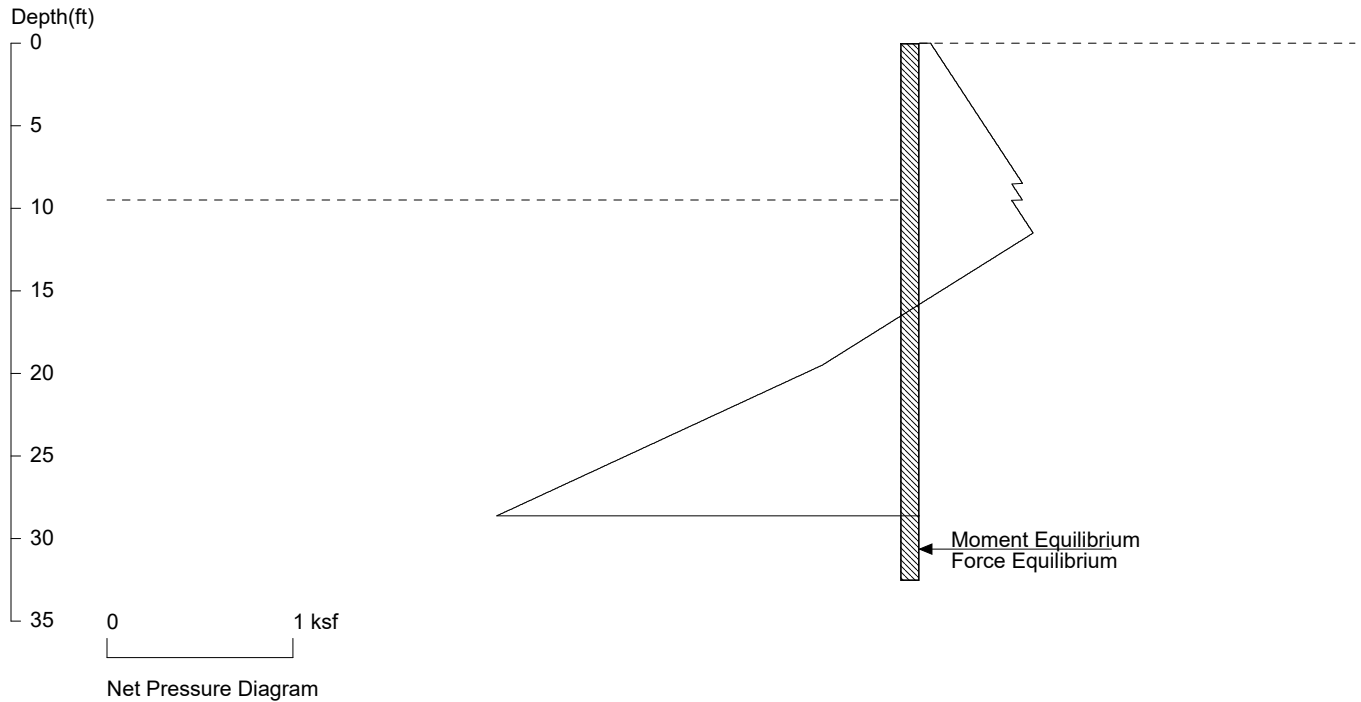
No.	Z depth	Spacing
1	0.00	6.00
2	8.50	2.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	8.50	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

E13-E14 (9.5 ft @ 6 ft oc)



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X57: E (ksi)=29000.0, I (in⁴)/pile=758.0

File: C:\Users\javid\OneDrive\Desktop\Atlas Projects\269-2024 (5818 West Mercer)\Shoring\E13_8.5 ft @ 6 ft oc (Cant).SH8