Ground Support PLLC

15704 NE 157th Street
Woodinville, WA 98072
Phone 425.985.9338
www.groundsupport.com

Design Memorandum

PROJECT: Saint Luke's Mixed Use (Project No. 23-10)

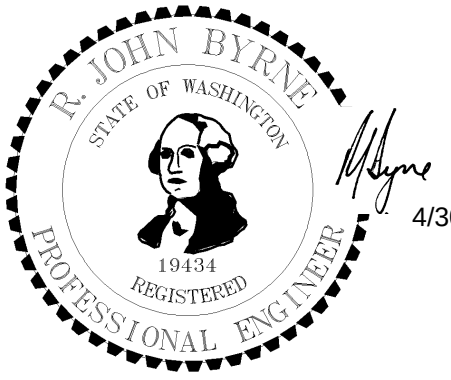
ADDRESS: 5710 22nd Avenue NW
Seattle, WA 98107

CLIENT: Security Properties
701 Fifth Avenue, Suite 5700
Seattle, WA 98104
Attn: Mike Gruber

DATE: April 30, 2023

REFERENCES:

1. "Geotechnical Report, Proposed Mixed-Use Development, 22nd Avenue Northwest and Northwest 58th Street, Seattle, Washington", prepared by PanGEO Incorporated, dated January 6, 2020.
2. FHWA Manual for the Design and Construction Monitoring of Soil Nail Walls, Report No. FHWA-SA-96-069.
3. 2018 International Building Code.
4. "Geotechnical Engineering Circular No. 4, Ground Anchors and Anchored Systems", FHWA, dated June 1999.



4/30/2023

BACKGROUND:

The mixed-use apartment development site is located at 5710 22nd Avenue NW in Seattle, Washington. The site to be developed is bounded by NW 57th Street to the south, 22nd Avenue NW to the west, NW 58th Street to the north and by private properties to the east. The planned project consists of 8 above-grade levels over two levels of underground parking. The surface topography slopes from elevation 87 feet in the north to 81 feet in the south. The building excavation footprint is slightly irregular in shape with overall dimensions of 199 feet (east-west) by 196 feet and generally follows the property lines along the south and west sides. Much of the north side is set back approximately 30 feet from the property line and much of the east side is set back about 10 feet from the property line. The planned base of excavation elevation is at 57 feet in general (allowing for footing depths) and steps up to elevation 62 feet in the southeast, with depths of excavation ranging from 19 to 30 feet and an overall shored surface area of 20,000 SF.

SUBSURFACE CONDITIONS:

The geotechnical report indicates that the soils consist of up to 5 feet of fill materials overlying glacial till. The upper few feet of the till may be weathered. Limited perched water might be encountered during construction.

SHORING SYSTEM:

A soil nail shoring system will be used to support most of the planned excavation. The soil nail construction sequence consists of excavating a vertical cut, installing fully grouted bar tendons, placing face reinforcement, and shooting a temporary structural shotcrete facing that is connected to the nail heads. This sequence is subsequently repeated until the base of the excavation is reached. The project is built close to the City ROW along the south and west sides and vertical elements will not be used to keep soil nails at a minimum depth of 4 feet below the surface grades. Instead, temporary construction sloping will be used to allow safe construction without the use of vertical steel. At a couple of locations, anchored soldier pile shoring will be used. In the northern portion of the east wall, conventional anchored soldier piles with wood lagging will be used to protect the adjacent development that is planned to precede this project. In addition, in the northwest portion of the site where a complex excavation shape is planned with re-entrant corners requiring crossing shoring elements, the shoring design will revert to anchored soldier piles with bar anchors and a shotcrete facing in order to facilitate crossing of the anchors (fewer anchors than nails are required) and to blend seamlessly with the soil nail shoring.

DESIGN PARAMETERS:

Soil Nail Shoring:

The following soil properties have been used to design the soil nail shoring:

Fill:

Unit Weight	125 pcf
Cohesion	50 psf
Friction Angle	32 degrees
Ultimate Pullout	2 klf

Till:

Unit Weight	130 pcf
Cohesion	150 psf
Friction Angle	38 degrees
Ultimate Pullout	6 klf

The Service Load Method (SLD) of design was employed in this study. In accordance with the FHWA Manual, a factor of safety of 1.35 was applied to the soil strengths. In addition, the allowable steel tendon load was taken as 55 percent of yield, the allowable pullout resistance of the nail grout-ground bond was taken as 50 percent of ultimate, and the allowable load at the nail head connection was taken as 67 percent of nominal.

A live load vertical surcharge of 500 psf was used to account for surface construction surcharge loading around the perimeter of the excavation.

Soldier Pile Shoring:

Design earth pressures corresponding to the soil self-weight are recommended in the geotechnical report as an equivalent fluid density of 35 pcf for cantilevered soldier piles. For anchored soldier piles supported by multiple rows of anchors, a trapezoidal design earth pressure with a maximum value of 20H psf is recommended.

In addition, the geotechnical report recommends the following design values for determining the depth of toe embedment of the soldier piles beneath the base of the excavation:

Passive Equivalent Fluid Density	350 pcf over 2 pile diameters
Allowable Pile End Bearing	30 ksf
Allowable Pile Skin Friction	0.5 ksf

Lateral earth pressures corresponding to anticipated live load and dead load surcharges are indicated on the Plans.

DESIGN:

Nails:

The design analysis output is presented in Appendix A, which indicates that No. 8 through No. 9 Grade 75 steel nails will be required, on a horizontal spacing 6 feet. Nail lengths vary up to 25 feet.

Temporary Facing:

The analyses of Appendix A also indicate the required nominal nail head strength for each of the design sections and the facing and connection designs are presented in Table 1. The temporary shotcrete facing will consist of 4-inches of shotcrete, reinforced with welded wire mesh, waler bars and vertical bearing bars as noted on the Plans. The facing is connected to each nail by an 8-inch square bearing plate and nut.

Anchors:

Individual anchor loads are developed from the design earth pressure diagrams presented on the Plans, using a tributary area method to assign loads to the individual anchors and to the toe shear in the piles. Anchor lengths are then determined from the no-load zone (see Plans) and the required

bond zone. The length of the bond zone is determined from the anchor design load and the allowable pullout value. The pullout values have been determined based on an assessment of the predominant materials within which anchorage occurs. An allowable pullout resistance of about 3.5 kips per linear foot (klf) has been used for the till within which the anchors will be bonded. Anchor design loads and lengths are provided for each anchor in Appendix B.

Soldier Piles:

Soldier pile loadings are determined from the design earth pressure diagrams and the locations and inclinations of the anchors. The spreadsheet output presented in Appendix C summarizes the following design aspects for the final condition following completion of the excavation:

- Calculation of soldier pile loads and bending moments, consistent with the design apparent earth pressure diagrams provided on the Plans. For each soldier pile, the calculated shear force, axial load and bending moment are provided. Representative earth pressure diagrams, together with calculated shear force and bending moment diagrams, are also shown for a number of piles, in Appendix C.
- Calculation of pile toe embedment requirements (for lateral support and vertical load resistance) using the criteria indicated on the Plans.
- Pile structural steel sizing in accordance with the AISC 360-16 Specification for Structural Steel Buildings. Combined flexure and axial load, shear, and compact section steel design checks are performed for the critically loaded section of each pile along the length of the wall. The spreadsheet output summarizes the minimum steel section required for each pile.

Similar information is provided for the initial cantilever stage of construction, prior to the installation of the anchors, in Appendix D.

Anchor/Pile Connections:

The tieback anchors will use two types of connections to the soldier piles. Where strand anchors are used on the east shoring wall to support the wood-lagged soldier piles, conventional sidewinder type connections will be used. The design of this type of connection system is summarized in Table 2. Required weld lengths and connection plate sizes were determined in accordance with AISC 360-16 and for ASTM A572 (Grade 50) steel plates and E70XX weld electrodes. In general, where bar anchors are used to support the shotcrete-faced soldier piles of the north wall, the anchors will be connected via tubular steel walers that are encapsulated within the shotcrete facing. The design of these waler connections is summarized in Table 3. At specific corner piles within the north wall, the bar anchors are connected directly to the soldier piles with conventional sidewinder type pockets.

Lagging:

Timber lagging will be used to support the soil between adjacent soldier piles of the east wall. The average design earth pressures for the lagging are indicated in Appendix B, and these design earth pressures are derived directly from the design earth pressure diagrams. Hem-Fir No. 2 lagging (4-inch) or equivalent will provide adequate support for the soil between the soldier piles, per the recommendations of the FHWA Engineering Circular No. 4.

Shotcrete Facing – Bar Anchored North Wall:

In the western portion of the north shoring wall where bar anchors and soldier piles are used to facilitate shoring the complex geometrical shape of the excavation, the shotcrete facing must be attached directly to the soldier piles with welded headed studs. Design calculations for the facing and connection design are presented in Appendix E. These calculations indicate that the 4-inch-thick shotcrete facing in this area must be reinforced with No. 4 bars on 9-inch vertical centers in addition to the welded wire mesh used more generally for the shotcrete facing and attached to the soldier piles with welded headed studs on 18-inch vertical centers.

Deformation Calculations:

Appendix F presents representative design calculations of the deformations of the soldier piles that are immediately adjacent the footing loads for the planned project to the immediate east, for the initial cantilevered stage prior to the installation of the top row of anchors. The calculations indicate that predicted deformations at the base of the footing will not exceed 0.5 inches. In terms of overall deformations adjacent the City ROW, it is anticipated that maximum lateral movements at the top of wall will not exceed 0.5 inches.

TABLES

Soil Nail Wall Facing Analysis	Version 2.00 - 01/13/98

Geometry & Miscellaneous Input Data	
Vertical Nail Spacing, S_V (ft)	6.00
Horizontal Nail Spacing, S_H (ft)	6.00
Facing Thickness, t_F (in)	4.00
Facing Usuage (Temporary, Permanent)	Temporary
Nail Pattern (Rectangular, Staggered)	Rectangular
Resistance Factor for Facing Flexure, ϕ_F	1.00
Vertical Bearing Bar Continuity Factor (0 = Cutoff, 1 = Continuous)	0.00
Continuity Factor For All Positive Moment Steel (0 = Cutoff, 1 = Continuous)	1.00

Reinforcement Details	
Steel Depth, d (in)	2.00
Area of a Main Vertical Bar/Wire, A_{MV1} (in^2)	0.040
Main Vertical Bar/Wire Spacing, s_{MV} (in)	6.0
Area of Vertical Bearing Bar Reinforcement, A_{VB} (in^2)	0.60
Area of a Main Horizontal Bar/Wire, A_{MH1} (in^2)	0.040
Main Horizontal Bar/Wire Spacing, s_{MH} (in)	6.0
Area of Waler Bar Reinforcement, A_{WB} (in^2)	0.40

Material Properties	
Concrete Compressive Strength, f'_C (ksi)	4.0
Main Reinforcement Yield Stress, F_Y (ksi)	60.0
Waler/Vertical Bearing Bar Reinforcement Yield Stress, F_Y (ksi)	60.0

Facing Flexure Nailhead Capacity Calculations	
Facing Flexure Factor, C_F	2.00
Gross Reinforcement Ratio, Negative Moment, Vertical Direction, ρ_{NV}	0.38%
Gross Reinforcement Ratio, Positive Moment, Vertical Direction, ρ_{PV}	0.17%
Gross Reinforcement Ratio, Negative Moment, Horizontal Direction, ρ_{NH}	0.31%
Gross Reinforcement Ratio, Positive Moment, Horizontal Direction, ρ_{PH}	0.31%
Negative Unit Moment Capacity in Vertical Direction, m^-_V (k-ft/ft)	1.681
Positive Unit Moment Capacity in Vertical Direction, m^+_V (k-ft/ft)	0.776
Negative Unit Moment Capacity in Horizontal Direction, m^-_H (k-ft/ft)	1.388
Positive Unit Moment Capacity in Horizontal Direction, m^+_H (k-ft/ft)	1.388
Nominal Nail Head Strength in Vertical Direction, $T_{FN,V}$ (k)	39.3
Nominal Nail Head Strength in Horizontal Direction, $T_{FN,H}$ (k)	44.4
Design Nail Head Strength, ϕT_{FN} (k)	39.3

TABLE 1

FACING FLEXURAL STRENGTH

Soil Nail Wall Facing Analysis & Design	Version 1.10 - 08/05/96

Geometric and Material Parameters	
Vertical Nail Spacing, S_V (ft)	6.00
Horizontal Nail Spacing, S_H (ft)	6.00
Facing Thickness, t_F (in)	4.00
Connection Type (Bearing, Headed Stud)	Bearing
Facing Usuage (Temporary, Permanent)	Temporary
Resistance Factor for Facing Punching Shear, ϕ_S	1.00
Plate Width, b_{PL} (in)	8.00
Plate Thickness, t_{PL} (in)	0.75
Permanent Cover to Plate on Soil Side, C_{PL} (in)	0.00
Headed Stud Embedment Length, L_{HS} (in)	0.00
Headed Stud Spacing, S_{HS} (in)	0.00
Grout Column Diameter, D_{GC} (in)	0.00
Concrete Compressive Strength, f'_C (ksi)	4.0

Calculations	
Nail Head Pressure Increase Factor for Punching Shear, C_S	2.40
Equivalent Cone Depth, h_C (in)	4.00
Equivalent Top Cone Diameter, D''_C (in)	8.00
Cone Bottom Diameter, D_C (in)	16.00
Effective Cone Diameter, D'_C (in)	12.00
Cone Bottom Area, A_C (in^2)	201.1
Grout Column Area, A_{GC} (in^2)	0.0
Shear Stress Area, A_V (in^2)	150.8
Nominal Punching Shear Stress, v_N (psi)	253.0
Nominal Punching Shear Strength of Facing, V_N (k)	38.1
Strength Ratio From Pressure Concentration, T_{FN}/V_N	1.10
Design Nail Head Strength, $\phi_S T_{FN}$ (k)	42.1

TABLE 1 (cont'd)

FACING PUNCHING SHEAR STRENGTH

ANCHOR POCKET DESIGN SPREADSHEET **VERSION 2.0 (7/24/01)**

DESIGN ASSUMPTIONS

E70XX Electrodes For All Welding
Cover Plates Welded to Flange at Each End, Along Narrow End & Returned Down Edge Along Pile Web
Web Stiffener Plates Are Full Depth, Are Flush At Bearing End, & Welded Full Length & Along Bearing End On One Side Only

Case	Pile Section	Pile Grade (ksi)	Plate Steel Grade (ksi)	Design Anchor Load (k)	Actual Design Pile Moment (ft-k)	Max Design Pile Moment (ft-k)	Flange Width b_f (in)	Flange Thick t_f (in)	Beam Depth d (in)	Web Thick t_w (in)	Max Cutout Width (in)	Max Cutout Area (in^2)
1	W14X34	50.0	50.0	80.0	133.7	133.7	6.750	0.455	14.000	0.285	3.23	1.47
2	W14x38	50.0	50.0	80.0	150.2	150.2	6.770	0.515	14.100	0.310	3.23	1.66
3	W14x43	50.0	50.0	80.0	172.2	172.2	8.000	0.530	13.700	0.305	3.85	2.04
4	W14x61	50.0	50.0	120.0	253.3	253.3	10.000	0.645	13.900	0.375	4.81	3.10

DESIGN CALCULATIONS FOR COVER PLATE

Case	Max Cutout Force (k)	Design Cutout Force (k)	Cover Plate E70XX Weld Size (in)	Req'd Weld Length L (in)	Design Weld Length L (in)	Design Weld Width (in)	Req'd Weld Return Length (in)	Design Cover Plate Thick (in)	Req'd Cover Plate Width (in)	Design Cover Plate Width (in)	Req'd Cover Plate Length (in)	Design Cover Plate Length (in)
1	48.5	48.5	0.3125	10.5	11.5	2.5	9.0	0.500	2.94	3.00	24.0	24.0
2	54.9	54.9	0.3125	11.8	11.5	2.5	9.0	0.500	3.33	3.50	24.0	24.0
3	67.3	67.3	0.3125	14.5	14.5	2.5	12.0	0.500	4.08	4.00	30.0	30.0
4	102.4	102.4	0.3125	22.1	22.5	3.0	19.5	0.750	4.14	4.00	45.0	45.0

DESIGN CALCULATIONS FOR WEB STIFFENER

Case	Single Stiffener Force (k)	Total Stiffener E70XX Weld Size (in)	Stiffener Thickness (in)	Req'd Weld Length (in)	Design Weld & Stiffener Length (in)	Req'd Stiffener Compress Area (in^2)	Req'd Stiffener Width (in)	Design Stiffener Width (in)	Stiffener "b/t" Ratio	Allowable Stiffener "b/t" Ratio
1	40.0	0.3125	0.500	8.6	12.0	1.333	2.7	4.0	8.0	10.7
2	40.0	0.3125	0.500	8.6	12.0	1.333	2.7	4.0	8.0	10.7
3	40.0	0.3125	0.500	8.6	12.0	1.333	2.7	4.0	8.0	10.7
4	60.0	0.3125	0.500	12.9	12.0	2.000	4.0	4.0	8.0	10.7

TABLE 2
ANCHOR POCKET DESIGN

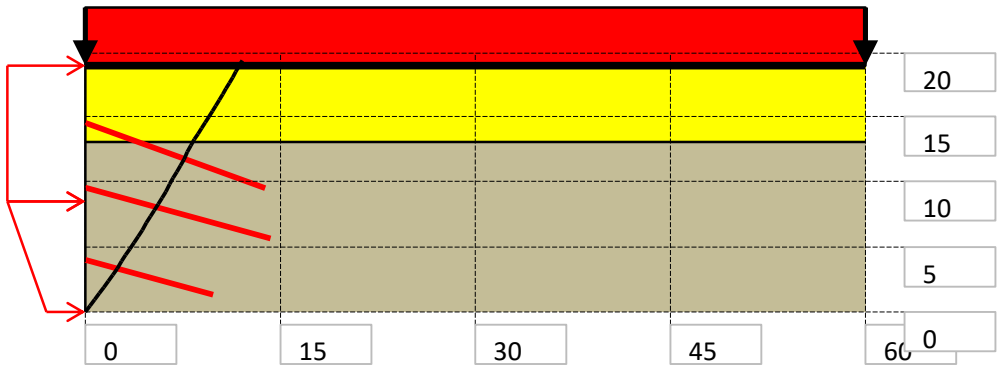
General Input Data								
Case	Rectangular Steel Tube Section	Weight (lb/ft)	Steel Yield (ksi)	Gross Plastic Modulus Z (in^3)	Narrow Side Outer Dimension (in)	Wall Thickness t (in)	Cutout Width b_h (in)	VE/ Anchor Moment Arm h (ft)
1	HSS10x4x1/2	41.9	46.0	17.6	4.0	0.465	2.600	0.670
2	HSS12x4x1/2	48.7	46.0	20.9	4.0	0.465	2.600	0.670

Flexure					
Case	Net Plastic Modulus Z' (in^3)	Plastic Moment M_N (ft-k)	Allowable Moment M_A (ft-k)	Allowable Load (Flex) P (k)	Bearing Plate Size - Chord Plastification (in)
1	13.33	51.1	30.7	45.7	8x8x1/2
2	16.63	63.7	38.2	57.1	10x10x1/2

TABLE 3
BAR ANCHOR WALER DESIGN

APPENDIX A

SOIL NAIL ANALYSIS



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Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	40
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	13.0
3	0.0	19.0
4	60.0	19.0
5	60.0	13.0
6	0.0	8.5

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	14.5	1.0	20.0	10000	10000		6.0	
2	0.0	9.5	1.0	15.0	10000	10000		6.0	
3	0.0	4.0	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

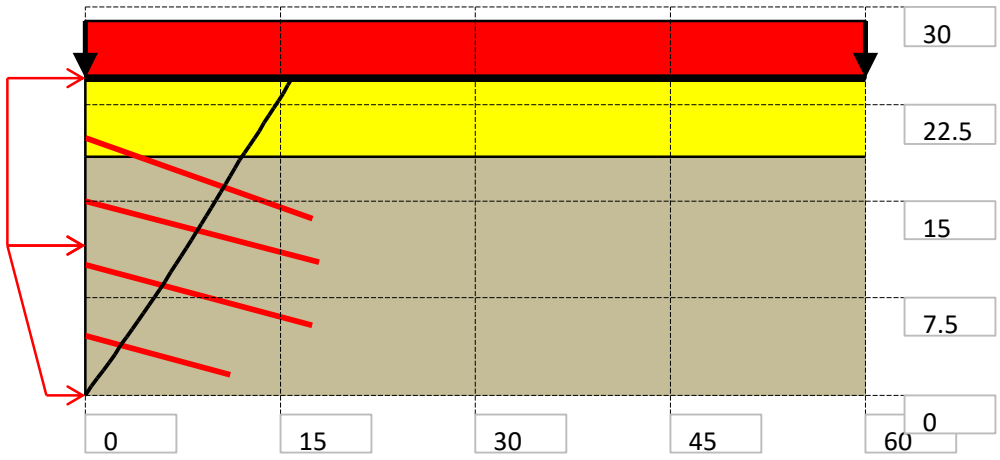
Nail Head Strength Factor (Multiplier): 2.58

Nail	Length	Capacity	Slip Surf.
1	14.7	45818	24
2	14.7	50813	31
3	10.2	37849	40

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-115.15	80.81	1.04	85.00	0.62
2	-95.74	74.68	1.82	82.11	3.84
3	-51.05	44.14	1.66	79.21	4.33
4	-55.65	48.12	1.90	79.21	4.86
5	-84.33	72.92	2.66	79.21	6.05
6	-50.67	48.50	2.74	76.32	6.81
7	-80.52	77.06	3.63	76.32	7.90
8	-35.10	37.17	2.74	73.42	7.90
9	-47.18	49.96	3.65	73.42	8.61
10	-75.53	79.98	4.60	73.42	9.66
11	-33.13	38.84	3.69	70.53	9.66
12	-45.76	53.65	4.70	70.53	10.41
13	-79.11	92.74	5.77	70.53	11.10
14	-24.71	32.13	3.67	67.63	11.10
15	-31.64	41.13	4.72	67.63	11.10
16	-46.59	60.56	5.86	67.63	11.63
17	-89.79	116.71	7.09	67.63	12.39
18	-23.51	33.99	4.72	64.74	12.39
19	-30.98	44.78	5.88	64.74	12.39
20	-47.14	68.14	7.09	64.74	12.81
21	-96.06	138.85	8.40	64.74	13.42
22	-22.62	36.51	5.87	61.84	13.42
23	-30.92	49.91	7.12	61.84	13.42
24	-49.86	80.47	8.48	61.84	13.67
25	-17.34	31.43	5.88	58.95	13.67
26	-21.99	39.86	7.14	58.95	13.67
27	-31.31	56.75	8.51	58.95	13.94
28	-56.15	101.77	10.05	58.95	14.27
29	-16.51	33.86	7.14	56.05	14.27
30	-21.72	44.54	8.51	56.05	14.27

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
31	-33.09	67.86	10.12	56.05	14.46
32	-70.07	143.72	11.86	56.05	14.59
33	-12.71	29.80	7.14	53.16	14.59
34	-15.91	37.29	8.57	53.16	14.59
35	-21.75	51.00	10.09	53.16	14.59
36	-35.26	82.68	11.84	53.16	14.73
37	-9.88	26.85	7.14	50.26	14.73
38	-11.92	32.38	8.56	50.26	14.73
39	-15.36	41.75	10.10	50.26	14.73
40	-22.00	59.78	11.84	50.26	14.73
41	-39.71	107.91	13.83	50.26	14.73
42	-9.03	28.97	8.58	47.37	14.73
43	-11.15	35.77	10.11	47.37	14.73
44	-14.89	47.79	11.87	47.37	14.73
45	-22.55	72.35	13.82	47.37	14.73
46	-45.71	146.66	16.00	47.37	14.73
47	-6.77	26.34	8.57	44.47	14.73
48	-8.10	31.53	10.10	44.47	14.73
49	-10.31	40.13	11.87	44.47	14.73
50	-14.30	55.64	13.83	44.47	14.73
51	-22.68	88.25	15.93	44.47	14.73
52	-51.13	198.91	18.33	44.47	14.73
53	-5.81	28.49	10.16	41.58	14.73
54	-7.12	34.95	11.88	41.58	14.73
55	-9.32	45.74	13.84	41.58	14.73
56	-13.47	66.08	16.02	41.58	14.73
57	-23.82	116.86	18.51	41.58	14.73
58	-3.96	26.11	10.16	38.68	14.73
59	-4.73	31.18	11.88	38.68	14.73
60	-5.94	39.19	13.84	38.68	14.73
61	-8.05	53.08	16.06	38.68	14.73
62	-12.08	79.67	18.46	38.68	14.73
63	-22.78	150.19	21.17	38.68	14.73
64	-2.84	28.32	11.89	35.79	14.73
65	-3.46	34.53	13.85	35.79	14.73
66	-4.46	44.44	16.04	35.79	14.73
67	-6.19	61.67	18.47	35.79	14.73
68	-9.71	96.76	21.17	35.79	14.73
69	-20.76	206.92	24.36	35.79	14.73
70	-1.29	26.06	11.89	32.89	14.73
71	-1.54	31.04	13.86	32.89	14.73
72	-1.91	38.62	16.05	32.89	14.73
73	-2.52	50.86	18.49	32.89	14.73
74	-3.59	72.47	21.20	32.89	14.73

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
75	-5.84	118.01	24.22	32.89	14.73
76	-12.26	247.59	27.54	32.89	14.73
77	0.03	28.32	13.86	30.00	14.73
78	0.04	34.33	16.05	30.00	14.73
79	0.05	43.51	18.49	30.00	14.73
80	0.06	58.46	21.22	30.00	14.73
81	0.09	85.17	24.25	30.00	14.73
82	0.15	140.94	27.56	30.00	14.73
83	0.30	289.52	31.02	30.00	14.73



S2

Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	40
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	18.5
3	0.0	24.5
4	60.0	24.5
5	60.0	18.5
6	0.0	11.5

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	20.0	1.0	20.0	10000	10000		6.0	
2	0.0	15.0	1.0	15.0	10000	10000		6.0	
3	0.0	10.0	1.0	15.0	10000	10000		6.0	
4	0.0	4.5	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

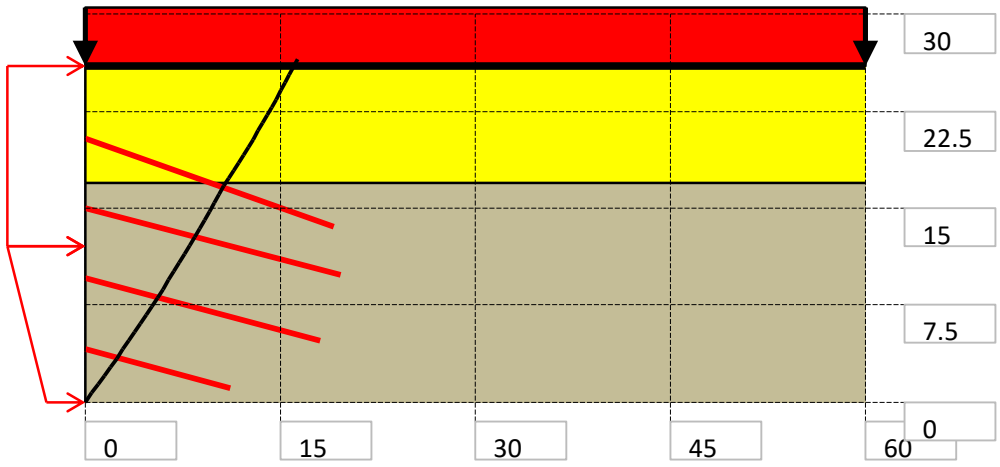
Nail Head Strength Factor (Multiplier): 2.72

Nail	Length	Capacity	Slip Surf.
1	18.6	56510	32
2	18.6	60022	24
3	18.1	57741	40
4	11.5	42970	40

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-102.20	79.72	1.87	82.11	4.01
2	-74.07	64.04	2.35	79.21	5.85
3	-83.55	72.25	2.72	79.21	6.46
4	-129.26	111.77	3.58	79.21	7.51
5	-54.48	52.14	2.73	76.32	7.51
6	-71.59	68.52	3.66	76.32	8.61
7	-108.95	104.27	4.62	76.32	9.75
8	-44.29	46.90	3.24	73.42	9.75
9	-48.76	51.63	3.71	73.42	9.75
10	-62.57	66.25	4.65	73.42	10.68
11	-99.24	105.08	5.81	73.42	11.91
12	-44.10	51.70	4.76	70.53	11.91
13	-57.62	67.54	5.82	70.53	12.96
14	-92.52	108.45	7.07	70.53	13.97
15	-32.57	42.34	4.72	67.63	13.97
16	-40.23	52.30	5.86	67.63	13.97
17	-54.33	70.62	7.11	67.63	14.79
18	-88.09	114.51	8.48	67.63	15.59
19	-27.13	39.22	5.22	64.74	15.59
20	-29.97	43.32	5.86	64.74	15.59
21	-37.52	54.23	7.12	64.74	15.59
22	-52.50	75.89	8.54	64.74	16.10
23	-96.31	139.21	10.14	64.74	16.46
24	-27.95	45.10	7.15	61.84	16.46
25	-35.81	57.79	8.55	61.84	16.46
26	-52.17	84.20	10.09	61.84	16.80
27	-97.84	157.90	11.76	61.84	17.20
28	-21.51	38.99	7.14	58.95	17.20
29	-26.12	47.35	8.53	58.95	17.20

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
30	-34.48	62.49	10.12	58.95	17.37
31	-53.63	97.20	11.89	58.95	17.69
32	-19.97	40.96	8.56	56.05	17.69
33	-24.81	50.89	10.12	56.05	17.69
34	-33.92	69.58	11.84	56.05	17.97
35	-55.19	113.18	13.79	56.05	18.24
36	-15.53	36.41	8.56	53.16	18.24
37	-18.63	43.68	10.15	53.16	18.24
38	-23.76	55.72	11.90	53.16	18.24
39	-33.75	79.13	13.80	53.16	18.42
40	-57.01	133.67	15.90	53.16	18.60
41	-14.18	38.53	10.14	50.26	18.60
42	-17.30	47.01	11.88	50.26	18.60
43	-22.81	61.98	13.81	50.26	18.60
44	-33.99	92.35	15.99	50.26	18.60
45	-68.21	185.34	18.46	50.26	18.60
46	-10.85	34.81	10.14	47.37	18.60
47	-12.86	41.27	11.91	47.37	18.60
48	-16.17	51.87	13.85	47.37	18.60
49	-21.90	70.28	15.99	47.37	18.60
50	-34.48	110.65	18.42	47.37	18.60
51	-9.52	37.03	11.91	44.47	18.60
52	-11.51	44.77	13.82	44.47	18.60
53	-14.78	57.51	16.00	44.47	18.60
54	-20.86	81.15	18.43	44.47	18.60
55	-35.45	137.92	21.19	44.47	18.60
56	-6.89	33.81	11.91	41.58	18.60
57	-8.13	39.90	13.85	41.58	18.60
58	-10.02	49.17	16.01	41.58	18.60
59	-13.23	64.91	18.44	41.58	18.60
60	-19.41	95.26	21.15	41.58	18.60
61	-35.18	172.61	24.17	41.58	18.60
62	-5.48	36.10	13.88	38.68	18.60
63	-6.55	43.19	15.99	38.68	18.60
64	-8.29	54.64	18.45	38.68	18.60
65	-11.25	74.17	21.16	38.68	18.60
66	-17.04	112.31	24.12	38.68	18.60
67	-34.73	228.95	27.67	38.68	18.60
68	-3.33	33.20	13.88	35.79	18.60
69	-3.91	38.93	16.02	35.79	18.60
70	-4.77	47.56	18.45	35.79	18.60
71	-6.16	61.34	21.17	35.79	18.60
72	-8.59	85.59	24.19	35.79	18.60
73	-13.63	135.85	27.56	35.79	18.60

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
74	-27.23	271.32	31.19	35.79	18.60
75	-1.76	35.55	16.02	32.89	18.60
76	-2.10	42.36	18.46	32.89	18.60
77	-2.61	52.72	21.18	32.89	18.60
78	-3.44	69.39	24.20	32.89	18.60
79	-4.91	99.15	27.57	32.89	18.60
80	-8.03	162.11	31.31	32.89	18.60
81	0.03	32.85	16.03	30.00	18.60
82	0.04	38.38	18.47	30.00	18.60
83	0.05	46.48	21.19	30.00	18.60
84	0.06	58.83	24.22	30.00	18.60
85	0.08	78.76	27.58	30.00	18.60
86	0.12	114.63	31.34	30.00	18.60
87	0.20	192.44	35.54	30.00	18.60



W1

Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	40
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	17.0
3	0.0	26.0
4	60.0	26.0
5	60.0	17.0
6	0.0	12.0

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	20.5	1.0	20.0	10000	10000		6.0	
2	0.0	15.0	1.0	15.0	10000	10000		6.0	
3	0.0	9.5	1.0	15.0	10000	10000		6.0	
4	0.0	4.0	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

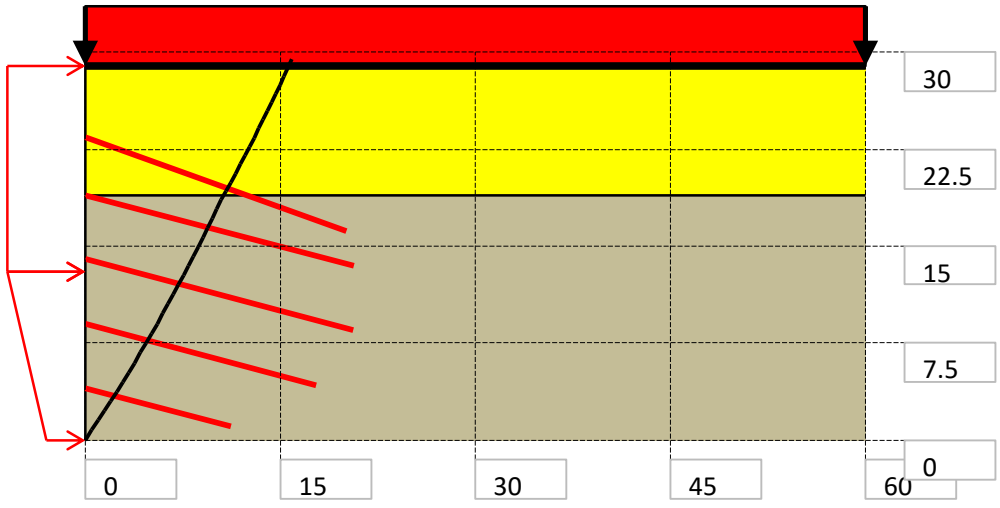
Nail Head Strength Factor (Multiplier): 3.61

Nail	Length	Capacity	Slip Surf.
1	20.3	57753	33
2	20.3	70371	34
3	18.7	63674	44
4	11.6	47385	44

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-183.97	129.10	1.78	85.00	3.00
2	-96.38	75.17	1.88	82.11	4.46
3	-94.27	73.53	1.85	82.11	4.51
4	-134.80	105.14	2.65	82.11	6.18
5	-76.60	66.23	2.64	79.21	7.10
6	-78.27	67.68	2.74	79.21	7.37
7	-109.03	94.28	3.63	79.21	8.81
8	-67.26	64.38	3.70	76.32	9.82
9	-94.12	90.08	4.72	76.32	11.47
10	-158.48	151.67	5.74	76.32	12.94
11	-47.17	49.95	3.71	73.42	12.94
12	-59.34	62.84	4.74	73.42	12.94
13	-83.17	88.07	5.87	73.42	14.01
14	-146.34	154.96	7.07	73.42	15.44
15	-41.84	49.05	4.68	70.53	15.44
16	-53.48	62.70	5.87	70.53	15.44
17	-74.87	87.77	7.08	70.53	16.11
18	-139.65	163.70	8.50	70.53	17.18
19	-38.66	50.25	5.90	67.63	17.18
20	-49.13	63.86	7.11	67.63	17.18
21	-72.93	94.80	8.58	67.63	17.74
22	-137.55	178.79	10.02	67.63	18.34
23	-29.19	42.20	5.83	64.74	18.34
24	-35.72	51.64	7.17	64.74	18.34
25	-46.61	67.37	8.55	64.74	18.34
26	-70.81	102.35	10.13	64.74	18.73
27	-139.93	202.25	11.67	64.74	19.12
28	-27.04	43.65	7.14	61.84	19.12
29	-33.34	53.81	8.56	61.84	19.12

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
30	-44.89	72.45	10.13	61.84	19.12
31	-70.44	113.68	11.83	61.84	19.55
32	-25.18	45.64	8.57	58.95	19.55
33	-31.65	57.36	10.14	58.95	19.55
34	-44.06	79.86	11.90	58.95	19.82
35	-76.88	139.34	13.90	58.95	20.03
36	-19.53	40.06	8.57	56.05	20.03
37	-23.53	48.26	10.14	56.05	20.03
38	-30.39	62.33	11.91	56.05	20.03
39	-44.08	90.40	13.86	56.05	20.13
40	-83.21	170.65	16.05	56.05	20.13
41	-18.04	42.31	10.18	53.16	20.13
42	-22.12	51.88	11.91	53.16	20.13
43	-29.42	68.97	13.87	53.16	20.13
44	-44.92	105.33	16.05	53.16	20.32
45	-95.52	223.96	18.46	53.16	20.32
46	-13.92	37.84	10.15	50.26	20.32
47	-16.56	45.00	11.91	50.26	20.32
48	-20.88	56.74	13.89	50.26	20.32
49	-28.68	77.93	16.06	50.26	20.32
50	-46.56	126.53	18.49	50.26	20.32
51	-12.50	40.11	11.92	47.37	20.32
52	-15.15	48.62	13.88	47.37	20.32
53	-19.58	62.82	16.07	47.37	20.32
54	-28.00	89.86	18.43	47.37	20.32
55	-49.08	157.50	21.22	47.37	20.32
56	-9.37	36.45	11.92	44.47	20.32
57	-11.05	42.98	13.89	44.47	20.32
58	-13.68	53.23	16.08	44.47	20.32
59	-18.18	70.75	18.44	44.47	20.32
60	-27.16	105.66	21.14	44.47	20.32
61	-52.00	202.33	24.26	44.47	20.32
62	-7.91	38.81	13.89	41.58	20.32
63	-9.50	46.63	16.03	41.58	20.32
64	-12.03	59.02	18.45	41.58	20.32
65	-16.47	80.82	21.16	41.58	20.32
66	-25.43	124.78	24.09	41.58	20.32
67	-55.50	272.31	27.70	41.58	20.32
68	-5.40	35.59	13.90	38.68	20.32
69	-6.33	41.74	16.09	38.68	20.32
70	-7.75	51.07	18.47	38.68	20.32
71	-10.02	66.03	21.15	38.68	20.32
72	-14.17	93.44	24.19	38.68	20.32
73	-23.21	152.99	27.54	38.68	20.32

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
74	-49.92	329.13	31.06	38.68	20.32
75	-3.81	38.01	16.09	35.79	20.32
76	-4.55	45.32	18.48	35.79	20.32
77	-5.67	56.53	21.19	35.79	20.32
78	-7.48	74.52	24.15	35.79	20.32
79	-10.92	108.78	27.57	35.79	20.32
80	-18.40	183.39	31.35	35.79	20.32
81	-1.74	35.07	16.10	32.89	20.32
82	-2.03	40.96	18.49	32.89	20.32
83	-2.46	49.65	21.20	32.89	20.32
84	-3.12	63.08	24.23	32.89	20.32
85	-4.22	85.25	27.59	32.89	20.32
86	-6.27	126.69	31.33	32.89	20.32
87	-11.15	225.18	35.52	32.89	20.32
88	0.04	37.53	18.49	30.00	20.32
89	0.05	44.50	21.21	30.00	20.32
90	0.06	54.78	24.24	30.00	20.32
91	0.07	70.73	27.62	30.00	20.32
92	0.10	97.28	31.38	30.00	20.32
93	0.15	146.99	35.54	30.00	20.32



W2

Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	45
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	19.0
3	0.0	29.0
4	60.0	29.0
5	60.0	19.0
6	0.0	13.0

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	23.5	1.0	20.0	10000	10000		6.0	
2	0.0	19.0	1.0	15.0	10000	10000		6.0	
3	0.0	14.0	1.0	15.0	10000	10000		6.0	
4	0.0	9.0	1.0	15.0	10000	10000		6.0	
5	0.0	4.0	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

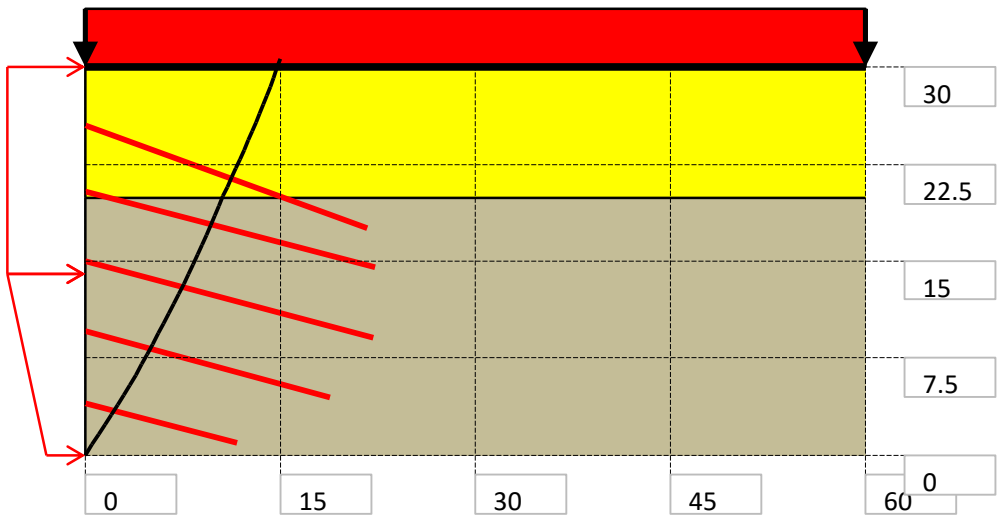
Nail Head Strength Factor (Multiplier): 3.14

Nail	Length	Capacity	Slip Surf.
1	21.4	52294	22
2	21.4	68832	33
3	21.3	69438	38
4	18.4	58755	38
5	11.6	45402	38

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-202.42	142.05	1.96	85.00	3.20
2	-105.73	82.47	2.05	82.11	4.61
3	-104.84	81.78	2.06	82.11	4.72
4	-149.32	116.47	2.95	82.11	6.28
5	-84.03	72.66	2.88	79.21	7.17
6	-85.47	73.90	2.98	79.21	7.39
7	-121.15	104.76	4.04	79.21	8.99
8	-73.26	70.12	4.03	76.32	10.00
9	-104.81	100.31	5.26	76.32	12.24
10	-176.85	169.26	6.40	76.32	14.38
11	-51.79	54.84	4.05	73.42	14.38
12	-66.14	70.03	5.28	73.42	14.38
13	-92.79	98.26	6.54	73.42	15.40
14	-163.97	173.63	7.90	73.42	17.15
15	-46.66	54.69	5.22	70.53	17.15
16	-59.66	69.94	6.55	70.53	17.15
17	-83.68	98.09	7.90	70.53	17.52
18	-157.15	184.22	9.49	70.53	18.60
19	-43.12	56.06	6.58	67.63	18.60
20	-54.86	71.31	7.94	67.63	18.60
21	-81.69	106.19	9.58	67.63	19.22
22	-155.54	202.18	11.20	67.63	19.82
23	-32.72	47.30	6.54	64.74	19.82
24	-39.87	57.63	8.00	64.74	19.82
25	-52.35	75.67	9.57	64.74	19.82
26	-82.81	119.69	11.46	64.74	19.96
27	-30.23	48.79	7.98	61.84	19.96
28	-37.56	60.63	9.61	61.84	19.96

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
29	-50.59	81.64	11.36	61.84	20.18
30	-79.34	128.05	13.22	61.84	20.78
31	-28.12	50.96	9.57	58.95	20.78
32	-35.57	64.47	11.36	58.95	20.78
33	-50.58	91.67	13.42	58.95	21.02
34	-87.04	157.76	15.55	58.95	21.21
35	-21.80	44.71	9.56	56.05	21.21
36	-26.41	54.16	11.37	56.05	21.21
37	-34.04	69.81	13.31	56.05	21.21
38	-50.97	104.54	15.64	56.05	21.36
39	-104.11	213.53	18.13	56.05	21.36
40	-20.15	47.25	11.36	53.16	21.36
41	-24.89	58.36	13.36	53.16	21.36
42	-33.27	78.02	15.56	53.16	21.36
43	-51.37	120.44	18.02	53.16	21.36
44	-109.79	257.42	20.66	53.16	21.36
45	-15.60	42.39	11.38	50.26	21.36
46	-18.60	50.54	13.36	50.26	21.36
47	-23.39	63.56	15.53	50.26	21.36
48	-32.56	88.48	17.95	50.26	21.36
49	-53.68	145.88	20.77	50.26	21.36
50	-14.02	45.00	13.37	47.37	21.36
51	-17.05	54.72	15.58	47.37	21.36
52	-22.14	71.05	17.97	47.37	21.36
53	-31.93	102.47	20.70	47.37	21.36
54	-55.91	179.41	23.76	47.37	21.36
55	-10.50	40.87	13.37	44.47	21.36
56	-12.40	48.25	15.57	44.47	21.36
57	-15.43	60.05	17.98	44.47	21.36
58	-20.63	80.25	20.71	44.47	21.36
59	-31.14	121.14	23.76	44.47	21.36
60	-61.19	238.07	27.27	44.47	21.36
61	-8.88	43.58	15.59	41.58	21.36
62	-10.69	52.47	17.99	41.58	21.36
63	-13.63	66.89	20.75	41.58	21.36
64	-18.88	92.65	23.84	41.58	21.36
65	-29.66	145.53	27.16	41.58	21.36
66	-64.21	315.05	31.01	41.58	21.36
67	-6.06	39.93	15.60	38.68	21.36
68	-7.12	46.94	18.00	38.68	21.36
69	-8.75	57.71	20.76	38.68	21.36
70	-11.38	75.06	23.79	38.68	21.36
71	-16.19	106.72	27.19	38.68	21.36
72	-26.89	177.26	30.96	38.68	21.36

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
73	-58.05	382.72	34.78	38.68	21.36
74	-4.29	42.71	18.01	35.79	21.36
75	-5.12	51.05	20.75	35.79	21.36
76	-6.42	63.94	23.81	35.79	21.36
77	-8.55	85.19	27.21	35.79	21.36
78	-12.52	124.80	31.00	35.79	21.36
79	-21.01	209.40	35.11	35.79	21.36
80	-1.95	39.37	18.08	32.89	21.36
81	-2.28	46.09	20.76	32.89	21.36
82	-2.78	56.04	23.83	32.89	21.36
83	-3.54	71.48	27.24	32.89	21.36
84	-4.79	96.80	30.97	32.89	21.36
85	-7.26	146.66	35.30	32.89	21.36
86	-13.11	264.63	39.97	32.89	21.36
87	0.04	42.20	20.77	30.00	21.36
88	0.05	50.15	23.84	30.00	21.36
89	0.06	61.96	27.26	30.00	21.36
90	0.08	80.32	31.06	30.00	21.36
91	0.11	111.10	35.29	30.00	21.36
92	0.18	169.75	40.00	30.00	21.36



N1

Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	50
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	20.0
3	0.0	30.0
4	60.0	30.0
5	60.0	20.0
6	0.0	14.0

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	25.5	1.0	20.0	10000	10000		6.0	
2	0.0	20.5	1.0	15.0	10000	10000		6.0	
3	0.0	15.0	1.0	15.0	10000	10000		6.0	
4	0.0	9.5	1.0	15.0	10000	10000		6.0	
5	0.0	4.0	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

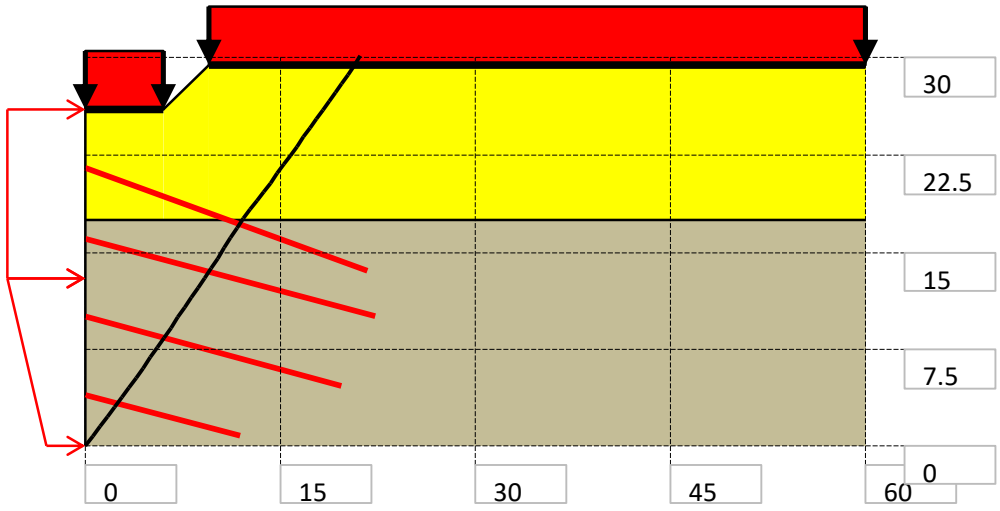
Nail Head Strength Factor (Multiplier): 3.47

Nail	Length	Capacity	Slip Surf.
1	23.1	53693	21
2	23.1	75259	31
3	22.9	75905	36
4	19.5	63706	36
5	12.1	48796	36

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-109.93	85.74	2.13	82.11	5.08
2	-113.03	88.16	2.19	82.11	5.20
3	-166.49	129.86	3.13	82.11	6.83
4	-90.10	77.90	3.12	79.21	7.96
5	-95.11	82.24	3.28	79.21	8.20
6	-136.48	118.01	4.32	79.21	9.73
7	-63.78	61.04	3.30	76.32	9.73
8	-82.89	79.34	4.47	76.32	11.11
9	-119.91	114.76	5.65	76.32	13.20
10	-53.52	56.67	4.14	73.42	13.20
11	-56.54	59.87	4.44	73.42	13.20
12	-74.29	78.67	5.76	73.42	14.47
13	-107.95	114.31	7.05	73.42	18.26
14	-51.73	60.64	5.76	70.53	18.26
15	-68.21	79.96	7.17	70.53	19.58
16	-106.41	124.74	8.76	70.53	21.25
17	-39.00	50.70	5.86	67.63	21.25
18	-47.58	61.84	7.15	67.63	21.25
19	-64.08	83.29	8.73	67.63	21.38
20	-100.62	130.78	10.40	67.63	21.90
21	-35.79	51.73	7.23	64.74	21.90
22	-44.74	64.66	8.74	64.74	21.90
23	-61.61	89.05	10.47	64.74	21.90
24	-107.87	155.91	12.48	64.74	21.90
25	-33.53	54.11	8.84	61.84	21.90
26	-43.08	69.54	10.56	61.84	21.90
27	-62.42	100.74	12.53	61.84	22.14
28	-125.49	202.54	14.84	61.84	22.48

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
29	-25.99	47.11	8.85	58.95	22.48
30	-31.70	57.46	10.56	58.95	22.48
31	-41.85	75.85	12.54	58.95	22.48
32	-63.86	115.73	14.74	58.95	22.82
33	-132.76	240.61	17.03	58.95	22.82
34	-24.29	49.82	10.66	56.05	22.82
35	-30.22	61.98	12.55	56.05	22.82
36	-41.39	84.89	14.76	56.05	23.05
37	-65.34	134.01	17.07	56.05	23.05
38	-18.85	44.19	10.61	53.16	23.05
39	-22.66	53.13	12.55	53.16	23.05
40	-29.02	68.04	14.75	53.16	23.05
41	-40.87	95.83	17.13	53.16	23.05
42	-73.02	171.20	19.91	53.16	23.05
43	-17.30	47.00	12.56	50.26	23.05
44	-21.21	57.64	14.76	50.26	23.05
45	-28.04	76.20	17.23	50.26	23.05
46	-41.20	111.96	19.84	50.26	23.05
47	-89.39	242.92	23.22	50.26	23.05
48	-13.25	42.53	12.63	47.37	23.05
49	-15.73	50.49	14.76	47.37	23.05
50	-19.79	63.49	17.23	47.37	23.05
51	-27.03	86.73	19.96	47.37	23.05
52	-42.61	136.72	22.97	47.37	23.05
53	-93.33	299.48	26.19	47.37	23.05
54	-11.66	45.37	14.78	44.47	23.05
55	-14.14	55.04	17.24	44.47	23.05
56	-18.25	70.99	19.97	44.47	23.05
57	-25.89	100.72	23.02	44.47	23.05
58	-43.86	170.65	26.41	44.47	23.05
59	-8.45	41.45	14.78	41.58	23.05
60	-9.98	48.96	17.24	41.58	23.05
61	-12.37	60.69	19.98	41.58	23.05
62	-16.41	80.53	23.04	41.58	23.05
63	-24.22	118.86	26.43	41.58	23.05
64	-44.33	217.51	30.21	41.58	23.05
65	-6.73	44.40	17.25	38.68	23.05
66	-8.10	53.39	19.98	38.68	23.05
67	-10.28	67.74	23.05	38.68	23.05
68	-14.02	92.46	26.45	38.68	23.05
69	-21.69	143.00	30.28	38.68	23.05
70	-42.79	282.12	34.45	38.68	23.05
71	-4.10	40.83	17.26	35.79	23.05
72	-4.82	48.03	20.00	35.79	23.05

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
73	-5.91	58.92	23.06	35.79	23.05
74	-7.65	76.19	26.44	35.79	23.05
75	-10.75	107.13	30.26	35.79	23.05
76	-17.19	171.30	34.49	35.79	23.05
77	-36.39	362.64	39.10	35.79	23.05
78	-2.17	43.85	20.01	32.89	23.05
79	-2.60	52.45	23.07	32.89	23.05
80	-3.25	65.55	26.40	32.89	23.05
81	-4.28	86.33	30.12	32.89	23.05
82	-6.16	124.46	34.50	32.89	23.05
83	-10.37	209.28	39.38	32.89	23.05
84	-21.15	427.11	44.11	32.89	23.05
85	0.04	40.51	20.01	30.00	23.05
86	0.05	47.50	23.08	30.00	23.05
87	0.06	57.74	26.41	30.00	23.05
88	0.08	73.39	30.20	30.00	23.05
89	0.10	98.71	34.41	30.00	23.05
90	0.15	144.41	39.10	30.00	23.05
91	0.24	234.37	44.13	30.00	23.05
92	0.51	490.83	49.60	30.00	23.05



N2

Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	45
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	17.5
3	0.0	26.0
4	6.0	26.0
5	60.0	17.5
6	0.0	13.0
7	9.5	29.5
8	60.0	29.5

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2
5	4	7	0	1	0	1
6	7	8	0	1	0	1

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270
2	7	500	8	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	21.5	1.0	20.0	10000	10000		6.0	
2	0.0	16.0	1.0	15.0	10000	10000		6.0	
3	0.0	10.0	1.0	15.0	10000	10000		6.0	
4	0.0	4.0	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

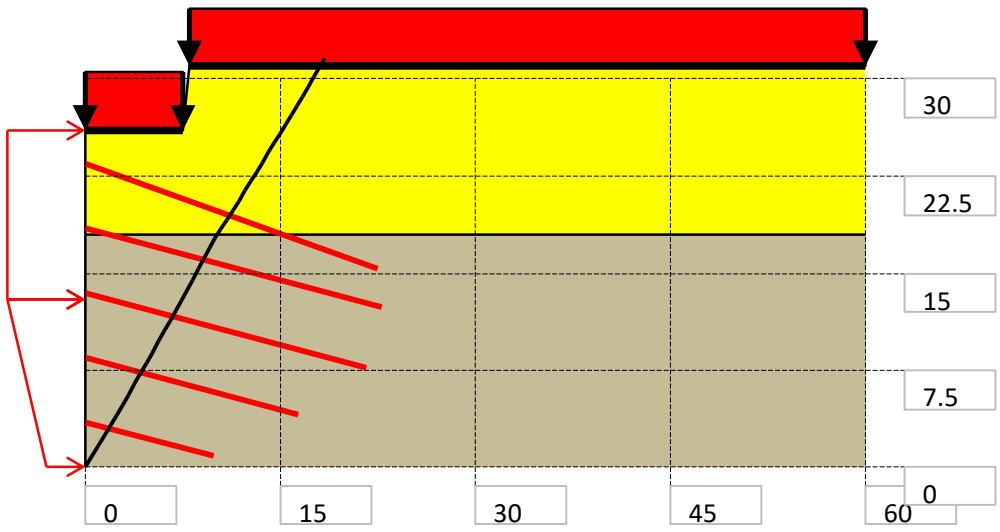
Nail Head Strength Factor (Multiplier): 3.91

Nail	Length	Capacity	Slip Surf.
1	23.1	63962	33
2	23.1	75383	43
3	20.4	67553	53
4	12.3	49931	53

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-98.72	77.00	1.94	82.11	4.68
2	-103.04	80.37	2.03	82.11	4.86
3	-164.84	128.58	2.93	82.11	6.68
4	-67.10	58.02	2.16	79.21	6.68
5	-85.66	74.07	2.96	79.21	7.76
6	-136.63	118.14	4.02	79.21	9.40
7	-57.13	54.68	3.01	76.32	9.40
8	-75.27	72.04	4.02	76.32	10.33
9	-115.33	110.39	5.12	76.32	12.16
10	-47.75	50.57	3.74	73.42	12.16
11	-51.17	54.19	4.05	73.42	12.16
12	-68.10	72.11	5.19	73.42	13.04
13	-104.71	110.87	6.45	73.42	14.02
14	-173.18	183.38	7.77	73.42	14.37
15	-47.42	55.59	5.27	70.53	14.37
16	-63.60	74.56	6.55	70.53	14.67
17	-89.11	104.46	8.01	70.53	15.12
18	-136.38	159.87	9.46	70.53	15.59
19	-35.10	45.62	5.26	67.63	15.59
20	-43.48	56.51	6.56	67.63	15.59
21	-56.08	72.90	8.00	67.63	15.69
22	-76.45	99.37	9.58	67.63	16.27
23	-131.01	170.30	11.15	67.63	18.01
24	-32.35	46.76	6.55	64.74	18.01
25	-39.96	57.76	8.02	64.74	18.01
26	-49.63	71.74	9.49	64.74	18.01
27	-73.71	106.54	11.32	64.74	18.82
28	-152.05	219.77	13.32	64.74	20.28
29	-29.97	48.37	7.98	61.84	20.28

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
30	-36.35	58.66	9.55	61.84	20.28
31	-48.11	77.65	11.32	61.84	20.28
32	-74.14	119.65	13.30	61.84	20.68
33	-159.15	256.86	15.34	61.84	21.71
34	-23.39	42.39	7.97	58.95	21.71
35	-27.65	50.11	9.62	58.95	21.71
36	-34.43	62.41	11.33	58.95	21.71
37	-47.51	86.10	13.37	58.95	21.71
38	-75.44	136.72	15.43	58.95	22.15
39	-21.60	44.30	9.62	56.05	22.15
40	-25.84	52.99	11.34	56.05	22.15
41	-32.78	67.24	13.28	56.05	22.15
42	-46.96	96.31	15.54	56.05	22.15
43	-84.35	173.00	18.03	56.05	22.64
44	-19.88	46.60	11.41	53.16	22.64
45	-24.24	56.85	13.33	53.16	22.64
46	-31.80	74.55	15.53	53.16	22.64
47	-47.56	111.51	18.02	53.16	22.79
48	-93.60	219.46	20.72	53.16	23.03
49	-15.45	41.99	11.41	50.26	23.03
50	-18.26	49.63	13.34	50.26	23.03
51	-22.78	61.89	15.54	50.26	23.03
52	-31.07	84.42	18.05	50.26	23.03
53	-48.40	131.52	20.73	50.26	23.03
54	-109.77	298.28	23.74	50.26	23.03
55	-13.85	44.45	13.34	47.37	23.03
56	-16.68	53.52	15.55	47.37	23.03
57	-21.33	68.43	18.01	47.37	23.03
58	-29.99	96.25	20.76	47.37	23.03
59	-50.21	161.11	23.79	47.37	23.03
60	-116.92	375.17	26.70	47.37	23.03
61	-10.42	40.54	13.35	44.47	23.03
62	-12.22	47.56	15.56	44.47	23.03
63	-15.03	58.47	18.03	44.47	23.03
64	-19.62	76.34	20.71	44.47	23.03
65	-29.12	113.29	23.88	44.47	23.03
66	-51.29	199.55	27.13	44.47	23.03
67	-8.79	43.11	15.57	41.58	23.03
68	-10.49	51.47	18.04	41.58	23.03
69	-13.18	64.65	20.78	41.58	23.03
70	-17.81	87.36	23.83	41.58	23.03
71	-27.13	133.10	27.23	41.58	23.03
72	-53.60	262.99	31.02	41.58	23.03
73	-6.01	39.65	15.58	38.68	23.03

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
74	-7.02	46.29	18.05	38.68	23.03
75	-8.54	56.29	20.79	38.68	23.03
76	-10.97	72.33	23.85	38.68	23.03
77	-15.24	100.48	27.25	38.68	23.03
78	-24.20	159.53	31.03	38.68	23.03
79	-54.21	357.41	35.41	38.68	23.03
80	-4.24	42.30	18.06	35.79	23.03
81	-5.03	50.16	20.80	35.79	23.03
82	-6.24	62.19	23.79	35.79	23.03
83	-8.19	81.64	27.18	35.79	23.03
84	-11.68	116.39	31.06	35.79	23.03
85	-19.30	192.30	35.29	35.79	23.03
86	-42.90	427.54	39.71	35.79	23.03
87	-1.94	39.12	18.06	32.89	23.03
88	-2.25	45.51	20.82	32.89	23.03
89	-2.72	54.89	23.80	32.89	23.03
90	-3.43	69.25	27.21	32.89	23.03
91	-4.59	92.70	31.00	32.89	23.03
92	-6.71	135.38	35.34	32.89	23.03
93	-11.31	228.38	39.97	32.89	23.03
94	-24.85	501.77	44.78	32.89	23.03
95	0.04	41.82	20.83	30.00	23.03
96	0.05	49.37	23.82	30.00	23.03
97	0.06	60.47	27.23	30.00	23.03
98	0.08	77.34	30.99	30.00	23.03
99	0.11	105.34	35.24	30.00	23.03
100	0.16	156.02	40.06	30.00	23.03



E1

Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	45
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	18.0
3	0.0	26.0
4	7.5	26.0
5	60.0	18.0
6	0.0	13.0
7	8.0	31.0
8	60.0	31.0

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2
5	4	7	0	1	0	1
6	7	8	0	1	0	1

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270
2	7	500	8	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	23.5	1.0	20.0	10000	10000		6.0	
2	0.0	18.5	1.0	15.0	10000	10000		6.0	
3	0.0	13.5	1.0	15.0	10000	10000		6.0	
4	0.0	8.5	1.0	15.0	10000	10000		6.0	
5	0.0	3.5	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

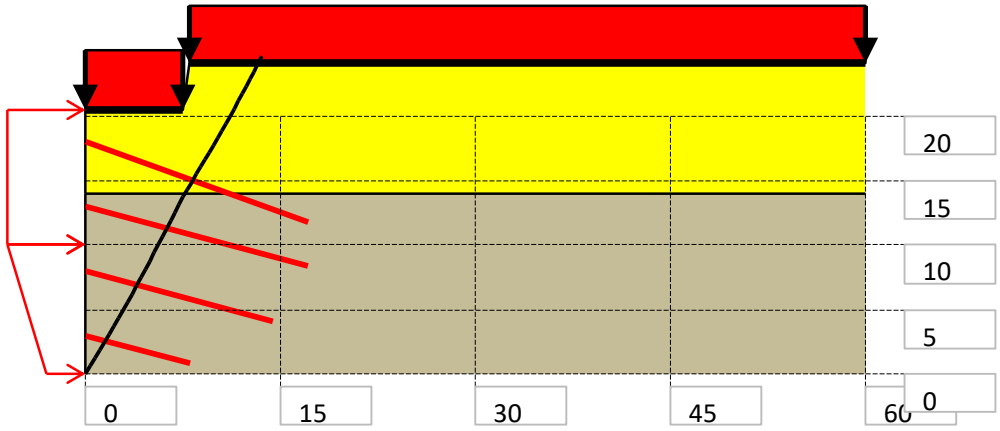
Nail Head Strength Factor (Multiplier): 2.86

Nail	Length	Capacity	Slip Surf.
1	23.9	52171	31
2	23.6	67744	36
3	22.4	67744	36
4	17.0	56019	36
5	10.2	42991	36

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-98.72	77.00	1.88	82.11	3.78
2	-105.11	81.99	2.02	82.11	4.03
3	-164.84	128.58	2.87	82.11	5.36
4	-67.10	58.02	2.10	79.21	5.36
5	-87.76	75.89	2.97	79.21	6.38
6	-136.63	118.14	3.96	79.21	7.59
7	-58.03	55.54	3.02	76.32	7.59
8	-77.51	74.18	4.06	76.32	8.64
9	-122.69	117.43	5.19	76.32	10.10
10	-47.75	50.57	3.68	73.42	10.10
11	-52.17	55.25	4.08	73.42	10.10
12	-70.53	74.69	5.25	73.42	10.86
13	-113.32	119.99	6.49	73.42	12.49
14	-47.42	55.59	5.22	70.53	12.49
15	-65.98	77.34	6.56	70.53	13.25
16	-118.85	139.32	9.56	70.53	17.66
17	-35.10	45.62	5.26	67.63	17.66
18	-44.20	57.45	6.50	67.63	17.66
19	-68.90	89.55	9.48	67.63	17.66
20	-111.02	144.31	11.24	67.63	20.28
21	-32.54	47.04	6.48	64.74	20.28
22	-38.94	56.29	8.06	64.74	20.28
23	-48.31	69.82	9.58	64.74	20.28
24	-66.05	95.46	11.27	64.74	20.28
25	-118.76	171.65	13.38	64.74	21.88
26	-25.30	40.83	6.57	61.84	21.88
27	-29.79	48.09	7.95	61.84	21.88
28	-35.76	57.71	9.59	61.84	21.88

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
29	-45.58	73.57	11.34	61.84	21.88
30	-64.93	104.79	13.27	61.84	21.88
31	-117.06	188.93	15.38	61.84	22.88
32	-27.55	49.94	9.59	58.95	22.88
33	-33.52	60.75	11.37	58.95	22.88
34	-43.98	79.72	13.35	58.95	22.88
35	-65.74	119.15	15.52	58.95	23.04
36	-143.74	260.52	18.07	58.95	23.93
37	-25.53	52.36	11.38	56.05	23.93
38	-31.68	64.98	13.36	56.05	23.93
39	-42.85	87.88	15.56	56.05	23.93
40	-69.12	141.76	18.08	56.05	23.93
41	-154.04	315.92	20.52	56.05	23.93
42	-19.84	46.52	11.38	53.16	23.93
43	-23.72	55.61	13.37	53.16	23.93
44	-30.13	70.64	15.57	53.16	23.93
45	-42.24	99.05	18.03	53.16	23.93
46	-72.19	169.26	20.77	53.16	23.93
47	-18.08	49.13	13.37	50.26	23.93
48	-22.03	59.87	15.58	50.26	23.93
49	-28.75	78.14	18.04	50.26	23.93
50	-42.05	114.26	20.78	50.26	23.93
51	-75.56	205.33	23.67	50.26	23.93
52	-13.83	44.39	13.38	47.37	23.93
53	-16.38	52.56	15.61	47.37	23.93
54	-20.37	65.36	18.06	47.37	23.93
55	-27.38	87.86	20.71	47.37	23.93
56	-42.06	134.97	23.75	47.37	23.93
57	-95.00	304.84	27.51	47.37	23.93
58	-12.11	47.12	15.60	44.47	23.93
59	-14.57	56.68	18.05	44.47	23.93
60	-18.59	72.33	20.73	44.47	23.93
61	-26.05	101.34	23.84	44.47	23.93
62	-41.83	162.73	27.15	44.47	23.93
63	-96.46	375.30	30.89	44.47	23.93
64	-8.77	43.04	15.61	41.58	23.93
65	-10.30	50.55	18.08	41.58	23.93
66	-12.65	62.07	20.75	41.58	23.93
67	-16.52	81.08	23.79	41.58	23.93
68	-23.75	116.53	27.18	41.58	23.93
69	-40.72	199.81	31.07	41.58	23.93
70	-6.95	45.84	18.07	38.68	23.93
71	-8.31	54.79	20.76	38.68	23.93
72	-10.41	68.65	23.82	38.68	23.93

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
73	-13.94	91.91	27.21	38.68	23.93
74	-20.73	136.70	30.99	38.68	23.93
75	-35.82	236.16	35.00	38.68	23.93
76	-4.24	42.21	18.09	35.79	23.93
77	-4.95	49.34	20.78	35.79	23.93
78	-6.02	59.96	23.83	35.79	23.93
79	-7.69	76.64	27.24	35.79	23.93
80	-10.52	104.84	31.00	35.79	23.93
81	-16.17	161.17	35.24	35.79	23.93
82	-31.26	311.56	40.11	35.79	23.93
83	-2.23	45.05	20.77	32.89	23.93
84	-2.65	53.53	23.85	32.89	23.93
85	-3.28	66.14	27.26	32.89	23.93
86	-4.27	86.12	31.06	32.89	23.93
87	-5.97	120.47	35.27	32.89	23.93
88	-9.38	189.46	39.97	32.89	23.93
89	0.04	41.71	20.80	30.00	23.93
90	0.05	48.57	23.86	30.00	23.93
91	0.06	58.40	27.24	30.00	23.93
92	0.08	73.38	31.07	30.00	23.93
93	0.10	97.06	35.32	30.00	23.93
94	0.14	137.80	40.01	30.00	23.93



E2

Analysis Mode	
Design(D)/Factor of Safety(FS)	D

Analysis Type	
Soil Nail(SN)/Tie Back(TB)/Active EP(AEP)/Passive EP(PEP)	SN

General	
Toe Segment No.	1
Toe Specification Type (X/Y)	Y
Toe Y Value	0
X-Base	0
Y-Base	0
Minimum Toe Angle (deg)	30
Maximum Toe Angle (deg)	85
No. Toe Angles	20
Minimum Exit X Value	0.5
Maximum Exit X Value	45
No. Exit Points	20
Water Unit Weight	62.4
Seismic Coefficient (g's)	0

Factors of Safety	
Service Load Design(SLD)/Load-Resistance Factor Design(LRFD)	SLD
FS - Cohesion	1.35
FS - Friction Angle	1.35
Strength Factor - Nail Tendon	0.55
Strength Factor - Nail Head	0.67
Strength Factor - Pullout	0.5
	0
	0
	0
	0
	0

Soil	Cohesion	Friction	Unit Wt.	Pullout
1	50	32	125	2000
2	150	38	130	6000

Piezo	X	Y

Node	X	Y
1	0.0	0.0
2	0.0	14.0
3	0.0	20.5
4	7.5	20.5
5	60.0	14.0
6	0.0	10.0
7	8.0	24.0
8	60.0	24.0

Segment	Node 1	Node 2	Top Soil #	Bot. Soil #	Top PO #	Bot. PO #
1	1	2	0	2	0	2
2	2	3	0	1	0	1
3	3	4	0	1	0	1
4	2	5	1	2	1	2
5	4	7	0	1	0	1
6	7	8	0	1	0	1

Surcharge	Node 1	P1	Node 2	P2	Angle
1	3	500	4	500	270
2	7	500	8	500	270

Nail	Xs	Ys	Length	Dip	Tendon Str	Head Str.	Fixed?	Spacing	Tieback?
1	0.0	18.0	1.0	20.0	10000	10000		6.0	
2	0.0	13.0	1.0	15.0	10000	10000		6.0	
3	0.0	8.0	1.0	15.0	10000	10000		6.0	
4	0.0	3.0	1.0	15.0	10000	10000		6.0	

Face Press	Node 1	P1	Node 2	P2	Angle
1	1	0.50	6	1.00	0.00
2	6	1.00	3	1.00	0.00

Analysis Type: Soil Nail

Analysis Mode: Design

Nail Head Strength Factor (Multiplier): 2.22

Nail	Length	Capacity	Slip Surf.
1	18.2	41019	30
2	17.7	51700	30
3	14.9	46530	30
4	8.3	33605	30

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
1	-123.90	86.95	1.12	85.00	0.80
2	-104.13	81.22	1.97	82.11	3.48
3	-54.51	47.13	1.76	79.21	3.85
4	-61.30	53.01	2.10	79.21	4.50
5	-96.81	83.71	2.97	79.21	5.72
6	-56.47	54.05	3.05	76.32	6.52
7	-89.58	85.73	4.01	76.32	8.11
8	-38.60	40.87	3.03	73.42	8.11
9	-53.31	56.45	4.07	73.42	8.77
10	-91.76	97.17	5.16	73.42	10.66
11	-36.41	42.68	4.05	70.53	10.66
12	-52.72	61.80	5.25	70.53	11.48
13	-101.44	118.91	6.49	70.53	12.49
14	-27.35	35.55	4.09	67.63	12.49
15	-35.53	46.19	5.25	67.63	12.49
16	-52.04	67.64	6.46	67.63	12.76
17	-136.52	177.45	9.54	67.63	15.16
18	-26.31	38.04	5.28	64.74	15.16
19	-35.42	51.19	6.56	64.74	15.16
20	-64.94	93.86	9.50	64.74	15.16
21	-147.31	212.92	11.14	64.74	16.82
22	-20.23	32.65	5.27	61.84	16.82
23	-25.39	40.97	6.53	61.84	16.82
24	-41.98	67.75	9.57	61.84	16.82
25	-69.31	111.86	11.27	61.84	16.95
26	-19.25	34.89	6.53	58.95	16.95
27	-23.19	42.04	8.03	58.95	16.95
28	-29.54	53.53	9.58	58.95	16.95
29	-43.32	78.51	11.36	58.95	16.95

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
30	-79.24	143.61	13.29	58.95	18.24
31	-15.05	30.87	6.54	56.05	18.24
32	-17.99	36.89	8.02	56.05	18.24
33	-21.93	44.98	9.59	56.05	18.24
34	-29.10	59.69	11.36	56.05	18.24
35	-44.62	91.51	13.28	56.05	18.24
36	-101.84	208.87	15.55	56.05	18.24
37	-16.76	39.30	9.60	53.16	18.24
38	-21.06	49.39	11.37	53.16	18.24
39	-29.05	68.12	13.29	53.16	18.24
40	-47.85	112.18	15.49	53.16	18.24
41	-114.48	268.41	17.74	53.16	18.24
42	-12.96	35.21	9.60	50.26	18.24
43	-15.69	42.64	11.38	50.26	18.24
44	-20.32	55.21	13.30	50.26	18.24
45	-29.13	79.16	15.46	50.26	18.24
46	-54.42	147.88	18.04	50.26	18.24
47	-11.83	37.95	11.40	47.37	18.24
48	-14.64	46.97	13.31	47.37	18.24
49	-19.47	62.48	15.47	47.37	18.24
50	-29.36	94.20	17.88	47.37	18.24
51	-60.88	195.36	20.79	47.37	18.24
52	-8.82	34.34	11.39	44.47	18.24
53	-10.61	41.27	13.32	44.47	18.24
54	-13.47	52.42	15.51	44.47	18.24
55	-18.74	72.93	17.98	44.47	18.24
56	-30.19	117.45	20.69	44.47	18.24
57	-71.34	277.57	23.81	44.47	18.24
58	-7.55	37.02	13.36	41.58	18.24
59	-9.28	45.55	15.54	41.58	18.24
60	-12.15	59.64	18.00	41.58	18.24
61	-17.53	85.99	20.73	41.58	18.24
62	-30.24	148.35	23.77	41.58	18.24
63	-5.14	33.88	13.39	38.68	18.24
64	-6.14	40.51	15.55	38.68	18.24
65	-7.72	50.91	18.01	38.68	18.24
66	-10.39	68.49	20.75	38.68	18.24
67	-15.57	102.67	23.79	38.68	18.24
68	-27.49	181.26	27.06	38.68	18.24
69	-3.68	36.69	15.56	35.79	18.24
70	-4.49	44.73	18.02	35.79	18.24
71	-5.77	57.48	20.77	35.79	18.24
72	-7.97	79.42	23.81	35.79	18.24
73	-12.45	124.03	27.24	35.79	18.24

Surface	X Center	Y Center	Surf. X Value	Toe Angle	Lngth Fac
74	-24.68	245.93	31.14	35.79	18.24
75	-1.67	33.69	15.57	32.89	18.24
76	-1.99	40.12	18.03	32.89	18.24
77	-2.47	49.86	20.78	32.89	18.24
78	-3.24	65.41	23.84	32.89	18.24
79	-4.59	92.60	27.24	32.89	18.24
80	-7.35	148.47	31.03	32.89	18.24
81	-16.32	329.57	35.66	32.89	18.24
82	0.03	31.28	15.57	30.00	18.24
83	0.04	36.54	18.05	30.00	18.24
84	0.05	44.25	20.80	30.00	18.24
85	0.06	55.92	23.78	30.00	18.24
86	0.08	74.69	27.27	30.00	18.24
87	0.11	107.65	31.06	30.00	18.24
88	0.18	175.80	35.27	30.00	18.24
89	0.40	382.00	40.18	30.00	18.24

APPENDIX B

ANCHOR DESIGN

															Anchor 1						Anchor 2						Design	Pile Top	Pile Toe	Pile Toe	Pile	Lagging
					L=NH'	Unif. Pres	Linear Pressure 1				Linear Pressure 2				Elevation	Angle	Anchor Load	No. of	Total Length	Bond Length	Elevation	Angle	Anchor Load	No. of	Total Length	Bond Length	Beam	Elevation	Embed	Elevation	Length	Pressure
Pile ID	Station (ft)	Height (ft)	Spacing (ft)	No. Anchors	N (psf/ft)	P (psf)	Ptop (psf)	EFD (psf/ft)	Z_{TOP}	Z_{BOT}	Ptop (psf)	EFD (psf/ft)	Z_{TOP}	Z_{BOT}	(feet)	(degrees)	(kips)	Strands	(feet)	(feet)	(feet)	(degrees)	(kips)	Strands	(feet)	(feet)		(feet)	(feet)	(feet)	(feet)	(psf)
N1	442.5	29.0	6	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.00	20	42	No. 9	29.5	11.9	68.00	20	51	No. 10	26.5	14.5	W14x34	86.0	8.0	49.0	37.0	655
N2	450.8	29.0	7.15	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.00	20	49	No. 10	31.8	14.2	68.00	20	60	No. 11	29.3	17.3	W14x34	86.0	8.0	49.0	37.0	655
N3	456.8	29.0	7.1	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.00	20	49	No. 10	31.7	14.1	68.00	20	60	No. 11	29.2	17.2	W14x34	86.0	8.0	49.0	37.0	655
N4	465	29.3	7.25	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.00	20	51	No. 10	32.3	14.5	68.00	20	63	No. 11	30.1	17.9	W14x34	86.0	8.0	48.0	38.0	661
N5	471.3	26.8	6.3	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.00	15	30	No. 8	27.6	10.0	68.00	15	47	No. 10	25.5	13.6	W14x34	84.0	8.0	48.0	36.0	611
N6	477.6	26.7	6.15	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.00	20	37	No. 9	26.7	10.5	67.00	25	46	No. 10	24.3	13.3	W14x34	84.0	8.0	48.0	36.0	610
N7	483.6	26.1	6	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.00	40	43	No. 9	28.1	12.4	67.00	45	55	No. 10	26.7	15.8	W14x34	84.0	8.0	49.0	35.0	597
N8	489.6	26.1	6	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.00	42.5	50	No. 10	29.6	14.2	66.00	40	50	No. 10	24.6	14.4	W14x34	84.0	8.0	49.0	35.0	597
N9	495.6	26.1	6	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.00	45	52	No. 10	30.3	14.8	66.00	45	54	No. 10	26.0	15.6	W14x34	84.0	8.0	49.0	35.0	597
N10	501.6	26.1	6	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.50	25	35	No. 8	26.0	10.2	67.00	27.5	44	No. 9	23.2	12.7	W14x34	84.0	8.0	49.0	35.0	597
N11	507.6	26.1	6	2	16	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.00	15	32	No. 8	26.6	10.0	67.00	15	41	No. 9	22.7	11.8	W14x34	84.0	8.0	49.0	35.0	597
E1	702.5	30.6	7	2	16	0	720.00	0.00	3.50	13.50	720.00	-72.00	13.50	23.50	82.00	42.5	107	4	50.2	30.8	70.50	37.5	113	4	47.3	32.3	W14x38	89.0	17.0	40.0	49.0	1332
E2	709.5	30.6	7	2	16	0	720.00	0.00	3.50	13.50	720.00	-72.00	13.50	23.50	82.00	42.5	107	4	50.2	30.8	70.50	37.5	113	4	47.3	32.3	W14x38	89.0	17.0	40.0	49.0	1332
E3	716.5	30.6	7	2	16	0	720.00	0.00	3.50	13.50	720.00	-72.00	13.50	23.50	82.00	42.5	107	4	50.2	30.8	70.50	37.5	113	4	47.3	32.3	W14x38	89.0	17.0	40.0	49.0	1332
E4	723.5	30.6	7	2	16	0	720.00	0.00	3.50	13.50	720.00	-72.00	13.50	23.50	82.00	42.5	107	4	50.2	30.8	70.50	37.5	113	4	47.3	32.3	W14x38	89.0	17.0	40.0	49.0	1332
E5	730.5	30.6	7	2	16	0	720.00	0.00	3.50	13.50	720.00	-72.00	13.50	23.50	82.00	42.5	107	4	50.2	30.8	70.50	37.5	113	4	47.3	32.3	W14x38	89.0	17.0	40.0	49.0	1332
E6	737.5	31.1	7.35	2	16	0	720.00	0.00	3.50	13.50	720.00	-72.00	13.50	23.50	82.00	42.5	113	4	52.2	32.5	70.50	37.5	121	4	49.7	34.7	W14x43	89.0	19.9	37.0	52.0	1342
E7	745.2	26.7	6.85	2	16	50	230.00	0.00	7.20	26.70	0.00	0.00	0.00	0.00	78.00	20	41	2	31.6	15.0	68.00	25	71	3	35.3	20.3	W14x34	84.0	8.0	49.0	35.0	814
E8	751.2	26.6	7	2	16	50	230.00	0.00	7.13	26.63	0.00	0.00	0.00	0.00	76.00	20	55	2	31.4	15.8	65.50	20	65	2	33.7	18.7	W14x34	84.0	8.0	49.0	35.0	813
E9	759.2	26.4	8	2	16	50	230.00	0.00	6.95	26.45	0.00	0.00	0.00	0.00	78.00	20	48	2	31.5	15.0	67.50	20	79	3	37.7	22.7	W14x34	84.0	8.0	49.0	35.0	809
E10	767.2	26.3	8	2	16	50	230.00	0.00	6.76	26.26	0.00	0.00	0.00	0.00	77.50	20	49	2	31.2	15.0	67.50	20	78	3	37.2	22.2	W14x34	84.0	8.0	49.0	35.0	805
E11	775.2	26.1	8	2	16	50	230.00	0.00	6.58	26.08	0.00	0.00	0.00	0.00	77.50	20	48	2	31.2	15.0	67.50	20	77	3	37.1	22.1	W14x34	84.0	8.0	49.0	35.0	802

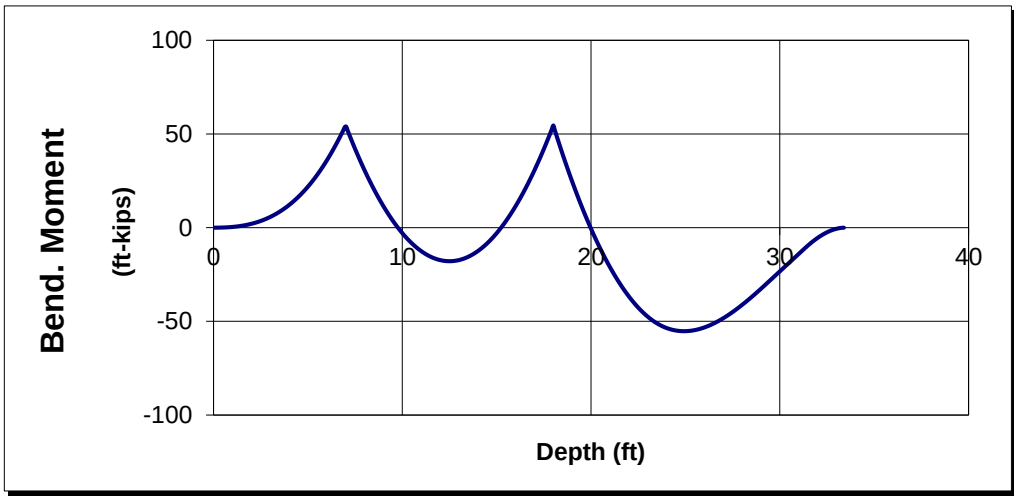
TABLE B1
ANCHOR DESIGN

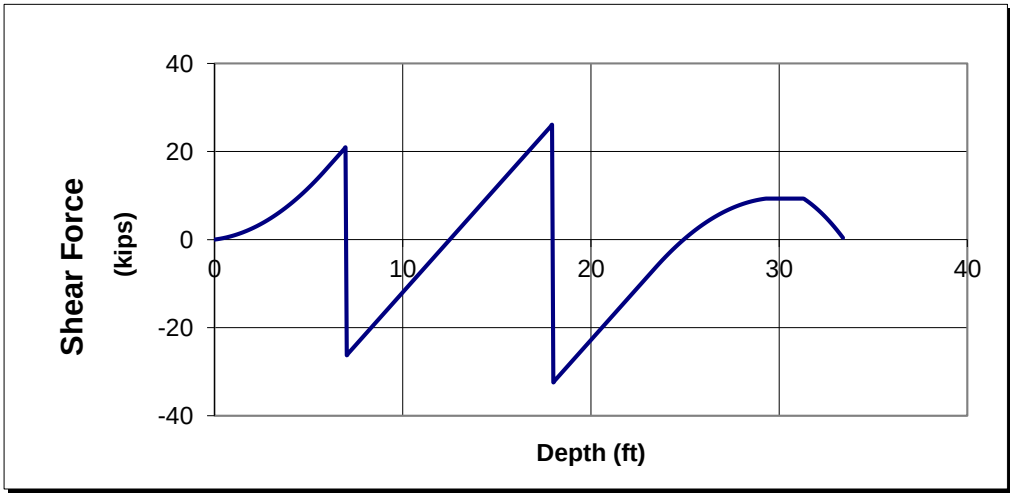
APPENDIX C

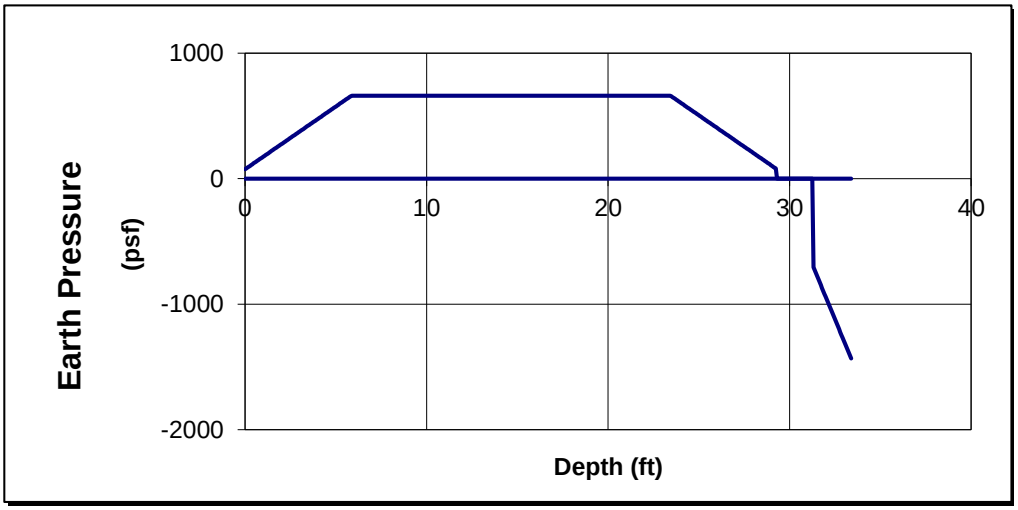
SOLDIER PILE DESIGN

		Soldier Beam Loads-Below Anchor 1					Soldier Beam Loads-Below Anchor 2					Pile Vertical Load Analysis								Toe Dist. Depth (ft) 2	Pile Vertical Punching Analysis								
Pile ID	Design Beam	Axial Load (kips)	Moment (ft-kips)	Free Length (feet)	Steel Section	Flex/Ax Ratio	Axial Load (kips)	Moment (ft-kips)	Free Length (feet)	Steel Section	Flex/Ax Ratio	Pile Diameter (ft)	Pile End Area (ft^2)	Pile Skin Area (ft^2/ft)	Pile End Bear (ksf)	Pile Skin Frict (ksf)	End Bearing (kips)	Skin Friction (klf)	Axial Load (kips)	Embed Length (ft)	Pile Depth (in)	Pile Flange (in)	Pile End Area (ft^2)	Pile Skin Area (ft^2/ft)	Pile End Bear (ksf)	Pile Skin Frict (ksf)	End Bearing (kips)	Skin Friction (klf)	Axial Load (kips)	Embed Length (ft)
N1	W14x34	14	45	11.00	W14x34	0.36	32	45	11.00	W14x34	0.39	2.00	3.14	6.28	30.00	0.50	94.2	3.1	32	-18.0	14	6.75	0.66	3.46	30	3.6	19.7	12.5	32	0.9
N2	W14x34	17	54	11.00	W14x34	0.43	38	54	11.00	W14x34	0.47	2.00	3.14	6.28	30.00	0.50	94.2	3.1	38	-16.0	14	6.75	0.66	3.46	30	3.6	19.7	12.5	38	1.4
N3	W14x34	17	53	11.00	W14x34	0.42	37	53	11.00	W14x34	0.46	2.00	3.14	6.28	30.00	0.50	94.2	3.1	37	-16.1	14	6.75	0.66	3.46	30	3.6	19.7	12.5	37	1.4
N4	W14x34	17	55	11.00	W14x34	0.43	39	55	11.30	W14x34	0.48	2.00	3.14	6.28	30.00	0.50	94.2	3.1	39	-15.7	14	6.75	0.66	3.46	30	3.6	19.7	12.5	39	1.5
N5	W14x34	8	44	11.00	W14x34	0.34	20	63	11.30	W14x34	0.50	2.00	3.14	6.28	30.00	0.50	94.2	3.1	20	-21.6	14	6.75	0.66	3.46	30	3.6	19.7	12.5	20	0.0
N6	W14x34	12	38	10.00	W14x34	0.30	32	38	10.23	W14x34	0.34	2.00	3.14	6.28	30.00	0.50	94.2	3.1	32	-17.8	14	6.75	0.66	3.46	30	3.6	19.7	12.5	32	1.0
N7	W14x34	28	37	10.00	W14x34	0.32	67	37	9.60	W14x34	0.48	2.00	3.14	6.28	30.00	0.50	94.2	3.1	67	-6.8	14	6.75	0.66	3.46	30	3.6	19.7	12.5	67	3.8
N8	W14x34	34	54	10.00	W14x34	0.46	66	54	8.60	W14x34	0.59	2.00	3.14	6.28	30.00	0.50	94.2	3.1	66	-7.1	14	6.75	0.66	3.46	30	3.6	19.7	12.5	66	3.7
N9	W14x34	37	54	10.00	W14x34	0.46	75	54	8.60	W14x34	0.62	2.00	3.14	6.28	30.00	0.50	94.2	3.1	75	-4.1	14	6.75	0.66	3.46	30	3.6	19.7	12.5	75	4.4
N10	W14x34	15	30	10.50	W14x34	0.25	35	30	9.60	W14x34	0.28	2.00	3.14	6.28	30.00	0.50	94.2	3.1	35	-16.7	14	6.75	0.66	3.46	30	3.6	19.7	12.5	35	1.3
N11	W14x34	8	31	11.00	W14x34	0.24	19	33	9.60	W14x34	0.27	2.00	3.14	6.28	30.00	0.50	94.2	3.1	19	-21.9	14	6.75	0.66	3.46	30	3.6	19.7	12.5	19	-0.1
E1	W14x38	73	108	11.50	W14x34	0.98	141	85	13.00	W14x38	0.97	2.00	3.14	6.28	30.00	0.50	94.2	3.1	141	17.0	14.1	6.77	0.66	3.48	30	3.6	19.9	12.5	141	9.7
E2	W14x38	73	108	11.50	W14x34	0.98	141	85	13.00	W14x38	0.97	2.00	3.14	6.28	30.00	0.50	94.2	3.1	141	17.0	14.1	6.77	0.66	3.48	30	3.6	19.9	12.5	141	9.7
E3	W14x38	73	108	11.50	W14x34	0.98	141	85	13.00	W14x38	0.97	2.00	3.14	6.28	30.00	0.50	94.2	3.1	141	17.0	14.1	6.77	0.66	3.48	30	3.6	19.9	12.5	141	9.7
E4	W14x38	73	108	11.50	W14x34	0.98	141	85	13.00	W14x38	0.97	2.00	3.14	6.28	30.00	0.50	94.2	3.1	141	17.0	14.1	6.77	0.66	3.48	30	3.6	19.9	12.5	141	9.7
E5	W14x38	73	108	11.50	W14x34	0.98	141	85	13.00	W14x38	0.97	2.00	3.14	6.28	30.00	0.50	94.2	3.1	141	17.0	14.1	6.77	0.66	3.48	30	3.6	19.9	12.5	141	9.7
E6	W14x43	77	114	11.50	W14x38	0.92	150	101	13.50	W14x43	0.97	2.00	3.14	6.28	30.00	0.50	94.2	3.1	150	19.9	13.7	8	0.76	3.62	30	3.6	22.8	13.0	150	9.8
E7	W14x34	14	42	10.00	W14x34	0.33	44	94	11.00	W14x34	0.77	2.00	3.14	6.28	30.00	0.50	94.2	3.1	44	-14.0	14	6.75	0.66	3.46	30	3.6	19.7	12.5	44	2.0
E8	W14x34	19	61	10.50	W14x34	0.48	41	61	8.50	W14x34	0.52	2.00	3.14	6.28	30.00	0.50	94.2	3.1	41	-14.9	14	6.75	0.66	3.46	30	3.6	19.7	12.5	41	1.7
E9	W14x34	17	61	10.50	W14x34	0.48	44	100	10.50	W14x34	0.82	2.00	3.14	6.28	30.00	0.50	94.2	3.1	44	-14.1	14	6.75	0.66	3.46	30	3.6	19.7	12.5	44	1.9
E10	W14x34	17	48	10.00	W14x34	0.38	43	97	10.50	W14x34	0.80	2.00	3.14	6.28	30.00	0.50	94.2	3.1	43	-14.2	14	6.75	0.66	3.46	30	3.6	19.7	12.5	43	1.9
E11	W14x34	16	50	10.00	W14x34	0.40	43	99	10.50	W14x34	0.81	2.00	3.14	6.28	30.00	0.50	94.2	3.1	43	-14.4	14	6.75	0.66	3.46	30	3.6	19.7	12.5	43	1.9

TABLE C1
SOLDIER PILE DESIGN







Wall Height (ft)	**29.3**
Pile Spacing (ft)	**7.25**

FIGURE C1 SOLDIER BEAM - N4

Point	Depth	Pressure	Width		Force	Depth(CG)	Moment
A	0.00	0.0	7.25	F_{AB}	12448	3.91	367871
B	5.86	586.0	7.25	F_{BC}	74689	14.65	1404822
C	23.44	586.0	7.25	F_{CD}	12448	25.39	100403
D	29.30	0.0	7.25	F_{AD}	99585	14.65	
	29.30	0.0					
E	29.30	0.0	2.00	F_{EF}	0	0.00	0
F	33.46	0.0	2.00				
	33.46	0.0					
G	31.30	0.0	4.00	F_{GH}	0	0.00	0
H	31.30	-700.0	4.00	F_{HI}	-9308	32.51	-8874
I	33.46	-1455.7	4.00	F_{IJ}	0	0.00	0
J	33.46	-1455.7	4.00	F_{JK}	0	0.00	0
K	33.46	-1455.7	4.00	F_{GK}	-9308	32.51	
	33.46	0.0					
	0.00	0.0					
L	0.00	75.0	7.25	F_{LM}	15932	14.65	299663
M	29.30	75.0	7.25				
	29.30	0.0					
	0.00	0.0					
N	0.00	0.0	7.25	F_{NO}	0	0.00	0
O	0.00	0.0	7.25				
	0.00	0.0					
	0.00	0.0					
P	0.00	0.0	7.25	F_{PQ}	0	0.00	0
Q	0.00	0.0	7.25				
	0.00	0.0					
	0.00	0.0					
R	0.00	0.0	7.25	F_{RS}	0	0.00	0
S	0.00	0.0	7.25				
	0.00	0.0					
T	29.30	0.0	7.25	F_{TU}	0	0.00	0
U	29.30	0.0	7.25	F_{UV}	0	0.00	0
V	29.30	0.0	7.25	F_{VW}	0	0.00	0
W	33.46	0.0	7.25	F_{TW}	0	0.00	
	33.46	0					
				Anchor 1	47455	7.00	1255615
				Amchor 2	58753	18.00	908270
				Anchor 3	0	0.00	0
				Anchor 4	0	0.00	0
				Load 1	0	0.00	0
				Σ Forces	0	Σ Moments	0

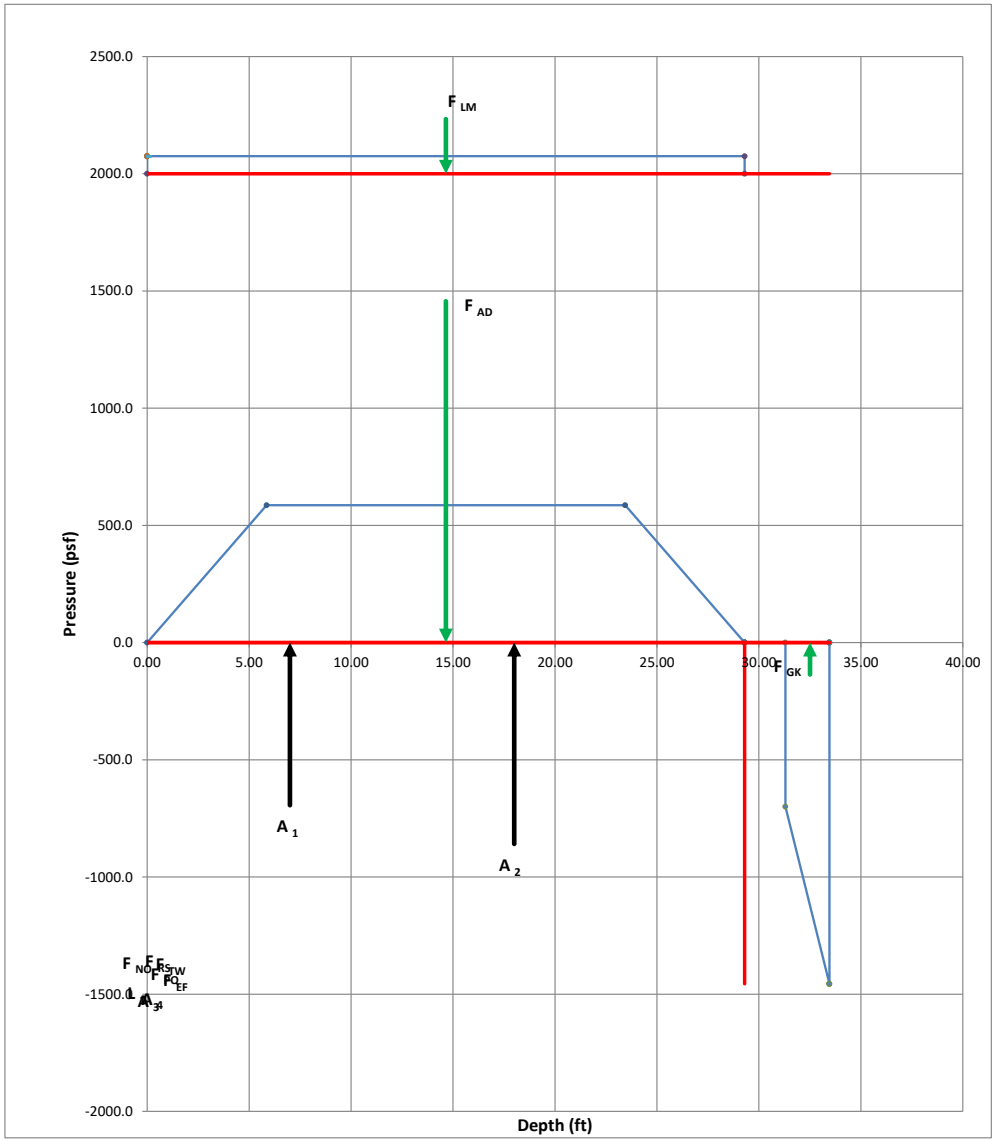
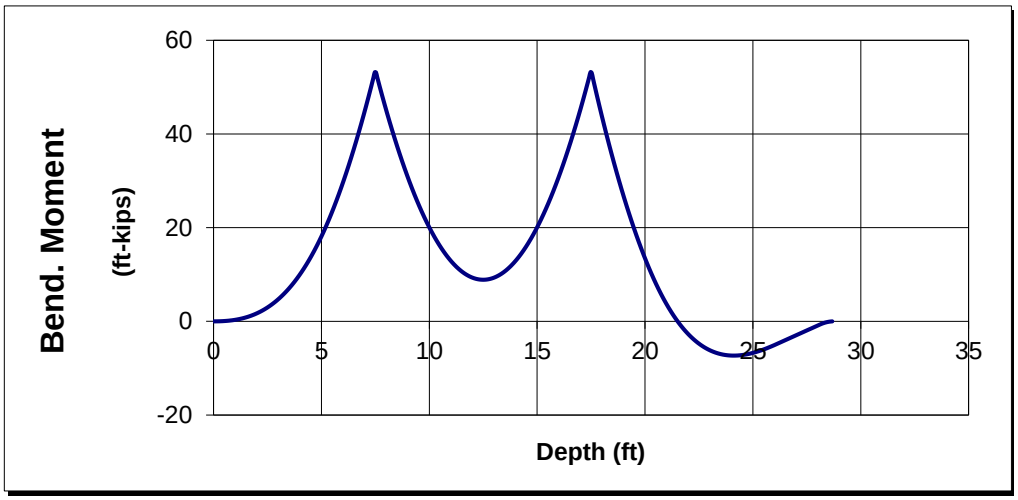
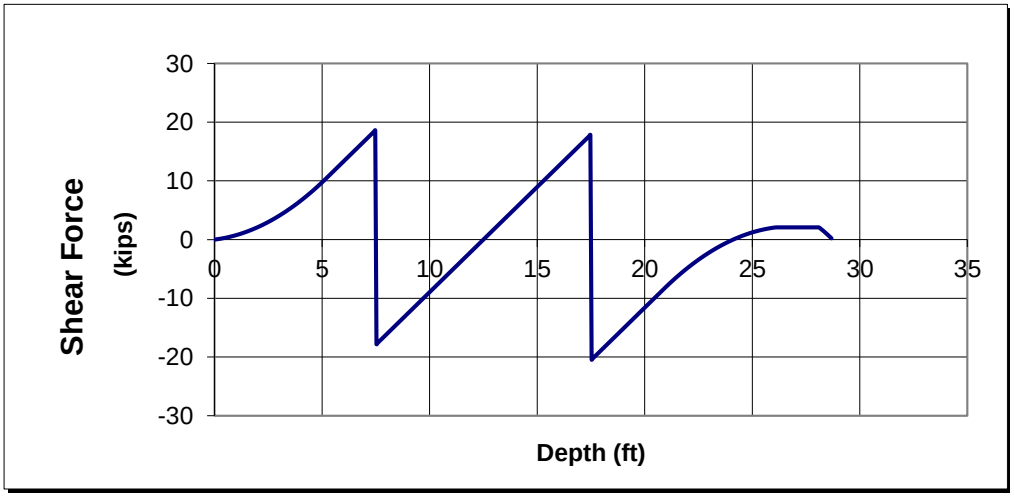
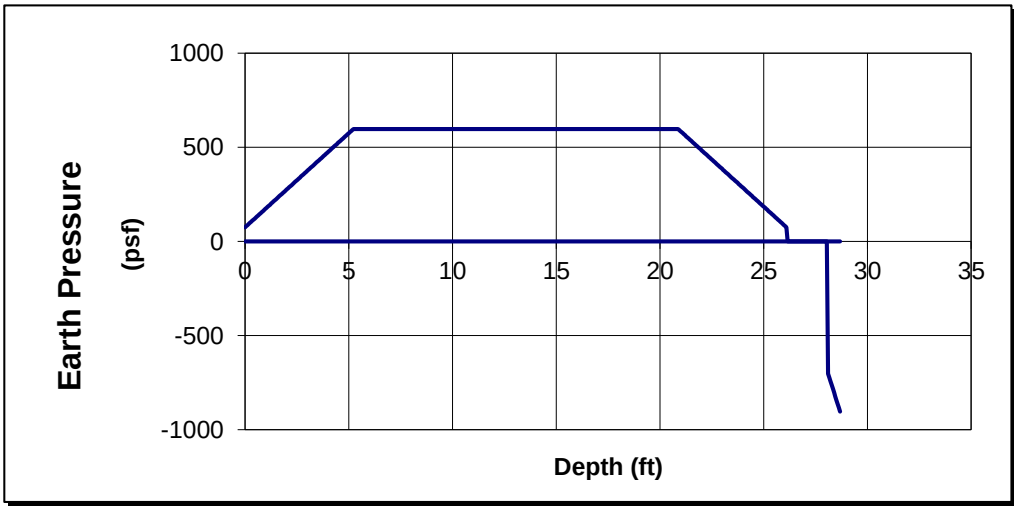


FIGURE C1 (cont'd) SOLDIER BEAM - N4

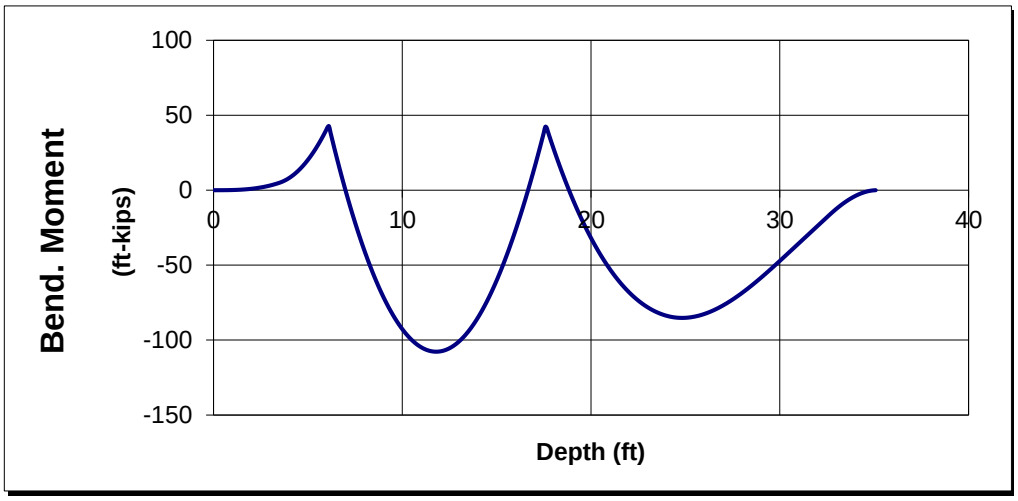


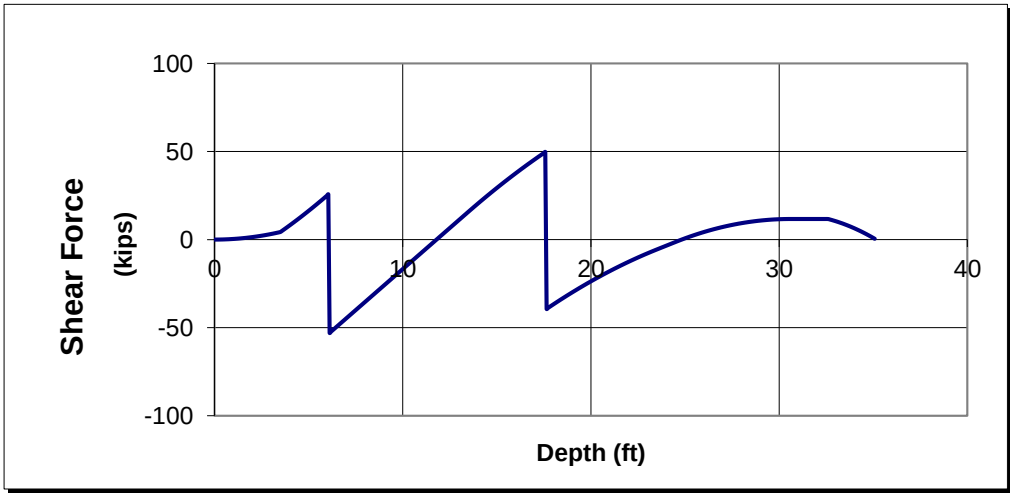


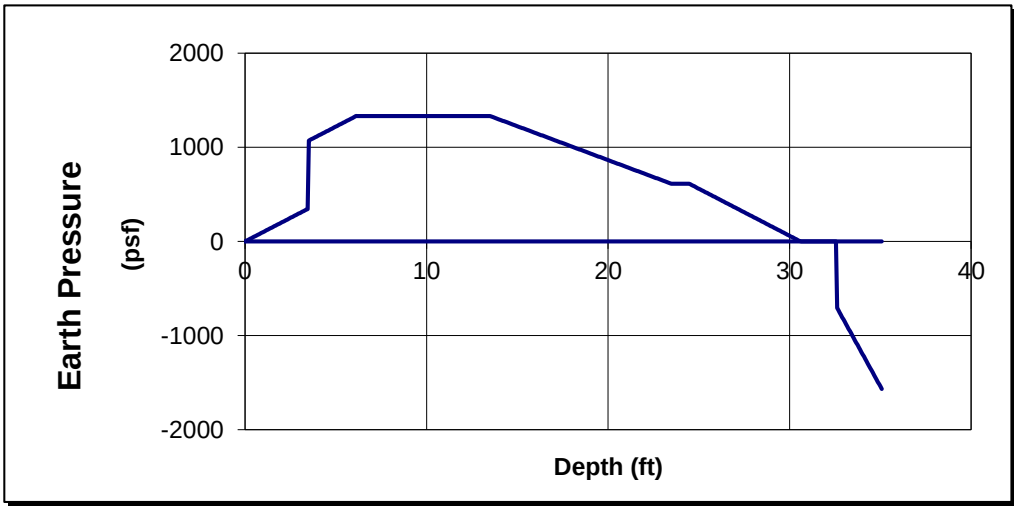


Wall Height (ft)	**26.1**
Pile Spacing (ft)	**6.00**

FIGURE C2 SOLDIER BEAM - N9

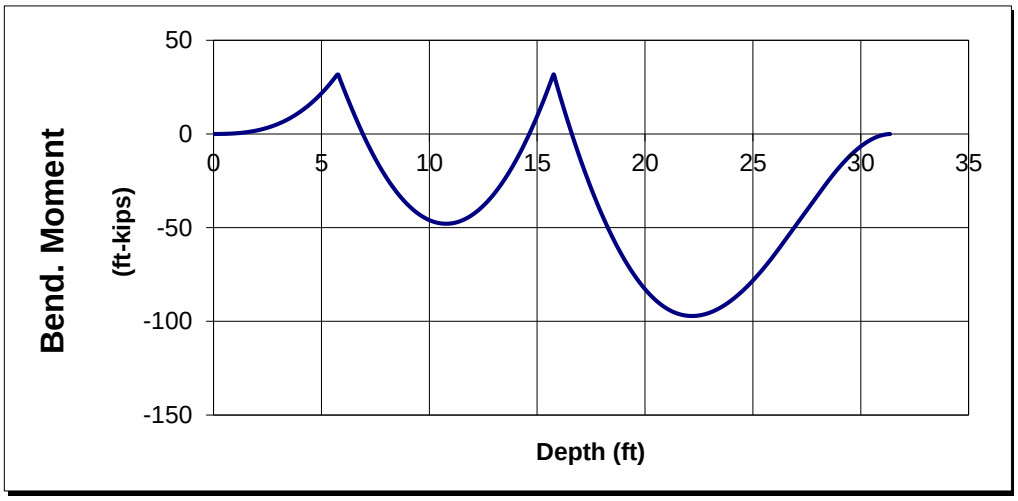


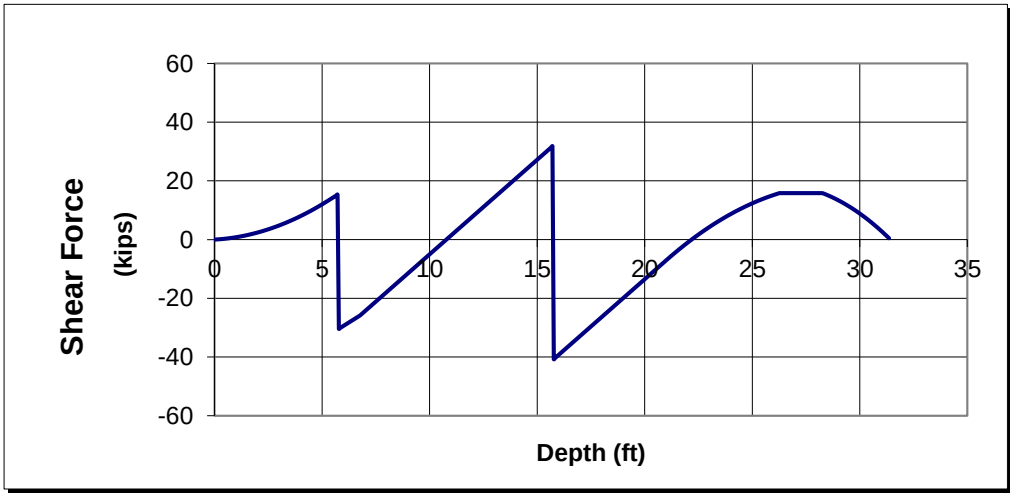


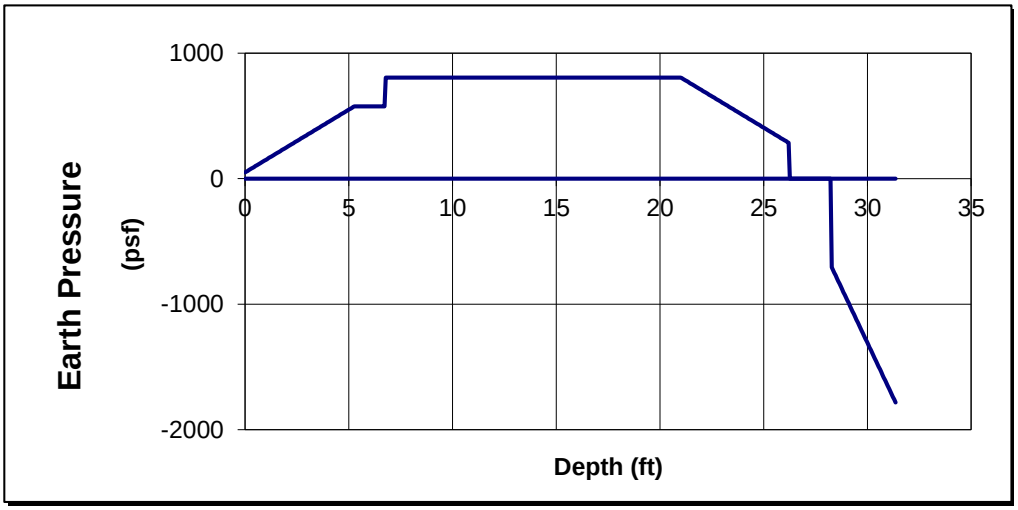


Wall Height (ft)	**30.6**
Pile Spacing (ft)	**7.00**

FIGURE C3 SOLDIER BEAM - E3







Wall Height (ft)	**26.3**
Pile Spacing (ft)	**8.00**

FIGURE C4 SOLDIER BEAM - E10

APPENDIX D

SOLDIER PILE DESIGN – INITIAL CANTILEVER STAGE

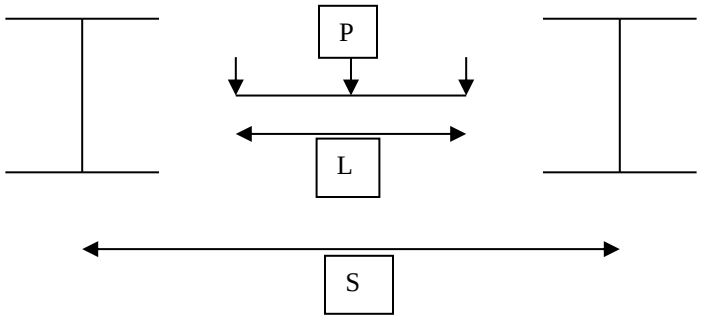
																	Soldier Beam - Flexure/Compression				
					L=NH^2	Unif. Press.	Linear Pressure 1				Design	Pile Top	Pile Toe	Pile Toe	Pile	Lagging	Axial		Free		
Pile ID	Station (ft)	Height (ft)	Spacing (ft)	No. Anchors	N (psf/ft)	P (psf)	Ptop (psf)	EFD (psf/ft)	Z_{TOP}	Z_{BOT}	Beam	Elevation (feet)	Embed (feet)	Elevation (feet)	Length (feet)	Pressure (psf)	Load (kips)	Moment (ft-kips)	Length (feet)	Steel Section	Flex/Ax Ratio
N1	442.5	9.0	6	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	86.0	11.0	66.0	20.0	390	0	97	9.00	W14x34	0.71
N2	450.8	9.0	7.15	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	86.0	11.7	65.0	21.0	390	0	119	9.00	W14x34	0.87
N3	456.8	9.0	7.1	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	86.0	11.7	65.0	21.0	390	0	118	9.00	W14x34	0.86
N4	465	9.0	7.25	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	86.0	11.8	65.0	21.0	390	0	121	9.00	W14x34	0.88
N5	471.3	6.5	6.3	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	84.0	8.7	68.0	16.0	303	0	48	6.50	W14x34	0.35
N6	477.6	8.5	6.15	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	84.0	10.6	64.0	20.0	373	0	87	8.50	W14x34	0.64
N7	483.6	8.5	6	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	84.0	10.5	64.0	20.0	373	0	85	8.50	W14x34	0.62
N8	489.6	9.5	6	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	84.0	11.5	62.0	22.0	408	0	111	9.50	W14x34	0.81
N9	495.6	9.5	6	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	84.0	11.5	62.0	22.0	408	0	111	9.50	W14x34	0.81
N10	501.6	8.0	6	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	84.0	10.0	65.0	19.0	355	0	74	8.00	W14x34	0.54
N11	507.6	7.5	6	0	17.5	75	0.00	0.00	0.00	0.00	W14x34	84.0	9.5	66.0	18.0	338	0	63	7.50	W14x34	0.46
E1	702.5	8.1	7	0	17.5	0	720.00	0.00	3.50	8.10	W18x50	89.0	13.9	66.0	23.0	1004	0	236	8.10	W18x50	0.99
E2	709.5	8.1	7	0	17.5	0	720.00	0.00	3.50	8.10	W18x50	89.0	13.9	66.0	23.0	1004	0	236	8.10	W18x50	0.99
E3	716.5	8.1	7	0	17.5	0	720.00	0.00	3.50	8.10	W18x50	89.0	13.9	66.0	23.0	1004	0	236	8.10	W18x50	0.99
E4	723.5	8.1	7	0	17.5	0	720.00	0.00	3.50	8.10	W18x50	89.0	13.9	66.0	23.0	1004	0	236	8.10	W18x50	0.99
E5	730.5	8.1	7	0	17.5	0	720.00	0.00	3.50	8.10	W18x50	89.0	13.9	66.0	23.0	1004	0	236	8.10	W18x50	0.99
E6	737.5	8.1	7.35	0	17.5	0	720.00	0.00	3.50	8.10	W18x55	89.0	14.2	65.0	24.0	1004	0	250	8.10	W18x55	0.95
E7	745.2	9.7	6.85	0	17.5	50	230.00	0.00	7.20	9.70	W14x38	84.0	12.7	61.0	23.0	620	0	146	9.70	W14x38	0.95
E8	751.2	9.6	7	0	17.5	50	230.00	0.00	7.13	9.63	W14x38	84.0	12.7	61.0	23.0	617	0	148	9.63	W14x38	0.96
E9	759.2	9.4	8	0	17.5	50	230.00	0.00	6.95	9.45	W14x43	84.0	13.3	60.0	24.0	611	0	166	9.45	W14x43	0.96
E10	767.2	7.8	8	0	17.5	50	230.00	0.00	6.76	7.76	W14x34	84.0	10.9	64.0	20.0	552	0	92	7.76	W14x34	0.67
E11	775.2	7.6	8	0	17.5	50	230.00	0.00	6.58	7.58	W14x34	84.0	10.7	64.0	20.0	545	0	87	7.58	W14x34	0.64

TABLE D1
SOLDIER PILE DESIGN - STAGE 1 CANTILEVER

APPENDIX E

SHOTCRETE FACING DESIGN

SHOTCRETE FACING DESIGN



General

Facing consists of reinforced shotcrete with a single layer of reinforcement at mid thickness, and attached to soldier piles with headed studs.

Soldier Pile Spacing (S) 6 ft
Effective Load Width (L) 4 ft

Service Static Load (P_{ST}) = 600 psf
Ultimate Load (P_{ULT}) = $1.6P_{ST}$
= 960 psf

Flexure

Ultimate Moment = $P_{ULT}.L.(S-L/2)/6$
= (960) (4) (6-4/2)/6
= 2,560 ft-lbf/ft

Design Flexural Strength ϕM_n = 0.9 (3,110)
= 2,799 ft-lbf/ft (OK in flexure)

(Note: Nominal flexural strength of facing is for a 4-inch-thick shotcrete facing reinforced with 6x6 W4.0xW4.0 WWM and with No. 4 bars on 9-inch vertical centers)

One-Way Shear

Ultimate Shear Force = $P_{ULT}.L/2$
= (960) (4)/2
= 1,920 lbf/ft

Design Shear Strength ϕV_n = 0.75 (2) $(f^1_c)^{0.5}$ (2) (12)
= 0.75 (2) $(5{,}000)^{0.5}$ (2) (12)
= 2,546 lbf/ft (OK in shear)

Headed Studs and Punching Shear

Ultimate Stud Load = $P_{ULT}.L$
= (960) (4)
= 3,840 lbf/ft

Design Shear Strength ϕV_n = $0.7N_b$
= $(0.7)k(f'_c)^{0.5}h^{1.5}$ per D-7 of ACI 318
= $(0.7)(24)(5000)^{0.5}(3.188)^{1.5}$ for 3.5-inch stud
= 6,761 lbf/stud

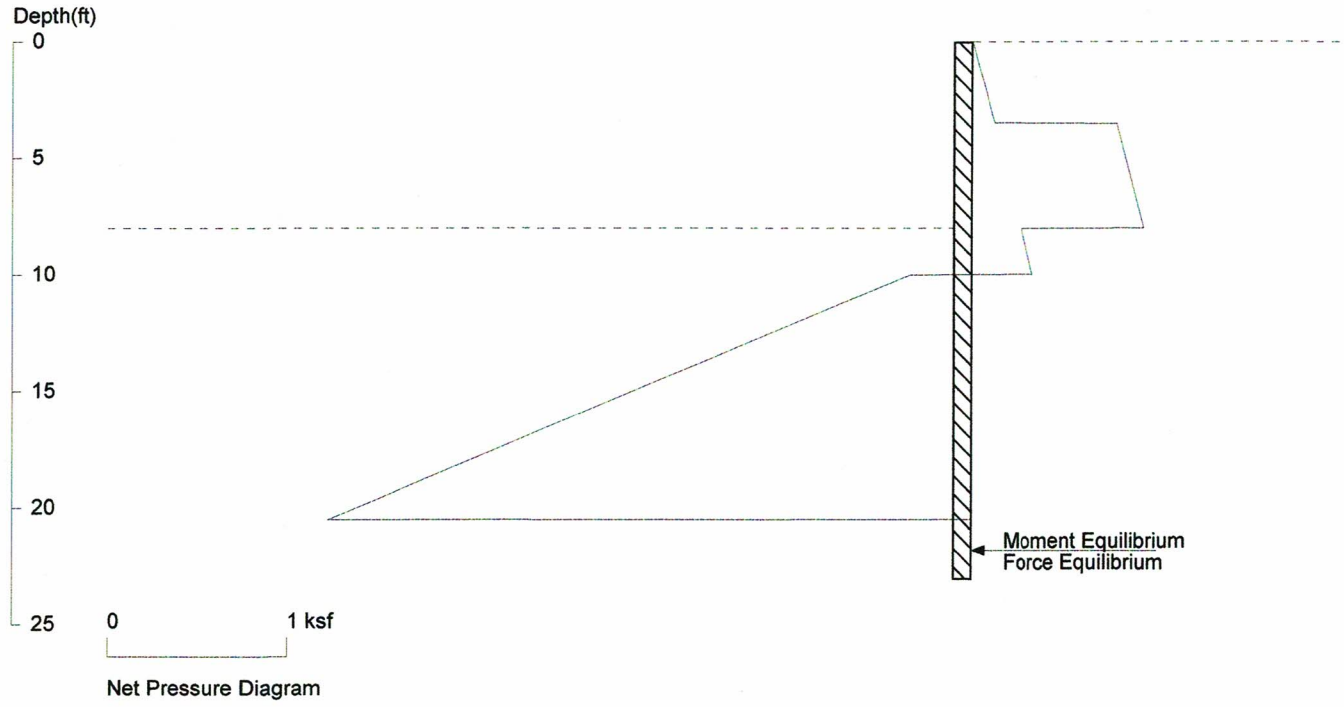
Design Stud Tensile Strength = $0.75\ A_{STUD}\ f_{UT}$
= 075 (0.2) (61,000) (for 1/2-inch diam. studs conforming to ASTM A29 with minimum ultimate tensile strength of 61 ksi)
= 9,150 lbf/stud

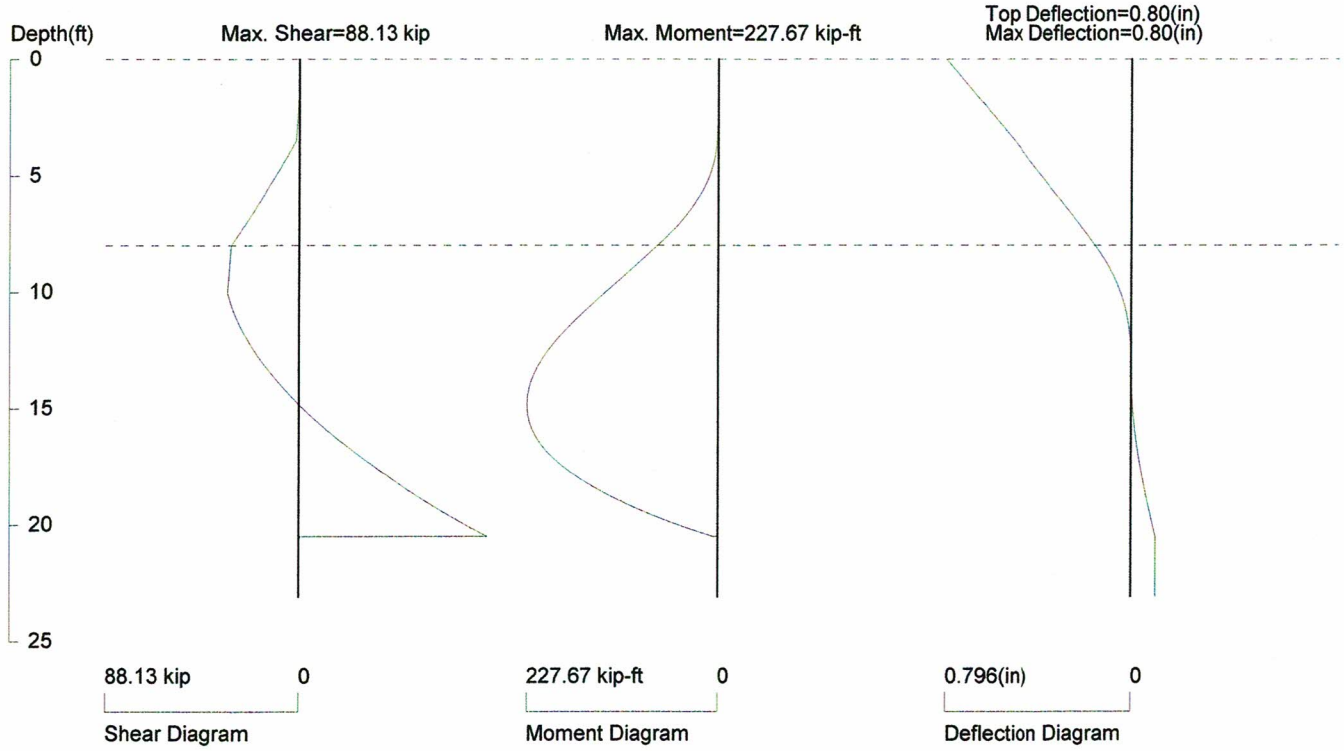
Design OK for 3.5-inch long headed studs on 9-inch vertical centers.

APPENDIX F

DEFORMATION CALCULATIONS

Saint Lukes
E3





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.0 foot or meter

User Input Pile, W14x61: E (ksi)=29000.0, I (in4)/pile=640.0

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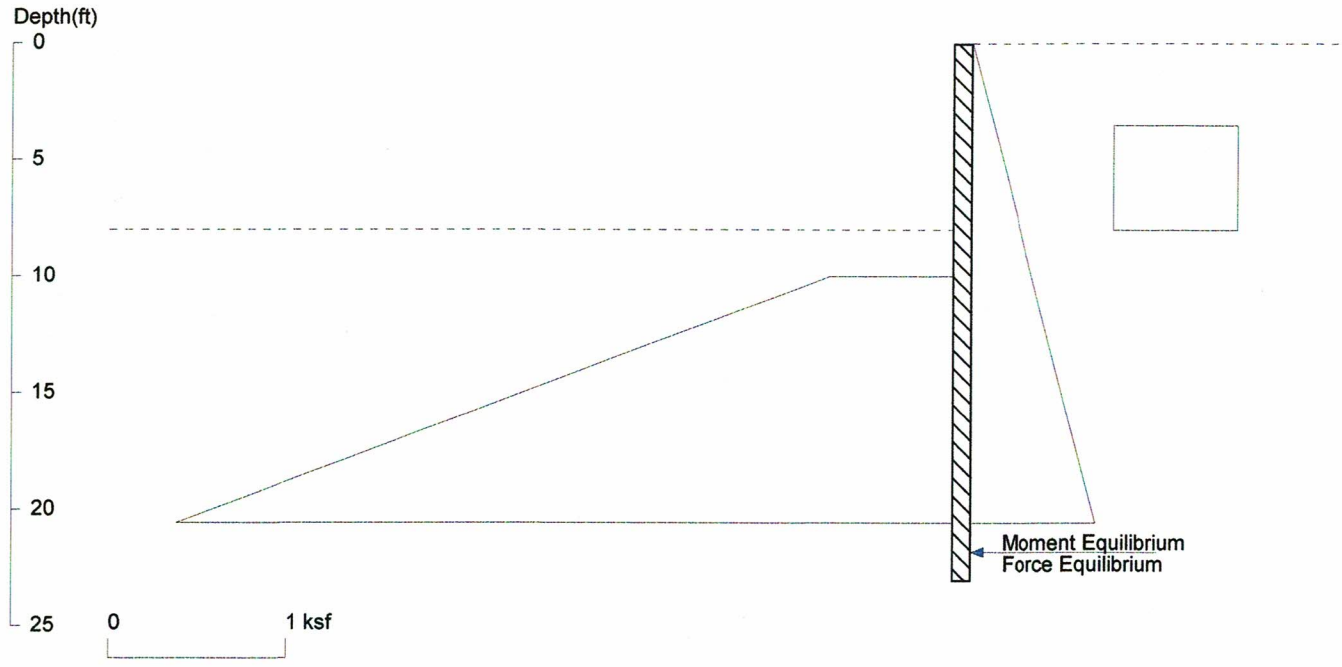
Saint Lukes
E3



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Wall Height=8.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=15.08 Min. Pile Length=23.08
MOMENT IN PILE: Max. Moment=227.67 per Pile Spacing=7.0 at Depth=14.83

VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=0.2, Vertical Factor of Safety=999.00

PILE SELECTION:
Request Min. Section Modulus = 82.8 in3/pile=1356.67 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W14X61 has Section Modulus = 92.1 in3/pile=1509.24 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.80(in) based on E (ksi)=29000.00 and I (in4)/pile=640.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	25	.875	0.035000
3.5	.72	8	.72	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
10	.7	25	5.95	0.3500

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	7.00
2	8.00	2.50

PASSIVE SPACING:

No.	Z depth	Spacing
1	8.00	5.00

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