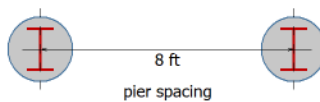
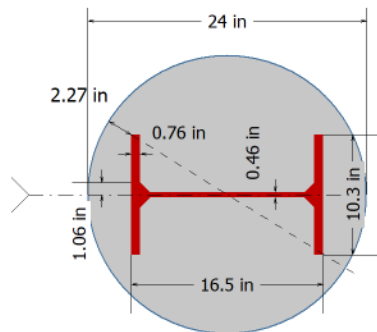
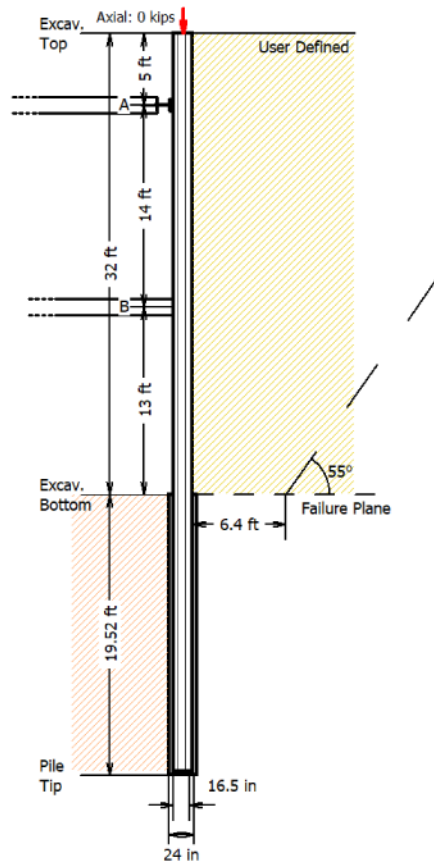


Anchored or Braced Shoring Analysis

Organization: **SOILSTRUCTURE SOFTWARE**
 Project Name: **STRUT 2 LEVEL COMPARISON**
 Design by: **L. AFFI, P.E.**
 Job #: **1111**
 Date: **7/29/2021**



Inputs

General Data

Units	English
Analysis Method	Apparent Earth Press.
Installation Method	Drilled
Pile Type	Soldier Beam (King Pile)
Reinforcement	I-Beam
Shored Height, H	32.00 ft
Pile Spacing, S	8.00 ft
Pile Width or Pier Diameter, B	2.00 ft

Earth Pressure and Surcharges

Loading Height	35.20 ft
Pile Spacing	8.00 ft
Soil Unit Weight	115.0 pcf
Vert. Uniform Surcharge	0.00 psf
Water Depth, GWT	39.00 ft
Soil/Bedrock Type	User Defined

Unfactored Earth Pressure

	x, ft	w, ksf
	0.00	0.90
	8.00	0.90
	24.00	0.90
	35.20	0.90
Act. Earth Press. Coeff, Ka		0.32
Seismic Horiz. Accel, Kh		0.00 g

Structural data

I-Beam

Beam Type	North American
Beam Size	W16X77
Beam Diagonal Length (<24 in - 4 in, O.K.)	19.45 in
Pipe Filled with Concrete	No
Steel Modulus of Elasticity	29000 ksi
Yield Strength, Fy	50 ksi
Conc. Compress. Str, f'c	2.50 ksi

Loads Applied to the Pile

Axial Load	0.00 kips
Vertical Axial Component	0.00 kips
Total Vertical Load	0.00 kips
Drilled Pier Diameter	2.00 ft
Drilled Pier Embedment	19.52 ft
Allow. Skin Friction	0.60 ksf
Allow. End Bearing	3.00 ksf

Anchors or Braces

Shored Height, H	32.00 ft
Loading Height, L	35.20 ft
Number of Anchors	2
Anchor Spacing	8.00 ft

Level	Anchor Type	Ht. from Prev, ft	Angle, deg
A	Strut (Cross Brace)	5.00	0.00
B	Strut (Cross Brace)	14.00	0.00
C		13.00	

Embedment Ratio	0.61 H
Required Embedment	19.52 ft
Unbraced Length, Lb	168.00 in
Modification Factor, Cb	1.00
Total Vertical Load, P	0.00 kips
Effect. Length Factor, K	0.80
Max Deflection	1.00 in
Test Load Factor	1.25

Corner Braces

Use Corner Brace	No
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Water Design - Level A

Left Side Tributary, a	6.00 ft
Length between Anchors, b	12.00 ft
Right Side Tributary, c	6.00 ft
Loc. from Excav. Top	5.00 ft
Loading on Water, wl	297.79 kips
Beam Type	North American
Beam Size	W16X57
Steel Yield Strength, Fy	50.00 ksi
Modulus of Elasticity, E	29000 ksi
Moment of Inertia, Ix	758 in^4
Two Channel Section	No

Lagging Design

Plate Type	Timber Lagging
Arching Factor	0.6
Allowed Stress	
Bending, Fb	1200.00 psi
Shear Parallel to Grain, Fv	150.00 psi
Reference Modulus of EI, E	1.7 10^6 psi
Lumber is Southern Pine	No
Lumber Grade	#2

Results

Anchored or Braced Results

Unfactored Earth Pressure		x, ft	w, kips/ft
		0.00	7.20
		8.21	7.20
		24.05	7.20
		35.20	7.20

Level	Depth, ft	Tension (T) or Compression (C), kips	Unbonded Tieback Length, ft	Test Load, kips
A	5.00	79.4 (C)	N.A.	99.3
B	19.00	127.3 (C)	N.A.	159.1

Strut Calculations

Level	Axial Load - P util.	Moment Load Mx util.	Moment Load My util.	Combined Util. Ratio
A	0.65	0.00	N.A.	0.65
B	0.00	0.00	0.00	0.00

Static Check

Sum of Reactions	-253.4 kips
Sum of Loads	253.4 kips
Lateral Torsional Buckling Check, Mn/Omega	335 kip-ft
Axially-Loaded Member Check, Pn/Omega	545 kips
Combined Forces Utilization	56 %

Design

Max. Shear	-69.9 k @ 19.00 ft	
Max. Moment	187.6 k-ft @ 19.00 ft	
Max. Deflection	-0.18 in @ 27.91 ft	
	Required	Provided
Aw (Adequate for Shear)	3.49	7.51 in ²
Zx (Adequate for Bending)	75.19	150.00 in ³
Utilized Ix (Adequate for Deflection)	18 %	
Slenderness Ratio, kL/r	54	

Waler Design - Level A

Waler Length, l	24.00 ft	
Uniform Loading, w	12.41 kips/ft	
Reactions	R1	R2
	148.89	148.89 kips
	V1	V2
	74.45	74.45
Shear	V3	V4
	74.45	74.45
	M1	M2
	-223.34	-223.34
Moment	M3	M4
	0.00	0.00
	Required	Provided
Sec. Mod, Sx (Waler is Adequate)	89.34	92.20 in ³
Max. Deflection	0.369	0.600 in

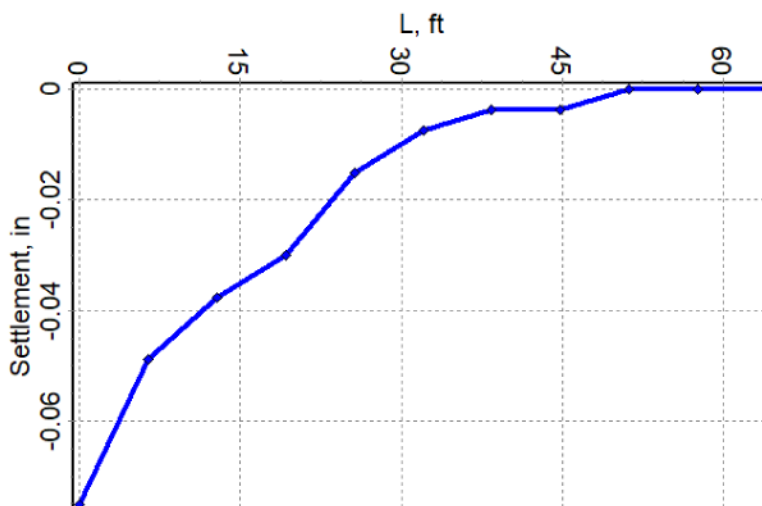
Loads Applied to the Pile

Allowable Axial Load	83.01 kips
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Lagging Design

Soil Pressure	132 psf	
Max Bending Moment	596 lb-ft/ft	
Shear	397.4 plf	
	Adjusted	Actual
Bending Stress	1223.7	572.3 psi
Shear Parallel to Grain	145.5	19.9 psi
Deflection	0.16 in	
Wood Lagging Size	3x12 timber	

Surface Settlement



Guardrail Design

Guardrail Design

Shape	L3X3X3/8
Length of the Guardrail	3.50 ft
Lateral Bracing	3.50 ft
Max. Spacing of Guardrail	8.00 ft
Dist. Load in Any Dir.	50 plf
Point Load in Any Dir.	200 lbf
ASD Safety Factor of Comp.	1.67
ASD Safety Factor of Bend.	1.67

Guardrail Design Results

	Allowable	Applied
Compression in the Post	24.95	0.40 k
Yield Mom. Axis of Bending		3.713 k-ft
Elastic lat-tors. Buckling Mom.		4.060 k-ft
Bending moment in the post	2.223	1.400 k-ft
Welding Stress, y-axis	31.49	10.81 ksi
Welding Stress, x-axis	30.09	19.19 ksi

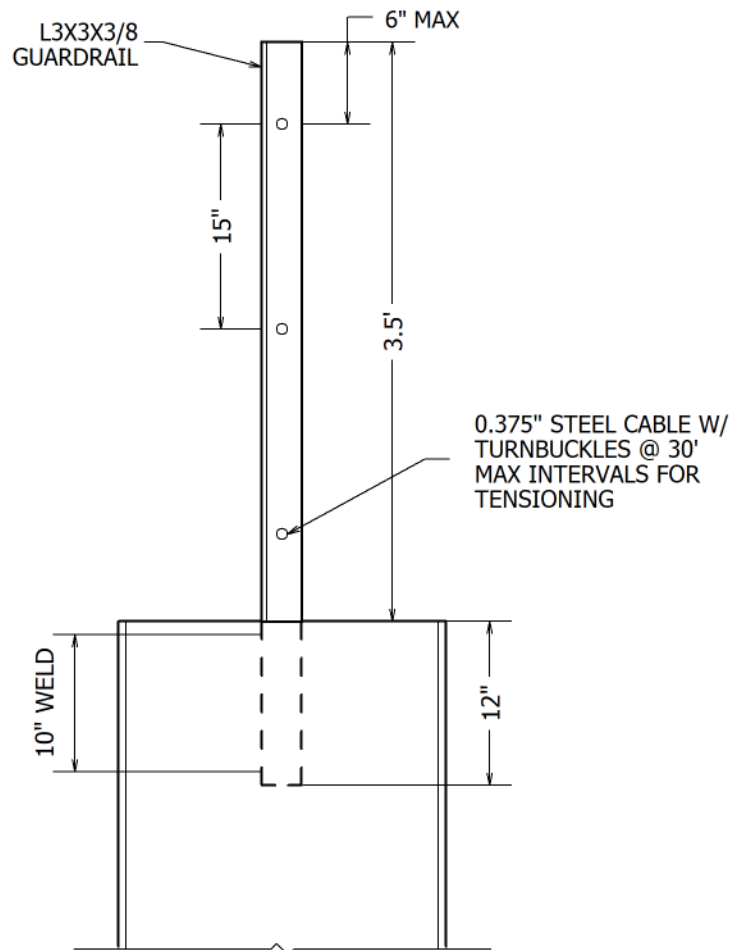
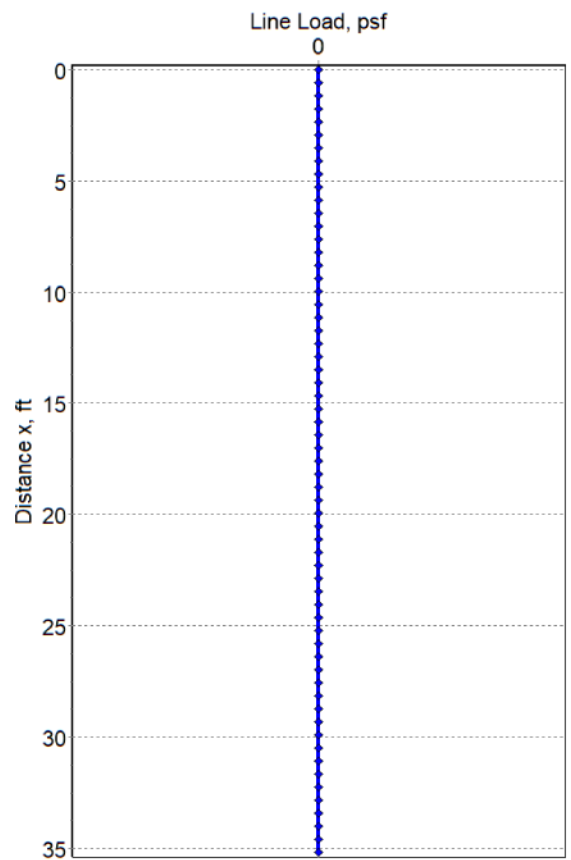
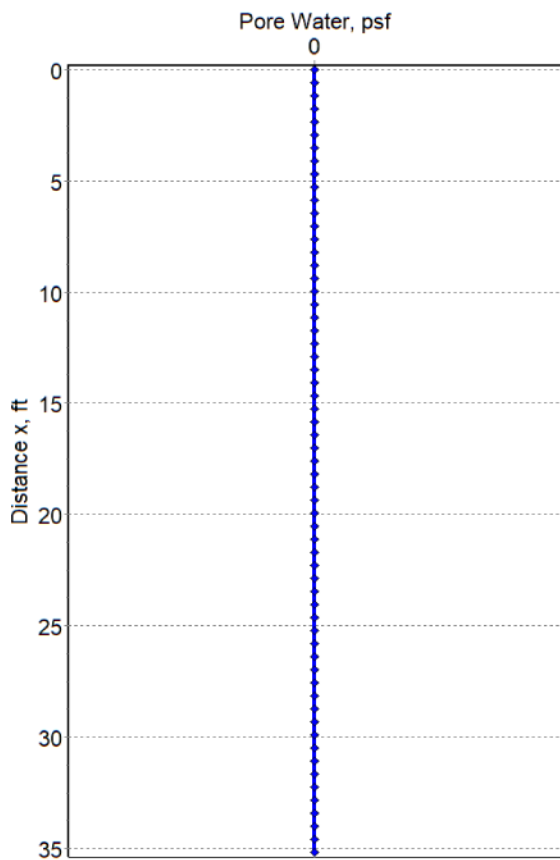
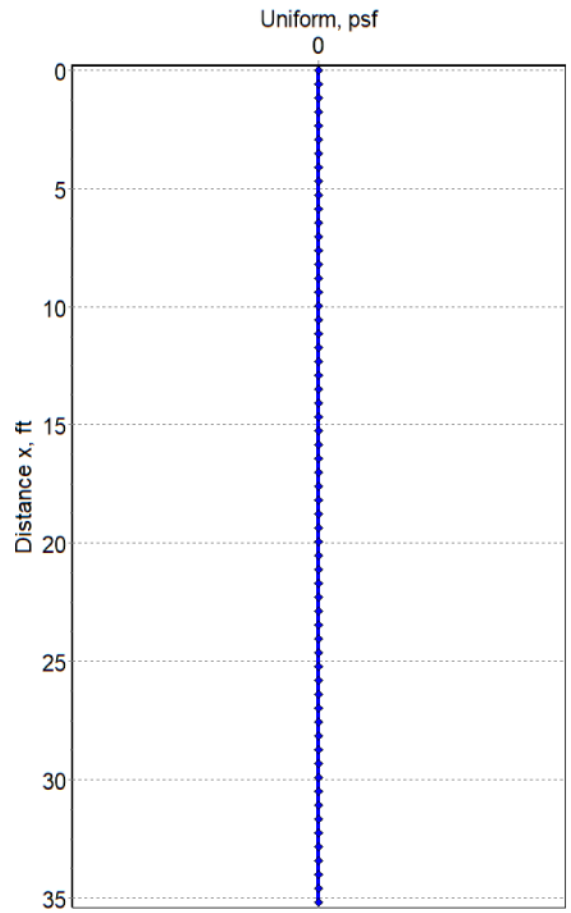
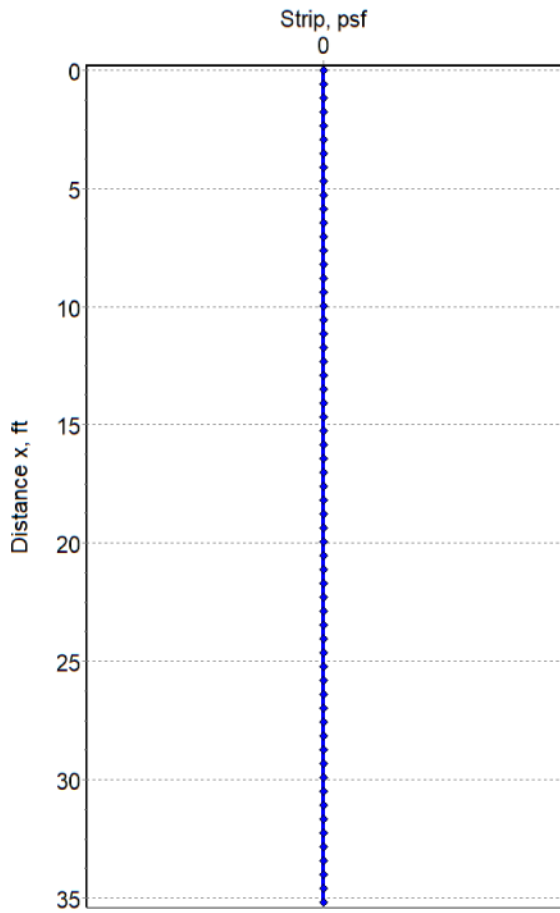


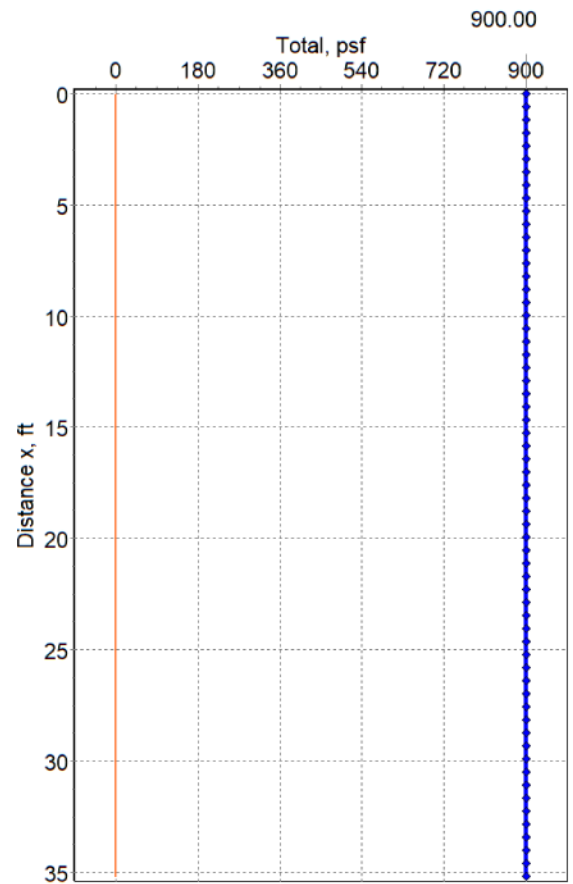
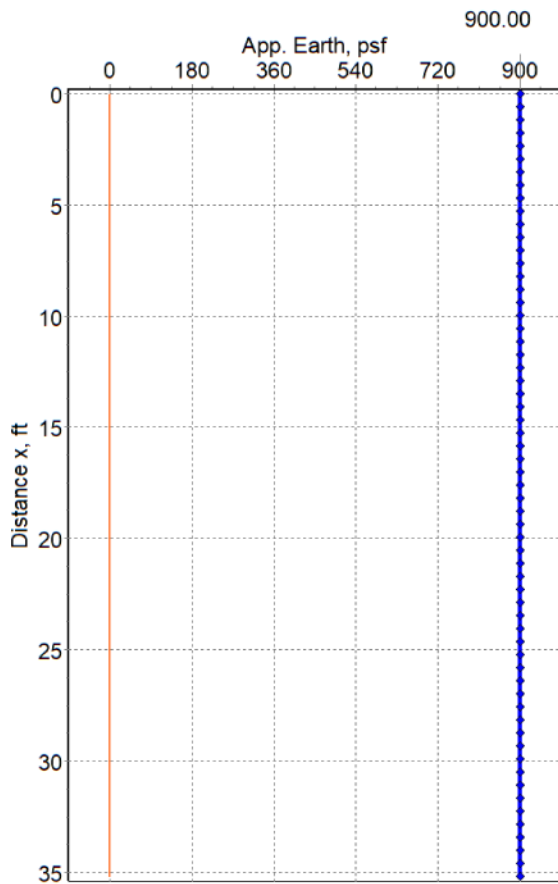
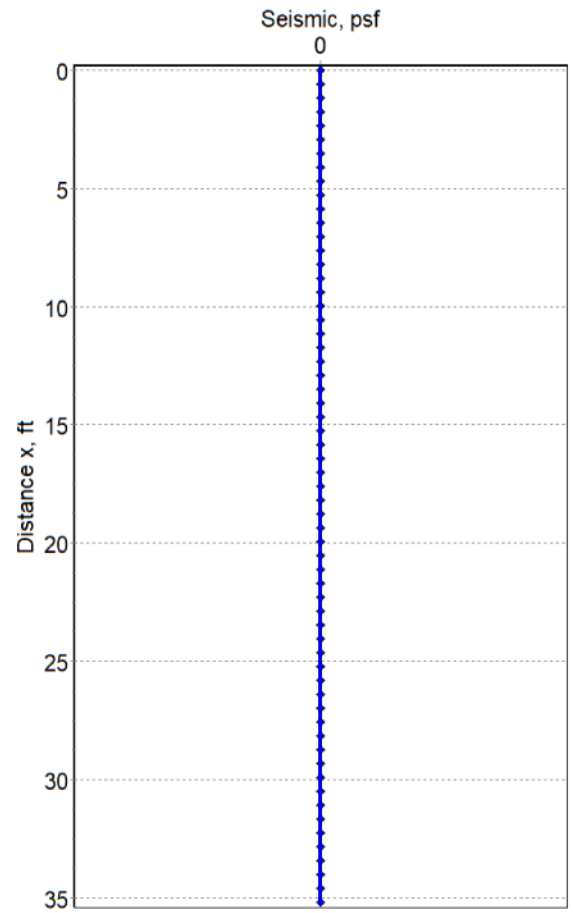
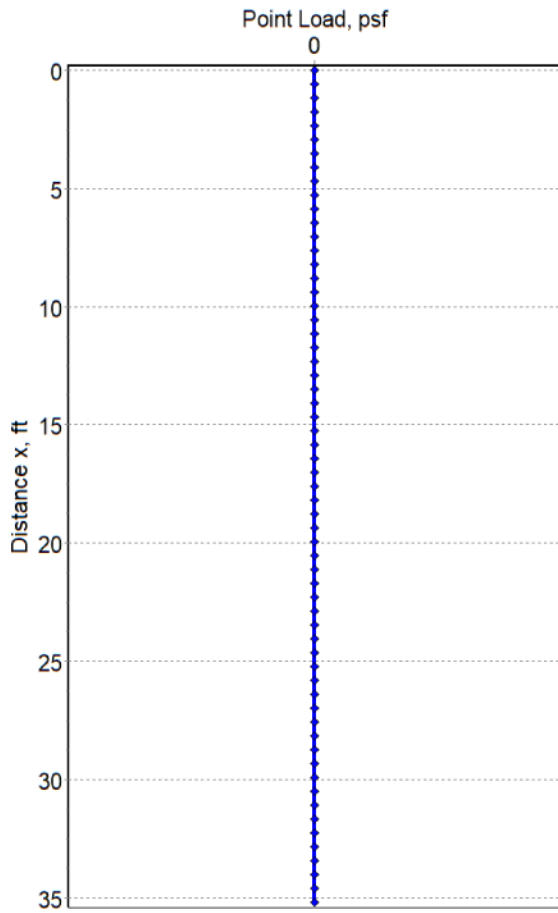
Table of Test Results

#	Depth, ft	Strip Load, psf	Unif. Surch, psf	Pore Water, psf	App. Earth, psf	Line Load, psf	Point Load, psf	Seism. Load, psf	Total per ft, psf/ft	Total per Pile, k/ft
0	0.00	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
1	0.59	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
2	1.17	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
3	1.76	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
4	2.35	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
5	2.93	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
6	3.52	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
7	4.11	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
8	4.69	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
9	5.28	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
10	5.87	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
11	6.45	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
12	7.04	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
13	7.63	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
14	8.21	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
15	8.80	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
16	9.39	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
17	9.97	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
18	10.56	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
19	11.15	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
20	11.73	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
21	12.32	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
22	12.91	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
23	13.49	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
24	14.08	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
25	14.67	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
26	15.25	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
27	15.84	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
28	16.43	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
29	17.01	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
30	17.60	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
31	18.19	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
32	18.77	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
33	19.36	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
34	19.95	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
35	20.53	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
36	21.12	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
37	21.71	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
38	22.29	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
39	22.88	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
40	23.47	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
41	24.05	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
42	24.64	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
43	25.23	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
44	25.81	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
45	26.40	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
46	26.99	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
47	27.57	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
48	28.16	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
49	28.75	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
50	29.33	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
51	29.92	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
52	30.51	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
53	31.09	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
54	31.68	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
55	32.27	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
56	32.85	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
57	33.44	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
58	34.03	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
59	34.61	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20
60	35.20	0.00	0.00	0.00	900.00	0.00	0.00	0.00	900.00	7.20

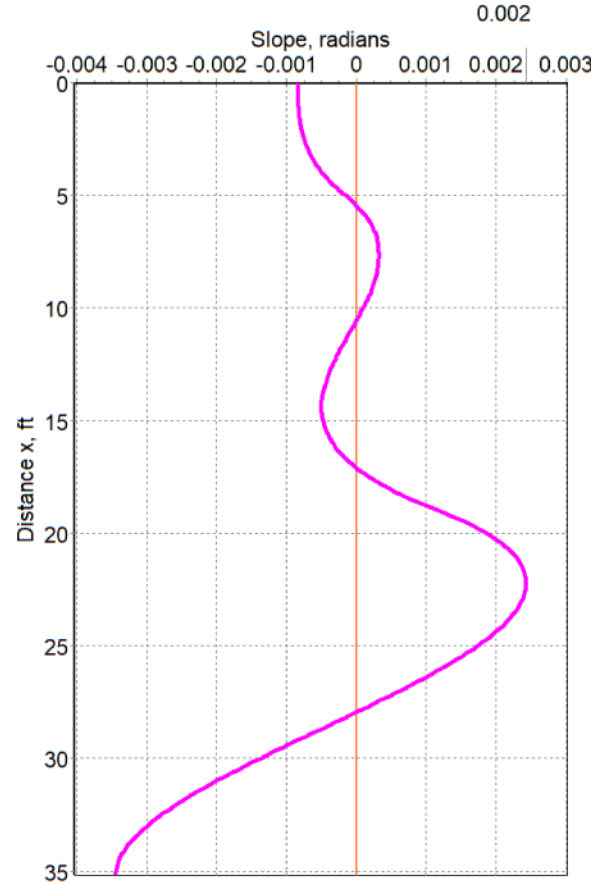
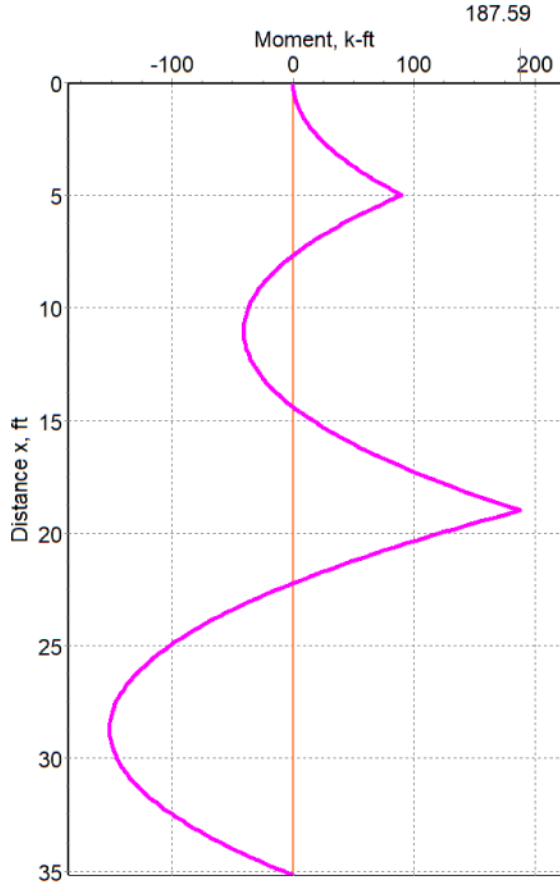
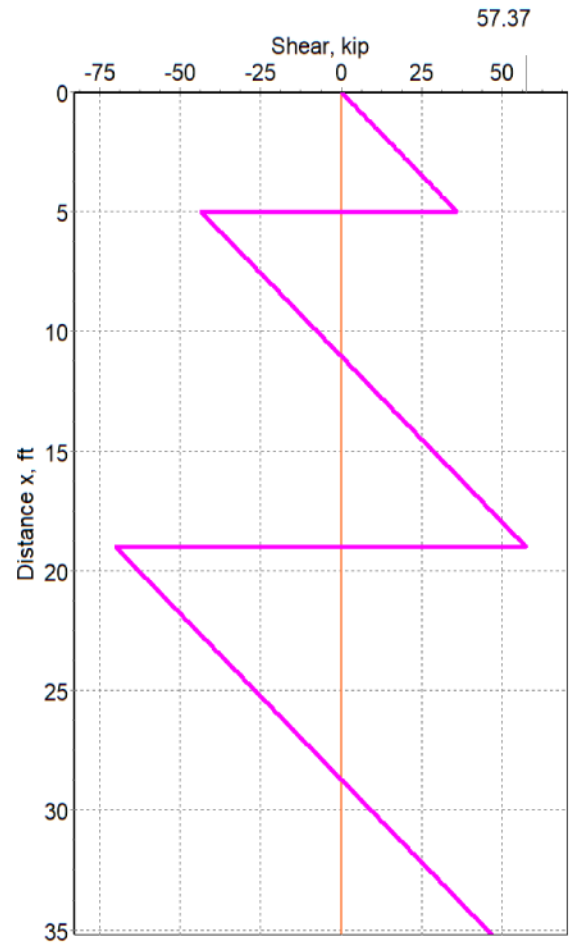
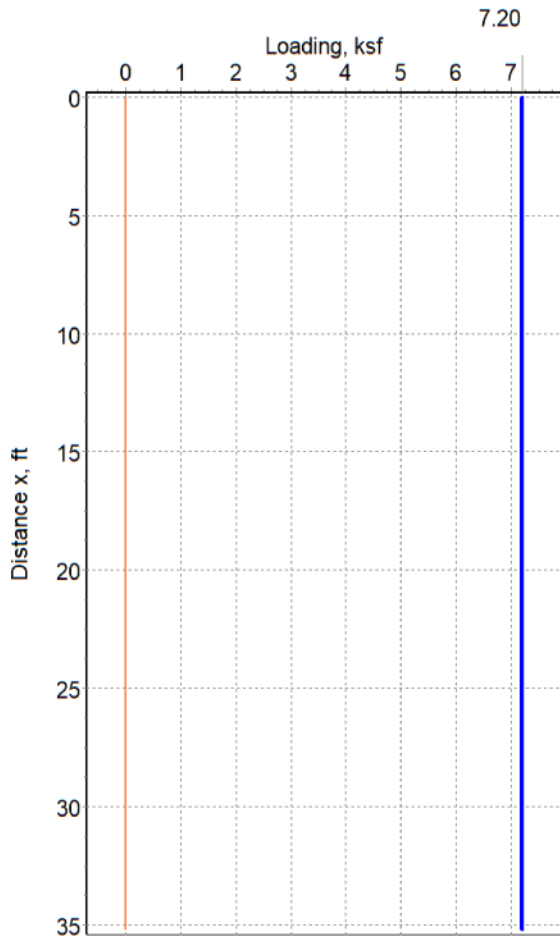
Charts

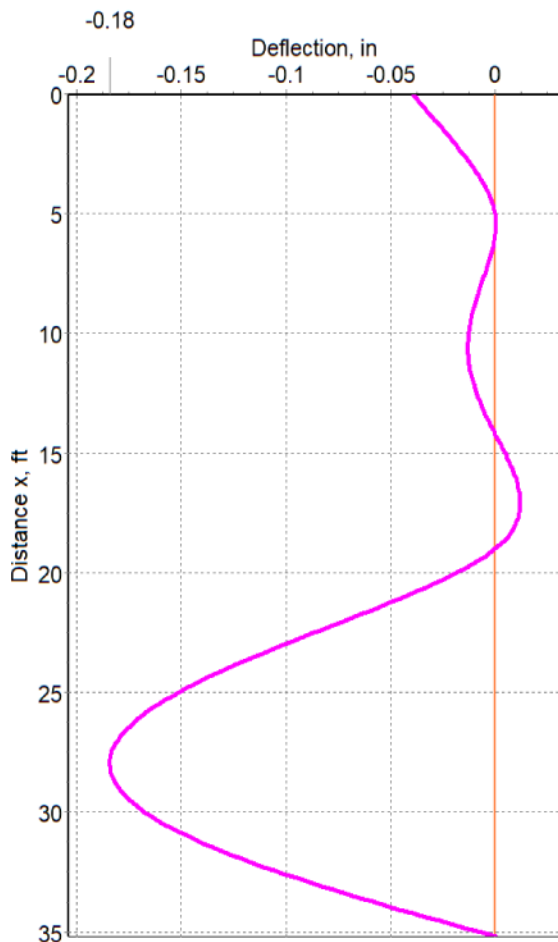


Charts



Charts





NOTES:

1. The Shoring Engineer shall check that the earth pressures entered in the software match the soils report & site soils parameters.
2. The Shoring Engineer shall check (a) Cantilever Shoring Height assuming a 2 ft over-excavation for top (A) anchor. You can use CANTILEVER SHORING Software by SoilStructure.com
3. The Shoring Engineer shall check all anchor stability before the final design. For example, a 3 level anchor should be checked for cantilever position of the first anchor (assuming 2 ft (0.6 m) over-excavation), the second anchor (also a 2 ft (0.6 m) over-excavation) and then the final third anchor installation.
4. It is advised that the Combined Forces Utilization be limited to 90% maximum due to the accuracy of the Apparent Earth Pressures assumed in this Software.
5. It is also advised that the vertical height between anchors or braces be limited to 16.4 ft (5 m) maximum. Also advised to limit height from lowest anchor to base of excavation to 16.4 ft (5 m) maximum.
6. We have tried our best to check the stability of excavations using generally accepted procedures. However, the final design of the shoring is the responsibility of the shoring engineer (licensed professional engineer).
7. The Apparent Earth Pressure Diagrams have been established on the basis of a rather limited number of cuts from about 26 ft to 62 ft (8 m to 19 m) in Height. Therefore, the user should use it with caution on much deeper cuts.
8. The Apparent Earth Pressure Diagrams do not bear any resemblance to the distribution of earth pressure against the shoring piles. It is merely an approximate method of calculating strut or tieback loads.
9. In no event will SOILSTRUCTURE SOFTWARE, INC., its employees, consultants or owners be liable to anyone for any unfavorable conditions occurring from the use of this Software. The Licensee acknowledges and accepts all of these statements when choosing to use this Software.

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