Report No. RC-1633

Report Title:

A Manual for the Design of Temporary Earth Retention Systems (TERS) for the Michigan Dept. of Transportation

Center for Structural Durability at Michigan Tech – a MDOT Center of Excellence

FINAL REPORT

Part 2 of 2

Sponsoring Organization:

Michigan Department of Transportation

Research Agency:

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Date Submitted:

April 22, 2019

Michigan Tech

Engineering Manual Preamble

This manual provides guidance to administrative, engineering, and technical staff. Engineering practice requires that professionals use a combination of technical skills and judgment in decision making. Engineering judgment is necessary to allow decisions to account for unique site-specific conditions and considerations to provide high-quality products, within budget, and to protect the public health, safety, and welfare. This manual provides the general operational guidelines; however, it is understood that adaptation, adjustments, and deviations are sometimes necessary. Innovation is a key foundational element to advance the state of engineering practice and develop more effective and efficient engineering solutions and materials. As such, it is essential that our engineering manuals provide a vehicle to promote, pilot, or implement technologies or practices that provide efficiencies and quality products, while maintaining the safety, health, and welfare of the public. When making significant or impactful deviations from the technical information from these guidance materials, it is expected that reasonable consultations with experts, technical committees, and/or policy setting bodies occur prior to actions within the time frames allowed. It is also expected that these consultations will eliminate any potential conflicts of interest, perceived or otherwise. Michigan Department of Transportation Leadership is committed to a culture of innovation to optimize engineering solutions.

The National Society of Professional Engineers Code of Ethics for Engineering is founded on six fundamental canons. Those canons are provided below.

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform Services only in areas of their competence.
3. Issue public statement only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, reasonably, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

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Lansing, Michigan 48909
(517) 636-5453

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4. Title and Subtitle *A Manual for the Design of Temporary Earth Retention Systems (TERS) for the Michigan Department of Transportation*		**5. Report Date** April 22, 2019 **6. Performing Organization Code** N/A
7. Author(s) Theresa (Tess) M. Ahlborn, R. Andrew Swartz, Stanley J. Vitton		**8. Performing Org. Report No.** N/A
9. Performing Organization Name and Address Michigan Technological University 1400 Townsend Drive Houghton, Michigan 49931		**10. Work Unit No. (TRAIS)** N/A **11. Contract No.** 2013-0067 Z8 **11(a). Authorization No.** Z5
12. Sponsoring Agency Name and Address Michigan Department of Transportation Office of Research and Best Practices 425 West Ottawa Street Lansing MI 48933		**13. Type of Report & Period Covered** FINAL Report: 10/1/2013 – 09/30/2018 **14. Sponsoring Agency Code** N/A
15. Supplementary Notes: None		
16. Abstract The purpose of this manual is to provide basic guidance on the design of temporary earth retaining systems (TERS) used on Michigan Department of Transportation (MDOT) projects. Temporary works are designed as short-term systems during construction and are either removed after construction or, in some cases, left in place. MDOT must approve all TERS with a design height of six feet or greater before construction. This manual covers the basic design elements for a TERS by providing nine detailed design examples. The structural steel design of typical internal bracing of TERS is provided in the manual's final chapter.		
17. Key Words sheet pile, temporary construction, earth retention, soldier pile, cofferdams		**18. Distribution Statement** No restrictions. This document is available to the public through the Michigan Department of Transportation.

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Appendix B.1 – SupportIT Output, Case 1

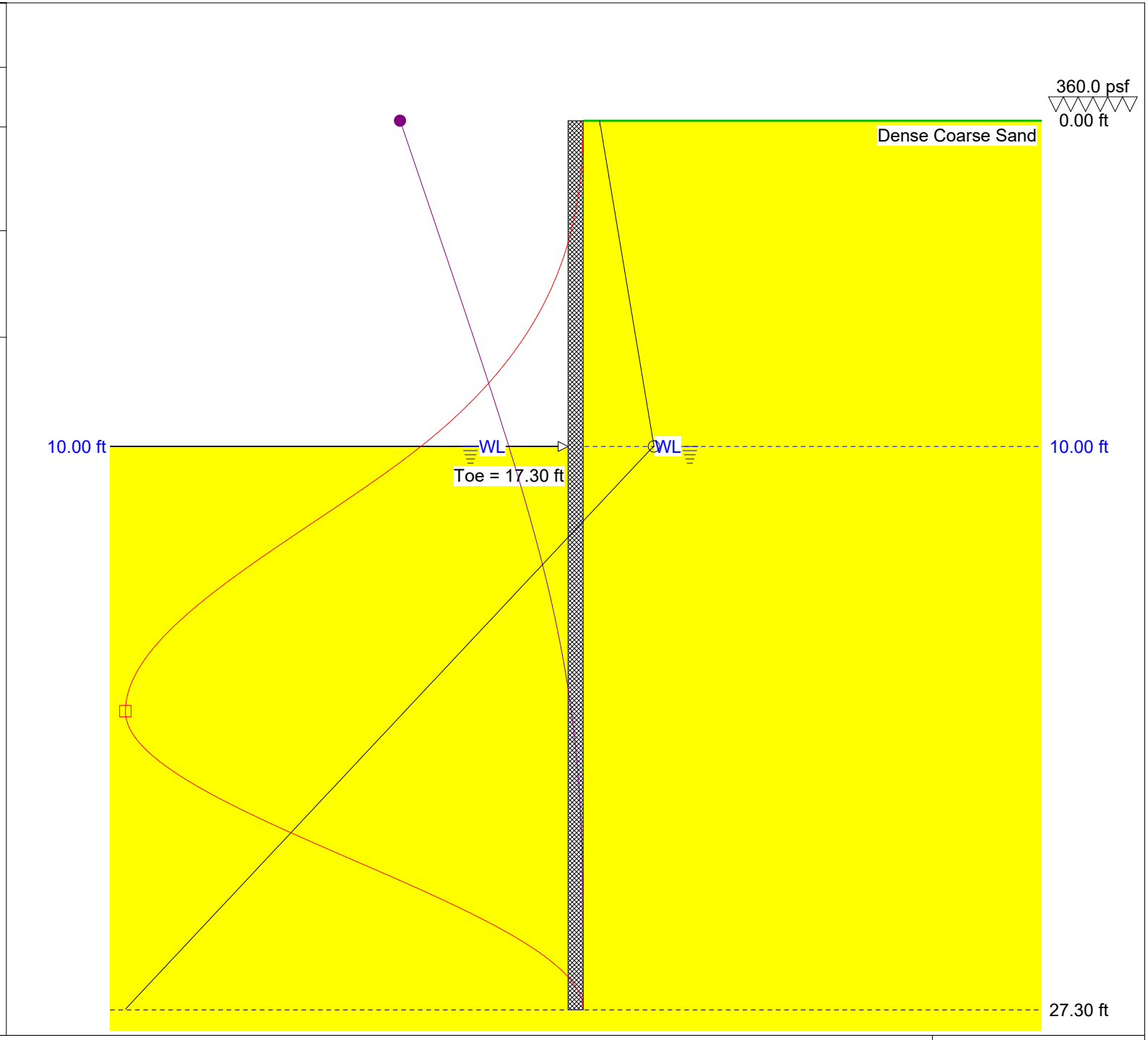
Case 1 – Cantilever TERS in Cohesionless Soil with Level Backfill

Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.00

Ref: Case 1
Page: 1
Date: 8.29.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 483.6 psf	10.00
□ 33109.1 ftlb/ft	18.13
● 1.9 in	0.00



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Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.00

Ref: Case 1
Page: 2
Date: 8.29.18

Sheet: PZ27
Works: Temporary
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Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 360.0psf

Depth Of Active Water = 10.00ft
Depth Of Passive Water = 10.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ27	3.04E+07	187.50	24966.8	31.00	64497.5	17.99	7.93	40.5	0.00	17.30	27.30

Maxima

	Maximum	Depth (ft)
Pressure	483.6 psf	10.00
Bending Moment	33109.1 ftlb/ft	18.13
Deflection	1.9 in	0.00
Shear Force	3527.0 lb/ft	12.28

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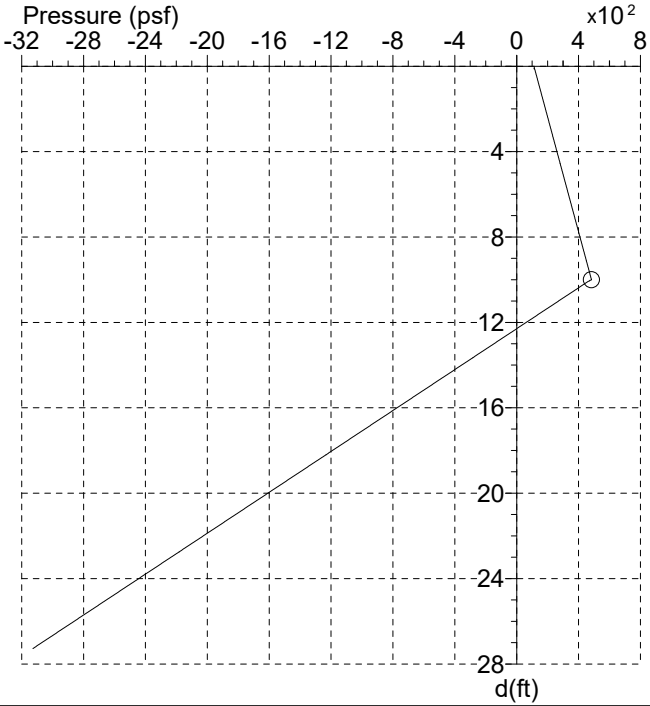
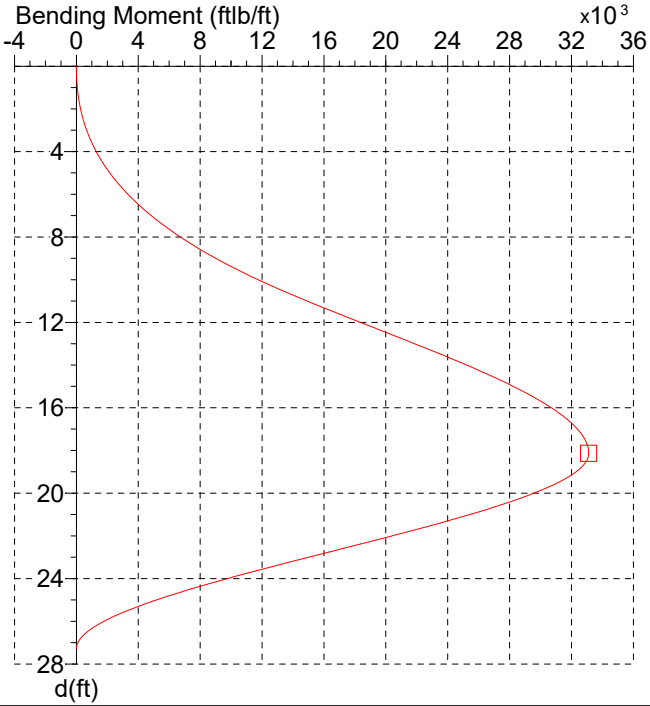
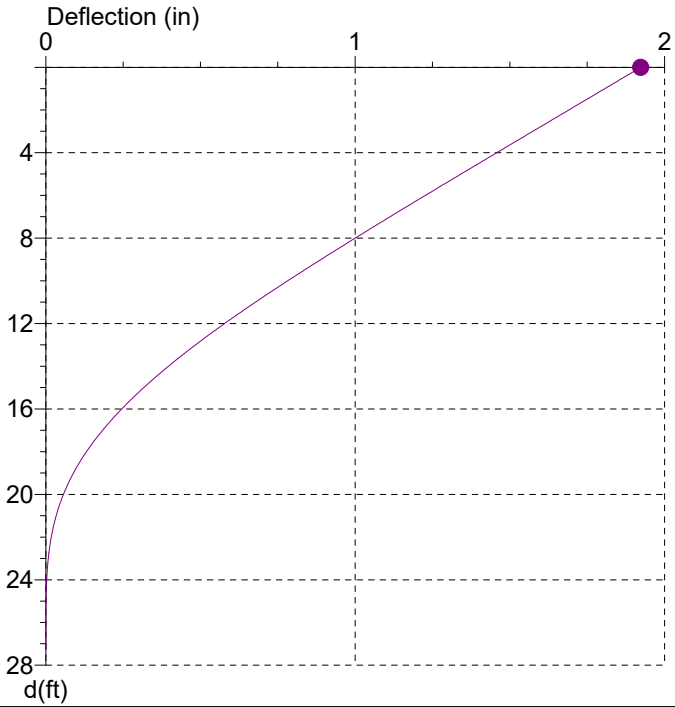
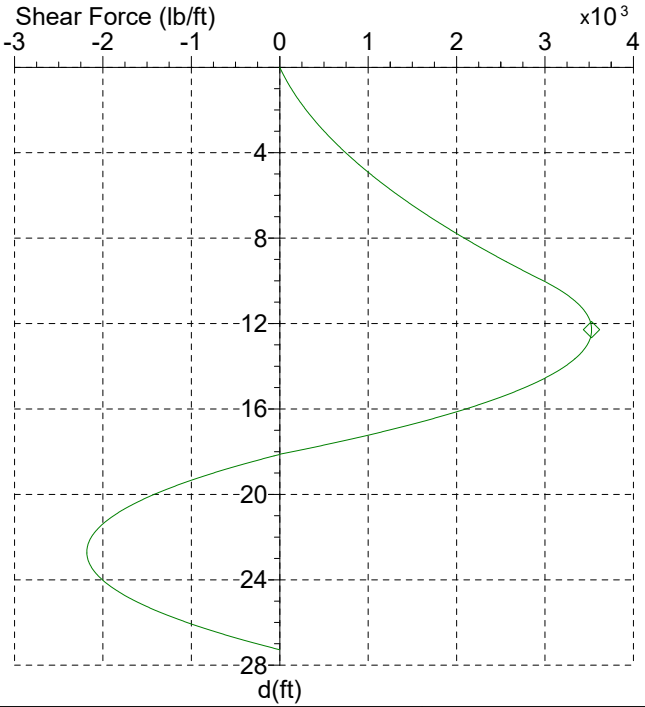
Maximum	d (ft)
○ 483.6 psf	10.00
□ 33109.1 ftlb/ft	18.13
◇ 3527.0 lb/ft	12.28
● 1.9 in	0.00









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depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.0	1.9	0.0	9.16	452.6	9435.6	0.9	2591.8	18.33	-1260.9	33065.4	0.1	-191.0
0.19	119.2	2.1	1.9	23.6	9.36	459.4	9912.6	0.9	2674.9	18.52	-1298.9	32946.4	0.1	-353.5
0.39	126.0	8.2	1.9	46.0	9.55	467.0	10467.4	0.8	2769.9	18.72	-1341.7	32726.4	0.1	-528.0
0.58	133.6	20.0	1.9	72.7	9.75	474.6	11041.8	0.8	2866.4	18.91	-1379.7	32457.7	0.1	-675.8
0.78	140.4	35.1	1.8	97.7	9.94	481.4	11569.0	0.8	2953.6	19.11	-1422.4	32077.3	0.1	-833.8
0.97	148.0	57.8	1.8	127.4	10.14	448.7	12181.0	0.8	3049.6	19.30	-1465.1	31618.3	0.1	-983.0
1.17	154.8	83.0	1.8	155.0	10.33	410.7	12740.8	0.7	3127.4	19.50	-1503.1	31147.9	0.1	-1108.4
1.36	162.4	117.6	1.8	187.6	10.53	368.0	13386.7	0.7	3206.7	19.69	-1545.9	30552.8	0.1	-1241.1
1.56	170.0	159.0	1.7	221.7	10.72	330.0	13973.9	0.7	3269.8	19.89	-1583.9	29968.5	0.1	-1351.7
1.75	176.8	201.7	1.7	253.4	10.92	287.2	14647.4	0.7	3332.5	20.08	-1626.6	29253.1	0.1	-1467.9
1.95	184.4	256.8	1.7	290.4	11.11	244.5	15333.0	0.7	3386.5	20.28	-1664.6	28569.1	0.0	-1563.8
2.14	191.1	312.2	1.7	324.7	11.31	206.5	15951.0	0.6	3427.1	20.47	-1707.3	27749.3	0.0	-1663.5
2.34	198.8	382.2	1.7	364.7	11.50	163.8	16654.4	0.6	3464.6	20.67	-1750.1	26880.8	0.0	-1754.4
2.53	205.5	451.3	1.6	401.6	11.70	125.8	17285.4	0.6	3490.5	20.86	-1788.1	26071.4	0.0	-1827.8
2.73	213.1	537.2	1.6	444.6	11.89	83.0	18000.2	0.6	3511.4	21.06	-1830.8	25122.9	0.0	-1902.2
2.92	220.8	632.0	1.6	489.1	12.09	45.0	18638.6	0.6	3522.7	21.25	-1868.8	24249.5	0.0	-1961.0
3.12	227.5	724.0	1.6	530.0	12.28	2.3	19358.4	0.6	3527.0	21.45	-1911.5	23236.9	0.0	-2018.8
3.31	235.1	836.5	1.5	577.5	12.48	-40.4	20078.5	0.5	3523.5	21.64	-1949.5	22313.5	0.0	-2062.9
3.51	241.9	944.8	1.5	621.0	12.67	-78.4	20717.3	0.5	3513.1	21.84	-1992.3	21252.7	0.0	-2104.2
3.70	249.5	1076.1	1.5	671.4	12.87	-121.2	21433.0	0.5	3493.2	22.03	-2035.0	20172.9	0.0	-2136.8
3.90	256.3	1201.6	1.5	717.6	13.06	-159.2	22065.2	0.5	3468.1	22.23	-2073.0	19200.6	0.0	-2158.4
4.09	263.9	1353.0	1.4	771.0	13.26	-201.9	22770.2	0.5	3431.6	22.42	-2115.7	18096.8	0.0	-2174.4
4.29	271.5	1515.4	1.4	825.9	13.45	-239.9	23390.0	0.4	3391.8	22.62	-2153.7	17110.4	0.0	-2181.3
4.48	278.3	1669.3	1.4	876.0	13.65	-282.6	24078.0	0.4	3338.8	22.81	-2196.5	15998.7	0.0	-2180.8
4.68	285.9	1853.4	1.4	933.9	13.84	-325.4	24754.3	0.4	3277.1	23.01	-2234.5	15012.2	0.0	-2173.1
4.87	292.7	2027.1	1.4	986.7	14.04	-363.4	25344.3	0.4	3214.9	23.20	-2277.2	13908.5	0.0	-2156.1
5.07	300.3	2234.0	1.3	1047.5	14.23	-406.1	25993.8	0.4	3136.6	23.40	-2319.9	12815.4	0.0	-2130.3
5.26	307.1	2428.5	1.3	1102.9	14.43	-444.1	26557.2	0.4	3059.6	23.59	-2357.9	11856.3	0.0	-2100.0
5.46	314.7	2659.5	1.3	1166.7	14.62	-486.8	27173.5	0.3	2964.8	23.79	-2400.7	10795.5	0.0	-2057.8
5.65	322.3	2903.7	1.3	1232.0	14.82	-524.8	27704.5	0.3	2873.2	23.98	-2438.7	9872.2	0.0	-2012.8
5.85	329.1	3132.0	1.2	1291.4	15.01	-567.6	28281.2	0.3	2761.9	24.18	-2481.4	8859.6	0.0	-1954.0
6.04	336.7	3401.9	1.2	1359.7	15.21	-610.3	28834.4	0.3	2641.8	24.37	-2519.4	7986.1	0.0	-1894.4
6.24	343.5	3653.6	1.2	1421.7	15.40	-648.3	29305.0	0.3	2527.7	24.57	-2562.1	7037.6	0.0	-1819.0
6.43	351.1	3950.3	1.2	1492.9	15.60	-691.0	29808.9	0.3	2391.1	24.76	-2604.9	6129.5	0.0	-1734.9
6.63	357.8	4226.4	1.2	1557.6	15.79	-729.0	30232.8	0.3	2262.3	24.96	-2642.9	5359.7	0.0	-1652.8
6.82	365.5	4551.2	1.1	1631.7	15.99	-771.8	30681.0	0.2	2109.2	25.15	-2685.6	4540.0	0.0	-1552.2
7.02	373.1	4891.2	1.1	1707.5	16.18	-809.8	31052.5	0.2	1965.7	25.35	-2723.6	3855.9	0.0	-1455.4
7.21	379.8	5206.6	1.1	1776.1	16.38	-852.5	31438.7	0.2	1796.0	25.54	-2766.4	3140.5	0.0	-1338.2
7.41	387.5	5576.4	1.1	1854.8	16.57	-895.3	31789.4	0.2	1617.6	25.74	-2804.3	2556.3	0.0	-1226.8
7.60	394.2	5918.7	1.0	1926.1	16.77	-933.2	32069.9	0.2	1451.7	25.93	-2847.1	1961.1	0.0	-1093.1
7.80	401.8	6319.4	1.0	2007.7	16.96	-976.0	32348.8	0.2	1256.7	26.13	-2889.8	1436.1	0.0	-950.6
7.99	408.6	6689.6	1.0	2081.6	17.16	-1014.0	32562.7	0.2	1076.1	26.32	-2927.8	1031.8	0.0	-816.7
8.19	416.2	7122.3	1.0	2166.1	17.35	-1056.7	32763.4	0.2	864.6	26.52	-2970.6	651.3	0.0	-657.7
8.38	423.8	7572.5	1.0	2252.3	17.55	-1094.7	32904.9	0.2	669.3	26.71	-3008.5	382.6	0.0	-509.1
8.58	430.6	7987.4	0.9	2330.2	17.74	-1137.5	33021.0	0.1	441.3	26.91	-3051.3	162.6	0.0	-333.6
8.77	438.2	8471.3	0.9	2419.3	17.94	-1180.2	33089.8	0.1	204.5	27.10	-3089.3	43.6	0.0	-170.3
8.97	445.0	8916.8	0.9	2499.8	18.13	-1218.2	33109.1	0.1	0.0	27.30	-3127.3	0.0	0.0	0.0

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Ref: Case 1
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Sheet: PZ27
Works: Temporary
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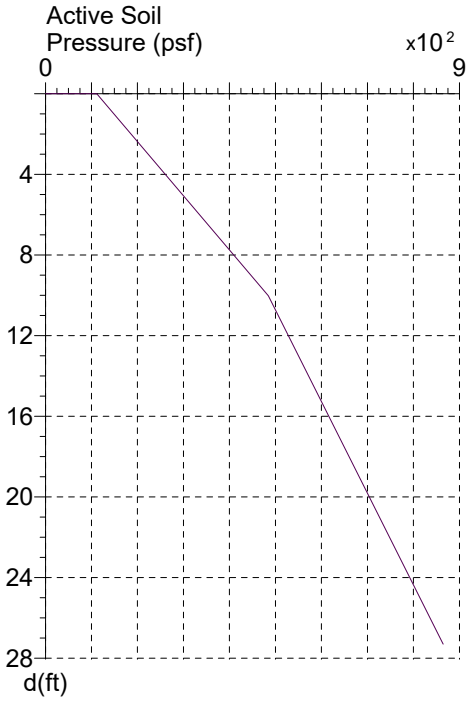
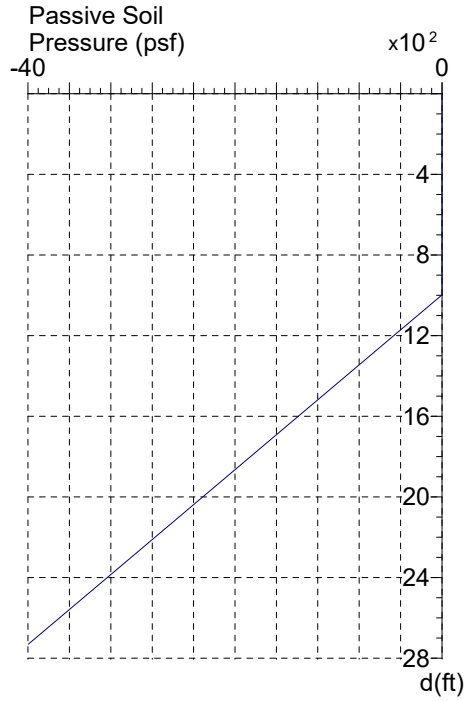
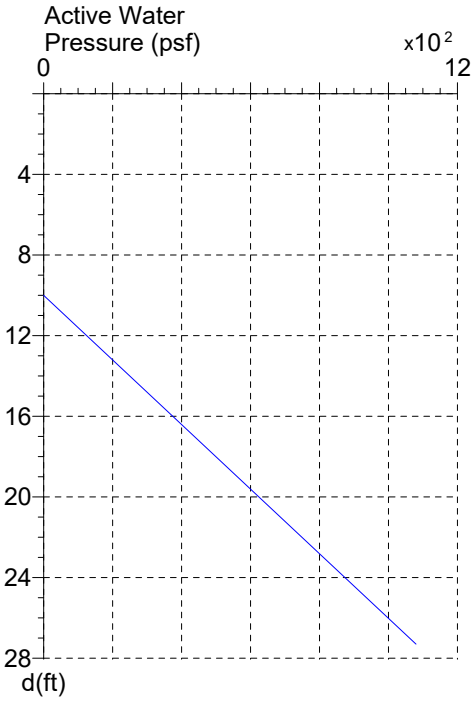
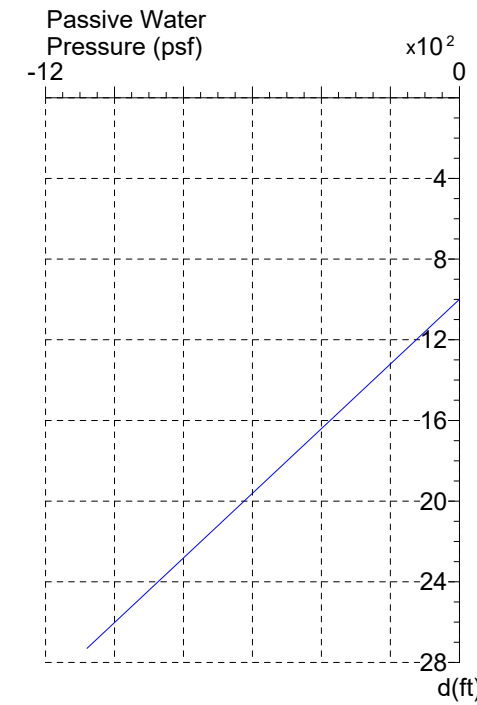
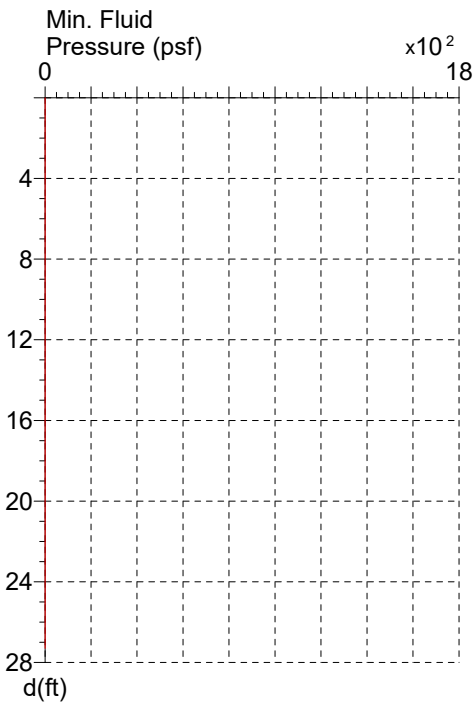
Analysis: Gross Pressure
Toe: Cantilever

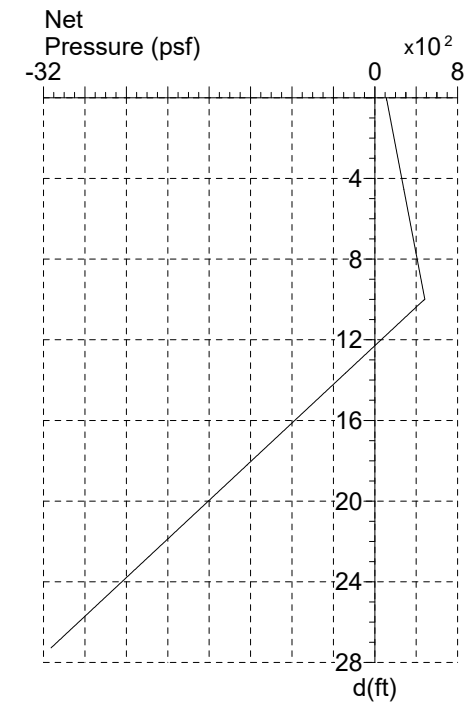












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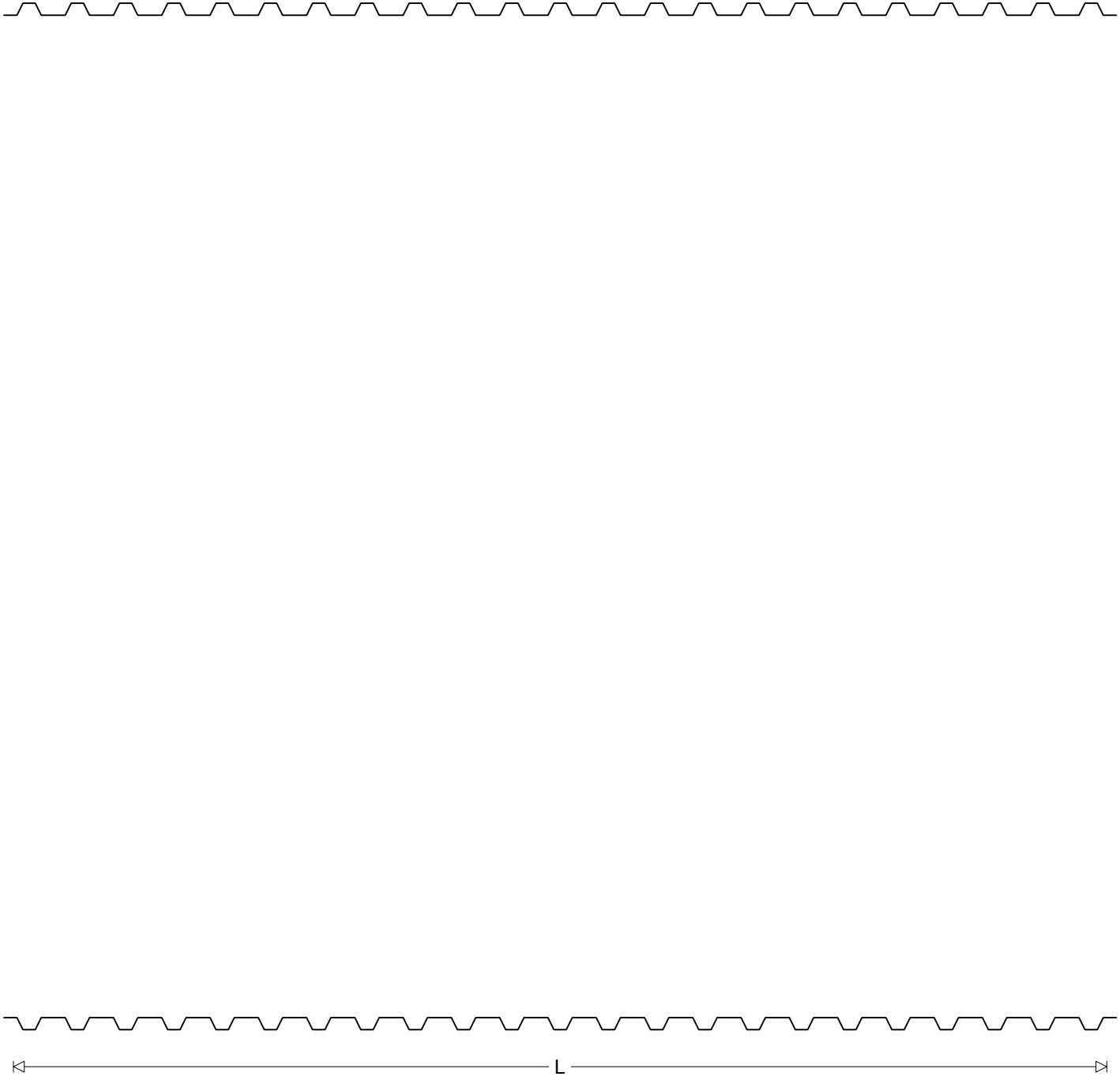

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Page:	7
Date:	8.29.18
Sheet:	PZ27
Works:	Temporary
Pressure:	Rankine
Analysis:	Gross Pressure
Toe:	Cantilever

Design Report

1. Maximum bending moment = 33109.1ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 15.91in³/ft (= M/f).
   Sheet section modulus in this design is Z = 31.00in³/ft, and is satisfactory.

2. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50

Ref: Case 1
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Date: 8.29.18

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Works: Temporary
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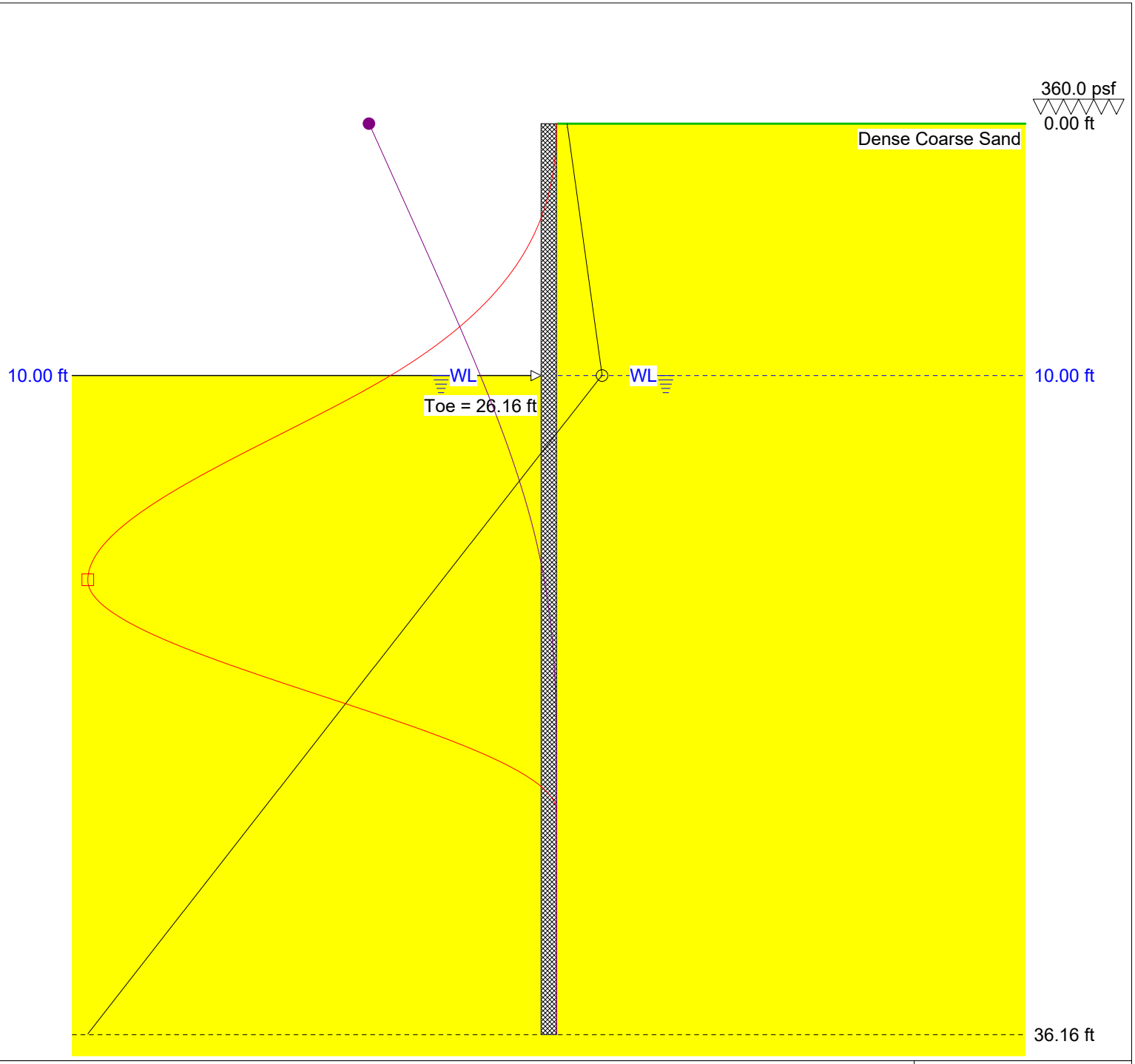
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 483.6 psf	10.00
□ 33093.6 ftlb/ft	18.11
● 1.9 in	0.00



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Web: www.GTSoft.org

Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50

Ref: Case 1
Page: 2
Date: 8.29.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 360.0psf

Depth Of Active Water = 10.00ft
Depth Of Passive Water = 10.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ27	3.04E+07	187.50	24966.8	31.00	64497.5	17.99	7.93	40.5	0.00	26.16	36.16

Maxima

	Maximum	Depth (ft)
Pressure	483.6 psf	10.00
Bending Moment	33093.6 ftlb/ft	18.11
Deflection	1.9 in	0.00
Shear Force	3526.6 lb/ft	12.26

MDOT Sheet Pile Manual

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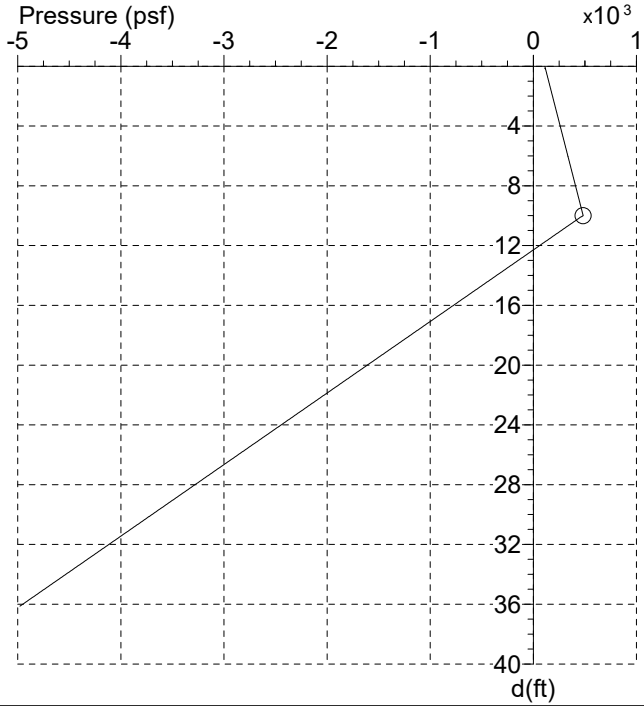
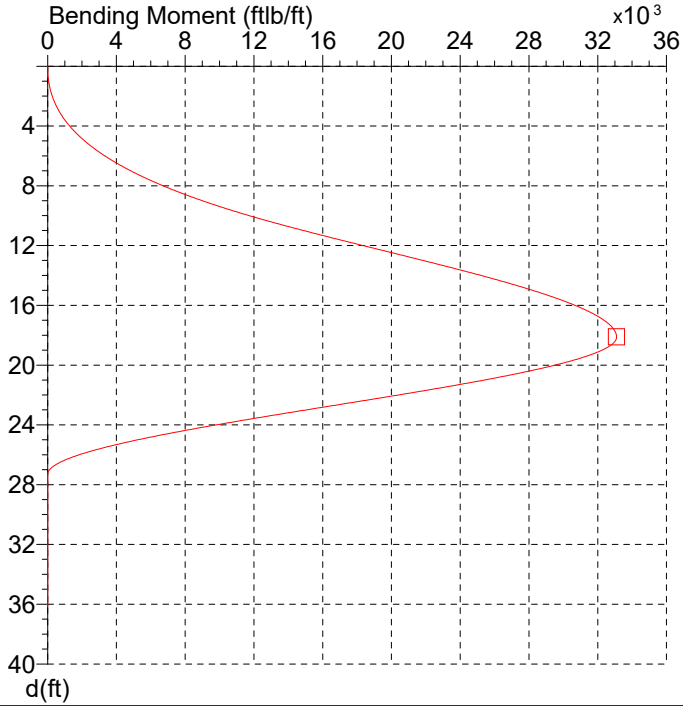
Site: FOS = 1.50

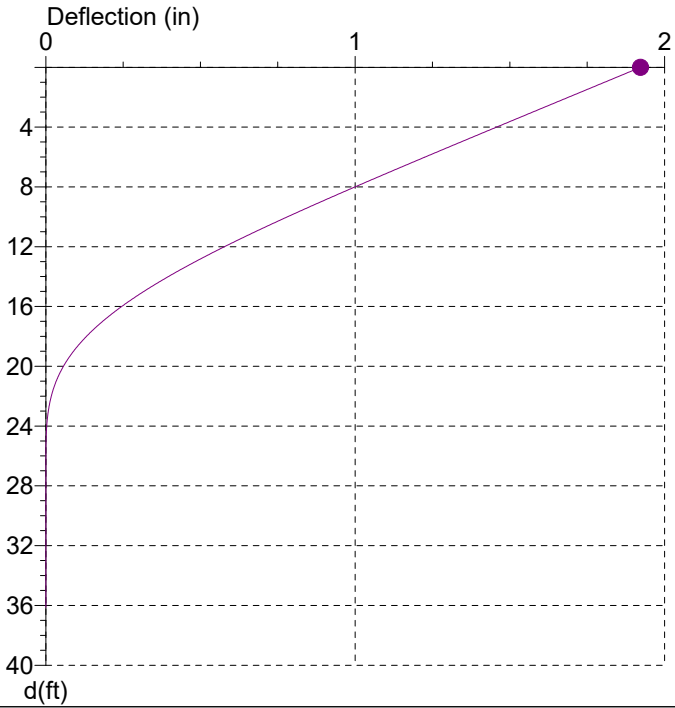
Ref: Case 1
Page: 3
Date: 8.29.18

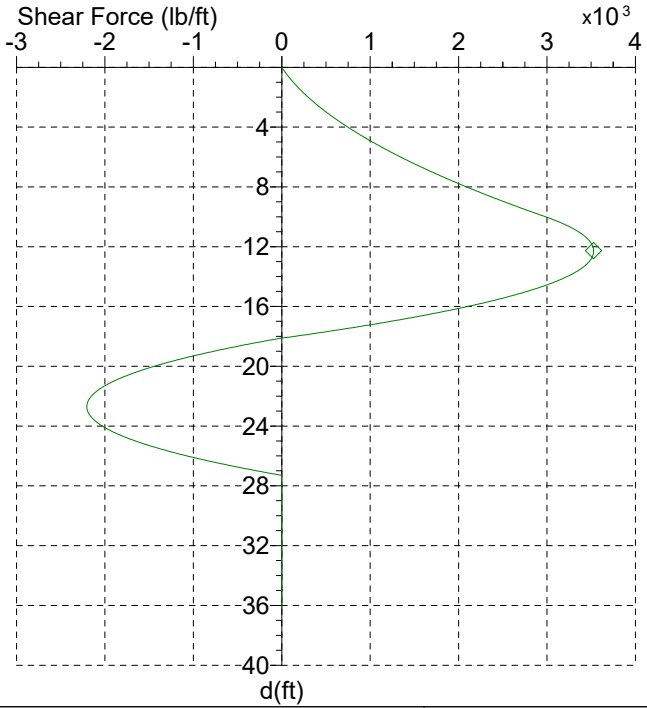
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 483.6 psf	10.00
□ 33093.6 ftlb/ft	18.11
◇ 3526.6 lb/ft	12.26
● 1.9 in	0.00









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Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50

Ref: Case 1
Page: 4
Date: 8.29.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.0	1.9	0.0
0.26	121.7	3.7	1.9	31.6
0.52	130.7	14.5	1.9	62.2
0.77	140.7	35.7	1.8	99.2
1.03	149.7	63.2	1.8	134.4
1.29	159.8	104.5	1.8	176.5
1.55	168.8	151.1	1.7	216.3
1.81	178.9	215.1	1.7	263.6
2.07	188.9	292.3	1.7	313.7
2.32	197.9	372.6	1.7	360.5
2.58	208.0	476.6	1.6	415.7
2.84	217.0	581.8	1.6	467.1
3.10	227.0	715.3	1.6	527.6
3.36	236.0	847.8	1.5	583.5
3.62	246.1	1013.4	1.5	649.1
3.87	256.2	1196.9	1.5	717.4
4.13	265.2	1375.9	1.4	780.5
4.39	275.2	1595.6	1.4	854.0
4.65	284.2	1807.8	1.4	921.6
4.91	294.3	2066.2	1.4	1000.3
5.17	303.3	2314.1	1.3	1072.5
5.42	313.4	2613.9	1.3	1156.3
5.68	323.4	2936.8	1.3	1242.9
5.94	332.4	3243.6	1.2	1322.1
6.20	342.5	3611.9	1.2	1413.9
6.46	351.5	3960.3	1.2	1497.7
6.71	361.5	4376.7	1.1	1594.7
6.97	370.5	4769.0	1.1	1683.1
7.23	380.6	5236.1	1.1	1785.2
7.49	390.7	5731.1	1.1	1890.0
7.75	399.7	6195.1	1.0	1985.5
8.01	409.7	6744.9	1.0	2095.5
8.26	418.7	7258.7	1.0	2195.6
8.52	428.8	7865.9	0.9	2310.8
8.78	437.8	8432.0	0.9	2415.4
9.04	447.9	9099.1	0.9	2535.8
9.30	457.9	9799.2	0.9	2658.9
9.56	466.9	10449.6	0.8	2770.6
9.81	477.0	11213.7	0.8	2898.8
10.07	471.8	11922.3	0.8	3014.3
10.33	408.9	12751.4	0.7	3132.1
10.59	358.6	13513.7	0.7	3223.9
10.85	301.9	14396.0	0.7	3312.7
11.11	245.3	15300.4	0.7	3386.1
11.36	195.0	16119.6	0.6	3438.5
11.62	138.3	17054.6	0.6	3482.9
11.88	88.0	17894.3	0.6	3509.4
12.14	31.3	18844.9	0.6	3524.7
12.40	-19.0	19692.0	0.5	3526.0
12.65	-75.6	20643.8	0.5	3514.1
12.91	-132.3	21590.6	0.5	3486.7
13.17	-182.6	22424.5	0.5	3449.5
13.43	-239.2	23350.3	0.4	3393.2
13.69	-289.6	24159.1	0.4	3330.2
13.95	-346.2	25049.2	0.4	3244.9
14.20	-396.6	25819.6	0.4	3156.1
14.46	-453.2	26659.2	0.4	3041.7
14.72	-509.8	27466.0	0.3	2912.0
14.98	-560.2	28152.3	0.3	2783.8
15.24	-616.8	28885.9	0.3	2625.1
15.50	-667.1	29500.6	0.3	2471.1
15.75	-723.8	30146.2	0.3	2283.4
16.01	-774.1	30676.1	0.2	2103.6
16.27	-830.8	31218.9	0.2	1886.9
16.53	-887.4	31701.3	0.2	1654.8
16.79	-937.7	32076.1	0.2	1435.5
17.05	-994.4	32433.0	0.2	1174.4
17.30	-1044.7	32689.6	0.2	929.4
17.56	-1101.3	32906.3	0.2	639.3
17.82	-1151.7	33031.7	0.1	368.5
18.08	-1208.3	33092.1	0.1	49.4
18.34	-1265.0	33034.8	0.1	-225.2
18.59	-1315.3	32846.2	0.1	-438.4
18.85	-1371.9	32487.6	0.1	-663.6
19.11	-1422.3	32046.7	0.1	-850.9
19.37	-1478.9	31422.5	0.1	-1047.2
19.63	-1529.2	30761.8	0.1	-1208.7
19.89	-1585.9	29908.5	0.1	-1375.9
20.14	-1642.5	28948.6	0.1	-1527.8
20.40	-1692.9	28014.2	0.0	-1649.9
20.66	-1749.5	26880.9	0.0	-1772.8
20.92	-1799.8	25808.4	0.0	-1869.1
21.18	-1856.5	24538.0	0.0	-1962.9
21.44	-1906.8	23359.9	0.0	-2033.5
21.69	-1963.4	21988.9	0.0	-2098.3
21.95	-2020.1	20579.3	0.0	-2147.8
22.21	-2070.4	19302.3	0.0	-2178.9
22.47	-2127.0	17847.7	0.0	-2199.4
22.73	-2177.4	16546.8	0.0	-2204.7
22.99	-2234.0	15083.7	0.0	-2196.1
23.24	-2284.4	13791.4	0.0	-2175.7
23.50	-2341.0	12356.1	0.0	-2138.1
23.76	-2397.6	10950.3	0.0	-2085.2
24.02	-2448.0	9733.7	0.0	-2025.3
24.28	-2504.6	8411.4	0.0	-1943.4
24.53	-2555.0	7285.2	0.0	-1857.7
24.79	-2611.6	6082.9	0.0	-1746.8
25.05	-2661.9	5079.5	0.0	-1635.3
25.31	-2718.6	4033.4	0.0	-1495.4
25.57	-2775.2	3084.9	0.0	-1340.1
25.83	-2825.5	2331.9	0.0	-1189.2
26.08	-2882.2	1595.4	0.0	-1004.9
26.34	-2932.5	1047.0	0.0	-828.2
26.60	-2989.1	558.9	0.0	-614.9
26.86	-3039.5	247.5	0.0	-412.4
27.12	-3096.1	44.2	0.0	-170.1
27.38	-3152.8	0.0	0.0	0.0
27.63	-3203.1	0.0	0.0	0.0
27.89	-3259.7	0.0	0.0	0.0
28.15	-3310.1	0.0	0.0	0.0
28.41	-3366.7	0.0	0.0	0.0
28.67	-3417.0	0.0	0.0	0.0
28.92	-3473.7	0.0	0.0	0.0
29.18	-3530.3	0.0	0.0	0.0
29.44	-3580.7	0.0	0.0	0.0
29.70	-3637.3	0.0	0.0	0.0
29.96	-3687.6	0.0	0.0	0.0
30.22	-3744.3	0.0	0.0	0.0
30.47	-3794.6	0.0	0.0	0.0
30.73	-3851.2	0.0	0.0	0.0
30.99	-3907.9	0.0	0.0	0.0
31.25	-3958.2	0.0	0.0	0.0
31.51	-4014.9	0.0	0.0	0.0
31.77	-4065.2	0.0	0.0	0.0
32.02	-4121.8	0.0	0.0	0.0
32.28	-4172.2	0.0	0.0	0.0
32.54	-4228.8	0.0	0.0	0.0
32.80	-4285.4	0.0	0.0	0.0
33.06	-4335.8	0.0	0.0	0.0
33.32	-4392.4	0.0	0.0	0.0
33.57	-4442.8	0.0	0.0	0.0
33.83	-4499.4	0.0	0.0	0.0
34.09	-4549.7	0.0	0.0	0.0
34.35	-4606.4	0.0	0.0	0.0
34.61	-4663.0	0.0	0.0	0.0
34.86	-4713.3	0.0	0.0	0.0
35.12	-4770.0	0.0	0.0	0.0
35.38	-4820.3	0.0	0.0	0.0
35.64	-4877.0	0.0	0.0	0.0
35.90	-4927.3	0.0	0.0	0.0
36.16	-4977.6	0.0	0.0	0.0

MDOT Sheet Pile Manual

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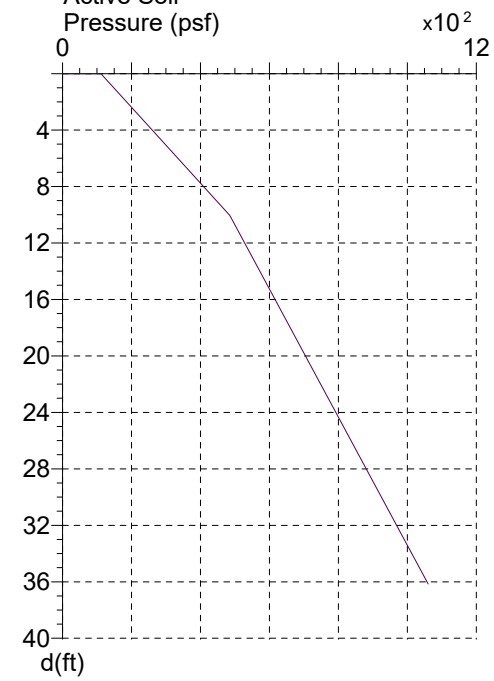
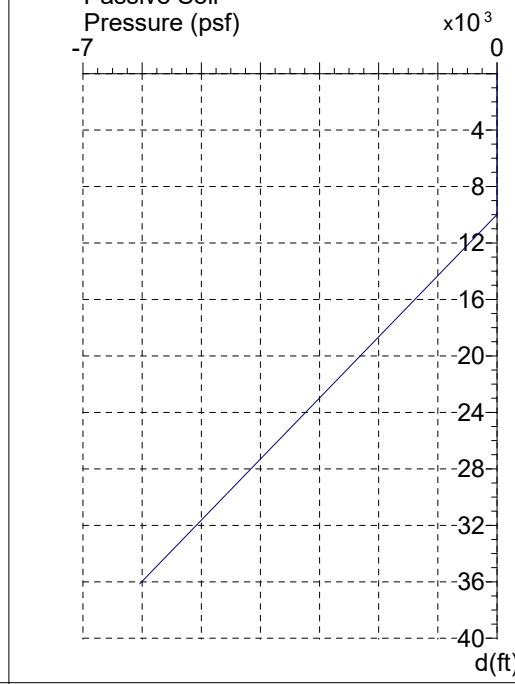
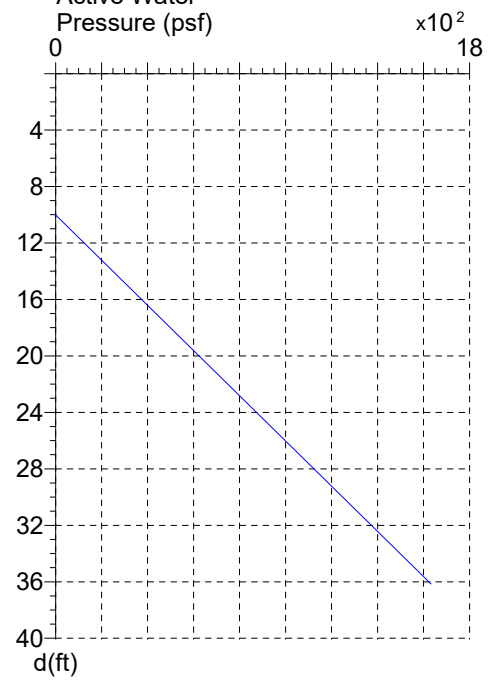
Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50

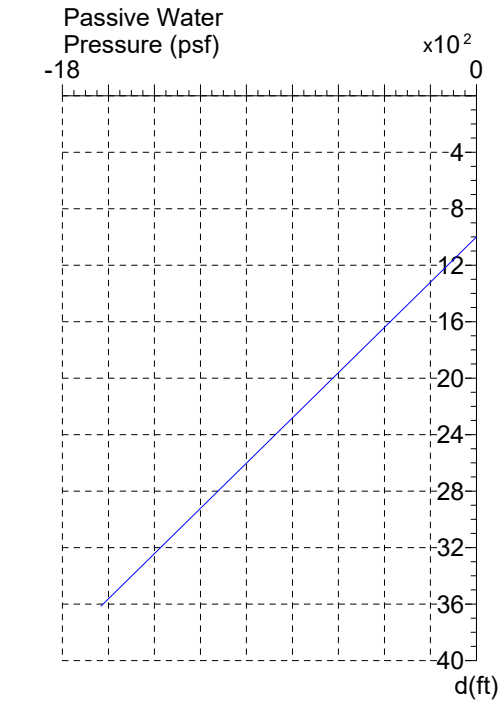
Ref: Case 1
Page: 5
Date: 8.29.18

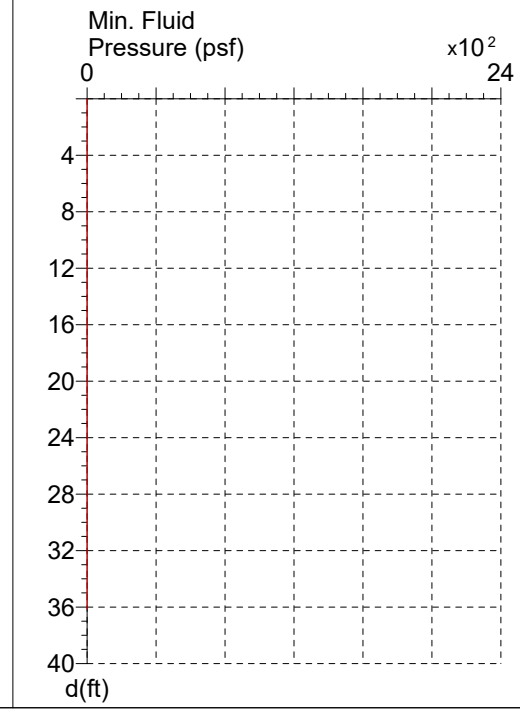
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

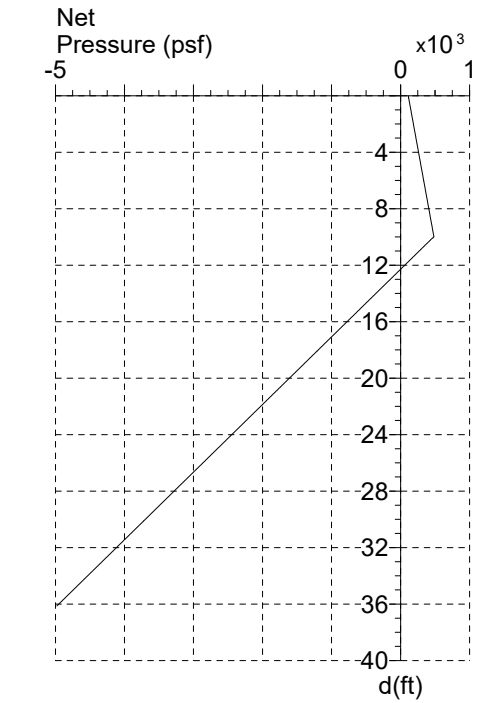












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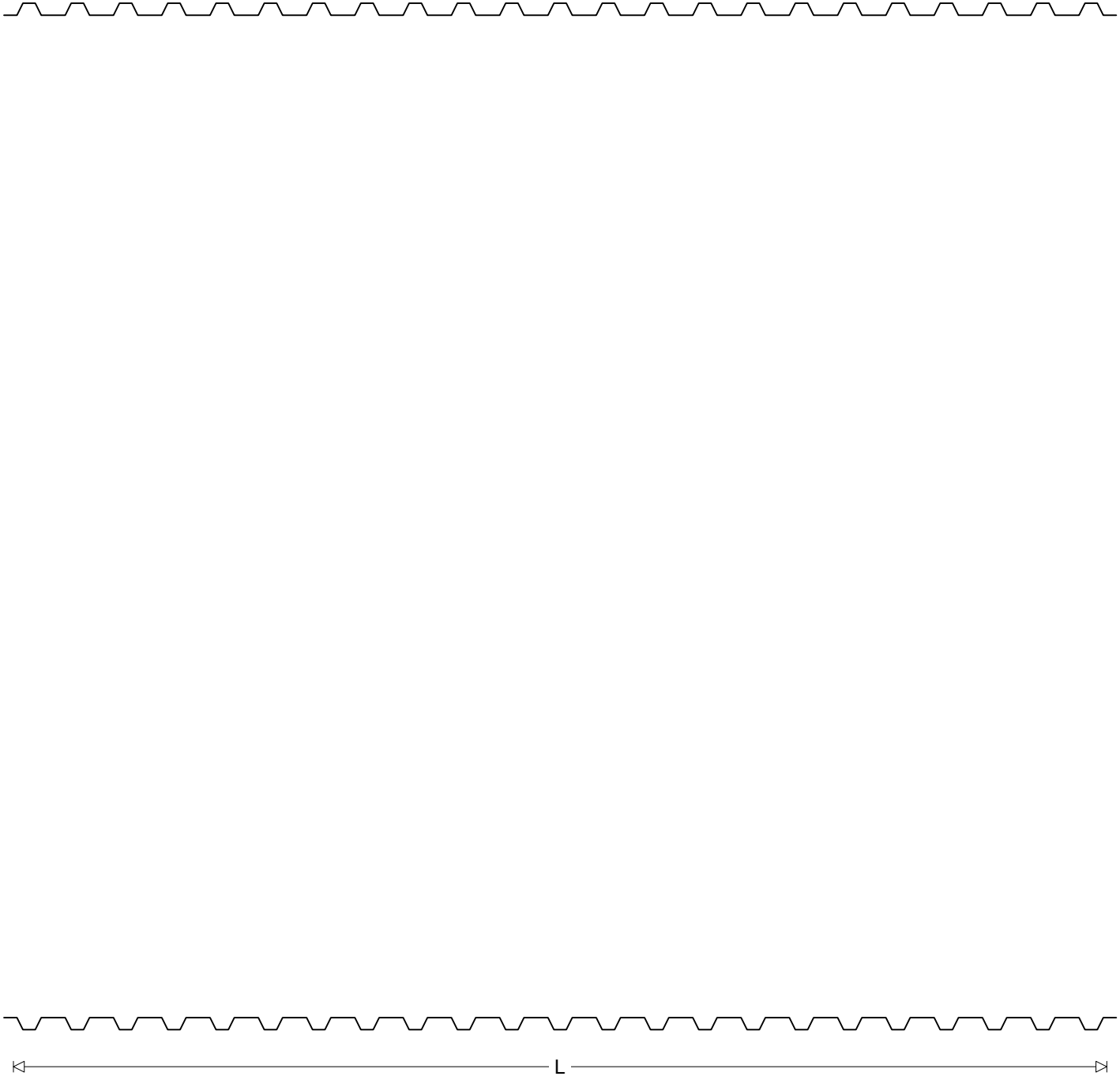
Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50

Ref: Case 1
Page: 6
Date: 8.29.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever



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Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50

Ref: Case 1
Page: 7
Date: 8.29.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Maximum bending moment = 33093.6ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 15.91in³/ft (= M/f).
   Sheet section modulus in this design is Z = 31.00in³/ft, and is satisfactory.

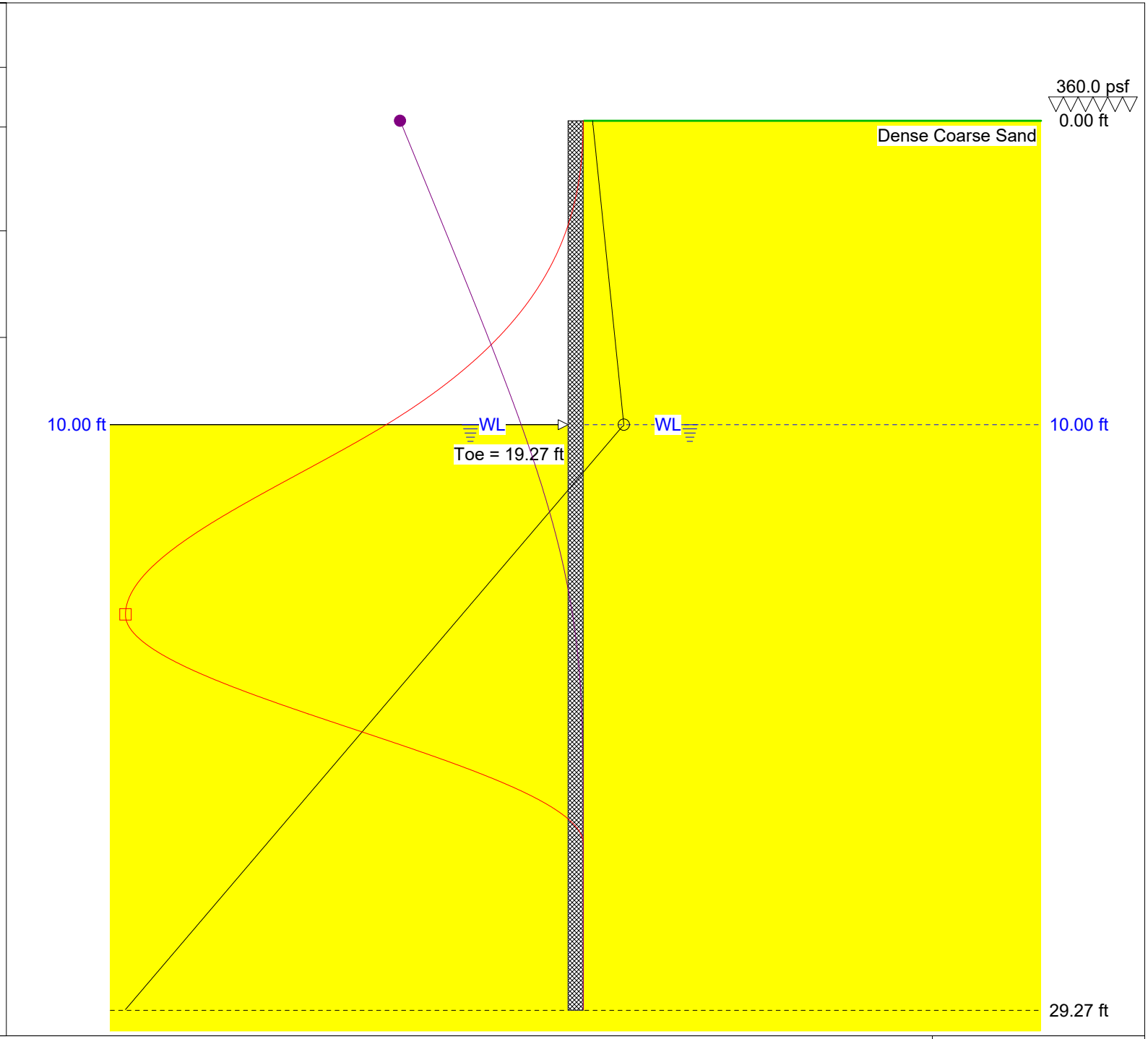
2. FOS = 1.50 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50 with 10 Friction

Ref: Case 1
Page: 1
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 436.8 psf	10.00
□ 24631.2 ftlb/ft	16.24
● 1.1 in	0.00



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Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50 with 10 Friction

Ref: Case 1
Page: 2
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 360.0psf

Depth Of Active Water = 10.00ft
Depth Of Passive Water = 10.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	120.00	71.10	0.0	0.0	32.0	10.0	0.28	0.00	4.20	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ27	3.04E+07	187.50	24966.8	31.00	64497.5	17.99	7.93	40.5	0.00	19.27	29.27

Maxima

	Maximum	Depth (ft)
Pressure	436.8 psf	10.00
Bending Moment	24631.2 ftlb/ft	16.24
Deflection	1.1 in	0.00
Shear Force	3031.7 lb/ft	11.56

MDOT Sheet Pile Manual

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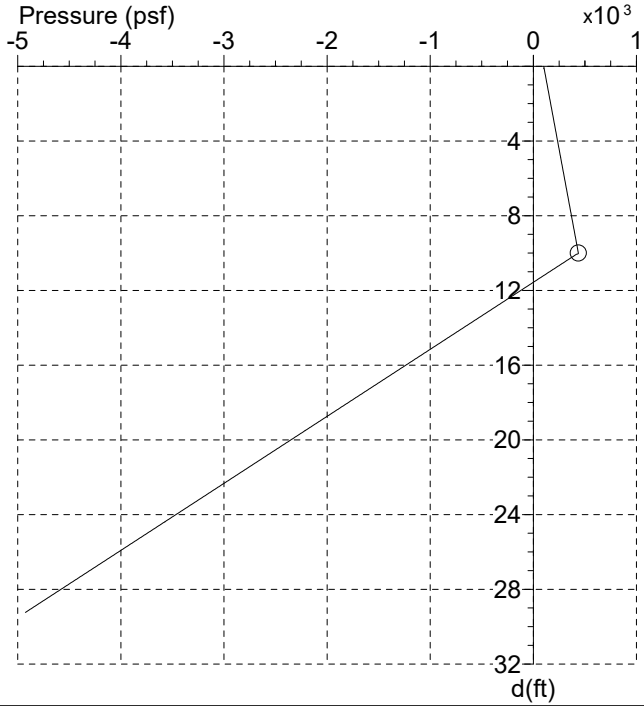
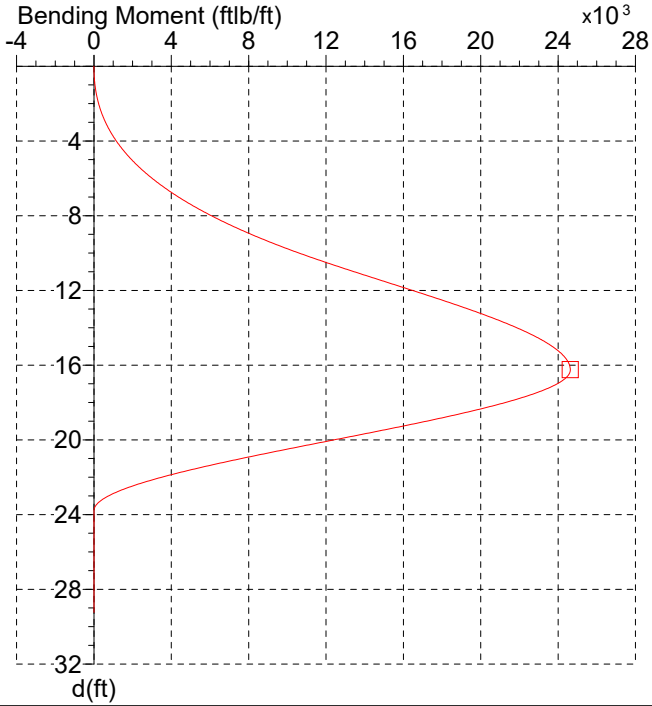
Site: FOS = 1.50 with 10 Friction

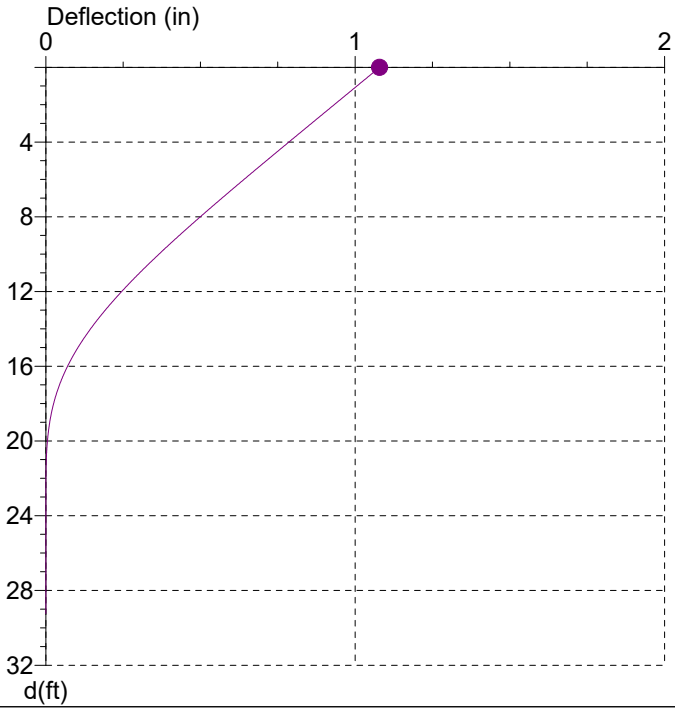
Ref: Case 1
Page: 3
Date: 8.30.18

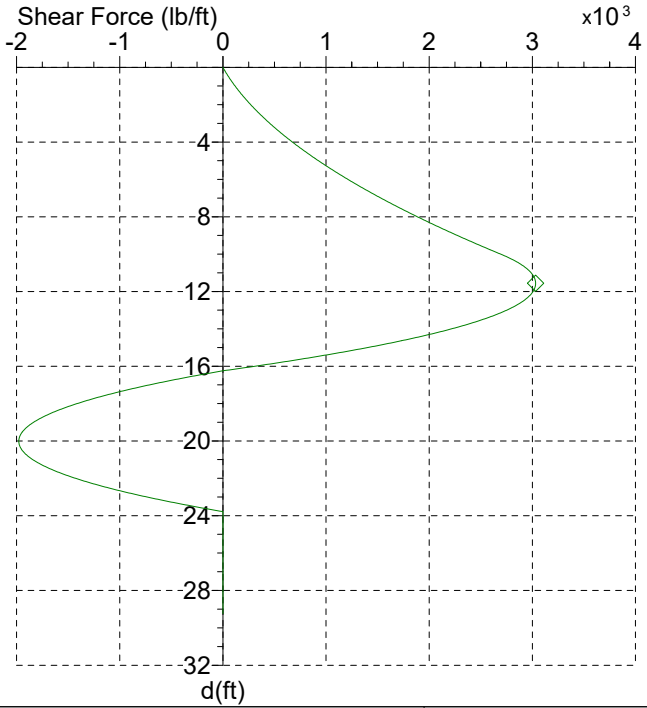
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 436.8 psf	10.00
□ 24631.2 ftlb/ft	16.24
◇ 3031.7 lb/ft	11.56
● 1.1 in	0.00









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Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50 with 10 Friction

Ref: Case 1
Page: 4
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	100.8	0.0	1.1	0.0
0.21	108.2	2.2	1.1	22.9
0.42	114.7	8.5	1.0	44.8
0.63	122.1	20.8	1.0	70.9
0.84	128.7	36.7	1.0	95.5
1.05	136.0	60.4	1.0	124.6
1.25	142.6	86.9	1.0	151.9
1.46	150.0	123.2	1.0	184.1
1.67	157.3	166.8	1.0	218.0
1.88	163.9	211.8	0.9	249.4
2.09	171.3	270.0	0.9	286.3
2.30	177.8	328.5	0.9	320.5
2.51	185.2	402.5	0.9	360.4
2.72	191.8	475.8	0.9	397.3
2.93	199.1	566.8	0.9	440.3
3.14	206.5	667.5	0.8	485.0
3.34	213.1	765.3	0.8	526.0
3.55	220.4	885.0	0.8	573.7
3.76	227.0	1000.3	0.8	617.5
3.97	234.4	1140.3	0.8	668.2
4.18	240.9	1274.3	0.8	714.7
4.39	248.3	1435.9	0.8	768.6
4.60	255.7	1609.4	0.7	824.0
4.81	262.2	1773.9	0.7	874.6
5.02	269.6	1971.0	0.7	933.1
5.23	276.2	2157.0	0.7	986.5
5.44	283.5	2378.8	0.7	1048.1
5.64	290.1	2587.4	0.7	1104.2
5.85	297.5	2835.3	0.7	1168.8
6.06	304.8	3097.5	0.6	1235.0
6.27	311.4	3342.8	0.6	1295.3
6.48	318.8	3632.9	0.6	1364.6
6.69	325.3	3903.7	0.6	1427.5
6.90	332.7	4223.0	0.6	1499.9
7.11	339.3	4520.3	0.6	1565.6
7.32	346.6	4870.2	0.5	1641.0
7.53	354.0	5236.8	0.5	1718.1
7.73	360.6	5576.9	0.5	1787.9
7.94	367.9	5975.8	0.5	1868.0
8.15	374.5	6345.3	0.5	1940.6
8.36	381.9	6778.0	0.5	2023.7
8.57	388.4	7178.0	0.5	2099.0
8.78	395.8	7645.7	0.4	2185.2
8.99	403.2	8132.3	0.4	2273.1
9.20	409.7	8581.2	0.4	2352.5
9.41	417.1	9104.8	0.4	2443.4
9.62	423.7	9587.0	0.4	2525.6
9.82	431.0	10148.8	0.4	2619.6
10.03	436.8	10665.5	0.4	2704.4
10.24	369.1	11266.0	0.4	2791.6
10.45	307.9	11884.2	0.3	2865.3
10.66	253.5	12446.3	0.3	2919.4
10.87	192.4	13090.1	0.3	2967.6
11.08	138.0	13670.1	0.3	2999.2
11.29	76.8	14328.9	0.3	3022.1
11.50	22.4	14917.6	0.3	3031.1
11.71	-38.8	15580.9	0.3	3029.4
11.92	-99.9	16242.6	0.2	3014.9
12.12	-154.3	16827.1	0.2	2990.8
12.33	-215.5	17477.9	0.2	2950.9
12.54	-269.9	18048.1	0.2	2904.2
12.75	-331.0	18677.5	0.2	2839.1
12.96	-385.4	19223.9	0.2	2769.8
13.17	-446.6	19821.5	0.2	2679.3
13.38	-507.8	20397.8	0.2	2575.3
13.59	-562.1	20890.1	0.2	2471.6
13.80	-623.3	21418.6	0.2	2342.2
14.01	-677.7	21863.6	0.1	2216.0
14.21	-738.9	22333.6	0.1	2061.2
14.42	-793.2	22722.1	0.1	1912.4
14.63	-854.4	23123.3	0.1	1732.4
14.84	-915.6	23483.7	0.1	1538.9
15.05	-970.0	23767.6	0.1	1355.6
15.26	-1031.1	24043.2	0.1	1136.7
15.47	-1085.5	24247.0	0.1	930.9
15.68	-1146.7	24427.1	0.1	686.7
15.89	-1201.1	24541.4	0.1	458.3
16.10	-1262.2	24615.7	0.1	188.7
16.31	-1323.4	24626.6	0.1	-76.1
16.51	-1377.8	24548.0	0.1	-271.7
16.72	-1439.0	24349.5	0.1	-479.1
16.93	-1493.4	24080.8	0.0	-652.1
17.14	-1554.5	23681.5	0.0	-834.2
17.35	-1608.9	23245.9	0.0	-984.7
17.56	-1670.1	22671.9	0.0	-1141.3
17.77	-1731.3	22015.9	0.0	-1284.6
17.98	-1785.6	21369.9	0.0	-1400.6
18.19	-1846.8	20579.0	0.0	-1518.5
18.40	-1901.2	19824.6	0.0	-1612.0
18.60	-1962.4	18924.9	0.0	-1704.5
18.81	-2016.7	18085.4	0.0	-1775.4
19.02	-2077.9	17102.9	0.0	-1842.5
19.23	-2139.1	16087.1	0.0	-1896.3
19.44	-2193.5	15162.2	0.0	-1932.7
19.65	-2254.6	14103.5	0.0	-1961.1
19.86	-2309.0	13152.0	0.0	-1975.0
20.07	-2370.2	12076.5	0.0	-1978.0
20.28	-2424.6	11121.5	0.0	-1969.4
20.49	-2485.7	10055.2	0.0	-1947.0
20.69	-2546.9	9004.3	0.0	-1911.2
20.90	-2601.3	8088.9	0.0	-1868.1
21.11	-2662.5	7087.1	0.0	-1806.9
21.32	-2716.9	6226.9	0.0	-1741.3
21.53	-2778.0	5300.2	0.0	-1654.7
21.74	-2832.4	4518.4	0.0	-1566.5
21.95	-2893.6	3692.8	0.0	-1454.6
22.16	-2954.8	2931.3	0.0	-1329.3
22.37	-3009.1	2314.1	0.0	-1206.6
22.58	-3070.3	1693.6	0.0	-1056.0
22.79	-3124.7	1213.4	0.0	-910.7
22.99	-3185.9	760.0	0.0	-734.7
23.20	-3240.2	439.8	0.0	-566.9
23.41	-3301.4	179.5	0.0	-365.5
23.62	-3362.6	32.0	0.0	-150.7
23.83	-3417.0	0.0	0.0	0.0
24.04	-3478.1	0.0	0.0	0.0
24.25	-3532.5	0.0	0.0	0.0
24.46	-3593.7	0.0	0.0	0.0
24.67	-3648.1	0.0	0.0	0.0
24.88	-3709.2	0.0	0.0	0.0
25.08	-3770.4	0.0	0.0	0.0
25.29	-3824.8	0.0	0.0	0.0
25.50	-3886.0	0.0	0.0	0.0
25.71	-3940.4	0.0	0.0	0.0
25.92	-4001.5	0.0	0.0	0.0
26.13	-4055.9	0.0	0.0	0.0
26.34	-4117.1	0.0	0.0	0.0
26.55	-4178.3	0.0	0.0	0.0
26.76	-4232.6	0.0	0.0	0.0
26.97	-4293.8	0.0	0.0	0.0
27.18	-4348.2	0.0	0.0	0.0
27.38	-4409.4	0.0	0.0	0.0
27.59	-4463.7	0.0	0.0	0.0
27.80	-4524.9	0.0	0.0	0.0
28.01	-4586.1	0.0	0.0	0.0
28.22	-4640.5	0.0	0.0	0.0
28.43	-4701.6	0.0	0.0	0.0
28.64	-4756.0	0.0	0.0	0.0
28.85	-4817.2	0.0	0.0	0.0
29.06	-4871.6	0.0	0.0	0.0
29.27	-4925.9	0.0	0.0	0.0

MDOT Sheet Pile Manual

SupportIT, v2.37

Tel/Fax: +44 (0)1292 477754
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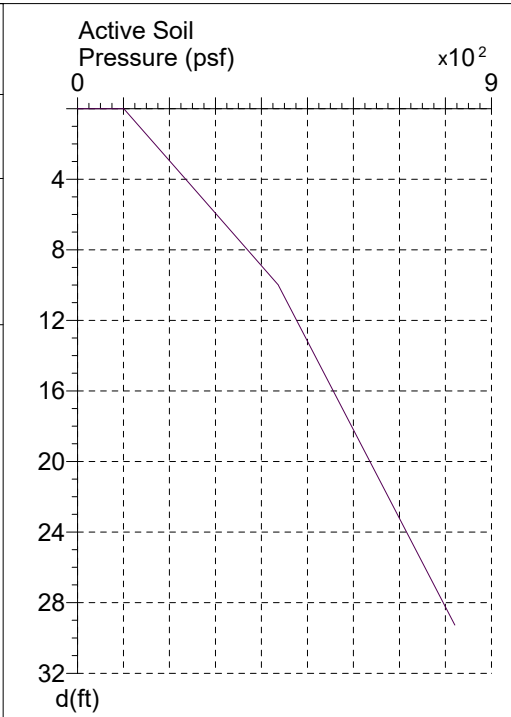
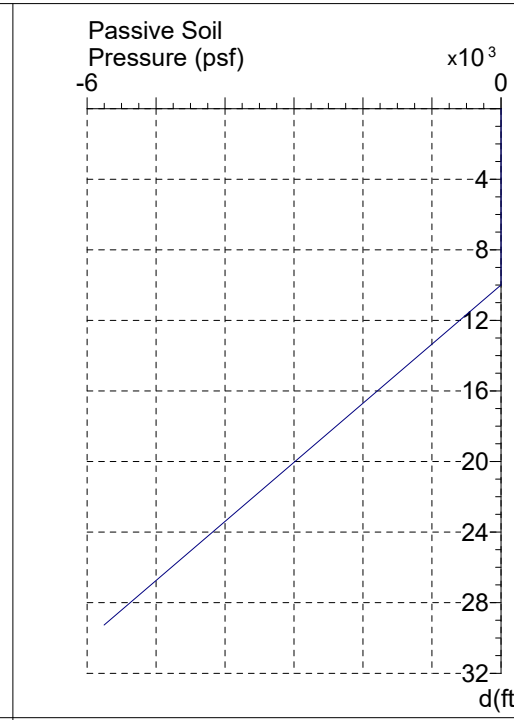
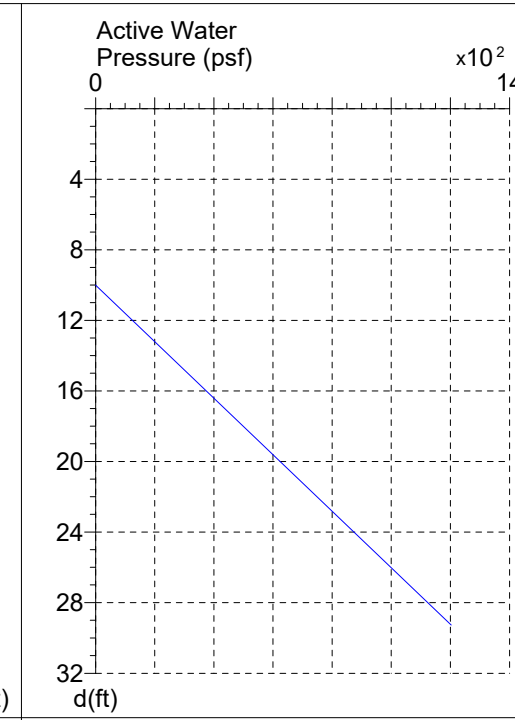
Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50 with 10 Friction

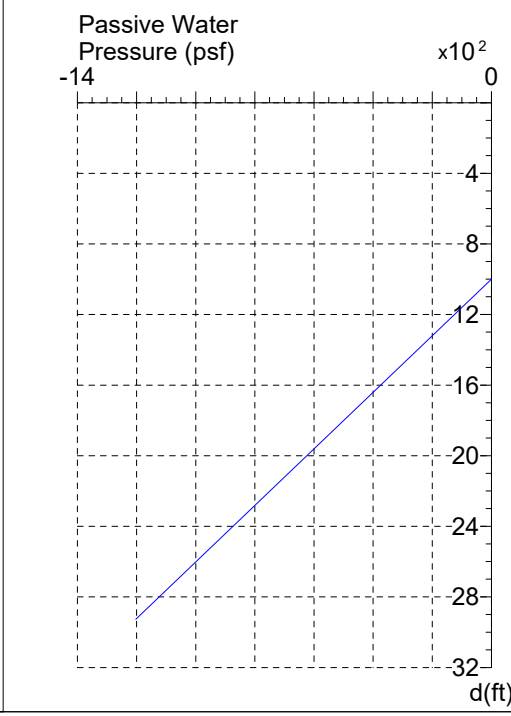
Ref: Case 1
Page: 5
Date: 8.30.18

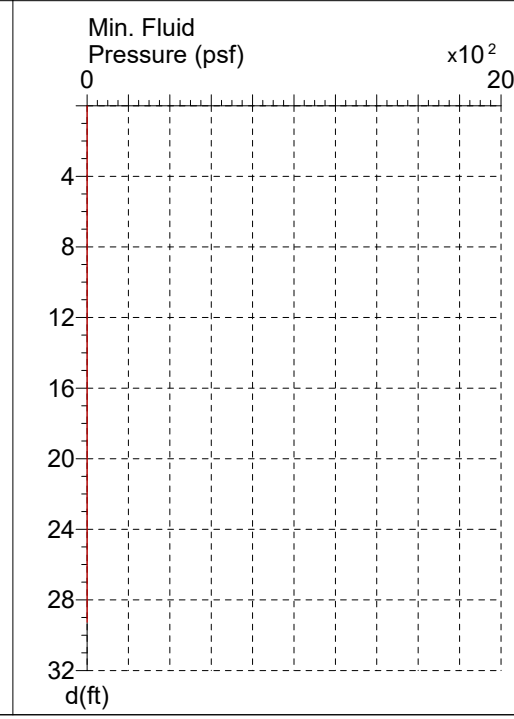
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

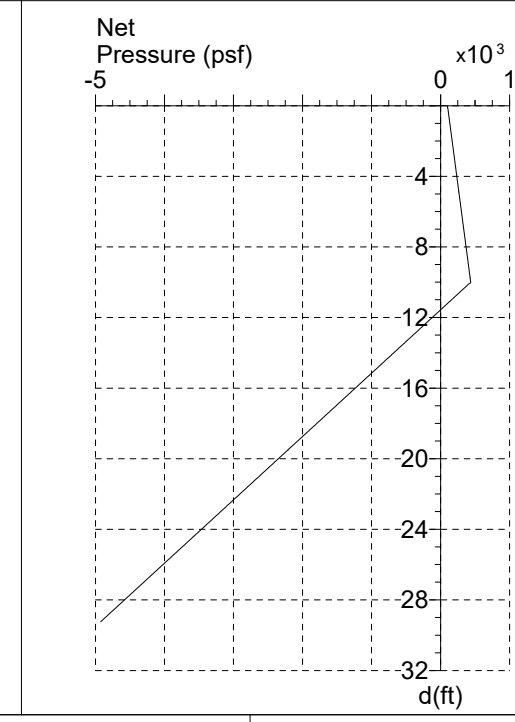












MDOT Sheet Pile Manual

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Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50 with 10 Friction

Ref: Case 1
Page: 6
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

MDOT Sheet Pile Manual

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Client: MDOT - Case 1 - Cantilever Cohesionlesss Soil
Site: FOS = 1.50 with 10 Friction

Ref: Case 1
Page: 7
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Maximum bending moment = 24631.2ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 11.84in³/ft (= M/f).
   Sheet section modulus in this design is Z = 31.00in³/ft, and is satisfactory.

2. FOS = 1.49 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Appendix B.2 – SupportIT Output, Case 2

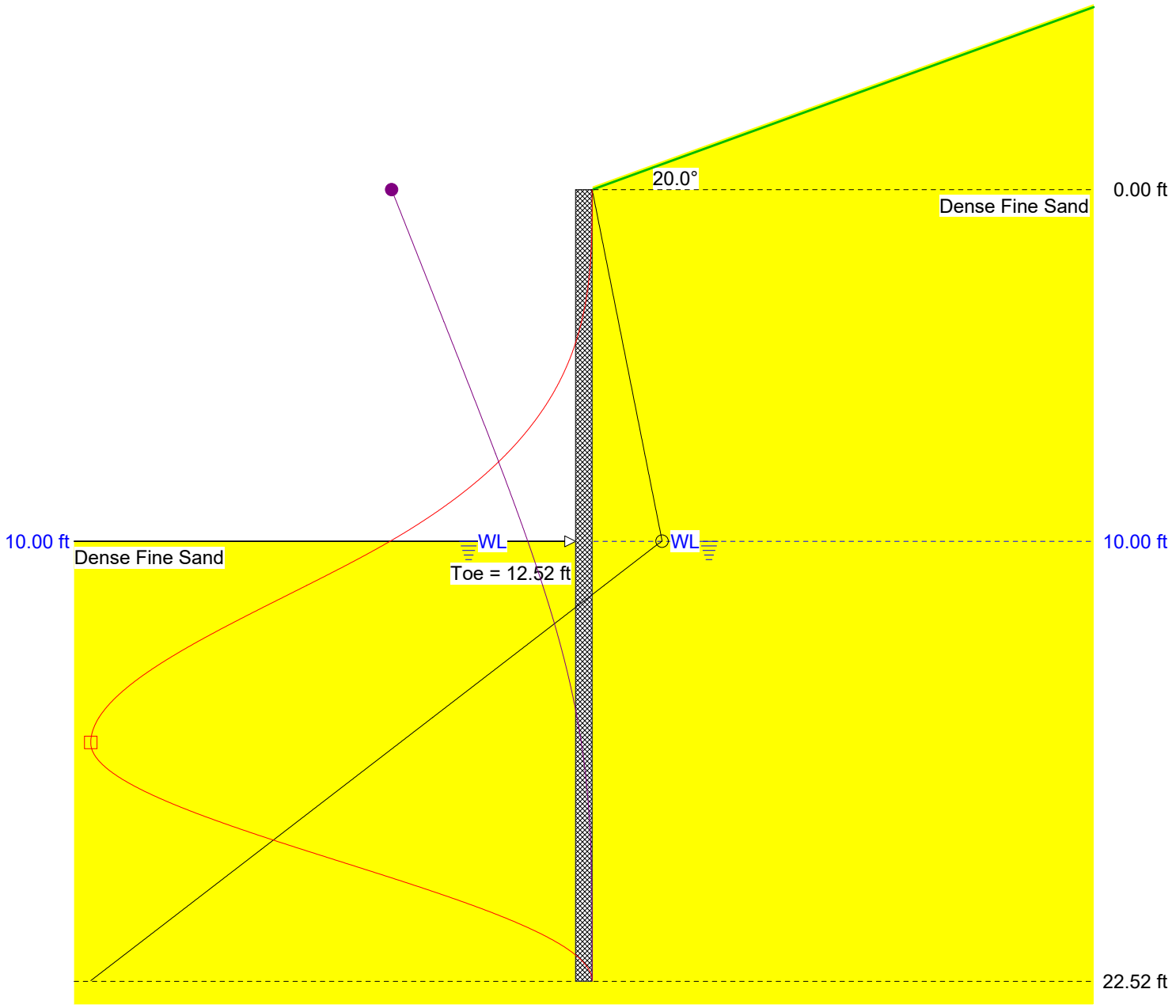
Case 2 – Cantilever TERS in Cohesionless Soil with Sloped Backfill

Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.00

Title: MDOT - Case 2 Sloped Backfill
Page: 1
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

Maximum		d (ft)
○	456.0 psf	10.00
□	18753.5 ftlb/ft	15.72
●	0.4 in	0.00



Your Company Name

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Tel/Fax: +44 (0)1292 477754
Email: GTSoftLtd@aol.com
Web: www.GTSoft.org

Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.00

Title: MDOT - Case 2 Sloped Backfill
Page: 2
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf
Slope (active) = 20.0degrees

Depth Of Active Water = 10.00ft
Depth Of Passive Water = 10.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	10.0	0.38	0.00	12.15	0.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	10.0	0.29	0.00	4.57	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	12.52	22.52

Maxima

	Maximum	Depth (ft)
Pressure	456.0 psf	10.00
Bending Moment	18753.5 ftlb/ft	15.72
Deflection	0.4 in	0.00
Shear Force	2623.3 lb/ft	11.52

Your Company Name

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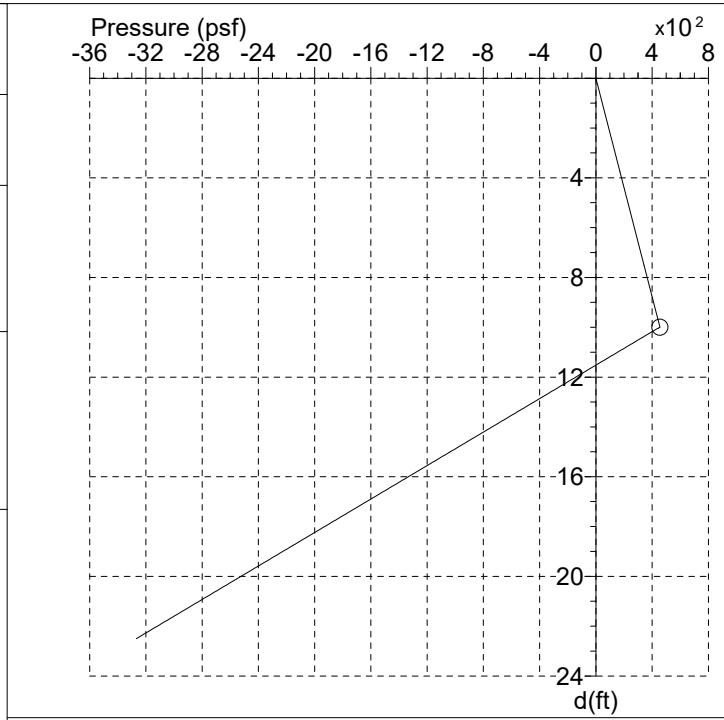
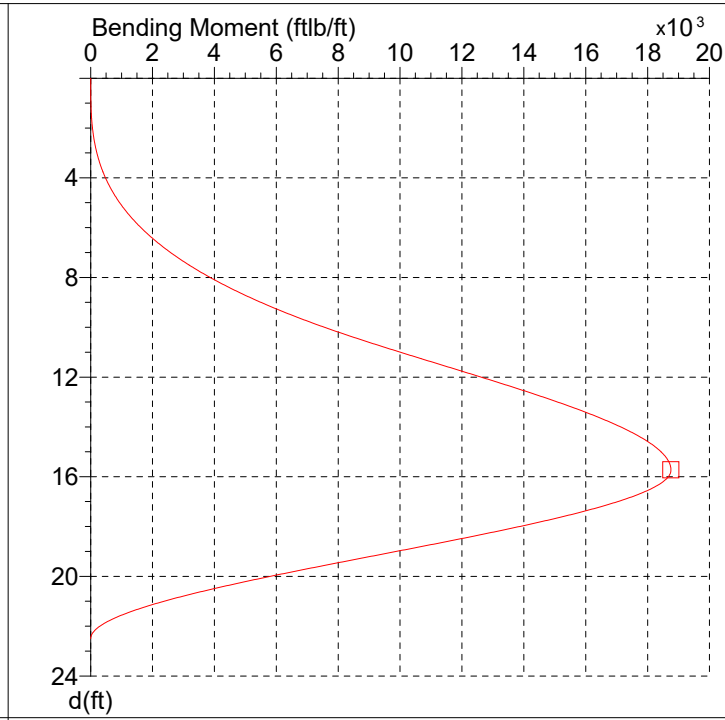
Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.00

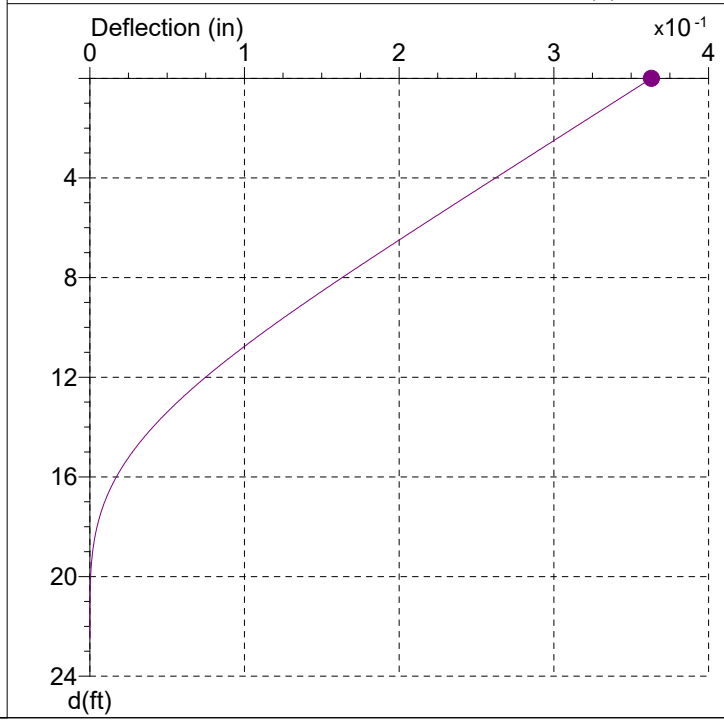
Title: MDOT - Case 2 Sloped Backfill
Page: 3
Date: 4.27.20

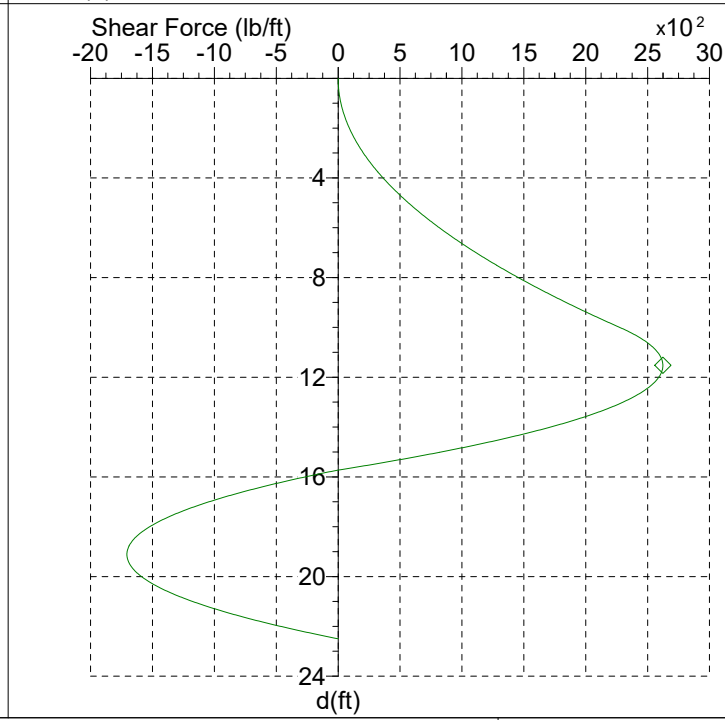
Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 456.0 psf	10.00
□ 18753.5 ftlb/ft	15.72
◇ 2623.3 lb/ft	11.52
● 0.4 in	0.00









Your Company Name

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Web: www.GTSoft.org

Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.00

Title: MDOT - Case 2 Sloped Backfill
Page: 4
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.6	0.4	0.0
0.16	7.7	0.6	0.4	0.5
0.32	14.5	0.8	0.4	2.1
0.48	22.2	1.4	0.4	5.1
0.64	29.1	2.4	0.3	8.9
0.80	36.8	4.3	0.3	14.4
0.96	43.6	6.8	0.3	20.4
1.13	51.3	10.9	0.3	28.3
1.29	59.0	16.3	0.3	37.6
1.45	65.9	22.6	0.3	46.9
1.61	73.6	31.3	0.3	58.6
1.77	80.4	40.9	0.3	70.1
1.93	88.1	53.8	0.3	84.2
2.09	95.0	67.3	0.3	97.9
2.25	102.7	85.0	0.3	114.5
2.41	110.4	105.7	0.3	132.5
2.57	117.2	126.7	0.3	149.5
2.73	124.9	153.5	0.3	169.8
2.89	131.8	180.2	0.3	189.0
3.06	139.5	213.8	0.3	211.9
3.22	146.3	247.0	0.3	233.3
3.38	154.0	288.3	0.3	258.5
3.54	161.7	333.9	0.3	285.1
3.70	168.6	378.3	0.3	309.8
3.86	176.3	432.8	0.3	338.9
4.02	183.1	485.4	0.3	365.8
4.18	190.8	549.5	0.3	397.3
4.34	197.6	611.1	0.3	426.4
4.50	205.3	685.6	0.2	460.3
4.66	213.0	766.0	0.2	495.6
4.82	219.9	842.5	0.2	528.0
4.99	227.6	934.5	0.2	565.7
5.15	234.4	1021.6	0.2	600.3
5.31	242.1	1126.0	0.2	640.5
5.47	249.0	1224.6	0.2	677.3
5.63	256.7	1342.1	0.2	719.9
5.79	264.4	1467.0	0.2	763.8
5.95	271.2	1584.2	0.2	804.0
6.11	278.9	1723.5	0.2	850.4
6.27	285.8	1853.9	0.2	892.7
6.43	293.5	2008.3	0.2	941.5
6.59	300.3	2152.5	0.2	986.0
6.75	308.0	2322.8	0.2	1037.3
6.92	315.7	2501.9	0.2	1089.9
7.08	322.6	2668.6	0.2	1137.7
7.24	330.3	2864.9	0.2	1192.8
7.40	337.1	3047.2	0.2	1242.8
7.56	344.8	3261.4	0.2	1300.3
7.72	351.6	3460.0	0.2	1352.5
7.88	359.3	3692.8	0.2	1412.5
8.04	367.0	3935.9	0.2	1473.7
8.20	373.9	4160.8	0.2	1529.3
8.36	381.6	4423.8	0.2	1593.0
8.52	388.4	4666.7	0.2	1650.7
8.68	396.1	4950.4	0.1	1716.9
8.85	403.0	5212.0	0.1	1776.8
9.01	410.7	5517.2	0.1	1845.4
9.17	418.4	5834.1	0.1	1915.4
9.33	425.2	6125.7	0.1	1978.6
9.49	432.9	6465.2	0.1	2051.0
9.65	439.8	6777.4	0.1	2116.4
9.81	447.5	7140.4	0.1	2191.3
9.97	454.3	7473.7	0.1	2258.9
10.13	412.7	7860.9	0.1	2333.3
10.29	362.5	8259.9	0.1	2399.2
10.45	317.8	8623.5	0.1	2450.7
10.61	267.5	9041.2	0.1	2500.6
10.78	222.9	9419.1	0.1	2537.8
10.94	172.6	9850.3	0.1	2571.7
11.10	127.9	10237.9	0.1	2594.6
11.26	77.7	10677.5	0.1	2612.5
11.42	27.4	11119.5	0.1	2621.8
11.58	-17.2	11513.2	0.1	2623.0
11.74	-67.5	11955.8	0.1	2616.3
11.90	-112.1	12347.7	0.1	2603.3
12.06	-162.4	12785.7	0.1	2580.5
12.22	-207.1	13171.4	0.1	2553.2
12.38	-257.3	13599.7	0.1	2514.5
12.54	-307.6	14020.9	0.1	2467.3
12.71	-352.2	14388.1	0.1	2418.2
12.87	-402.5	14791.9	0.1	2354.9
13.03	-447.2	15141.3	0.1	2291.6
13.19	-497.4	15522.4	0.1	2212.3
13.35	-542.1	15849.5	0.1	2134.7
13.51	-592.3	16202.9	0.0	2039.4
13.67	-642.6	16539.6	0.0	1935.6
13.83	-687.3	16823.7	0.0	1836.2
13.99	-737.5	17124.9	0.0	1716.4
14.15	-782.2	17375.1	0.0	1602.7
14.31	-832.4	17635.7	0.0	1466.9
14.47	-877.1	17847.6	0.0	1339.0
14.64	-927.4	18062.4	0.0	1187.1
14.80	-977.6	18251.0	0.0	1026.7
14.96	-1022.3	18395.3	0.0	877.0
15.12	-1072.5	18530.3	0.0	700.6
15.28	-1117.2	18624.8	0.0	536.7
15.44	-1167.5	18701.1	0.0	344.3
15.60	-1212.1	18741.1	0.0	166.1
15.76	-1262.4	18752.6	0.0	-37.6
15.92	-1312.6	18706.9	0.0	-201.7
16.08	-1357.3	18610.9	0.0	-340.4
16.24	-1407.6	18443.7	0.0	-488.4
16.40	-1452.2	18245.2	0.0	-612.9
16.57	-1502.5	17969.0	0.0	-744.9
16.73	-1547.2	17679.1	0.0	-855.1
16.89	-1597.4	17306.2	0.0	-971.1
17.05	-1647.7	16887.2	0.0	-1078.6
17.21	-1692.3	16478.9	0.0	-1167.0
17.37	-1742.6	15982.4	0.0	-1258.5
17.53	-1787.2	15510.7	0.0	-1332.6
17.69	-1837.5	14949.0	0.0	-1408.1
17.85	-1882.2	14424.9	0.0	-1468.0
18.01	-1932.4	13810.5	0.0	-1527.4
18.17	-1982.7	13173.3	0.0	-1578.3
18.33	-2027.3	12590.5	0.0	-1616.4
18.49	-2077.6	11919.6	0.0	-1651.3
18.66	-2122.3	11312.4	0.0	-1675.2
18.82	-2172.5	10620.3	0.0	-1694.1
18.98	-2217.2	9999.7	0.0	-1703.7
19.14	-2267.4	9298.8	0.0	-1706.5
19.30	-2317.7	8598.3	0.0	-1700.9
19.46	-2362.4	7978.8	0.0	-1688.7
19.62	-2412.6	7288.5	0.0	-1667.0
19.78	-2457.3	6683.6	0.0	-1640.6
19.94	-2507.5	6016.0	0.0	-1602.9
20.10	-2552.2	5436.8	0.0	-1562.3
20.26	-2602.5	4804.4	0.0	-1508.5
20.42	-2652.7	4195.5	0.0	-1446.3
20.59	-2697.4	3677.0	0.0	-1383.9
20.75	-2747.6	3122.4	0.0	-1305.6
20.91	-2792.3	2657.5	0.0	-1228.9
21.07	-2842.6	2169.5	0.0	-1134.6
21.23	-2887.2	1769.3	0.0	-1043.7
21.39	-2937.5	1360.3	0.0	-933.4
21.55	-2987.7	998.2	0.0	-814.6
21.71	-3032.4	718.5	0.0	-701.8
21.87	-3082.7	454.4	0.0	-567.0
22.03	-3127.3	267.4	0.0	-440.0
22.19	-3177.6	113.8	0.0	-289.2
22.35	-3222.3	30.6	0.0	-147.9
22.52	-3266.9	0.0	0.0	0.0

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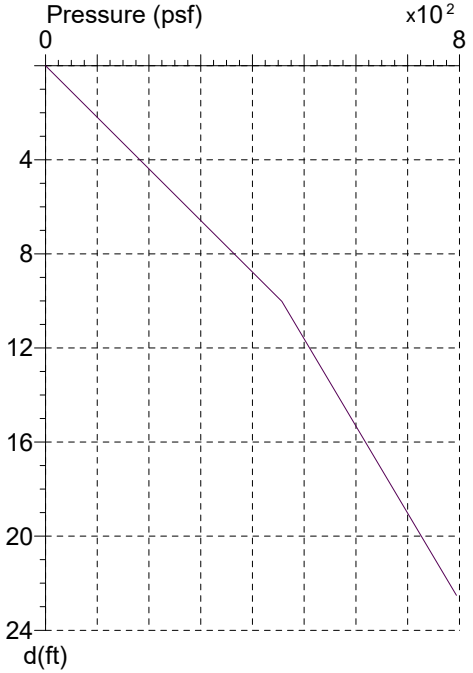
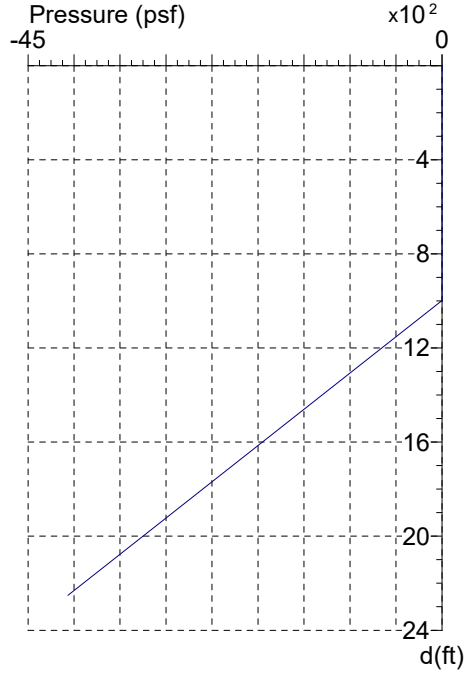
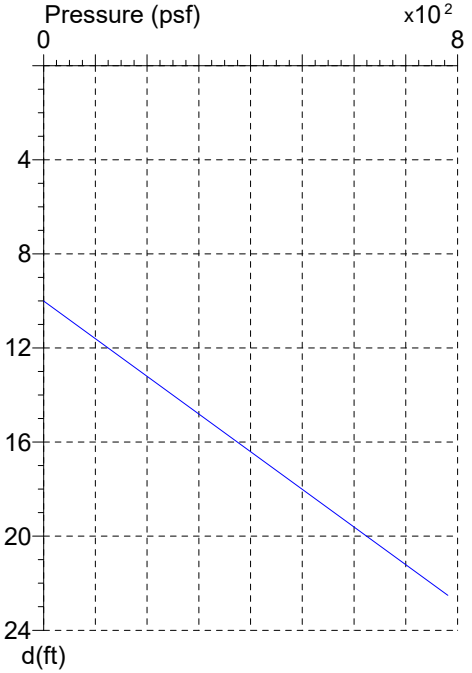
Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.00

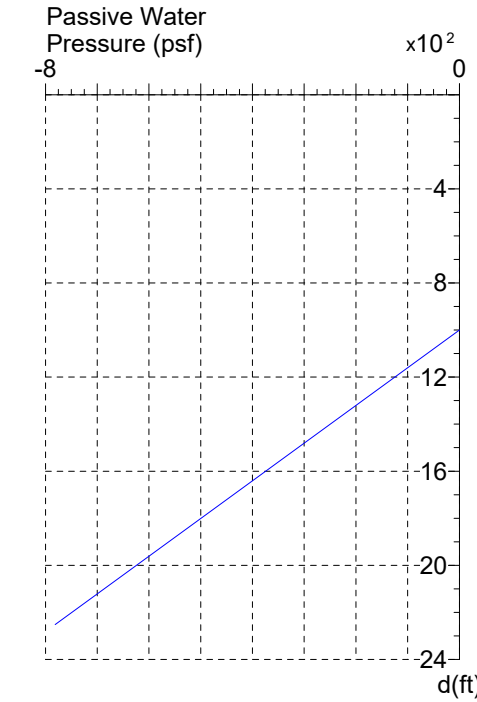
Title: MDOT - Case 2 Sloped Backfill
Page: 5
Date: 4.27.20

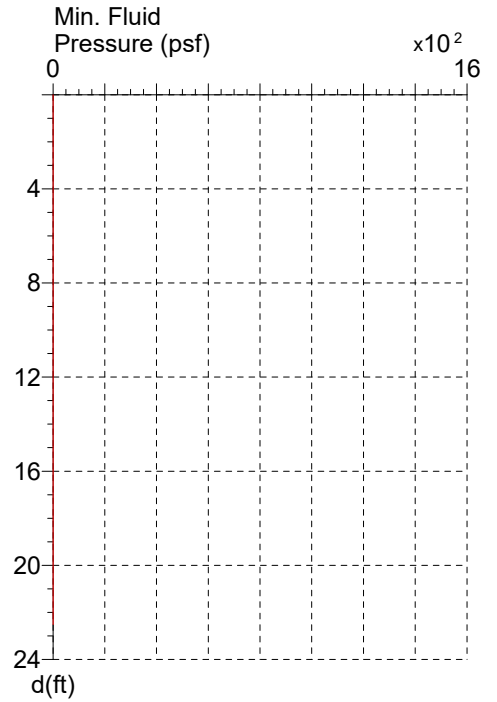
Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

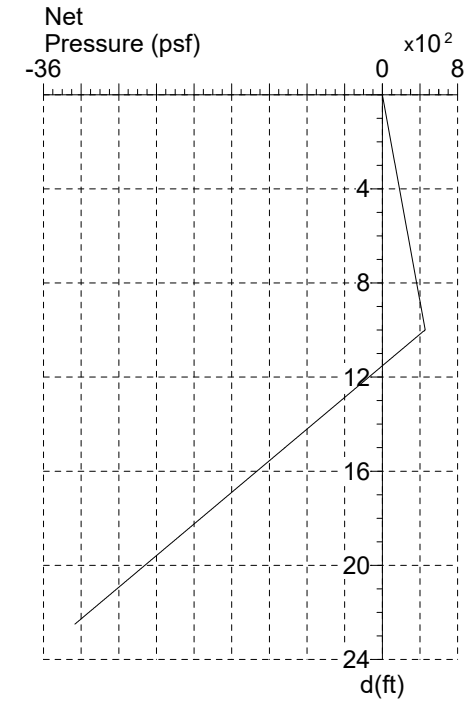












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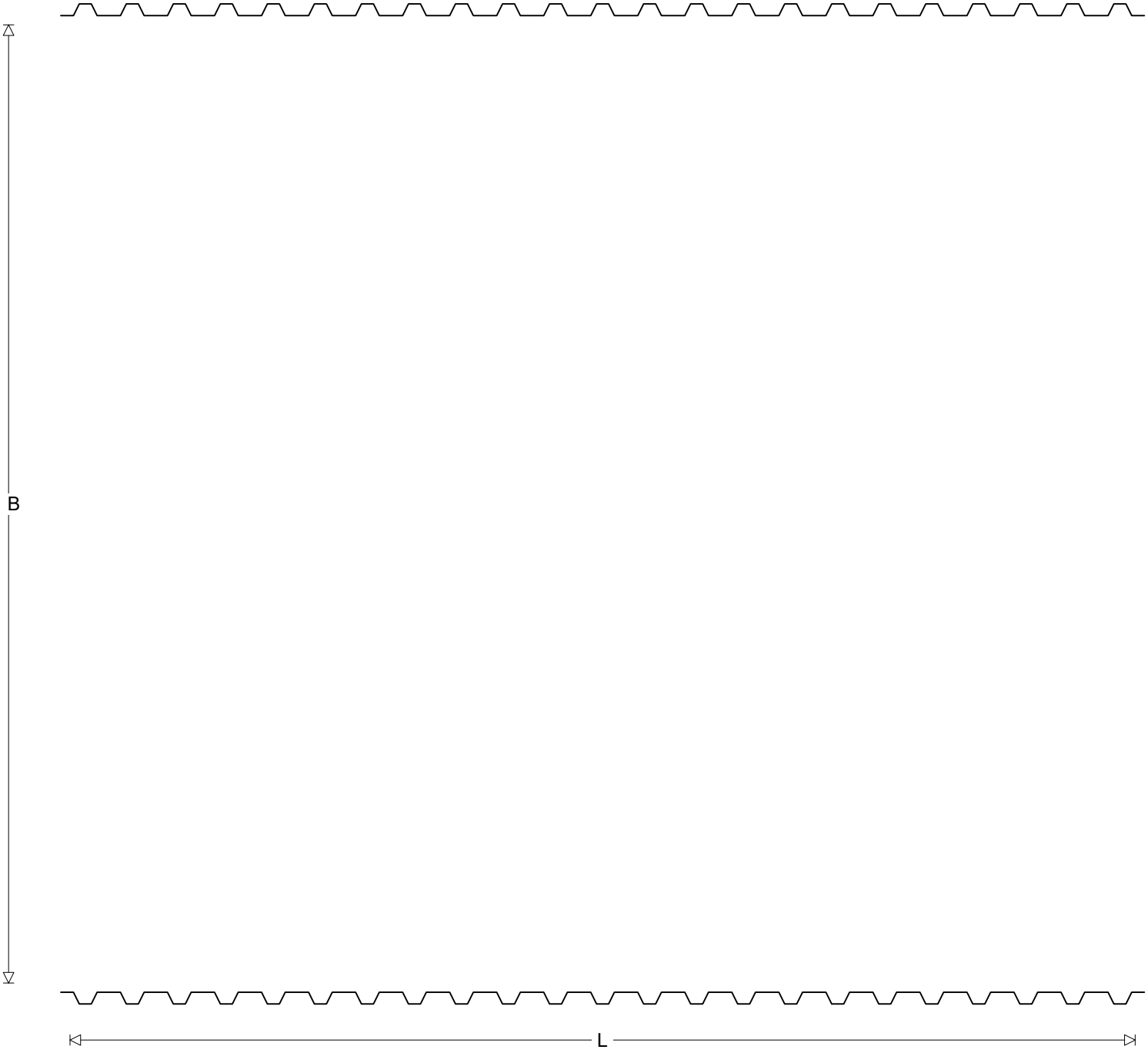
Site: FOS = 1.00

Title: MDOT - Case 2 Sloped Backfill
Page: 6
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever



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Site:	FOS = 1.00
Title:	MDOT - Case 2 Sloped Backfill
Page:	7
Date:	4.27.20
Sheet:	PZ35
Works:	Temporary
Pressure:	Coulomb
Analysis:	Gross Pressure
Toe:	Cantilever

Design Report

1. The standard surcharge is 0.0psf. The Piling Handbook recommends a minimum surcharge of 200.0psf.

2. Maximum bending moment = 18753.5ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 9.01in³/ft (= M/f).
   Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

3. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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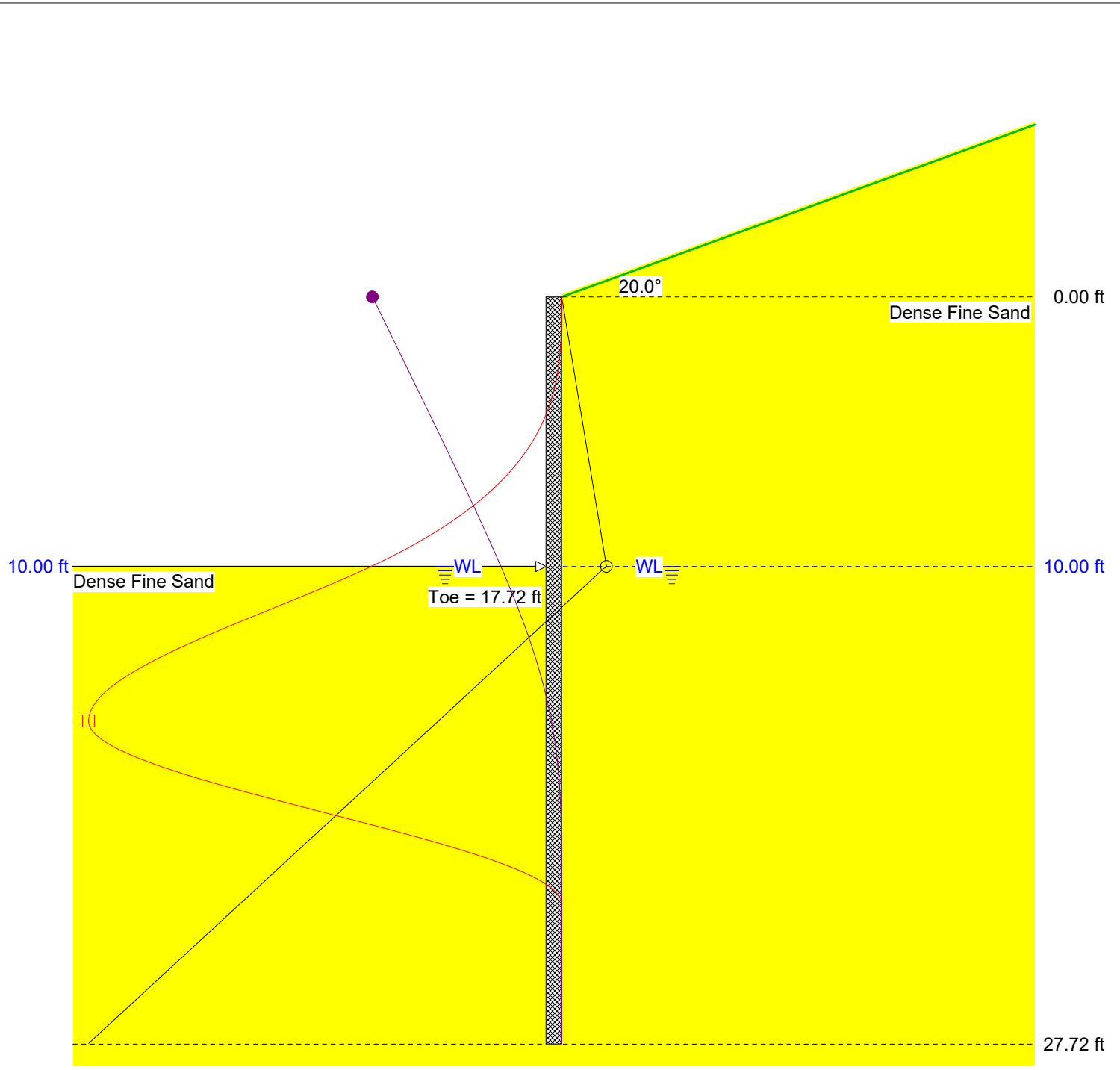
Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.50

Title: MDOT - Case 2 Sloped Backfill
Page: 1
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 456.0 psf	10.00
□ 18733.7 ftlb/ft	15.73
● 0.4 in	0.00



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Site: FOS = 1.50

Title: MDOT - Case 2 Sloped Backfill
Page: 2
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf
Slope (active) = 20.0degrees

Depth Of Active Water = 10.00ft
Depth Of Passive Water = 10.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	10.0	0.38	0.00	12.15	0.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	10.0	0.29	0.00	4.57	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	17.72	27.72

Maxima

	Maximum	Depth (ft)
Pressure	456.0 psf	10.00
Bending Moment	18733.7 ftlb/ft	15.73
Deflection	0.4 in	0.00
Shear Force	2621.6 lb/ft	11.53

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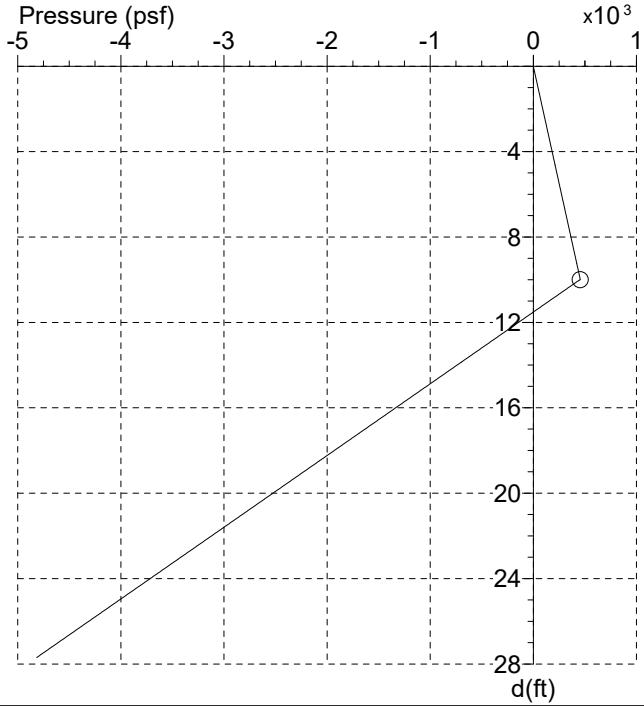
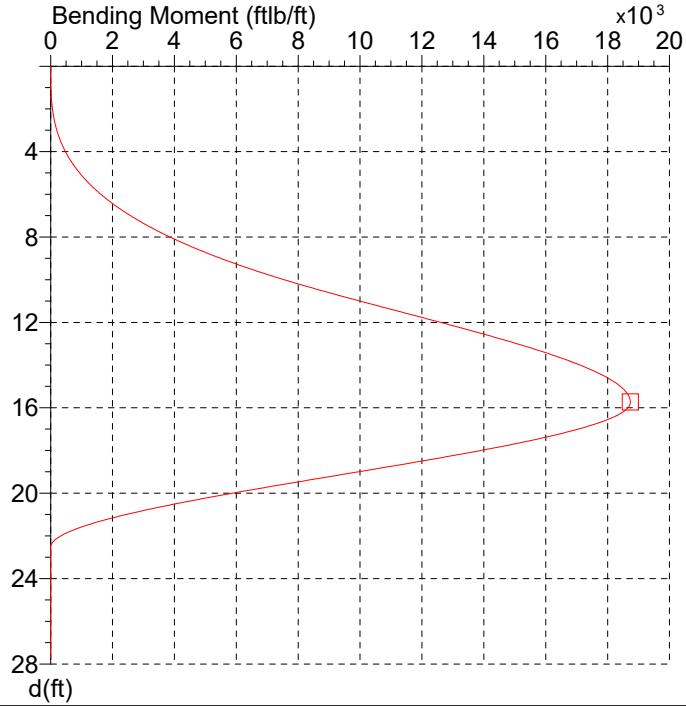
Site: FOS = 1.50

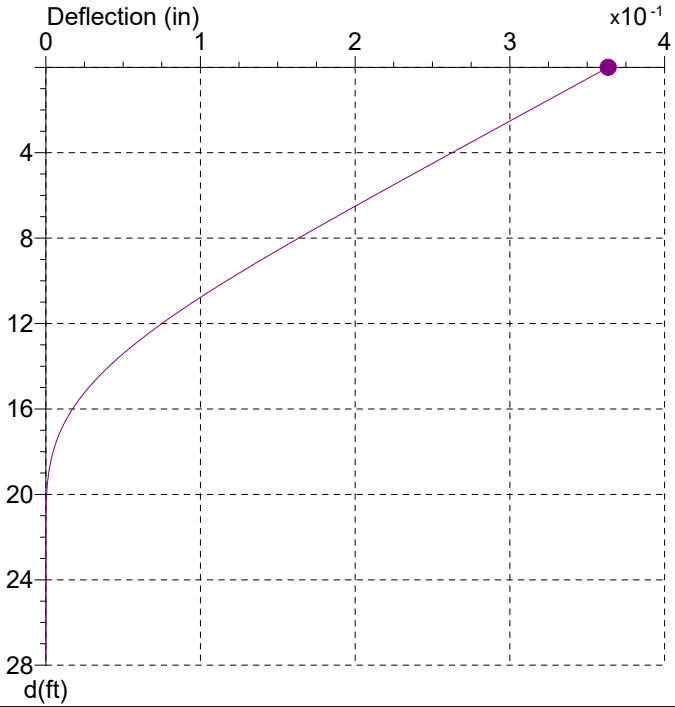
Title: MDOT - Case 2 Sloped Backfill
Page: 3
Date: 4.27.20

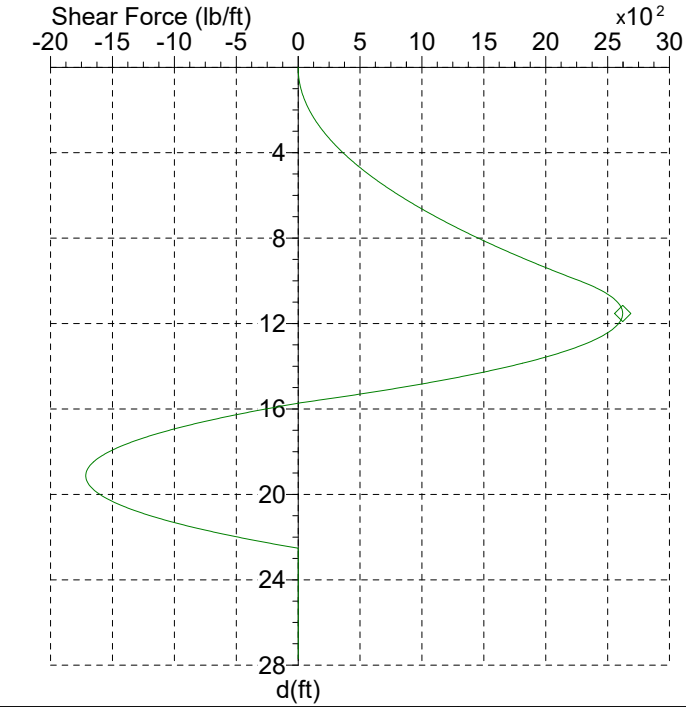
Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 456.0 psf	10.00
□ 18733.7 ftlb/ft	15.73
◇ 2621.6 lb/ft	11.53
● 0.4 in	0.00









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Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.50

Title: MDOT - Case 2 Sloped Backfill
Page: 4
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.6	0.4	0.0
0.20	9.5	0.7	0.4	0.8
0.40	17.9	1.0	0.4	3.2
0.59	27.4	2.0	0.3	7.8
0.79	35.8	3.9	0.3	13.5
0.99	45.3	7.5	0.3	21.8
1.19	53.7	12.2	0.3	30.9
1.39	63.2	19.7	0.3	42.9
1.58	72.7	29.9	0.3	57.0
1.78	81.1	41.5	0.3	71.1
1.98	90.6	57.9	0.3	88.8
2.18	99.0	75.7	0.3	106.2
2.38	108.5	99.7	0.3	127.7
2.57	116.9	125.0	0.3	148.4
2.77	126.4	158.1	0.3	173.6
2.97	135.9	196.7	0.3	200.7
3.17	144.3	235.9	0.3	226.5
3.37	153.8	285.8	0.3	257.4
3.56	162.2	335.7	0.3	286.5
3.76	171.7	398.4	0.3	321.1
3.96	180.1	460.3	0.3	353.5
4.16	189.6	537.3	0.3	391.8
4.36	199.1	622.5	0.3	432.1
4.55	207.5	705.3	0.2	469.6
4.75	217.0	807.0	0.2	513.6
4.95	225.4	905.2	0.2	554.4
5.15	234.9	1024.8	0.2	602.1
5.35	243.3	1139.6	0.2	646.2
5.54	252.8	1278.6	0.2	697.6
5.74	262.3	1428.6	0.2	751.1
5.94	270.7	1571.3	0.2	800.2
6.14	280.2	1742.9	0.2	857.4
6.34	288.6	1905.6	0.2	909.8
6.53	298.1	2100.3	0.2	970.7
6.73	306.5	2284.2	0.2	1026.5
6.93	316.0	2503.5	0.2	1091.1
7.13	325.5	2736.5	0.2	1157.6
7.33	333.9	2955.3	0.2	1218.5
7.52	343.4	3215.0	0.2	1288.8
7.72	351.8	3458.4	0.2	1352.9
7.92	361.3	3746.4	0.2	1426.9
8.12	369.7	4015.5	0.2	1494.3
8.32	379.2	4333.3	0.2	1572.1
8.51	388.7	4667.5	0.2	1651.8
8.71	397.1	4978.6	0.1	1724.3
8.91	406.6	5344.7	0.1	1807.7
9.11	415.0	5684.9	0.1	1883.5
9.31	424.5	6084.4	0.1	1970.7
9.50	432.9	6455.0	0.1	2049.8
9.70	442.4	6889.5	0.1	2140.7
9.90	451.9	7343.1	0.1	2233.5
10.10	422.8	7762.6	0.1	2316.4
10.30	361.0	8251.9	0.1	2398.6
10.49	306.0	8700.3	0.1	2460.8
10.69	244.1	9217.5	0.1	2518.7
10.89	189.1	9686.4	0.1	2559.4
11.09	127.2	10221.8	0.1	2593.0
11.29	65.3	10762.9	0.1	2613.7
11.48	10.3	11246.7	0.1	2621.3
11.68	-51.5	11791.5	0.1	2617.8
11.88	-106.5	12274.3	0.1	2603.8
12.08	-168.4	12813.3	0.1	2575.9
12.28	-223.4	13286.5	0.1	2540.4
12.47	-285.3	13810.1	0.1	2488.2
12.67	-347.1	14321.5	0.1	2423.2
12.87	-402.1	14763.9	0.1	2354.6
13.07	-464.0	15245.4	0.1	2265.3
13.27	-519.0	15656.9	0.1	2175.1
13.46	-580.9	16098.8	0.0	2061.5
13.66	-635.9	16470.8	0.0	1949.7
13.86	-697.7	16863.6	0.0	1811.8
14.06	-759.6	17226.6	0.0	1661.0
14.26	-814.6	17522.0	0.0	1516.2
14.45	-876.5	17821.2	0.0	1341.1
14.65	-931.5	18055.7	0.0	1174.7
14.85	-993.4	18281.7	0.0	975.3
15.05	-1048.4	18446.9	0.0	787.3
15.25	-1110.2	18590.2	0.0	563.7
15.44	-1172.1	18685.7	0.0	327.1
15.64	-1227.1	18728.5	0.0	106.1
15.84	-1289.0	18720.8	0.0	-114.7
16.04	-1344.0	18635.1	0.0	-290.0
16.24	-1405.8	18447.9	0.0	-475.1
16.43	-1460.8	18205.8	0.0	-628.8
16.63	-1522.7	17854.2	0.0	-789.6
16.83	-1584.6	17424.8	0.0	-937.5
17.03	-1639.6	16983.0	0.0	-1058.2
17.23	-1701.4	16424.4	0.0	-1181.9
17.42	-1756.4	15878.0	0.0	-1280.9
17.62	-1818.3	15213.1	0.0	-1380.3
17.82	-1873.3	14582.5	0.0	-1457.8
18.02	-1935.2	13834.3	0.0	-1532.8
18.22	-1997.1	13051.4	0.0	-1595.0
18.41	-2052.1	12331.6	0.0	-1639.4
18.61	-2113.9	11500.6	0.0	-1677.3
18.81	-2168.9	10748.3	0.0	-1700.2
19.01	-2230.8	9892.3	0.0	-1713.7
19.21	-2285.8	9127.9	0.0	-1715.0
19.40	-2347.7	8269.9	0.0	-1704.3
19.60	-2409.5	7420.1	0.0	-1680.7
19.80	-2464.5	6676.9	0.0	-1649.0
20.00	-2526.4	5860.3	0.0	-1601.1
20.20	-2581.4	5156.8	0.0	-1547.7
20.39	-2643.3	4396.3	0.0	-1475.6
20.59	-2698.3	3753.0	0.0	-1400.6
20.79	-2760.2	3071.7	0.0	-1304.1
20.99	-2822.0	2441.7	0.0	-1194.8
21.19	-2877.0	1929.9	0.0	-1086.8
21.38	-2938.9	1414.2	0.0	-953.2
21.58	-2993.9	1014.3	0.0	-823.6
21.78	-3055.8	636.0	0.0	-665.7
21.98	-3110.8	368.5	0.0	-514.5
22.17	-3172.6	150.6	0.0	-332.3
22.37	-3234.5	26.9	0.0	-137.2
22.57	-3289.5	0.0	0.0	0.0
22.77	-3351.4	0.0	0.0	0.0
22.97	-3406.4	0.0	0.0	0.0
23.16	-3468.2	0.0	0.0	0.0
23.36	-3523.2	0.0	0.0	0.0
23.56	-3585.1	0.0	0.0	0.0
23.76	-3647.0	0.0	0.0	0.0
23.96	-3702.0	0.0	0.0	0.0
24.15	-3763.9	0.0	0.0	0.0
24.35	-3818.9	0.0	0.0	0.0
24.55	-3880.7	0.0	0.0	0.0
24.75	-3935.7	0.0	0.0	0.0
24.95	-3997.6	0.0	0.0	0.0
25.14	-4059.5	0.0	0.0	0.0
25.34	-4114.5	0.0	0.0	0.0
25.54	-4176.3	0.0	0.0	0.0
25.74	-4231.3	0.0	0.0	0.0
25.94	-4293.2	0.0	0.0	0.0
26.13	-4348.2	0.0	0.0	0.0
26.33	-4410.1	0.0	0.0	0.0
26.53	-4471.9	0.0	0.0	0.0
26.73	-4526.9	0.0	0.0	0.0
26.93	-4588.8	0.0	0.0	0.0
27.12	-4643.8	0.0	0.0	0.0
27.32	-4705.7	0.0	0.0	0.0
27.52	-4760.7	0.0	0.0	0.0
27.72	-4815.7	0.0	0.0	0.0

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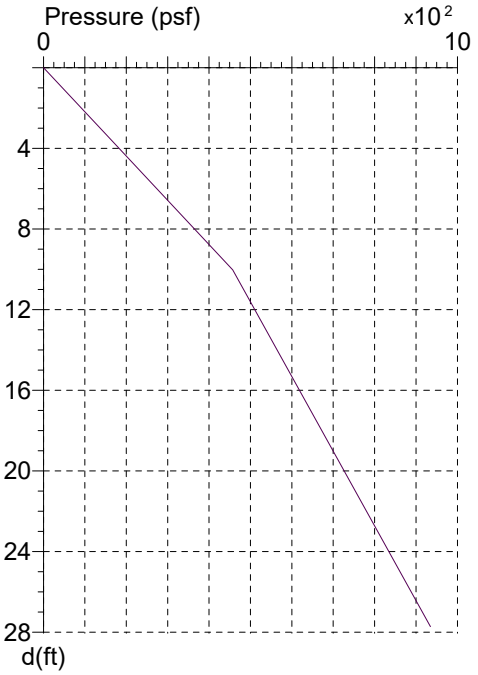
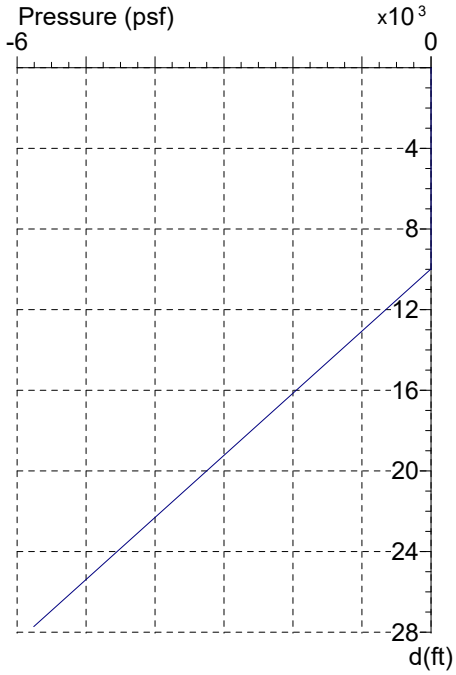
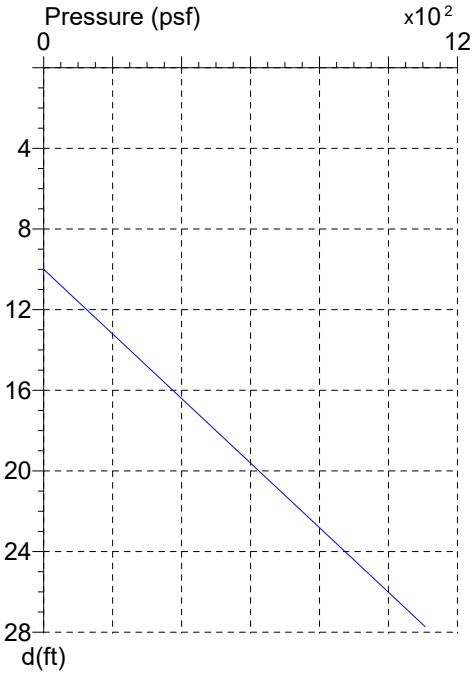
Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.50

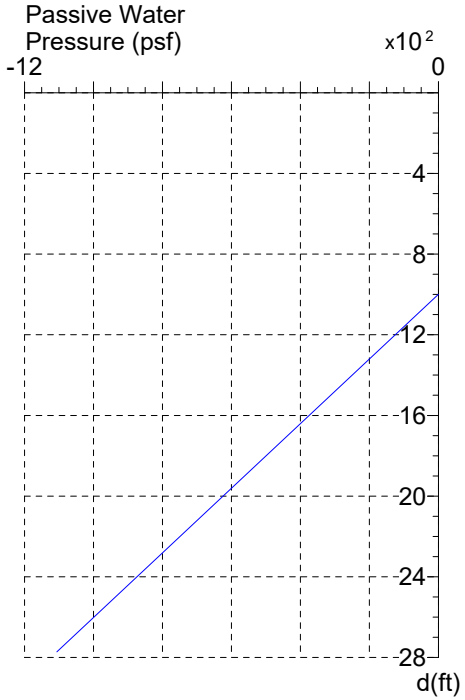
Title: MDOT - Case 2 Sloped Backfill
Page: 5
Date: 4.27.20

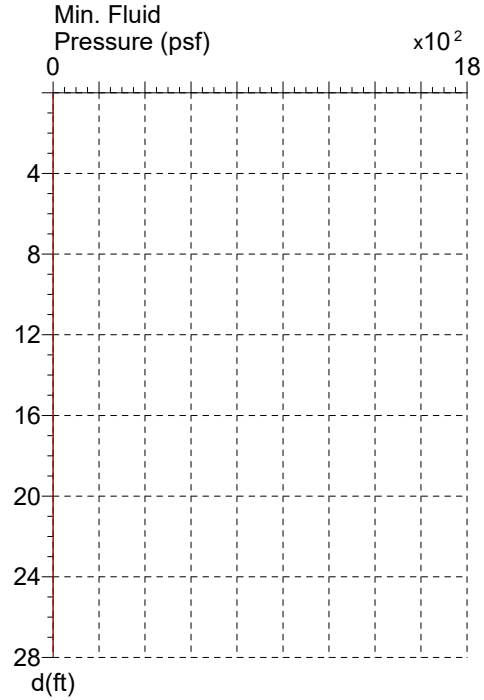
Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever

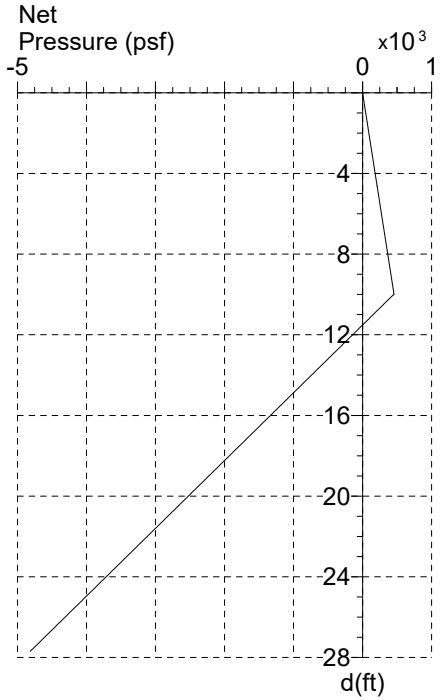












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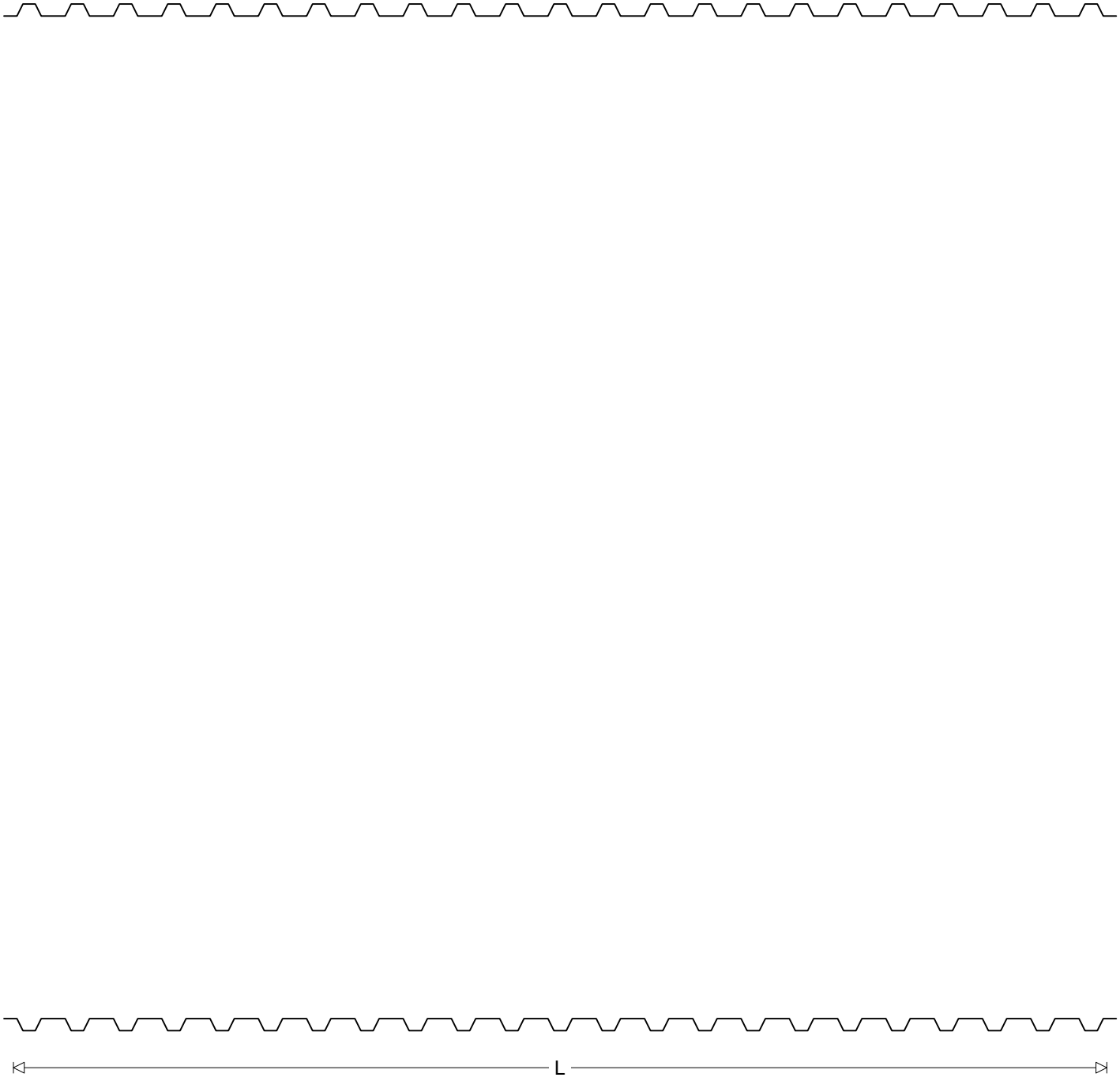
Client: Case 2: Cantilever with Sloped Backfill
Site: FOS = 1.50

Title: MDOT - Case 2 Sloped Backfill
Page: 6
Date: 4.27.20

Sheet: PZ35
Works: Temporary
Pressure: Coulomb
Analysis: Gross Pressure
Toe: Cantilever



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Client:	Case 2: Cantilever with Sloped Backfill
Site:	FOS = 1.50
Title:	MDOT - Case 2 Sloped Backfill
Page:	7
Date:	4.27.20
Sheet:	PZ35
Works:	Temporary
Pressure:	Coulomb
Analysis:	Gross Pressure
Toe:	Cantilever

Design Report

1. The standard surcharge is 0.0psf. The Piling Handbook recommends a minimum surcharge of 200.0psf.

2. Maximum bending moment = 18733.7ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 9.00in³/ft (= M/f).
   Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

3. FOS = 1.50 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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Appendix B.3 – SupportIT Output, Case 3

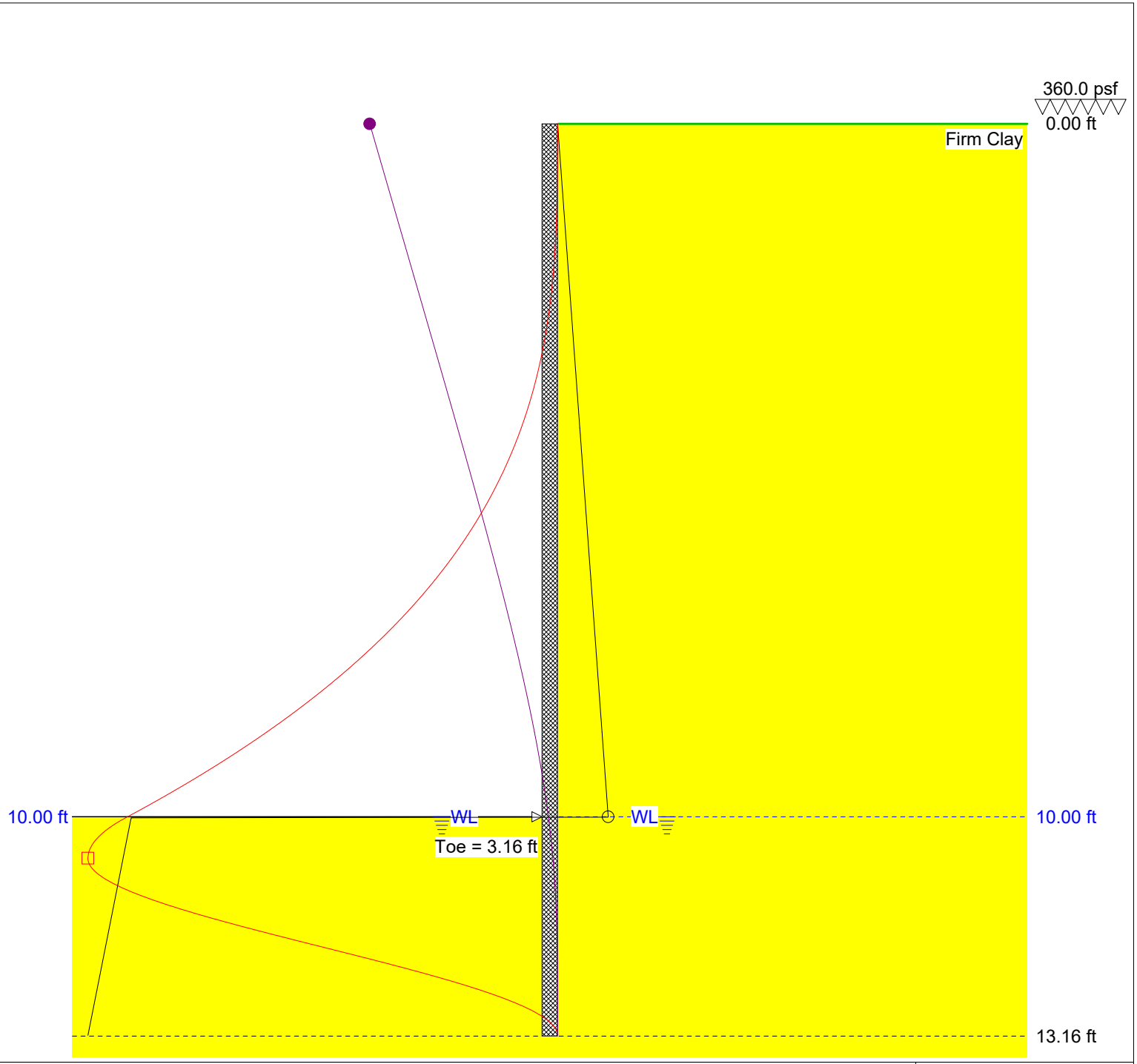
Case 3 – Cantilever TERS in Stiff Clay with Level Back Slope

Client: MDOT
Site: FOS = 1.00

Title: Case 3 Cantilever Firm Clay
Page: 1
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 318.3 psf	10.00
□ 5795.5 ftlb/ft	10.60
● 0.2 in	0.00



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Client: MDOT
Site: FOS = 1.00

Title: Case 3 Cantilever Firm Clay
Page: 2
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 360.0psf

Depth Of Active Water = 10.00ft
Depth Of Passive Water = 10.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Firm Clay	118.37	56.00	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	3.16	13.16

Maxima

	Maximum	Depth (ft)
Pressure	318.3 psf	10.00
Bending Moment	5795.5 ftlb/ft	10.60
Deflection	0.2 in	0.00
Shear Force	1595.5 lb/ft	10.00

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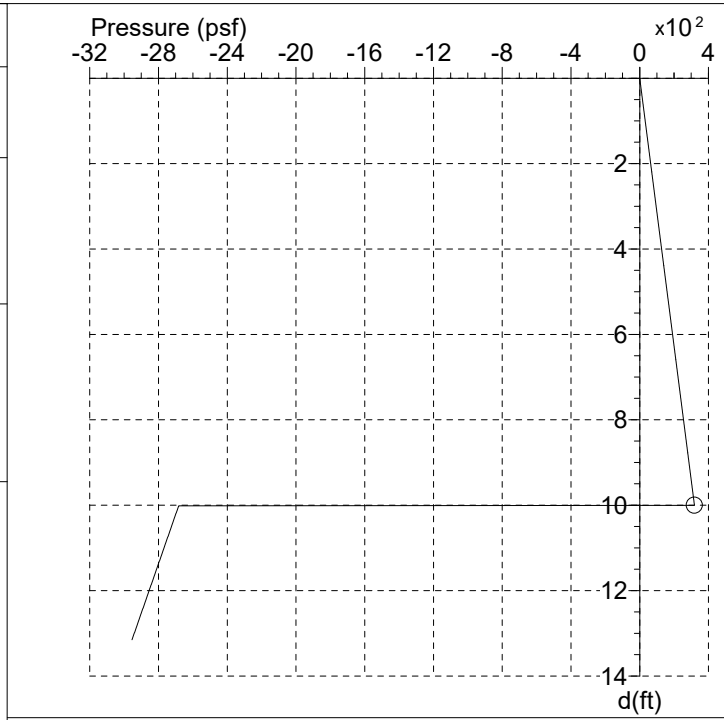
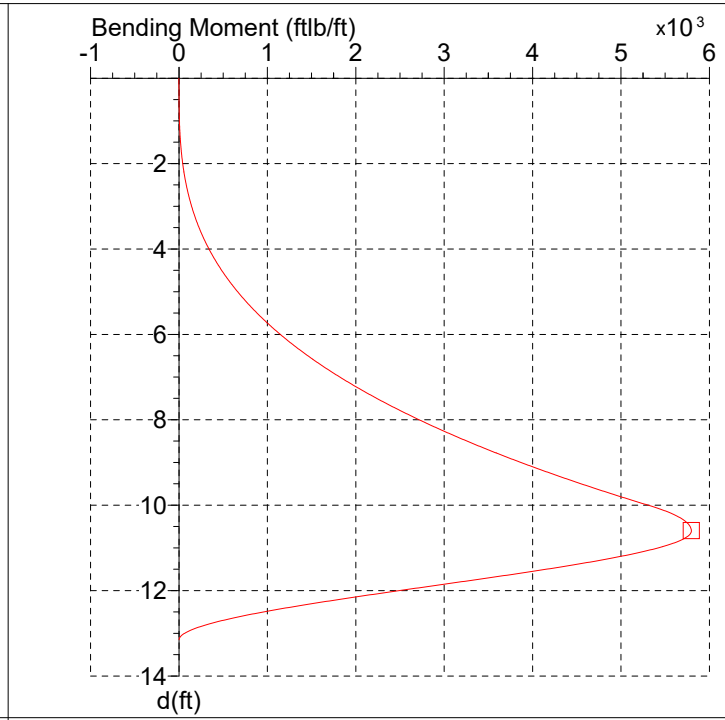
Client: MDOT
Site: FOS = 1.00

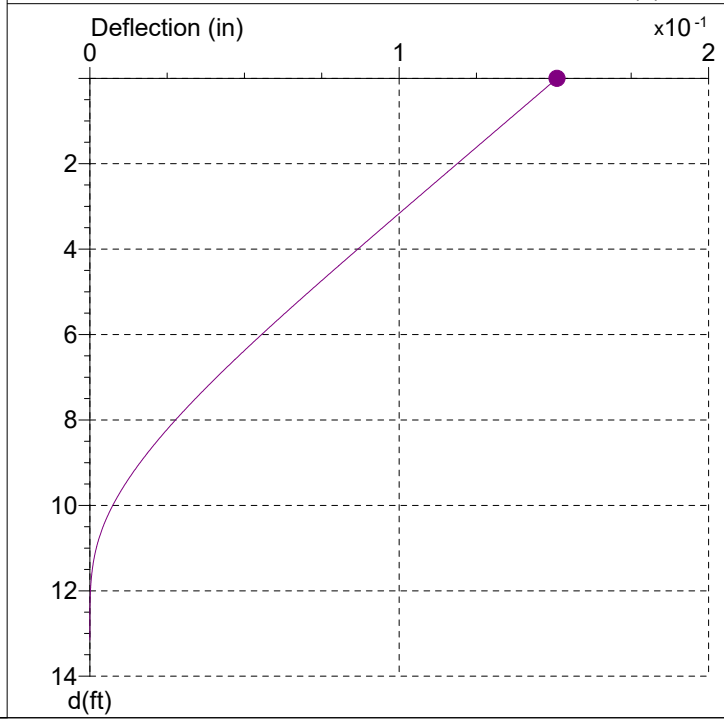
Title: Case 3 Cantilever Firm Clay
Page: 3
Date: 8.30.18

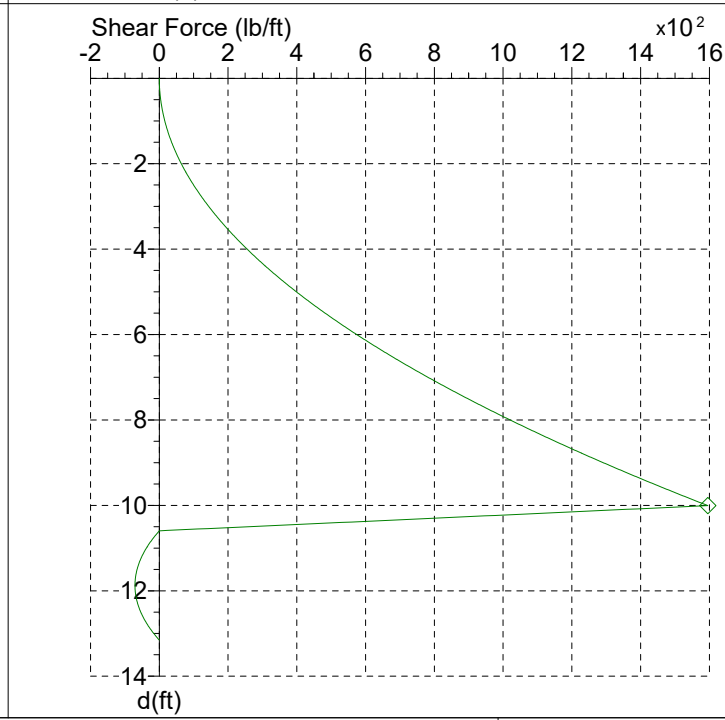
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
318.3 psf	10.00
5795.5 ftlb/ft	10.60
1595.5 lb/ft	10.00
0.2 in	0.00









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Client: MDOT
Site: FOS = 1.00

Title: Case 3 Cantilever Firm Clay
Page: 4
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	-0.1	0.2	0.0	4.42	140.8	458.5	0.1	312.0	8.84	281.6	3668.8	0.0	1246.4
0.09	3.1	-0.1	0.1	0.2	4.51	143.6	486.4	0.1	324.5	8.93	284.4	3779.1	0.0	1271.2
0.19	5.9	0.0	0.1	0.6	4.61	146.7	519.1	0.1	338.8	9.03	287.5	3905.9	0.0	1299.5
0.28	9.1	0.0	0.1	1.3	4.70	149.9	553.1	0.1	353.5	9.12	290.3	4020.9	0.0	1324.8
0.38	11.9	0.2	0.1	2.3	4.80	152.7	584.7	0.1	366.8	9.21	293.5	4153.0	0.0	1353.7
0.47	15.0	0.5	0.1	3.6	4.89	155.8	621.6	0.1	382.0	9.31	296.6	4287.9	0.0	1382.8
0.56	17.8	0.9	0.1	5.1	4.98	158.6	655.6	0.1	395.8	9.40	299.4	4410.3	0.0	1409.0
0.66	21.0	1.4	0.1	7.0	5.08	161.8	695.4	0.1	411.7	9.50	302.5	4550.7	0.0	1438.7
0.75	24.1	2.2	0.1	9.3	5.17	164.5	732.1	0.1	426.0	9.59	305.3	4678.0	0.0	1465.4
0.85	26.9	3.1	0.1	11.5	5.27	167.7	774.8	0.1	442.4	9.68	308.5	4824.0	0.0	1495.7
0.94	30.0	4.4	0.1	14.3	5.36	170.8	819.2	0.1	459.1	9.78	311.3	4956.3	0.0	1522.9
1.03	32.8	5.7	0.1	17.1	5.45	173.6	860.1	0.1	474.3	9.87	314.4	5108.0	0.0	1553.8
1.13	36.0	7.6	0.1	20.5	5.55	176.8	907.7	0.1	491.6	9.97	317.6	5262.8	0.0	1585.1
1.22	38.8	9.5	0.1	23.8	5.64	179.6	951.4	0.1	507.2	10.06	-2686.5	5399.3	0.0	1448.3
1.32	41.9	12.0	0.1	27.8	5.74	182.7	1002.3	0.1	525.1	10.16	-2695.1	5530.7	0.0	1182.7
1.41	45.1	15.0	0.1	32.1	5.83	185.5	1049.0	0.1	541.3	10.25	-2702.7	5625.4	0.0	945.9
1.50	47.9	17.9	0.1	36.2	5.92	188.7	1103.3	0.1	559.8	10.34	-2711.2	5707.1	0.0	678.7
1.60	51.0	21.7	0.1	41.1	6.02	191.8	1159.4	0.1	578.6	10.44	-2718.8	5757.5	0.0	440.5
1.69	53.8	25.5	0.1	45.7	6.11	194.6	1210.8	0.1	595.6	10.53	-2727.3	5789.2	0.0	171.7
1.79	56.9	30.3	0.1	51.2	6.21	197.7	1270.4	0.1	615.0	10.63	-2735.9	5793.6	0.0	-3.6
1.88	59.7	35.0	0.1	56.4	6.30	200.5	1325.1	0.1	632.4	10.72	-2743.5	5761.4	0.0	-12.7
1.97	62.9	40.8	0.1	62.4	6.39	203.7	1388.4	0.0	652.4	10.81	-2752.0	5680.6	0.0	-22.2
2.07	66.0	47.2	0.1	68.8	6.49	206.5	1446.3	0.0	670.4	10.91	-2759.6	5572.5	0.0	-29.9
2.16	68.8	53.5	0.1	74.7	6.58	209.6	1513.4	0.0	691.0	11.00	-2768.2	5413.5	0.0	-37.8
2.26	72.0	61.2	0.1	81.7	6.68	212.8	1582.6	0.0	711.9	11.10	-2775.8	5242.2	0.0	-44.0
2.35	74.8	68.6	0.1	88.2	6.77	215.5	1645.8	0.0	730.7	11.19	-2784.3	5019.3	0.0	-50.3
2.44	77.9	77.6	0.1	95.7	6.86	218.7	1718.8	0.0	752.1	11.28	-2792.8	4768.3	0.0	-55.8
2.54	80.7	86.3	0.1	102.7	6.96	221.5	1785.6	0.0	771.4	11.38	-2800.4	4524.9	0.0	-59.9
2.63	83.8	96.8	0.1	110.8	7.05	224.6	1862.7	0.0	793.5	11.47	-2809.0	4231.9	0.0	-63.7
2.73	87.0	108.1	0.1	119.3	7.15	227.4	1933.1	0.0	813.3	11.57	-2816.6	3957.5	0.0	-66.4
2.82	89.8	118.9	0.1	127.1	7.24	230.6	2014.4	0.0	836.0	11.66	-2825.1	3636.7	0.0	-68.7
2.91	92.9	131.8	0.1	136.1	7.33	233.7	2097.9	0.0	858.9	11.75	-2832.7	3343.9	0.0	-70.0
3.01	95.7	144.1	0.1	144.4	7.43	236.5	2174.1	0.0	879.6	11.85	-2841.2	3009.7	0.0	-70.6
3.10	98.9	158.7	0.1	154.0	7.52	239.7	2262.0	0.0	903.1	11.94	-2849.8	2674.1	0.0	-70.4
3.20	101.7	172.6	0.1	162.8	7.62	242.4	2342.0	0.0	924.2	12.04	-2857.4	2377.9	0.0	-69.6
3.29	104.8	189.1	0.1	173.0	7.71	245.6	2434.3	0.0	948.4	12.13	-2865.9	2050.8	0.0	-67.8
3.39	107.9	206.7	0.1	183.6	7.80	248.4	2518.4	0.0	970.0	12.22	-2873.5	1768.4	0.0	-65.5
3.48	110.7	223.1	0.1	193.2	7.90	251.5	2615.3	0.0	994.7	12.32	-2882.1	1464.0	0.0	-62.1
3.57	113.9	242.7	0.1	204.3	7.99	254.7	2714.6	0.0	1019.7	12.41	-2889.7	1208.2	0.0	-58.4
3.67	116.7	261.0	0.1	214.4	8.09	257.5	2804.9	0.0	1042.2	12.51	-2898.2	940.7	0.0	-53.4
3.76	119.8	282.7	0.1	226.1	8.18	260.6	2908.9	0.0	1067.8	12.60	-2906.7	698.7	0.0	-47.6
3.86	122.6	302.9	0.1	236.8	8.27	263.4	3003.5	0.0	1090.8	12.69	-2914.3	508.1	0.0	-41.8
3.95	125.8	326.8	0.1	249.0	8.37	266.6	3112.4	0.0	1117.0	12.79	-2922.9	324.9	0.0	-34.4
4.04	128.9	352.0	0.1	261.6	8.46	269.3	3211.3	0.0	1140.5	12.88	-2930.5	193.0	0.0	-27.1
4.14	131.7	375.4	0.1	273.1	8.56	272.5	3325.1	0.0	1167.3	12.98	-2939.0	83.0	0.0	-18.1
4.23	134.8	402.9	0.1	286.2	8.65	275.6	3441.5	0.0	1194.4	13.07	-2946.6	22.5	0.0	-9.4
4.33	137.6	428.5	0.1	298.2	8.74	278.4	3547.3	0.0	1218.7	13.16	-2954.2	0.0	0.0	0.0

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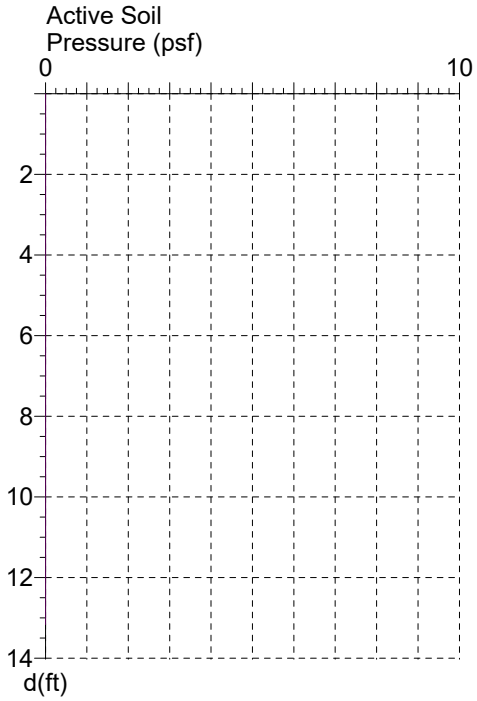
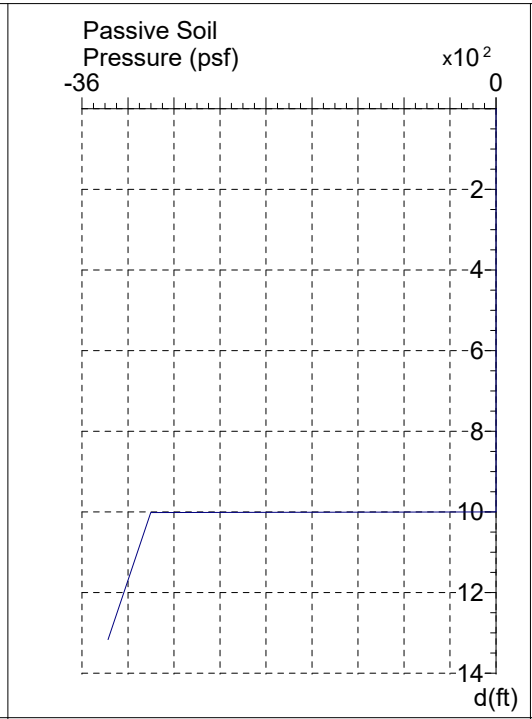
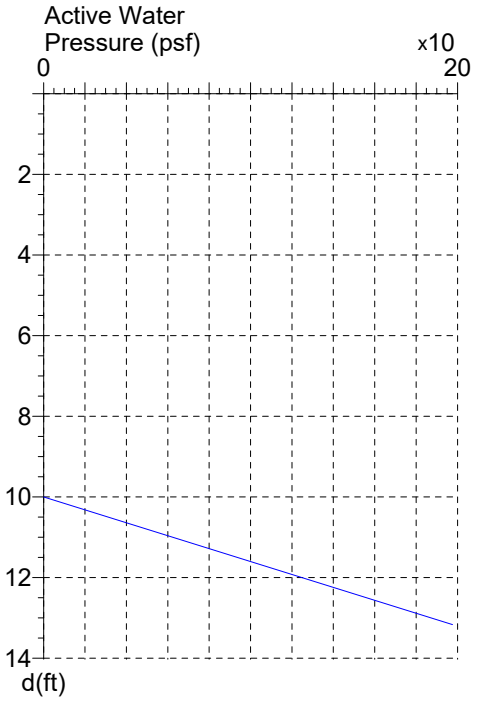
Client: MDOT
Site: FOS = 1.00

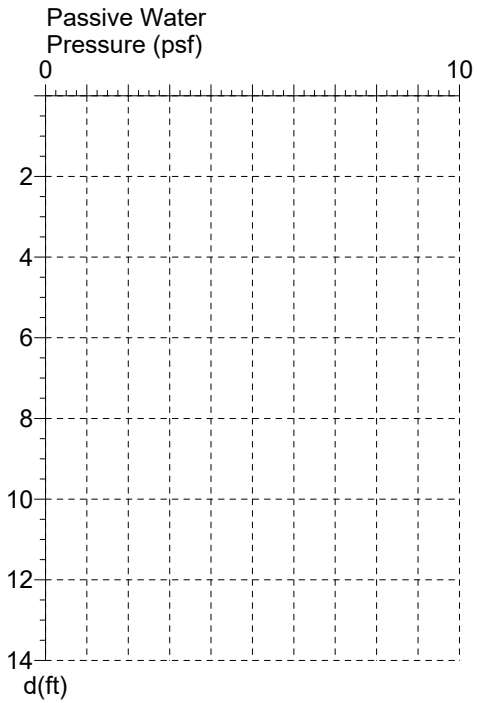
Title: Case 3 Cantilever Firm Clay
Page: 5
Date: 8.30.18

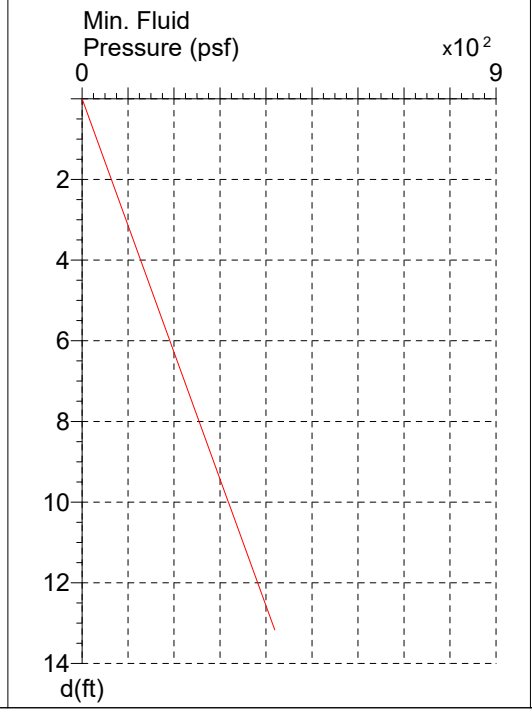
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

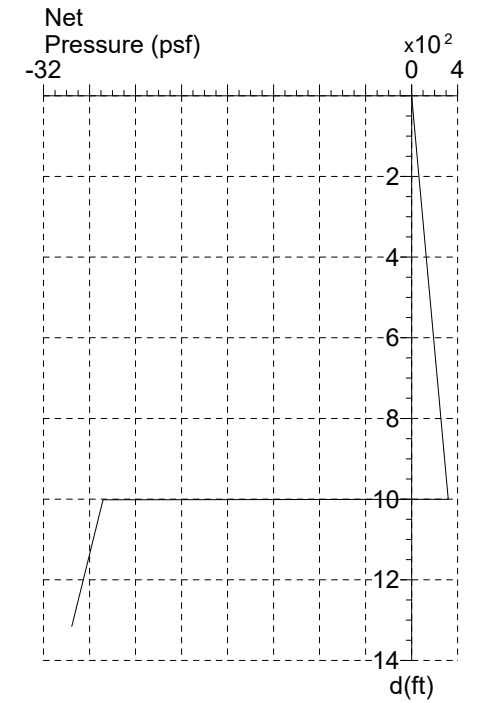












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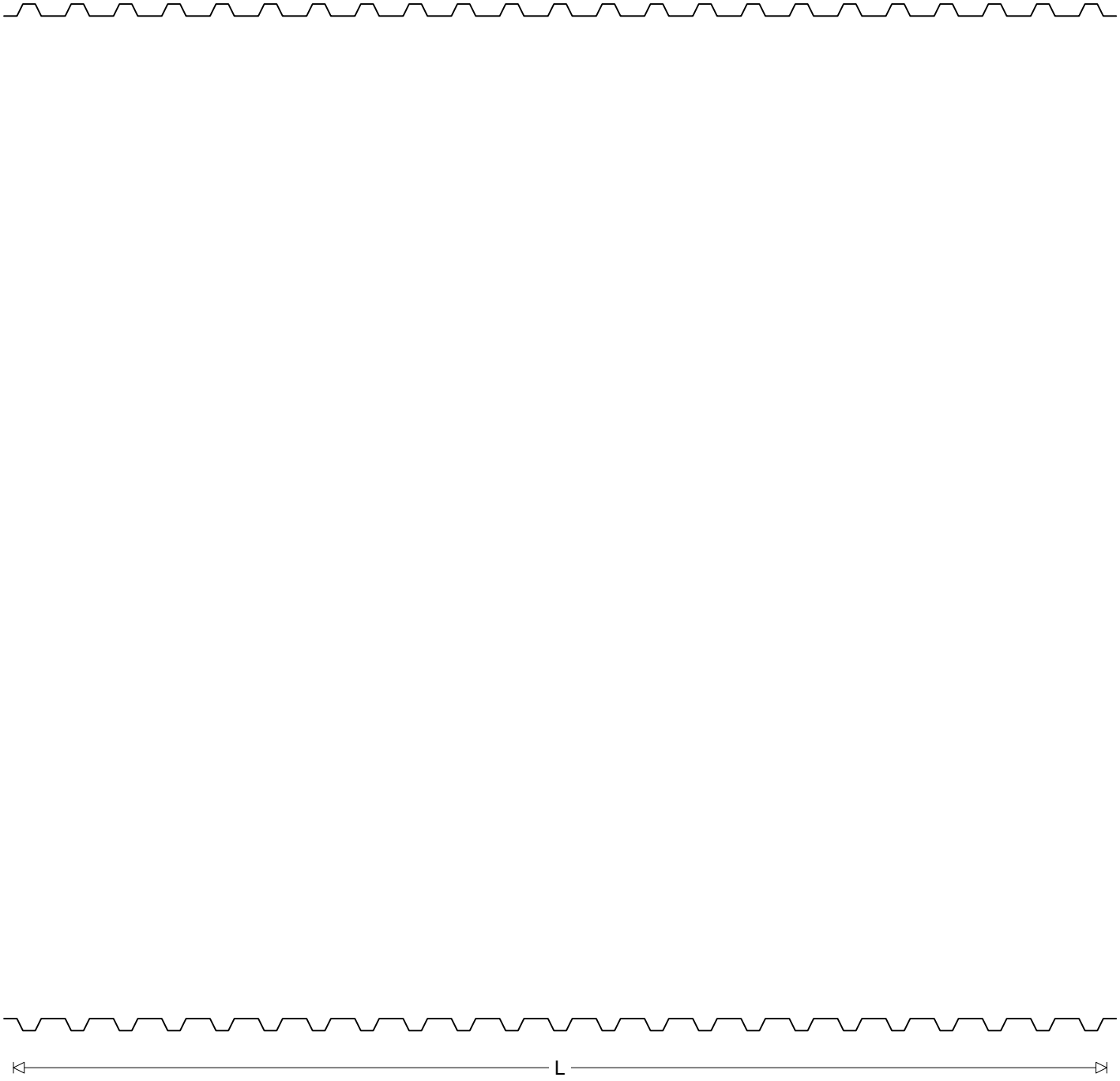
Client: MDOT
Site: FOS = 1.00

Title: Case 3 Cantilever Firm Clay
Page: 6
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever



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Client: MDOT
Site: FOS = 1.00

Title: Case 3 Cantilever Firm Clay
Page: 7
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 5795.5ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 2.79in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

4. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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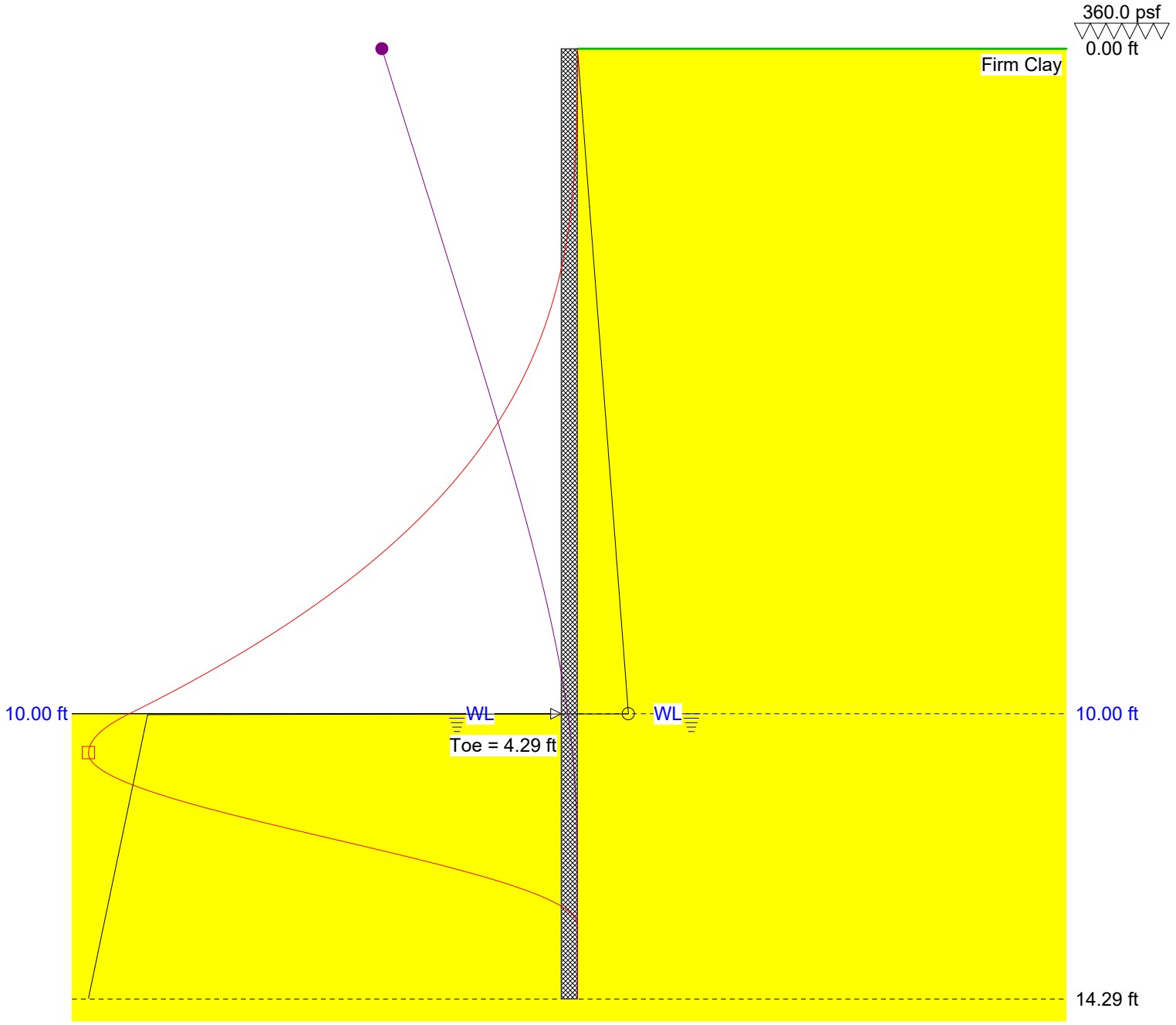
Client: MDOT
Site: FOS = 1.50

Title: Case 3 Cantilever Firm Clay
Page: 1
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
318.2 psf	10.00
5792.0 ftlb/ft	10.59
0.2 in	0.00



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Client: MDOT
Site: FOS = 1.50

Title: Case 3 Cantilever Firm Clay
Page: 2
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 360.0psf

Depth Of Active Water = 10.00ft
Depth Of Passive Water = 10.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Firm Clay	118.37	56.00	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	4.29	14.29

Maxima

	Maximum	Depth (ft)
Pressure	318.2 psf	10.00
Bending Moment	5792.0 ftlb/ft	10.59
Deflection	0.2 in	0.00
Shear Force	1594.9 lb/ft	10.00

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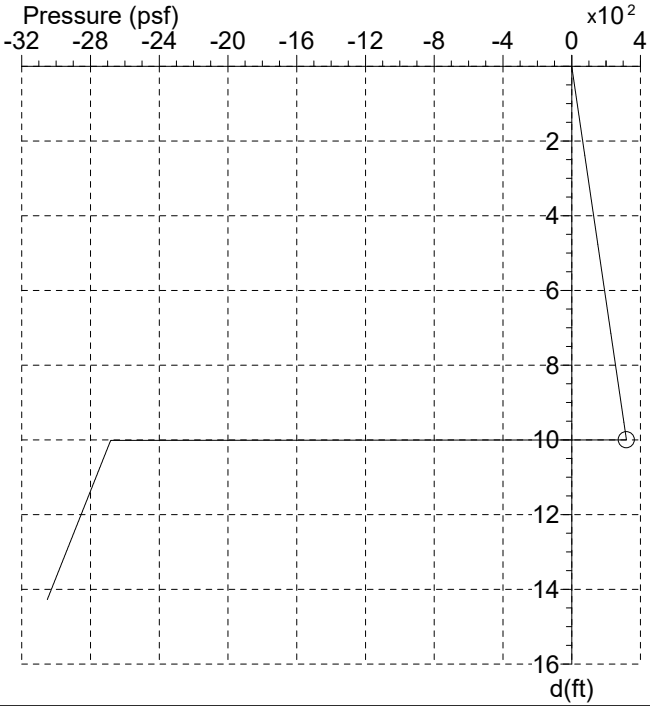
Web: www.GTSoft.org

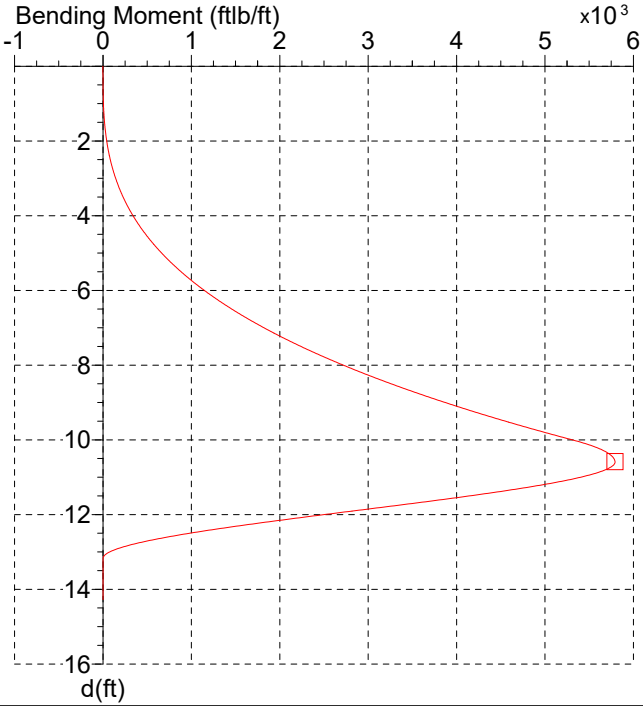
Client: MDOT
Site: FOS = 1.50

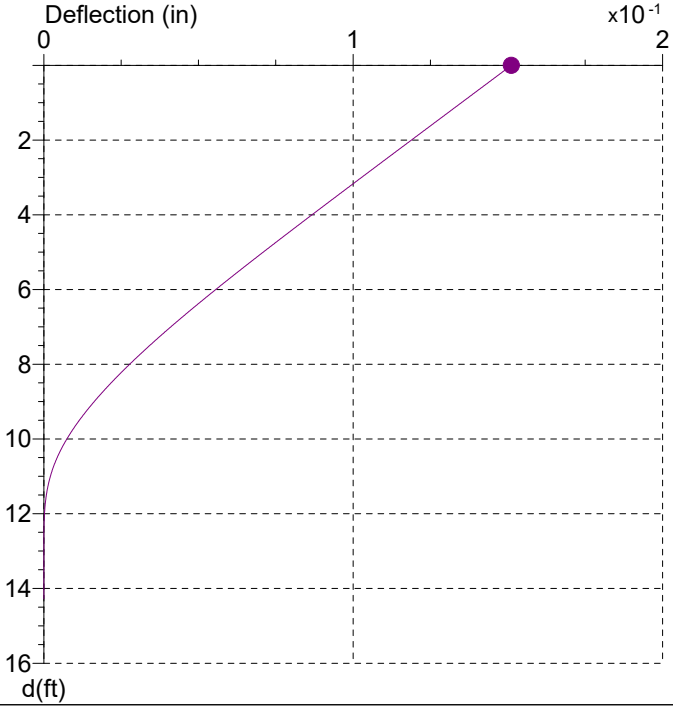
Title: Case 3 Cantilever Firm Clay
Page: 3
Date: 8.30.18

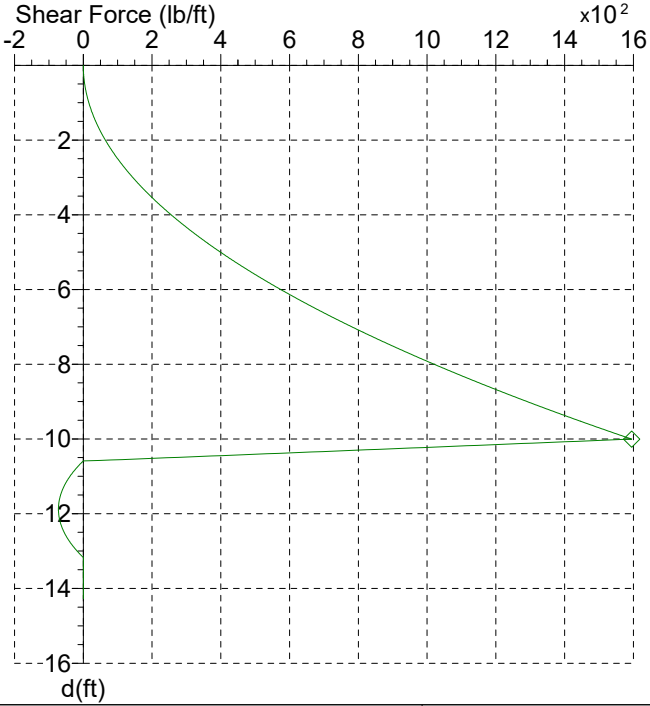
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
318.2 psf	10.00
5792.0 ftlb/ft	10.59
1594.9 lb/ft	10.00
0.2 in	0.00









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Client: MDOT
Site: FOS = 1.50

Title: Case 3 Cantilever Firm Clay
Page: 4
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	-0.1	0.2	0.0
0.10	3.4	-0.1	0.1	0.2
0.20	6.4	0.0	0.1	0.7
0.31	9.9	0.1	0.1	1.6
0.41	12.9	0.3	0.1	2.7
0.51	16.3	0.7	0.1	4.3
0.61	19.3	1.1	0.1	6.0
0.71	22.8	1.9	0.1	8.3
0.82	26.2	2.9	0.1	10.9
0.92	29.2	4.0	0.1	13.6
1.02	32.6	5.6	0.1	16.9
1.12	35.6	7.4	0.1	20.2
1.22	39.1	9.7	0.1	24.2
1.33	42.1	12.2	0.1	28.1
1.43	45.5	15.4	0.1	32.8
1.53	48.9	19.2	0.1	37.9
1.63	52.0	23.0	0.1	42.7
1.74	55.4	27.8	0.1	48.5
1.84	58.4	32.7	0.1	53.9
1.94	61.8	38.7	0.1	60.4
2.04	64.8	44.7	0.1	66.4
2.14	68.3	52.2	0.1	73.6
2.25	71.7	60.4	0.1	81.1
2.35	74.7	68.4	0.1	88.1
2.45	78.1	78.3	0.1	96.3
2.55	81.2	87.8	0.1	103.9
2.65	84.6	99.3	0.1	112.8
2.76	87.6	110.4	0.1	121.0
2.86	91.0	123.8	0.1	130.6
2.96	94.4	138.3	0.1	140.5
3.06	97.5	152.1	0.1	149.7
3.16	100.9	168.6	0.1	160.3
3.27	103.9	184.3	0.1	170.1
3.37	107.3	203.0	0.1	181.5
3.47	110.3	220.8	0.1	191.8
3.57	113.8	241.9	0.1	203.9
3.67	117.2	264.3	0.1	216.3
3.78	120.2	285.4	0.1	227.6
3.88	123.6	310.4	0.1	240.7
3.98	126.7	333.8	0.1	252.6
4.08	130.1	361.6	0.1	266.4
4.18	133.1	387.4	0.1	278.9
4.29	136.5	418.0	0.1	293.4
4.39	139.9	450.2	0.1	308.2
4.49	143.0	480.1	0.1	321.7
4.59	146.4	515.3	0.1	337.3
4.69	149.4	548.0	0.1	351.4
4.80	152.8	586.5	0.1	367.6
4.90	155.9	622.1	0.1	382.3
5.00	159.3	663.9	0.1	399.2
5.10	162.7	707.5	0.1	416.5
5.21	165.7	747.8	0.1	432.1
5.31	169.1	794.9	0.1	450.1
5.41	172.2	838.5	0.1	466.4
5.51	175.6	889.4	0.1	485.0
5.61	178.6	936.3	0.1	501.9
5.72	182.0	991.0	0.1	521.3
5.82	185.4	1047.8	0.1	541.0
5.92	188.5	1100.0	0.1	558.8
6.02	191.9	1160.9	0.1	579.2
6.12	194.9	1216.8	0.1	597.6
6.23	198.3	1281.9	0.1	618.7
6.33	201.4	1341.6	0.1	637.8
6.43	204.8	1411.0	0.0	659.6
6.53	208.2	1482.7	0.0	681.7
6.63	211.2	1548.5	0.0	701.7
6.74	214.6	1624.8	0.0	724.5
6.84	217.7	1694.7	0.0	745.2
6.94	221.1	1775.6	0.0	768.7
7.04	224.1	1849.7	0.0	789.9
7.14	227.5	1935.5	0.0	814.1
7.25	230.9	2024.0	0.0	838.7
7.35	234.0	2104.8	0.0	860.9
7.45	237.4	2198.2	0.0	886.2
7.55	240.4	2283.6	0.0	908.9
7.65	243.8	2382.2	0.0	934.9
7.76	246.9	2472.3	0.0	958.3
7.86	250.3	2576.2	0.0	984.9
7.96	253.7	2683.1	0.0	1012.0
8.06	256.7	2780.5	0.0	1036.3
8.17	260.1	2892.9	0.0	1064.0
8.27	263.2	2995.3	0.0	1089.0
8.37	266.6	3113.3	0.0	1117.4
8.47	269.6	3220.8	0.0	1142.9
8.57	273.0	3344.7	0.0	1172.0
8.68	276.4	3471.7	0.0	1201.5
8.78	279.5	3587.2	0.0	1228.0
8.88	282.9	3720.3	0.0	1258.1
8.98	285.9	3841.2	0.0	1285.2
9.08	289.3	3980.5	0.0	1316.1
9.19	292.4	4107.0	0.0	1343.8
9.29	295.8	4252.5	0.0	1375.3
9.39	299.2	4401.4	0.0	1407.2
9.49	302.2	4536.6	0.0	1435.9
9.59	305.6	4692.1	0.0	1468.5
9.70	308.7	4833.2	0.0	1497.8
9.80	312.1	4995.3	0.0	1531.1
9.90	315.1	5142.4	0.0	1561.0
10.00	318.2	5311.3	0.0	1594.9
10.10	-2690.9	5468.5	0.0	1307.1
10.21	-2699.1	5582.3	0.0	1050.4
10.31	-2708.4	5681.1	0.0	760.7
10.41	-2716.6	5742.8	0.0	502.4
10.51	-2725.9	5782.8	0.0	210.8
10.61	-2734.1	5791.3	0.0	-2.6
10.72	-2743.4	5752.8	0.0	-13.9
10.82	-2752.7	5660.2	0.0	-24.2
10.92	-2760.9	5536.6	0.0	-32.5
11.02	-2770.2	5355.6	0.0	-40.9
11.13	-2778.4	5161.3	0.0	-47.5
11.23	-2787.7	4909.5	0.0	-54.0
11.33	-2795.9	4660.1	0.0	-58.9
11.43	-2805.2	4355.3	0.0	-63.6
11.53	-2814.5	4029.5	0.0	-67.2
11.64	-2822.7	3726.3	0.0	-69.6
11.74	-2832.0	3374.5	0.0	-71.4
11.84	-2840.2	3056.1	0.0	-72.1
11.94	-2849.5	2696.0	0.0	-72.0
12.04	-2857.8	2378.0	0.0	-71.1
12.15	-2867.0	2027.3	0.0	-69.1
12.25	-2876.3	1688.6	0.0	-66.1
12.35	-2884.5	1401.8	0.0	-62.6
12.45	-2893.8	1099.6	0.0	-57.8
12.55	-2902.1	853.0	0.0	-52.6
12.66	-2911.3	604.9	0.0	-45.9
12.76	-2919.6	414.2	0.0	-39.1
12.86	-2928.9	238.0	0.0	-30.5
12.96	-2938.1	106.8	0.0	-20.9
13.06	-2946.4	32.2	0.0	-11.5
13.17	-2955.6	0.0	0.0	0.0
13.27	-2963.9	0.0	0.0	0.0
13.37	-2973.2	0.0	0.0	0.0
13.47	-2981.4	0.0	0.0	0.0
13.57	-2990.7	0.0	0.0	0.0
13.68	-2999.9	0.0	0.0	0.0
13.78	-3008.2	0.0	0.0	0.0
13.88	-3017.5	0.0	0.0	0.0
13.98	-3025.7	0.0	0.0	0.0
14.08	-3035.0	0.0	0.0	0.0
14.19	-3043.2	0.0	0.0	0.0
14.29	-3051.5	0.0	0.0	0.0

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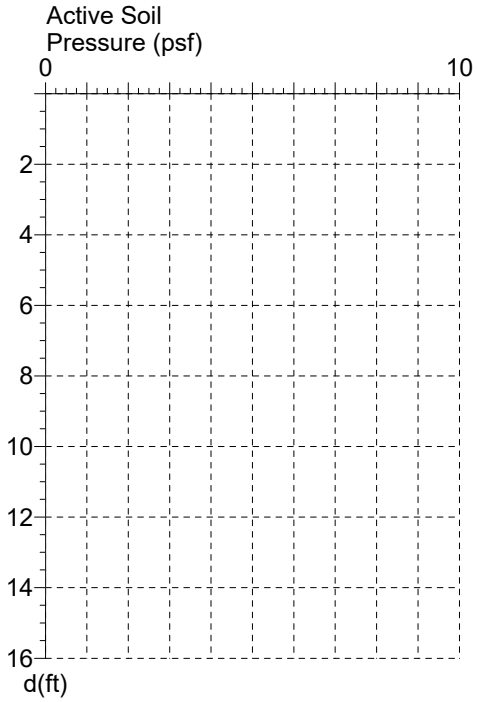
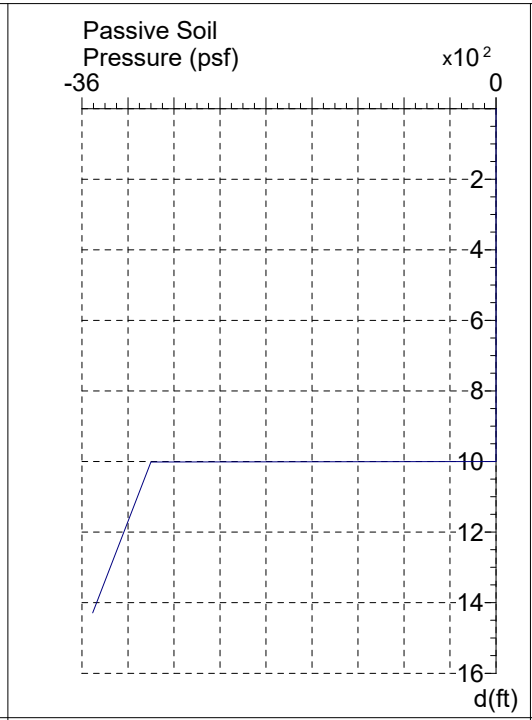
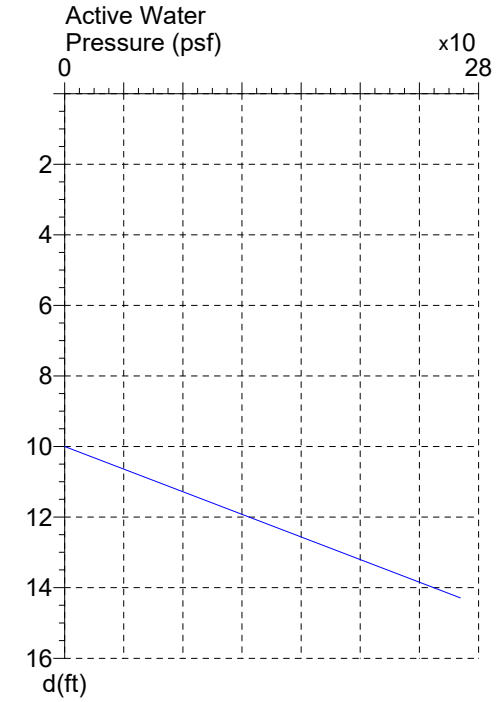
Client: MDOT
Site: FOS = 1.50

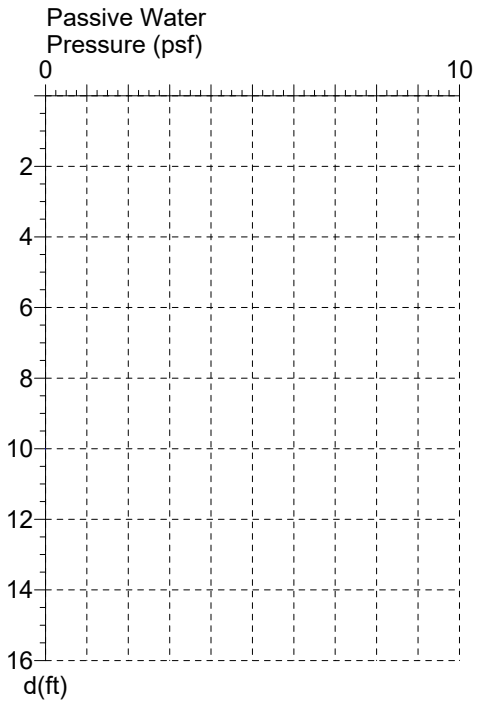
Title: Case 3 Cantilever Firm Clay
Page: 5
Date: 8.30.18

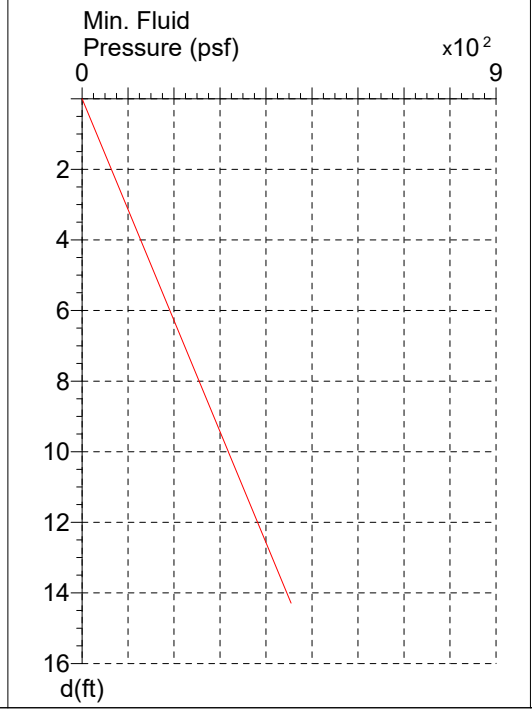
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

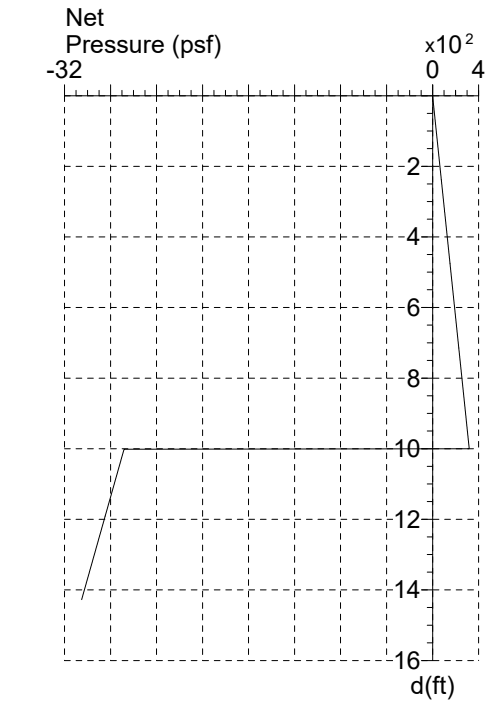












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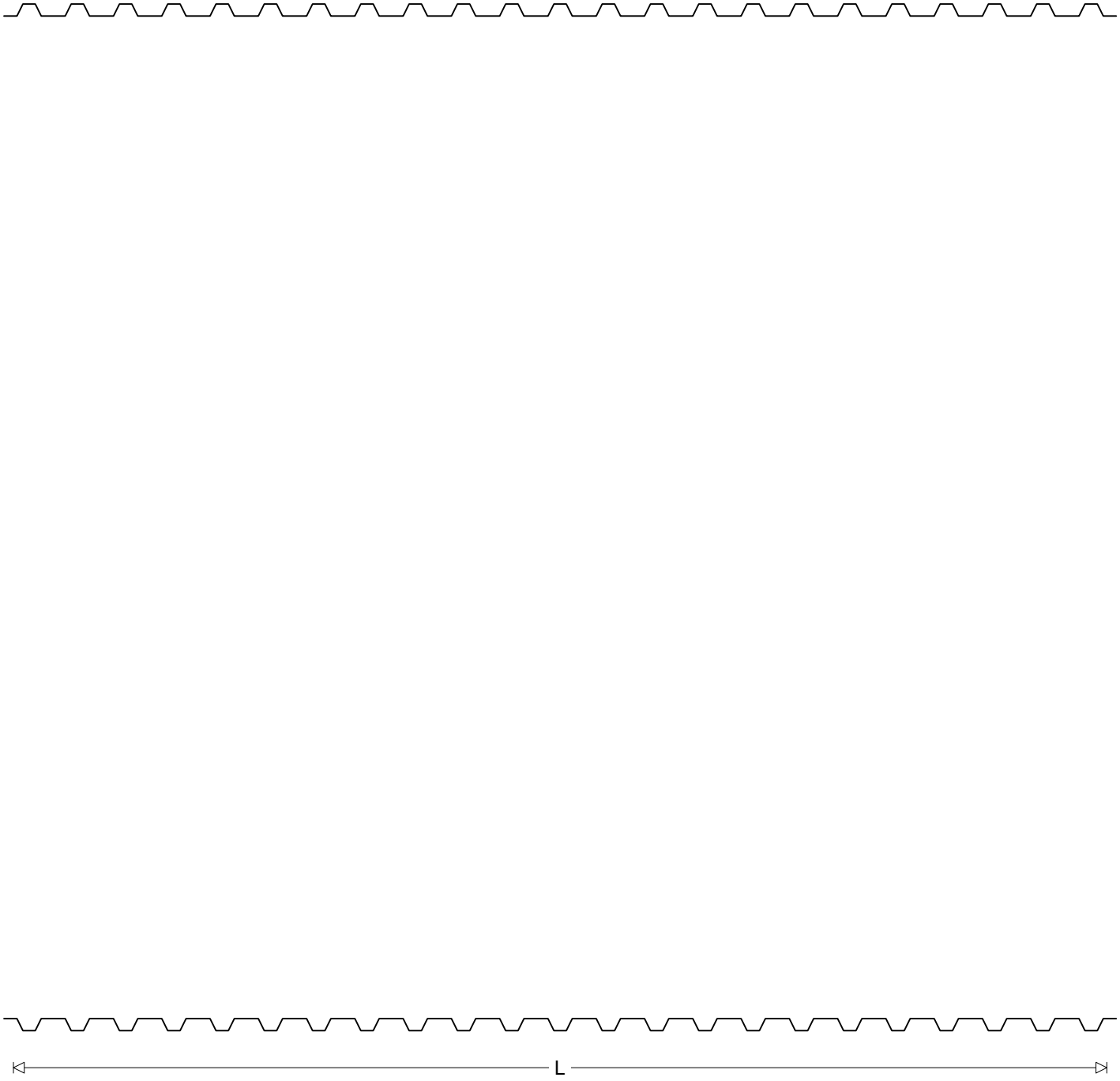
Title: Case 3 Cantilever Firm Clay
Page: 6
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever



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Client: MDOT
Site: FOS = 1.50

Title: Case 3 Cantilever Firm Clay
Page: 7
Date: 8.30.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 5792.0ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 2.78in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

4. FOS = 1.51 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Appendix B.4 – SupportIT Output, Case 4

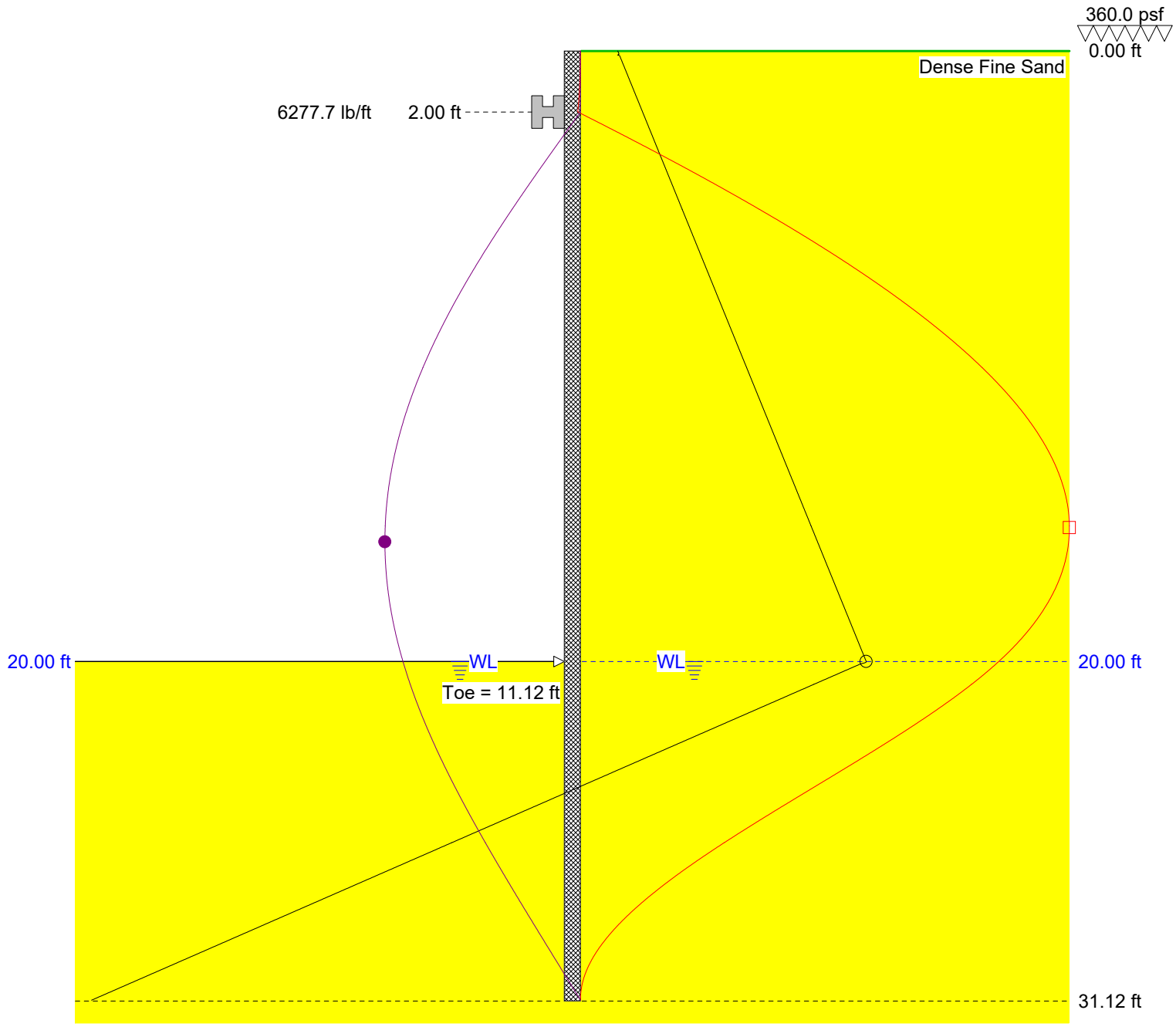
Case 4 – Anchored Cantilever TERS in Coarse-grained Soil

Client: MDOT
Site: Case 4 Anchored Wall in Sand

Title: FOS = 1.00
Page: 1
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 855.5 psf	20.00
□ 48262.5 ftlb/ft	15.61
● 1.2 in	16.08



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Web: www.GTSoft.org

Client: MDOT
Site: Case 4 Anchored Wall in Sand

Title: FOS = 1.00
Page: 2
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 360.0psf

Depth Of Active Water = 20.00ft
Depth Of Passive Water = 20.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ27	3.04E+07	187.50	24966.8	31.00	64497.5	17.99	7.93	40.5	0.00	11.12	31.12

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
2.00	Waler	6277.7

Maxima

	Maximum	Depth (ft)
Pressure	855.5 psf	20.00
Bending Moment	48262.5 ftlb/ft	15.61
Deflection	1.2 in	16.08
Shear Force	5977.0 lb/ft	2.00

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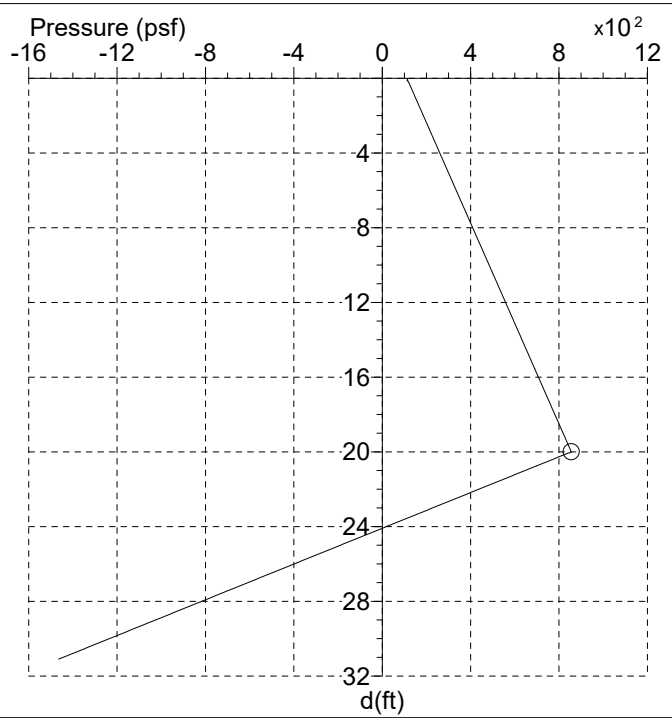
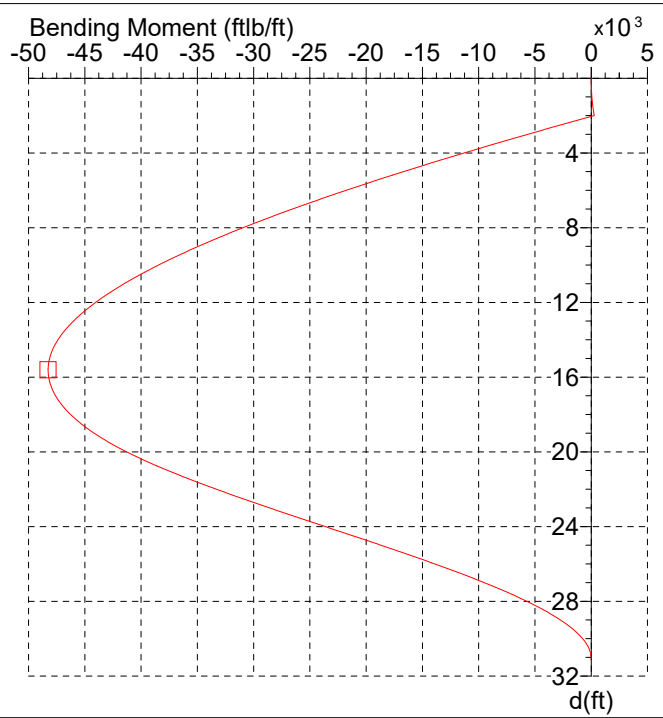
Site: Case 4 Anchored Wall in Sand

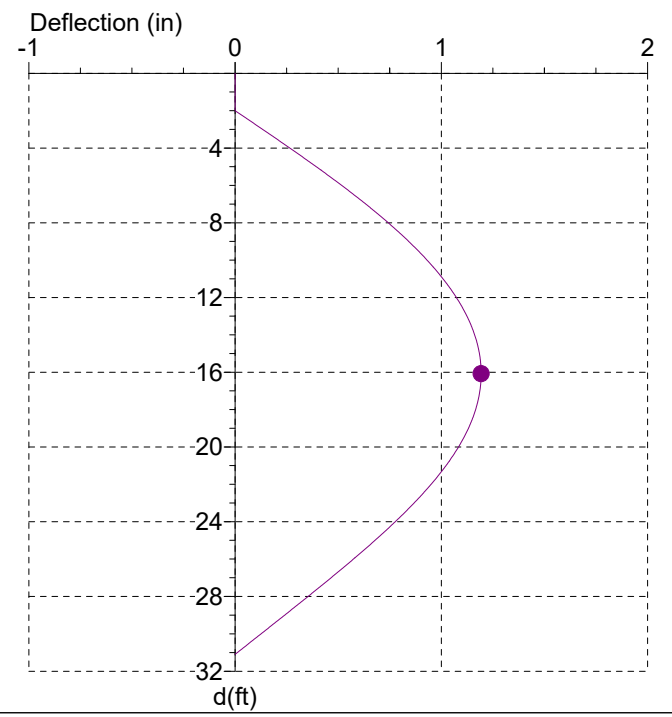
Title: FOS = 1.00
Page: 3
Date: 8.30.18

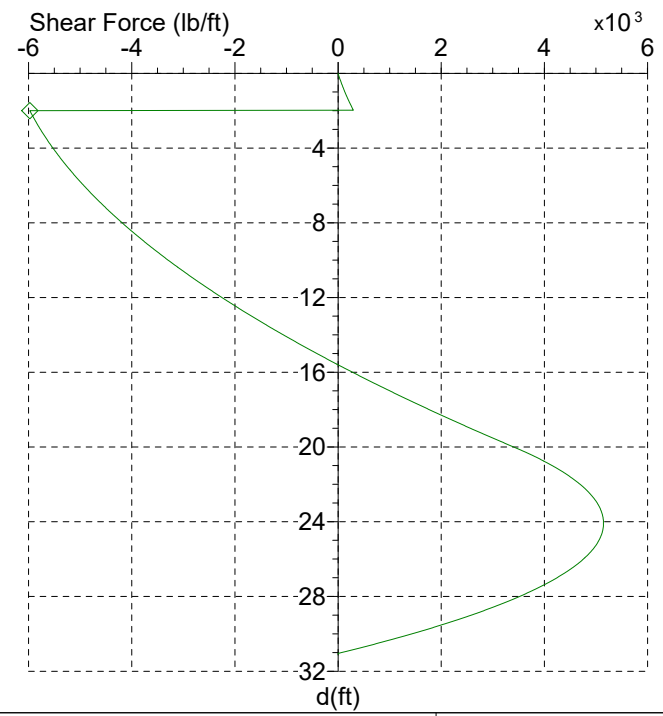
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 855.5 psf	20.00
□ 48262.5 ftlb/ft	15.61
◇ 5977.0 lb/ft	2.00
● 1.2 in	16.08









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Client: MDOT
Site: Case 4 Anchored Wall in Sand

Title: FOS = 1.00
Page: 4
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.2	0.0	0.0
0.22	120.3	3.0	0.0	27.3
0.44	128.0	11.0	0.0	53.4
0.67	136.7	26.7	0.0	84.7
0.89	144.4	46.9	0.0	114.3
1.11	153.1	77.2	0.0	149.5
1.33	160.8	111.2	0.0	182.5
1.56	169.5	157.8	0.0	221.5
1.78	178.2	213.8	0.0	262.6
2.00	185.9	270.1	0.0	-5977.0
2.22	194.6	-1120.5	0.0	-5932.4
2.45	202.3	-2347.7	0.1	-5891.2
2.67	211.0	-3717.8	0.1	-5842.8
2.89	218.7	-4926.1	0.1	-5798.1
3.11	227.4	-6274.2	0.1	-5746.0
3.33	236.1	-7609.9	0.2	-5691.8
3.56	243.8	-8786.4	0.2	-5641.9
3.78	252.5	-10097.3	0.2	-5583.9
4.00	260.2	-11251.1	0.3	-5530.6
4.22	268.9	-12535.7	0.3	-5468.7
4.45	276.6	-13665.3	0.3	-5412.0
4.67	285.3	-14921.9	0.4	-5346.3
4.89	294.0	-16162.9	0.4	-5278.6
5.11	301.7	-17252.5	0.4	-5216.7
5.34	310.4	-18462.9	0.4	-5145.2
5.56	318.1	-19524.5	0.5	-5079.9
5.78	326.8	-20702.5	0.5	-5004.5
6.00	334.5	-21734.7	0.5	-4935.8
6.22	343.2	-22878.7	0.5	-4856.6
6.45	351.8	-24004.0	0.6	-4775.4
6.67	359.6	-24988.1	0.6	-4701.5
6.89	368.2	-26076.8	0.6	-4616.4
7.11	376.0	-27027.7	0.6	-4539.1
7.34	384.6	-28078.0	0.7	-4450.2
7.56	392.4	-28994.1	0.7	-4369.5
7.78	401.0	-30004.5	0.7	-4276.8
8.00	409.7	-30993.0	0.7	-4182.1
8.23	417.5	-31853.0	0.8	-4096.2
8.45	426.1	-32799.0	0.8	-3997.6
8.67	433.9	-33620.3	0.8	-3908.3
8.89	442.5	-34522.0	0.8	-3805.9
9.11	450.3	-35303.3	0.9	-3713.1
9.34	458.9	-36159.1	0.9	-3606.9
9.56	467.6	-36989.8	0.9	-3498.7
9.78	475.3	-37706.9	0.9	-3400.7
10.00	484.0	-38489.2	0.9	-3288.6
10.23	491.7	-39162.4	0.9	-3187.3
10.45	500.4	-39894.4	1.0	-3071.4
10.67	508.1	-40522.2	1.0	-2966.7
10.89	516.8	-41202.3	1.0	-2846.9
11.12	525.5	-41854.3	1.0	-2725.2
11.34	533.2	-42409.7	1.0	-2615.2
11.56	541.9	-43007.2	1.0	-2489.6
11.78	549.6	-43513.5	1.1	-2376.3
12.00	558.3	-44054.8	1.1	-2246.9
12.23	566.0	-44510.5	1.1	-2130.1
12.45	574.7	-44993.9	1.1	-1996.9
12.67	583.4	-45446.0	1.1	-1861.6
12.89	591.1	-45821.2	1.1	-1739.6
13.12	599.8	-46212.9	1.1	-1600.5
13.34	607.5	-46533.7	1.1	-1475.2
13.56	616.2	-46863.2	1.1	-1332.2
13.78	623.9	-47128.0	1.2	-1203.5
14.01	632.6	-47393.7	1.2	-1056.7
14.23	641.3	-47625.0	1.2	-907.9
14.45	649.0	-47801.2	1.2	-774.0
14.67	657.7	-47966.1	1.2	-621.3
14.89	665.4	-48082.6	1.2	-484.0
15.12	674.1	-48179.3	1.2	-327.5
15.34	681.8	-48234.5	1.2	-186.7
15.56	690.5	-48261.6	1.2	-26.5
15.78	699.2	-48251.3	1.2	135.8
16.01	706.9	-48211.1	1.2	281.8
16.23	715.6	-48130.6	1.2	447.9
16.45	723.3	-48027.4	1.2	597.3
16.67	732.0	-47875.1	1.2	767.3
16.90	739.7	-47707.3	1.2	920.1
17.12	748.4	-47481.6	1.2	1093.9
17.34	757.1	-47216.3	1.2	1269.7
17.56	764.8	-46946.9	1.2	1427.7
17.78	773.5	-46605.7	1.2	1607.3
18.01	781.2	-46268.1	1.2	1768.7
18.23	789.9	-45849.3	1.2	1952.2
18.45	797.6	-45442.0	1.2	2117.0
18.67	806.3	-44943.9	1.1	2304.3
18.90	815.0	-44403.3	1.1	2493.6
19.12	822.7	-43886.6	1.1	2663.6
19.34	831.4	-43264.2	1.1	2856.8
19.56	839.1	-42674.1	1.1	3030.2
19.79	847.8	-41968.4	1.1	3227.2
20.01	855.5	-41303.4	1.1	3404.0
20.23	807.5	-40513.1	1.1	3597.8
20.45	758.7	-39680.1	1.1	3779.9
20.67	715.3	-38906.0	1.0	3932.3
20.90	666.5	-37999.4	1.0	4092.9
21.12	623.1	-37163.9	1.0	4226.1
21.34	574.3	-36193.0	1.0	4365.3
21.56	531.0	-35304.4	1.0	4479.4
21.79	482.2	-34278.4	1.0	4597.0
22.01	433.4	-33226.8	0.9	4703.2
22.23	390.0	-32272.8	0.9	4788.1
22.45	341.2	-31180.1	0.9	4872.8
22.68	297.8	-30193.7	0.9	4938.5
22.90	249.0	-29069.2	0.9	5001.7
23.12	205.7	-28058.4	0.9	5048.3
23.34	156.9	-26911.2	0.8	5090.0
23.56	108.1	-25755.7	0.8	5120.3
23.79	64.7	-24723.7	0.8	5137.7
24.01	15.9	-23559.6	0.8	5146.4
24.23	-27.5	-22524.0	0.8	5144.6
24.45	-76.3	-21360.4	0.7	5131.7
24.68	-119.6	-20329.5	0.7	5110.5
24.90	-168.4	-19175.9	0.7	5075.8
25.12	-217.2	-18031.3	0.7	5029.4
25.34	-260.6	-17023.6	0.6	4978.6
25.57	-309.4	-15903.2	0.6	4910.4
25.79	-352.7	-14921.1	0.6	4840.1
26.01	-401.5	-13834.3	0.6	4750.1
26.23	-444.9	-12886.2	0.6	4660.5
26.45	-493.7	-11842.2	0.5	4548.6
26.68	-542.5	-10824.7	0.5	4425.2
26.90	-585.9	-9944.6	0.5	4305.9
27.12	-634.7	-8984.2	0.5	4160.7
27.34	-678.0	-8159.1	0.4	4021.9
27.57	-726.8	-7265.2	0.4	3854.8
27.79	-770.2	-6503.3	0.4	3696.6
28.01	-819.0	-5685.3	0.4	3507.8
28.23	-867.8	-4911.1	0.3	3307.3
28.46	-911.2	-4262.0	0.3	3119.4
28.68	-960.0	-3578.0	0.3	2897.2
28.90	-1003.3	-3013.1	0.3	2689.9
29.12	-1052.1	-2428.5	0.2	2445.8
29.35	-1095.5	-1956.2	0.2	2219.1
29.57	-1144.3	-1480.4	0.2	1953.1
29.79	-1193.1	-1065.9	0.1	1675.6
30.01	-1236.5	-751.2	0.1	1419.3
30.23	-1285.3	-459.8	0.1	1119.9
30.46	-1328.6	-258.5	0.1	844.2
30.68	-1377.4	-99.5	0.0	523.0
30.90	-1420.8	-20.1	0.0	227.8
31.12	-1464.2	0.0	0.0	0.0

MDOT Sheet Pile Manual

SupportIT, v2.37

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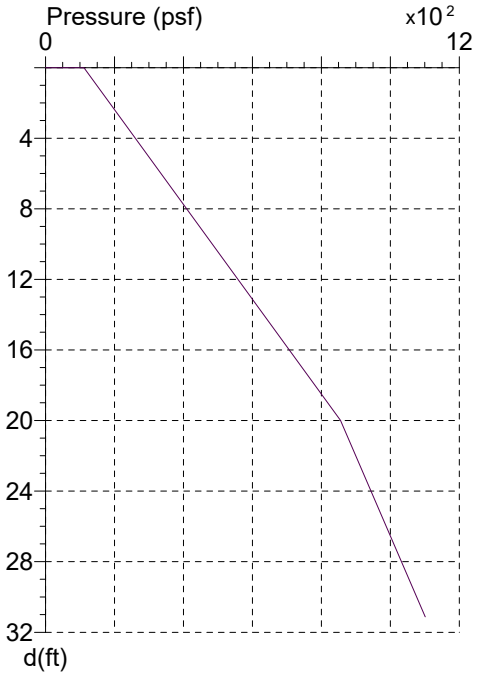
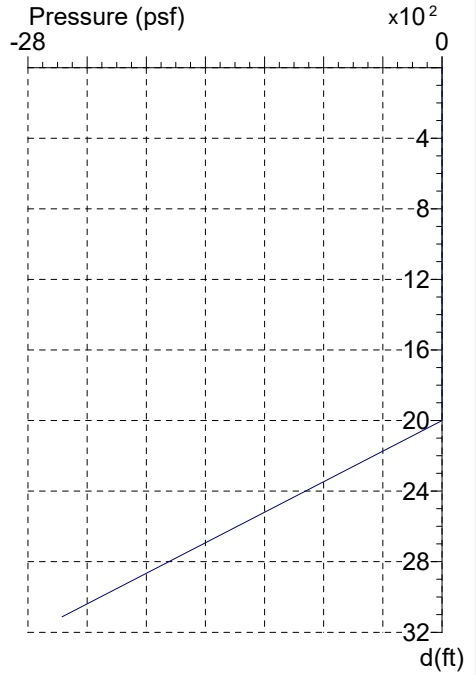
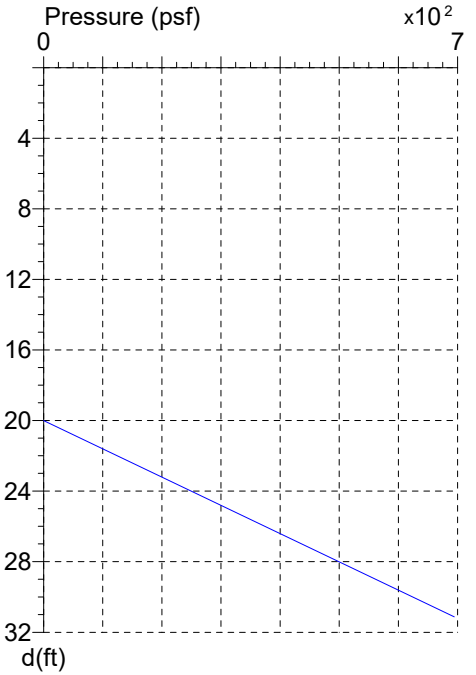
Client: MDOT
Site: Case 4 Anchored Wall in Sand

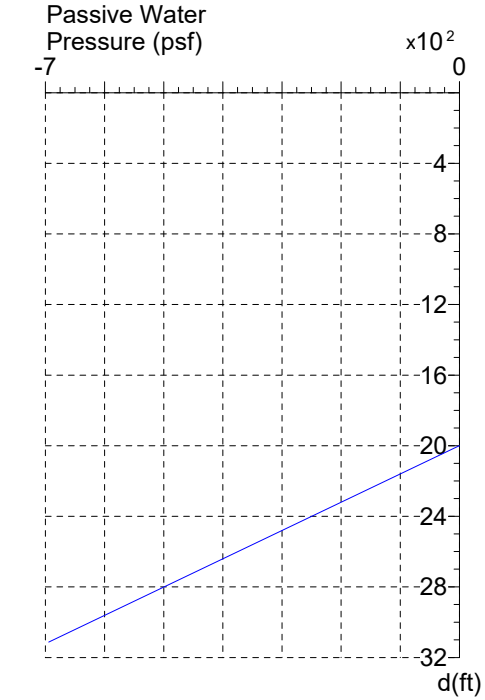
Title: FOS = 1.00
Page: 5
Date: 8.30.18

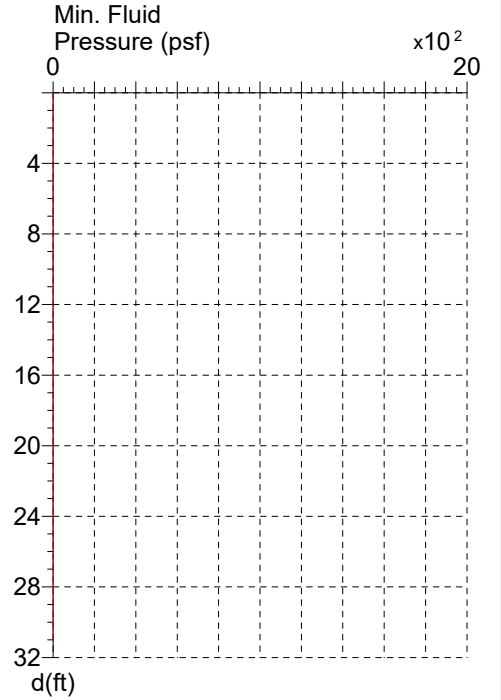
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

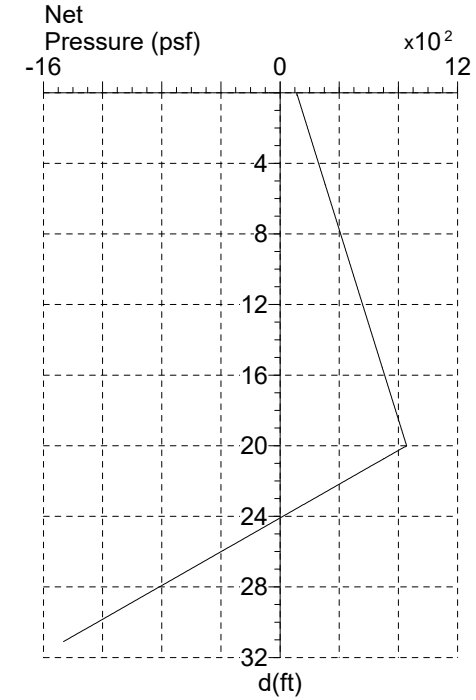












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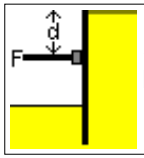
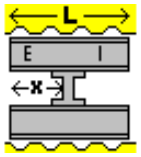
Title: FOS = 1.00
Page: 6
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 2.00 ft
F = 6277.7 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Title: FOS = 1.00
Page: 7
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Design Report

1. Maximum bending moment = 48262.5ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 23.20in³/ft (= M/f). Sheet section modulus in this design is Z = 31.00in³/ft, and is satisfactory.

2. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

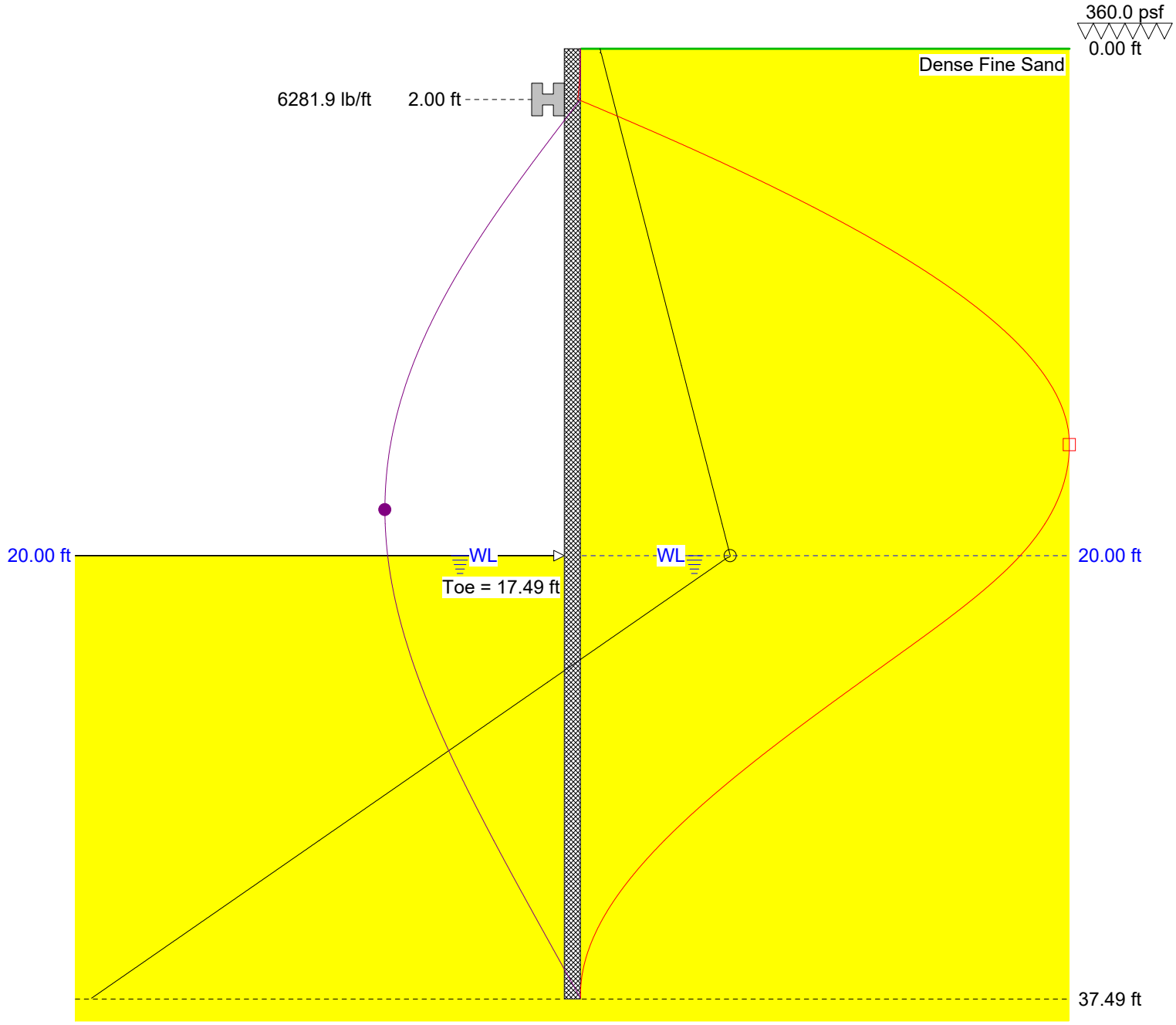
3. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: MDOT
Site: Case 4 Anchored Wall in Sand

Title: FOS = 1.50
Page: 1
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
855.4 psf	20.00
48320.5 ftlb/ft	15.62
1.7 in	18.18



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Client: MDOT
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Title: FOS = 1.50
Page: 2
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 360.0psf

Depth Of Active Water = 20.00ft
Depth Of Passive Water = 20.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ27	3.04E+07	187.50	24966.8	31.00	64497.5	17.99	7.93	40.5	0.00	17.49	37.49

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
2.00	Waler	6281.9

Maxima

	Maximum	Depth (ft)
Pressure	855.4 psf	20.00
Bending Moment	48320.5 ftlb/ft	15.62
Deflection	1.7 in	18.18
Shear Force	5980.0 lb/ft	2.00

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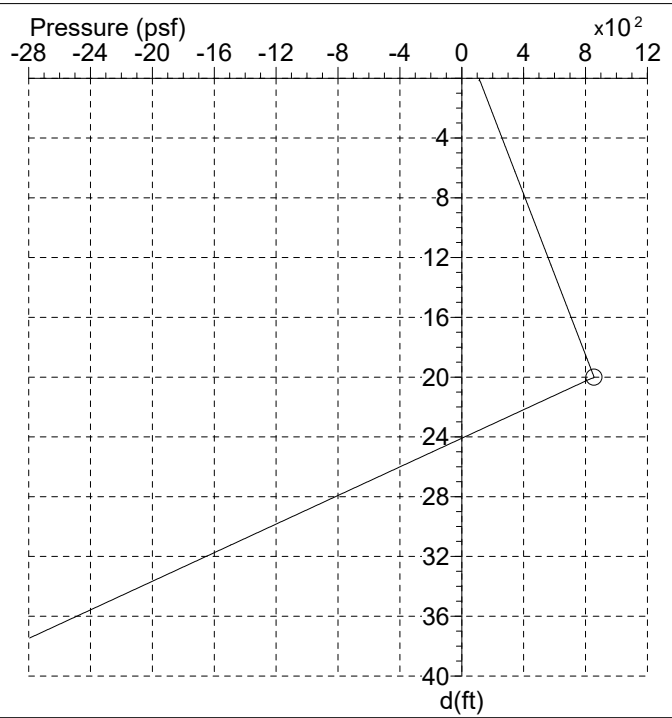
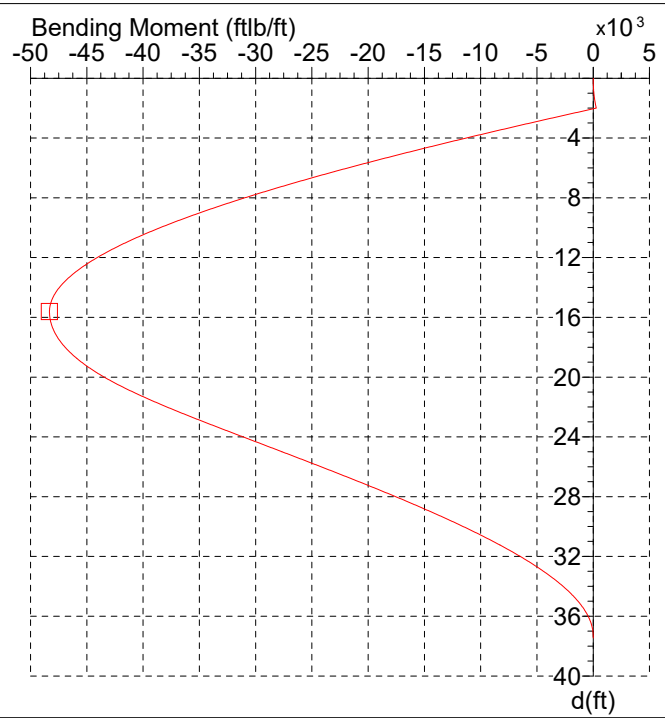
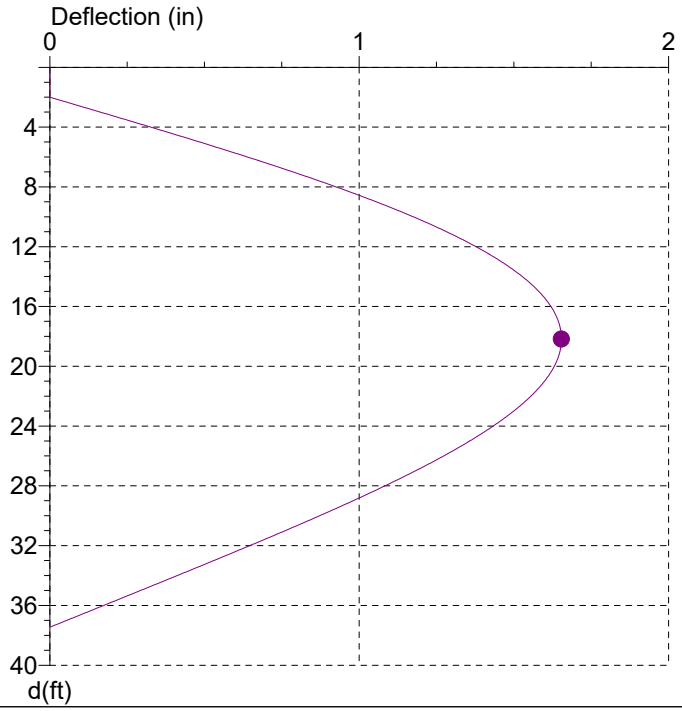
Title: FOS = 1.50
Page: 3
Date: 8.30.18

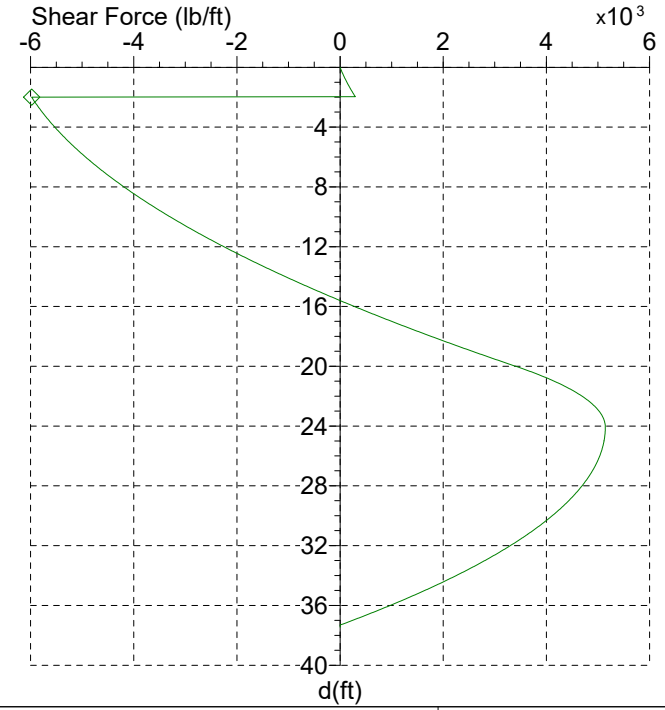
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 855.4 psf	20.00
□ 48320.5 ftlb/ft	15.62
◇ 5980.0 lb/ft	2.00
● 1.7 in	18.18









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Client: MDOT
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Title: FOS = 1.50
Page: 4
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.3	0.0	0.0
0.27	122.1	4.3	0.0	33.2
0.54	131.4	16.1	0.0	65.4
0.80	141.8	39.3	0.0	104.4
1.07	151.1	69.4	0.0	141.6
1.34	161.6	114.8	0.0	186.3
1.61	170.9	165.9	0.0	228.5
1.87	181.3	236.3	0.0	278.7
2.14	191.8	-660.4	0.0	-5950.4
2.41	201.1	-2142.8	0.1	-5901.1
2.68	211.5	-3795.5	0.1	-5843.0
2.95	220.8	-5250.5	0.2	-5788.8
3.21	231.3	-6870.8	0.2	-5725.1
3.48	240.6	-8295.8	0.2	-5666.0
3.75	251.1	-9881.0	0.3	-5596.7
4.02	261.5	-11446.2	0.3	-5524.5
4.28	270.8	-12820.3	0.4	-5457.8
4.55	281.3	-14345.8	0.4	-5380.0
4.82	290.6	-15683.2	0.5	-5308.4
5.09	301.0	-17166.0	0.5	-5225.1
5.36	310.3	-18464.0	0.5	-5148.6
5.62	320.8	-19901.2	0.6	-5059.7
5.89	331.2	-21313.0	0.6	-4967.9
6.16	340.5	-22545.9	0.7	-4883.8
6.43	351.0	-23907.5	0.7	-4786.4
6.69	360.3	-25094.5	0.7	-4697.4
6.96	370.8	-26403.0	0.8	-4594.4
7.23	380.1	-27541.5	0.8	-4500.4
7.50	390.5	-28793.9	0.9	-4392.0
7.77	401.0	-30015.4	0.9	-4280.5
8.03	410.3	-31074.6	0.9	-4179.0
8.30	420.7	-32235.5	1.0	-4062.0
8.57	430.0	-33239.5	1.0	-3955.6
8.84	440.5	-34336.9	1.0	-3833.0
9.10	449.8	-35283.1	1.1	-3721.6
9.37	460.2	-36313.9	1.1	-3593.5
9.64	470.7	-37308.4	1.1	-3462.5
9.91	480.0	-38161.1	1.2	-3343.5
10.18	490.5	-39084.6	1.2	-3207.0
10.44	499.8	-39872.9	1.2	-3083.1
10.71	510.2	-40722.4	1.3	-2940.9
10.98	519.5	-41443.7	1.3	-2812.1
11.25	530.0	-42216.3	1.3	-2664.4
11.51	540.4	-42947.0	1.3	-2513.8
11.78	549.7	-43560.6	1.4	-2377.4
12.05	560.2	-44209.9	1.4	-2221.2
12.32	569.5	-44749.8	1.4	-2079.9
12.59	579.9	-45314.7	1.4	-1918.1
12.85	589.2	-45778.3	1.4	-1771.9
13.12	599.7	-46255.9	1.5	-1604.6
13.39	610.2	-46686.0	1.5	-1434.3
13.66	619.5	-47027.8	1.5	-1280.5
13.92	629.9	-47366.1	1.5	-1104.7
14.19	639.2	-47625.0	1.5	-946.0
14.46	649.7	-47868.5	1.6	-764.6
14.73	659.0	-48041.8	1.6	-601.0
15.00	669.4	-48187.5	1.6	-414.0
15.26	679.9	-48280.3	1.6	-224.2
15.53	689.2	-48317.7	1.6	-53.0
15.80	699.6	-48312.1	1.6	142.4
16.07	708.9	-48274.9	1.6	318.6
16.33	719.4	-48197.2	1.6	519.6
16.60	728.7	-48095.6	1.6	700.7
16.87	739.2	-47944.5	1.6	907.2
17.14	749.6	-47753.7	1.6	1116.6
17.41	758.9	-47550.4	1.6	1305.3
17.67	769.4	-47283.2	1.7	1520.3
17.94	778.7	-47011.0	1.7	1713.9
18.21	789.1	-46665.4	1.7	1934.5
18.48	798.4	-46322.7	1.7	2133.0
18.74	808.9	-45896.6	1.7	2359.1
19.01	819.3	-45427.2	1.6	2588.2
19.28	828.6	-44973.0	1.6	2794.2
19.55	839.1	-44420.1	1.6	3028.9
19.82	848.4	-43890.8	1.6	3239.9
20.08	837.3	-43252.4	1.6	3479.1
20.35	785.0	-42647.2	1.6	3681.0
20.62	726.3	-41926.8	1.6	3892.6
20.89	667.5	-41167.4	1.6	4087.6
21.15	615.3	-40462.2	1.6	4247.1
21.42	556.5	-39637.8	1.6	4410.9
21.69	504.2	-38879.8	1.6	4542.6
21.96	445.5	-38001.7	1.6	4675.2
22.23	393.2	-37200.9	1.5	4779.2
22.49	334.5	-36280.3	1.5	4880.6
22.76	275.7	-35341.7	1.5	4965.4
23.03	223.4	-34494.9	1.5	5027.0
23.30	164.7	-33531.1	1.5	5080.6
23.56	112.4	-32666.8	1.5	5114.4
23.83	53.7	-31688.9	1.4	5136.9
24.10	1.4	-30817.2	1.4	5142.9
24.37	-57.4	-29836.2	1.4	5140.4
24.64	-116.1	-28856.0	1.4	5133.3
24.90	-168.4	-27986.2	1.4	5123.0
25.17	-227.1	-27010.1	1.3	5107.2
25.44	-279.4	-26145.3	1.3	5089.2
25.71	-338.2	-25176.4	1.3	5064.5
25.97	-390.4	-24319.4	1.3	5038.7
26.24	-449.2	-23360.9	1.3	5005.3
26.51	-507.9	-22409.1	1.2	4967.3
26.78	-560.2	-21569.5	1.2	4929.6
27.05	-619.0	-20633.0	1.2	4882.7
27.31	-671.2	-19808.3	1.2	4837.2
27.58	-730.0	-18890.1	1.1	4781.7
27.85	-782.2	-18083.1	1.1	4728.4
28.12	-841.0	-17186.4	1.1	4664.0
28.38	-899.8	-16302.4	1.0	4595.0
28.65	-952.0	-15527.9	1.0	4529.8
28.92	-1010.8	-14670.2	1.0	4452.1
29.19	-1063.0	-13920.6	1.0	4379.1
29.46	-1121.8	-13092.4	0.9	4292.5
29.72	-1174.0	-12370.4	0.9	4211.7
29.99	-1232.8	-11574.9	0.9	4116.5
30.26	-1291.6	-10798.0	0.8	4016.5
30.53	-1343.8	-10123.7	0.8	3923.8
30.79	-1402.6	-9384.2	0.8	3815.1
31.06	-1454.8	-8744.7	0.8	3714.6
31.33	-1513.6	-8045.9	0.7	3597.2
31.60	-1565.9	-7443.9	0.7	3488.9
31.87	-1624.6	-6788.9	0.7	3362.6
32.13	-1683.4	-6158.4	0.6	3231.8
32.40	-1735.6	-5619.2	0.6	3111.6
32.67	-1794.4	-5037.3	0.6	2971.9
32.94	-1846.7	-4542.8	0.5	2843.9
33.20	-1905.4	-4012.7	0.5	2695.5
33.47	-1957.7	-3565.7	0.5	2559.7
33.74	-2016.4	-3090.6	0.4	2402.6
34.01	-2075.2	-2645.8	0.4	2240.8
34.28	-2127.5	-2276.8	0.4	2093.1
34.54	-2186.2	-1891.8	0.3	1922.5
34.81	-2238.5	-1577.3	0.3	1767.0
35.08	-2297.2	-1255.3	0.3	1587.6
35.35	-2349.5	-998.2	0.3	1424.3
35.61	-2408.3	-742.3	0.2	1236.2
35.88	-2467.0	-522.7	0.2	1043.5
36.15	-2519.3	-358.7	0.2	868.3
36.42	-2578.1	-210.1	0.1	666.8
36.69	-2630.3	-110.5	0.1	483.8
36.95	-2689.1	-36.0	0.1	273.5
37.22	-2741.3	-3.7	0.0	82.7
37.49	-2793.5	0.0	0.0	0.0

MDOT Sheet Pile Manual

SupportIT, v2.37

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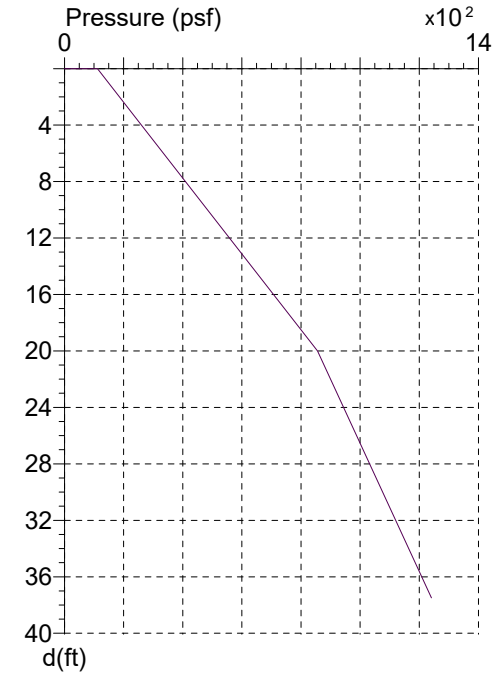
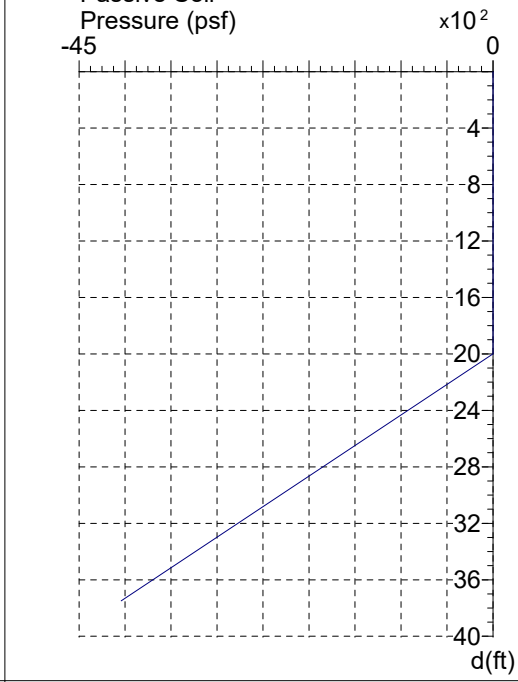
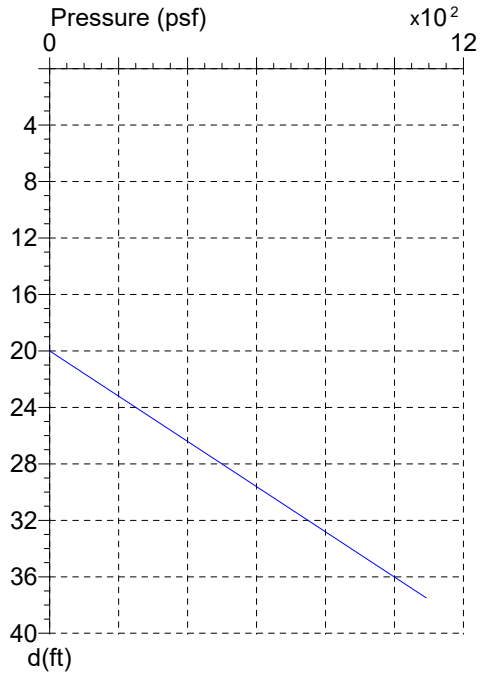
Client: MDOT
Site: Case 4 Anchored Wall in Sand

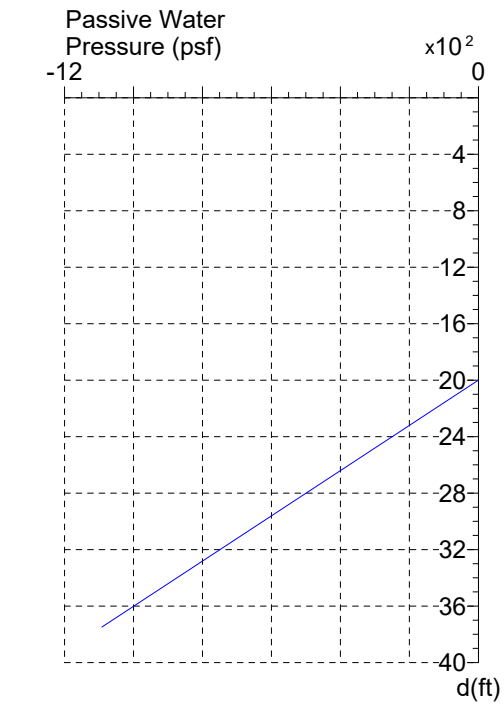
Title: FOS = 1.50
Page: 5
Date: 8.30.18

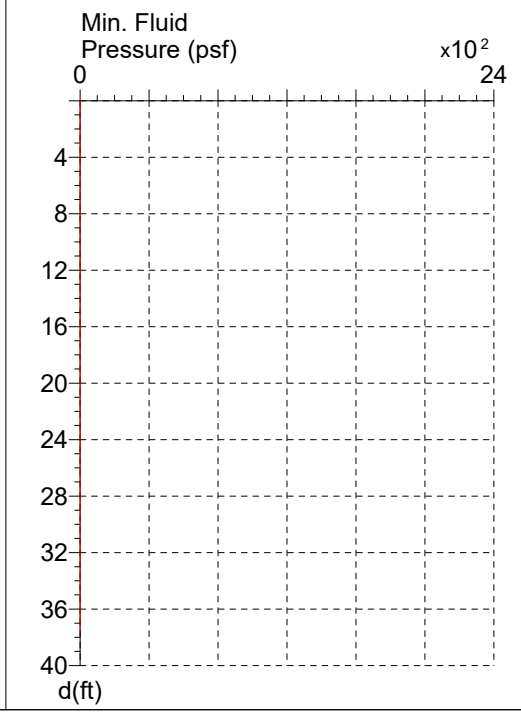
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

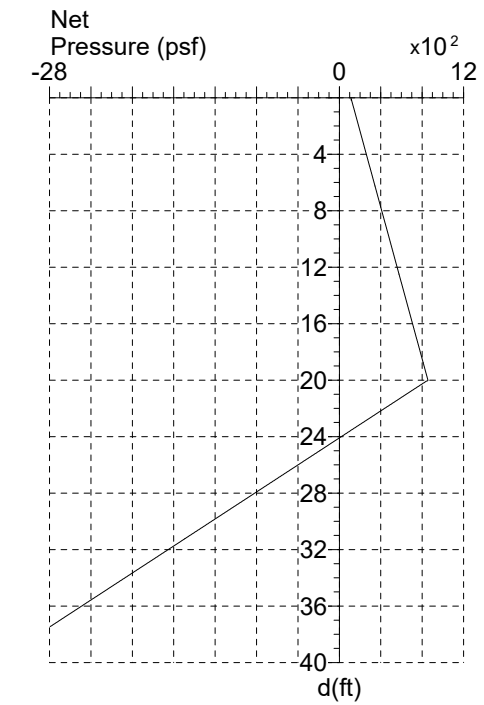












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Client: MDOT
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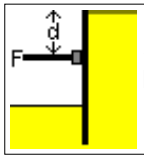
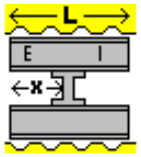
Title: FOS = 1.50
Page: 6
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 2.00 ft
F = 6281.9 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Client: MDOT
Site: Case 4 Anchored Wall in Sand

Title: FOS = 1.50
Page: 7
Date: 8.30.18

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Design Report

1. Maximum bending moment = 48320.5ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 23.22in³/ft (= M/f). Sheet section modulus in this design is Z = 31.00in³/ft, and is satisfactory.

2. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

3. FOS = 1.50 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Appendix B.5 – SupportIT Output, Case 5

Case 5 – Anchored Cantilever TERS in Stiff Clay

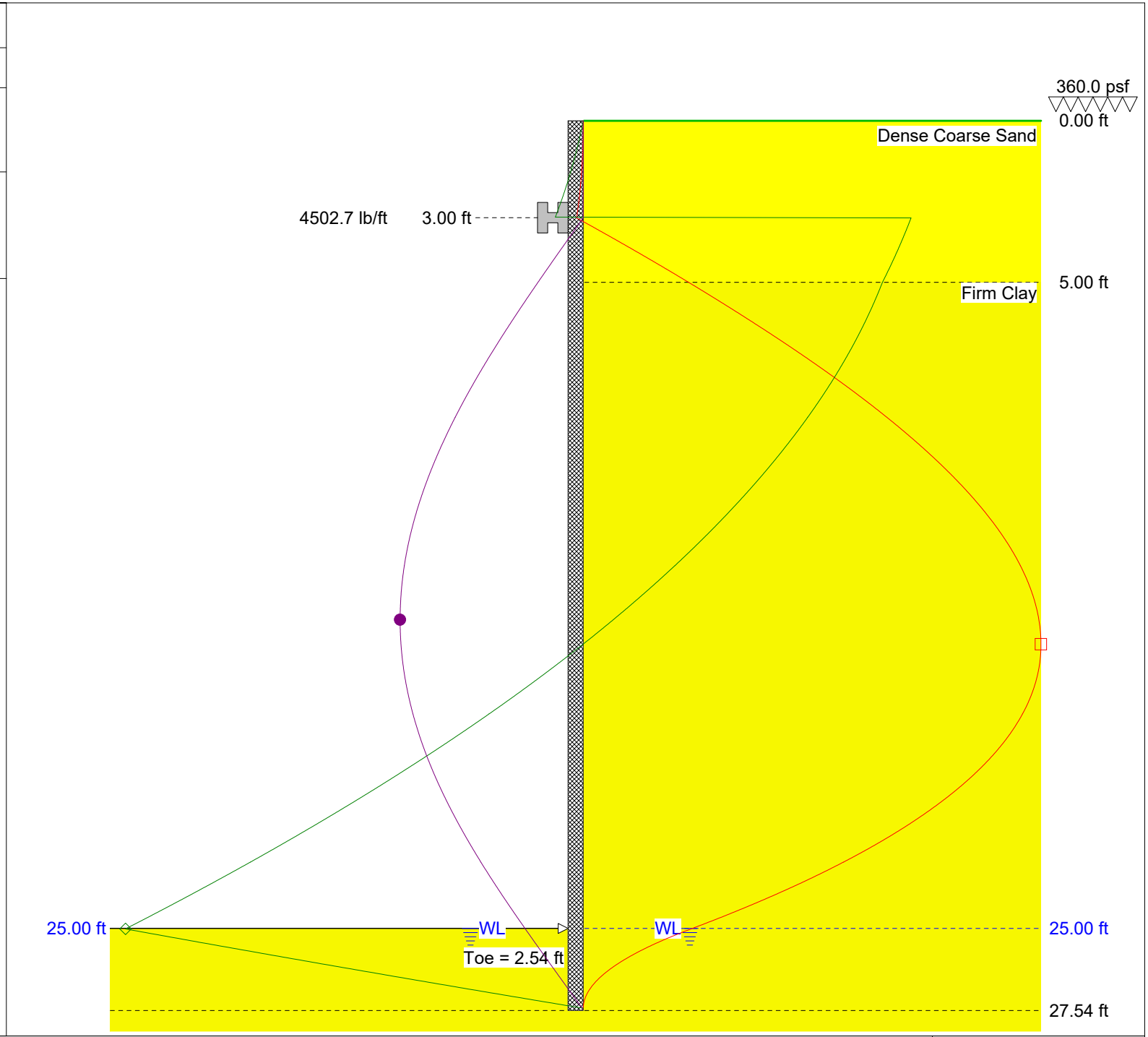
Client: Case 5 Anchor in Clay with Sand Backfill

Page: 1
Date: 10.1.18

FOS = 1.0

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum		d (ft)
□	32460.7 ftlb/ft	16.20
◇	5790.0 lb/ft	25.02
●	1.3 in	15.45



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Web: www.GTSoft.org

Client: Case 5 Anchor in Clay with Sand Backfill

Page: 2
Date: 10.1.18

FOS = 1.0

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 25.00ft
Surcharge = 360.0psf

Depth Of Active Water = 25.00ft
Depth Of Passive Water = 25.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	115.82	68.73	0.0	0.0	40.0	0.0	0.22	0.00	4.60	0.00
5.00	Firm Clay	118.37	56.00	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	2.54	27.54

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	4502.7

Maxima

	Maximum	Depth (ft)
Pressure	795.2 psf	25.00
Bending Moment	32460.7 ftlb/ft	16.20
Deflection	1.3 in	15.45
Shear Force	5790.0 lb/ft	25.02

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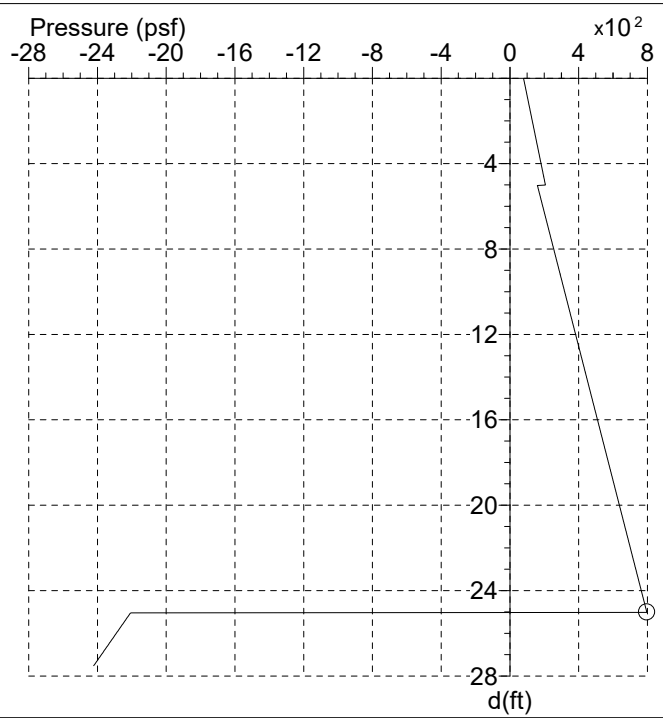
Client: Case 5 Anchor in Clay with Sand Backfill

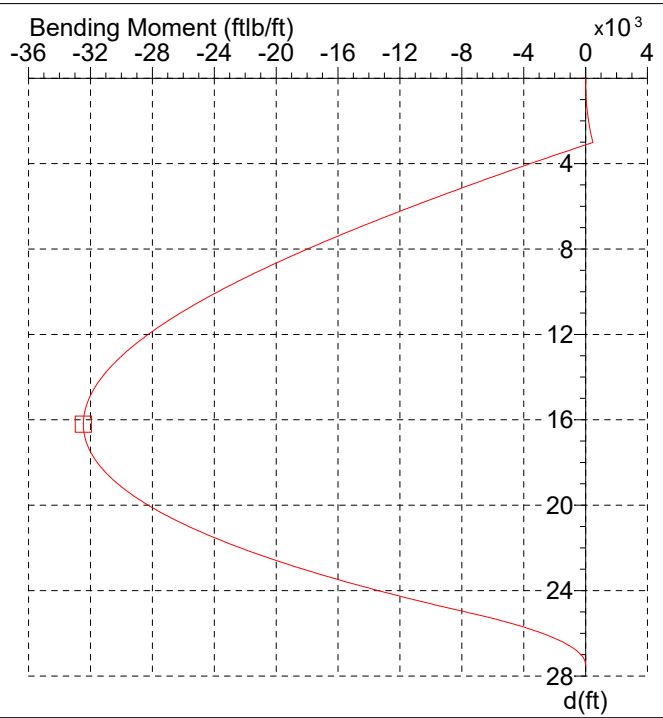
Page: 3
Date: 10.1.18

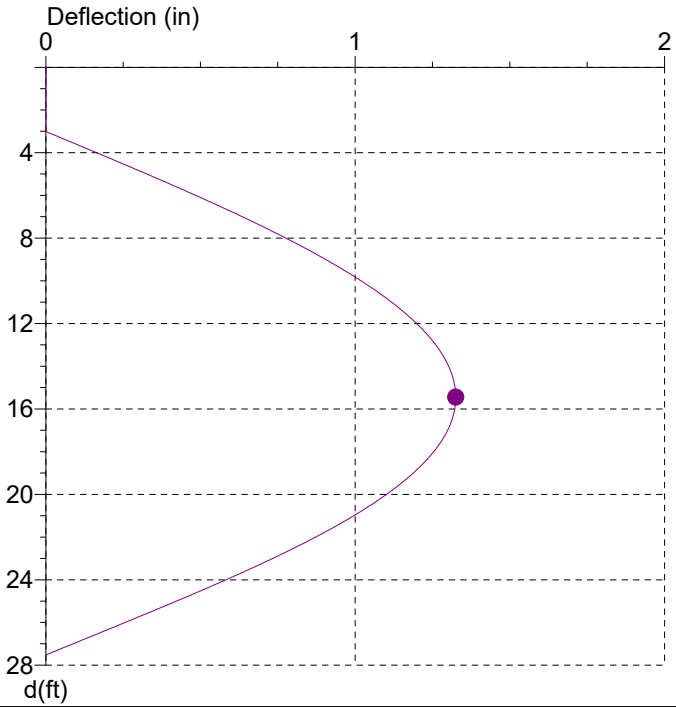
FOS = 1.0

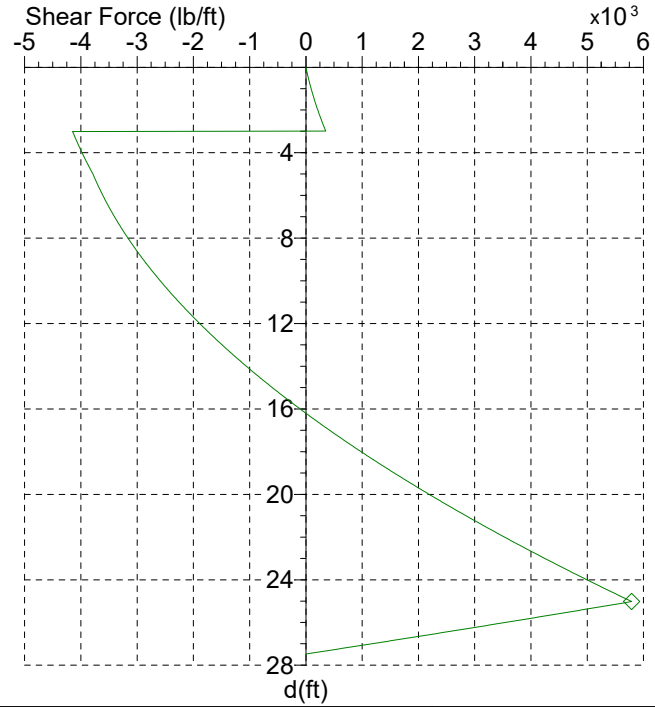
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
795.2 psf	25.00
32460.7 ftlb/ft	16.20
5790.0 lb/ft	25.02
1.3 in	15.45









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Client: Case 5 Anchor in Clay with Sand Backfill

Page: 4
Date: 10.1.18

FOS = 1.0

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	79.2	0.3	0.0	0.0
0.20	84.5	1.8	0.0	17.1
0.39	89.1	6.2	0.0	33.1
0.59	94.4	14.8	0.0	52.2
0.79	99.1	25.8	0.0	70.2
0.98	104.3	42.3	0.0	91.3
1.18	109.0	60.6	0.0	111.1
1.38	114.3	85.7	0.0	134.3
1.57	119.6	115.6	0.0	158.7
1.77	124.2	146.5	0.0	181.2
1.97	129.5	186.4	0.0	207.6
2.16	134.2	226.5	0.0	232.0
2.36	139.4	277.0	0.0	260.5
2.56	144.1	326.9	0.0	286.7
2.75	149.4	388.9	0.0	317.2
2.95	154.6	457.3	0.0	348.8
3.15	159.3	-97.1	0.0	-4124.9
3.34	164.6	-947.2	0.1	-4091.4
3.54	169.3	-1697.0	0.1	-4060.7
3.74	174.5	-2533.6	0.1	-4025.2
3.93	179.2	-3271.0	0.2	-3992.6
4.13	184.5	-4093.4	0.2	-3955.0
4.33	189.7	-4907.8	0.2	-3916.3
4.52	194.4	-5625.0	0.2	-3881.0
4.72	199.7	-6424.0	0.3	-3840.2
4.92	204.4	-7127.0	0.3	-3803.1
5.11	163.0	-7909.9	0.3	-3765.6
5.31	168.8	-8599.8	0.4	-3735.1
5.51	175.4	-9369.1	0.4	-3699.5
5.71	182.0	-10130.9	0.4	-3662.5
5.90	187.8	-10801.5	0.5	-3628.5
6.10	194.4	-11548.3	0.5	-3588.9
6.30	200.3	-12205.3	0.5	-3552.6
6.49	206.8	-12936.2	0.6	-3510.5
6.69	212.7	-13578.5	0.6	-3471.9
6.89	219.3	-14292.5	0.6	-3427.2
7.08	225.9	-14997.2	0.6	-3381.2
7.28	231.7	-15615.4	0.7	-3339.1
7.48	238.3	-16301.6	0.7	-3290.5
7.67	244.1	-16903.0	0.7	-3246.1
7.87	250.7	-17569.7	0.8	-3194.9
8.07	256.6	-18153.3	0.8	-3148.3
8.26	263.1	-18799.6	0.8	-3094.6
8.46	269.7	-19434.6	0.8	-3039.4
8.66	275.6	-19989.4	0.9	-2989.3
8.85	282.1	-20602.4	0.9	-2931.6
9.05	288.0	-21137.1	0.9	-2879.2
9.25	294.6	-21727.1	0.9	-2819.0
9.44	300.4	-22241.0	1.0	-2764.3
9.64	307.0	-22807.0	1.0	-2701.5
9.84	313.6	-23359.9	1.0	-2637.3
10.03	319.4	-23840.1	1.0	-2579.2
10.23	326.0	-24367.4	1.0	-2512.4
10.43	331.8	-24824.5	1.1	-2452.0
10.62	338.4	-25325.3	1.1	-2382.7
10.82	344.3	-25758.3	1.1	-2319.9
11.02	350.8	-26231.5	1.1	-2248.1
11.21	357.4	-26689.8	1.1	-2174.8
11.41	363.3	-27084.3	1.2	-2108.6
11.61	369.8	-27513.5	1.2	-2032.8
11.80	375.7	-27881.7	1.2	-1964.3
12.00	382.3	-28280.8	1.2	-1885.9
12.20	388.1	-28621.9	1.2	-1815.1
12.39	394.7	-28989.9	1.2	-1734.2
12.59	401.3	-29341.0	1.2	-1651.9
12.79	407.1	-29638.8	1.2	-1577.7
12.98	413.7	-29957.3	1.3	-1492.8
13.18	419.5	-30225.6	1.3	-1416.2
13.38	426.1	-30510.5	1.3	-1328.8
13.57	432.0	-30748.5	1.3	-1250.0
13.77	438.5	-30998.8	1.3	-1160.0
13.97	445.1	-31230.3	1.3	-1068.6
14.16	451.0	-31420.2	1.3	-986.3
14.36	457.6	-31615.6	1.3	-892.4
14.56	463.4	-31772.8	1.3	-807.8
14.75	470.0	-31931.1	1.3	-711.3
14.95	475.8	-32054.9	1.3	-624.4
15.15	482.4	-32174.9	1.3	-525.4
15.34	489.0	-32274.4	1.3	-425.0
15.54	494.8	-32345.3	1.3	-334.6
15.74	501.4	-32405.0	1.3	-231.6
15.94	507.3	-32440.1	1.3	-138.9
16.13	513.8	-32459.2	1.3	-33.4
16.33	519.7	-32457.6	1.3	61.5
16.53	526.3	-32433.9	1.3	169.6
16.72	532.8	-32386.6	1.3	279.1
16.92	538.7	-32324.5	1.3	377.5
17.12	545.3	-32231.9	1.3	489.6
17.31	551.1	-32129.1	1.3	590.3
17.51	557.7	-31990.1	1.3	704.9
17.71	563.5	-31845.6	1.3	807.9
17.90	570.1	-31659.1	1.3	925.1
18.10	576.7	-31447.2	1.2	1043.6
18.30	582.5	-31237.1	1.2	1150.1
18.49	589.1	-30976.1	1.2	1271.1
18.69	595.0	-30722.0	1.2	1379.9
18.89	601.5	-30411.0	1.2	1503.6
19.08	607.4	-30111.9	1.2	1614.6
19.28	614.0	-29749.7	1.2	1740.8
19.48	620.5	-29360.0	1.1	1868.4
19.67	626.4	-28990.3	1.1	1983.0
19.87	633.0	-28547.9	1.1	2113.1
20.07	638.8	-28130.8	1.1	2229.9
20.26	645.4	-27634.6	1.1	2362.7
20.46	651.2	-27169.3	1.1	2481.8
20.66	657.8	-26618.2	1.0	2617.0
20.85	664.4	-26037.7	1.0	2753.7
21.05	670.2	-25496.8	1.0	2876.3
21.25	676.8	-24859.8	1.0	3015.5
21.44	682.7	-24268.2	0.9	3140.4
21.64	689.2	-23573.7	0.9	3282.1
21.84	695.1	-22930.5	0.9	3409.3
22.03	701.7	-22177.5	0.9	3553.6
22.23	708.3	-21393.1	0.8	3699.3
22.43	714.1	-20669.2	0.8	3829.9
22.62	720.7	-19824.6	0.8	3978.2
22.82	726.5	-19046.8	0.8	4111.1
23.02	733.1	-18141.0	0.7	4262.0
23.21	738.9	-17308.3	0.7	4397.2
23.41	745.5	-16340.2	0.7	4550.6
23.61	752.1	-15338.8	0.6	4705.3
23.80	758.0	-14420.3	0.6	4844.0
24.00	764.5	-13355.0	0.6	5001.4
24.20	770.4	-12379.4	0.6	5142.3
24.39	777.0	-11249.1	0.5	5302.2
24.59	782.8	-10215.3	0.5	5445.5
24.79	789.4	-9019.1	0.5	5607.9
24.98	795.2	-7787.5	0.4	5771.7
25.18	-2219.1	-6698.2	0.4	5428.5
25.38	-2237.0	-5566.5	0.4	4959.1
25.57	-2252.9	-4646.2	0.3	4538.6
25.77	-2270.7	-3708.1	0.3	4062.1
25.97	-2286.6	-2961.2	0.3	3635.3
26.16	-2304.5	-2219.6	0.2	3151.7
26.36	-2322.4	-1583.3	0.2	2664.2
26.56	-2338.2	-1106.6	0.2	2227.8
26.76	-2356.1	-671.2	0.1	1733.3
26.95	-2372.0	-374.4	0.1	1290.5
27.15	-2389.9	-142.9	0.1	788.9
27.35	-2405.8	-28.7	0.0	339.8
27.54	-2421.6	0.0	0.0	0.0

MDOT Sheet Pile Manual

SupportIT, v2.37

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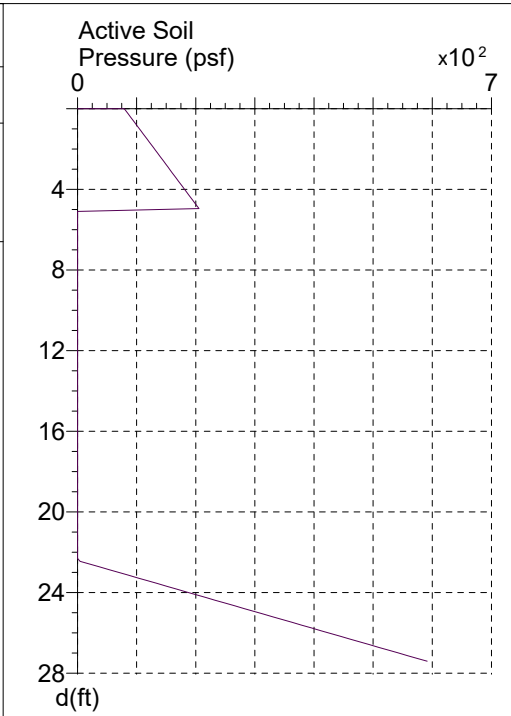
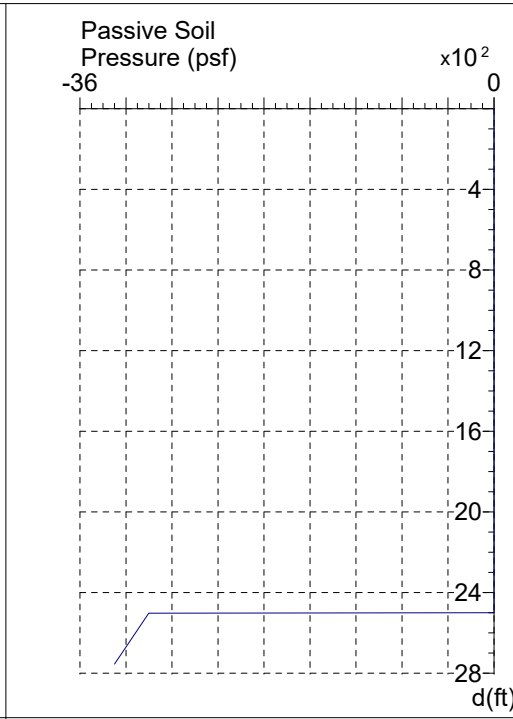
Client: Case 5 Anchor in Clay with Sand Backfill

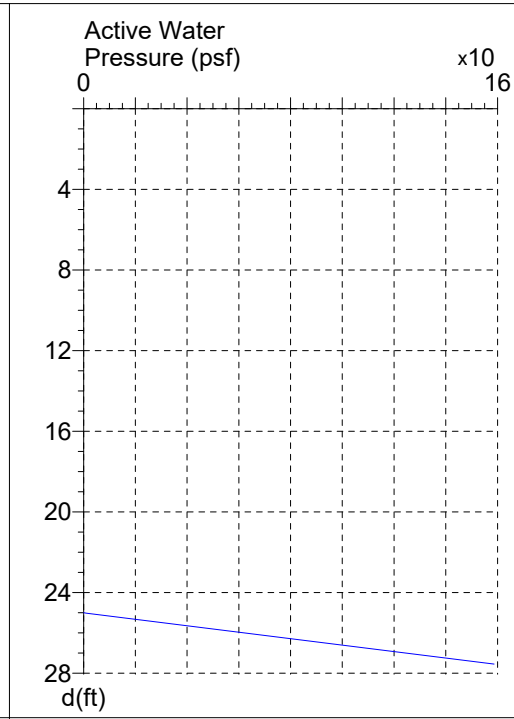
Page: 5
Date: 10.1.18

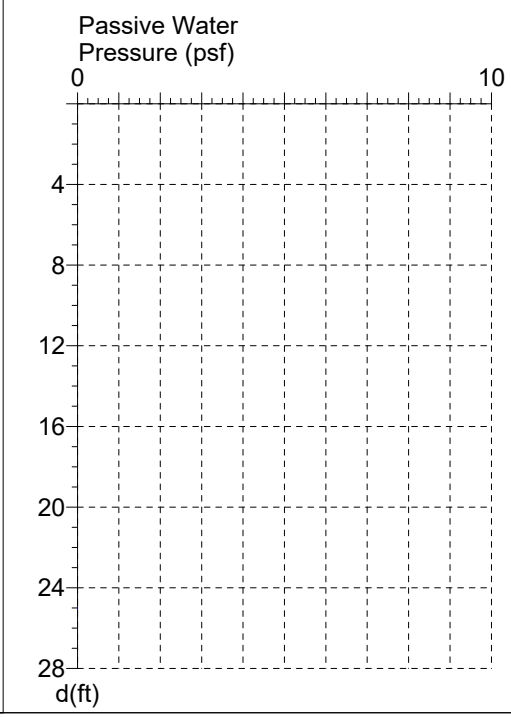
FOS = 1.0

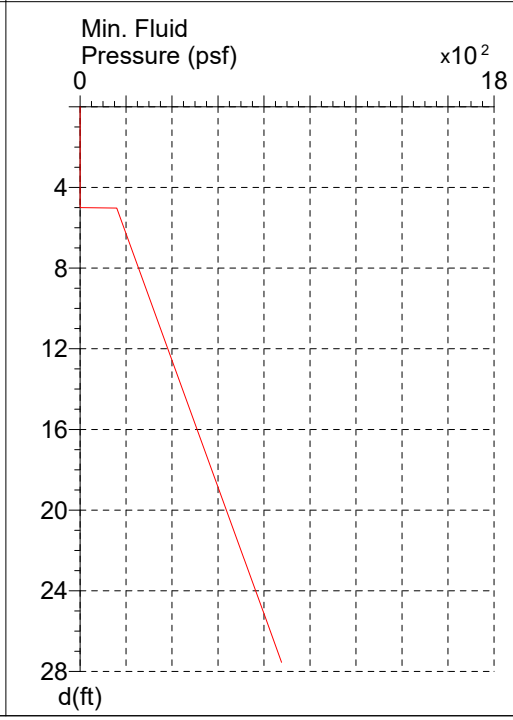
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

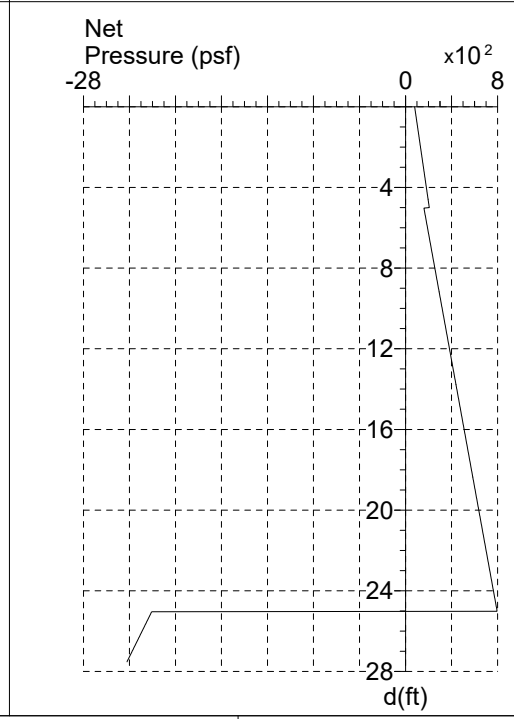












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SupportIT, v2.37

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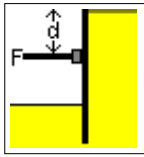
Client: Case 5 Anchor in Clay with Sand Backfill

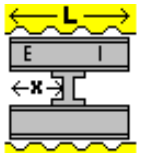
Page: 6
Date: 10.1.18

FOS = 1.0

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 3.00 ft
F = 4502.7 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

MDOT Sheet Pile Manual

SupportIT, v2.37

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Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 32460.7ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 15.60in³/ft (= M/f). Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

5. FOS = 0.99 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

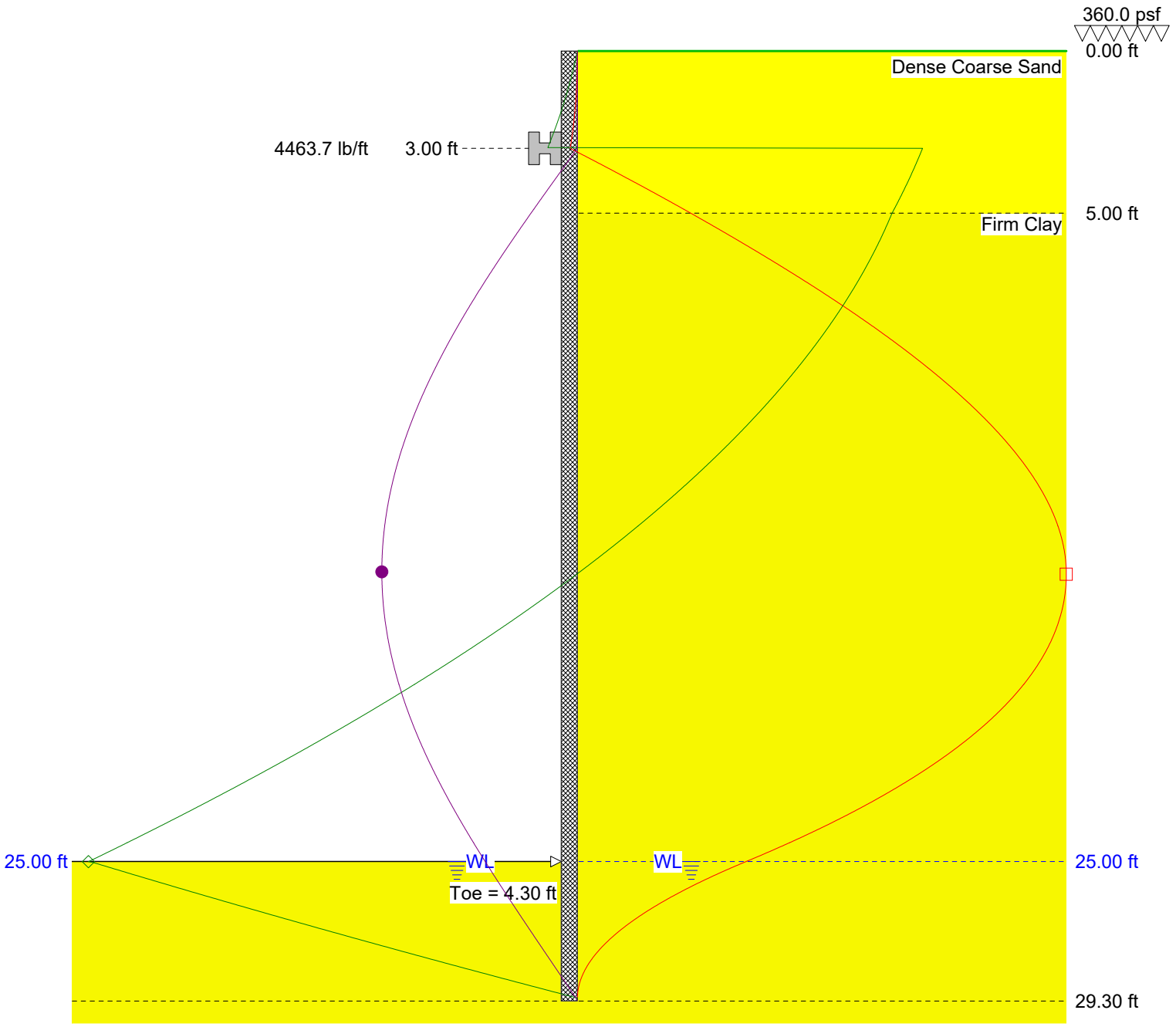
Client: Case 5 Anchor in Clay with Sand Backfill

Page: 1
Date: 10.1.18

FOS = 1.5

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
31945.0 ftlb/ft	16.14
5819.8 lb/ft	25.00
1.5 in	16.07



MDOT Sheet Pile Manual

SupportIT, v2.37

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Client: Case 5 Anchor in Clay with Sand Backfill

Page: 2
Date: 10.1.18

FOS = 1.5

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 25.00ft
Surcharge = 360.0psf

Depth Of Active Water = 25.00ft
Depth Of Passive Water = 25.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	115.82	68.73	0.0	0.0	40.0	0.0	0.22	0.00	4.60	0.00
5.00	Firm Clay	118.37	56.00	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	4.30	29.30

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	4463.7

Maxima

	Maximum	Depth (ft)
Pressure	795.5 psf	25.00
Bending Moment	31945.0 ftlb/ft	16.14
Deflection	1.5 in	16.07
Shear Force	5819.8 lb/ft	25.00

MDOT Sheet Pile Manual

SupportIT, v2.37

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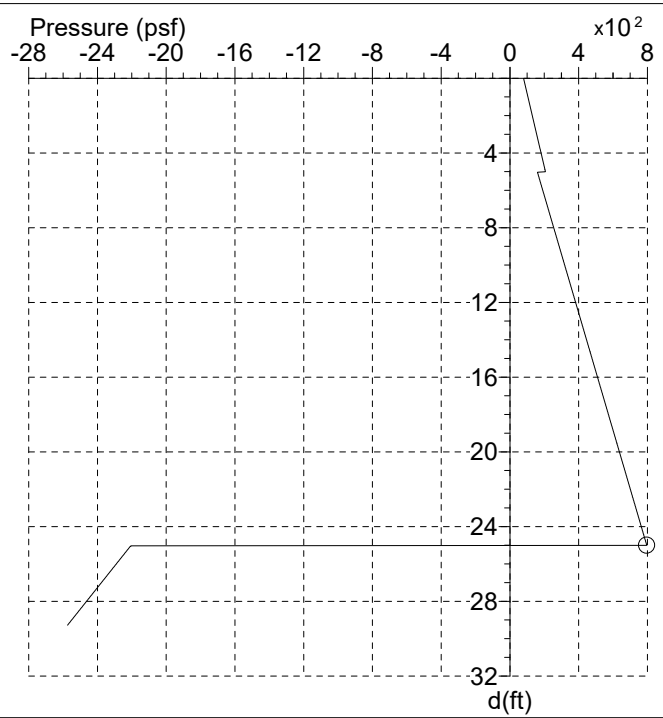
Client: Case 5 Anchor in Clay with Sand Backfill

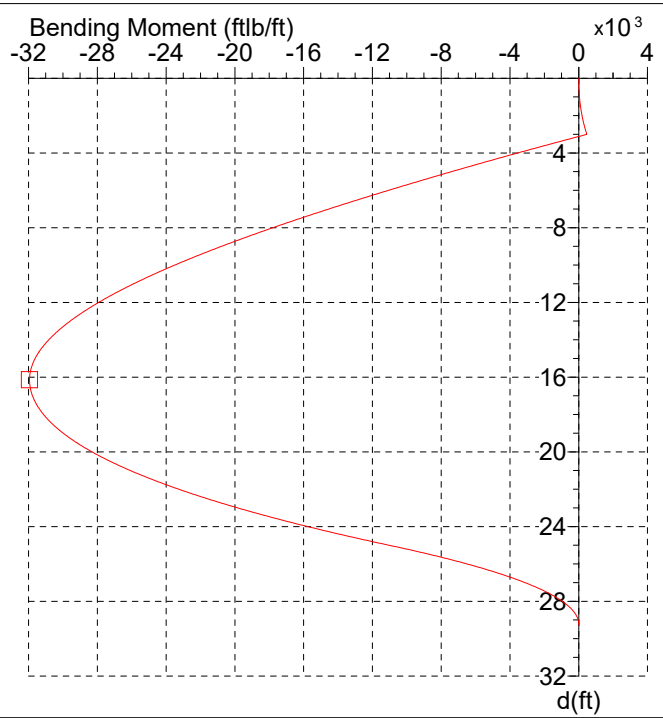
Page: 3
Date: 10.1.18

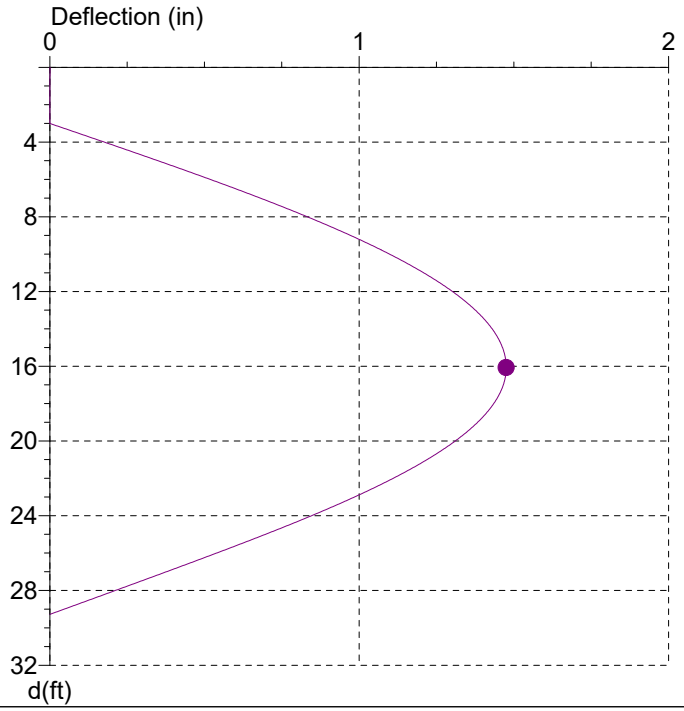
FOS = 1.5

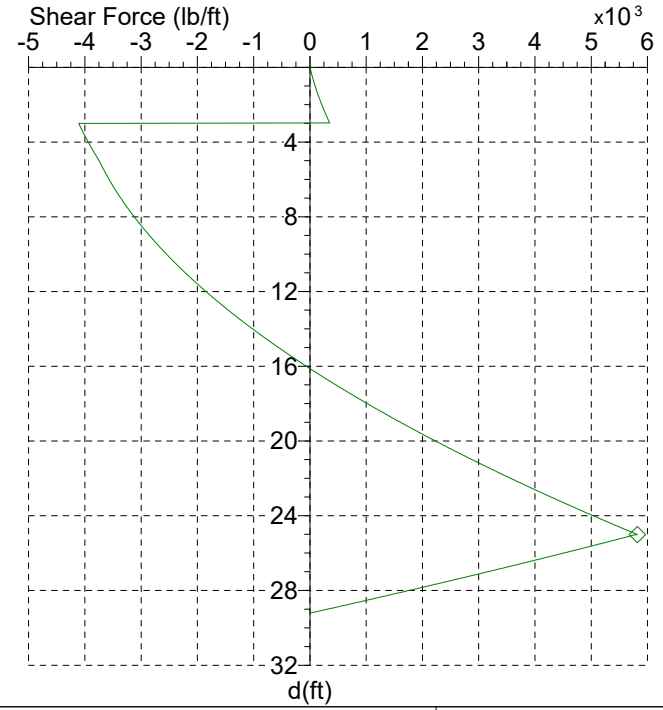
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
795.5 psf	25.00
31945.0 ftlb/ft	16.14
5819.8 lb/ft	25.00
1.5 in	16.07









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Client: Case 5 Anchor in Clay with Sand Backfill

Page: 4
Date: 10.1.18

FOS = 1.5

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	79.2	0.3	0.0	0.0
0.21	84.8	2.1	0.0	18.2
0.42	89.8	7.1	0.0	35.4
0.63	95.4	16.8	0.0	55.9
0.84	100.4	29.4	0.0	75.2
1.05	106.0	48.1	0.0	98.1
1.26	110.9	69.1	0.0	119.4
1.47	116.5	97.8	0.0	144.6
1.67	122.1	132.1	0.0	171.1
1.88	127.1	167.6	0.0	195.6
2.09	132.7	213.4	0.0	224.4
2.30	137.7	259.5	0.0	251.0
2.51	143.3	317.7	0.0	282.1
2.72	148.3	375.2	0.0	310.8
2.93	153.9	446.8	0.0	344.3
3.14	159.5	-128.7	0.0	-4084.9
3.35	164.4	-924.7	0.1	-4053.2
3.56	170.0	-1812.6	0.1	-4016.3
3.77	175.0	-2595.0	0.1	-3982.6
3.98	180.6	-3467.2	0.2	-3943.4
4.19	185.6	-4235.2	0.2	-3907.6
4.40	191.2	-5090.7	0.2	-3866.1
4.60	196.8	-5936.9	0.3	-3823.4
4.81	201.8	-6681.2	0.3	-3784.4
5.02	160.2	-7509.2	0.4	-3740.6
5.23	166.4	-8237.9	0.4	-3708.6
5.44	173.4	-9050.0	0.4	-3671.2
5.65	179.6	-9764.8	0.5	-3636.6
5.86	186.6	-10560.8	0.5	-3596.3
6.07	193.6	-11347.8	0.5	-3554.4
6.28	199.9	-12039.5	0.6	-3515.9
6.49	206.9	-12808.5	0.6	-3471.1
6.70	213.1	-13483.7	0.6	-3430.0
6.91	220.1	-14233.5	0.7	-3382.3
7.12	226.3	-14891.1	0.7	-3338.7
7.33	233.3	-15620.6	0.7	-3288.1
7.53	240.3	-16338.7	0.8	-3236.0
7.74	246.5	-16967.4	0.8	-3188.3
7.95	253.5	-17663.3	0.8	-3133.3
8.16	259.7	-18271.7	0.9	-3083.1
8.37	266.7	-18944.2	0.9	-3025.2
8.58	273.0	-19531.2	0.9	-2972.4
8.79	279.9	-20179.1	0.9	-2911.5
9.00	286.9	-20813.4	1.0	-2849.2
9.21	293.2	-21365.7	1.0	-2792.4
9.42	300.2	-21973.5	1.0	-2727.1
9.63	306.4	-22501.7	1.1	-2667.8
9.84	313.4	-23081.9	1.1	-2599.6
10.05	319.6	-23584.9	1.1	-2537.7
10.26	326.6	-24136.1	1.1	-2466.6
10.47	333.6	-24671.6	1.2	-2394.0
10.67	339.8	-25134.1	1.2	-2328.1
10.88	346.8	-25638.8	1.2	-2252.6
11.09	353.0	-26073.4	1.2	-2184.2
11.30	360.0	-26546.2	1.2	-2105.7
11.51	366.3	-26951.9	1.3	-2034.7
11.72	373.3	-27391.5	1.3	-1953.4
11.93	380.3	-27813.1	1.3	-1870.5
12.14	386.5	-28172.4	1.3	-1795.5
12.35	393.5	-28559.0	1.3	-1709.7
12.56	399.7	-28886.7	1.3	-1632.2
12.77	406.7	-29237.0	1.4	-1543.5
12.98	412.9	-29532.0	1.4	-1463.3
13.19	419.9	-29844.9	1.4	-1371.7
13.40	426.9	-30137.6	1.4	-1278.6
13.60	433.1	-30380.4	1.4	-1194.5
13.81	440.1	-30633.8	1.4	-1098.5
14.02	446.4	-30841.1	1.4	-1011.8
14.23	453.4	-31054.0	1.4	-912.8
14.44	459.6	-31224.9	1.4	-823.6
14.65	466.6	-31396.1	1.5	-721.7
14.86	473.6	-31544.8	1.5	-618.4
15.07	479.8	-31657.8	1.5	-525.2
15.28	486.8	-31762.9	1.5	-418.9
15.49	493.0	-31836.6	1.5	-323.1
15.70	500.0	-31897.1	1.5	-213.9
15.91	506.2	-31930.5	1.5	-115.5
16.12	513.2	-31945.0	1.5	-3.4
16.33	520.2	-31935.9	1.5	110.2
16.53	526.5	-31909.4	1.5	212.6
16.74	533.5	-31858.6	1.5	329.1
16.95	539.7	-31794.5	1.5	434.0
17.16	546.7	-31700.8	1.5	553.5
17.37	552.9	-31598.1	1.5	660.9
17.58	559.9	-31460.5	1.5	783.3
17.79	566.9	-31299.2	1.4	907.2
18.00	573.1	-31135.7	1.4	1018.6
18.21	580.1	-30928.9	1.4	1145.4
18.42	586.3	-30724.5	1.4	1259.4
18.63	593.3	-30471.1	1.4	1389.2
18.84	599.6	-30224.8	1.4	1505.7
19.05	606.6	-29923.8	1.4	1638.4
19.26	613.5	-29597.1	1.4	1772.5
19.47	619.8	-29285.0	1.4	1893.1
19.67	626.8	-28909.1	1.3	2030.1
19.88	633.0	-28552.7	1.3	2153.2
20.09	640.0	-28126.5	1.3	2293.2
20.30	646.2	-27724.9	1.3	2418.9
20.51	653.2	-27247.3	1.3	2561.8
20.72	660.2	-26742.1	1.2	2706.2
20.93	666.4	-26269.6	1.2	2835.8
21.14	673.4	-25711.4	1.2	2983.2
21.35	679.6	-25191.3	1.2	3115.4
21.56	686.6	-24579.1	1.2	3265.6
21.77	692.9	-24010.5	1.1	3400.4
21.98	699.9	-23343.2	1.1	3553.6
22.19	706.9	-22646.3	1.1	3708.2
22.40	713.1	-22001.7	1.1	3847.0
22.60	720.1	-21248.1	1.0	4004.5
22.81	726.3	-20552.7	1.0	4145.9
23.02	733.3	-19741.3	1.0	4306.4
23.23	739.5	-18994.0	1.0	4450.3
23.44	746.5	-18123.8	0.9	4613.7
23.65	753.5	-17222.1	0.9	4778.6
23.86	759.7	-16393.8	0.9	4926.5
24.07	766.7	-15431.6	0.8	5094.3
24.28	773.0	-14549.1	0.8	5244.8
24.49	780.0	-13525.4	0.8	5415.5
24.70	786.2	-12587.8	0.7	5568.5
24.91	793.2	-11501.6	0.7	5742.2
25.12	-2214.7	-10394.6	0.7	5641.3
25.33	-2231.6	-9448.5	0.6	5390.4
25.53	-2250.6	-8435.7	0.6	5106.0
25.74	-2267.5	-7581.5	0.6	4851.1
25.95	-2286.5	-6672.8	0.5	4562.1
26.16	-2303.4	-5911.9	0.5	4303.1
26.37	-2322.4	-5109.0	0.5	4009.5
26.58	-2341.4	-4362.9	0.4	3713.5
26.79	-2358.3	-3747.6	0.4	3448.4
27.00	-2377.3	-3109.8	0.4	3147.9
27.21	-2394.2	-2591.5	0.3	2878.7
27.42	-2413.3	-2063.7	0.3	2573.6
27.63	-2430.2	-1644.0	0.3	2300.3
27.84	-2449.2	-1227.8	0.2	1990.7
28.05	-2468.2	-871.5	0.2	1678.6
28.26	-2485.1	-605.3	0.2	1399.1
28.47	-2504.1	-363.1	0.1	1082.5
28.67	-2521.0	-199.2	0.1	799.0
28.88	-2540.0	-72.9	0.1	477.8
29.09	-2556.9	-12.6	0.0	190.3
29.30	-2573.8	0.0	0.0	0.0

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SupportIT, v2.37

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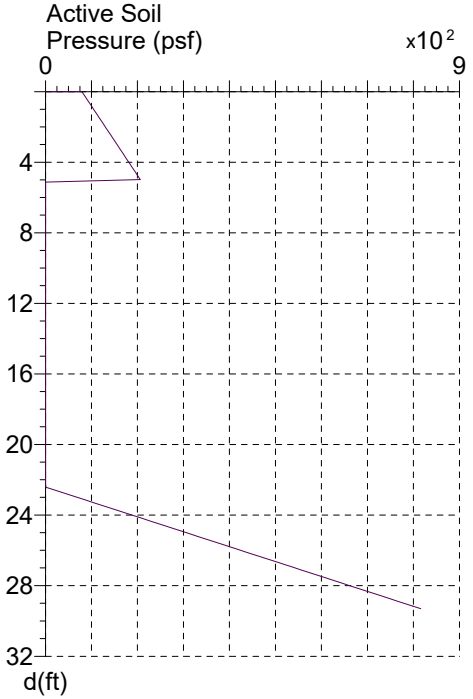
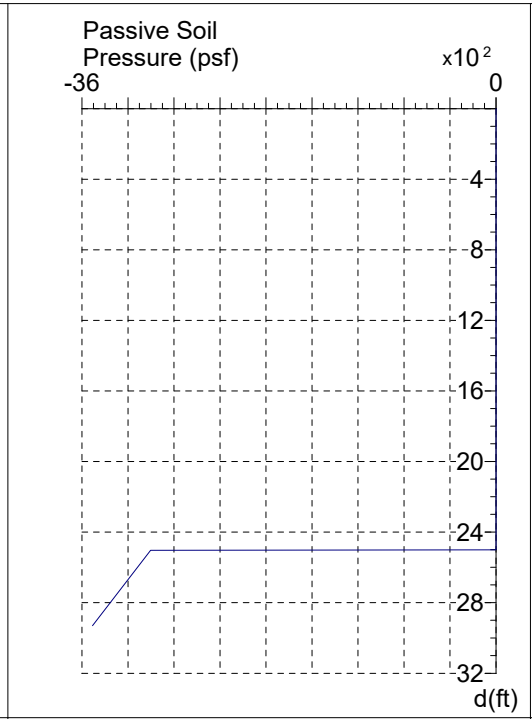
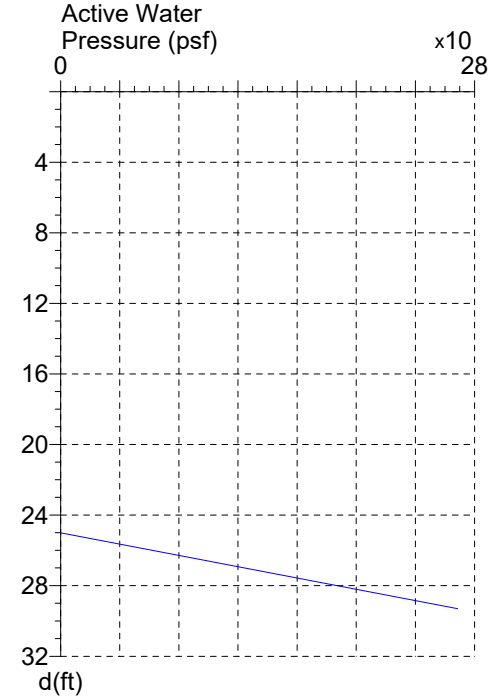
Page: 5
Date: 10.1.18

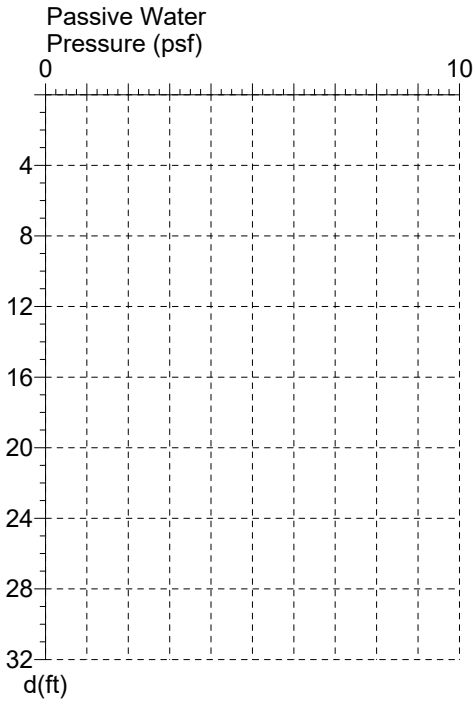
FOS = 1.5

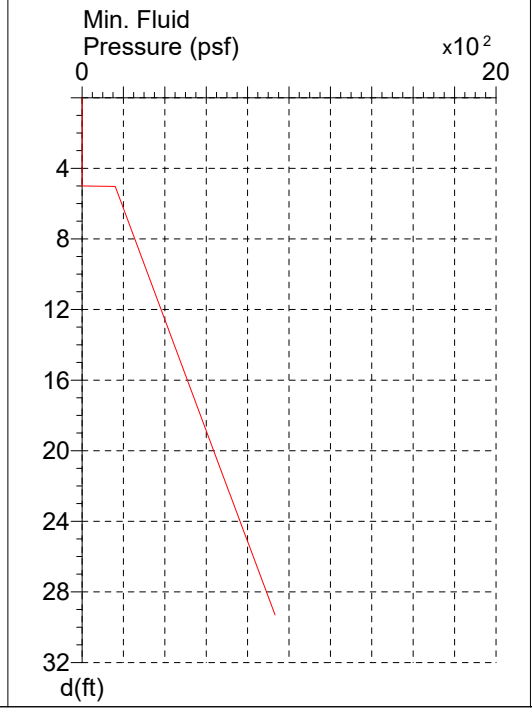
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

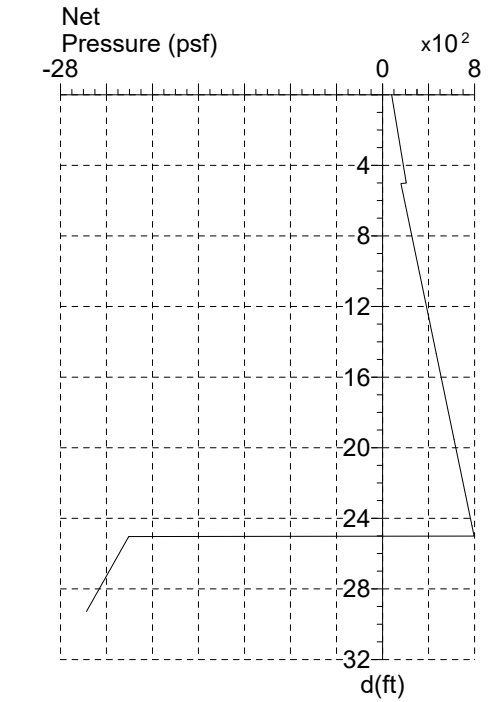












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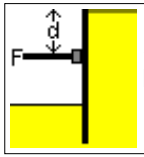
Client: Case 5 Anchor in Clay with Sand Backfill

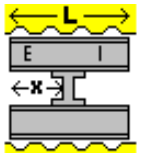
Page: 6
Date: 10.1.18

FOS = 1.5

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 3.00 ft
F = 4463.7 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Client: Case 5 Anchor in Clay with Sand Backfill

Page: 7
Date: 10.1.18

FOS = 1.5

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 31945.0ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 15.35in³/ft (= M/f). Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

5. FOS = 1.49 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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Appendix B.6 – SupportIT Output, Case 6

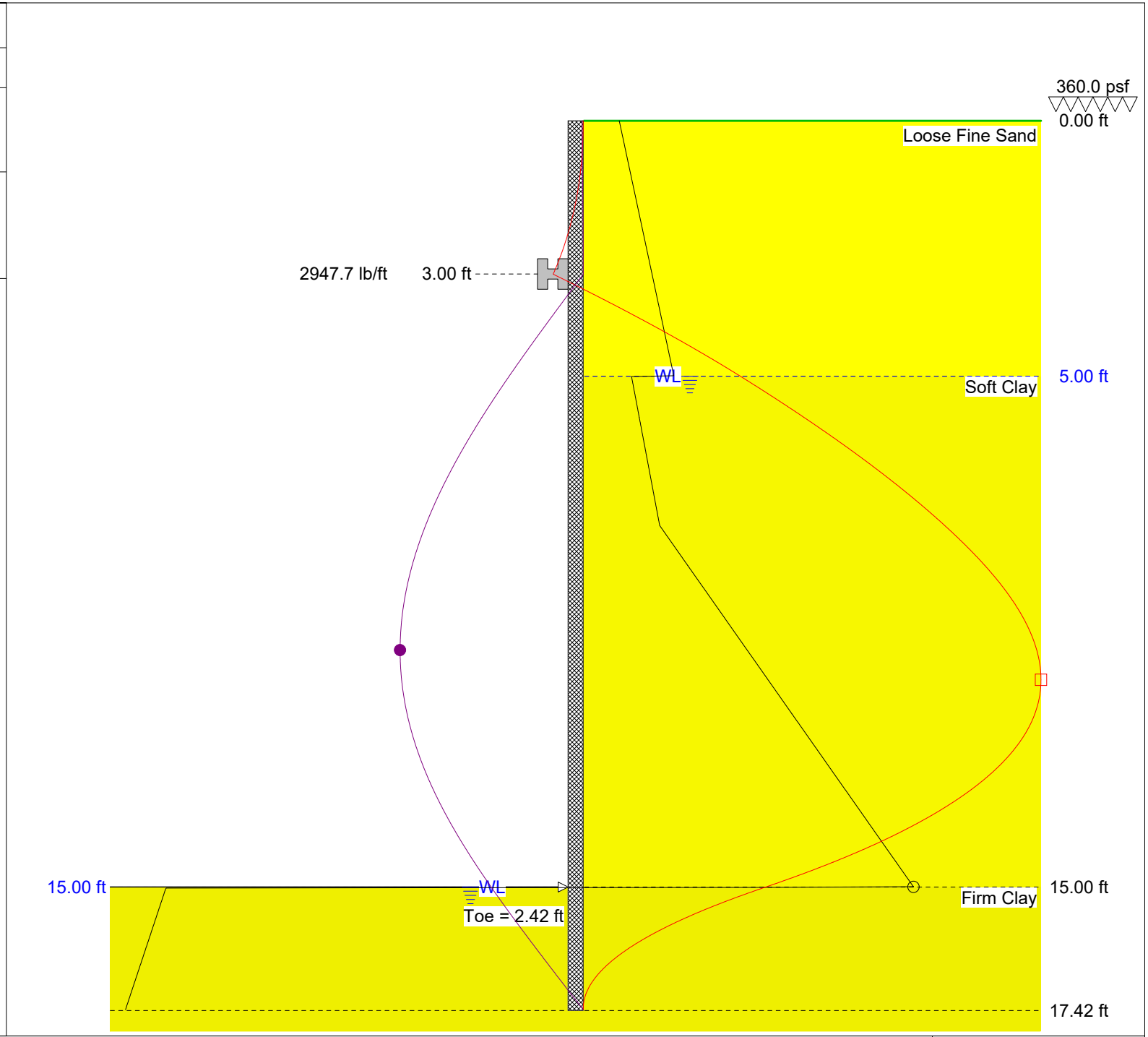
Case 6 – Braced Cofferdam TERS in Soft and Stiff Clay

Client: MDOT Case 6
Site: FOS = 1.00

Page: 1
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 1089.7 psf	15.00
□ 10650.4 ftlb/ft	10.94
● 0.1 in	10.36



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Client: MDOT Case 6
Site: FOS = 1.00

Page: 2
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 15.00ft
Surcharge = 360.0psf

Depth Of Active Water = 5.00ft
Depth Of Passive Water = 15.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Loose Fine Sand	109.20	65.55	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
5.00	Soft Clay	118.37	56.00	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
15.00	Firm Clay	118.37	56.00	1000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	2.42	17.42

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	2947.7

Maxima

	Maximum	Depth (ft)
Pressure	1089.7 psf	15.00
Bending Moment	10650.4 ftlb/ft	10.94
Deflection	0.1 in	10.36
Shear Force	3457.4 lb/ft	15.01

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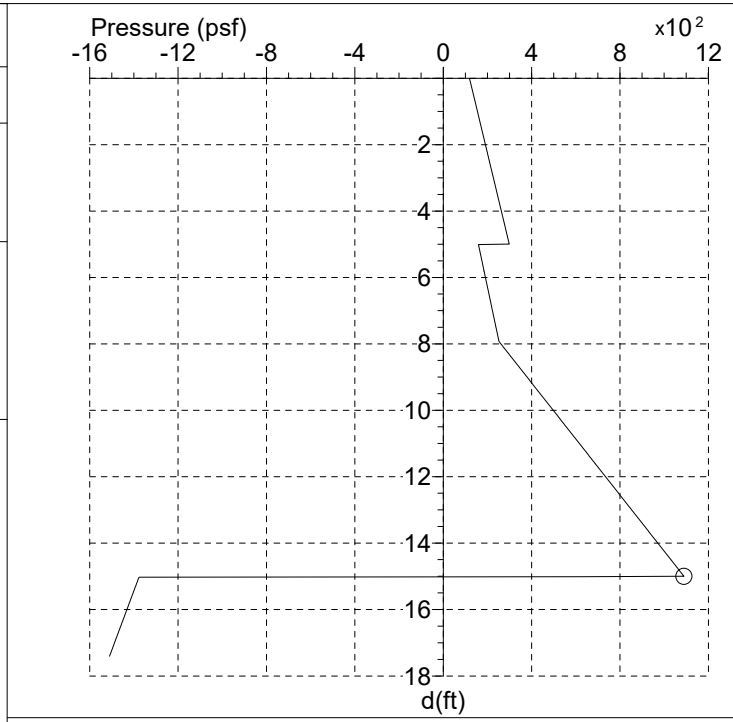
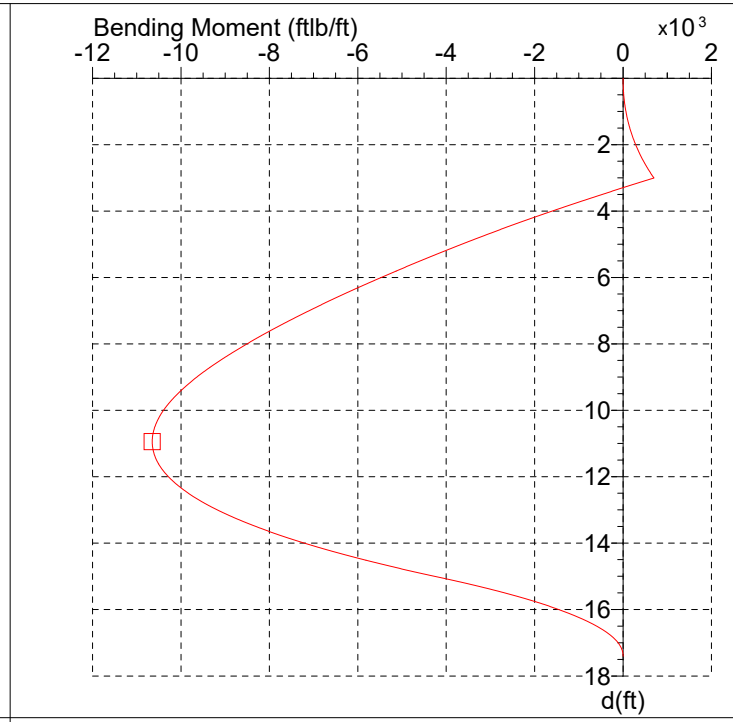
Client: MDOT Case 6
Site: FOS = 1.00

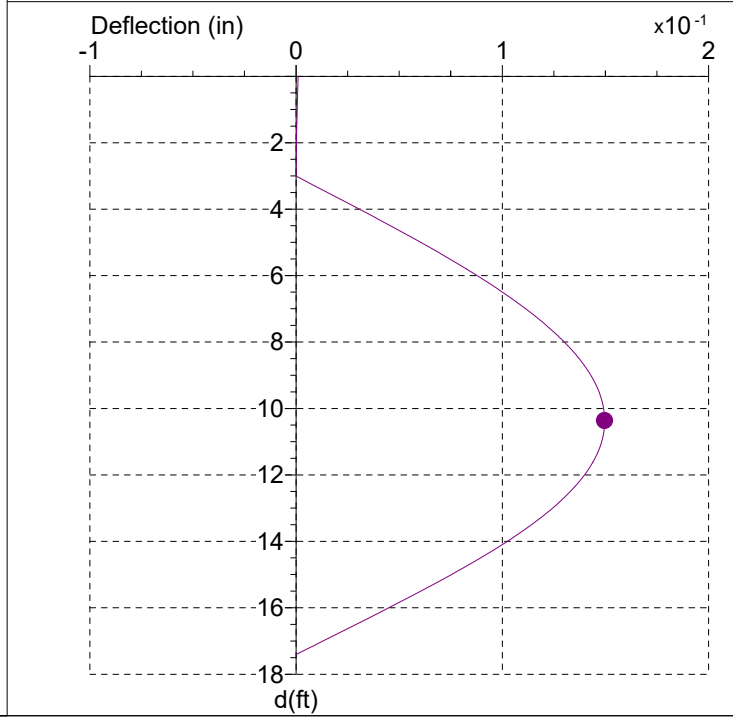
Page: 3
Date: 10.20.18

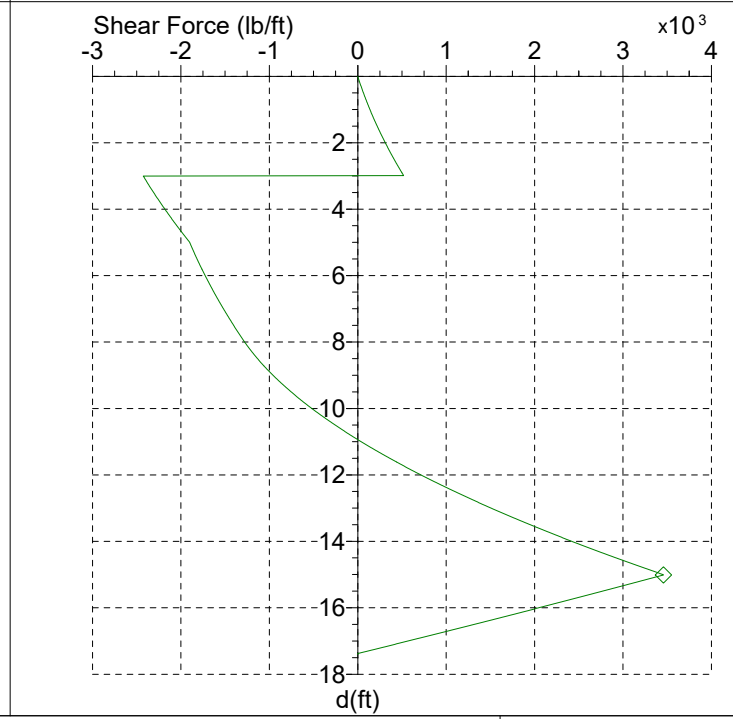
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 1089.7 psf	15.00
□ 10650.4 ftlb/ft	10.94
◇ 3457.4 lb/ft	15.01
● 0.1 in	10.36









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Client: MDOT Case 6
Site: FOS = 1.00

Page: 4
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	118.8	0.3	0.0	0.0
0.12	123.5	1.2	0.0	15.9
0.25	127.7	3.8	0.0	30.6
0.37	132.4	8.7	0.0	47.7
0.50	136.6	15.1	0.0	63.4
0.62	141.3	24.4	0.0	81.6
0.75	145.5	34.7	0.0	98.3
0.87	150.2	48.7	0.0	117.8
1.00	154.9	65.2	0.0	137.8
1.12	159.1	82.2	0.0	156.1
1.24	163.8	103.8	0.0	177.3
1.37	168.0	125.3	0.0	196.7
1.49	172.7	152.3	0.0	219.0
1.62	176.9	178.8	0.0	239.4
1.74	181.6	211.4	0.0	262.9
1.87	186.3	247.2	0.0	287.1
1.99	190.5	281.6	0.0	309.1
2.12	195.2	323.5	0.0	334.4
2.24	199.4	363.4	0.0	357.4
2.36	204.1	411.7	0.0	383.8
2.49	208.2	457.5	0.0	407.9
2.61	213.0	512.3	0.0	435.5
2.74	217.7	570.9	0.0	463.8
2.86	221.8	626.0	0.0	489.4
2.99	226.6	691.7	0.0	518.8
3.11	230.7	453.3	0.0	-2402.3
3.23	235.4	140.7	0.0	-2371.8
3.36	239.6	-133.9	0.0	-2344.2
3.48	244.3	-438.8	0.0	-2312.6
3.61	249.0	-739.6	0.0	-2280.3
3.73	253.2	-1003.4	0.0	-2251.1
3.86	257.9	-1296.1	0.0	-2217.7
3.98	262.1	-1552.6	0.0	-2187.5
4.11	266.8	-1836.9	0.0	-2152.9
4.23	271.0	-2085.8	0.0	-2121.6
4.35	275.7	-2361.4	0.0	-2085.9
4.48	280.4	-2632.2	0.0	-2049.5
4.60	284.6	-2869.0	0.0	-2016.7
4.73	289.3	-3130.8	0.1	-1979.1
4.85	293.5	-3359.3	0.1	-1945.3
4.98	298.2	-3611.7	0.1	-1906.6
5.10	162.2	-3832.3	0.1	-1885.9
5.23	166.3	-4077.9	0.1	-1864.4
5.35	170.5	-4320.6	0.1	-1842.4
5.47	174.2	-4534.0	0.1	-1822.4
5.60	178.3	-4771.1	0.1	-1799.3
5.72	182.0	-4979.4	0.1	-1778.4

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
5.85	186.2	-5210.8	0.1	-1754.3
5.97	189.9	-5413.7	0.1	-1732.4
6.10	194.0	-5639.0	0.1	-1707.3
6.22	198.2	-5861.0	0.1	-1681.7
6.35	201.9	-6055.4	0.1	-1658.4
6.47	206.0	-6271.0	0.1	-1631.7
6.59	209.7	-6459.6	0.1	-1607.6
6.72	213.9	-6668.3	0.1	-1579.9
6.84	217.6	-6850.9	0.1	-1554.8
6.97	221.7	-7052.7	0.1	-1526.1
7.09	225.9	-7250.7	0.1	-1496.8
7.22	229.6	-7423.5	0.1	-1470.3
7.34	233.8	-7614.2	0.1	-1440.0
7.47	237.5	-7780.3	0.1	-1412.6
7.59	241.6	-7963.4	0.1	-1381.3
7.71	245.3	-8122.7	0.1	-1353.0
7.84	249.5	-8297.9	0.1	-1320.7
7.96	257.4	-8468.8	0.1	-1287.6
8.09	271.2	-8617.1	0.1	-1256.9
8.21	286.7	-8779.4	0.1	-1220.3
8.34	300.4	-8919.7	0.1	-1186.1
8.46	315.9	-9072.6	0.1	-1145.8
8.58	329.6	-9204.0	0.1	-1108.2
8.71	345.1	-9346.5	0.1	-1064.0
8.83	360.5	-9483.1	0.1	-1017.8
8.96	374.3	-9599.3	0.1	-975.0
9.08	389.7	-9724.0	0.1	-925.0
9.21	403.5	-9829.3	0.1	-878.9
9.33	419.0	-9941.2	0.1	-825.0
9.46	432.7	-10034.7	0.1	-775.5
9.58	448.2	-10132.9	0.1	-717.8
9.70	463.6	-10223.4	0.1	-658.1
9.83	477.4	-10297.2	0.1	-603.4
9.95	492.8	-10372.5	0.1	-539.9
10.08	506.6	-10432.3	0.1	-481.8
10.20	522.0	-10491.5	0.1	-414.5
10.33	535.8	-10536.6	0.1	-353.0
10.45	551.3	-10578.7	0.1	-281.9
10.58	566.7	-10611.3	0.1	-208.7
10.70	580.5	-10632.2	0.1	-142.0
10.82	595.9	-10646.4	0.1	-65.1
10.95	609.7	-10650.4	0.1	5.0
11.07	625.1	-10645.0	0.1	85.8
11.20	638.9	-10631.2	0.1	159.3
11.32	654.3	-10605.2	0.1	243.9
11.45	669.8	-10568.0	0.1	330.5
11.57	683.6	-10525.2	0.1	409.2

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
11.70	699.0	-10465.9	0.1	499.6
11.82	712.8	-10403.1	0.1	581.7
11.94	728.2	-10320.8	0.1	675.9
12.07	742.0	-10237.1	0.1	761.4
12.19	757.4	-10130.9	0.1	859.4
12.32	772.9	-10011.6	0.1	959.5
12.44	786.7	-9894.4	0.1	1050.2
12.57	802.1	-9749.7	0.1	1154.0
12.69	815.9	-9609.5	0.1	1248.1
12.82	831.3	-9438.4	0.1	1355.8
12.94	845.1	-9274.4	0.1	1453.2
13.06	860.5	-9076.0	0.1	1564.7
13.19	876.0	-8862.9	0.1	1678.3
13.31	889.7	-8660.7	0.1	1780.9
13.44	905.2	-8418.8	0.1	1898.3
13.56	919.0	-8190.6	0.1	2004.3
13.69	934.4	-7919.0	0.1	2125.5
13.81	948.2	-7664.0	0.1	2234.9
13.93	963.6	-7361.7	0.1	2359.9
14.06	979.1	-7042.8	0.1	2486.9
14.18	992.8	-6745.1	0.1	2601.5
14.31	1008.3	-6394.1	0.1	2732.3
14.43	1022.0	-6067.5	0.1	2850.3
14.56	1037.5	-5683.4	0.1	2984.9
14.68	1051.3	-5327.0	0.1	3106.3
14.81	1066.7	-4908.8	0.1	3244.7
14.93	1082.2	-4472.3	0.1	3385.2
15.05	-1378.6	-4070.5	0.1	3396.9
15.18	-1385.9	-3632.9	0.1	3214.0
15.30	-1392.4	-3264.2	0.1	3050.5
15.43	-1399.7	-2872.4	0.1	2865.8
15.55	-1406.2	-2544.6	0.1	2700.7
15.68	-1413.5	-2199.1	0.1	2514.1
15.80	-1420.8	-1878.2	0.1	2326.5
15.93	-1427.3	-1613.8	0.0	2159.0
16.05	-1434.6	-1339.9	0.0	1969.6
16.17	-1441.1	-1117.5	0.0	1800.4
16.30	-1448.4	-891.1	0.0	1609.2
16.42	-1454.9	-711.0	0.0	1438.4
16.55	-1462.2	-532.5	0.0	1245.4
16.67	-1469.6	-379.5	0.0	1051.4
16.80	-1476.1	-265.0	0.0	878.1
16.92	-1483.4	-160.6	0.0	682.3
17.05	-1489.9	-89.5	0.0	507.4
17.17	-1497.2	-34.1	0.0	309.7
17.29	-1503.7	-6.8	0.0	133.2
17.42	-1510.2	0.0	0.0	0.0

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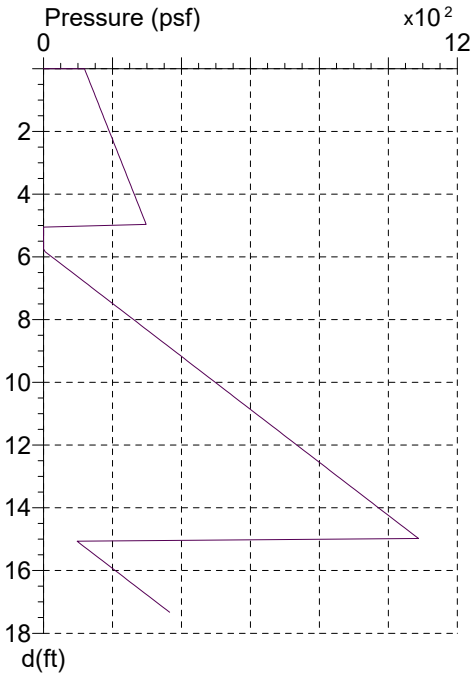
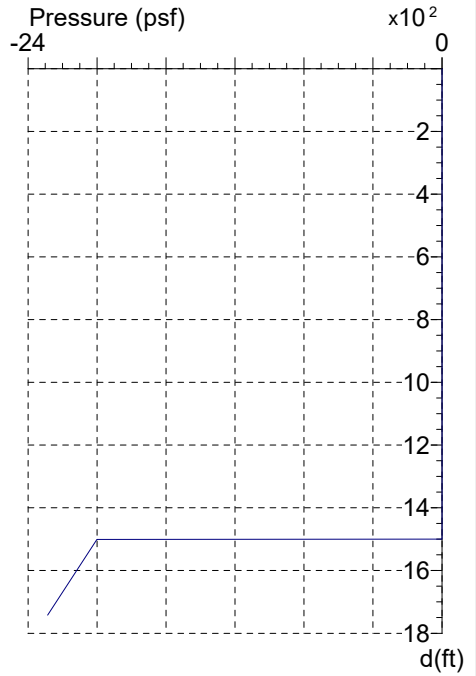
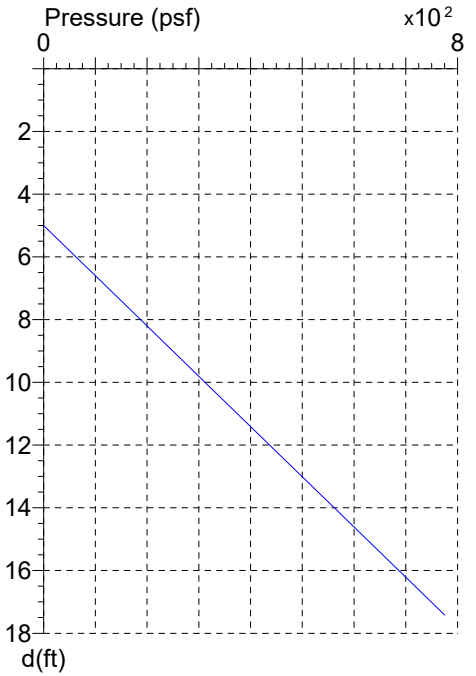
Site: FOS = 1.00

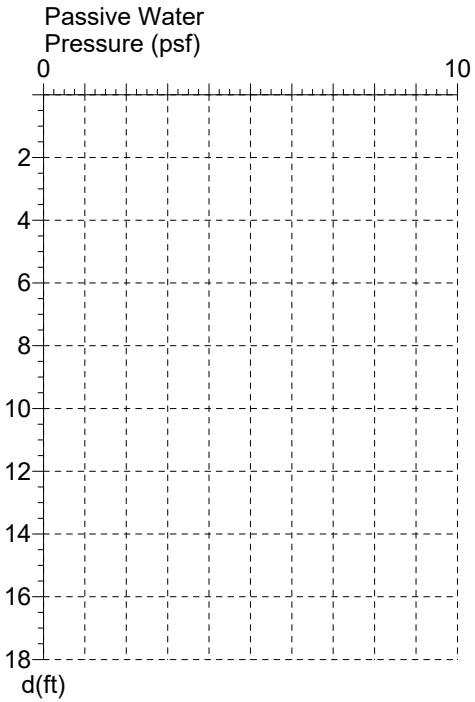
Page: 5
Date: 10.20.18

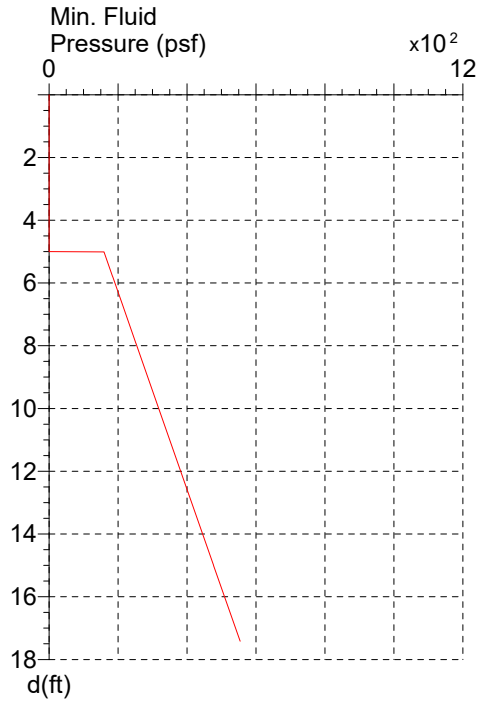
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

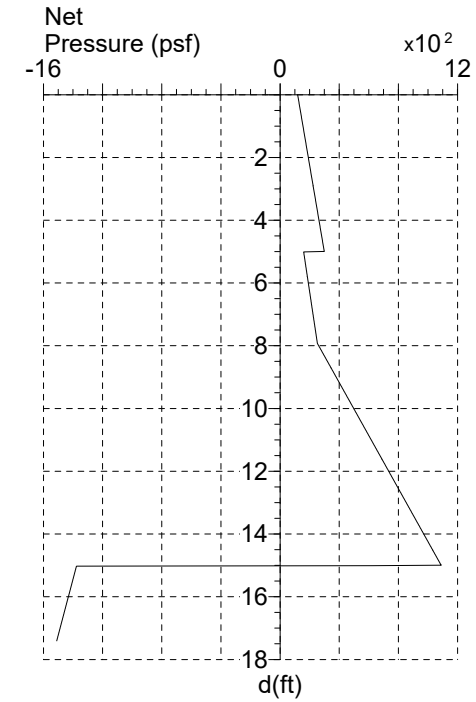












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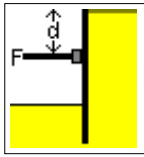
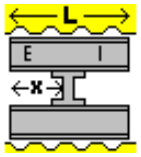
Client: MDOT Case 6
Site: FOS = 1.00

Page: 6
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 3.00 ft
F = 2947.7 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Design Report

1. Minimum fluid density is 31.8pcf. The Piling Handbook recommends 31.8pcf.

2. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

3. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

4. Maximum bending moment = 10650.4ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 5.12in³/ft (= M/f). Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

5. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

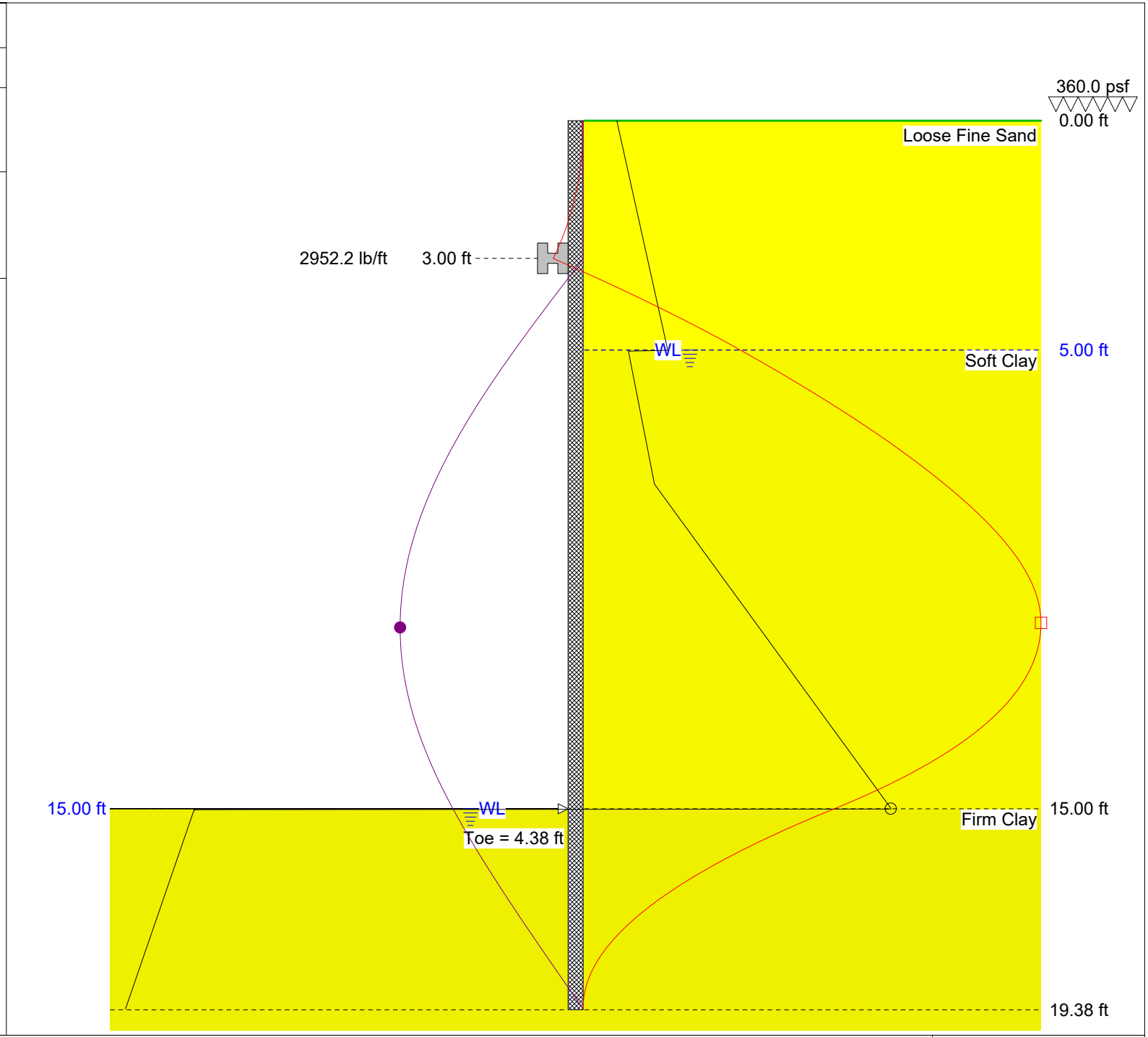
6. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: MDOT Case 6
Site: FOS = 1.50

Page: 1
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
1088.5 psf	15.00
10673.5 ftlb/ft	10.95
0.2 in	11.05



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Client: MDOT Case 6
Site: FOS = 1.50

Page: 2
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 15.00ft
Surcharge = 360.0psf

Depth Of Active Water = 5.00ft
Depth Of Passive Water = 15.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Loose Fine Sand	109.20	65.55	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
5.00	Soft Clay	118.37	56.00	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
15.00	Firm Clay	118.37	56.00	1000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	4.38	19.38

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	2952.2

Maxima

	Maximum	Depth (ft)
Pressure	1088.5 psf	15.00
Bending Moment	10673.5 ftlb/ft	10.95
Deflection	0.2 in	11.05
Shear Force	3459.5 lb/ft	15.01

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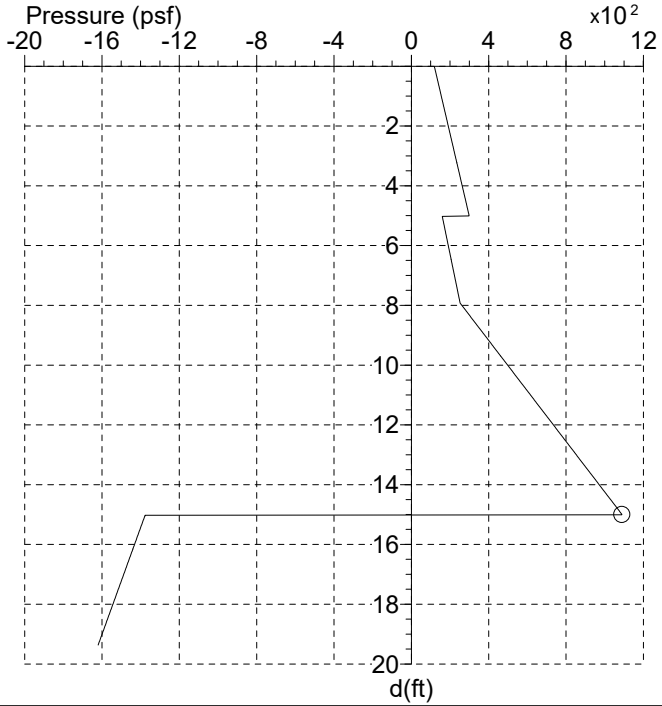
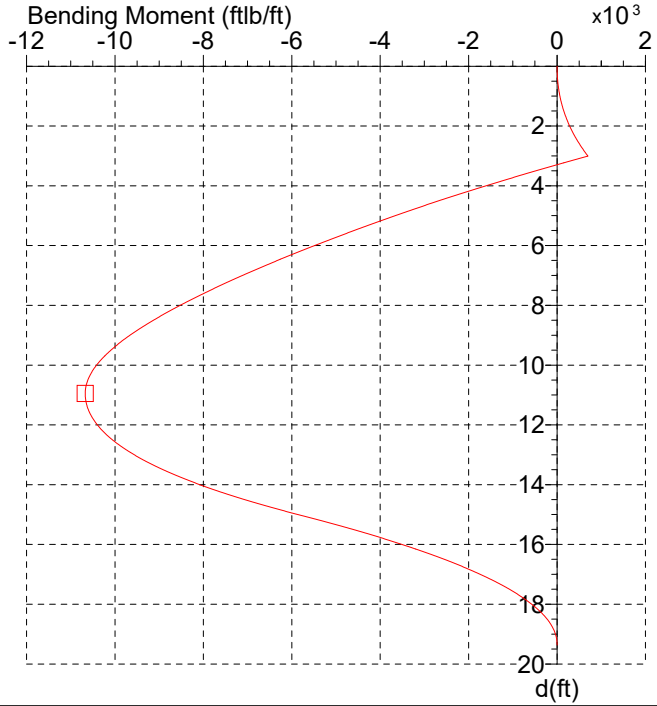
Client: MDOT Case 6
Site: FOS = 1.50

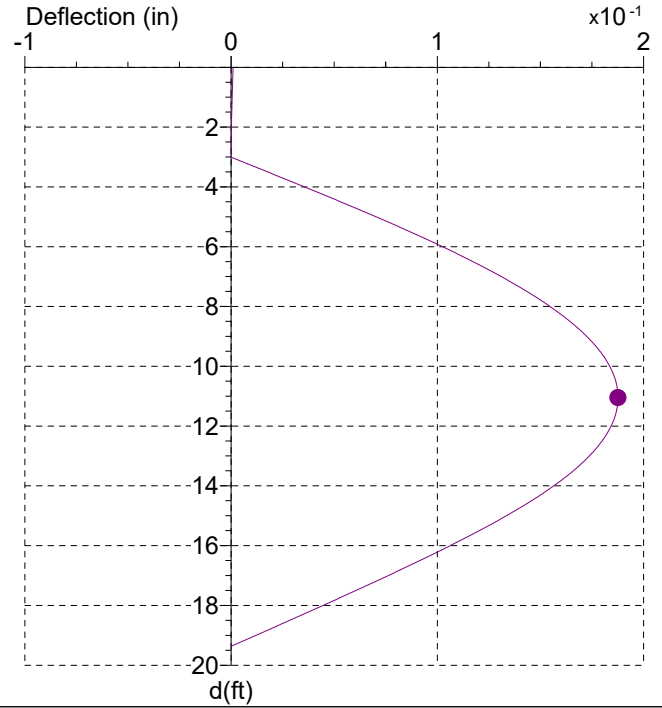
Page: 3
Date: 10.20.18

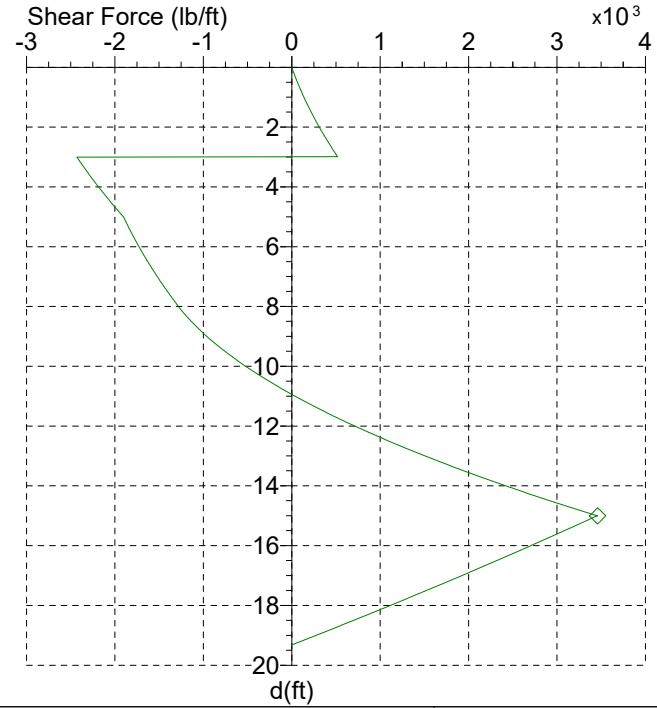
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 1088.5 psf	15.00
□ 10673.5 ftlb/ft	10.95
◇ 3459.5 lb/ft	15.01
● 0.2 in	11.05









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Site: FOS = 1.50

Page: 4
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	118.8	0.3	0.0	0.0
0.14	124.0	1.4	0.0	17.8
0.28	128.7	4.6	0.0	34.2
0.42	133.9	10.8	0.0	53.4
0.55	138.6	18.7	0.0	71.1
0.69	143.8	30.4	0.0	91.7
0.83	148.5	43.3	0.0	110.7
0.97	153.7	60.8	0.0	132.8
1.11	159.0	81.6	0.0	155.7
1.25	163.6	102.9	0.0	176.6
1.38	168.9	130.2	0.0	200.9
1.52	173.5	157.4	0.0	223.2
1.66	178.8	191.5	0.0	248.9
1.80	183.4	225.0	0.0	272.5
1.94	188.7	266.3	0.0	299.6
2.08	193.9	311.7	0.0	327.6
2.22	198.5	355.5	0.0	353.1
2.35	203.8	408.7	0.0	382.5
2.49	208.4	459.6	0.0	409.3
2.63	213.7	521.1	0.0	440.1
2.77	218.3	579.5	0.0	468.1
2.91	223.6	649.7	0.0	500.4
3.05	228.8	581.3	0.0	-2418.8
3.18	233.5	269.8	0.0	-2388.9
3.32	238.7	-75.9	0.0	-2354.5
3.46	243.4	-378.9	0.0	-2323.3
3.60	248.6	-715.0	0.0	-2287.5
3.74	253.3	-1009.3	0.0	-2255.1
3.88	258.5	-1335.3	0.0	-2217.8
4.02	263.7	-1655.9	0.0	-2179.8
4.15	268.4	-1936.1	0.0	-2145.4
4.29	273.6	-2246.1	0.0	-2105.9
4.43	278.3	-2516.7	0.1	-2070.2
4.57	283.5	-2815.6	0.1	-2029.4
4.71	288.2	-3076.2	0.1	-1992.4
4.85	293.4	-3363.6	0.1	-1950.1
4.98	298.7	-3644.9	0.1	-1907.0
5.12	163.0	-3890.3	0.1	-1883.9
5.26	167.6	-4163.1	0.1	-1859.8
5.40	171.7	-4402.7	0.1	-1837.9
5.54	176.3	-4668.7	0.1	-1812.6
5.68	180.4	-4902.1	0.1	-1789.5
5.82	185.1	-5161.0	0.1	-1762.9
5.95	189.7	-5416.0	0.1	-1735.6
6.09	193.8	-5639.3	0.1	-1710.8
6.23	198.4	-5886.6	0.1	-1682.2
6.37	202.6	-6102.9	0.1	-1656.3
6.51	207.2	-6342.2	0.1	-1626.5
6.65	211.3	-6551.2	0.1	-1599.4
6.78	215.9	-6782.2	0.1	-1568.3
6.92	220.5	-7008.5	0.1	-1536.5
7.06	224.7	-7205.8	0.1	-1507.7
7.20	229.3	-7423.3	0.1	-1474.7
7.34	233.4	-7612.5	0.1	-1444.8
7.48	238.0	-7820.7	0.1	-1410.5
7.61	242.1	-8001.6	0.1	-1379.4
7.75	246.8	-8200.2	0.1	-1343.8
7.89	251.4	-8393.6	0.2	-1307.6
8.03	264.4	-8561.0	0.2	-1274.3
8.17	281.6	-8744.0	0.2	-1234.4
8.31	296.9	-8901.7	0.2	-1196.9
8.45	314.1	-9073.2	0.2	-1152.4
8.58	329.4	-9220.1	0.2	-1110.7
8.72	346.6	-9378.7	0.2	-1061.4
8.86	363.9	-9529.9	0.2	-1009.6
9.00	379.1	-9657.9	0.2	-961.5
9.14	396.4	-9794.3	0.2	-905.0
9.28	411.7	-9908.5	0.2	-852.6
9.41	428.9	-10028.8	0.2	-791.4
9.55	444.2	-10128.1	0.2	-734.9
9.69	461.4	-10230.8	0.2	-668.9
9.83	478.6	-10323.9	0.2	-600.5
9.97	493.9	-10398.1	0.2	-537.5
10.11	511.1	-10471.6	0.2	-464.3
10.25	526.4	-10528.0	0.2	-397.2
10.38	543.6	-10580.8	0.2	-319.2
10.52	558.9	-10618.1	0.2	-247.9
10.66	576.1	-10648.9	0.2	-165.3
10.80	593.3	-10667.5	0.2	-80.1
10.94	608.6	-10673.5	0.2	-2.3
11.08	625.8	-10669.3	0.2	87.5
11.21	641.1	-10657.2	0.2	169.5
11.35	658.3	-10633.8	0.2	264.1
11.49	673.6	-10604.1	0.2	350.3
11.63	690.8	-10560.4	0.2	449.6
11.77	708.0	-10505.7	0.2	551.4
11.91	723.3	-10447.4	0.2	644.0
12.05	740.5	-10370.9	0.2	750.6
12.18	755.8	-10292.8	0.2	847.4
12.32	773.0	-10193.5	0.2	958.6
12.46	788.3	-10094.9	0.2	1059.6
12.60	805.5	-9971.8	0.2	1175.6
12.74	822.7	-9835.8	0.2	1294.1
12.88	838.0	-9703.8	0.2	1401.6
13.01	855.2	-9542.6	0.2	1524.8
13.15	870.5	-9387.7	0.2	1636.4
13.29	887.7	-9200.2	0.2	1764.3
13.43	903.0	-9021.6	0.2	1880.2
13.57	920.2	-8806.9	0.2	2012.8
13.71	937.5	-8577.3	0.2	2148.0
13.85	952.8	-8360.6	0.2	2270.3
13.98	970.0	-8102.4	0.2	2410.2
14.12	985.3	-7859.7	0.2	2536.6
14.26	1002.5	-7571.7	0.2	2681.2
14.40	1017.8	-7302.2	0.1	2811.9
14.54	1035.0	-6983.5	0.1	2961.3
14.68	1052.2	-6648.1	0.1	3113.1
14.81	1067.5	-6335.8	0.1	3250.2
14.95	1084.7	-5968.2	0.1	3406.8
15.09	-1380.7	-5630.9	0.1	3389.7
15.23	-1388.8	-5260.8	0.1	3282.2
15.37	-1396.0	-4941.9	0.1	3186.1
15.51	-1404.2	-4594.4	0.1	3077.4
15.65	-1412.3	-4259.0	0.1	2968.0
15.78	-1419.5	-3971.1	0.1	2870.3
15.92	-1427.7	-3658.6	0.1	2759.8
16.06	-1434.9	-3391.2	0.1	2661.0
16.20	-1443.0	-3102.1	0.1	2549.3
16.34	-1450.2	-2855.4	0.1	2449.4
16.48	-1458.4	-2589.7	0.1	2336.5
16.61	-1466.5	-2336.6	0.1	2223.0
16.75	-1473.7	-2122.1	0.1	2121.5
16.89	-1481.8	-1892.8	0.1	2006.8
17.03	-1489.1	-1699.7	0.1	1904.3
17.17	-1497.2	-1494.5	0.1	1788.4
17.31	-1504.4	-1322.9	0.1	1684.8
17.45	-1512.5	-1142.1	0.1	1567.7
17.58	-1520.7	-974.3	0.1	1449.9
17.72	-1527.9	-836.1	0.1	1344.8
17.86	-1536.0	-693.0	0.0	1225.8
18.00	-1543.2	-577.0	0.0	1119.6
18.14	-1551.4	-458.9	0.0	999.4
18.28	-1558.6	-365.1	0.0	892.1
18.41	-1566.7	-272.3	0.0	770.8
18.55	-1574.9	-192.9	0.0	648.9
18.69	-1582.1	-133.7	0.0	539.9
18.83	-1590.2	-80.0	0.0	416.8
18.97	-1597.4	-43.7	0.0	306.8
19.11	-1605.6	-15.9	0.0	182.5
19.25	-1612.8	-2.7	0.0	71.4
19.38	-1620.0	0.0	0.0	0.0

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SupportIT, v2.37

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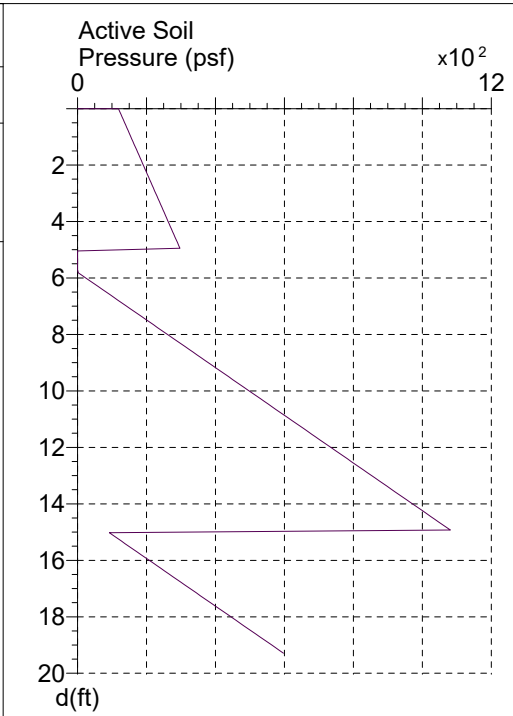
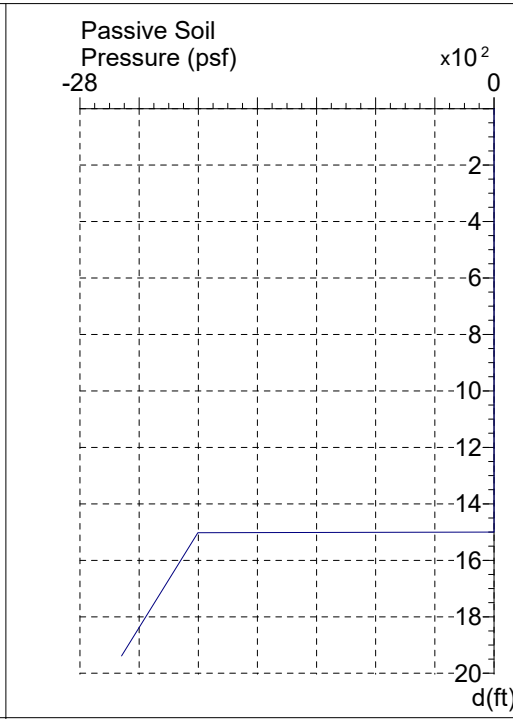
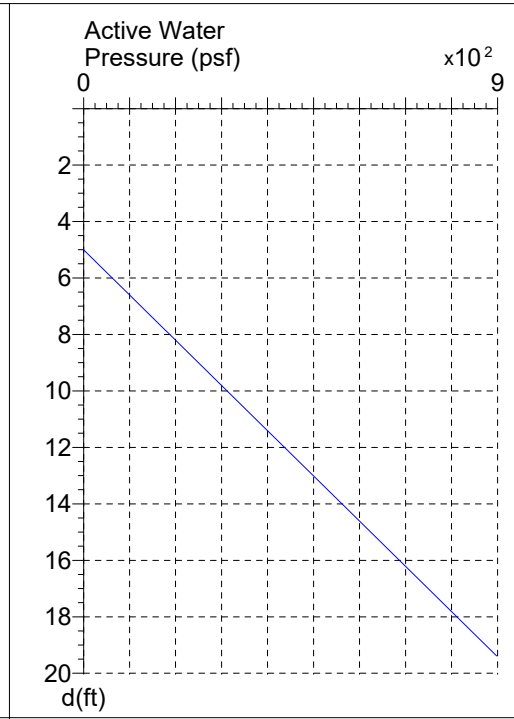
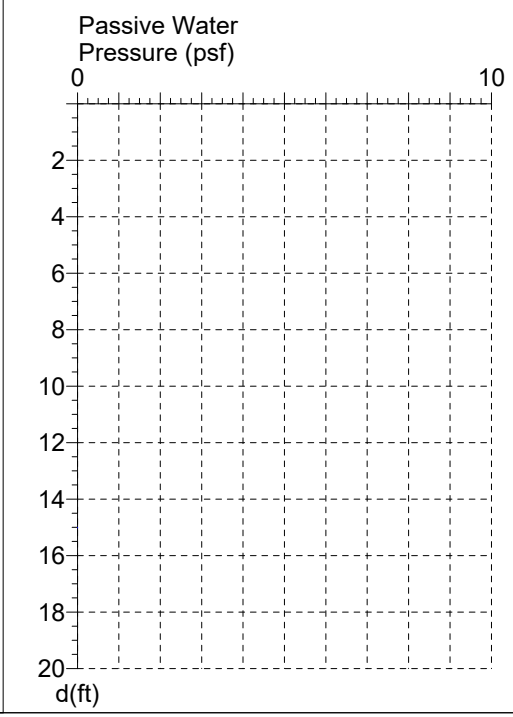
Page: 5
Date: 10.20.18

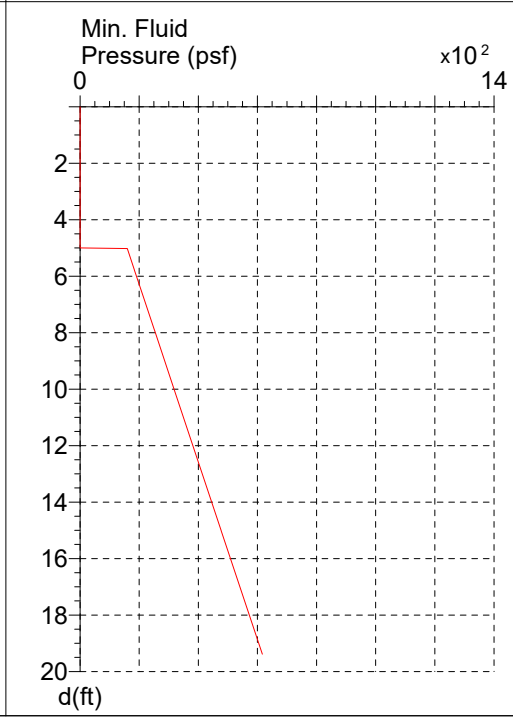
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

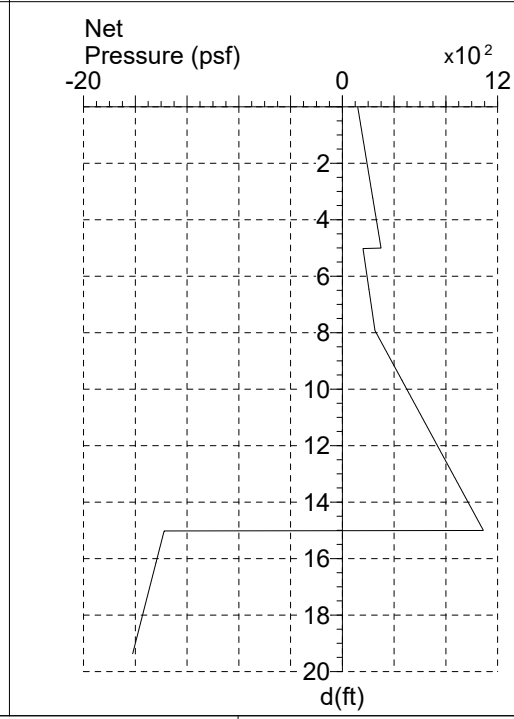












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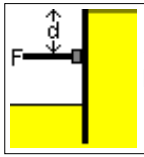
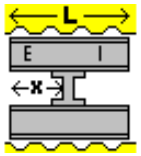
Site: FOS = 1.50

Page: 6
Date: 10.20.18

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 3.00 ft
F = 2952.2 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Design Report

1. Minimum fluid density is 31.8pcf. The Piling Handbook recommends 31.8pcf.

2. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

3. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

4. Maximum bending moment = 10673.5ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 5.13in³/ft (= M/f). Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

5. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

6. FOS = 1.51 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Appendix B.7 – SupportIT Output, Case 7

Case 7 – Braced Cofferdam TERS in Cohesionless Soil

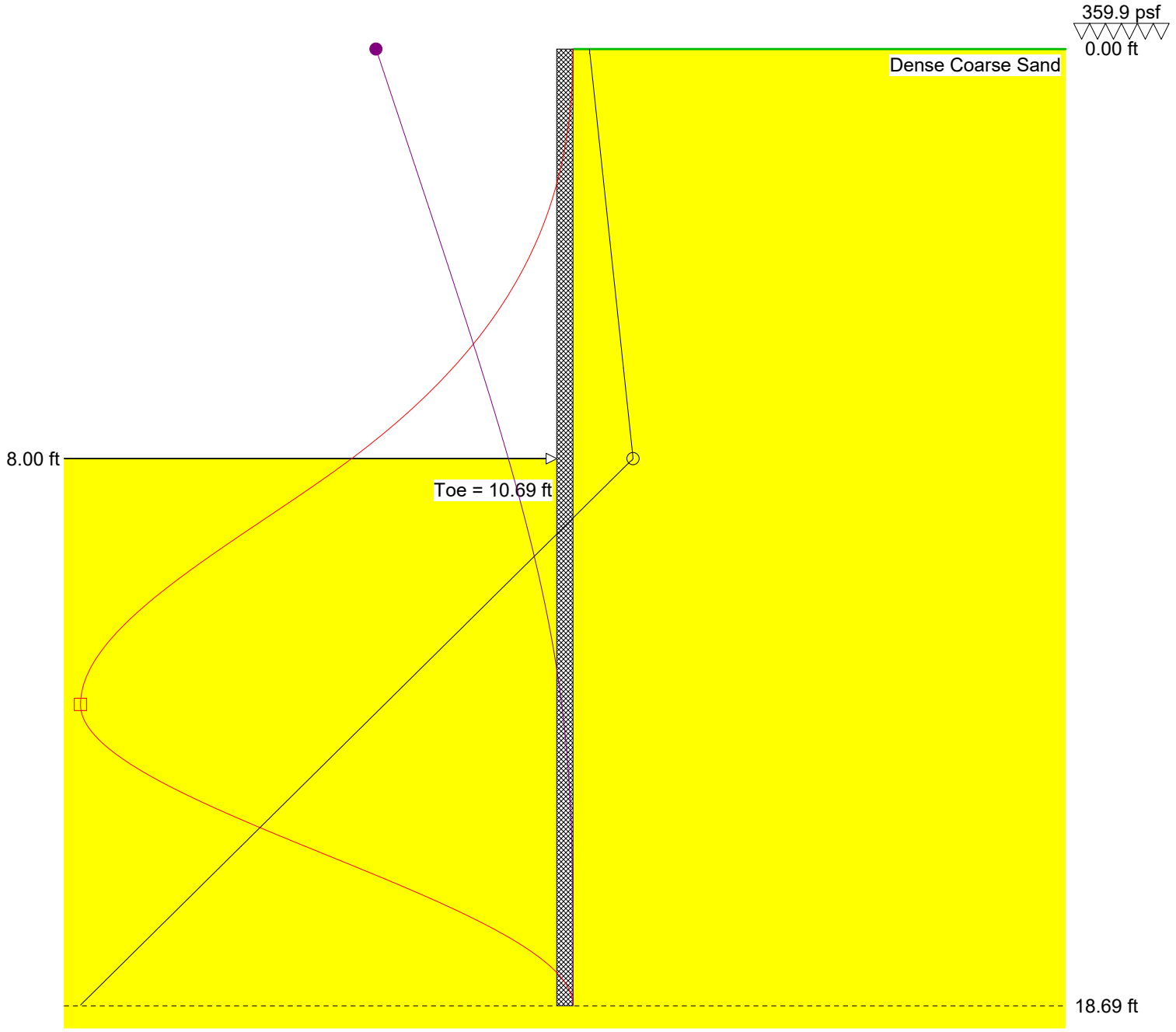
SupportIT output is included here for the four stages of construction.

Client: Case 7 - Stage 1 - 8 ft
Site: FOS = 1.0

Page: 1
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 409.2 psf	8.00
□ 14954.8 ftlb/ft	12.80
● 0.9 in	0.00



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Client: Case 7 - Stage 1 - 8 ft
Site: FOS = 1.0

Page: 2
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 8.00ft
Surcharge = 359.9psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	10.69	18.69

Maxima

	Maximum	Depth (ft)
Pressure	409.2 psf	8.00
Bending Moment	14954.8 ftlb/ft	12.80
Deflection	0.9 in	0.00
Shear Force	2321.3 lb/ft	9.16

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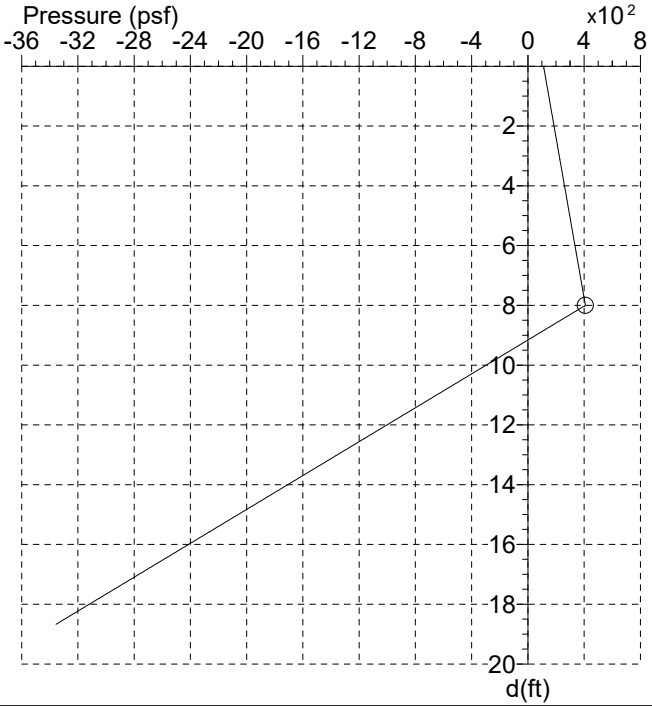
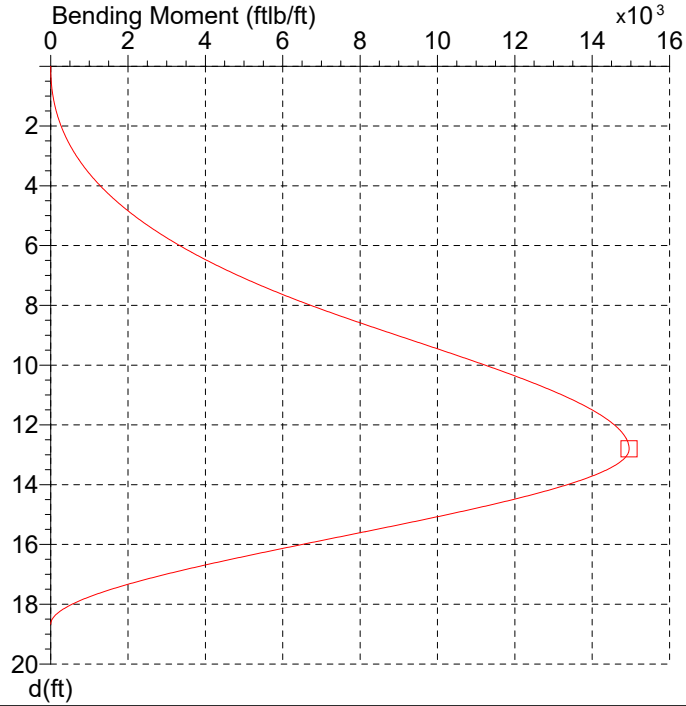
Site: FOS = 1.0

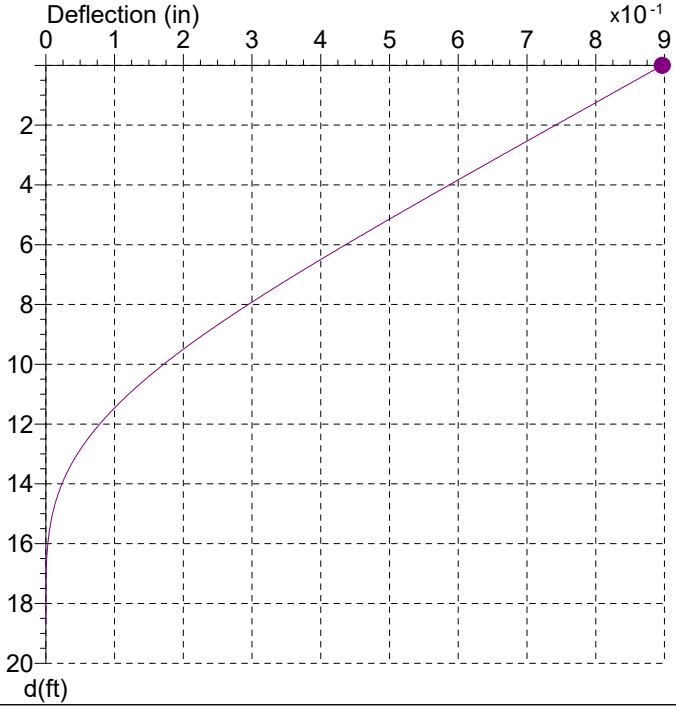
Page: 3
Date: 3.5.19

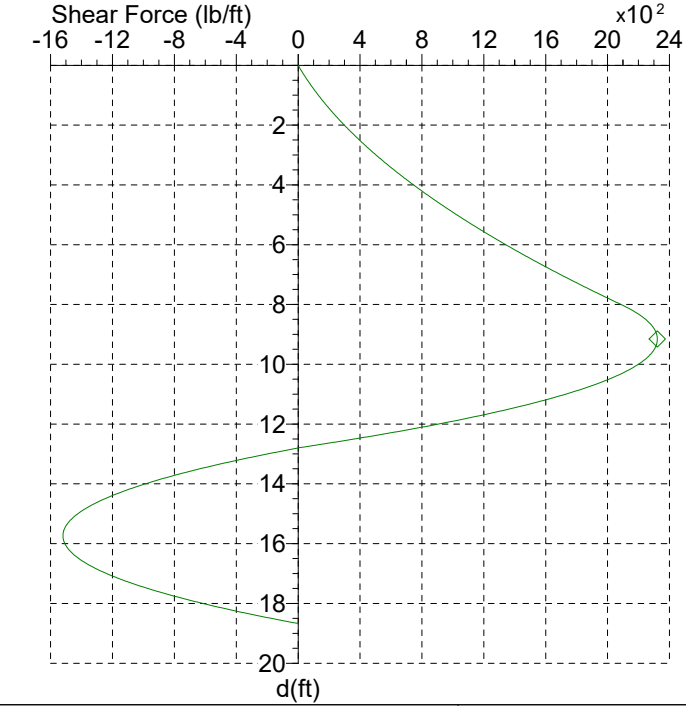
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
409.2 psf	8.00
14954.8 ftlb/ft	12.80
2321.3 lb/ft	9.16
0.9 in	0.00









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Site: FOS = 1.0

Page: 4
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.0	0.9	0.0
0.13	116.8	1.0	0.9	16.0
0.27	121.4	3.8	0.9	30.9
0.40	126.6	9.2	0.9	48.3
0.53	131.3	16.1	0.9	64.5
0.67	136.5	26.2	0.8	83.3
0.80	141.1	37.5	0.8	100.6
0.93	146.3	52.8	0.8	120.8
1.07	151.6	71.0	0.8	141.7
1.20	156.2	89.7	0.8	161.0
1.33	161.4	113.5	0.8	183.3
1.47	166.0	137.4	0.8	203.7
1.60	171.3	167.4	0.8	227.4
1.74	175.9	196.8	0.8	249.1
1.87	181.1	233.2	0.8	274.2
2.00	186.3	273.1	0.7	300.0
2.14	190.9	311.7	0.7	323.5
2.27	196.2	358.6	0.7	350.7
2.40	200.8	403.5	0.7	375.5
2.54	206.0	457.8	0.7	404.1
2.67	210.6	509.4	0.7	430.1
2.80	215.9	571.4	0.7	460.0
2.94	221.1	637.6	0.7	490.7
3.07	225.7	700.1	0.7	518.6
3.20	230.9	774.6	0.6	550.7
3.34	235.6	844.6	0.6	579.8
3.47	240.8	927.7	0.6	613.2
3.60	245.4	1005.5	0.6	643.6
3.74	250.6	1097.7	0.6	678.4
3.87	255.8	1194.7	0.6	714.0
4.00	260.5	1285.2	0.6	746.2
4.14	265.7	1391.8	0.6	783.1
4.27	270.3	1490.9	0.6	816.6
4.40	275.5	1607.5	0.6	854.9
4.54	280.2	1715.6	0.5	889.6
4.67	285.4	1842.4	0.5	929.3
4.81	290.6	1974.8	0.5	969.7
4.94	295.2	2097.3	0.5	1006.3
5.07	300.4	2240.6	0.5	1048.1
5.21	305.1	2372.9	0.5	1085.9
5.34	310.3	2527.3	0.5	1129.1
5.47	314.9	2669.8	0.5	1168.1
5.61	320.1	2835.8	0.5	1212.6
5.74	325.3	3008.2	0.5	1258.0
5.87	330.0	3166.7	0.4	1298.8
6.01	335.2	3351.2	0.4	1345.5
6.14	339.8	3520.7	0.4	1387.7
6.27	345.0	3717.6	0.4	1435.7
6.41	349.7	3898.4	0.4	1479.1
6.54	354.9	4108.3	0.4	1528.5
6.67	360.1	4325.1	0.4	1578.7
6.81	364.7	4523.7	0.4	1623.9
6.94	370.0	4753.9	0.4	1675.5
7.07	374.6	4964.7	0.4	1721.9
7.21	379.8	5208.7	0.3	1774.9
7.34	384.4	5431.8	0.3	1822.6
7.47	389.7	5690.0	0.3	1876.9
7.61	394.9	5955.8	0.3	1932.0
7.74	399.5	6198.6	0.3	1981.5
7.88	404.7	6479.1	0.3	2038.0
8.01	409.2	6735.1	0.3	2088.7
8.14	358.2	7030.5	0.3	2142.1
8.28	314.2	7299.0	0.3	2183.7
8.41	264.8	7606.9	0.3	2223.9
8.54	215.3	7919.9	0.3	2257.2
8.68	171.4	8201.8	0.3	2281.0
8.81	121.9	8522.0	0.2	2301.1
8.94	78.0	8808.7	0.2	2313.3
9.08	28.5	9132.6	0.2	2320.3
9.21	-15.4	9421.0	0.2	2321.0
9.34	-64.9	9745.3	0.2	2315.7
9.48	-114.3	10068.3	0.2	2303.6
9.61	-158.3	10353.8	0.2	2286.9
9.74	-207.7	10672.0	0.2	2261.7
9.88	-251.7	10951.6	0.2	2233.4
10.01	-301.1	11261.5	0.2	2195.0
10.14	-345.1	11532.1	0.2	2155.1
10.28	-394.5	11830.3	0.2	2103.7
10.41	-444.0	12120.9	0.1	2045.3
10.55	-487.9	12372.0	0.1	1987.6
10.68	-537.4	12645.5	0.1	1916.1
10.81	-581.3	12879.9	0.1	1846.8
10.95	-630.8	13132.9	0.1	1762.2
11.08	-674.7	13347.5	0.1	1681.2
11.21	-724.2	13576.6	0.1	1583.6
11.35	-773.6	13791.5	0.1	1479.0
11.48	-817.6	13970.0	0.1	1380.2
11.61	-867.0	14155.8	0.1	1262.6
11.75	-911.0	14306.7	0.1	1152.1
11.88	-960.4	14459.7	0.1	1021.4
12.01	-1004.4	14580.1	0.1	899.3
12.15	-1053.8	14697.0	0.1	755.5
12.28	-1103.3	14793.3	0.1	604.7
12.41	-1147.2	14860.9	0.1	464.9
12.55	-1196.7	14915.8	0.1	301.0
12.68	-1240.6	14945.0	0.1	149.5
12.81	-1290.1	14954.8	0.1	-16.1
12.95	-1334.0	14932.4	0.0	-141.7
13.08	-1383.5	14861.2	0.0	-276.4
13.21	-1432.9	14743.6	0.0	-404.3
13.35	-1476.9	14602.1	0.0	-512.1
13.48	-1526.3	14403.5	0.0	-626.8
13.62	-1570.3	14193.9	0.0	-723.0
13.75	-1619.7	13923.0	0.0	-824.6
13.88	-1663.7	13653.1	0.0	-909.2
14.02	-1713.1	13318.7	0.0	-997.7
14.15	-1762.6	12954.3	0.0	-1079.3
14.28	-1806.5	12607.0	0.0	-1146.1
14.42	-1856.0	12192.3	0.0	-1214.6
14.55	-1899.9	11804.2	0.0	-1269.7
14.68	-1949.4	11348.0	0.0	-1325.1
14.82	-1993.3	10927.0	0.0	-1368.6
14.95	-2042.8	10438.0	0.0	-1411.0
15.08	-2092.2	9935.1	0.0	-1446.4
15.22	-2136.2	9478.5	0.0	-1472.0
15.35	-2185.6	8956.2	0.0	-1494.4
15.48	-2229.6	8486.2	0.0	-1508.4
15.62	-2279.0	7953.1	0.0	-1517.7
15.75	-2323.0	7477.4	0.0	-1520.0
15.88	-2372.4	6942.3	0.0	-1516.2
16.02	-2421.9	6409.6	0.0	-1505.4
16.15	-2465.8	5940.1	0.0	-1490.0
16.28	-2515.3	5418.7	0.0	-1466.1
16.42	-2559.2	4963.2	0.0	-1439.1
16.55	-2608.7	4461.8	0.0	-1402.1
16.69	-2652.6	4027.8	0.0	-1363.5
16.82	-2702.1	3555.1	0.0	-1313.4
16.95	-2751.5	3101.1	0.0	-1256.4
17.09	-2795.5	2715.2	0.0	-1200.0
17.22	-2844.9	2303.3	0.0	-1129.9
17.35	-2888.9	1958.6	0.0	-1061.8
17.49	-2938.3	1597.4	0.0	-978.6
17.62	-2982.3	1301.7	0.0	-898.9
17.75	-3031.7	999.9	0.0	-802.6
17.89	-3081.2	733.1	0.0	-699.4
18.02	-3125.1	527.2	0.0	-601.9
18.15	-3174.6	333.2	0.0	-485.6
18.29	-3218.5	195.9	0.0	-376.5
18.42	-3268.0	83.4	0.0	-247.1
18.55	-3311.9	22.4	0.0	-126.3
18.69	-3355.9	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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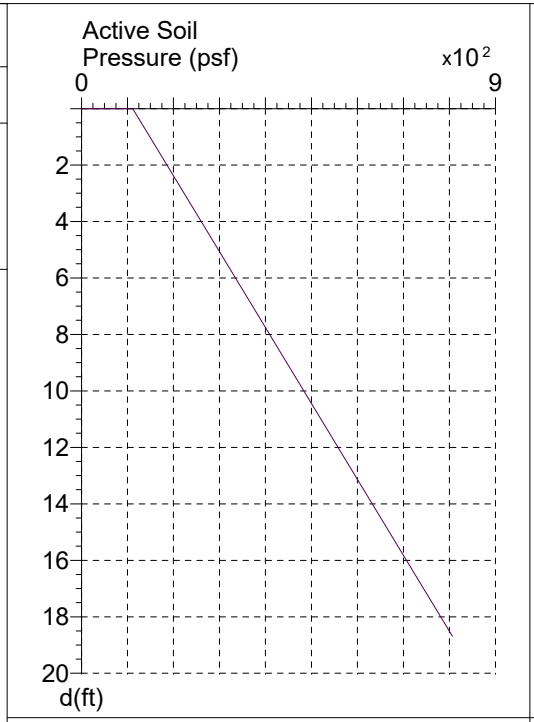
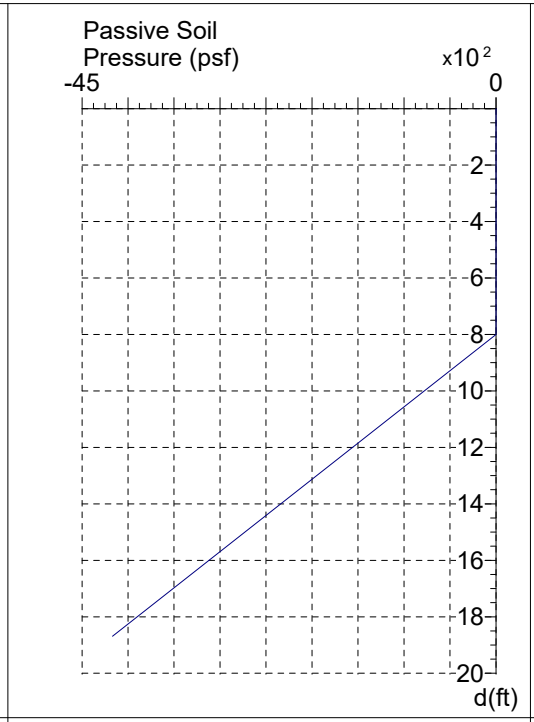
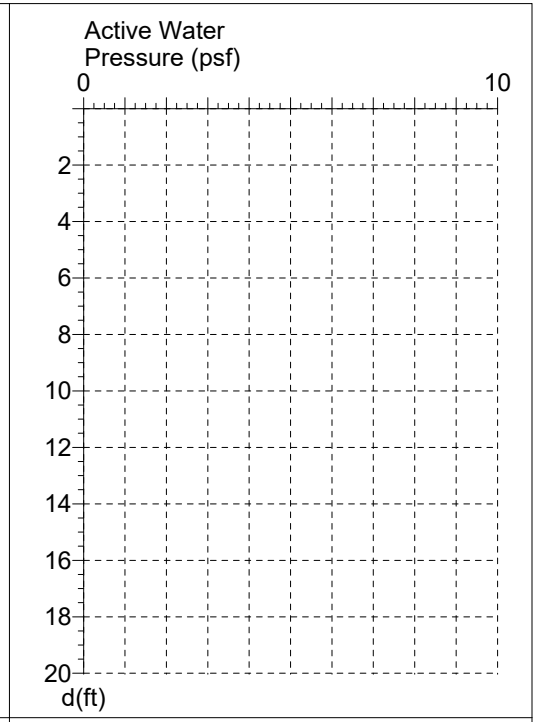
Client: Case 7 - Stage 1 - 8 ft
Site: FOS = 1.0

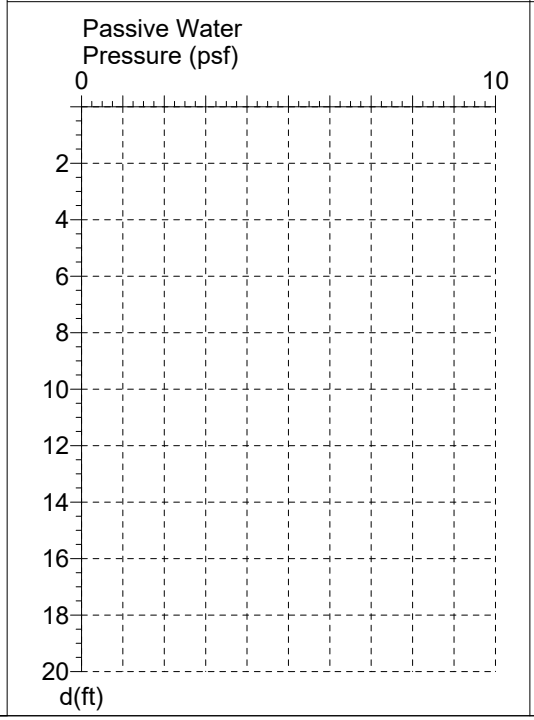
Page: 5
Date: 3.5.19

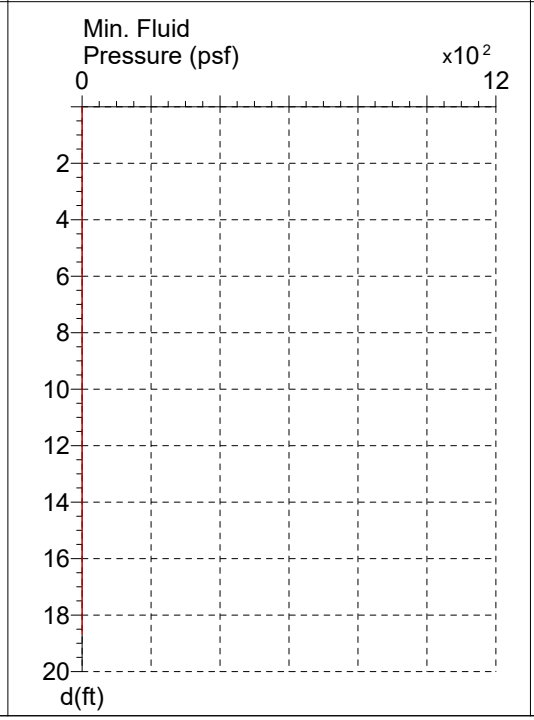
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

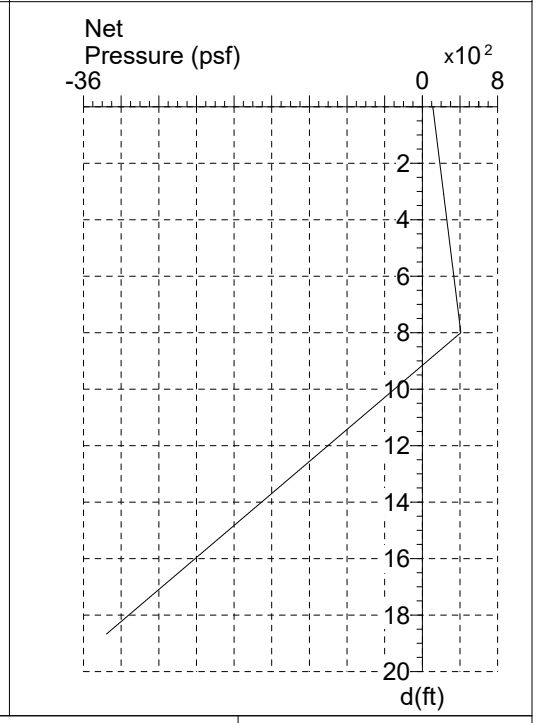












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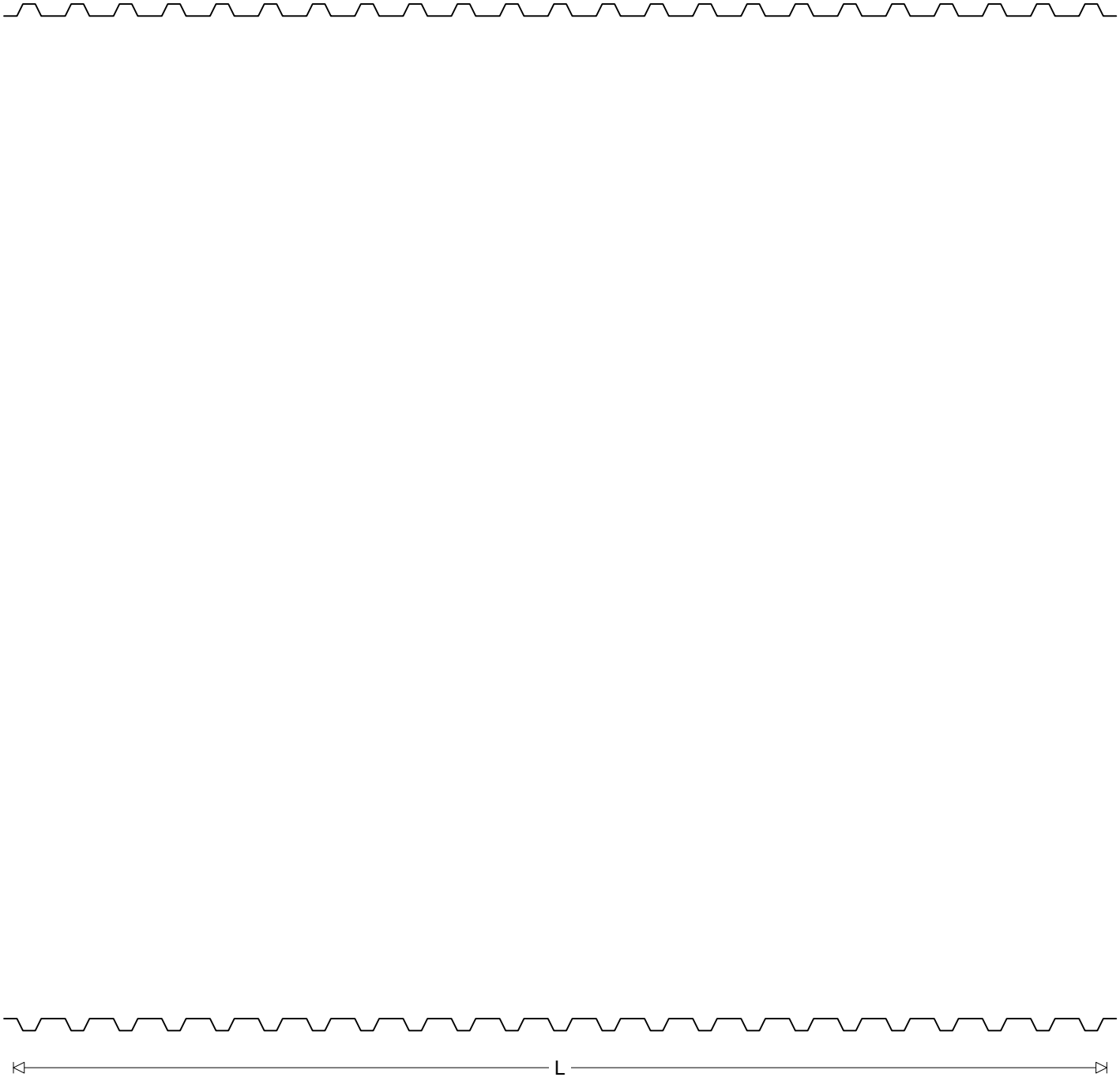
Page: 6
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever



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Client: Case 7 - Stage 1 - 8 ft
Site: FOS = 1.0

Page: 7
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Maximum bending moment = 14954.8ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 7.19in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

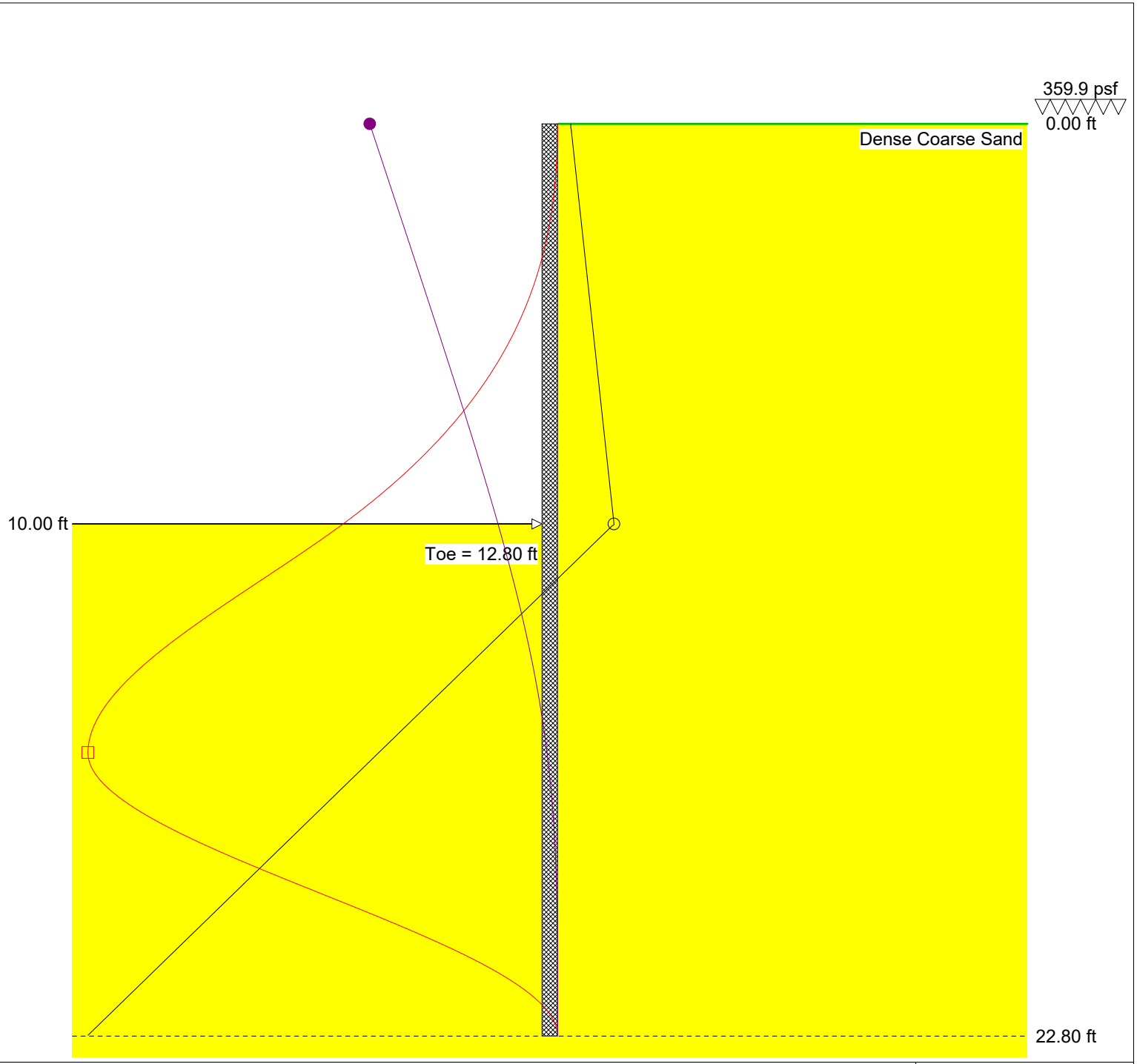
2. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 7 - Stage 1 - 10 ft
Site: FOS = 1.0

Page: 1
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
483.3 psf	10.00
25708.0 ftlb/ft	15.71
2.3 in	0.00



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Client: Case 7 - Stage 1 - 10 ft
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Page: 2
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 359.9psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	12.80	22.80

Maxima

	Maximum	Depth (ft)
Pressure	483.3 psf	10.00
Bending Moment	25708.0 ftlb/ft	15.71
Deflection	2.3 in	0.00
Shear Force	3308.4 lb/ft	11.36

MDOT Sheetpile Manual

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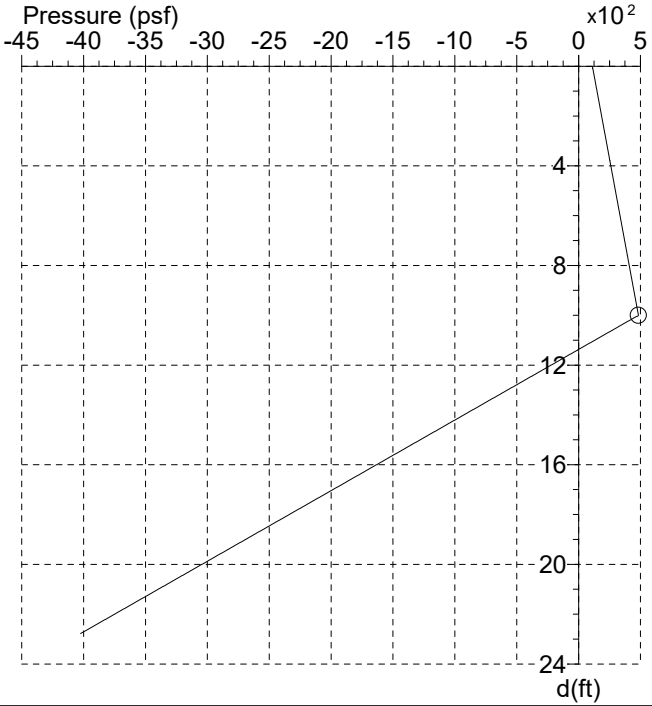
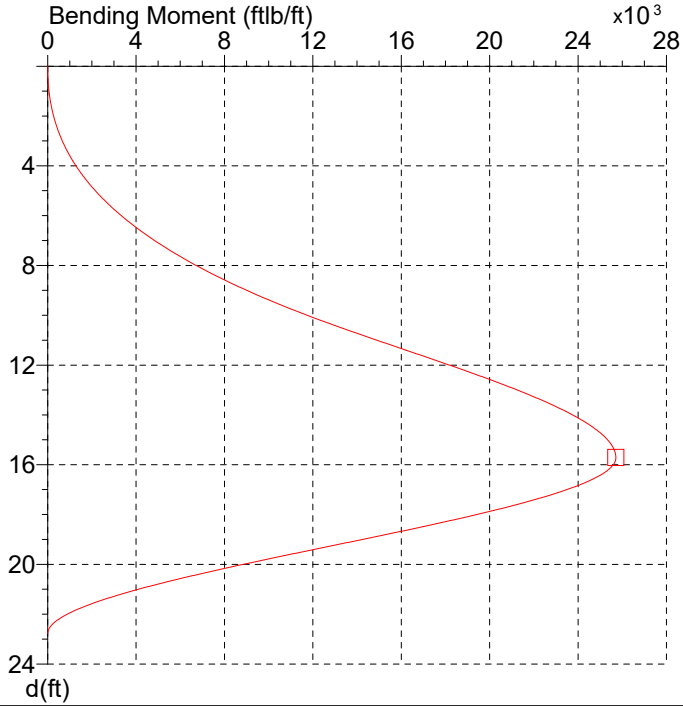
Client: Case 7 - Stage 1 - 10 ft
Site: FOS = 1.0

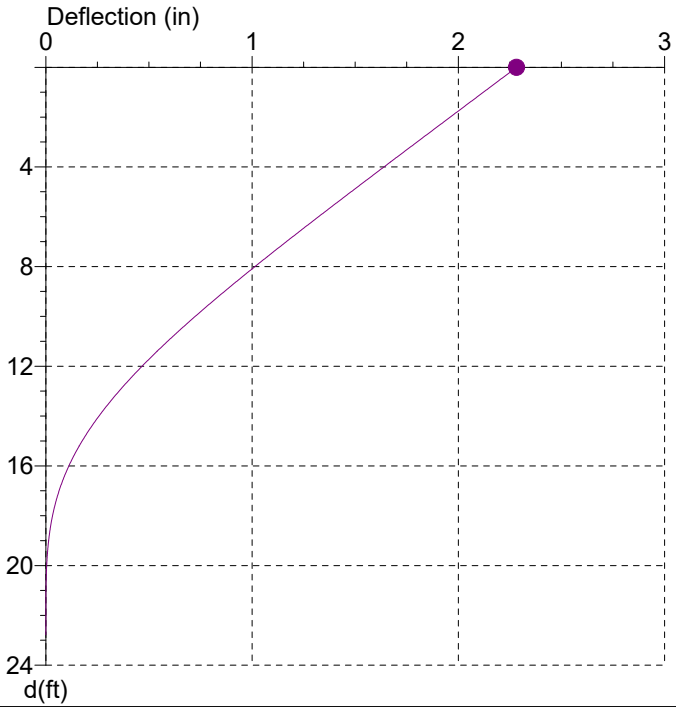
Page: 3
Date: 3.5.19

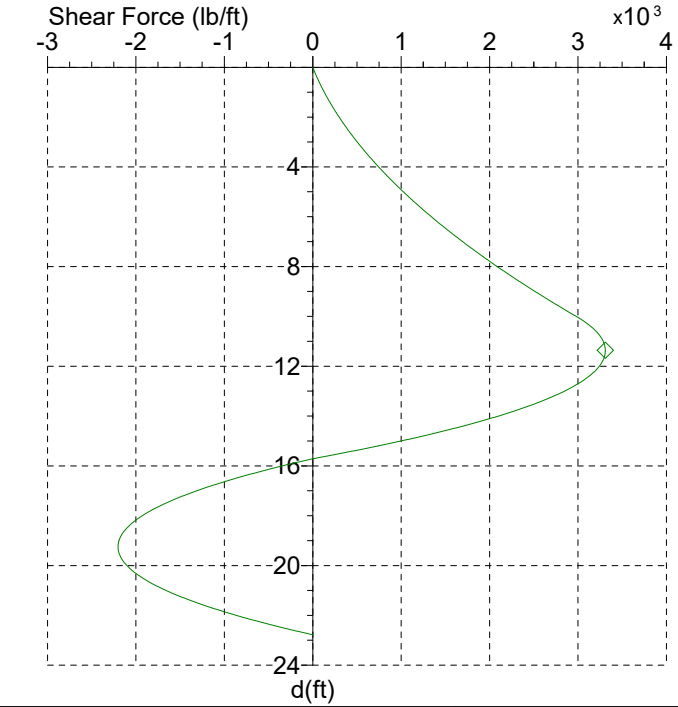
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
483.3 psf	10.00
25708.0 ftlb/ft	15.71
3308.4 lb/ft	11.36
2.3 in	0.00









MDOT Sheetpile Manual

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Client: Case 7 - Stage 1 - 10 ft
Site: FOS = 1.0

Page: 4
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.0	2.3	0.0
0.16	117.9	1.5	2.3	19.6
0.33	123.6	5.7	2.2	38.0
0.49	130.0	13.8	2.2	59.8
0.65	135.6	24.2	2.2	80.0
0.81	142.0	39.6	2.2	103.9
0.98	147.6	56.8	2.1	125.9
1.14	154.0	80.2	2.1	151.8
1.30	160.3	108.2	2.1	178.7
1.47	166.0	136.9	2.0	203.6
1.63	172.4	173.8	2.0	232.6
1.79	178.0	210.8	2.0	259.3
1.95	184.4	257.4	2.0	290.4
2.12	190.0	303.3	1.9	318.9
2.28	196.4	360.2	1.9	352.0
2.44	202.7	422.8	1.9	386.2
2.61	208.4	483.4	1.9	417.5
2.77	214.8	557.3	1.8	453.8
2.93	220.4	628.3	1.8	486.9
3.09	226.8	714.2	1.8	525.2
3.26	232.4	796.2	1.8	560.2
3.42	238.8	894.8	1.7	600.6
3.58	245.2	1000.3	1.7	642.0
3.75	250.8	1100.1	1.7	679.8
3.91	257.2	1219.4	1.7	723.3
4.07	262.8	1331.6	1.6	762.9
4.23	269.2	1465.2	1.6	808.5
4.40	274.8	1590.5	1.6	849.9
4.56	281.2	1739.0	1.6	897.5
4.72	287.6	1895.8	1.5	946.2
4.89	293.2	2042.1	1.5	990.4
5.05	299.6	2214.9	1.5	1041.2
5.21	305.2	2375.8	1.4	1087.3
5.37	311.6	2565.2	1.4	1140.1
5.54	317.2	2741.2	1.4	1187.9
5.70	323.6	2947.9	1.4	1242.8
5.86	330.0	3164.1	1.3	1298.8
6.02	335.6	3364.4	1.3	1349.5
6.19	342.0	3598.9	1.3	1407.5
6.35	347.6	3815.7	1.3	1460.0
6.51	354.0	4069.3	1.2	1520.0
6.68	359.6	4303.3	1.2	1574.4
6.84	366.0	4576.5	1.2	1636.5
7.00	372.4	4860.4	1.2	1699.7
7.16	378.0	5121.8	1.1	1756.8
7.33	384.4	5426.4	1.1	1822.1
7.49	390.0	5706.5	1.1	1881.0
7.65	396.4	6032.4	1.1	1948.4
7.82	402.0	6331.8	1.0	2009.1
7.98	408.4	6679.7	1.0	2078.5
8.14	414.8	7039.5	1.0	2149.0
8.30	420.4	7369.5	1.0	2212.6
8.47	426.8	7752.3	0.9	2285.1
8.63	432.4	8103.0	0.9	2350.5
8.79	438.8	8509.5	0.9	2425.1
8.96	444.4	8881.6	0.9	2492.3
9.12	450.8	9312.4	0.8	2568.9
9.28	457.2	9756.4	0.8	2646.6
9.44	462.8	10162.3	0.8	2716.7
9.61	469.2	10631.6	0.8	2796.4
9.77	474.8	11060.3	0.8	2868.3
9.93	481.2	11555.7	0.7	2950.1
10.10	452.7	12007.8	0.7	3022.1
10.26	392.4	12528.8	0.7	3093.8
10.42	332.0	13061.2	0.7	3155.2
10.58	278.4	13542.7	0.6	3201.1
10.75	218.1	14091.9	0.6	3243.0
10.91	164.5	14585.6	0.6	3271.6
11.07	104.2	15145.4	0.6	3294.0
11.24	50.5	15645.6	0.6	3305.3
11.40	-9.8	16209.7	0.5	3308.3
11.56	-70.1	16773.6	0.5	3302.1
11.72	-123.7	17273.3	0.5	3287.9
11.89	-184.0	17832.2	0.5	3262.1
12.05	-237.7	18324.8	0.5	3230.6
12.21	-298.0	18872.5	0.4	3185.4
12.38	-351.6	19352.2	0.4	3136.5
12.54	-411.9	19882.4	0.4	3071.8
12.70	-472.2	20400.7	0.4	2996.8
12.86	-525.9	20850.1	0.4	2921.5
13.03	-586.2	21341.4	0.4	2827.0
13.19	-639.8	21763.9	0.3	2734.3
13.35	-700.1	22221.7	0.3	2620.3
13.52	-753.7	22611.8	0.3	2510.4
13.68	-814.1	23029.9	0.3	2376.9
13.84	-874.4	23424.5	0.3	2233.1
14.00	-928.0	23754.1	0.3	2096.7
14.17	-988.3	24099.5	0.2	1933.4
14.33	-1041.9	24382.5	0.2	1779.7
14.49	-1102.3	24672.3	0.2	1596.9
14.66	-1155.9	24903.1	0.2	1425.9
14.82	-1216.2	25131.1	0.2	1223.7
14.98	-1276.5	25323.9	0.2	1011.1
15.14	-1330.1	25464.2	0.2	813.6
15.31	-1390.5	25585.5	0.2	581.6
15.47	-1444.1	25659.5	0.1	366.7
15.63	-1504.4	25703.1	0.1	115.2
15.79	-1558.0	25701.3	0.1	-93.7
15.96	-1618.3	25623.0	0.1	-297.1
16.12	-1678.6	25460.4	0.1	-490.2
16.28	-1732.3	25248.8	0.1	-653.2
16.45	-1792.6	24939.0	0.1	-826.8
16.61	-1846.2	24603.5	0.1	-972.5
16.77	-1906.5	24162.2	0.1	-1126.6
16.93	-1960.1	23716.6	0.1	-1254.9
17.10	-2020.5	23159.3	0.1	-1389.6
17.26	-2080.8	22546.9	0.1	-1513.9
17.42	-2134.4	21959.9	0.0	-1615.8
17.59	-2194.7	21255.3	0.0	-1720.6
17.75	-2248.3	20593.3	0.0	-1805.2
17.91	-2308.7	19812.2	0.0	-1890.5
18.07	-2362.3	19089.0	0.0	-1957.8
18.24	-2422.6	18247.0	0.0	-2023.7
18.40	-2482.9	17378.9	0.0	-2079.2
18.56	-2536.5	16589.1	0.0	-2120.0
18.73	-2596.9	15683.9	0.0	-2156.1
18.89	-2650.5	14868.0	0.0	-2179.5
19.05	-2710.8	13941.3	0.0	-2196.1
19.21	-2764.4	13113.1	0.0	-2202.2
19.38	-2824.7	12180.5	0.0	-2199.4
19.54	-2885.1	11250.9	0.0	-2186.2
19.70	-2938.7	10430.9	0.0	-2165.8
19.87	-2999.0	9519.3	0.0	-2133.2
20.03	-3052.6	8722.0	0.0	-2095.5
20.19	-3112.9	7843.9	0.0	-2043.3
20.35	-3166.6	7083.3	0.0	-1988.3
20.52	-3226.9	6254.2	0.0	-1916.7
20.68	-3287.2	5457.3	0.0	-1834.8
20.84	-3340.8	4779.7	0.0	-1753.3
21.01	-3401.1	4055.7	0.0	-1651.9
21.17	-3454.8	3449.8	0.0	-1553.1
21.33	-3515.1	2814.3	0.0	-1432.2
21.49	-3568.7	2293.9	0.0	-1316.0
21.66	-3629.0	1762.5	0.0	-1175.7
21.82	-3689.3	1292.6	0.0	-1025.0
21.98	-3742.9	929.9	0.0	-882.4
22.15	-3803.3	587.8	0.0	-712.2
22.31	-3856.9	345.7	0.0	-552.3
22.47	-3917.2	147.1	0.0	-362.6
22.63	-3970.8	39.5	0.0	-185.4
22.80	-4024.4	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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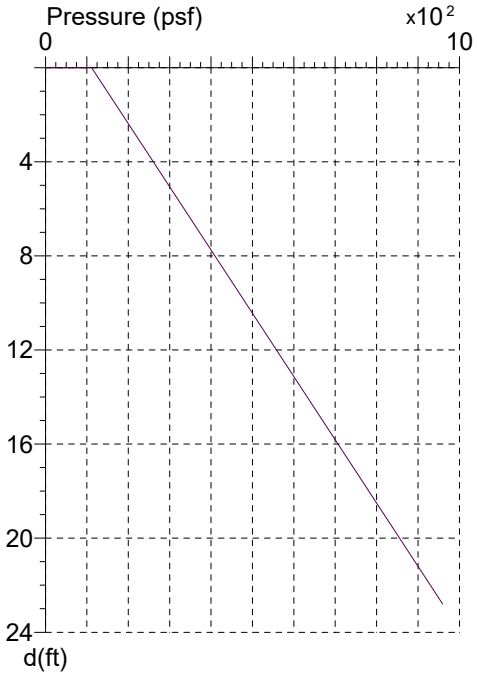
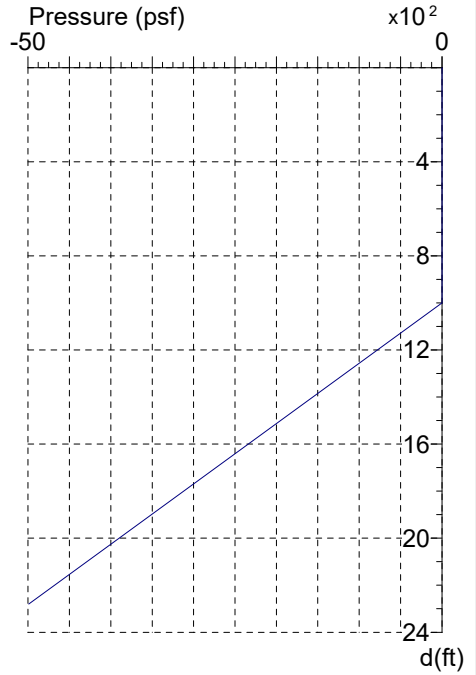
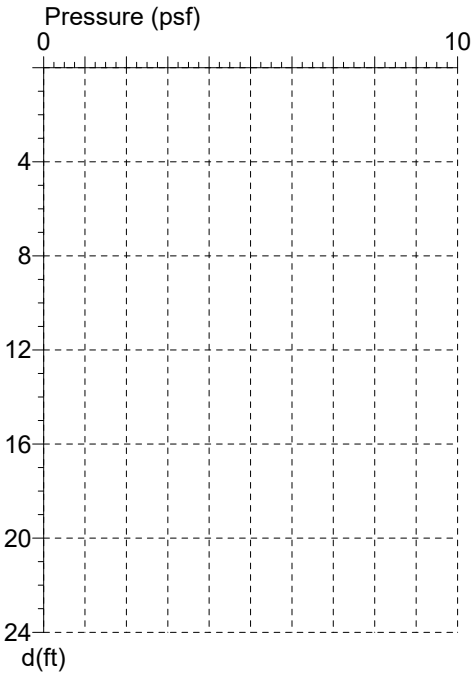
Client: Case 7 - Stage 1 - 10 ft
Site: FOS = 1.0

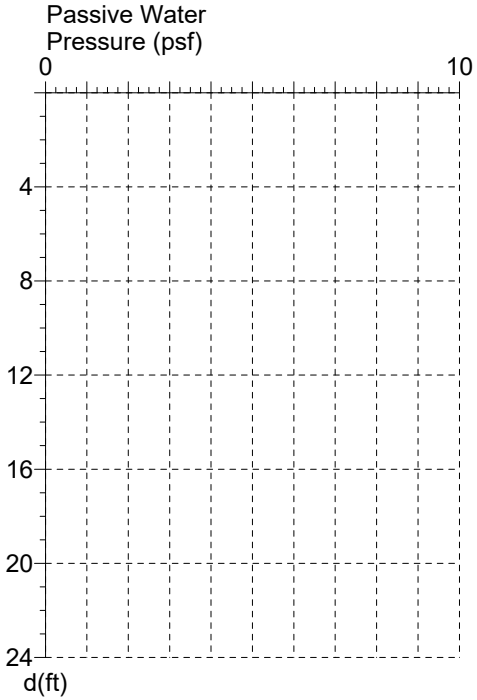
Page: 5
Date: 3.5.19

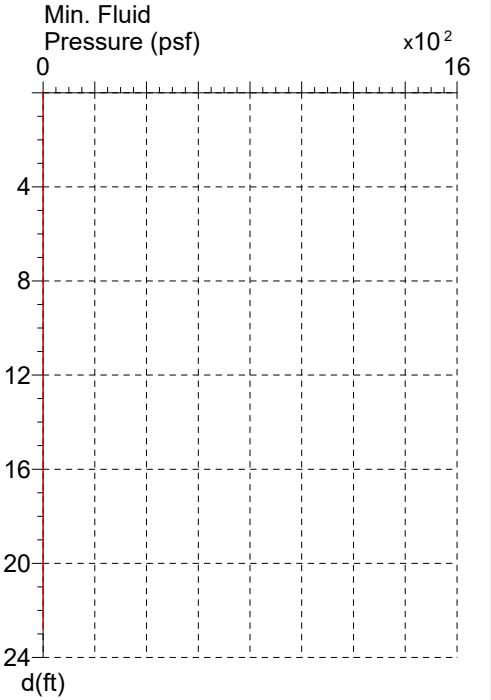
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

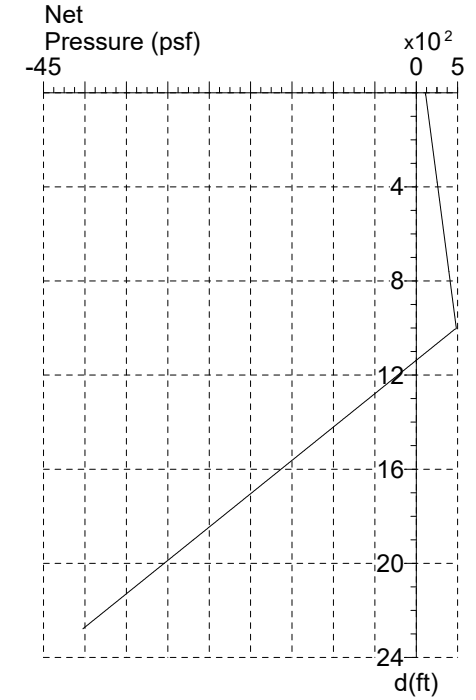












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Client: Case 7 - Stage 1 - 10 ft
Site: FOS = 1.0

Page: 6
Date: 3.5.19

Sheet: PZ22
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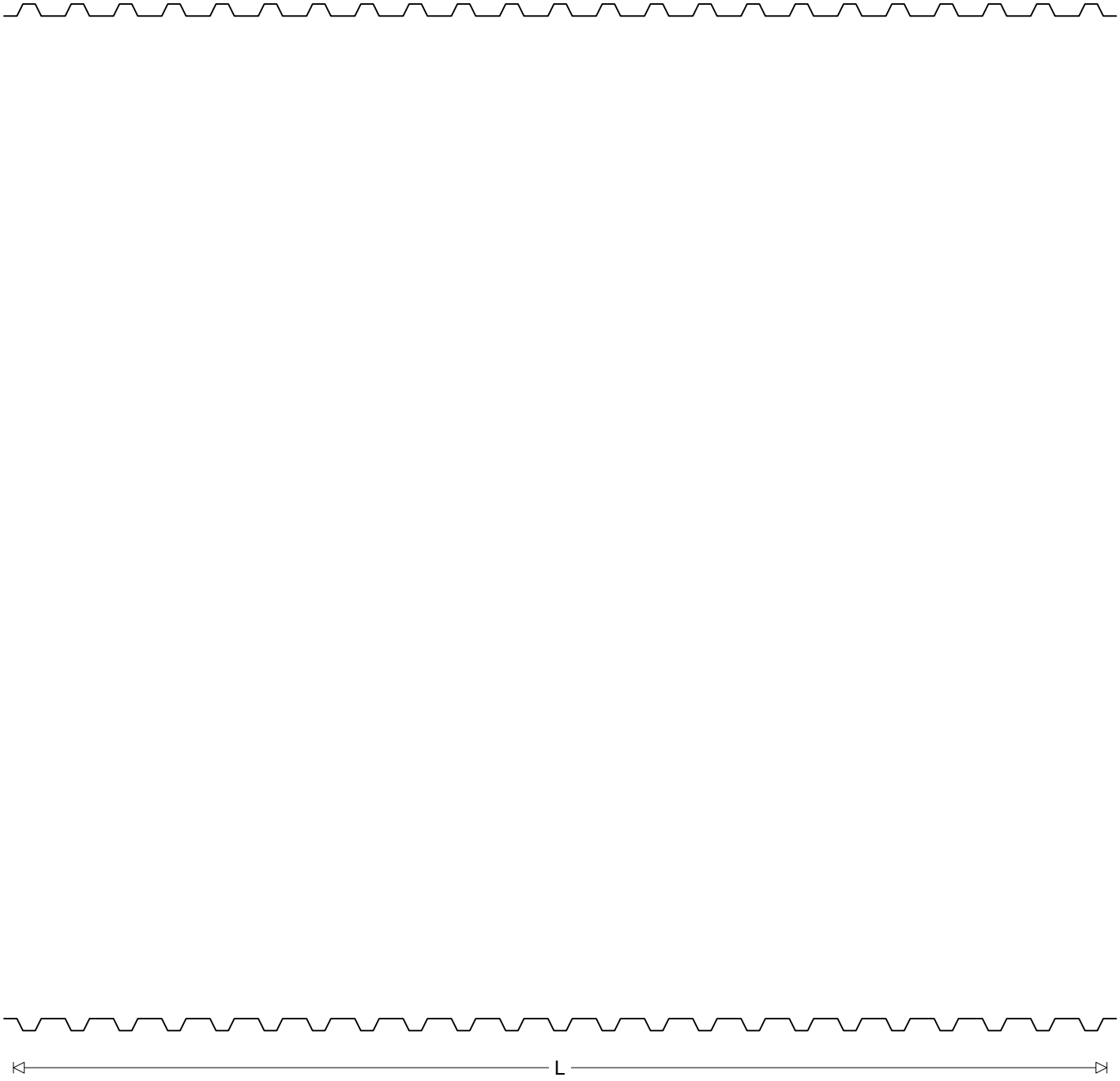
Analysis: Gross Pressure
Toe: Cantilever



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Client: Case 7 - Stage 1 - 10 ft
Site: FOS = 1.0

Page: 7
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Maximum bending moment = 25708.0ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 12.36in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

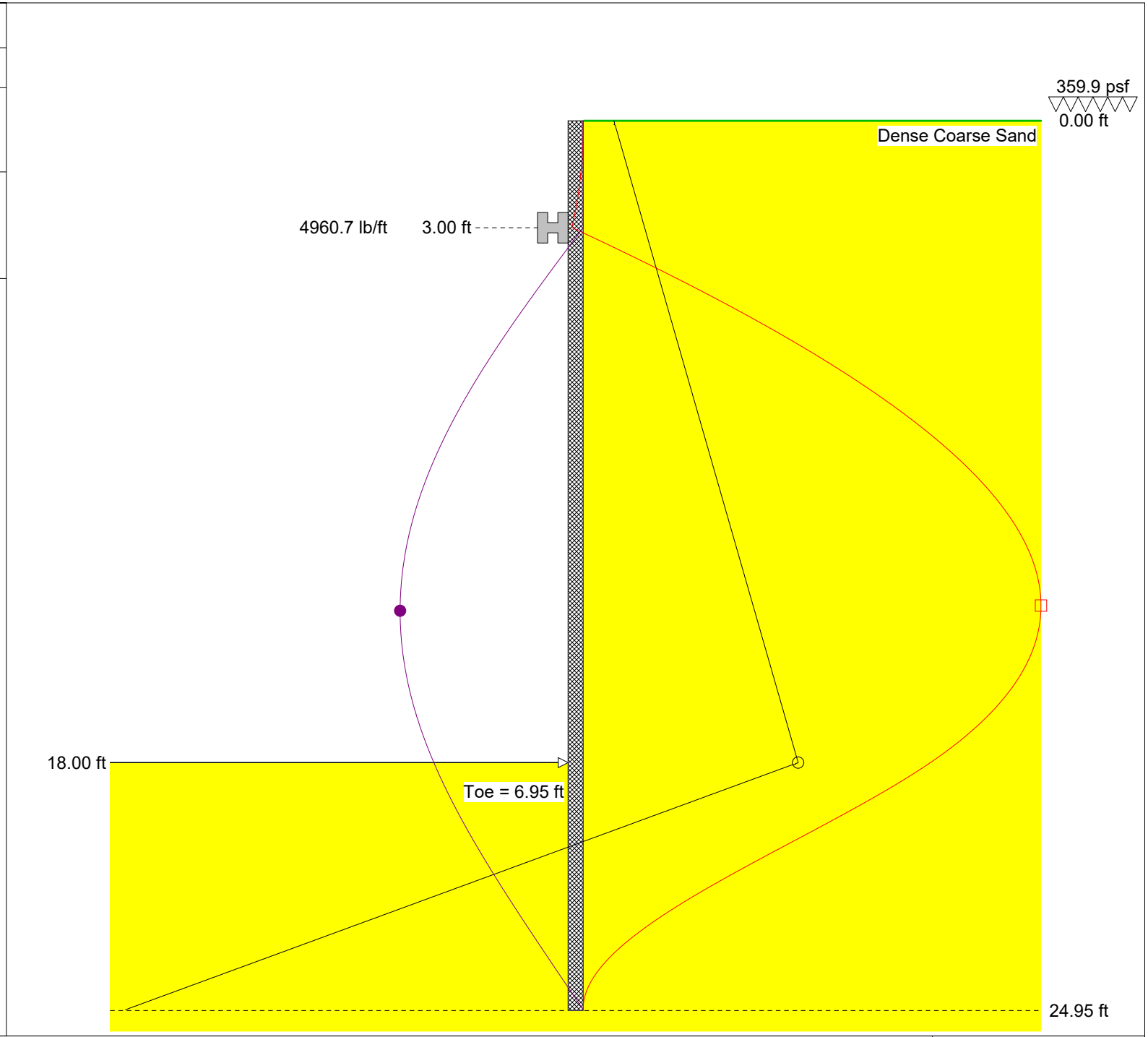
2. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 7 - Stage 2
Site: FOS = 1.0

Page: 1
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 781.2 psf	18.00
□ 26669.4 ftlb/ft	13.60
● 0.9 in	13.74



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Client: Case 7 - Stage 2
Site: FOS = 1.0

Page: 2
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 18.00ft
Surcharge = 359.9psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Coarse Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	6.95	24.95

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	4960.7

Maxima

	Maximum	Depth (ft)
Pressure	781.2 psf	18.00
Bending Moment	26669.4 ftlb/ft	13.60
Deflection	0.9 in	13.74
Shear Force	4456.4 lb/ft	3.00

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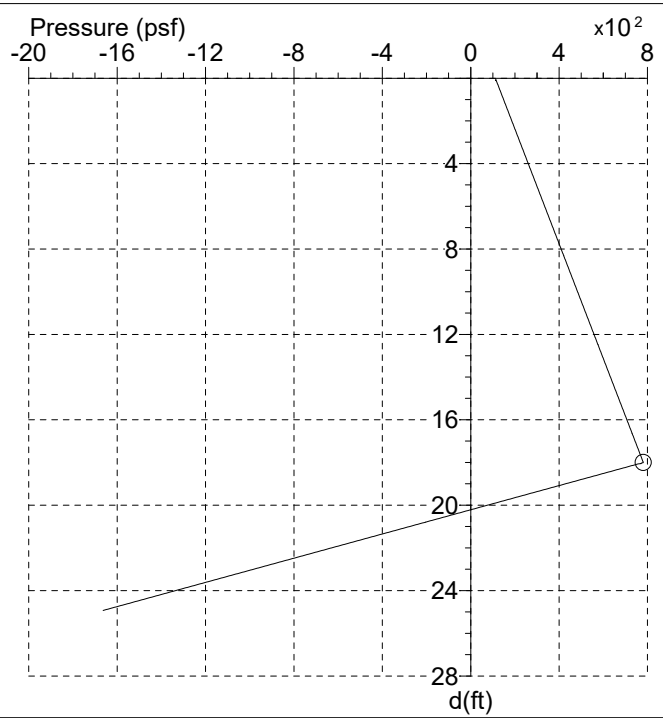
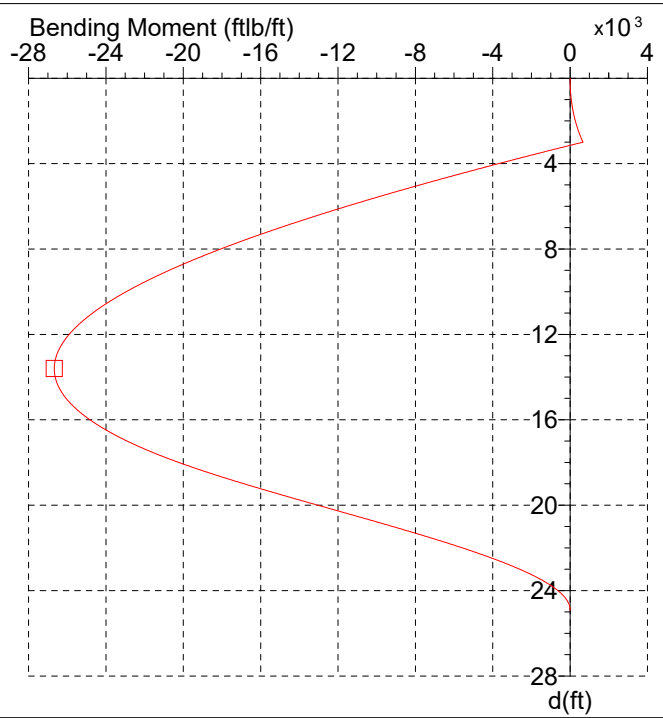
Site: FOS = 1.0

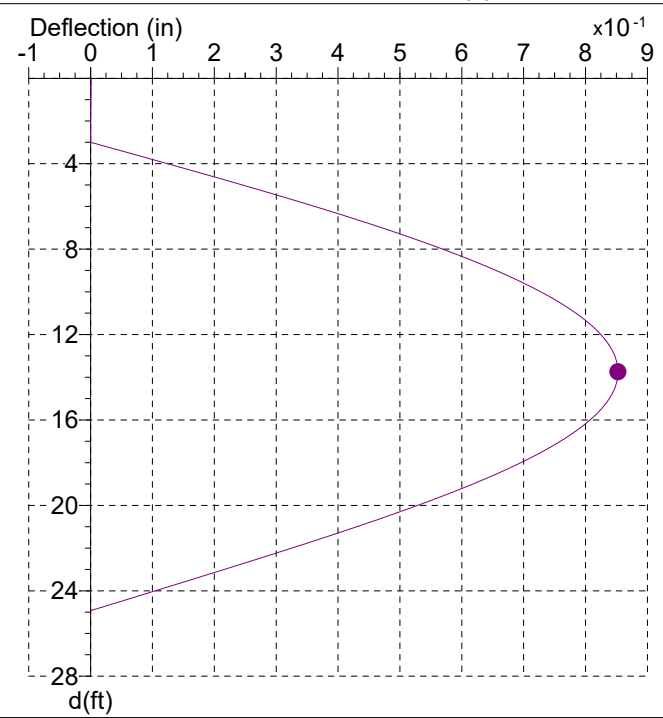
Page: 3
Date: 3.5.19

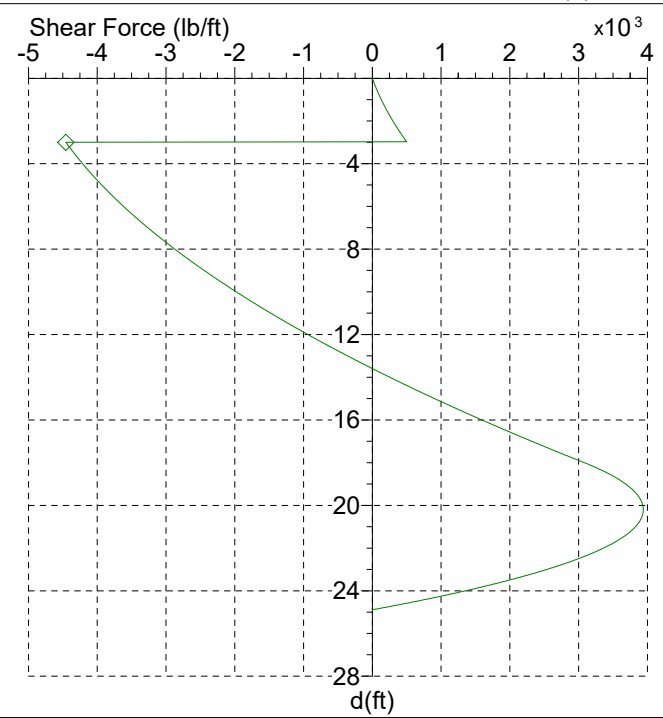
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
781.2 psf	18.00
26669.4 ftlb/ft	13.60
4456.4 lb/ft	3.00
0.9 in	13.74









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Client: Case 7 - Stage 2
Site: FOS = 1.0

Page: 4
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.4	0.0	0.0
0.18	118.5	2.1	0.0	21.6
0.36	124.7	7.2	0.0	42.0
0.53	131.7	17.1	0.0	66.2
0.71	137.9	29.7	0.0	88.8
0.89	144.8	48.5	0.0	115.4
1.07	151.0	69.5	0.0	140.2
1.25	158.0	98.2	0.0	169.3
1.43	165.0	132.4	0.0	199.8
1.60	171.1	167.6	0.0	227.9
1.78	178.1	213.0	0.0	260.8
1.96	184.3	258.6	0.0	291.2
2.14	191.3	316.0	0.0	326.5
2.32	197.4	372.6	0.0	359.1
2.50	204.4	443.0	0.0	396.9
2.67	211.4	520.5	0.0	436.1
2.85	217.5	595.6	0.0	472.0
3.03	224.5	481.2	0.0	-4447.1
3.21	230.7	-255.3	0.0	-4409.2
3.39	237.7	-1076.3	0.0	-4365.3
3.56	243.8	-1799.1	0.1	-4325.2
3.74	250.8	-2604.1	0.1	-4278.8
3.92	257.8	-3400.4	0.1	-4231.2
4.10	264.0	-4100.6	0.1	-4187.7
4.28	270.9	-4879.7	0.2	-4137.6
4.46	277.1	-5564.2	0.2	-4092.0
4.63	284.1	-6325.1	0.2	-4039.4
4.81	290.3	-6993.1	0.2	-3991.6
4.99	297.2	-7735.0	0.2	-3936.5
5.17	304.2	-8466.6	0.3	-3880.2
5.35	310.4	-9107.9	0.3	-3829.0
5.52	317.3	-9819.1	0.3	-3770.2
5.70	323.5	-10442.0	0.3	-3716.8
5.88	330.5	-11132.0	0.3	-3655.6
6.06	336.7	-11735.7	0.4	-3600.0
6.24	343.6	-12403.7	0.4	-3536.3
6.42	350.6	-13059.6	0.4	-3471.3
6.59	356.8	-13632.4	0.4	-3412.4
6.77	363.7	-14265.0	0.4	-3344.9
6.95	369.9	-14816.6	0.5	-3283.8
7.13	376.9	-15424.9	0.5	-3213.9
7.31	383.1	-15954.6	0.5	-3150.6
7.49	390.0	-16537.8	0.5	-3078.2
7.66	397.0	-17107.4	0.5	-3004.5
7.84	403.2	-17602.0	0.6	-2937.8
8.02	410.1	-18145.1	0.6	-2861.7
8.20	416.3	-18615.8	0.6	-2792.9
8.38	423.3	-19131.6	0.6	-2714.2
8.55	429.5	-19577.7	0.6	-2643.2
8.73	436.4	-20065.3	0.6	-2562.2
8.91	443.4	-20537.7	0.6	-2479.8
9.09	449.6	-20944.5	0.7	-2405.4
9.27	456.6	-21387.3	0.7	-2320.6
9.45	462.7	-21767.5	0.7	-2244.0
9.62	469.7	-22180.0	0.7	-2156.7
9.80	475.9	-22532.8	0.7	-2078.0
9.98	482.9	-22914.0	0.7	-1988.2
10.16	489.8	-23278.2	0.7	-1897.2
10.34	496.0	-23587.7	0.7	-1815.1
10.52	503.0	-23919.4	0.8	-1721.6
10.69	509.2	-24199.4	0.8	-1637.3
10.87	516.1	-24497.7	0.8	-1541.3
11.05	522.3	-24747.6	0.8	-1454.9
11.23	529.3	-25011.6	0.8	-1356.4
11.41	536.2	-25257.0	0.8	-1256.7
11.58	542.4	-25459.3	0.8	-1166.9
11.76	549.4	-25669.1	0.8	-1064.7
11.94	555.6	-25839.4	0.8	-972.7
12.12	562.5	-26012.6	0.8	-868.0
12.30	568.7	-26150.1	0.8	-773.9
12.48	575.7	-26285.9	0.8	-666.7
12.65	582.6	-26401.6	0.8	-558.3
12.83	588.8	-26487.4	0.8	-460.8
13.01	595.8	-26564.3	0.8	-349.9
13.19	602.0	-26615.3	0.8	-250.2
13.37	608.9	-26652.7	0.9	-136.8
13.54	615.1	-26668.0	0.9	-34.9
13.72	622.1	-26665.0	0.9	80.9
13.90	629.0	-26640.3	0.9	198.0
14.08	635.2	-26600.1	0.9	303.2
14.26	642.2	-26533.9	0.9	422.8
14.44	648.4	-26456.5	0.8	530.2
14.61	655.3	-26348.0	0.8	652.3
14.79	661.5	-26232.5	0.8	761.9
14.97	668.5	-26080.9	0.8	886.4
15.15	675.4	-25906.0	0.8	1012.2
15.33	681.6	-25730.9	0.8	1125.1
15.51	688.6	-25511.5	0.8	1253.4
15.68	694.8	-25296.4	0.8	1368.5
15.86	701.7	-25031.7	0.8	1499.3
16.04	707.9	-24775.9	0.8	1616.6
16.22	714.9	-24464.9	0.8	1749.8
16.40	721.9	-24129.1	0.8	1884.3
16.57	728.0	-23809.5	0.8	2004.9
16.75	735.0	-23426.2	0.8	2141.9
16.93	741.2	-23064.0	0.8	2264.7
17.11	748.2	-22632.2	0.8	2404.2
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17.47	761.3	-21745.5	0.7	2671.1
17.64	768.3	-21238.0	0.7	2814.3
17.82	774.5	-20764.4	0.7	2942.6
18.00	781.2	-20206.3	0.7	3088.3
18.18	720.3	-19687.8	0.7	3212.5
18.36	654.3	-19080.8	0.7	3340.4
18.53	595.6	-18522.1	0.7	3443.8
18.71	529.6	-17874.2	0.6	3548.4
18.89	463.6	-17207.9	0.6	3640.6
19.07	404.9	-16602.0	0.6	3712.2
19.25	338.8	-15907.1	0.6	3781.1
19.43	280.2	-15279.6	0.6	3832.0
19.60	214.1	-14564.4	0.6	3877.6
19.78	155.5	-13922.5	0.5	3907.7
19.96	89.4	-13195.2	0.5	3929.9
20.14	23.4	-12464.9	0.5	3939.8
20.32	-35.3	-11814.9	0.5	3938.2
20.50	-101.3	-11084.9	0.5	3924.5
20.67	-160.0	-10439.0	0.5	3901.7
20.85	-226.0	-9717.8	0.4	3864.3
21.03	-284.7	-9083.4	0.4	3820.4
21.21	-350.7	-8379.2	0.4	3759.2
21.39	-416.7	-7687.4	0.4	3685.5
21.56	-475.4	-7084.8	0.4	3609.3
21.74	-541.4	-6422.8	0.4	3511.8
21.92	-600.1	-5850.3	0.3	3414.6
22.10	-666.1	-5226.4	0.3	3293.3
22.28	-724.8	-4691.5	0.3	3174.9
22.46	-790.8	-4114.1	0.3	3029.9
22.63	-856.8	-3564.6	0.3	2872.3
22.81	-915.5	-3101.4	0.2	2721.7
22.99	-981.6	-2611.1	0.2	2540.3
23.17	-1040.2	-2204.3	0.2	2368.6
23.35	-1106.3	-1781.4	0.2	2163.5
23.53	-1164.9	-1438.3	0.2	1970.6
23.70	-1231.0	-1091.3	0.1	1741.8
23.88	-1297.0	-787.7	0.1	1500.4
24.06	-1355.7	-556.3	0.1	1275.2
24.24	-1421.7	-341.3	0.1	1010.1
24.42	-1480.4	-192.3	0.1	763.8
24.59	-1546.4	-74.2	0.0	474.9
24.77	-1605.1	-15.1	0.0	207.5
24.95	-1663.8	0.0	0.0	0.0

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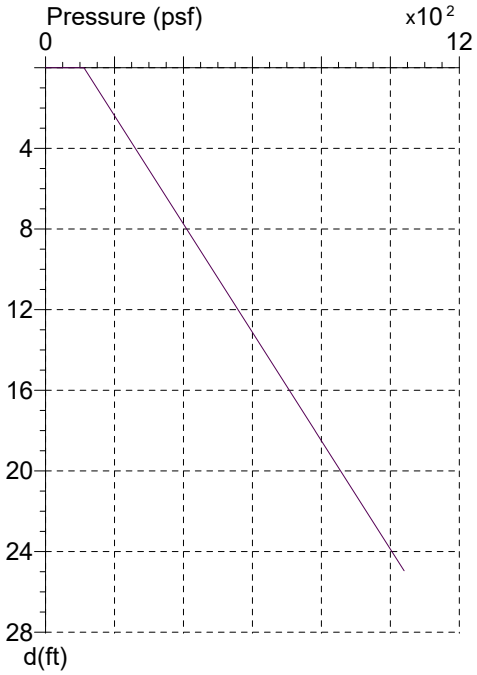
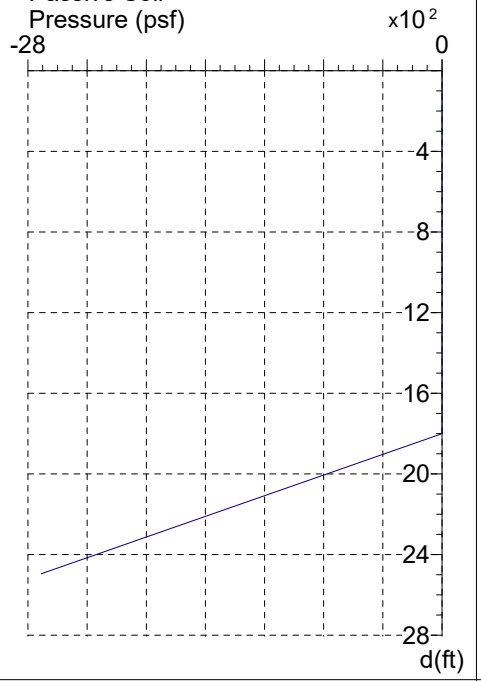
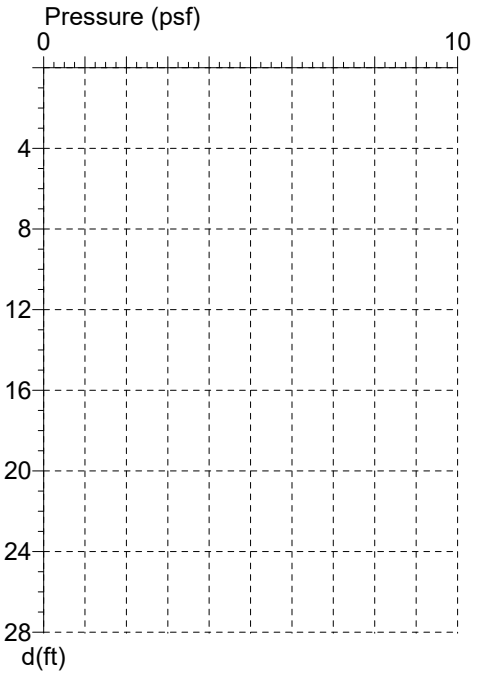
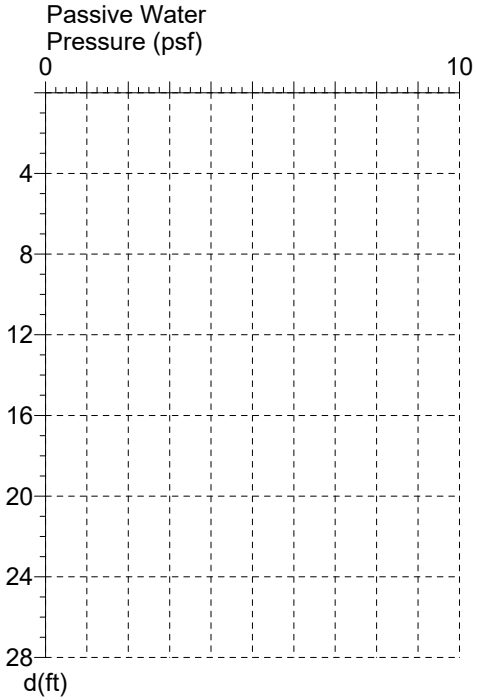
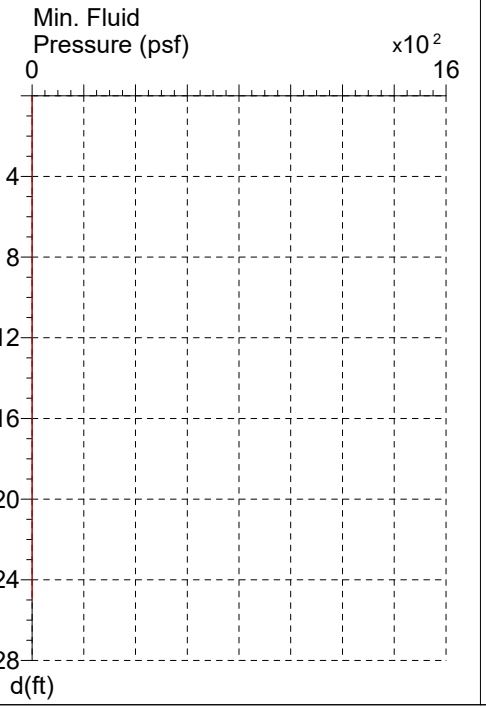
Analysis: Gross Pressure

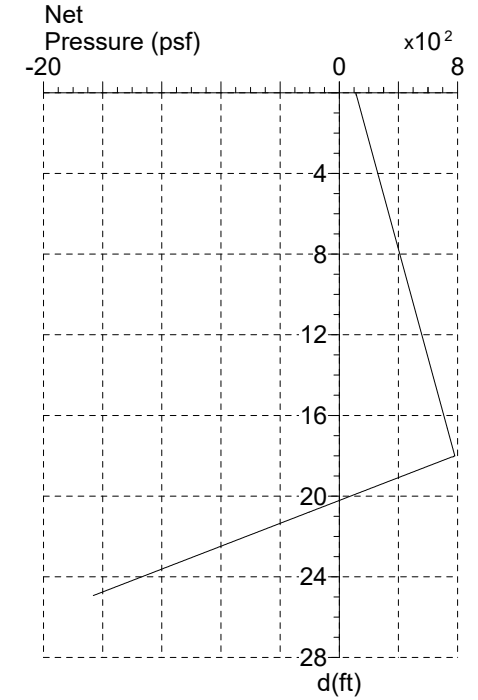












MDOT Sheetpile Manual

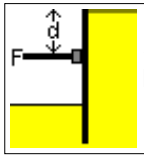
SupportIT, v2.37

Tel/Fax: +44 (0)1292 477754
Email: GTSoftLtd@aol.com
Web: www.GTSoft.org

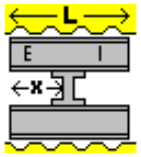
Client: Case 7 - Stage 2
Site: FOS = 1.0

Page: 6
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 3.00 ft
F = 4960.7 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

MDOT Sheetpile Manual

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Design Report

1. Maximum bending moment = 26669.4ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 12.82in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

2. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

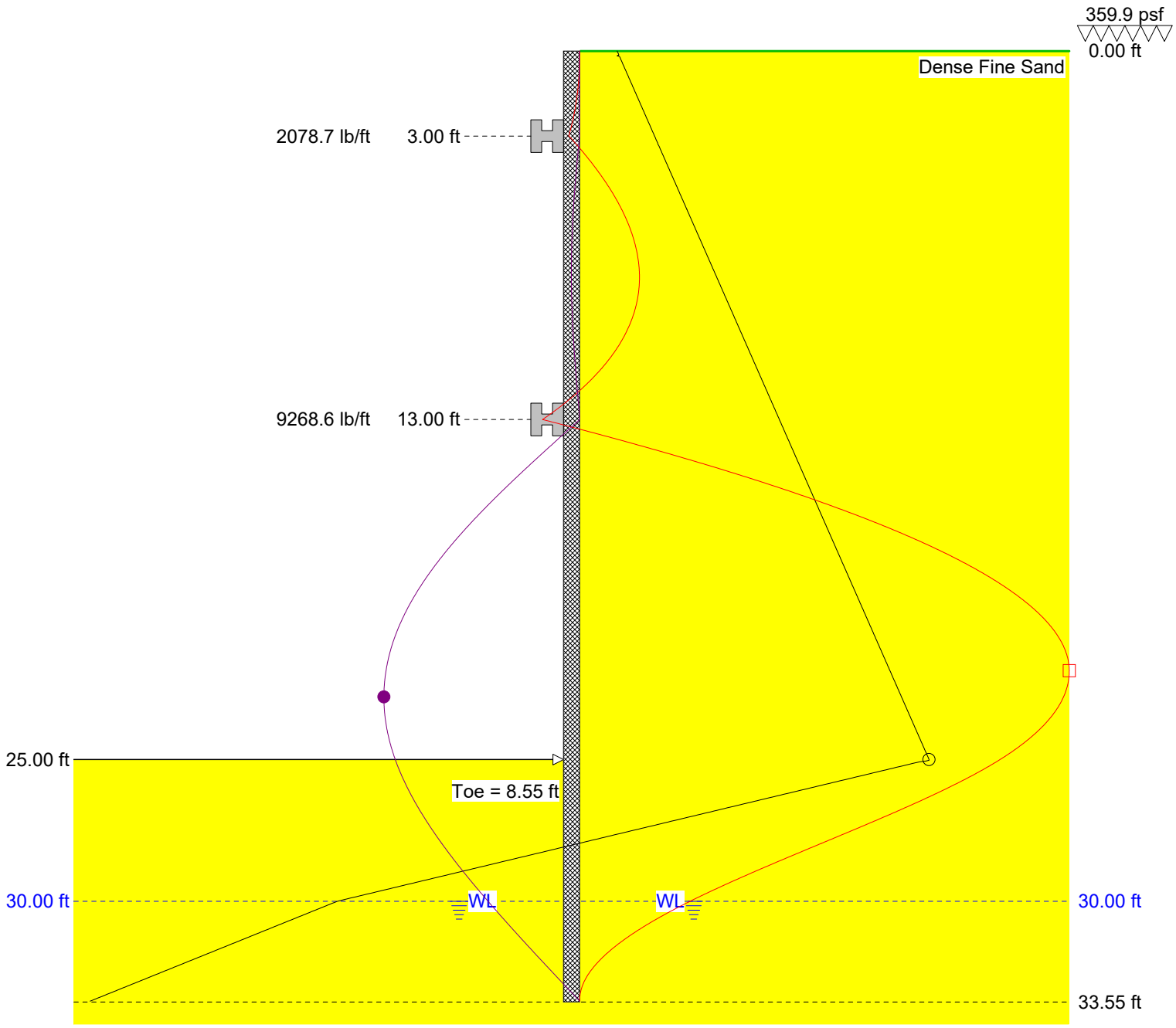
3. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 7 Stage 3 - Depth 25 ft
Site: FOS = 1.0

Page: 1
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
1041.5 psf	25.00
29903.3 ftlb/ft	21.87
0.8 in	22.79



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Client: Case 7 Stage 3 - Depth 25 ft
Site: FOS = 1.0

Page: 2
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 25.00ft
Surcharge = 359.9psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	8.55	33.55

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	2078.7
13.00	Waler	9268.6

Maxima

	Maximum	Depth (ft)
Pressure	1041.5 psf	25.00
Bending Moment	29903.3 ftlb/ft	21.87
Deflection	0.8 in	22.79
Shear Force	6742.2 lb/ft	13.00

MDOT Sheetpile Manual

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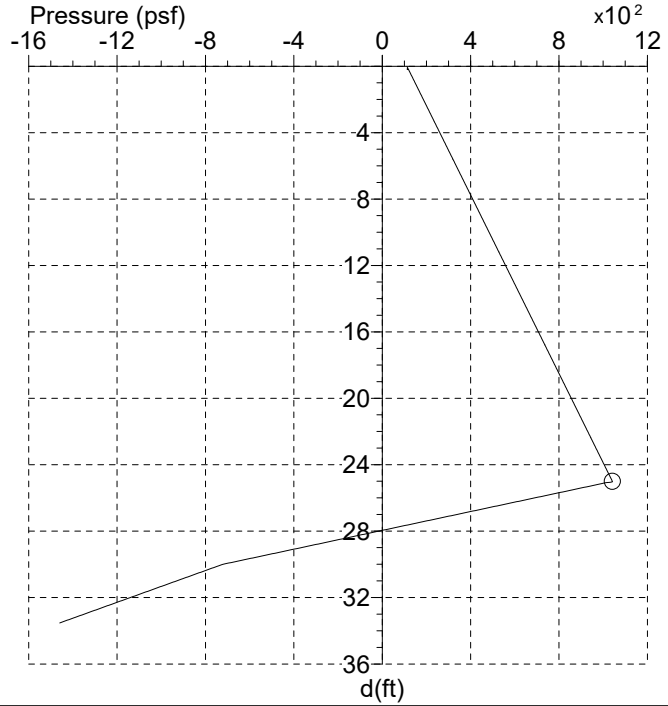
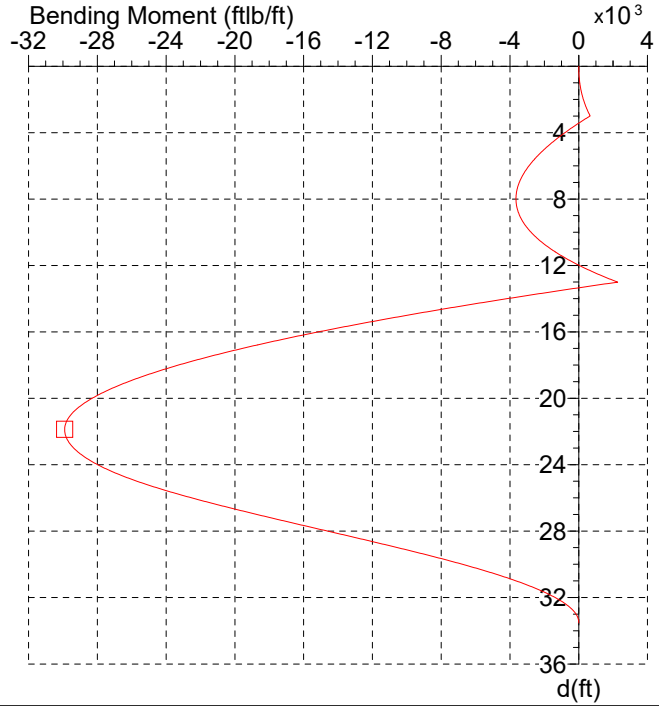
Client: Case 7 Stage 3 - Depth 25 ft
Site: FOS = 1.0

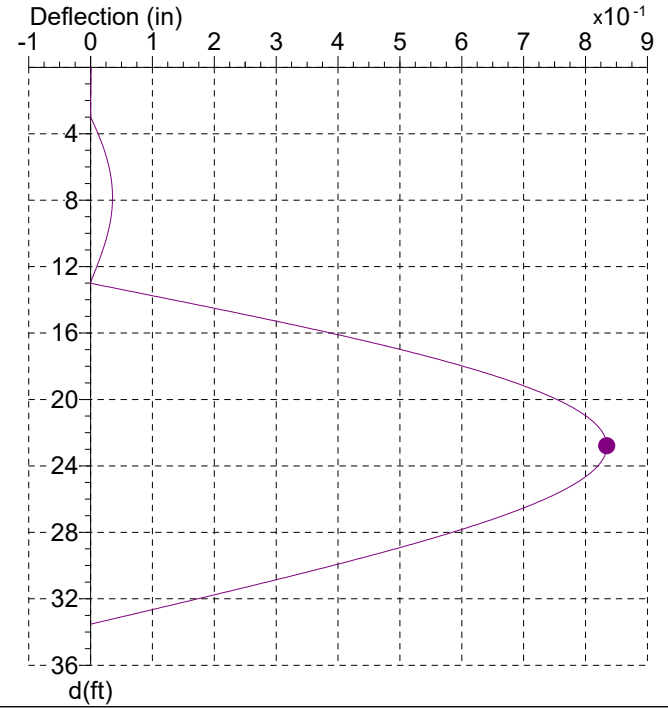
Page: 3
Date: 3.5.19

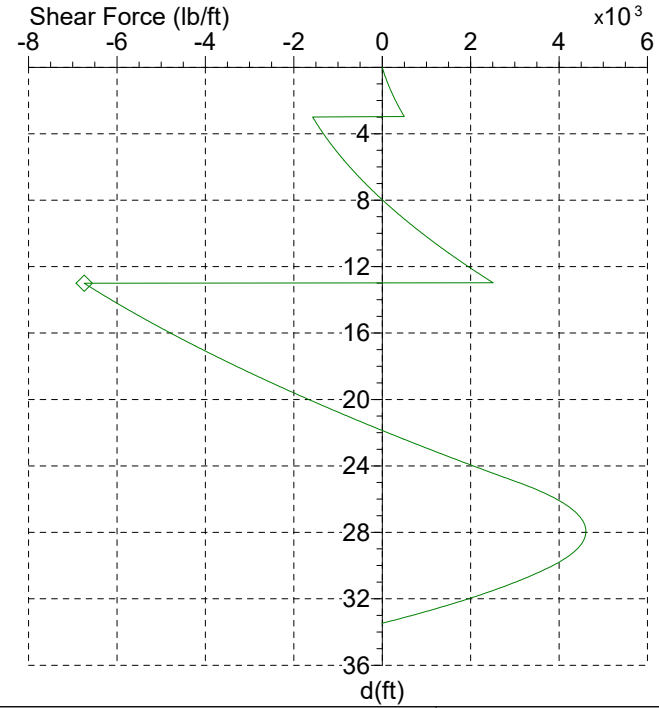
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
1041.5 psf	25.00
29903.3 ftlb/ft	21.87
6742.2 lb/ft	13.00
0.8 in	22.79









MDOT Sheetpile Manual

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Client: Case 7 Stage 3 - Depth 25 ft
Site: FOS = 1.0

Page: 4
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.5	0.0	0.0
0.24	120.9	3.7	0.0	29.4
0.48	129.3	13.0	0.0	57.7
0.72	138.6	31.3	0.0	91.7
0.96	147.0	55.0	0.0	124.0
1.20	156.3	90.4	0.0	162.5
1.44	164.6	130.3	0.0	198.8
1.68	174.0	185.1	0.0	241.8
1.92	183.4	250.9	0.0	287.2
2.16	191.7	319.3	0.0	329.5
2.40	201.0	407.7	0.0	379.3
2.64	209.4	497.1	0.0	425.7
2.88	218.7	610.2	0.0	480.0
3.12	227.0	490.3	0.0	-1548.6
3.36	236.4	107.9	0.0	-1490.2
3.60	245.8	-259.7	0.0	-1429.4
3.83	254.1	-573.3	0.0	-1373.4
4.07	263.5	-911.0	0.0	-1308.1
4.31	271.8	-1197.2	0.0	-1248.1
4.55	281.1	-1502.9	0.0	-1178.4
4.79	289.5	-1759.8	0.0	-1114.5
5.03	298.8	-2031.5	0.0	-1040.3
5.27	308.2	-2284.2	0.0	-963.8
5.51	316.5	-2492.6	0.0	-893.9
5.75	325.9	-2708.1	0.0	-812.9
5.99	334.2	-2882.4	0.0	-738.9
6.23	343.5	-3058.5	0.0	-653.5
6.47	351.9	-3196.8	0.0	-575.6
6.71	361.2	-3331.4	0.0	-485.8
6.95	370.6	-3443.1	0.0	-393.6
7.19	378.9	-3522.8	0.0	-309.6
7.43	388.3	-3589.9	0.0	-213.0
7.67	396.6	-3628.8	0.0	-125.0
7.91	406.0	-3649.0	0.0	-23.9
8.15	414.3	-3645.4	0.0	67.9
8.39	423.6	-3616.6	0.0	173.5
8.63	433.0	-3561.0	0.0	281.4
8.87	441.3	-3488.6	0.0	379.3
9.11	450.7	-3380.7	0.0	491.7
9.35	459.0	-3261.0	0.0	593.6
9.59	468.4	-3098.8	0.0	710.4
9.83	476.7	-2929.8	0.0	816.2
10.07	486.1	-2711.2	0.0	937.5
10.31	495.4	-2461.8	0.0	1061.1
10.55	503.7	-2213.8	0.0	1173.0
10.79	513.1	-1904.8	0.0	1301.1
11.03	521.4	-1602.8	0.0	1416.9
11.26	530.8	-1232.0	0.0	1549.4
11.50	539.1	-874.2	0.0	1669.2
11.74	548.5	-439.4	0.0	1806.2
11.98	557.8	30.0	0.0	1945.5
12.22	566.1	476.9	0.0	2071.3
12.46	575.5	1013.5	0.0	2215.1
12.70	583.8	1521.0	0.0	2344.9
12.94	593.2	2126.9	0.0	2493.2
13.18	601.5	1141.3	0.0	-6641.7
13.42	610.9	-515.0	0.1	-6489.0
13.66	620.2	-2132.6	0.1	-6334.0
13.90	628.6	-3537.5	0.1	-6194.2
14.14	637.9	-5080.3	0.2	-6034.7
14.38	646.2	-6417.8	0.2	-5891.0
14.62	655.6	-7883.7	0.2	-5727.0
14.86	663.9	-9151.8	0.2	-5579.3
15.10	673.3	-10538.7	0.3	-5410.9
15.34	682.7	-11882.9	0.3	-5240.2
15.58	691.0	-13041.5	0.3	-5086.4
15.82	700.3	-14303.4	0.4	-4911.2
16.06	708.7	-15387.9	0.4	-4753.5
16.30	718.0	-16565.5	0.4	-4573.9
16.54	726.3	-17574.0	0.4	-4412.2
16.78	735.7	-18665.1	0.5	-4228.1
17.02	745.1	-19709.5	0.5	-4041.6
17.26	753.4	-20598.2	0.5	-3873.9
17.50	762.7	-21552.9	0.6	-3683.0
17.74	771.1	-22361.0	0.6	-3511.3
17.98	780.4	-23223.8	0.6	-3316.0
18.22	788.8	-23949.3	0.6	-3140.4
18.46	798.1	-24718.2	0.6	-2940.6
18.69	807.5	-25436.5	0.7	-2738.4
18.93	815.8	-26032.0	0.7	-2556.7
19.17	825.2	-26653.1	0.7	-2350.1
19.41	833.5	-27161.2	0.7	-2164.5
19.65	842.8	-27683.0	0.7	-1953.4
19.89	851.2	-28101.9	0.7	-1763.8
20.13	860.5	-28522.2	0.8	-1548.3
20.37	869.9	-28888.0	0.8	-1330.4
20.61	878.2	-29166.8	0.8	-1134.8
20.85	887.6	-29427.8	0.8	-912.5
21.09	895.9	-29612.7	0.8	-712.9
21.33	905.3	-29766.9	0.8	-486.1
21.57	913.6	-29855.9	0.8	-282.6
21.81	922.9	-29901.2	0.8	-51.3
22.05	932.3	-29889.5	0.8	182.2
22.29	940.6	-29834.4	0.8	391.8
22.53	950.0	-29721.6	0.8	629.9
22.77	958.3	-29575.9	0.8	843.4
23.01	967.7	-29360.4	0.8	1085.9
23.25	976.0	-29122.4	0.8	1303.4
23.49	985.3	-28802.2	0.8	1550.3
23.73	994.7	-28425.7	0.8	1799.6
23.97	1003.0	-28043.4	0.8	2023.2
24.21	1012.4	-27559.3	0.8	2276.9
24.45	1020.7	-27080.5	0.8	2504.4
24.69	1030.1	-26486.9	0.8	2762.6
24.93	1038.4	-25909.9	0.8	2994.1
25.17	983.0	-25205.0	0.8	3250.9
25.41	894.2	-24444.1	0.8	3485.9
25.65	815.3	-23724.7	0.8	3676.0
25.89	726.5	-22871.6	0.7	3868.8
26.12	647.6	-22078.4	0.7	4021.4
26.36	558.8	-21151.3	0.7	4171.9
26.60	479.9	-20300.3	0.7	4287.0
26.84	391.1	-19317.2	0.7	4395.4
27.08	302.3	-18311.8	0.7	4481.4
27.32	223.4	-17403.5	0.6	4539.1
27.56	134.6	-16369.9	0.6	4582.9
27.80	55.7	-15444.4	0.6	4603.0
28.04	-33.1	-14400.5	0.6	4604.6
28.28	-112.0	-13474.0	0.6	4587.3
28.52	-200.8	-12437.8	0.5	4546.7
28.76	-289.6	-11413.2	0.5	4483.7
29.00	-368.5	-10516.1	0.5	4409.0
29.24	-457.3	-9526.9	0.5	4303.9
29.48	-536.2	-8669.3	0.4	4191.7
29.72	-625.0	-7733.6	0.4	4044.3
29.96	-703.9	-6931.7	0.4	3894.6
30.20	-764.1	-6067.6	0.4	3705.2
30.44	-816.7	-5248.1	0.3	3501.3
30.68	-863.4	-4559.4	0.3	3308.8
30.92	-916.0	-3832.3	0.3	3079.4
31.16	-962.8	-3230.6	0.3	2864.1
31.40	-1015.4	-2606.8	0.2	2609.2
31.64	-1062.2	-2101.9	0.2	2371.3
31.88	-1114.8	-1592.4	0.2	2090.8
32.12	-1167.4	-1147.9	0.2	1796.9
32.36	-1214.1	-809.7	0.1	1524.2
32.60	-1266.7	-496.1	0.1	1204.7
32.84	-1313.5	-279.3	0.1	909.3
33.08	-1366.1	-107.7	0.1	564.3
33.32	-1412.9	-21.8	0.0	246.2
33.55	-1459.6	0.0	0.0	0.0

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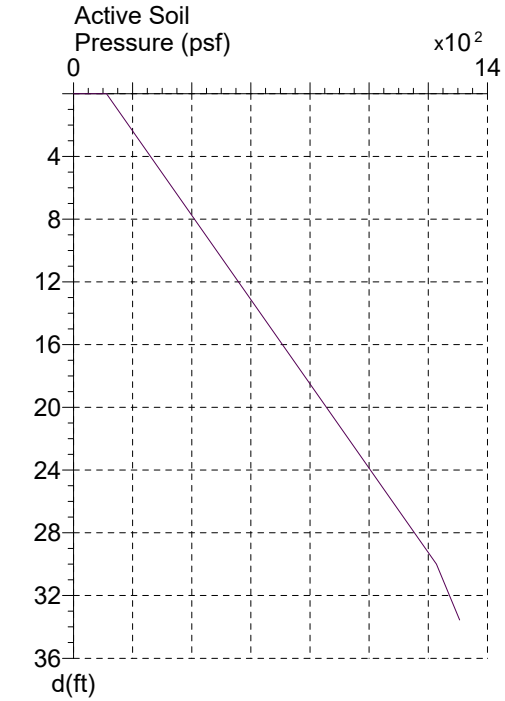
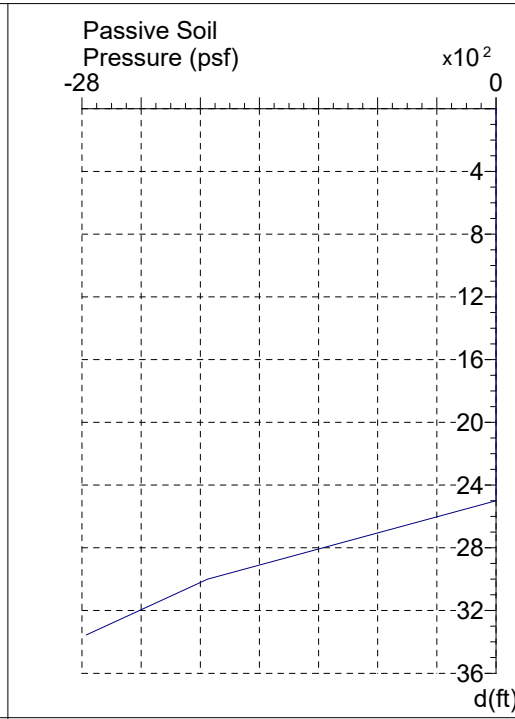
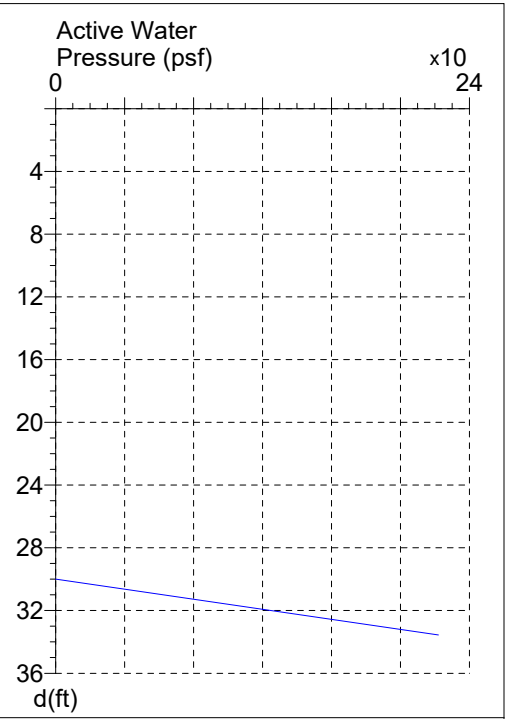
Client: Case 7 Stage 3 - Depth 25 ft
Site: FOS = 1.0

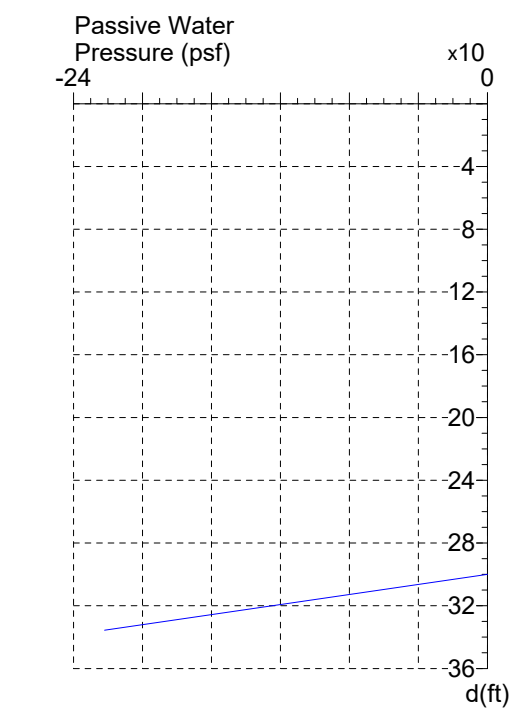
Page: 5
Date: 3.5.19

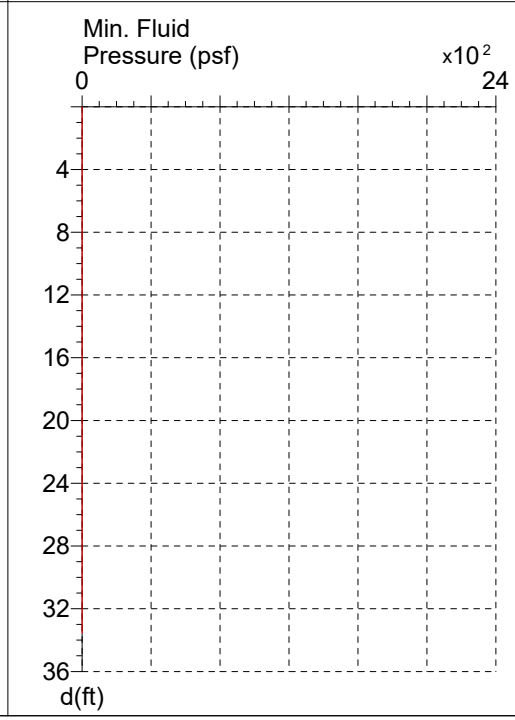
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

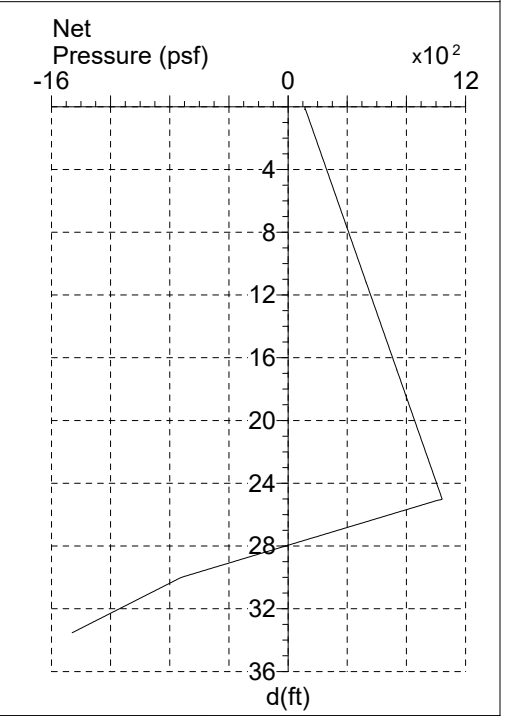












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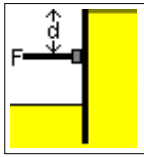
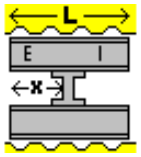
Client: Case 7 Stage 3 - Depth 25 ft
Site: FOS = 1.0

Page: 6
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 13.00 ft
F = 9268.6 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Design Report

1. Maximum bending moment = 29903.3ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 14.37in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

2. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

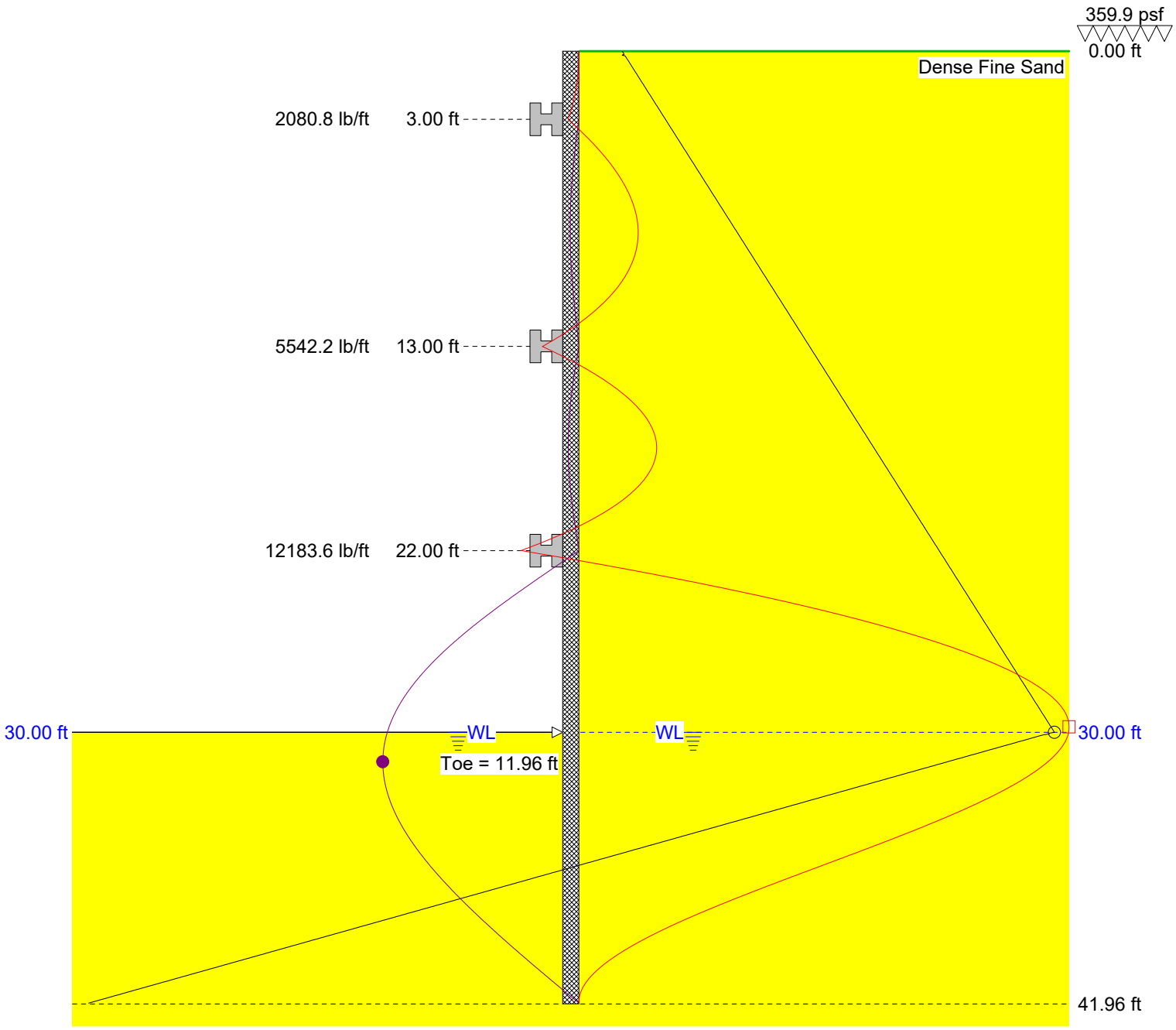
3. FOS = 1.01 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.0

Page: 1
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 1227.6 psf	30.00
□ 30295.3 ftlb/ft	29.76
● 0.8 in	31.30



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Web: www.GTSoft.org

Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.0

Page: 2
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 30.00ft
Surcharge = 359.9psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	11.96	41.96

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	2080.8
13.00	Waler	5542.2
22.00	Waler	12183.6

Maxima

	Maximum	Depth (ft)
Pressure	1227.6 psf	30.00
Bending Moment	30295.3 ftlb/ft	29.76
Deflection	0.8 in	31.30
Shear Force	8336.1 lb/ft	22.00

MDOT Sheetpile Manual

SupportIT, v2.37

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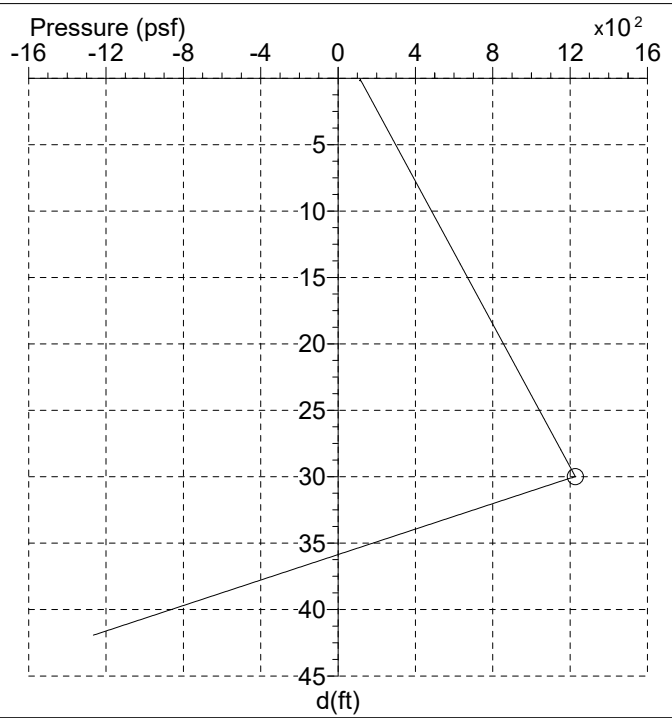
Web: www.GTSoft.org

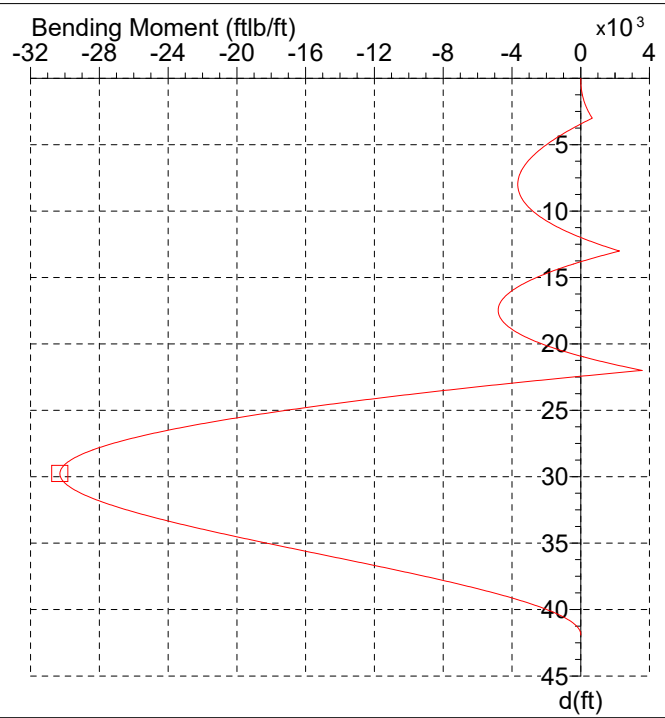
Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.0

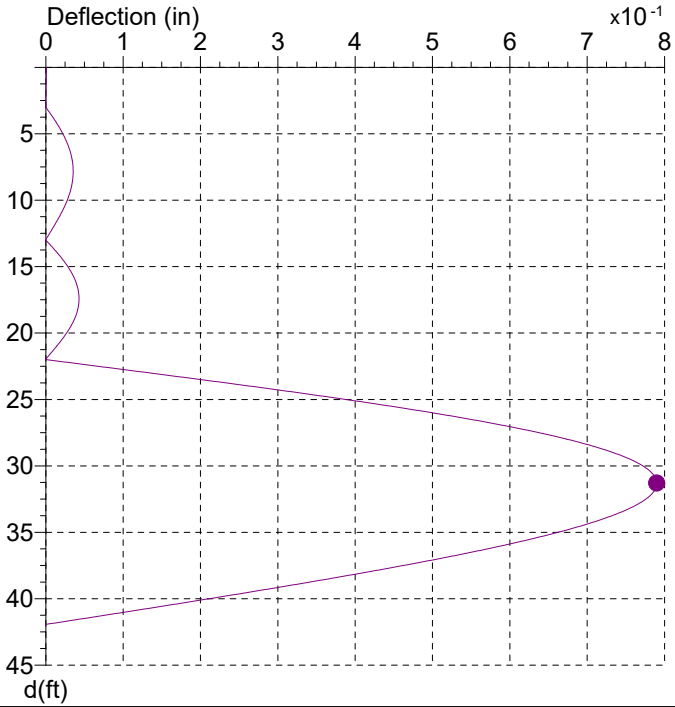
Page: 3
Date: 3.5.19

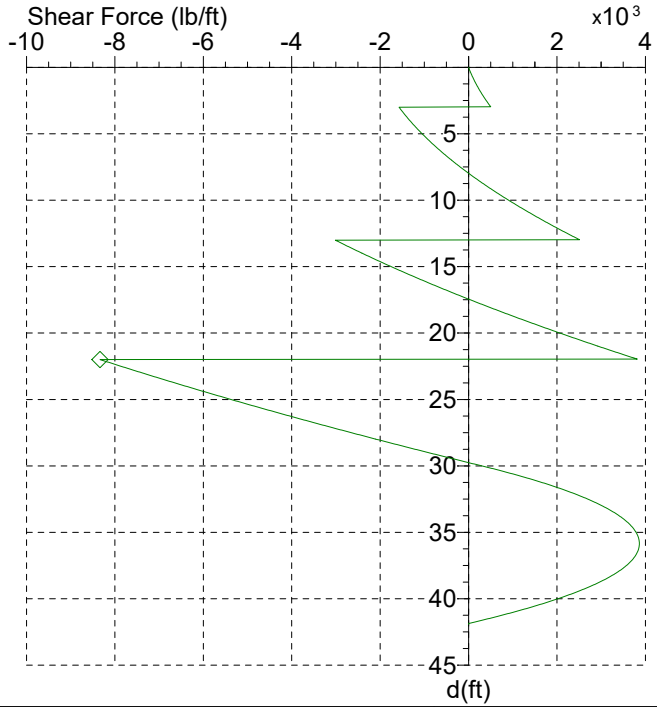
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
1227.6 psf	30.00
30295.3 ftlb/ft	29.76
8336.1 lb/ft	22.00
0.8 in	31.30









MDOT Sheetpile Manual

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Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.0

Page: 4
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.6	0.0	0.0
0.30	123.3	5.7	0.0	37.2
0.60	133.7	20.5	0.0	73.6
0.90	145.4	49.8	0.0	118.1
1.20	155.8	88.0	0.0	160.8
1.50	167.5	145.7	0.0	212.2
1.80	177.9	211.0	0.0	261.1
2.10	189.6	301.3	0.0	319.6
2.40	201.3	410.4	0.0	381.8
2.70	211.7	524.3	0.0	440.2
3.00	223.5	672.6	0.0	-1571.4
3.30	233.6	238.3	0.0	-1507.2
3.60	245.6	-228.3	0.0	-1431.6
3.90	256.0	-622.5	0.0	-1361.3
4.20	267.7	-1041.9	0.0	-1278.6
4.50	279.4	-1434.6	0.0	-1192.4
4.80	289.8	-1760.3	0.0	-1112.6
5.10	301.5	-2099.5	0.0	-1019.3
5.40	311.9	-2375.7	0.0	-933.3
5.69	323.6	-2657.2	0.0	-833.1
5.99	334.0	-2880.3	0.0	-741.0
6.29	345.7	-3099.9	0.0	-633.8
6.59	357.4	-3285.0	0.0	-522.9
6.89	367.8	-3419.7	0.0	-421.3
7.19	379.6	-3536.6	0.0	-303.5
7.49	390.0	-3608.8	0.0	-195.7
7.79	401.7	-3653.2	0.0	-70.9
8.09	412.1	-3659.2	0.0	43.1
8.39	423.8	-3627.4	0.0	174.8
8.69	435.5	-3553.7	0.0	310.2
8.99	445.9	-3452.0	0.0	433.7
9.29	457.6	-3296.0	0.0	576.1
9.59	468.0	-3119.3	0.0	705.7
9.89	479.7	-2876.8	0.0	855.1
10.19	490.1	-2621.5	0.0	990.9
10.49	501.8	-2288.4	0.0	1147.2
10.79	513.5	-1905.8	0.0	1307.2
11.09	523.9	-1523.0	0.0	1452.5
11.39	535.6	-1043.5	0.0	1619.4
11.69	546.1	-572.8	0.0	1770.9
11.99	557.8	7.8	0.0	1944.8
12.29	568.2	570.1	0.0	2102.4
12.59	579.9	1255.9	0.0	2283.3
12.89	591.6	1998.9	0.0	2467.8
13.19	602.0	1737.0	0.0	-2907.3
13.49	613.7	841.8	0.0	-2715.8
13.79	624.1	97.5	0.0	-2542.5
14.09	635.8	-681.0	0.0	-2344.0
14.39	646.2	-1319.7	0.0	-2164.5
14.69	657.9	-1977.4	0.0	-1959.1
14.99	669.6	-2569.3	0.0	-1750.0
15.29	680.0	-3039.4	0.0	-1561.0
15.59	691.7	-3504.2	0.0	-1344.9
15.89	702.2	-3859.3	0.0	-1149.8
16.19	713.9	-4192.7	0.0	-926.8
16.48	724.3	-4429.2	0.0	-725.4
16.78	736.0	-4626.9	0.0	-495.4
17.08	747.7	-4751.2	0.0	-261.8
17.38	758.1	-4799.1	0.0	-51.0
17.68	769.8	-4781.6	0.0	189.6
17.98	780.2	-4702.2	0.0	406.6
18.28	791.9	-4539.8	0.0	654.2
18.58	802.3	-4329.8	0.0	877.4
18.88	814.0	-4018.5	0.0	1131.9
19.18	825.7	-3626.7	0.0	1390.2
19.48	836.1	-3209.8	0.0	1622.8
19.78	847.8	-2662.7	0.0	1888.0
20.08	858.2	-2106.0	0.0	2126.8
20.38	870.0	-1399.4	0.0	2398.9
20.68	880.4	-699.2	0.0	2644.0
20.98	892.1	170.9	0.0	2923.1
21.28	903.8	1129.2	0.0	3205.9
21.58	914.2	2056.1	0.0	3460.3
21.88	925.9	3184.4	0.0	3750.1
22.18	936.3	2136.6	0.0	-8172.9
22.48	948.0	-390.7	0.1	-7876.2
22.78	958.4	-2558.4	0.1	-7609.3
23.08	970.1	-4907.6	0.1	-7305.7
23.38	981.8	-7160.8	0.2	-6998.3
23.68	992.2	-9082.1	0.2	-6722.0
23.98	1003.9	-11150.9	0.3	-6407.7
24.28	1014.3	-12906.5	0.3	-6125.2
24.58	1026.1	-14786.8	0.3	-5803.9
24.88	1036.5	-16373.0	0.4	-5515.3
25.18	1048.2	-18060.5	0.4	-5187.0
25.48	1059.9	-19644.5	0.4	-4855.1
25.78	1070.3	-20964.4	0.5	-4557.0
26.08	1082.0	-22349.4	0.5	-4218.1
26.38	1092.4	-23490.6	0.5	-3913.8
26.68	1104.1	-24672.4	0.6	-3567.9
26.98	1114.5	-25631.3	0.6	-3257.4
27.28	1126.2	-26605.9	0.6	-2904.6
27.57	1137.9	-27469.0	0.6	-2548.2
27.87	1148.3	-28141.8	0.7	-2228.2
28.17	1160.0	-28791.5	0.7	-1864.7
28.47	1170.4	-29272.6	0.7	-1538.6
28.77	1182.2	-29704.5	0.7	-1168.2
29.07	1192.6	-29990.3	0.7	-835.9
29.37	1204.3	-30200.4	0.8	-458.5
29.67	1216.0	-30291.4	0.8	-77.5
29.97	1226.4	-30271.9	0.8	264.3
30.27	1163.3	-30139.4	0.8	640.1
30.57	1104.9	-29927.4	0.8	956.3
30.87	1039.3	-29588.7	0.8	1292.6
31.17	980.9	-29203.4	0.8	1574.1
31.47	915.3	-28681.0	0.8	1871.3
31.77	849.6	-28070.5	0.8	2147.9
32.07	791.3	-27459.0	0.8	2376.4
32.37	725.6	-26699.3	0.8	2614.0
32.67	667.3	-25965.2	0.8	2807.8
32.97	601.6	-25078.8	0.8	3006.3
33.27	543.3	-24242.2	0.8	3165.4
33.57	477.7	-23251.8	0.7	3324.9
33.87	412.0	-22215.4	0.7	3463.8
34.17	353.7	-21260.7	0.7	3569.9
34.47	288.0	-20154.7	0.7	3669.7
34.77	229.7	-19148.1	0.7	3741.1
35.07	164.0	-17995.0	0.7	3801.9
35.37	105.7	-16956.6	0.6	3838.6
35.67	40.0	-15779.0	0.6	3860.4
35.97	-25.6	-14597.6	0.6	3861.4
36.27	-84.0	-13549.4	0.6	3844.7
36.57	-149.6	-12378.1	0.5	3805.9
36.87	-207.9	-11349.2	0.5	3753.7
37.17	-273.6	-10211.2	0.5	3674.9
37.47	-331.9	-9222.2	0.5	3587.2
37.77	-397.6	-8140.6	0.4	3468.5
38.07	-463.2	-7098.2	0.4	3328.6
38.37	-521.6	-6209.7	0.4	3186.5
38.66	-587.2	-5258.9	0.3	3006.7
38.96	-645.6	-4462.2	0.3	2829.2
39.26	-711.2	-3626.2	0.3	2609.4
39.56	-769.6	-2941.7	0.3	2396.3
39.86	-835.2	-2243.5	0.2	2136.7
40.16	-900.8	-1627.6	0.2	1855.8
40.46	-959.2	-1154.5	0.2	1588.4
40.76	-1024.8	-711.7	0.1	1267.6
41.06	-1083.2	-402.7	0.1	964.7
41.36	-1148.8	-156.1	0.1	604.0
41.66	-1207.2	-31.8	0.0	265.6
41.96	-1265.5	0.0	0.0	0.0

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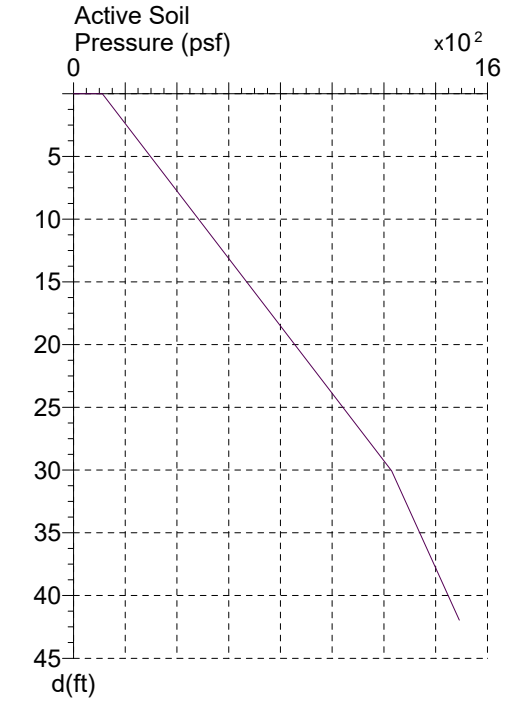
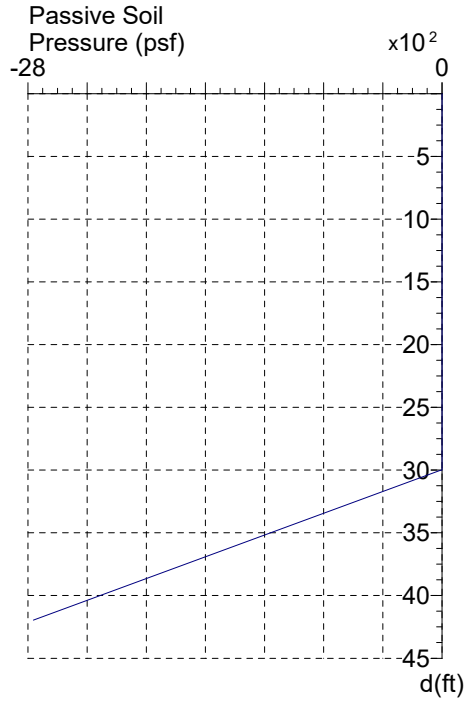
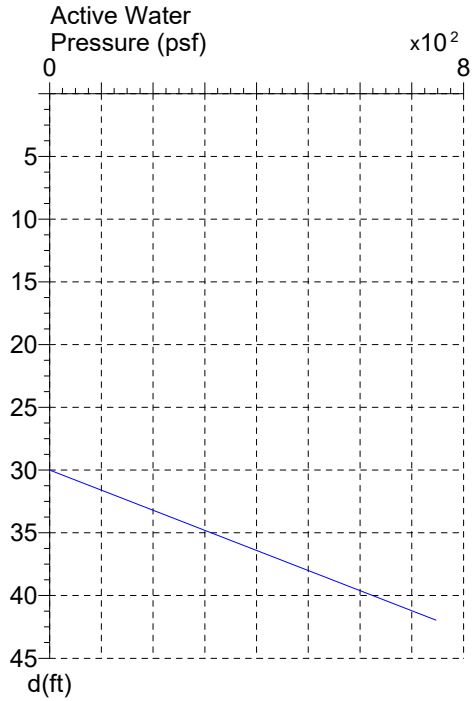
Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.0

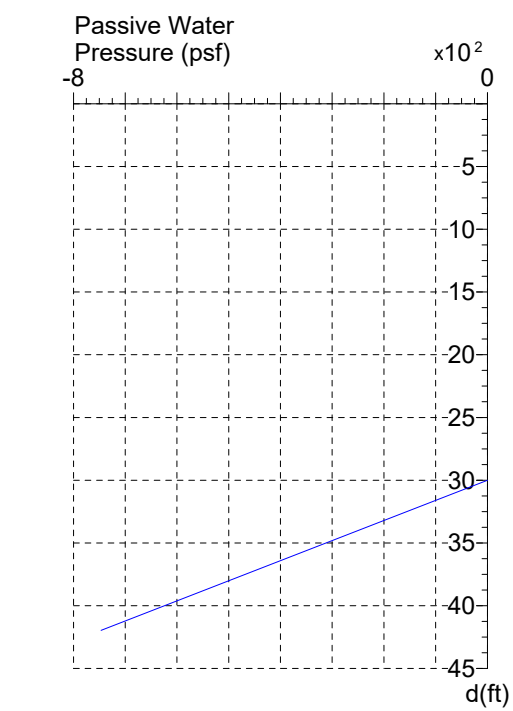
Page: 5
Date: 3.5.19

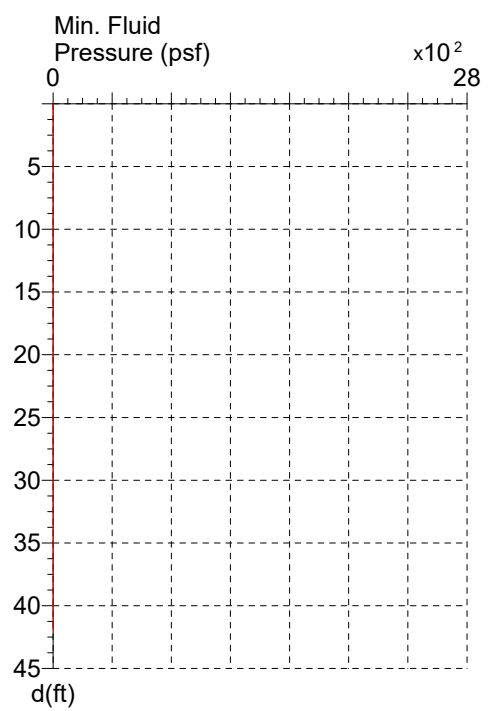
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

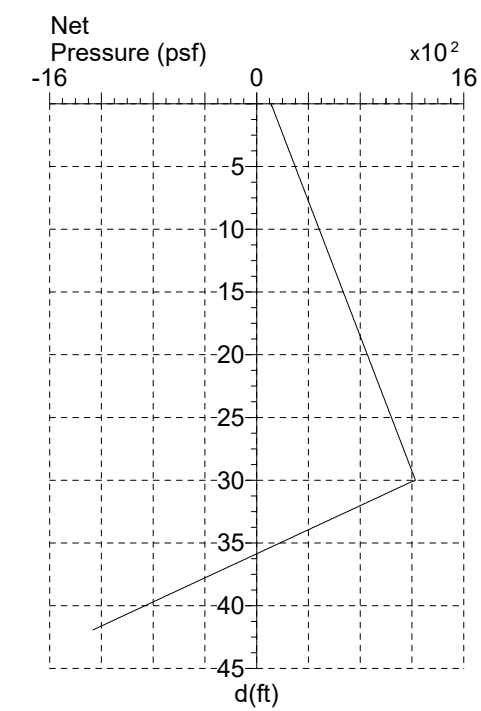










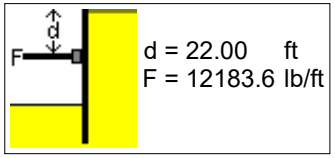


MDOT Sheetpile Manual

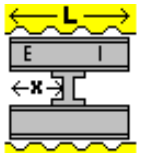
Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.0

Page: 6
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 22.00 ft
F = 12183.6 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Design Report

1. Maximum bending moment = 30295.3ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 14.56in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

2. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

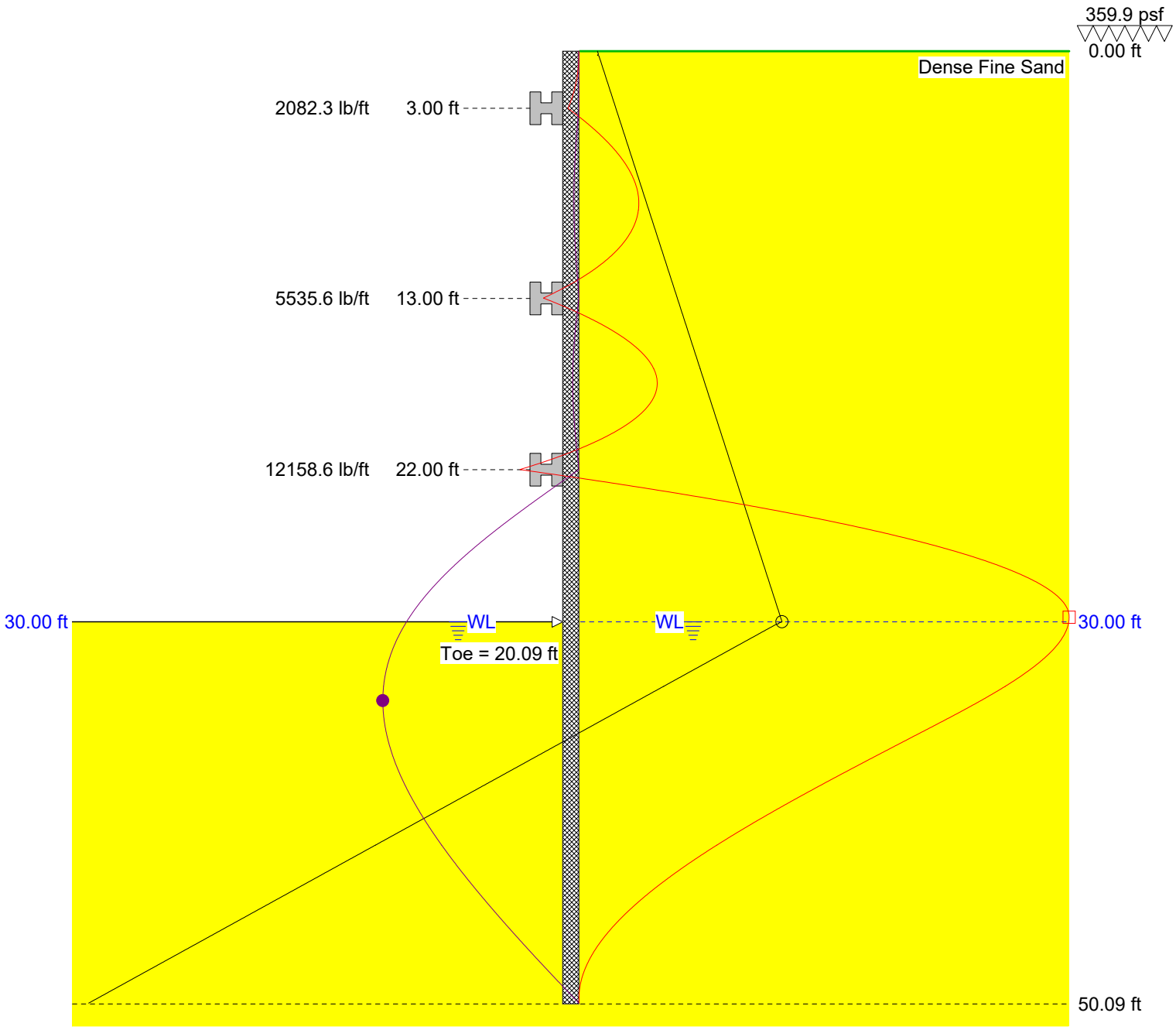
3. FOS = 0.99 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.50

Page: 1
Date: 3.22.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
1227.6 psf	30.00
30034.2 ftlb/ft	29.76
1.4 in	34.14



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Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.50

Page: 2
Date: 3.22.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 30.00ft
Surcharge = 359.9psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	20.09	50.09

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Waler	2082.3
13.00	Waler	5535.6
22.00	Waler	12158.6

Maxima

	Maximum	Depth (ft)
Pressure	1227.6 psf	30.00
Bending Moment	30034.2 ftlb/ft	29.76
Deflection	1.4 in	34.14
Shear Force	8300.5 lb/ft	22.00

MDOT Sheetpile Manual

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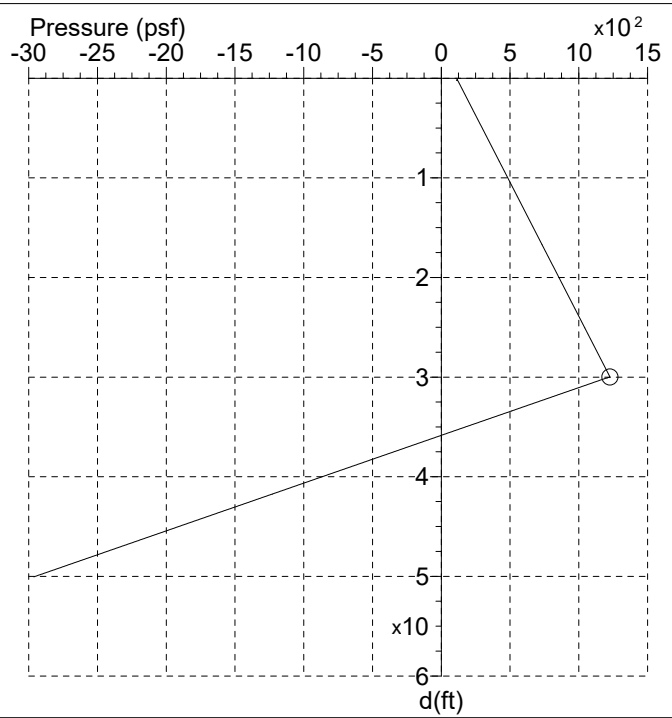
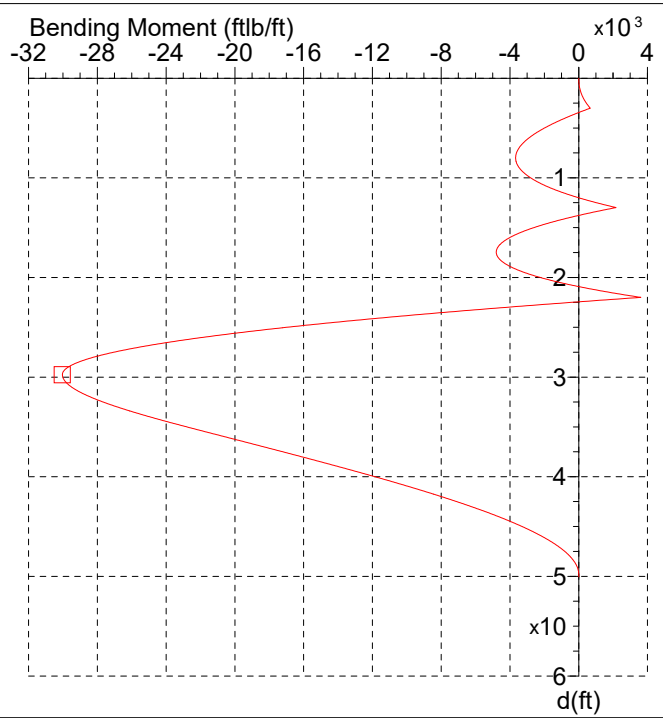
Site: FOS = 1.50

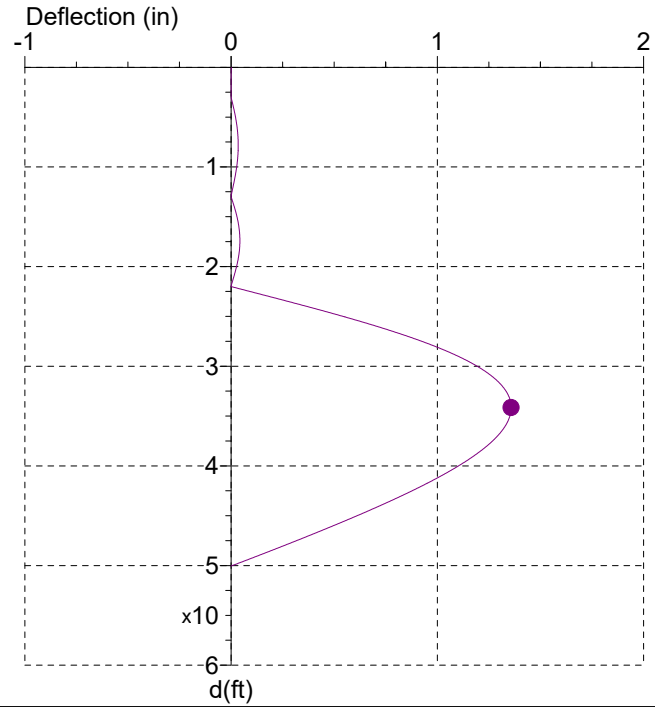
Page: 3
Date: 3.22.19

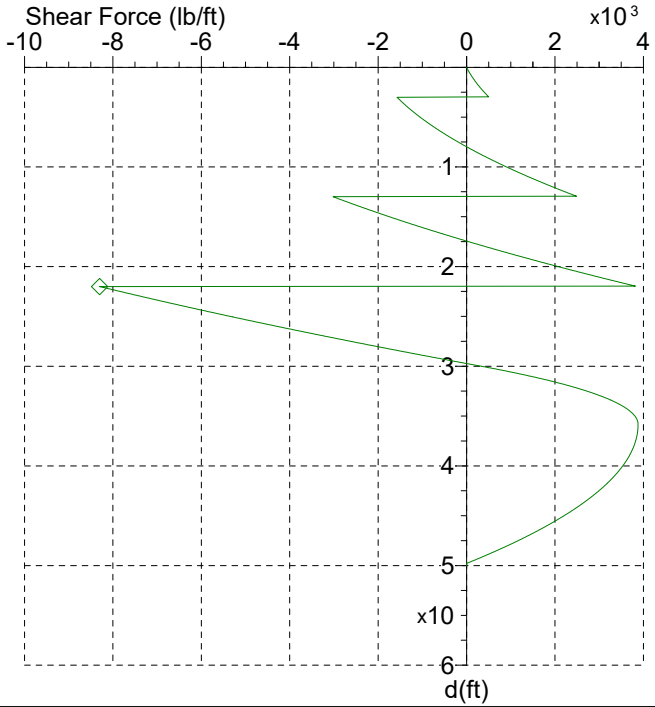
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

Maximum	d (ft)
○ 1227.6 psf	30.00
□ 30034.2 ftlb/ft	29.76
◇ 8300.5 lb/ft	22.00
● 1.4 in	34.14









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Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.50

Page: 4
Date: 3.22.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	111.6	0.7	0.0	0.0
0.36	125.6	8.1	0.0	44.9
0.72	138.0	29.5	0.0	89.6
1.07	152.0	72.2	0.0	144.9
1.43	164.4	128.3	0.0	198.4
1.79	178.4	213.6	0.0	263.7
2.15	190.8	310.6	0.0	326.2
2.50	204.7	445.6	0.0	401.5
2.86	218.7	609.7	0.0	482.1
3.22	231.1	345.4	0.0	-1524.7
3.58	245.1	-215.5	0.0	-1435.0
3.94	257.5	-685.0	0.0	-1350.8
4.29	271.5	-1178.5	0.0	-1251.1
4.65	283.9	-1585.0	0.0	-1158.1
5.01	297.9	-2004.1	0.0	-1048.5
5.37	311.9	-2381.0	0.0	-933.7
5.72	324.3	-2678.9	0.0	-827.2
6.08	338.3	-2970.5	0.0	-702.5
6.44	350.7	-3189.5	0.0	-587.2
6.80	364.7	-3388.8	0.0	-452.5
7.16	377.1	-3522.6	0.0	-328.4
7.51	391.1	-3622.5	0.0	-183.8
7.87	405.1	-3667.0	0.0	-34.0
8.23	417.5	-3658.4	0.0	103.6
8.59	431.4	-3593.1	0.0	263.3
8.94	443.9	-3484.1	0.0	409.7
9.30	457.8	-3302.4	0.0	579.4
9.66	470.3	-3086.8	0.0	734.6
10.02	484.2	-2781.6	0.0	914.2
10.38	498.2	-2408.3	0.0	1099.0
10.73	510.6	-2017.5	0.0	1267.7
11.09	524.6	-1510.0	0.0	1462.5
11.45	537.0	-996.9	0.0	1640.0
11.81	551.0	-348.1	0.0	1844.6
12.16	563.4	293.6	0.0	2031.0
12.52	577.4	1090.6	0.0	2245.5
12.88	591.4	1969.0	0.0	2465.4
13.24	603.8	1443.2	0.0	-2870.4
13.60	617.8	417.0	0.0	-2640.7
13.95	630.2	-423.0	0.0	-2432.1
14.31	644.2	-1285.1	0.0	-2192.4
14.67	656.6	-1976.2	0.0	-1975.0
15.03	670.6	-2667.2	0.0	-1725.4
15.38	684.5	-3264.9	0.0	-1470.6
15.74	697.0	-3716.2	0.0	-1239.7
16.10	710.9	-4132.2	0.0	-974.9
16.46	723.4	-4419.0	0.0	-735.2
16.82	737.3	-4646.4	0.0	-460.5
17.17	749.8	-4762.4	0.0	-212.0
17.53	763.7	-4794.2	0.0	72.6
17.89	777.7	-4718.8	0.0	362.4
18.25	790.1	-4559.8	0.0	624.4
18.60	804.1	-4275.7	0.0	924.2
18.96	816.5	-3928.1	0.0	1195.0
19.32	830.5	-3428.3	0.0	1504.7
19.68	842.9	-2885.8	0.0	1784.3
20.04	856.9	-2163.2	0.0	2103.9
20.39	870.9	-1319.9	0.0	2428.7
20.75	883.3	-467.3	0.0	2721.9
21.11	897.3	609.6	0.0	3056.6
21.47	909.7	1672.9	0.0	3358.6
21.82	923.7	2990.3	0.0	3703.2
22.18	936.1	2242.1	0.0	-8144.6
22.54	950.1	-757.1	0.1	-7790.0
22.90	964.0	-3622.3	0.2	-7430.2
23.26	976.5	-6055.0	0.2	-7105.9
23.61	990.4	-8661.6	0.3	-6736.2
23.97	1002.9	-10861.4	0.4	-6403.1
24.33	1016.8	-13202.5	0.4	-6023.5
24.69	1029.3	-15163.1	0.5	-5681.6
25.04	1043.2	-17231.7	0.6	-5292.0
25.40	1057.2	-19153.0	0.6	-4897.2
25.76	1069.6	-20735.8	0.7	-4541.9
26.12	1083.6	-22373.8	0.7	-4137.1
26.48	1096.0	-23701.6	0.8	-3773.0
26.83	1110.0	-25049.2	0.8	-3358.3
27.19	1122.4	-26115.8	0.9	-2985.3
27.55	1136.4	-27166.0	0.9	-2560.8
27.91	1150.4	-28056.0	1.0	-2130.9
28.26	1162.8	-28710.9	1.0	-1744.5
28.62	1176.8	-29292.7	1.1	-1304.7
28.98	1189.2	-29670.6	1.1	-909.4
29.34	1203.2	-29937.2	1.1	-459.8
29.70	1215.6	-30031.7	1.2	-55.7
30.05	1208.8	-30000.5	1.2	403.0
30.41	1130.5	-29870.0	1.2	841.1
30.77	1060.8	-29676.2	1.3	1205.5
31.13	982.4	-29376.5	1.3	1587.7
31.48	912.7	-29042.6	1.3	1902.6
31.84	834.3	-28596.7	1.3	2229.1
32.20	764.7	-28143.0	1.3	2494.7
32.56	686.3	-27573.7	1.3	2765.6
32.92	607.9	-26948.4	1.3	3007.0
33.27	538.2	-26350.6	1.4	3196.9
33.63	459.9	-25636.8	1.4	3382.8
33.99	390.2	-24970.6	1.4	3523.2
34.35	311.8	-24191.3	1.4	3653.4
34.70	242.1	-23476.9	1.4	3744.5
35.06	163.7	-22654.8	1.4	3819.1
35.42	85.4	-21819.4	1.3	3864.2
35.78	15.7	-21070.7	1.3	3879.6
36.14	-62.7	-20227.0	1.3	3877.8
36.49	-132.4	-19477.8	1.3	3871.3
36.85	-210.8	-18636.9	1.3	3858.7
37.21	-280.4	-17892.3	1.3	3842.8
37.57	-358.8	-17058.7	1.3	3819.5
37.92	-437.2	-16230.7	1.2	3790.7
38.28	-506.9	-15500.3	1.2	3760.3
38.64	-585.3	-14686.2	1.2	3720.9
39.00	-654.9	-13970.2	1.2	3681.1
39.36	-733.3	-13174.4	1.2	3631.0
39.71	-803.0	-12476.5	1.1	3581.7
40.07	-881.4	-11703.3	1.1	3521.0
40.43	-959.8	-10943.9	1.1	3454.7
40.79	-1029.4	-10281.3	1.0	3391.0
41.14	-1107.8	-9551.2	1.0	3314.1
41.50	-1177.5	-8916.6	1.0	3241.0
41.86	-1255.9	-8220.1	0.9	3153.5
42.22	-1325.5	-7617.4	0.9	3070.9
42.58	-1403.9	-6958.9	0.9	2972.7
42.93	-1482.3	-6322.3	0.8	2868.9
43.29	-1552.0	-5775.8	0.8	2772.0
43.65	-1630.4	-5183.9	0.8	2657.6
44.01	-1700.0	-4679.1	0.7	2551.2
44.36	-1778.4	-4136.2	0.7	2426.1
44.72	-1848.1	-3676.9	0.6	2310.3
45.08	-1926.5	-3187.5	0.6	2174.6
45.44	-2004.9	-2728.1	0.6	2033.4
45.80	-2074.5	-2346.0	0.5	1903.1
46.15	-2152.9	-1946.6	0.5	1751.2
46.51	-2222.6	-1619.9	0.4	1611.5
46.87	-2301.0	-1285.0	0.4	1449.0
47.23	-2370.6	-1017.4	0.4	1299.8
47.58	-2449.0	-751.3	0.3	1126.7
47.94	-2527.4	-523.5	0.3	948.0
48.30	-2597.1	-354.0	0.2	784.4
48.66	-2675.5	-201.6	0.2	595.1
49.02	-2745.1	-101.1	0.1	422.1
49.37	-2823.5	-28.5	0.1	222.1
49.73	-2893.2	-1.0	0.0	39.6
50.09	-2962.9	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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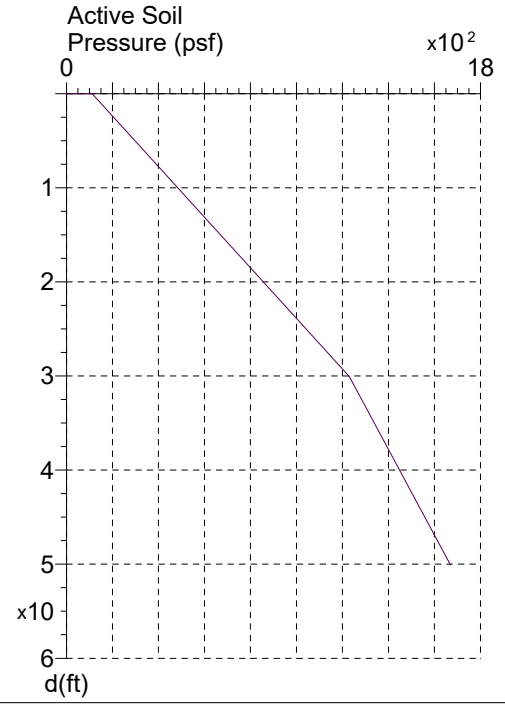
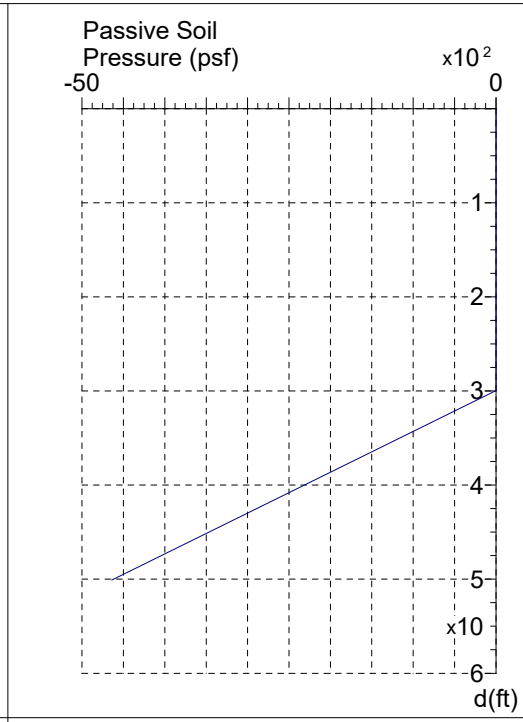
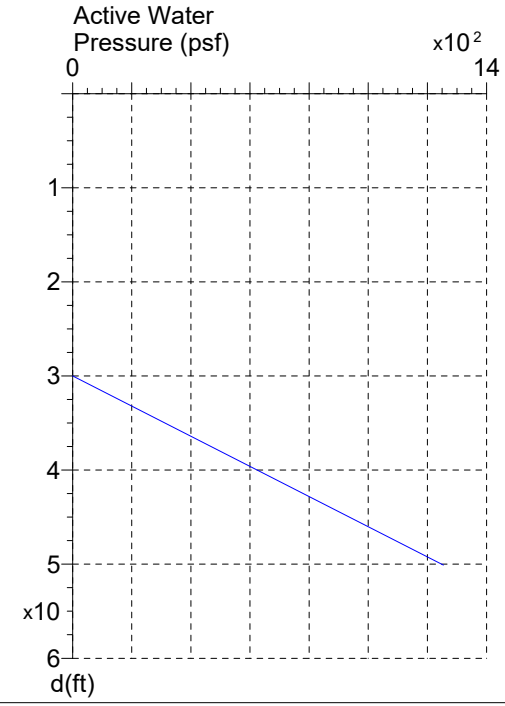
Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.50

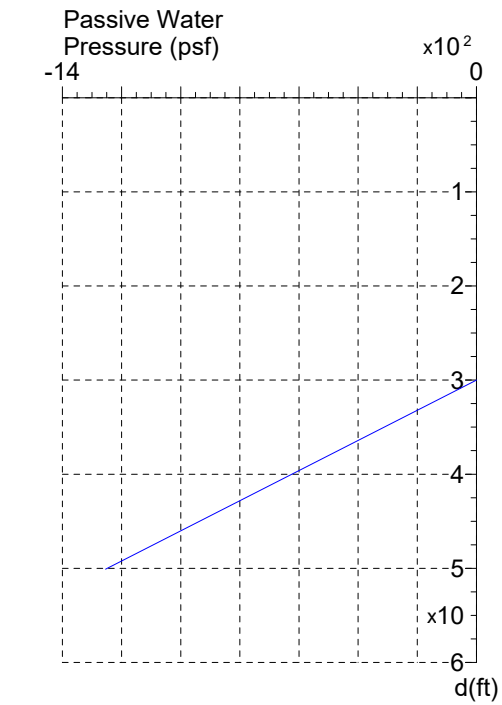
Page: 5
Date: 3.22.19

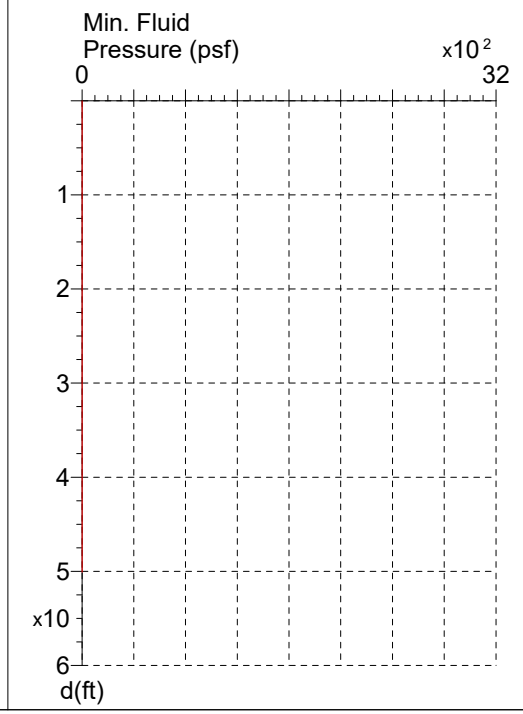
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure

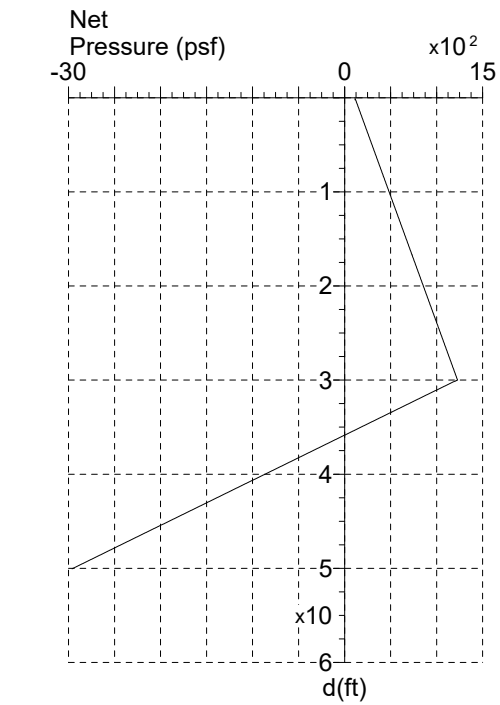












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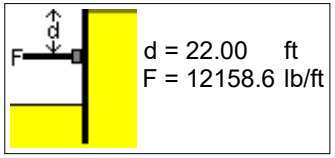
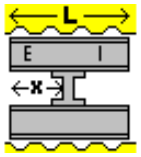
Client: Case 7 Stage 4 - Depth 30 ft
Site: FOS = 1.50

Page: 6
Date: 3.22.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure



d = 22.00 ft
F = 12158.6 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)

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Design Report

1. Maximum bending moment = 30034.2ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 14.44in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

2. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

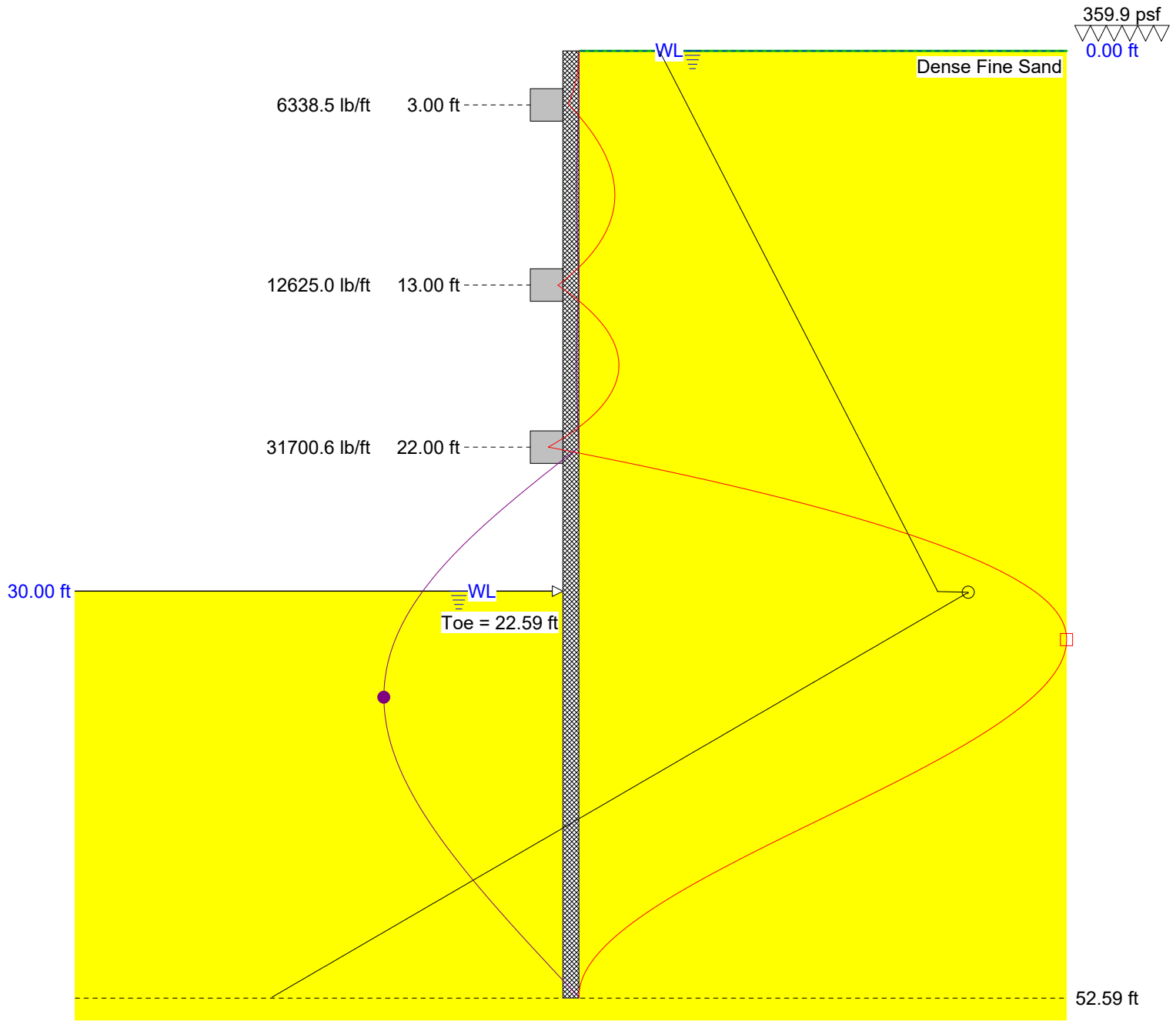
3. FOS = 1.50 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

Page: 1
Date: 3.5.19

Sheet: PZ35
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

Maximum	d (ft)
2621.6 psf	30.07
123027.4 ftlb/ft	32.70
1.6 in	35.89



MDOT Sheetpile Manual

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Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

Page: 2
Date: 3.5.19

Sheet: PZ35
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 30.00ft
Surcharge = 359.9psf

Depth Of Active Water = 0.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	22.59	52.59

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	6338.5
13.00	Brace	12625.0
22.00	Brace	31700.6

Maxima

	Maximum	Depth (ft)
Pressure	2621.6 psf	30.07
Bending Moment	123027.4 ftlb/ft	32.70
Deflection	1.6 in	35.89
Shear Force	23589.8 lb/ft	22.00

MDOT Sheetpile Manual

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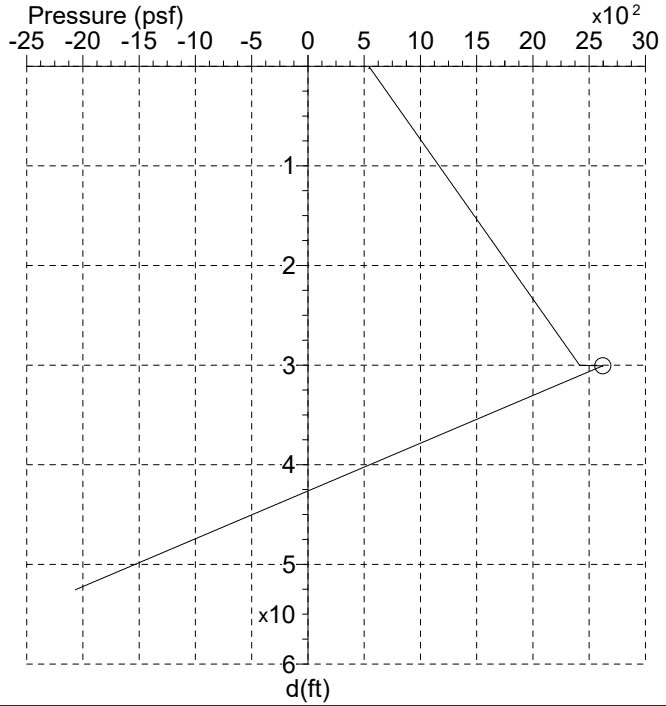
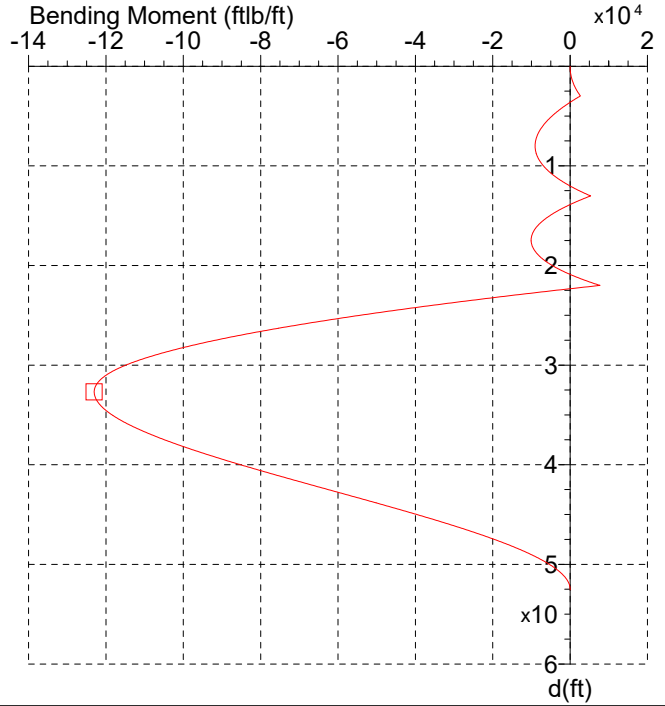
Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

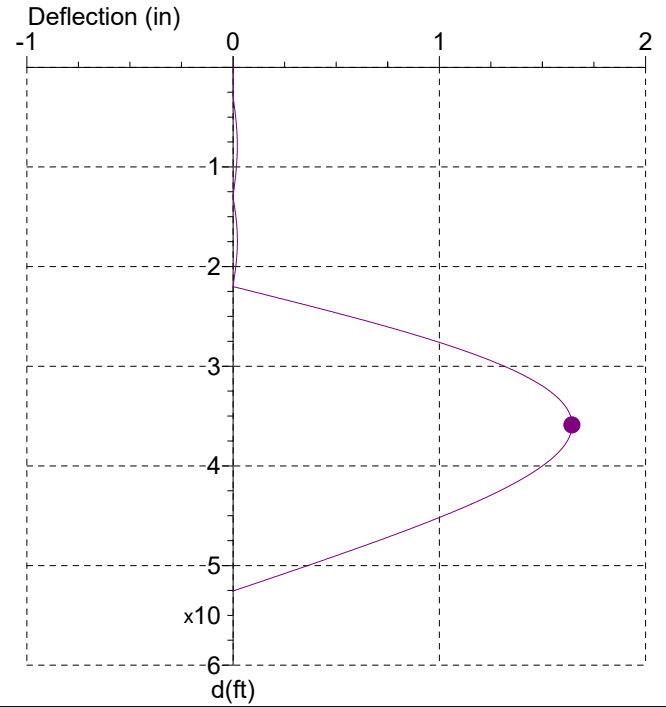
Page: 3
Date: 3.5.19

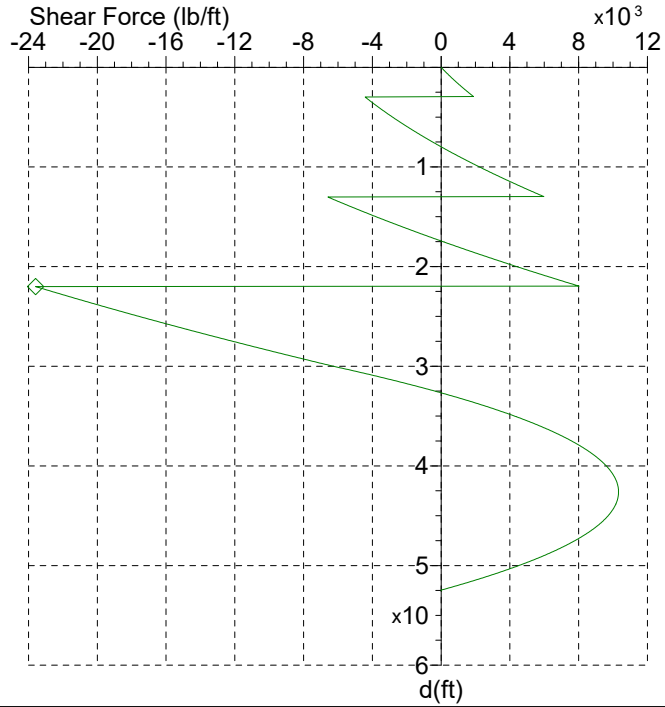
Sheet: PZ35
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

Maximum	d (ft)
2621.6 psf	30.07
123027.4 ftlb/ft	32.70
23589.8 lb/ft	22.00
1.6 in	35.89









MDOT Sheetpile Manual

SupportIT, v2.37

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Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

Page: 4
Date: 3.5.19

Sheet: PZ35
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	541.4	1.6	0.0	0.0
0.38	566.0	40.0	0.0	221.1
0.75	587.9	148.9	0.0	426.5
1.13	612.5	358.9	0.0	666.8
1.50	634.4	626.5	0.0	888.7
1.88	659.0	1022.1	0.0	1147.6
2.25	680.9	1460.8	0.0	1385.9
2.63	705.5	2055.8	0.0	1663.4
3.01	730.2	2484.8	0.0	-4388.6
3.38	752.1	994.2	0.0	-4128.2
3.76	776.7	-572.7	0.0	-3826.2
4.13	798.6	-1864.8	0.0	-3549.6
4.51	823.2	-3201.5	0.0	-3229.2
4.88	845.1	-4282.9	0.0	-2936.2
5.26	869.7	-5375.8	0.0	-2597.5
5.63	894.3	-6334.2	0.0	-2249.0
6.01	916.2	-7070.1	0.0	-1931.1
6.39	940.9	-7763.9	0.0	-1564.3
6.76	962.7	-8258.6	0.0	-1230.1
7.14	987.4	-8674.2	0.0	-845.0
7.51	1009.3	-8915.6	0.0	-494.5
7.89	1033.9	-9039.5	0.0	-91.0
8.26	1058.5	-9003.4	0.0	322.2
8.64	1080.4	-8833.8	0.0	697.7
9.02	1105.0	-8484.8	0.0	1129.2
9.39	1126.9	-8030.9	0.0	1521.0
9.77	1151.5	-7355.2	0.0	1970.9
10.14	1173.4	-6605.0	0.0	2379.0
10.52	1198.1	-5589.2	0.0	2847.2
10.89	1222.7	-4387.8	0.0	3325.2
11.27	1244.6	-3160.9	0.0	3758.2
11.65	1269.2	-1598.4	0.0	4254.5
12.02	1291.1	-44.6	0.0	4703.8
12.40	1315.7	1892.5	0.0	5218.5
12.77	1337.6	3785.3	0.0	5684.1
13.15	1362.2	4444.6	0.0	-6407.9
13.52	1386.8	1968.6	0.0	-5865.2
13.90	1408.7	-48.1	0.0	-5374.6
14.28	1433.4	-2106.0	0.0	-4813.5
14.65	1455.2	-3744.8	0.0	-4306.6
15.03	1479.9	-5370.7	0.0	-3727.2
15.40	1501.8	-6619.3	0.0	-3204.0
15.78	1526.4	-7799.3	0.0	-2606.3
16.15	1551.0	-8737.5	0.0	-1998.8
16.53	1572.9	-9365.5	0.0	-1450.7
16.90	1597.5	-9836.5	0.0	-824.9
17.28	1619.4	-10043.0	0.0	-260.4
17.66	1644.0	-10033.6	0.0	383.8
18.03	1665.9	-9810.9	0.0	964.5
18.41	1690.6	-9316.1	0.0	1627.0
18.78	1715.2	-8559.2	0.0	2299.3
19.16	1737.1	-7663.1	0.0	2905.0
19.53	1761.7	-6400.4	0.0	3595.5
19.91	1783.6	-5048.8	0.0	4217.5
20.29	1808.2	-3266.7	0.0	4926.5
20.66	1830.1	-1447.4	0.0	5564.8
21.04	1854.7	867.6	0.0	6292.0
21.41	1879.3	3470.3	0.0	7029.0
21.79	1901.2	6028.4	0.0	7692.3
22.16	1925.9	3628.1	0.0	-23252.9
22.54	1947.8	-4431.3	0.1	-22573.4
22.92	1972.4	-13211.5	0.2	-21799.7
23.29	1994.3	-20758.3	0.2	-21103.8
23.67	2018.9	-28954.8	0.3	-20311.8
24.04	2043.5	-36836.8	0.4	-19510.1
24.42	2065.4	-43575.9	0.5	-18789.2
24.79	2090.0	-50853.3	0.5	-17969.2
25.17	2111.9	-57048.9	0.6	-17232.0
25.55	2136.5	-63708.1	0.7	-16393.6
25.92	2158.4	-69348.0	0.7	-15640.2
26.30	2183.1	-75375.2	0.8	-14783.4
26.67	2207.7	-81062.4	0.9	-13916.9
27.05	2229.6	-85829.0	0.9	-13138.5
27.42	2254.2	-90863.2	1.0	-12253.7
27.80	2276.1	-95043.3	1.0	-11459.0
28.17	2300.7	-99411.0	1.1	-10555.8
28.55	2322.6	-102992.6	1.1	-9744.8
28.93	2347.2	-106680.0	1.2	-8823.3
29.30	2371.9	-110001.7	1.2	-7892.0
29.68	2393.7	-112644.2	1.3	-7056.1
30.05	2621.6	-115264.7	1.3	-6097.7
30.43	2548.4	-117265.7	1.4	-5192.5
30.80	2466.2	-119142.2	1.4	-4205.3
31.18	2393.0	-120487.2	1.4	-3355.1
31.56	2310.8	-121648.8	1.5	-2429.2
31.93	2228.5	-122450.4	1.5	-1535.8
32.31	2155.4	-122871.0	1.5	-768.8
32.68	2073.1	-123027.4	1.5	63.3
33.06	2000.0	-122908.0	1.6	775.8
33.43	1917.7	-122508.6	1.6	1546.6
33.81	1844.6	-121927.1	1.6	2204.6
34.19	1762.3	-121028.4	1.6	2914.1
34.56	1680.0	-119882.0	1.6	3591.2
34.94	1606.9	-118664.5	1.6	4165.8
35.31	1524.6	-117081.9	1.6	4781.6
35.69	1451.5	-115494.9	1.6	5301.8
36.06	1369.2	-113517.3	1.6	5856.3
36.44	1296.1	-111597.6	1.6	6321.9
36.82	1213.8	-109266.3	1.6	6815.2
37.19	1131.6	-106764.5	1.6	7275.9
37.57	1058.4	-104406.7	1.6	7658.2
37.94	976.2	-101614.2	1.6	8057.7
38.32	903.0	-99016.5	1.6	8385.5
38.69	820.8	-95974.5	1.6	8723.7
39.07	747.6	-93173.4	1.6	8997.0
39.44	665.4	-89923.3	1.5	9273.9
39.82	583.1	-86579.7	1.5	9518.3
40.20	510.0	-83538.5	1.5	9708.4
40.57	427.7	-80049.9	1.5	9891.5
40.95	354.6	-76898.1	1.4	10027.0
41.32	272.3	-73305.6	1.4	10148.8
41.70	199.2	-70079.8	1.4	10229.9
42.07	116.9	-66424.8	1.3	10290.4
42.45	34.6	-62753.3	1.3	10318.5
42.83	-38.5	-59485.4	1.3	10316.1
43.20	-120.8	-55814.5	1.2	10282.2
43.58	-193.9	-52565.8	1.2	10224.3
43.95	-276.2	-48937.5	1.1	10127.9
44.33	-349.3	-45745.3	1.1	10014.4
44.70	-431.6	-42201.8	1.1	9855.4
45.08	-513.8	-38720.1	1.0	9663.4
45.46	-587.0	-35686.8	1.0	9464.9
45.83	-669.2	-32354.2	0.9	9210.3
46.21	-742.4	-29472.1	0.9	8956.2
46.58	-824.6	-26330.6	0.8	8639.0
46.96	-897.8	-23637.0	0.8	8329.3
47.33	-980.0	-20728.8	0.7	7949.7
47.71	-1062.3	-17961.0	0.7	7536.9
48.08	-1135.4	-15628.3	0.6	7142.2
48.46	-1217.7	-13158.1	0.6	6666.9
48.84	-1290.8	-11108.5	0.5	6216.6
49.21	-1373.1	-8978.0	0.5	5678.8
49.59	-1446.2	-7249.1	0.4	5172.9
49.96	-1528.5	-5500.2	0.4	4572.6
50.34	-1610.8	-3970.6	0.3	3939.1
50.71	-1683.9	-2804.3	0.3	3348.2
51.09	-1766.2	-1720.7	0.2	2652.2
51.47	-1839.3	-969.7	0.2	2005.7
51.84	-1921.6	-374.3	0.1	1247.2
52.22	-1994.7	-75.9	0.1	545.1
52.59	-2067.8	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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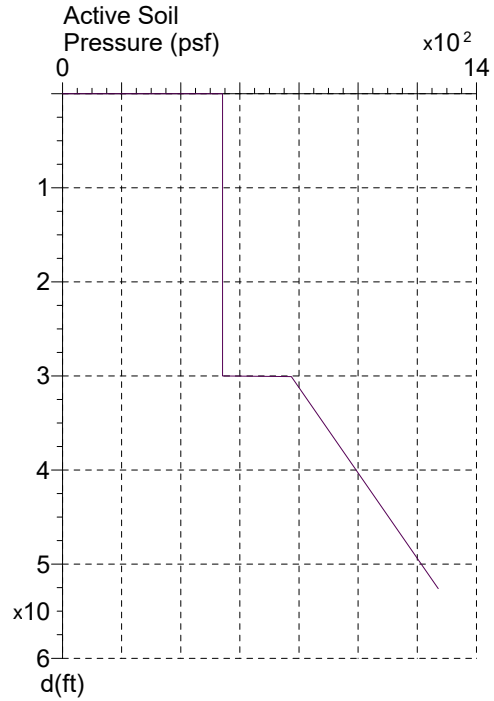
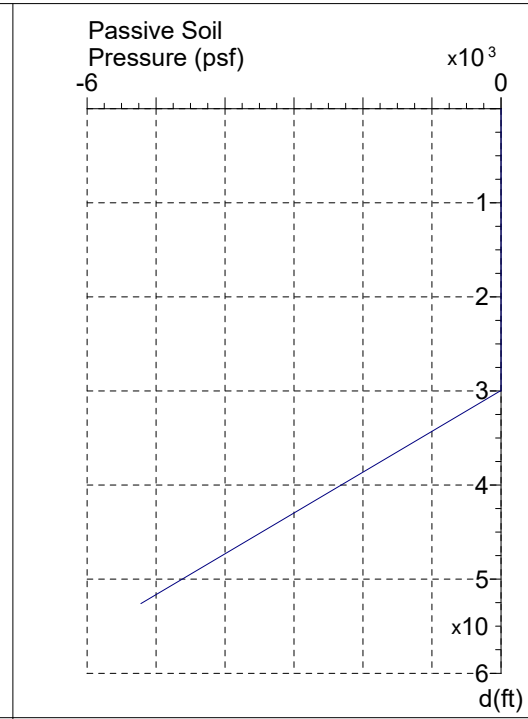
Web: www.GTSoft.org

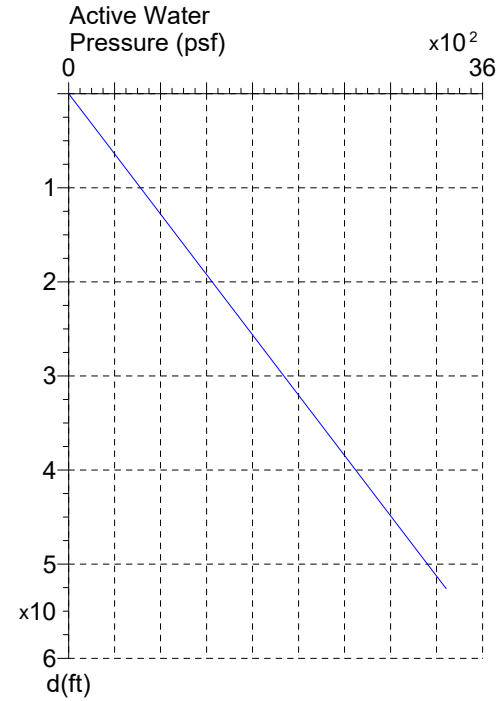
Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

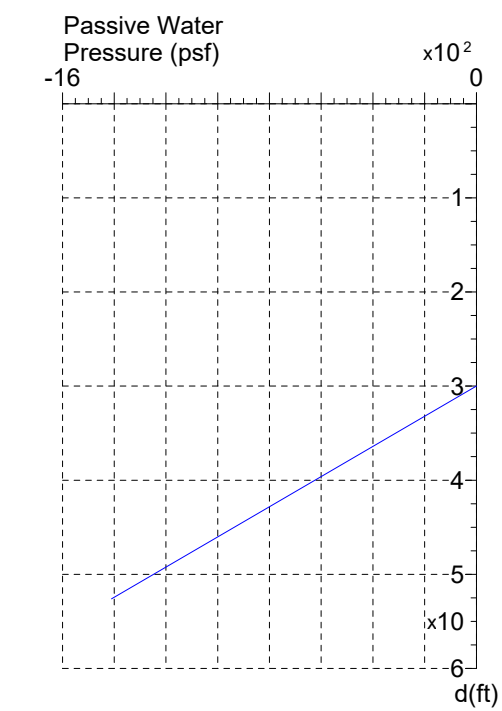
Page: 5
Date: 3.5.19

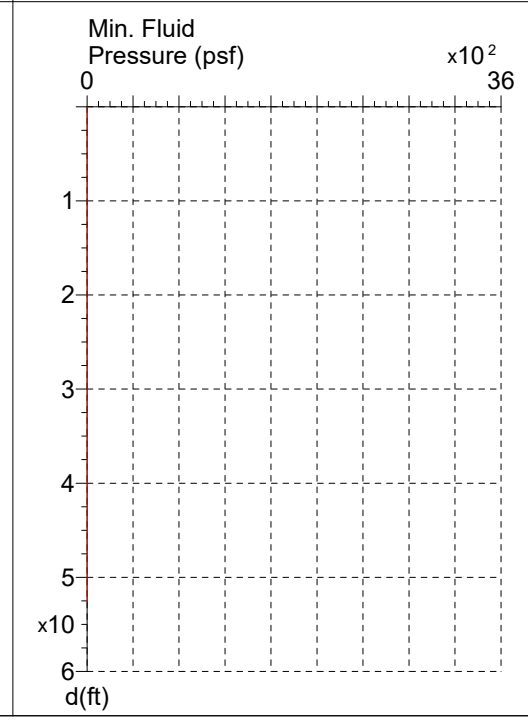
Sheet: PZ35
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

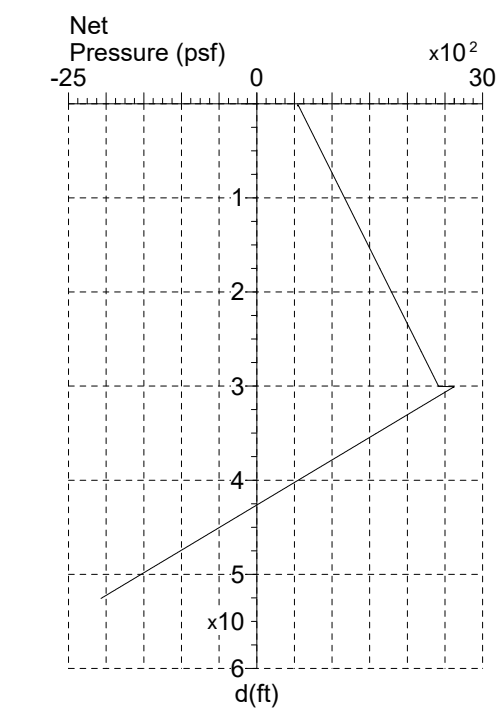












MDOT Sheetpile Manual

SupportIT, v2.37

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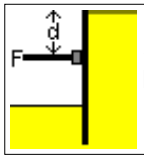
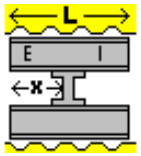
Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

Page: 6
Date: 3.5.19

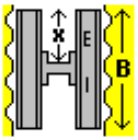
Sheet: PZ35
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure



d = 22.00 ft
F = 31700.6 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

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SupportIT, v2.37

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Client:	Case 7 Terzahgi & Peck Strut Loads
Site:	FOS = 1.0
Page:	7
Date:	3.5.19
Sheet:	PZ35
Works:	Temporary
Pressure:	Terzaghi
Analysis:	Gross Pressure

Design Report

1. Terzaghi was used for the active pressure down to the excavation depth. Rankine was used for the active pressure below the excavation depth and the passive pressure.

2. Maximum bending moment = 123027.4ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 59.13in³/ft (= M/f). Sheet section modulus in this design is Z = 48.90in³/ft, and is LESS THAN minimum required. Z should be increased.

3. Bending Moment (123027.4ftlb/ft) exceeds maximum allowed sheet moment (101739.5ftlb/ft).

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

5. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

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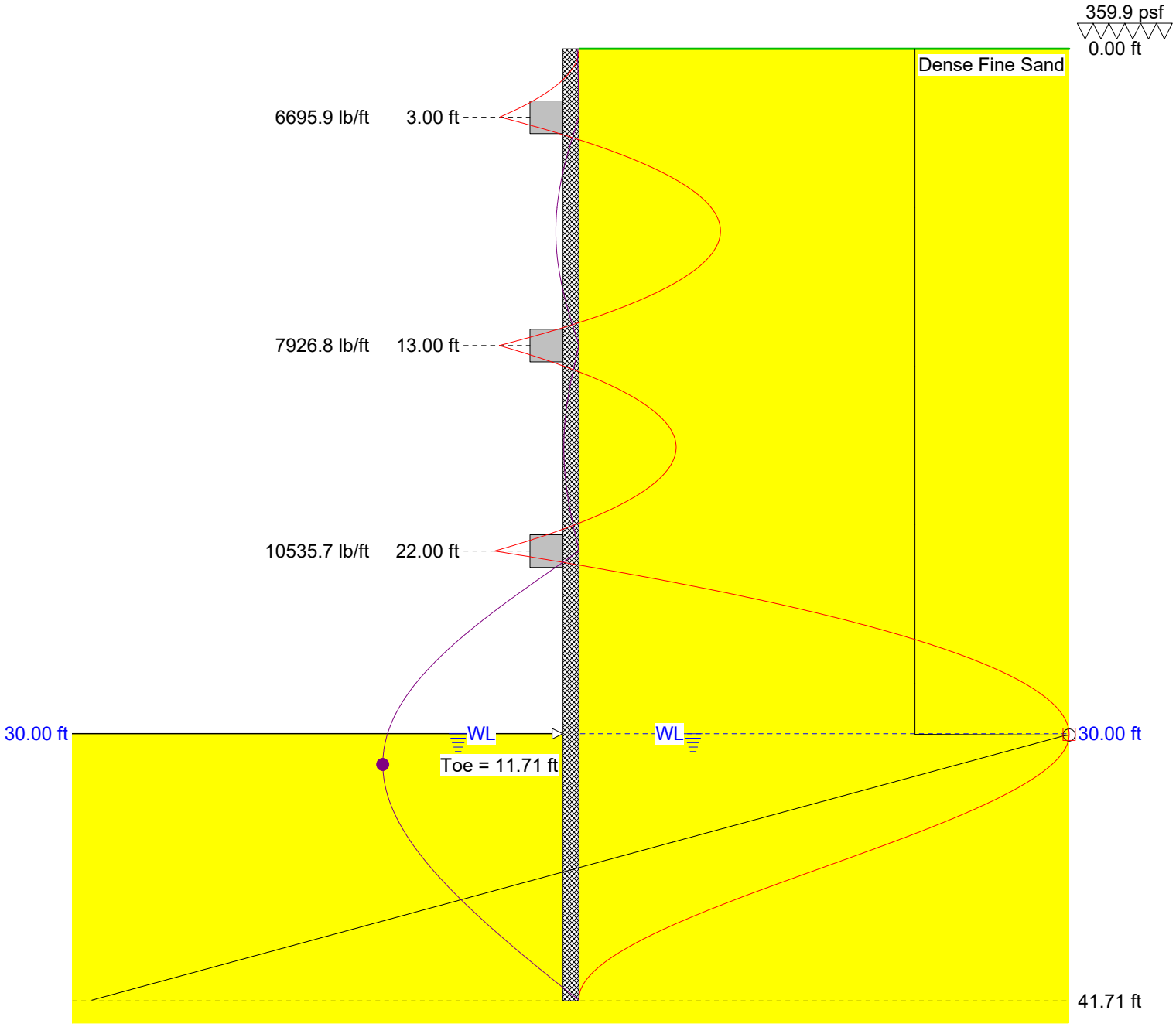
Web: www.GTSoft.org

Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

Page: 1
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

Maximum	d (ft)
1221.0 psf	30.07
23189.2 ftlb/ft	30.03
0.6 in	31.35



MDOT Sheetpile Manual

SupportIT, v2.37

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Web: www.GTSoft.org

Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

Page: 2
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

Input Data

Depth Of Excavation = 30.00ft
Surcharge = 359.9psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Dense Fine Sand	120.00	71.10	0.0	0.0	32.0	0.0	0.31	0.00	3.25	0.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	11.71	41.71

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	6695.9
13.00	Brace	7926.8
22.00	Brace	10535.7

Maxima

	Maximum	Depth (ft)
Pressure	1221.0 psf	30.07
Bending Moment	23189.2 ftlb/ft	30.03
Deflection	0.6 in	31.35
Shear Force	6713.9 lb/ft	22.00

MDOT Sheetpile Manual

SupportIT, v2.37

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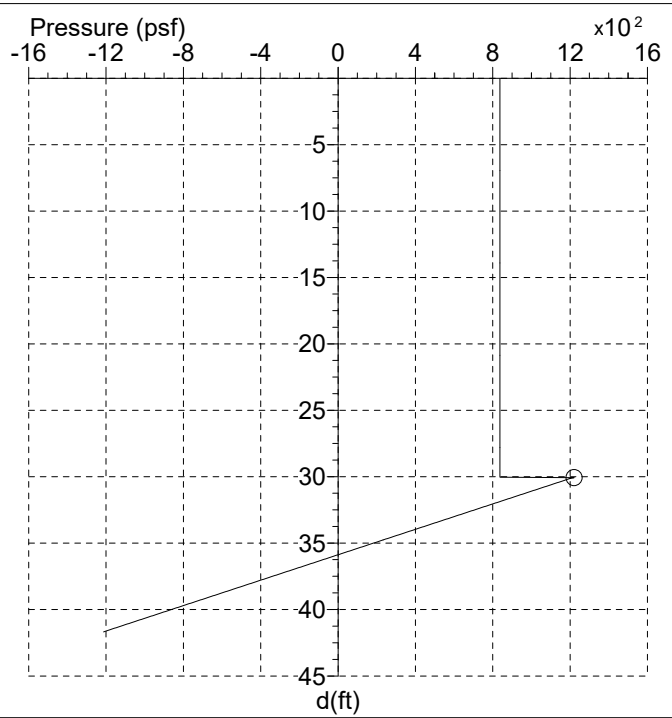
Web: www.GTSoft.org

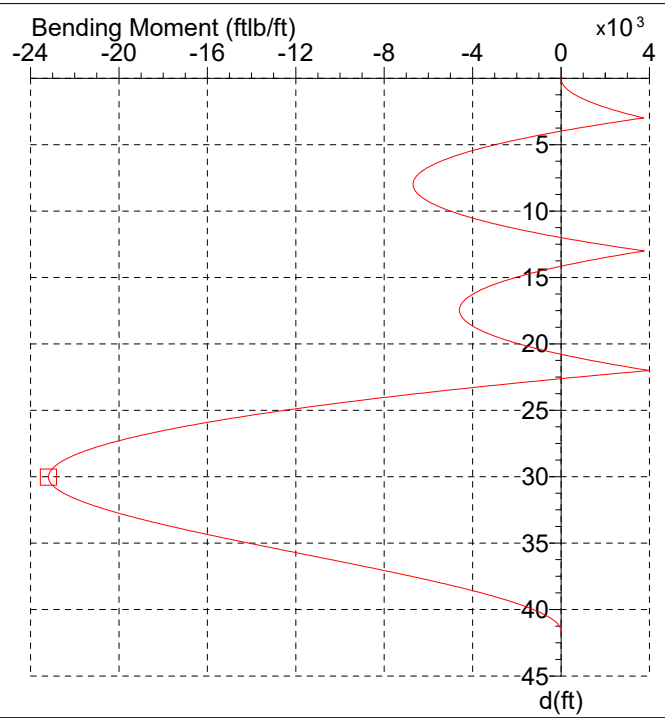
Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

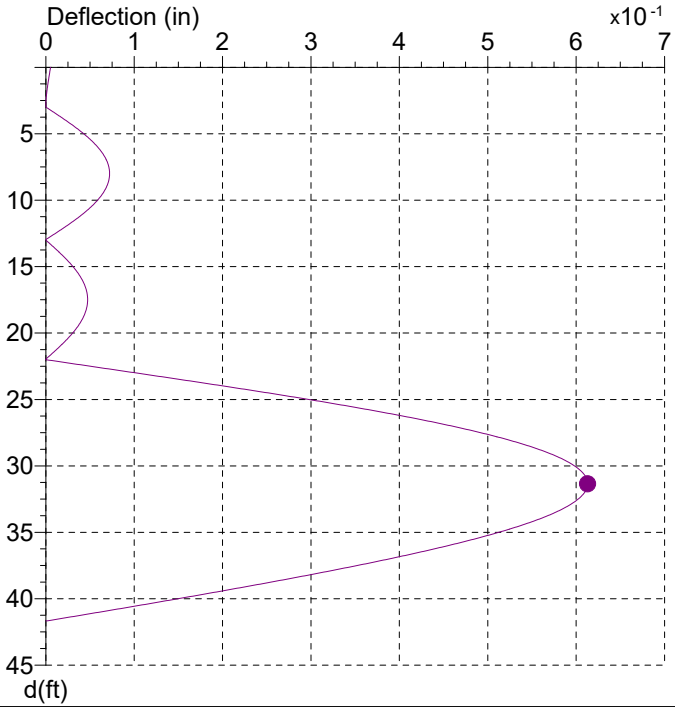
Page: 3
Date: 3.5.19

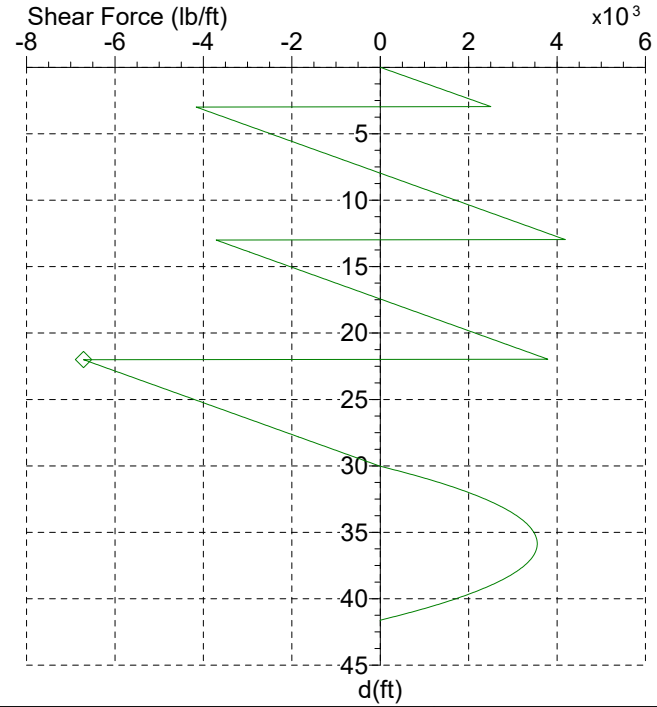
Sheet: PZ22
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

Maximum	d (ft)
1221.0 psf	30.07
23189.2 ftlb/ft	30.03
6713.9 lb/ft	22.00
0.6 in	31.35









MDOT Sheetpile Manual

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Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

Page: 4
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	837.0	0.0	0.0	0.0
0.30	837.0	36.8	0.0	264.9
0.60	837.0	139.1	0.0	500.4
0.89	837.0	332.5	0.0	765.3
1.19	837.0	574.0	0.0	1000.8
1.49	837.0	923.9	0.0	1265.7
1.79	837.0	1304.5	0.0	1501.2
2.09	837.0	1810.9	0.0	1766.1
2.38	837.0	2400.2	0.0	2031.0
2.68	837.0	2993.6	0.0	2266.5
2.98	837.0	3738.8	0.0	-4164.8
3.28	837.0	2609.0	0.0	-3932.1
3.58	837.0	1415.3	0.0	-3670.3
3.87	837.0	423.0	0.0	-3437.5
4.17	837.0	-615.9	0.0	-3175.7
4.47	837.0	-1573.0	0.0	-2913.9
4.77	837.0	-2354.9	0.0	-2681.1
5.06	837.0	-3157.2	0.0	-2419.3
5.36	837.0	-3801.7	0.0	-2186.6
5.66	837.0	-4449.3	0.1	-1924.7
5.96	837.0	-4956.2	0.1	-1692.0
6.26	837.0	-5449.1	0.1	-1430.2
6.55	837.0	-5860.1	0.1	-1168.3
6.85	837.0	-6156.6	0.1	-935.6
7.15	837.0	-6412.9	0.1	-673.8
7.45	837.0	-6571.9	0.1	-441.0
7.75	837.0	-6673.5	0.1	-179.2
8.04	837.0	-6695.0	0.1	53.6
8.34	837.0	-6642.2	0.1	315.4
8.64	837.0	-6508.1	0.1	577.2
8.94	837.0	-6320.6	0.1	810.0
9.24	837.0	-6032.8	0.1	1071.8
9.53	837.0	-5708.8	0.1	1304.5
9.83	837.0	-5267.4	0.1	1566.4
10.13	837.0	-4806.8	0.1	1799.1
10.43	837.0	-4211.7	0.1	2060.9
10.73	837.0	-3535.4	0.0	2322.8
11.02	837.0	-2865.9	0.0	2555.5
11.32	837.0	-2035.9	0.0	2817.3
11.62	837.0	-1229.8	0.0	3050.1
11.92	837.0	-246.2	0.0	3311.9
12.22	837.0	696.4	0.0	3544.7
12.51	837.0	1833.7	0.0	3806.5
12.81	837.0	3052.3	0.0	4068.3
13.11	837.0	3379.4	0.0	-3625.8
13.41	837.0	2273.2	0.0	-3364.0
13.70	837.0	1359.1	0.0	-3131.2
14.00	837.0	408.7	0.0	-2869.4
14.30	837.0	-366.8	0.0	-2636.7
14.60	837.0	-1161.2	0.0	-2374.8
14.90	837.0	-1873.2	0.0	-2113.0
15.19	837.0	-2436.7	0.0	-1880.3
15.49	837.0	-2992.8	0.0	-1618.4
15.79	837.0	-3417.7	0.0	-1385.7
16.09	837.0	-3817.8	0.0	-1123.9
16.39	837.0	-4104.2	0.0	-891.1
16.68	837.0	-4348.4	0.0	-629.3
16.98	837.0	-4510.1	0.0	-367.5
17.28	837.0	-4584.6	0.0	-134.7
17.58	837.0	-4590.5	0.0	127.1
17.88	837.0	-4527.3	0.0	359.9
18.17	837.0	-4379.5	0.0	621.7
18.47	837.0	-4179.8	0.0	854.4
18.77	837.0	-3878.5	0.0	1116.3
19.07	837.0	-3495.9	0.0	1378.1
19.37	837.0	-3087.5	0.0	1610.8
19.66	837.0	-2551.4	0.0	1872.7
19.96	837.0	-2006.6	0.0	2105.4
20.26	837.0	-1316.9	0.0	2367.2
20.56	837.0	-635.7	0.0	2600.0
20.86	837.0	207.5	0.0	2861.8
21.15	837.0	1131.9	0.0	3123.6
21.45	837.0	2021.9	0.0	3356.4
21.75	837.0	3099.9	0.0	3618.2
22.05	837.0	3761.6	0.0	-6684.8
22.34	837.0	1696.1	0.0	-6423.0
22.64	837.0	-70.8	0.1	-6190.2
22.94	837.0	-1980.8	0.1	-5928.4
23.24	837.0	-3808.4	0.1	-5666.5
23.54	837.0	-5363.9	0.2	-5433.8
23.83	837.0	-7036.0	0.2	-5172.0
24.13	837.0	-8453.2	0.2	-4939.2
24.43	837.0	-9969.8	0.2	-4677.4
24.73	837.0	-11248.8	0.3	-4444.7
25.03	837.0	-12609.9	0.3	-4182.8
25.32	837.0	-13888.6	0.3	-3921.0
25.62	837.0	-14956.1	0.4	-3688.3
25.92	837.0	-16079.4	0.4	-3426.4
26.22	837.0	-17008.6	0.4	-3193.7
26.52	837.0	-17976.3	0.4	-2931.9
26.81	837.0	-18767.4	0.4	-2699.1
27.11	837.0	-19579.6	0.5	-2437.3
27.41	837.0	-20309.4	0.5	-2175.4
27.71	837.0	-20889.0	0.5	-1942.7
28.01	837.0	-21463.3	0.5	-1680.9
28.30	837.0	-21904.7	0.5	-1448.1
28.60	837.0	-22323.5	0.6	-1186.3
28.90	837.0	-22626.6	0.6	-953.6
29.20	837.0	-22889.9	0.6	-691.7
29.50	837.0	-23070.8	0.6	-429.9
29.79	837.0	-23162.5	0.6	-197.1
30.09	1206.5	-23187.6	0.6	90.9
30.39	1148.3	-23132.4	0.6	417.3
30.69	1082.9	-22980.6	0.6	765.1
30.98	1024.8	-22770.3	0.6	1057.2
31.28	959.4	-22453.8	0.6	1366.4
31.58	894.0	-22057.9	0.6	1655.2
31.88	835.9	-21643.7	0.6	1894.7
32.18	770.5	-21112.6	0.6	2144.8
32.47	712.4	-20586.8	0.6	2350.0
32.77	647.0	-19939.8	0.6	2561.5
33.07	588.9	-19319.5	0.6	2732.3
33.37	523.5	-18575.9	0.6	2905.1
33.67	458.1	-17789.0	0.6	3057.5
33.96	400.0	-17057.4	0.6	3175.8
34.26	334.6	-16203.4	0.5	3289.6
34.56	276.4	-15420.9	0.5	3373.5
34.86	211.1	-14519.1	0.5	3448.6
35.16	152.9	-13702.7	0.5	3498.2
35.45	87.5	-12772.4	0.5	3534.7
35.75	22.1	-11835.0	0.5	3550.7
36.05	-36.0	-11000.0	0.5	3547.7
36.35	-101.4	-10063.6	0.4	3524.5
36.65	-159.5	-9238.4	0.4	3486.2
36.94	-224.9	-8323.1	0.4	3423.2
37.24	-283.0	-7525.3	0.4	3349.7
37.54	-348.4	-6650.7	0.3	3247.0
37.84	-413.8	-5805.7	0.3	3123.4
38.14	-471.9	-5084.0	0.3	2995.9
38.43	-537.3	-4310.2	0.3	2832.6
38.73	-595.4	-3660.5	0.3	2669.7
39.03	-660.8	-2977.6	0.2	2466.7
39.33	-719.0	-2417.6	0.2	2268.6
39.62	-784.4	-1845.4	0.2	2025.9
39.92	-849.7	-1340.0	0.2	1762.2
40.22	-907.9	-951.2	0.1	1510.2
40.52	-973.3	-586.9	0.1	1206.8
40.82	-1031.4	-332.3	0.1	919.4
41.11	-1096.8	-129.0	0.1	576.4
41.41	-1154.9	-26.3	0.0	253.7
41.71	-1213.0	0.0	0.0	0.0

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SupportIT, v2.37

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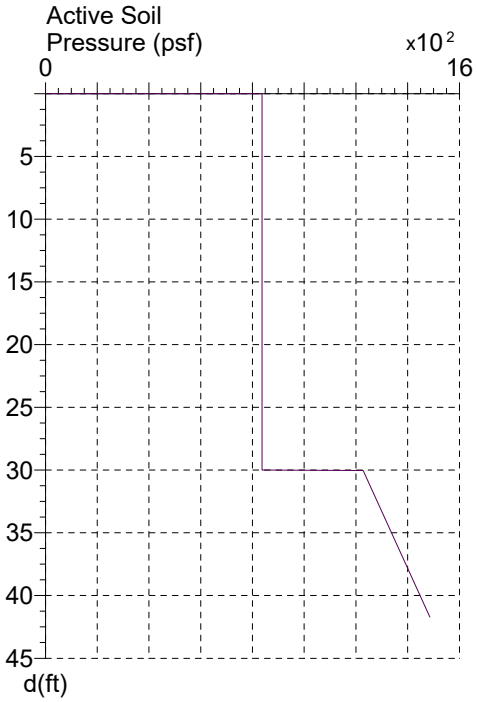
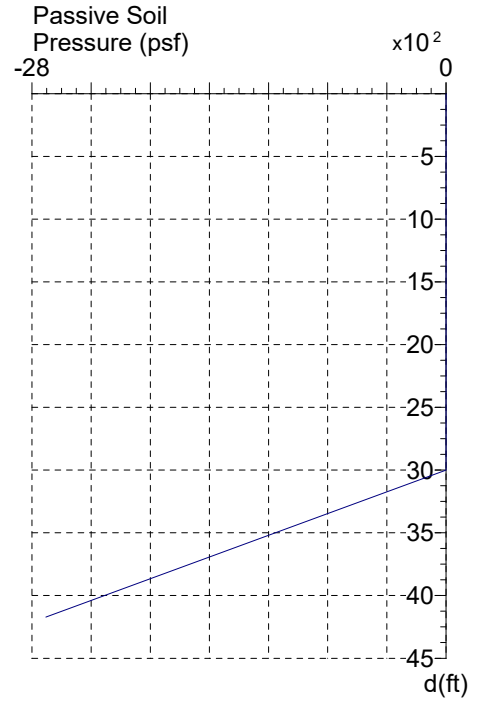
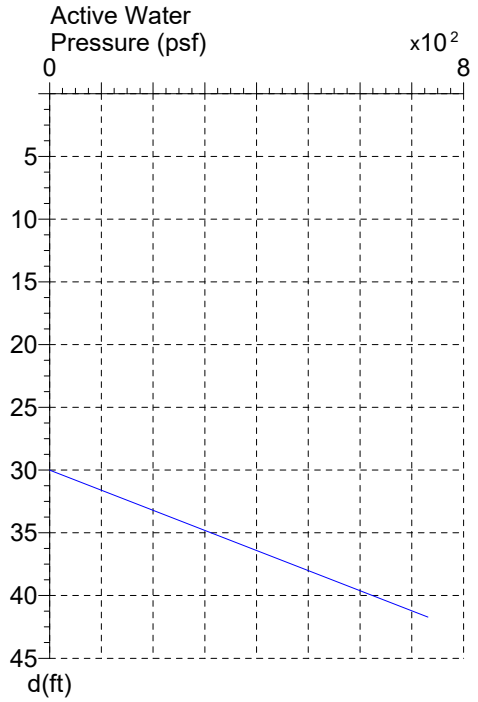
Client: Case 7 Terzahgi & Peck Strut Loads
Site: FOS = 1.0

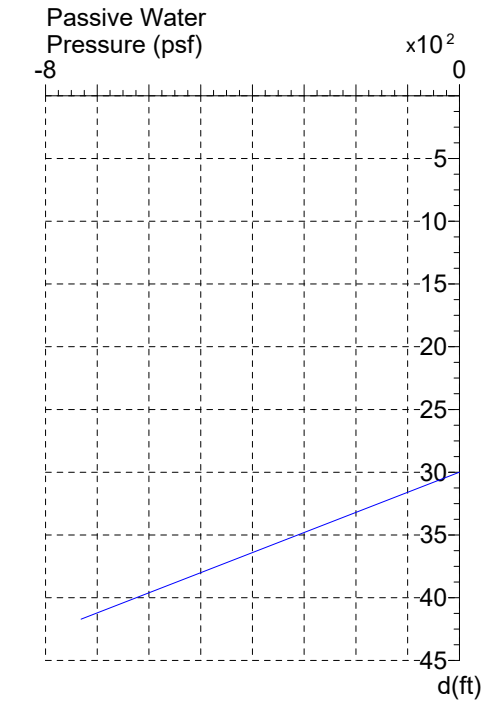
Page: 5
Date: 3.5.19

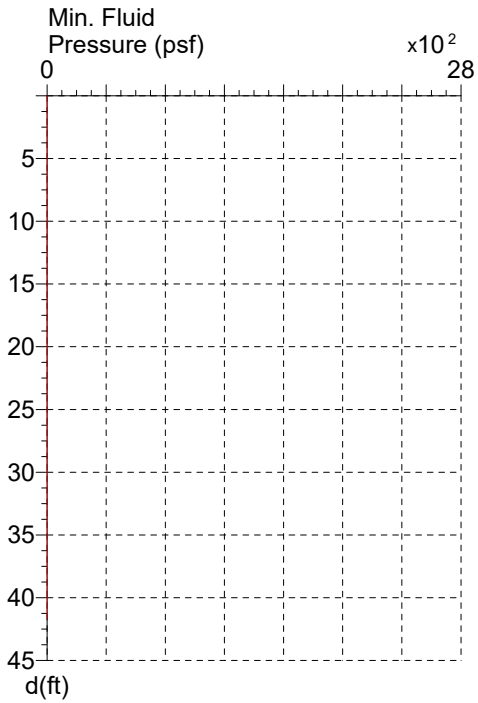
Sheet: PZ22
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

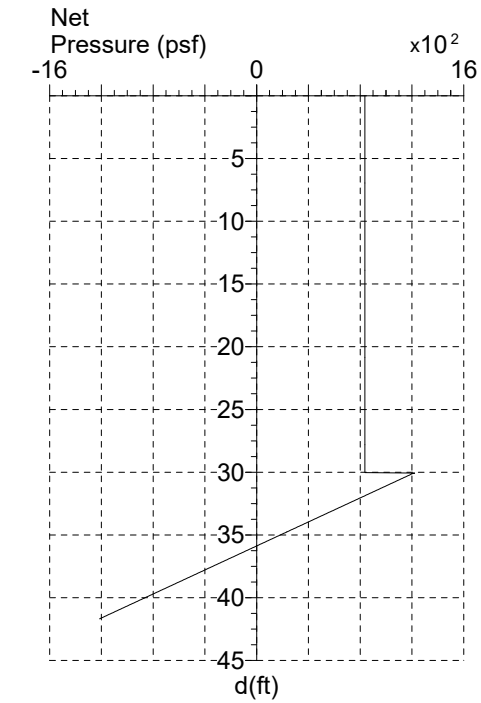












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Page: 6
Date: 3.5.19

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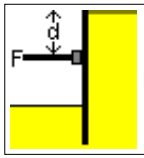
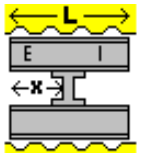
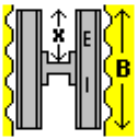
Pressure: Terzaghi
Analysis: Gross Pressure



d = 22.00 ft
F = 10535.7 lb/ft



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

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Site: FOS = 1.0

Page: 7
Date: 3.5.19

Sheet: PZ22
Works: Temporary
Pressure: Terzaghi
Analysis: Gross Pressure

Design Report

1. Terzaghi was used for the active pressure down to the excavation depth. Rankine was used for the active pressure below the excavation depth and the passive pressure.

2. Maximum bending moment = 23189.2ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 11.15in³/ft (= M/f). Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

3. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

4. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Appendix B.8 – SupportIT Output, Case 8

Case 8 – Braced Cofferdam TERS in Medium Stiff Clay

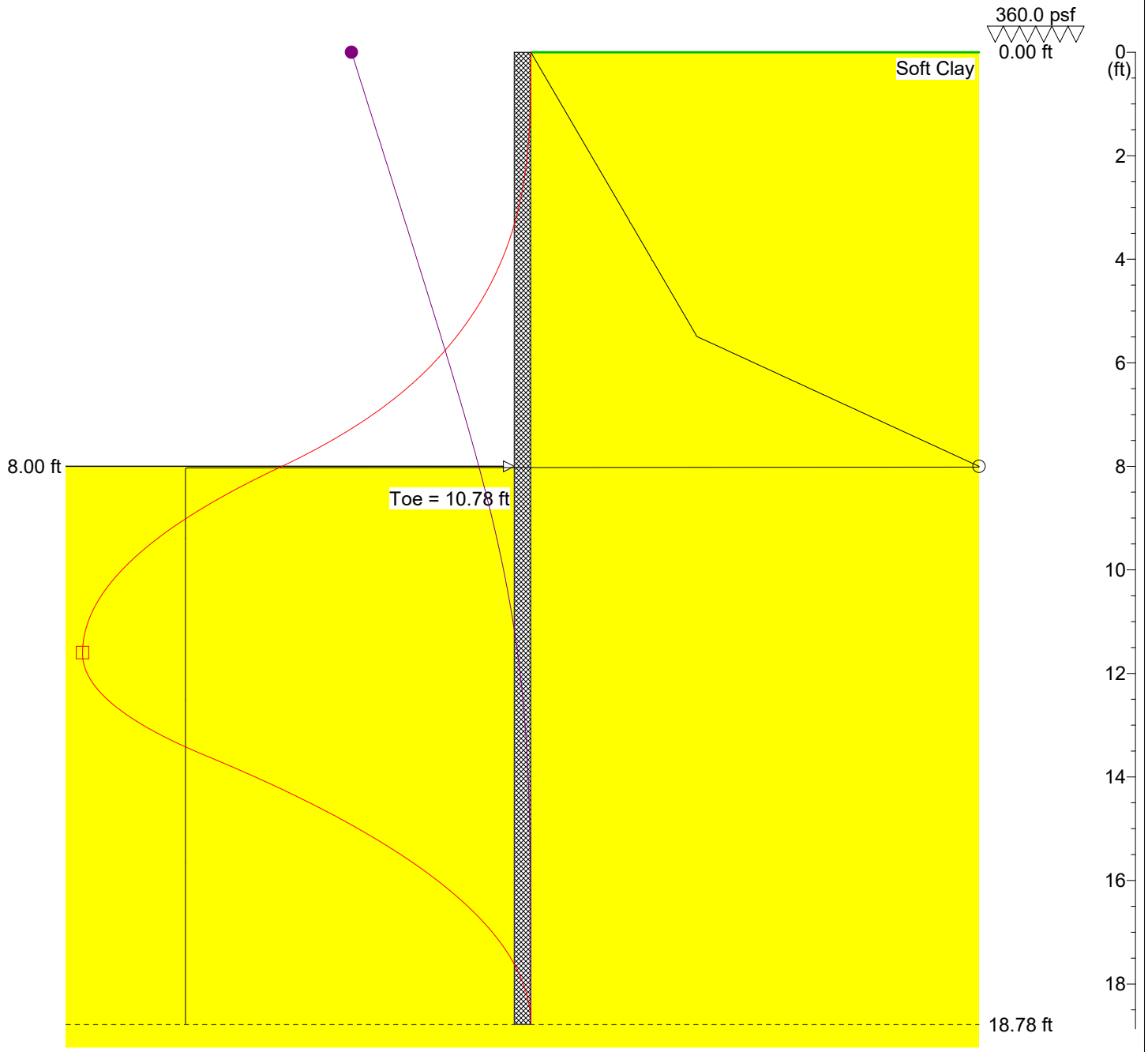
SupportIT output is included here for the four stages of construction and with a FOS = 1.5

Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.0

Page: 1
Date: 3.11.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
471.8 psf	8.00
5303.4 ftlb/ft	11.60
0.3 in	0.00



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SupportIT, v2.37

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Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.0

Page: 2
Date: 3.11.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 8.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ22	3.04E+07	84.70	24966.8	18.40	38282.3	22.01	6.46	40.3	0.00	10.78	18.78

Maxima

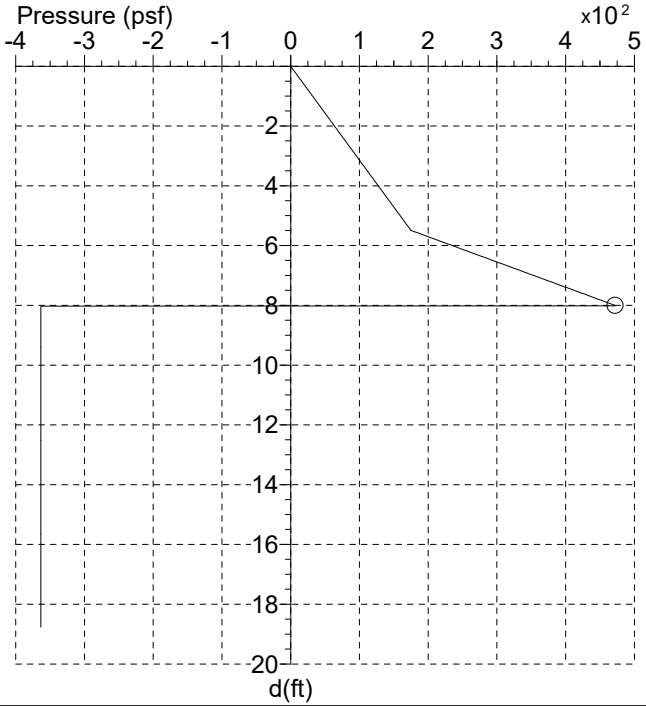
	Maximum	Depth (ft)
Pressure	471.8 psf	8.00
Bending Moment	5303.4 ftlb/ft	11.60
Deflection	0.3 in	0.00
Shear Force	1301.4 lb/ft	8.01

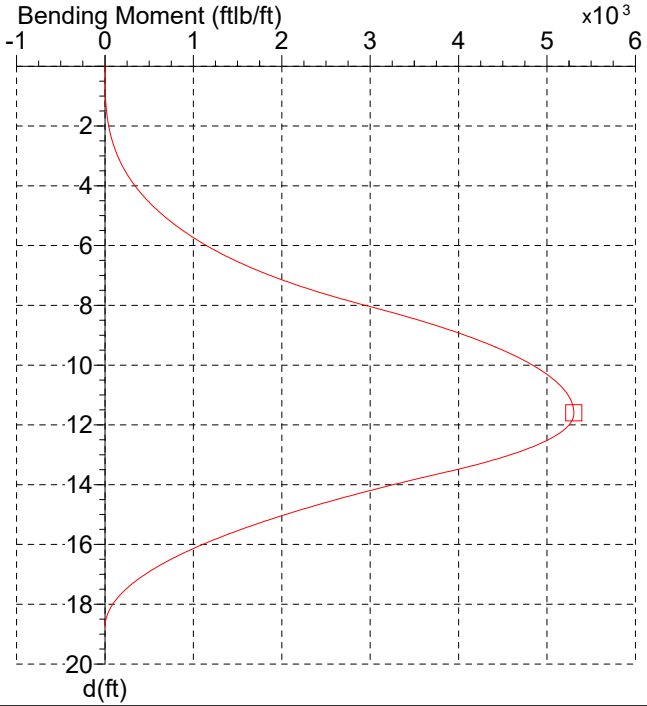
Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.0

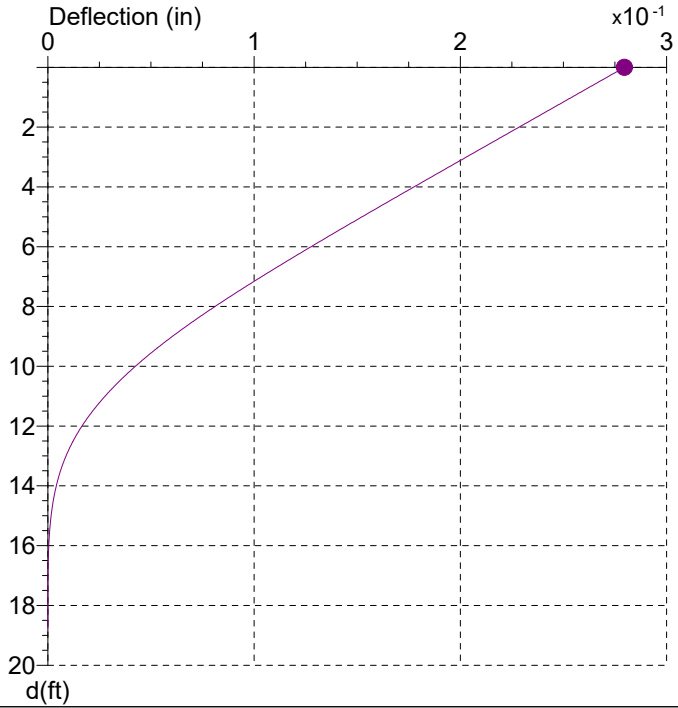
Page: 3
Date: 3.11.19

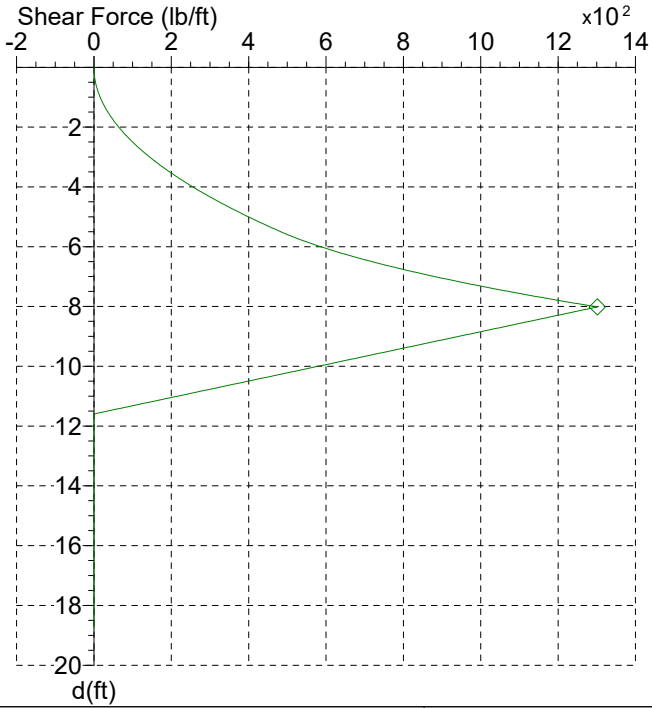
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
471.8 psf	8.00
5303.4 ftlb/ft	11.60
1301.4 lb/ft	8.01
0.3 in	0.00









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Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.0

Page: 4
Date: 3.11.19

Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	-0.1	0.3	0.0	6.31	271.5	1339.8	0.1	664.5	12.61	-363.4	4930.0	0.0	0.0
0.13	4.5	-0.1	0.3	0.4	6.44	286.3	1424.9	0.1	699.5	12.75	-363.4	4830.4	0.0	0.0
0.27	8.5	0.0	0.3	1.2	6.57	303.0	1526.1	0.1	741.1	12.88	-363.4	4704.2	0.0	0.0
0.40	13.0	0.3	0.3	2.7	6.71	319.6	1633.2	0.1	785.1	13.01	-363.4	4579.5	0.0	0.0
0.54	16.9	0.7	0.3	4.6	6.84	334.5	1733.7	0.1	826.2	13.15	-363.4	4425.0	0.0	0.0
0.67	21.4	1.5	0.3	7.4	6.98	351.1	1853.1	0.1	874.6	13.28	-363.4	4255.6	0.0	0.0
0.80	25.4	2.6	0.3	10.3	7.11	366.0	1965.1	0.1	919.6	13.42	-363.4	4092.6	0.0	0.0
0.94	29.9	4.3	0.3	14.3	7.24	382.6	2097.9	0.1	972.5	13.55	-363.4	3894.9	0.0	0.0
1.07	34.4	6.6	0.3	18.8	7.38	397.5	2222.3	0.1	1021.4	13.68	-363.4	3711.2	0.0	0.0
1.21	38.4	9.2	0.2	23.4	7.51	414.1	2369.8	0.1	1078.7	13.82	-363.4	3509.2	0.0	0.0
1.34	42.9	12.9	0.2	29.2	7.65	430.8	2525.4	0.1	1138.4	13.95	-363.4	3334.5	0.0	0.0
1.48	46.9	16.8	0.2	34.8	7.78	445.6	2671.0	0.1	1193.3	14.09	-363.4	3143.4	0.0	0.0
1.61	51.3	22.2	0.2	41.8	7.92	462.3	2843.1	0.1	1257.4	14.22	-363.4	2957.8	0.0	0.0
1.74	55.3	27.8	0.2	48.5	8.05	-363.4	3003.5	0.1	1290.1	14.36	-363.4	2797.6	0.0	0.0
1.88	59.8	35.1	0.2	56.6	8.18	-363.4	3182.1	0.1	1238.9	14.49	-363.4	2622.7	0.0	0.0
2.01	64.3	43.6	0.2	65.4	8.32	-363.4	3334.7	0.1	1193.4	14.62	-363.4	2472.0	0.0	0.0
2.15	68.3	52.3	0.2	73.8	8.45	-363.4	3499.6	0.1	1142.2	14.76	-363.4	2307.7	0.0	0.0
2.28	72.8	63.3	0.2	83.7	8.59	-363.4	3657.3	0.1	1091.0	14.89	-363.4	2166.5	0.0	0.0
2.41	76.8	74.3	0.2	93.1	8.72	-363.4	3791.4	0.1	1045.5	15.03	-363.4	2012.9	0.0	0.0
2.55	81.2	88.1	0.2	104.3	8.85	-363.4	3935.5	0.1	994.3	15.16	-363.4	1865.0	0.0	0.0
2.68	85.2	101.7	0.2	114.7	8.99	-363.4	4057.5	0.1	948.8	15.29	-363.4	1738.2	0.0	0.0
2.82	89.7	118.6	0.2	127.1	9.12	-363.4	4188.0	0.1	897.6	15.43	-363.4	1601.0	0.0	0.0
2.95	94.2	137.3	0.2	140.1	9.26	-363.4	4297.9	0.1	852.1	15.56	-363.4	1483.8	0.0	0.0
3.09	98.2	155.5	0.2	152.2	9.39	-363.4	4414.7	0.1	800.9	15.70	-363.4	1357.2	0.0	0.0
3.22	102.7	177.8	0.2	166.3	9.53	-363.4	4524.3	0.1	749.7	15.83	-363.4	1249.4	0.0	0.0
3.35	106.7	199.4	0.2	179.5	9.66	-363.4	4615.7	0.0	704.2	15.97	-363.4	1133.4	0.0	0.0
3.49	111.2	225.6	0.2	194.9	9.79	-363.4	4711.7	0.0	653.0	16.10	-363.4	1023.1	0.0	0.0
3.62	115.1	250.8	0.2	209.1	9.93	-363.4	4791.0	0.0	607.5	16.23	-363.4	929.9	0.0	0.0
3.76	119.6	281.3	0.2	225.6	10.06	-363.4	4873.3	0.0	556.3	16.37	-363.4	830.2	0.0	0.0
3.89	124.1	314.1	0.2	242.8	10.20	-363.4	4940.5	0.0	510.8	16.50	-363.4	746.4	0.0	0.0
4.02	128.1	345.4	0.2	258.6	10.33	-363.4	5009.3	0.0	459.6	16.64	-363.4	657.4	0.0	0.0
4.16	132.6	383.0	0.2	277.0	10.46	-363.4	5070.8	0.0	408.4	16.77	-363.4	583.1	0.0	0.0
4.29	136.6	418.6	0.2	293.9	10.60	-363.4	5119.4	0.0	362.9	16.90	-363.4	504.8	0.0	0.0
4.43	141.1	461.2	0.2	313.5	10.73	-363.4	5167.3	0.0	311.7	17.04	-363.4	432.1	0.0	0.0
4.56	145.1	501.5	0.2	331.5	10.87	-363.4	5203.9	0.0	266.2	17.17	-363.4	372.3	0.0	0.0
4.70	149.5	549.4	0.2	352.2	11.00	-363.4	5238.2	0.0	215.0	17.31	-363.4	310.3	0.0	0.0
4.83	154.0	600.4	0.2	373.7	11.14	-363.4	5262.6	0.0	169.5	17.44	-363.4	259.9	0.0	0.0
4.96	158.0	648.2	0.2	393.2	11.27	-363.4	5283.3	0.0	118.3	17.58	-363.4	208.5	0.0	0.0
5.10	162.5	705.1	0.1	415.8	11.40	-363.4	5296.7	0.0	67.1	17.71	-363.4	167.6	0.0	0.0
5.23	166.5	758.2	0.1	436.5	11.54	-363.4	5302.6	0.0	21.6	17.84	-363.4	126.9	0.0	0.0
5.37	171.0	821.2	0.1	460.3	11.67	-363.4	5302.1	0.0	0.0	17.98	-363.4	91.9	0.0	0.0
5.50	175.1	880.0	0.1	482.0	11.81	-363.4	5291.0	0.0	0.0	18.11	-363.4	65.5	0.0	0.0
5.63	191.8	949.5	0.1	507.9	11.94	-363.4	5264.1	0.0	0.0	18.25	-363.4	41.2	0.0	0.0
5.77	208.5	1022.8	0.1	536.3	12.07	-363.4	5227.9	0.0	0.0	18.38	-363.4	24.1	0.0	0.0
5.90	223.3	1091.4	0.1	563.4	12.21	-363.4	5172.7	0.0	0.0	18.51	-363.4	10.4	0.0	0.0
6.04	240.0	1172.8	0.1	596.2	12.34	-363.4	5102.9	0.0	0.0	18.65	-363.4	3.0	0.0	0.0
6.17	254.8	1249.2	0.1	627.3	12.48	-363.4	5028.4	0.0	0.0	18.78	-363.4	0.0	0.0	0.0

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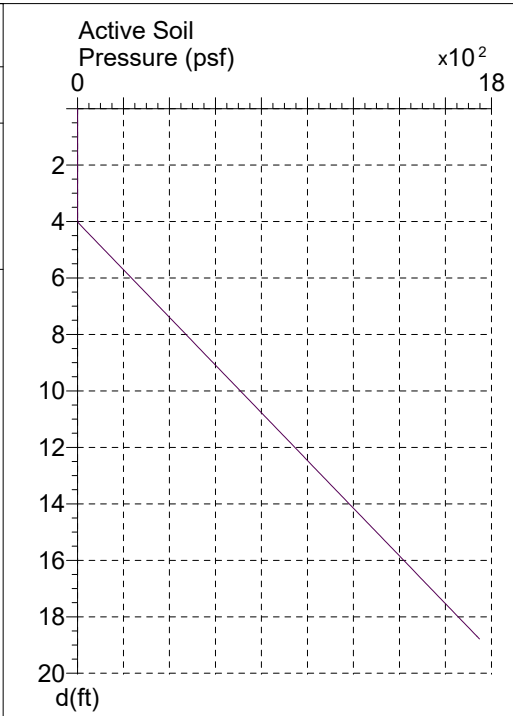
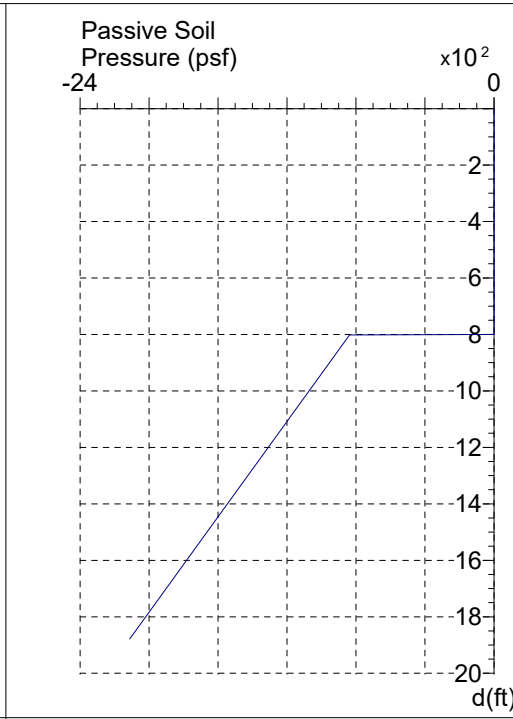
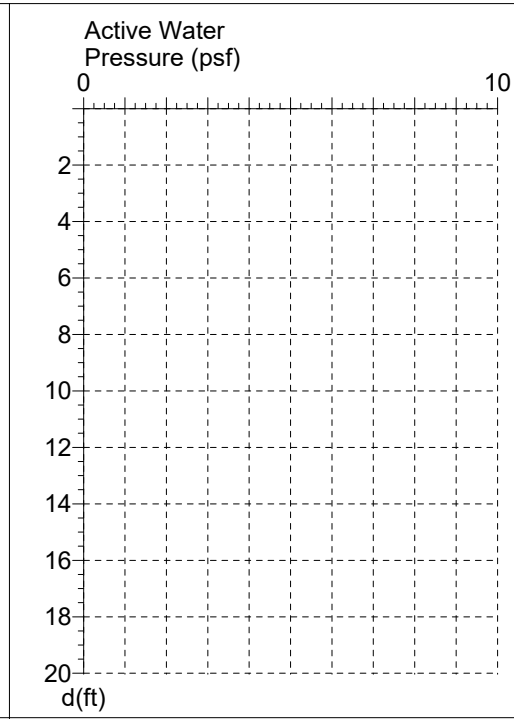
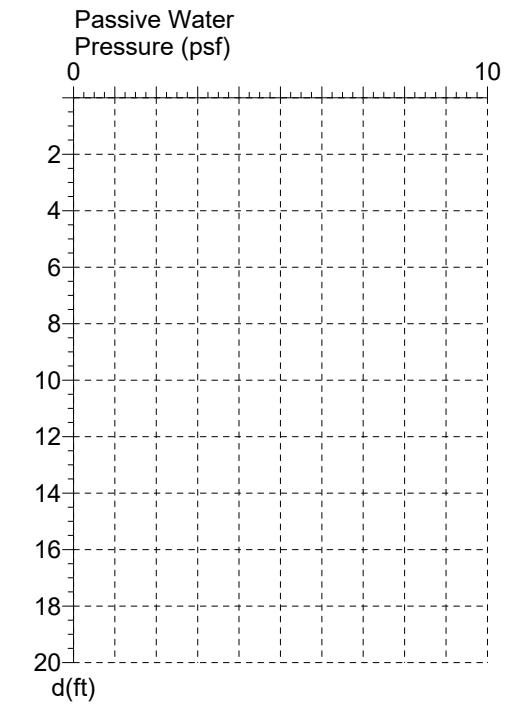
Page: 5
Date: 3.11.19

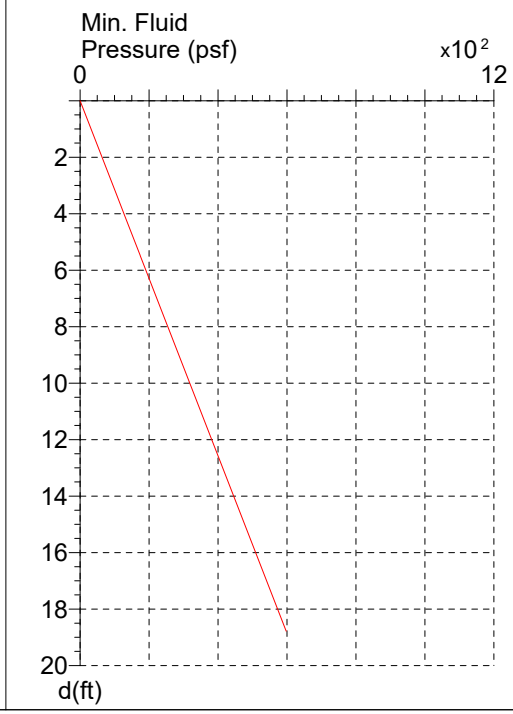
Sheet: PZ22
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

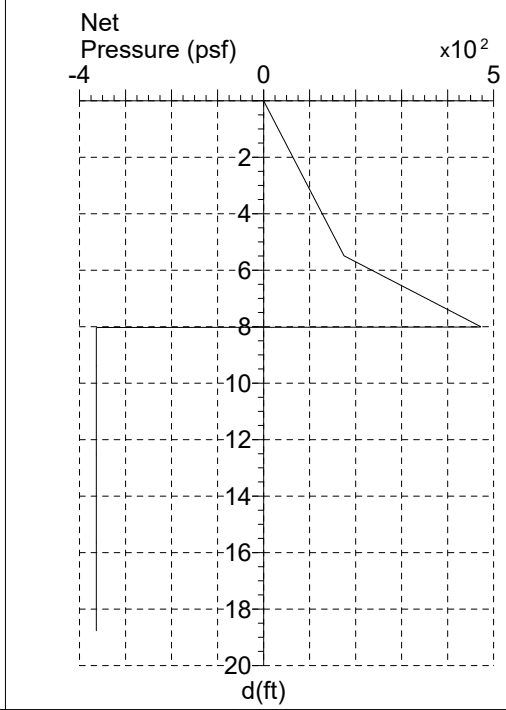












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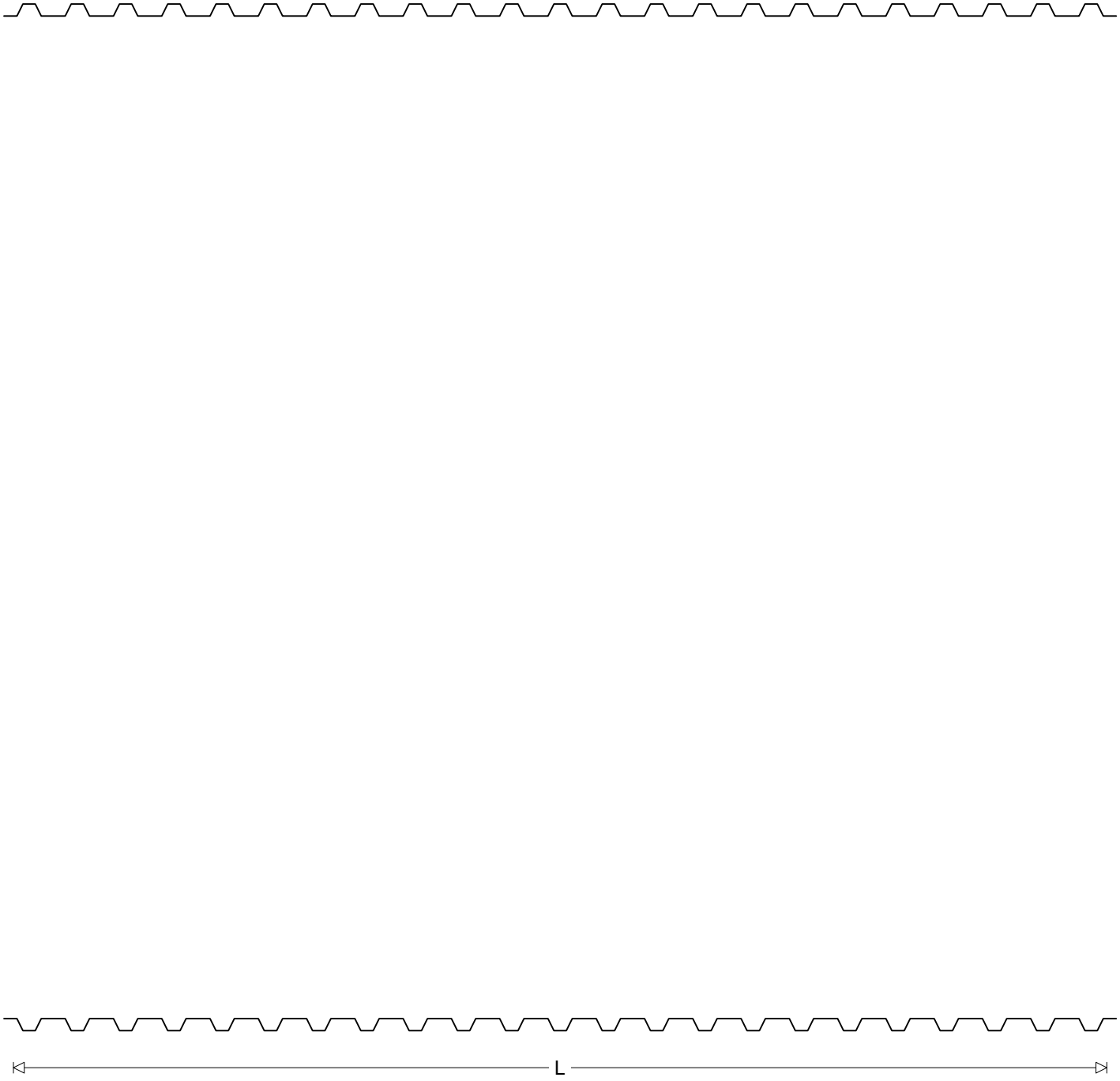
Analysis: Net Pressure
Toe: Cantilever



MDOT Sheetpile Manual

SupportIT, v2.37

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Design Report

1. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

2. Maximum bending moment = 5303.4ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 2.55in³/ft (= M/f).
   Sheet section modulus in this design is Z = 18.40in³/ft, and is satisfactory.

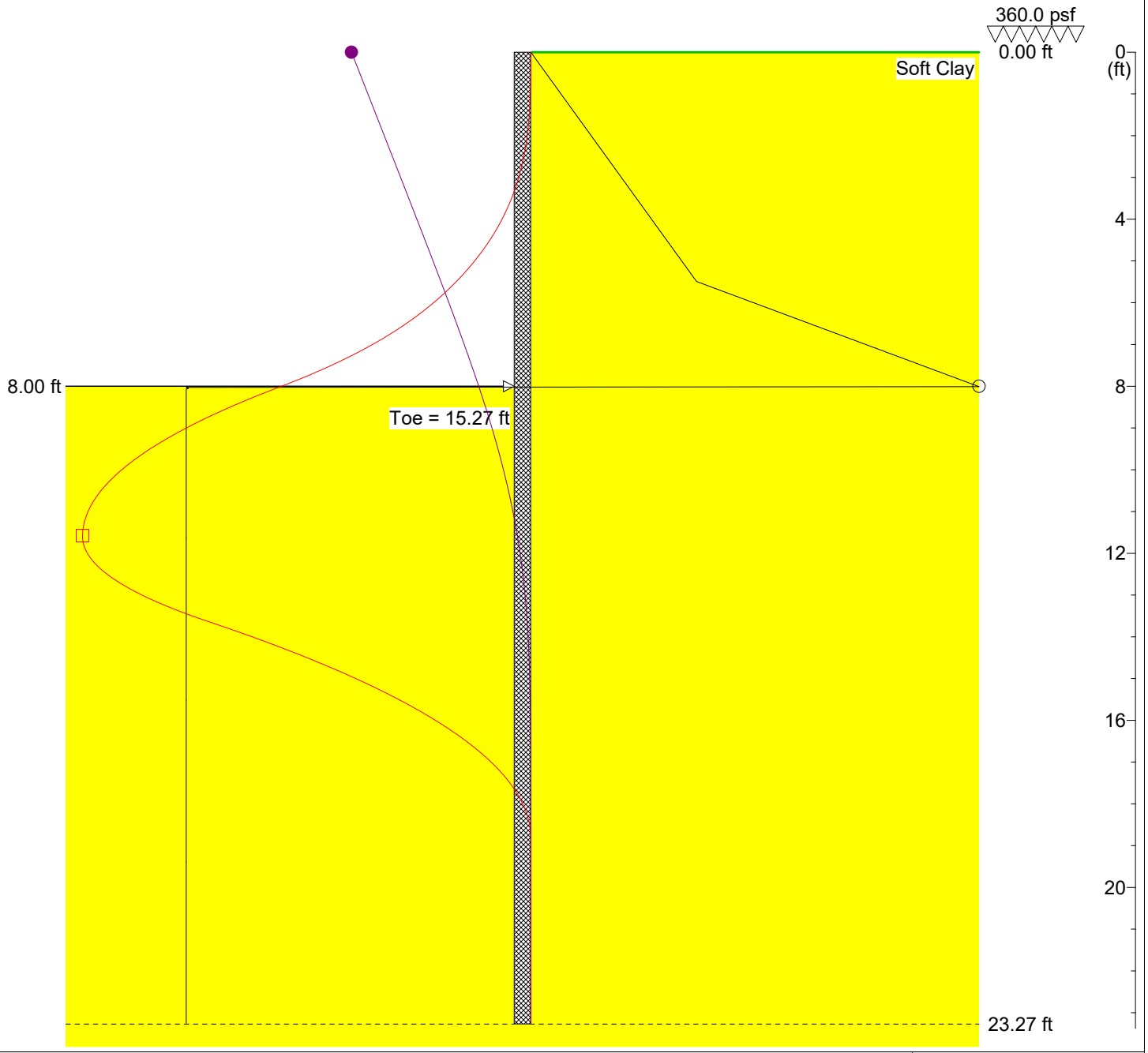
3. FOS = 1.00 (Net Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.50

Page: 1
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
472.8 psf	8.00
5293.7 ftlb/ft	11.58
0.1 in	0.00



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Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.50

Page: 2
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 8.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	15.27	23.27

Maxima

	Maximum	Depth (ft)
Pressure	472.8 psf	8.00
Bending Moment	5293.7 ftlb/ft	11.58
Deflection	0.1 in	0.00
Shear Force	1299.9 lb/ft	8.01

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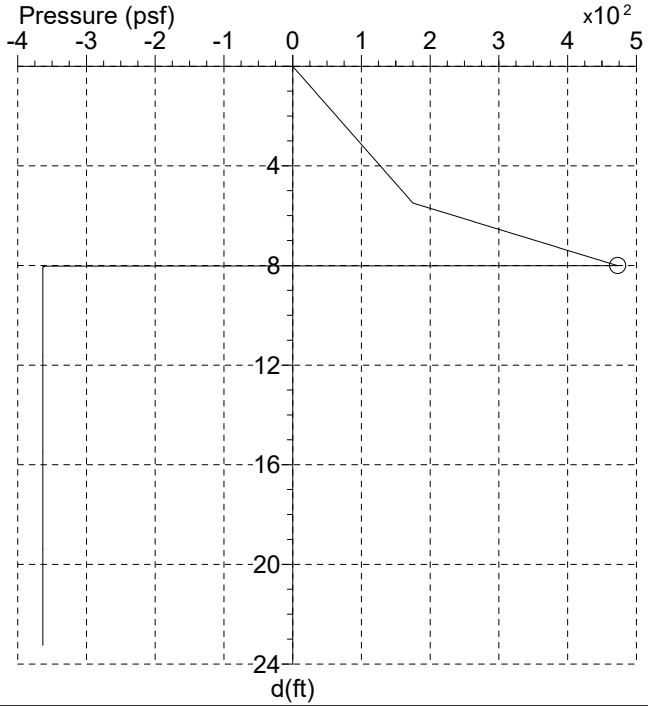
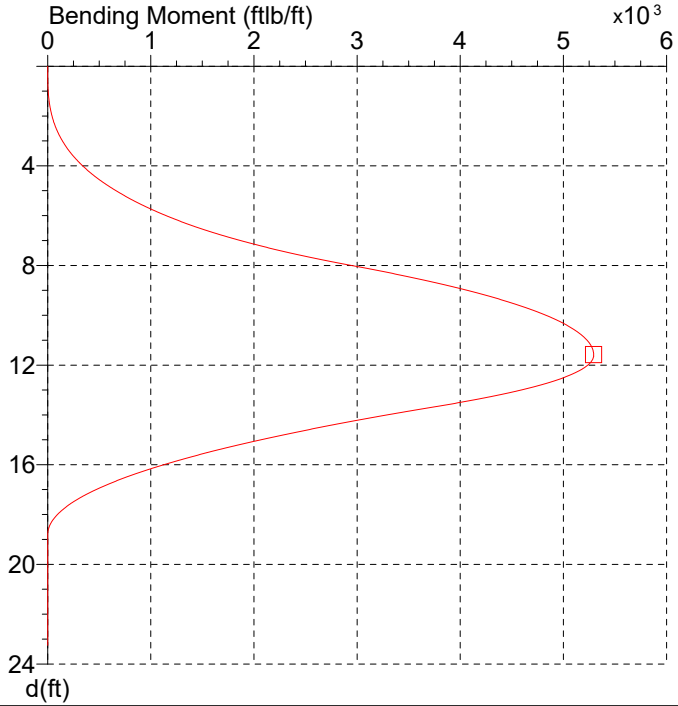
Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.50

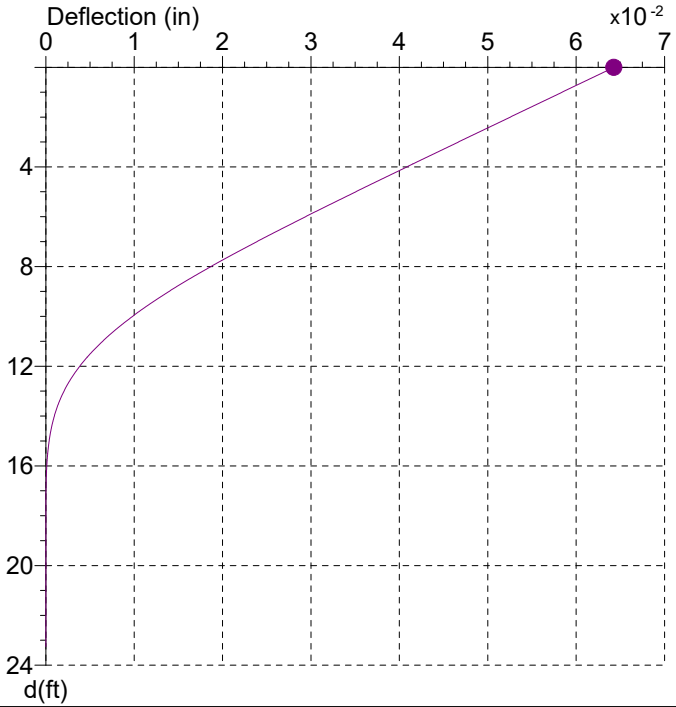
Page: 3
Date: 3.11.19

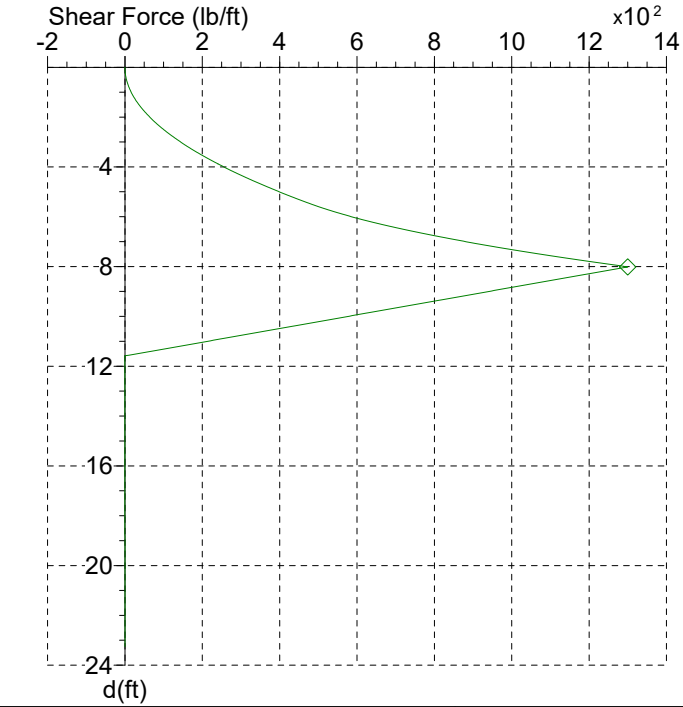
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
472.8 psf	8.00
5293.7 ftlb/ft	11.58
1299.9 lb/ft	8.01
0.1 in	0.00









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Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.50

Page: 4
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	0.1	0.0	7.81	449.8	2713.9	0.0	1210.2	15.62	-363.4	1440.1	0.0	0.0
0.17	5.6	0.1	0.1	0.5	7.98	468.2	2906.4	0.0	1281.6	15.79	-363.4	1303.3	0.0	0.0
0.33	10.5	0.2	0.1	1.8	8.14	-363.4	3129.9	0.0	1250.6	15.96	-363.4	1157.7	0.0	0.0
0.50	16.1	0.7	0.1	4.2	8.31	-363.4	3343.2	0.0	1187.2	16.12	-363.4	1035.4	0.0	0.0
0.66	21.0	1.6	0.1	7.1	8.48	-363.4	3523.6	0.0	1130.8	16.29	-363.4	906.0	0.0	0.0
0.83	26.6	3.1	0.1	11.3	8.64	-363.4	3716.0	0.0	1067.4	16.46	-363.4	785.3	0.0	0.0
1.00	31.5	5.2	0.1	15.9	8.81	-363.4	3877.8	0.0	1011.0	16.62	-363.4	685.3	0.0	0.0
1.16	37.1	8.4	0.1	21.9	8.98	-363.4	4049.3	0.0	947.6	16.79	-363.4	580.8	0.0	0.0
1.33	42.6	12.7	0.1	28.9	9.14	-363.4	4192.5	0.0	891.2	16.95	-363.4	495.2	0.0	0.0
1.50	47.6	17.7	0.1	36.0	9.31	-363.4	4343.1	0.0	827.7	17.12	-363.4	406.9	0.0	0.0
1.66	53.1	24.6	0.1	44.8	9.47	-363.4	4482.6	0.0	764.3	17.29	-363.4	335.8	0.0	0.0
1.83	58.0	32.2	0.1	53.5	9.64	-363.4	4597.4	0.0	707.9	17.45	-363.4	264.0	0.0	0.0
1.99	63.6	42.3	0.1	64.1	9.81	-363.4	4716.0	0.0	644.5	17.62	-363.4	200.9	0.0	0.0
2.16	68.5	53.0	0.1	74.4	9.97	-363.4	4812.2	0.0	588.1	17.78	-363.4	152.0	0.0	0.0
2.33	74.1	66.9	0.1	86.9	10.14	-363.4	4909.9	0.0	524.7	17.95	-363.4	105.0	0.0	0.0
2.49	79.7	83.1	0.0	100.4	10.31	-363.4	4987.5	0.0	468.3	18.12	-363.4	70.7	0.0	0.0
2.66	84.6	99.5	0.0	113.2	10.47	-363.4	5064.3	0.0	404.9	18.28	-363.4	40.0	0.0	0.0
2.83	90.2	120.5	0.0	128.5	10.64	-363.4	5130.0	0.0	341.5	18.45	-363.4	20.0	0.0	0.0
2.99	95.1	141.4	0.0	142.9	10.80	-363.4	5179.2	0.0	285.1	18.62	-363.4	5.9	0.0	0.0
3.16	100.7	167.6	0.0	160.1	10.97	-363.4	5224.0	0.0	221.6	18.78	-363.4	0.2	0.0	0.0
3.32	105.6	193.6	0.0	176.1	11.14	-363.4	5254.5	0.0	165.3	18.95	-363.4	0.0	0.0	0.0
3.49	111.2	225.7	0.0	195.1	11.30	-363.4	5278.5	0.0	101.8	19.11	-363.4	0.0	0.0	0.0
3.66	116.7	261.3	0.0	215.0	11.47	-363.4	5290.4	0.0	45.5	19.28	-363.4	0.0	0.0	0.0
3.82	121.7	295.9	0.0	233.6	11.64	-363.4	5293.3	0.0	0.0	19.45	-363.4	0.0	0.0	0.0
3.99	127.2	338.4	0.0	255.3	11.80	-363.4	5278.3	0.0	0.0	19.61	-363.4	0.0	0.0	0.0
4.16	132.2	379.3	0.0	275.5	11.97	-363.4	5246.6	0.0	0.0	19.78	-363.4	0.0	0.0	0.0
4.32	137.7	429.2	0.0	299.1	12.13	-363.4	5190.2	0.0	0.0	19.95	-363.4	0.0	0.0	0.0
4.49	142.7	477.1	0.0	320.9	12.30	-363.4	5121.6	0.0	0.0	20.11	-363.4	0.0	0.0	0.0
4.65	148.2	535.1	0.0	346.3	12.47	-363.4	5023.6	0.0	0.0	20.28	-363.4	0.0	0.0	0.0
4.82	153.8	597.5	0.0	372.7	12.63	-363.4	4918.2	0.0	0.0	20.44	-363.4	0.0	0.0	0.0
4.99	158.7	657.0	0.0	397.0	12.80	-363.4	4778.6	0.0	0.0	20.61	-363.4	0.0	0.0	0.0
5.15	164.3	728.5	0.0	425.3	12.96	-363.4	4617.2	0.0	0.0	20.78	-363.4	0.0	0.0	0.0
5.32	169.2	796.2	0.0	451.2	13.13	-363.4	4455.8	0.0	0.0	20.94	-363.4	0.0	0.0	0.0
5.49	174.8	877.2	0.0	481.2	13.30	-363.4	4252.8	0.0	0.0	21.11	-363.4	0.0	0.0	0.0
5.65	192.8	953.8	0.0	509.9	13.46	-363.4	4054.5	0.0	0.0	21.28	-363.4	0.0	0.0	0.0
5.82	213.4	1045.5	0.0	545.5	13.63	-363.4	3810.5	0.0	0.0	21.44	-363.4	0.0	0.0	0.0
5.98	234.1	1143.7	0.0	584.8	13.80	-363.4	3585.9	0.0	0.0	21.61	-363.4	0.0	0.0	0.0
6.15	252.4	1237.0	0.0	622.7	13.96	-363.4	3341.3	0.0	0.0	21.77	-363.4	0.0	0.0	0.0
6.32	273.1	1349.2	0.0	668.8	14.13	-363.4	3105.6	0.0	0.0	21.94	-363.4	0.0	0.0	0.0
6.48	291.5	1455.9	0.0	712.7	14.29	-363.4	2903.0	0.0	0.0	22.11	-363.4	0.0	0.0	0.0
6.65	312.1	1584.3	0.0	765.6	14.46	-363.4	2683.4	0.0	0.0	22.27	-363.4	0.0	0.0	0.0
6.81	330.5	1706.4	0.0	815.6	14.63	-363.4	2495.6	0.0	0.0	22.44	-363.4	0.0	0.0	0.0
6.98	351.1	1853.4	0.0	875.3	14.79	-363.4	2292.3	0.0	0.0	22.61	-363.4	0.0	0.0	0.0
7.15	371.8	2011.0	0.0	938.6	14.96	-363.4	2118.8	0.0	0.0	22.77	-363.4	0.0	0.0	0.0
7.31	390.2	2160.6	0.0	997.9	15.13	-363.4	1931.9	0.0	0.0	22.94	-363.4	0.0	0.0	0.0
7.48	410.8	2340.1	0.0	1068.0	15.29	-363.4	1753.4	0.0	0.0	23.10	-363.4	0.0	0.0	0.0
7.65	429.2	2510.2	0.0	1133.3	15.46	-363.4	1602.1	0.0	0.0	23.27	-363.4	0.0	0.0	0.0

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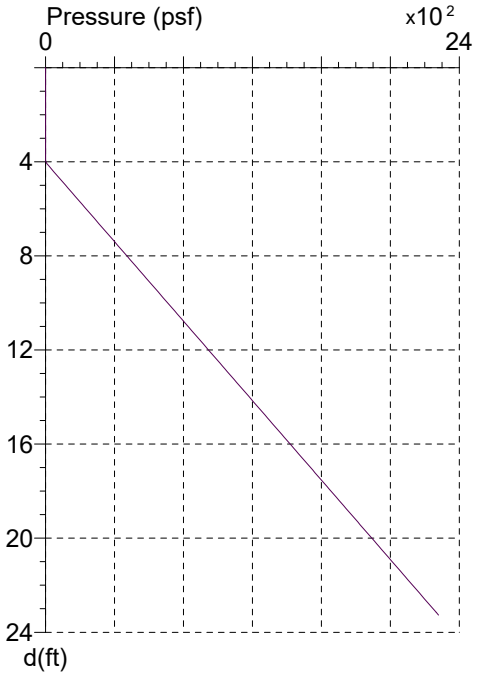
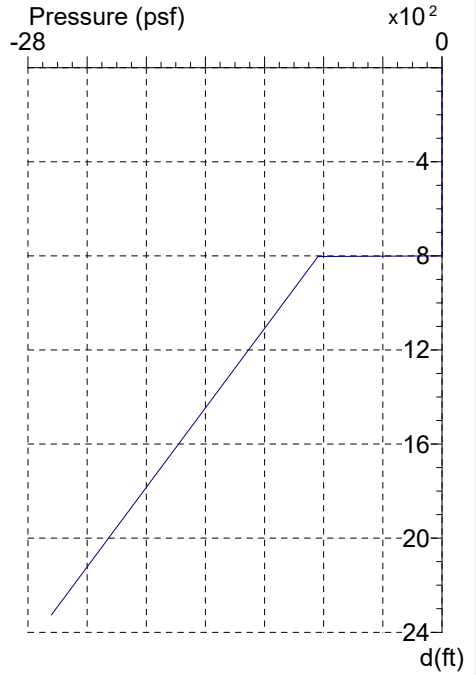
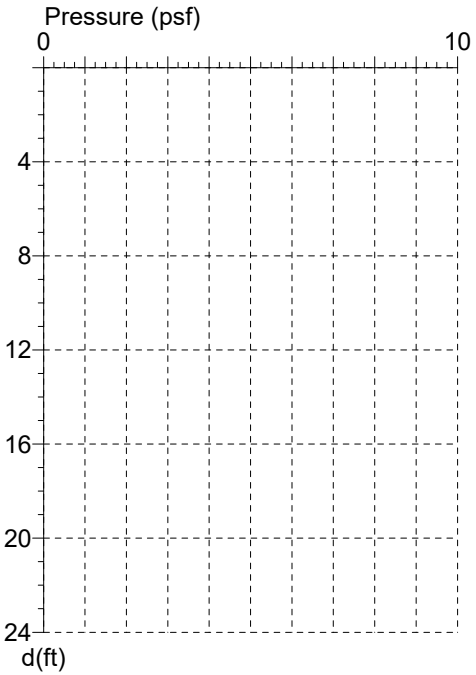
Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.50

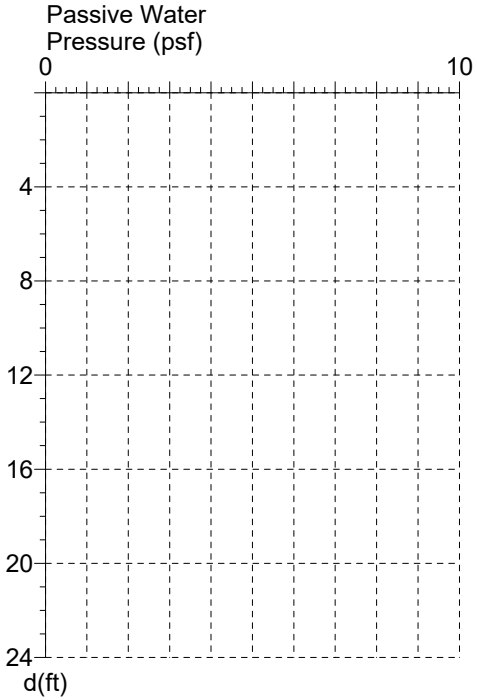
Page: 5
Date: 3.11.19

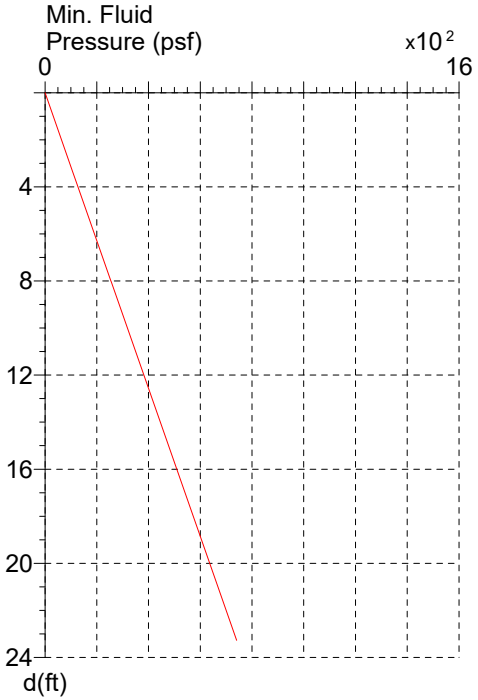
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever

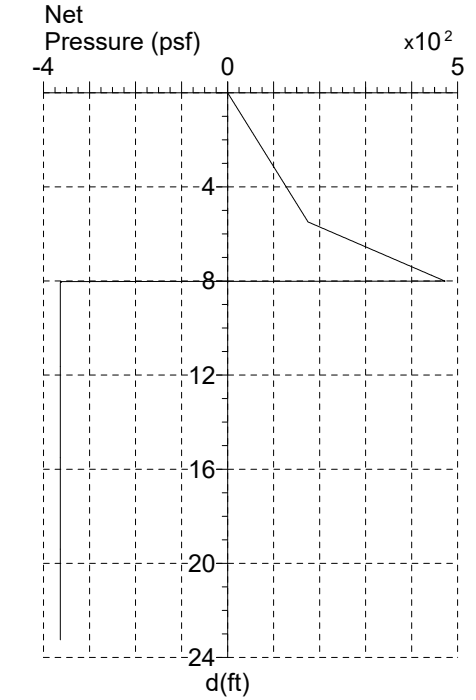












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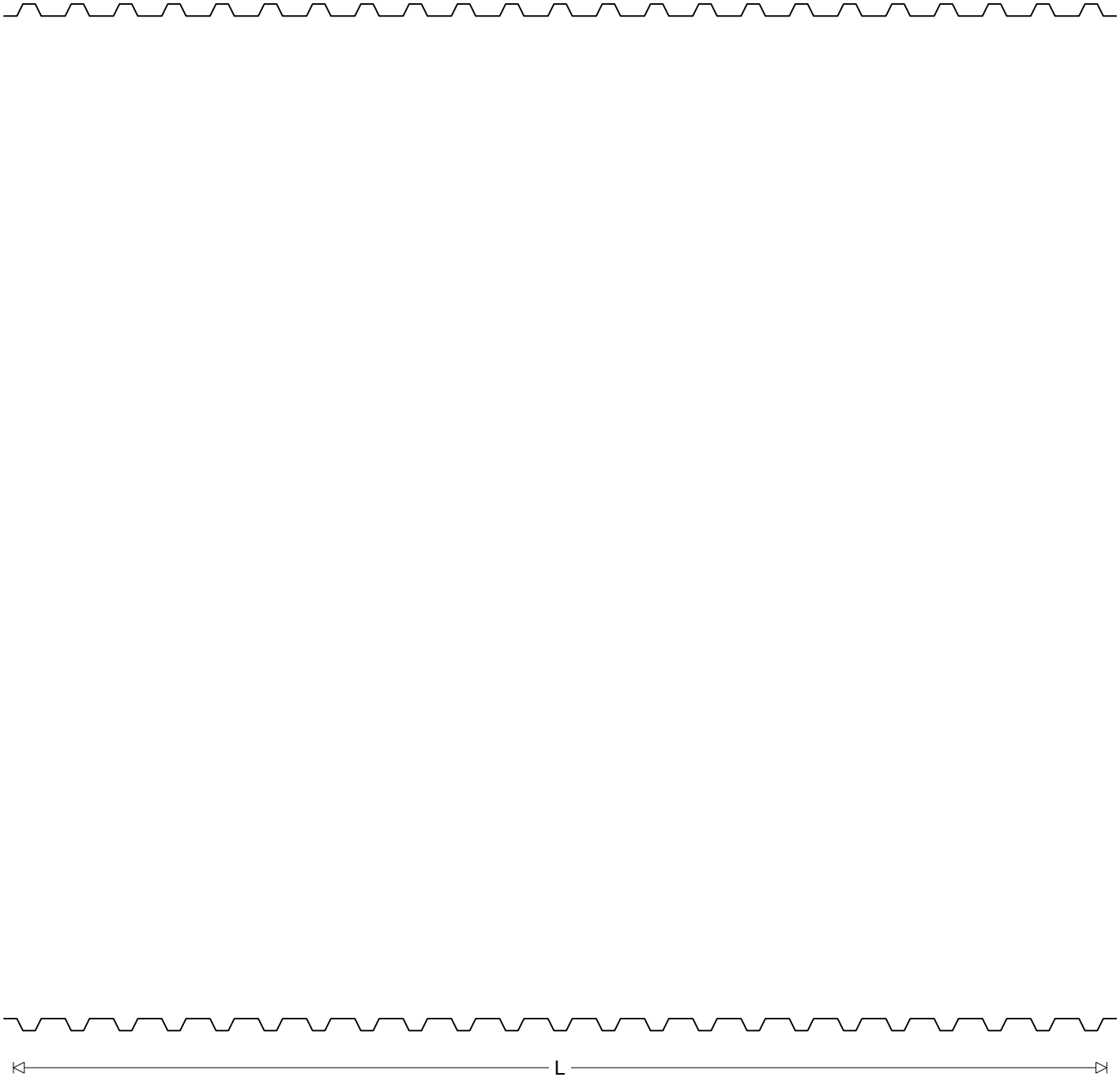
Client: Case 8 Braced - Clay - Stage 1
Site: FOS = 1.50

Page: 6
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure
Toe: Cantilever



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Design Report

1. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

2. Maximum bending moment = 5293.7ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 2.54in³/ft (= M/f).
   Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

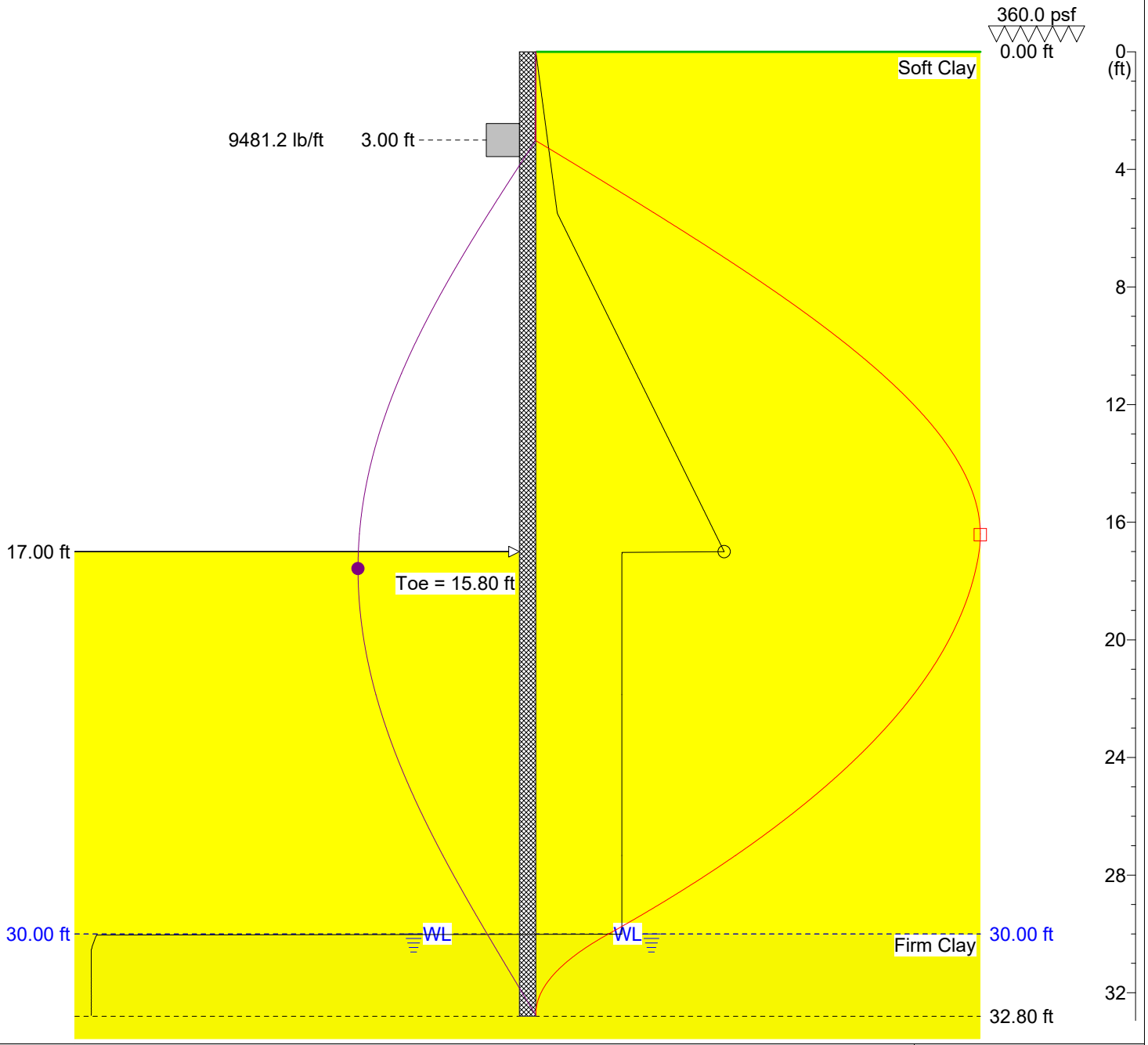
3. FOS = 1.52 (Net Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.00

Page: 1
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
1537.2 psf	17.00
84921.4 ftlb/ft	16.43
1.1 in	17.57



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Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.00

Page: 2
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Input Data

Depth Of Excavation = 17.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	15.80	32.80

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	9481.2

Maxima

	Maximum	Depth (ft)
Pressure	1537.2 psf	17.00
Bending Moment	84921.4 ftlb/ft	16.43
Deflection	1.1 in	17.57
Shear Force	10004.0 lb/ft	30.01

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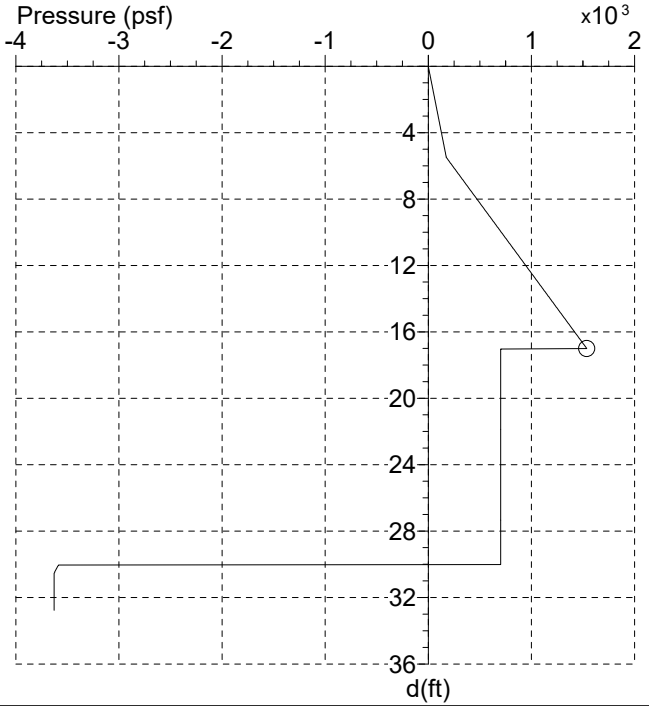
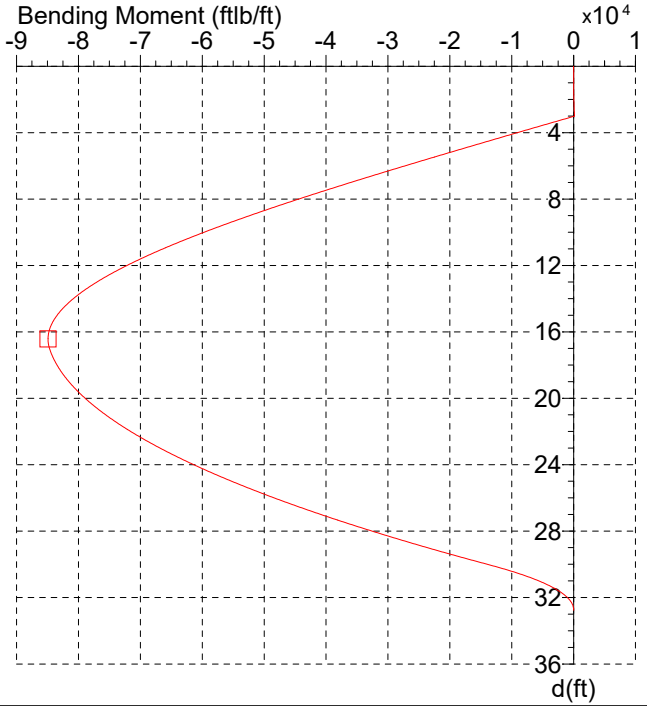
Site: FOS = 1.00

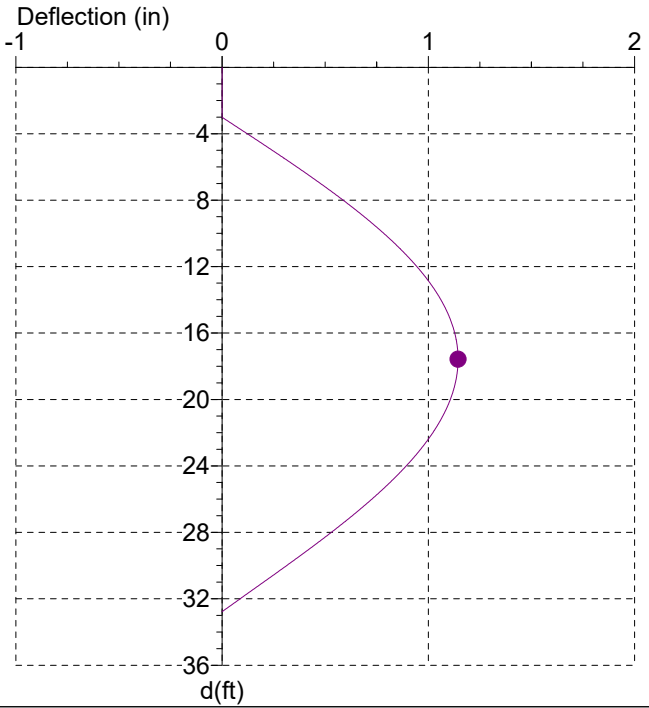
Page: 3
Date: 3.11.19

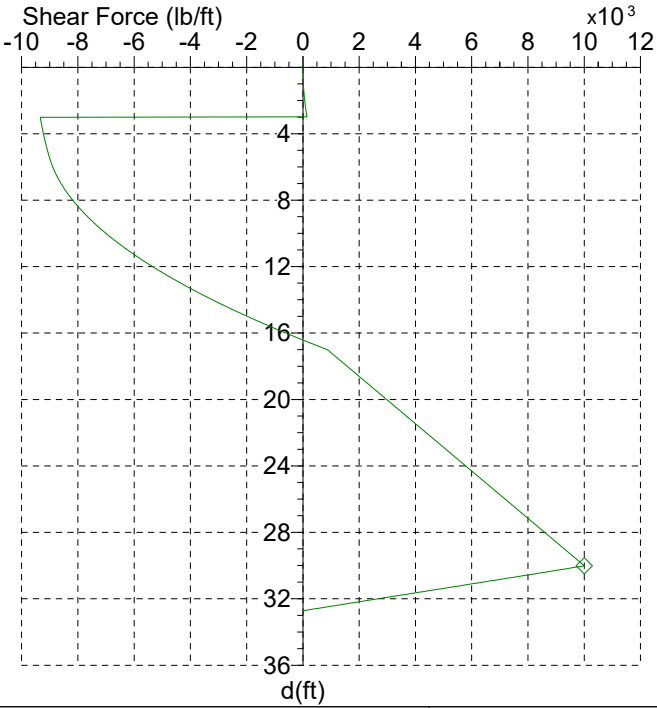
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
1537.2 psf	17.00
84921.4 ftlb/ft	16.43
10004.0 lb/ft	30.01
1.1 in	17.57









MDOT Sheetpile Manual

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Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.00

Page: 4
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	0.0	0.0
0.23	7.8	0.1	0.0	1.1
0.47	14.8	0.5	0.0	3.6
0.70	22.6	1.9	0.0	8.4
0.94	29.6	4.2	0.0	14.2
1.17	37.4	8.6	0.0	22.5
1.41	44.4	14.4	0.0	31.5
1.64	52.2	23.4	0.0	43.5
1.87	60.1	35.6	0.0	57.5
2.11	67.0	49.5	0.0	71.4
2.34	74.9	68.9	0.0	89.0
2.58	81.8	90.0	0.0	106.2
2.81	89.7	118.4	0.0	127.4
3.05	96.6	-111.1	0.0	-9333.3
3.28	104.5	-2406.1	0.0	-9308.5
3.51	112.3	-4694.7	0.1	-9281.7
3.75	119.2	-6723.3	0.1	-9256.3
3.98	127.1	-8998.7	0.1	-9225.9
4.22	134.0	-11014.8	0.1	-9197.2
4.45	141.9	-13275.2	0.2	-9163.2
4.69	148.8	-15277.3	0.2	-9131.3
4.92	156.7	-17521.1	0.2	-9093.6
5.15	164.5	-19755.4	0.3	-9054.0
5.39	171.5	-21733.1	0.3	-9017.2
5.62	191.3	-23948.1	0.3	-8972.9
5.86	217.2	-25907.4	0.3	-8927.9
6.09	246.3	-28099.1	0.4	-8870.5
6.33	272.2	-30034.8	0.4	-8813.5
6.56	301.3	-32196.8	0.4	-8742.6
6.79	330.4	-34340.6	0.5	-8664.5
7.03	356.3	-36229.5	0.5	-8589.0
7.26	385.4	-38334.0	0.5	-8497.4
7.50	411.3	-40185.1	0.5	-8410.0
7.73	440.4	-42244.1	0.6	-8304.8
7.97	466.3	-44051.9	0.6	-8205.3
8.20	495.4	-46059.0	0.6	-8086.6
8.43	524.5	-48036.1	0.6	-7960.8
8.67	550.4	-49766.9	0.7	-7842.9
8.90	579.5	-51682.5	0.7	-7703.5
9.14	605.4	-53355.9	0.7	-7573.6
9.37	634.5	-55203.7	0.7	-7420.7
9.61	660.4	-56814.0	0.7	-7278.8
9.84	689.5	-58587.8	0.8	-7112.4
10.07	718.6	-60319.9	0.8	-6938.8
10.31	744.5	-61823.0	0.8	-6778.4
10.54	773.7	-63471.3	0.8	-6591.3
10.78	799.5	-64897.2	0.9	-6419.0
11.01	828.7	-66455.6	0.9	-6218.3
11.25	854.5	-67798.8	0.9	-6033.9
11.48	883.7	-69260.9	0.9	-5819.8
11.71	912.8	-70669.5	0.9	-5598.4
11.95	938.7	-71875.2	0.9	-5395.6
12.18	967.8	-73177.9	1.0	-5160.8
12.42	993.7	-74286.7	1.0	-4946.0
12.65	1022.8	-75477.3	1.0	-4697.5
12.89	1048.7	-76483.6	1.0	-4470.7
13.12	1077.8	-77555.7	1.0	-4208.8
13.35	1106.9	-78562.5	1.0	-3939.7
13.59	1132.8	-79401.2	1.0	-3694.5
13.82	1161.9	-80279.9	1.1	-3411.8
14.06	1187.8	-81001.9	1.1	-3154.6
14.29	1216.9	-81746.3	1.1	-2858.4
14.53	1242.8	-82346.1	1.1	-2589.2
14.76	1271.9	-82949.7	1.1	-2279.5
14.99	1301.0	-83476.3	1.1	-1962.6
15.23	1326.9	-83878.4	1.1	-1675.0
15.46	1356.0	-84254.7	1.1	-1344.6
15.70	1381.9	-84520.3	1.1	-1044.9
15.93	1411.0	-84740.1	1.1	-701.0
16.17	1436.9	-84863.7	1.1	-389.3
16.40	1466.0	-84920.6	1.1	-31.8
16.63	1495.1	-84888.6	1.1	332.8
16.87	1521.0	-84783.9	1.1	662.9
17.10	701.9	-84582.7	1.1	948.9
17.34	701.9	-84359.6	1.1	1102.4
17.57	701.9	-84068.5	1.1	1275.0
17.81	701.9	-83773.9	1.1	1428.5
18.04	701.9	-83402.2	1.1	1601.2
18.27	701.9	-82987.8	1.1	1773.8
18.51	701.9	-82583.7	1.1	1927.3
18.74	701.9	-82088.9	1.1	2100.0
18.98	701.9	-81613.2	1.1	2253.5
19.21	701.9	-81037.8	1.1	2426.1
19.45	701.9	-80490.5	1.1	2579.6
19.68	701.9	-79834.6	1.1	2752.2
19.91	701.9	-79136.0	1.1	2924.9
20.15	701.9	-78479.3	1.1	3078.4
20.38	701.9	-77700.2	1.1	3251.0
20.62	701.9	-76971.8	1.1	3404.5
20.85	701.9	-76112.2	1.1	3577.2
21.09	701.9	-75312.3	1.1	3730.6
21.32	701.9	-74372.1	1.1	3903.3
21.55	701.9	-73389.3	1.0	4076.0
21.79	701.9	-72479.9	1.0	4229.4
22.02	701.9	-71416.6	1.0	4402.1
22.26	701.9	-70435.6	1.0	4555.6
22.49	701.9	-69291.7	1.0	4728.2
22.73	701.9	-68239.1	1.0	4881.7
22.96	701.9	-67014.7	1.0	5054.4
23.19	701.9	-65747.7	0.9	5227.0
23.43	701.9	-64585.6	0.9	5380.5
23.66	701.9	-63238.1	0.9	5553.2
23.90	701.9	-62004.4	0.9	5706.6
24.13	701.9	-60576.3	0.9	5879.3
24.37	701.9	-59271.1	0.9	6032.8
24.60	701.9	-57762.4	0.8	6205.4
24.83	701.9	-56211.1	0.8	6378.1
25.07	701.9	-54796.4	0.8	6531.6
25.30	701.9	-53164.6	0.8	6704.2
25.54	701.9	-51678.3	0.8	6857.7
25.77	701.9	-49966.0	0.7	7030.4
26.01	701.9	-48408.1	0.7	7183.8
26.24	701.9	-46615.2	0.7	7356.5
26.47	701.9	-44779.7	0.7	7529.2
26.71	701.9	-43112.3	0.7	7682.6
26.94	701.9	-41196.3	0.6	7855.3
27.18	701.9	-39457.3	0.6	8008.8
27.41	701.9	-37460.7	0.6	8181.4
27.64	701.9	-35650.2	0.6	8334.9
27.88	701.9	-33573.1	0.5	8507.6
28.11	701.9	-31453.3	0.5	8680.2
28.35	701.9	-29533.3	0.5	8833.7
28.58	701.9	-27333.0	0.5	9006.4
28.82	701.9	-25341.4	0.4	9159.9
29.05	701.9	-23060.5	0.4	9332.5
29.28	701.9	-20997.4	0.4	9486.0
29.52	701.9	-18636.0	0.4	9658.6
29.75	701.9	-16232.0	0.3	9831.3
29.99	701.9	-14059.3	0.3	9984.8
30.22	-3603.3	-11664.9	0.3	9218.0
30.46	-3622.2	-9717.4	0.3	8427.7
30.69	-3627.7	-7736.0	0.2	7516.5
30.92	-3627.7	-6164.2	0.2	6704.2
31.16	-3627.7	-4609.0	0.2	5790.3
31.39	-3627.7	-3279.5	0.2	4876.4
31.63	-3627.7	-2287.2	0.1	4064.1
31.86	-3627.7	-1383.9	0.1	3150.2
32.10	-3627.7	-770.4	0.1	2337.9
32.33	-3627.7	-293.4	0.0	1424.0
32.56	-3627.7	-58.9	0.0	611.6
32.80	-3627.7	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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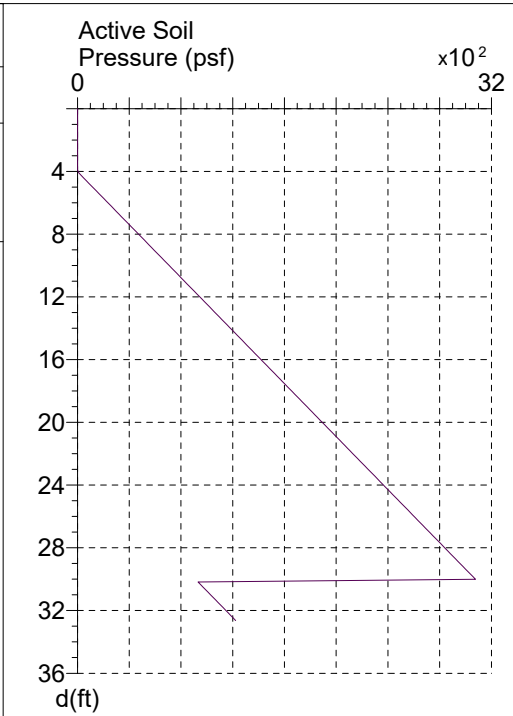
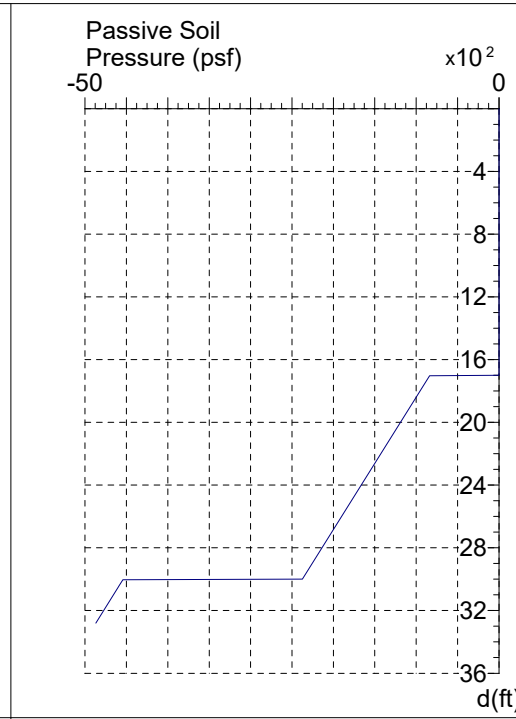
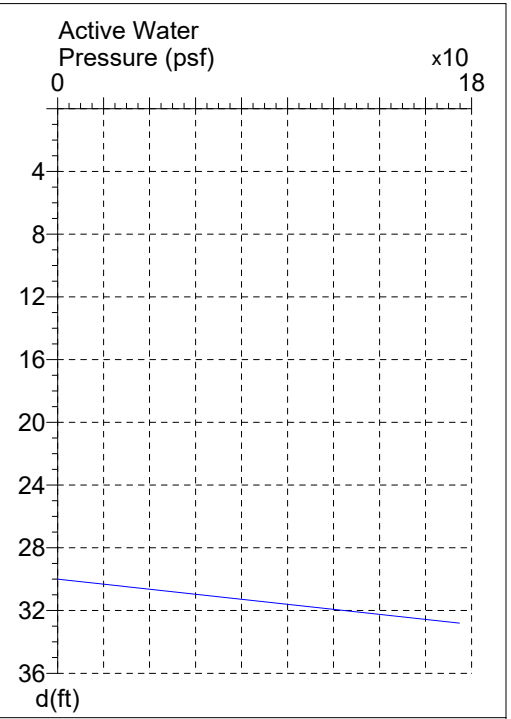
Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.00

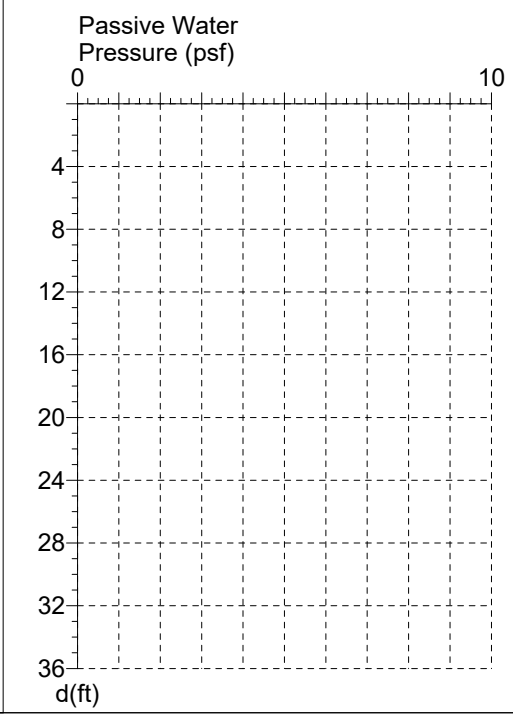
Page: 5
Date: 3.11.19

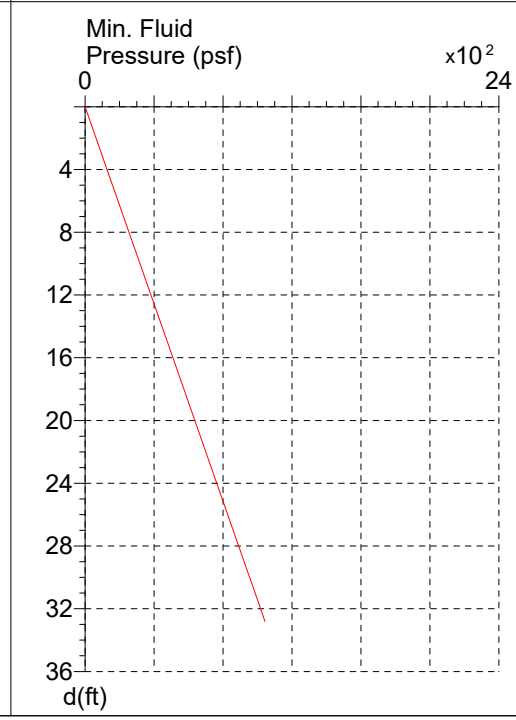
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

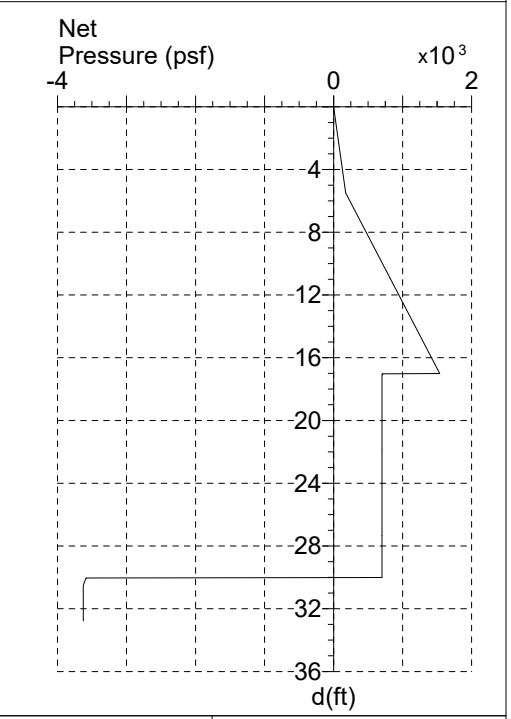












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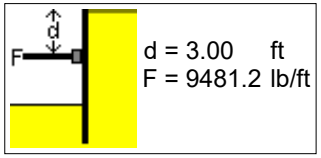
Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.00

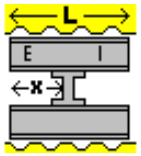
Page: 6
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

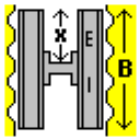


d = 3.00 ft
F = 9481.2 lb/ft

Shore/Shore



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

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Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 84921.4ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 40.82in³/ft (= M/f). Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

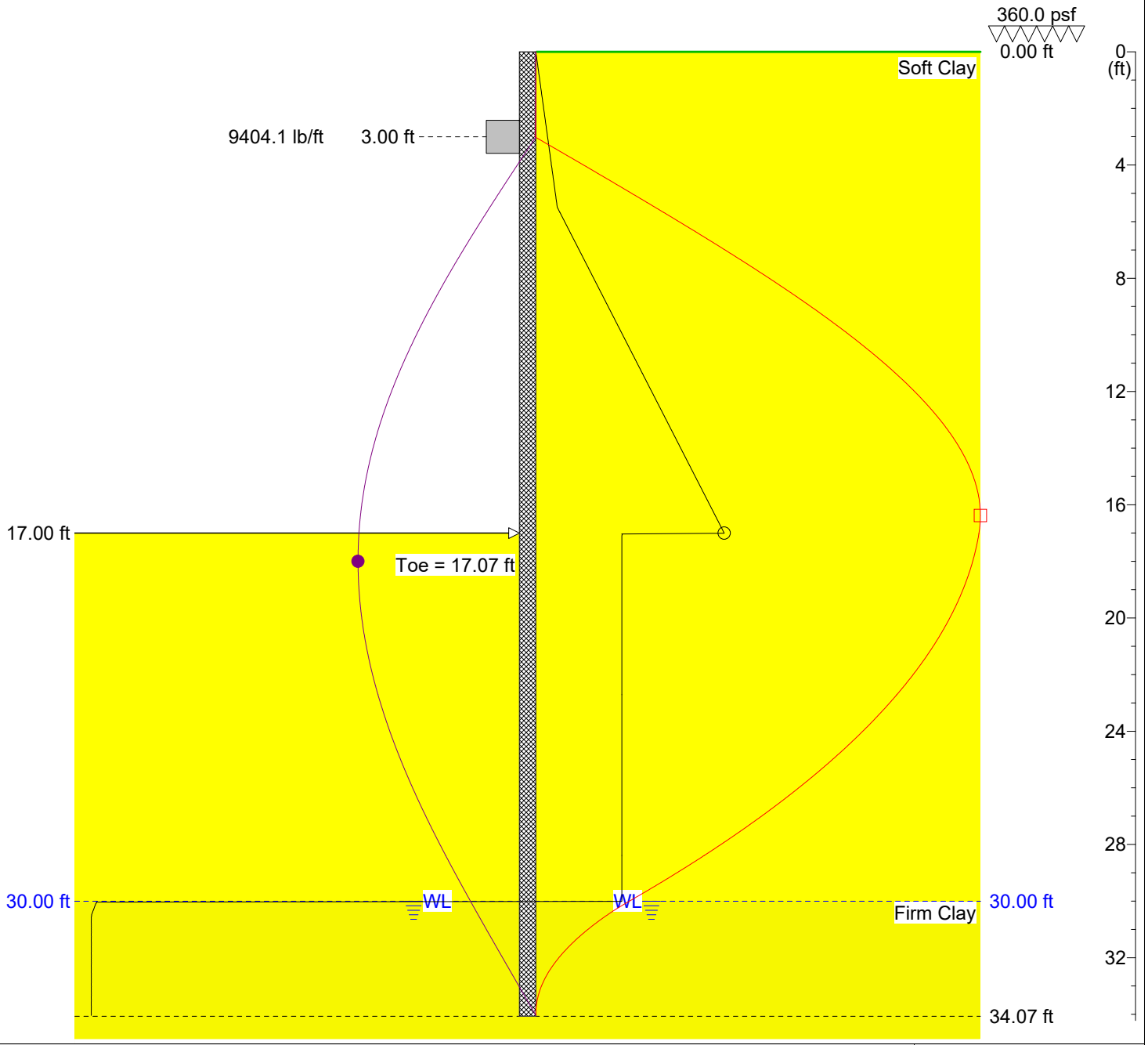
5. FOS = 1.00 (Net Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.50

Page: 1
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
○ 1537.6 psf	17.00
□ 83887.9 ftlb/ft	16.38
● 1.2 in	18.00



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Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.50

Page: 2
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Input Data

Depth Of Excavation = 17.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	17.07	34.07

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	9404.1

Maxima

	Maximum	Depth (ft)
Pressure	1537.6 psf	17.00
Bending Moment	83887.9 ftlb/ft	16.38
Deflection	1.2 in	18.00
Shear Force	10081.7 lb/ft	30.01

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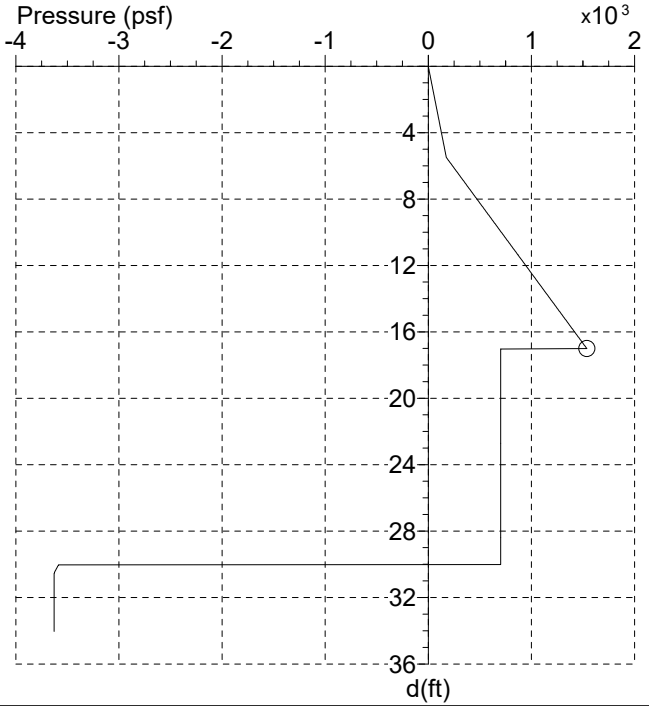
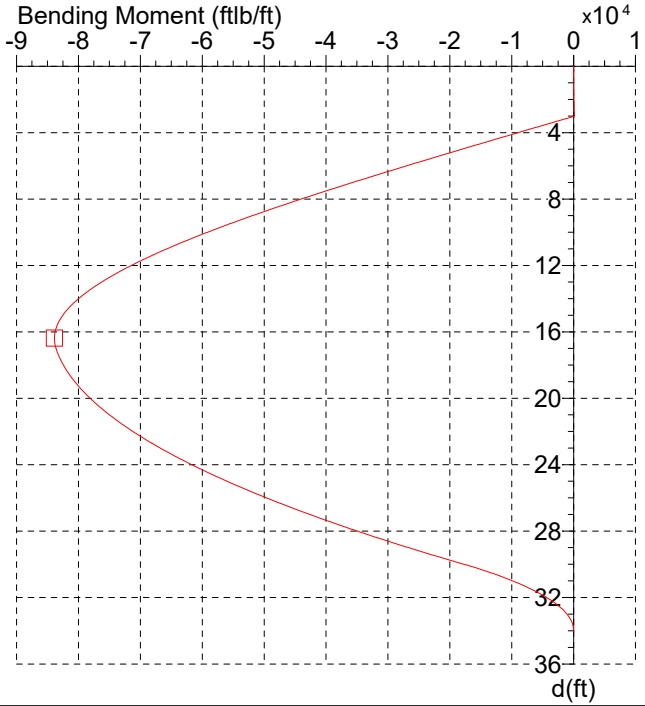
Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.50

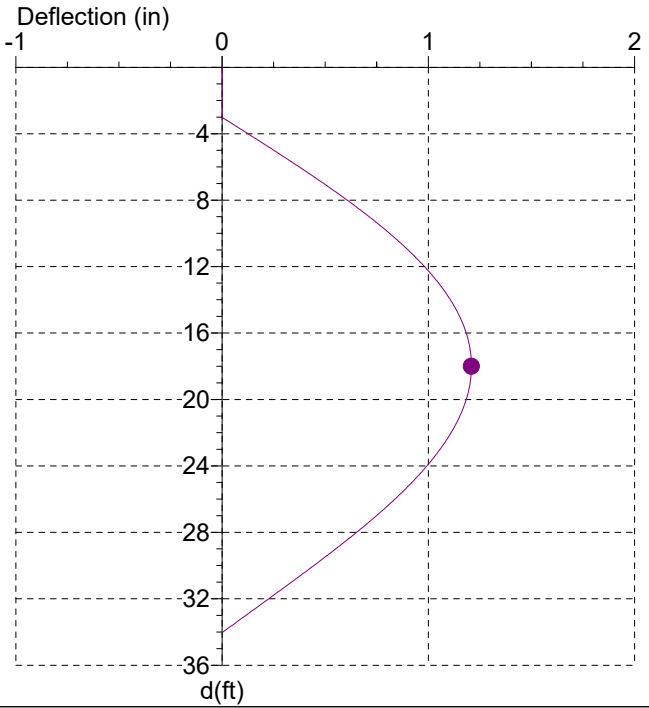
Page: 3
Date: 3.11.19

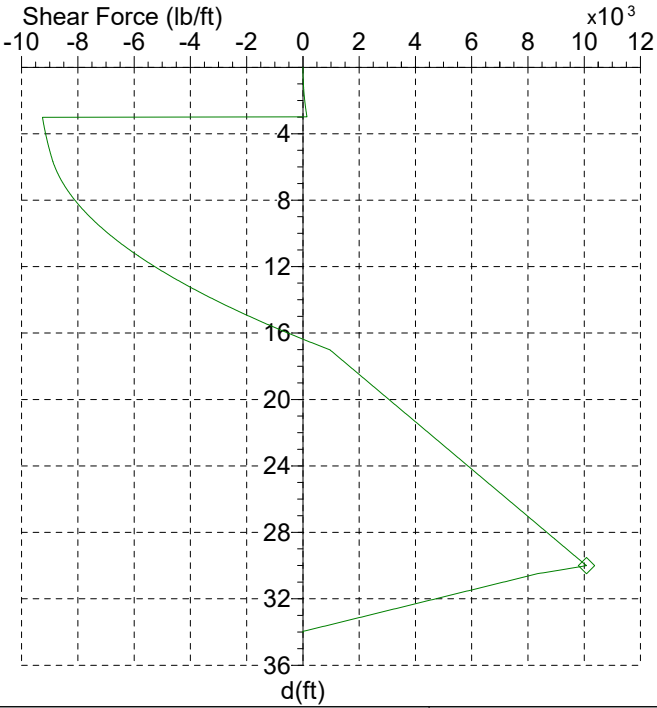
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum		d (ft)
○	1537.6 psf	17.00
□	83887.9 ftlb/ft	16.38
◇	10081.7 lb/ft	30.01
●	1.2 in	18.00









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Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.50

Page: 4
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	0.0	0.0
0.24	8.1	0.1	0.0	1.2
0.49	15.4	0.6	0.0	3.9
0.73	23.5	2.1	0.0	9.0
0.97	30.7	4.7	0.0	15.3
1.22	38.9	9.6	0.0	24.3
1.46	46.1	16.1	0.0	34.0
1.70	54.2	26.2	0.0	47.0
1.95	62.4	39.9	0.0	62.0
2.19	69.6	55.4	0.0	77.1
2.43	77.7	77.2	0.0	96.0
2.68	85.0	100.8	0.0	114.6
2.92	93.1	132.7	0.0	137.5
3.16	100.3	-1170.1	0.0	-9244.5
3.41	108.5	-3531.5	0.1	-9217.8
3.65	116.6	-5885.8	0.1	-9188.9
3.89	123.9	-7972.1	0.1	-9161.5
4.14	132.0	-10311.5	0.1	-9128.7
4.38	139.2	-12383.8	0.2	-9097.8
4.62	147.4	-14706.5	0.2	-9061.1
4.87	154.6	-16763.0	0.2	-9026.7
5.11	162.7	-19067.1	0.3	-8986.0
5.35	170.9	-21360.5	0.3	-8943.3
5.60	186.8	-23389.7	0.3	-8903.0
5.84	217.0	-25661.0	0.4	-8851.0
6.08	243.9	-27668.0	0.4	-8798.3
6.33	274.2	-29910.9	0.4	-8731.6
6.57	301.0	-31889.5	0.4	-8666.0
6.81	331.3	-34096.8	0.5	-8584.7
7.06	361.5	-36282.5	0.5	-8495.8
7.30	388.4	-38205.5	0.5	-8410.3
7.54	418.6	-40344.9	0.6	-8306.7
7.79	445.5	-42223.7	0.6	-8208.2
8.03	475.8	-44309.7	0.6	-8090.1
8.27	502.7	-46137.9	0.6	-7978.6
8.52	532.9	-48163.6	0.7	-7845.9
8.76	563.1	-50154.5	0.7	-7705.5
9.00	590.0	-51893.3	0.7	-7574.1
9.25	620.3	-53813.0	0.7	-7419.1
9.49	647.2	-55485.4	0.8	-7274.8
9.73	677.4	-57326.8	0.8	-7105.2
9.98	704.3	-58926.6	0.8	-6947.9
10.22	734.5	-60682.8	0.8	-6763.7
10.46	764.8	-62391.0	0.9	-6571.7
10.71	791.6	-63867.5	0.9	-6394.6
10.95	821.9	-65479.7	0.9	-6188.0
11.19	848.8	-66867.6	0.9	-5997.9
11.44	879.0	-68376.7	0.9	-5776.8
11.68	905.9	-69669.9	1.0	-5573.7
11.92	936.1	-71068.8	1.0	-5338.0
12.17	966.4	-72406.5	1.0	-5094.5
12.41	993.3	-73542.7	1.0	-4871.6
12.65	1023.5	-74759.4	1.0	-4613.6
12.90	1050.4	-75784.9	1.0	-4377.7
13.14	1080.6	-76873.7	1.1	-4105.0
13.38	1107.5	-77782.3	1.1	-3856.2
13.63	1137.8	-78736.1	1.1	-3568.9
13.87	1168.0	-79615.5	1.1	-3273.9
14.11	1194.9	-80333.2	1.1	-3005.2
14.36	1225.1	-81066.8	1.1	-2695.7
14.60	1252.0	-81651.7	1.1	-2414.0
14.84	1282.3	-82232.4	1.1	-2089.8
15.09	1309.1	-82678.3	1.2	-1795.2
15.33	1339.4	-83099.1	1.2	-1456.4
15.57	1369.6	-83432.4	1.2	-1109.9
15.82	1396.5	-83653.5	1.2	-795.4
16.06	1426.7	-83816.1	1.2	-434.3
16.30	1453.6	-83882.4	1.2	-106.9
16.55	1483.9	-83868.8	1.2	268.8
16.79	1510.8	-83781.4	1.2	609.2
17.03	701.9	-83597.2	1.2	975.7
17.28	701.9	-83348.7	1.2	1155.1
17.52	701.9	-83092.3	1.2	1314.5
17.76	701.9	-82763.9	1.2	1493.8
18.01	701.9	-82436.6	1.2	1653.2
18.25	701.9	-82028.4	1.2	1832.6
18.49	701.9	-81630.2	1.2	1992.0
18.74	701.9	-81142.3	1.2	2171.3
18.98	701.9	-80612.1	1.2	2350.6
19.22	701.9	-80105.4	1.2	2510.0
19.47	701.9	-79495.5	1.2	2689.4
19.71	701.9	-78917.9	1.2	2848.8
19.95	701.9	-78228.2	1.2	3028.1
20.20	701.9	-77579.7	1.2	3187.5
20.44	701.9	-76810.2	1.2	3366.8
20.68	701.9	-75998.5	1.2	3546.1
20.93	701.9	-75241.5	1.2	3705.5
21.17	701.9	-74350.0	1.1	3884.9
21.41	701.9	-73522.2	1.1	4044.3
21.66	701.9	-72550.9	1.1	4223.6
21.90	701.9	-71652.1	1.1	4383.0
22.14	701.9	-70601.1	1.1	4562.3
22.39	701.9	-69507.8	1.1	4741.7
22.63	701.9	-68500.5	1.1	4901.1
22.87	701.9	-67327.5	1.1	5080.4
23.12	701.9	-66249.3	1.1	5239.8
23.36	701.9	-64996.5	1.0	5419.1
23.60	701.9	-63847.4	1.0	5578.5
23.85	701.9	-62514.8	1.0	5757.9
24.09	701.9	-61140.0	1.0	5937.2
24.33	701.9	-59882.4	1.0	6096.6
24.58	701.9	-58427.8	1.0	6275.9
24.82	701.9	-57099.4	0.9	6435.3
25.06	701.9	-55565.0	0.9	6614.7
25.31	701.9	-54165.6	0.9	6774.1
25.55	701.9	-52551.5	0.9	6953.4
25.79	701.9	-50895.0	0.9	7132.7
26.04	701.9	-49387.2	0.8	7292.1
26.28	701.9	-47651.1	0.8	7471.5
26.52	701.9	-46072.3	0.8	7630.9
26.77	701.9	-44256.4	0.8	7810.2
27.01	701.9	-42606.7	0.7	7969.6
27.25	701.9	-40711.0	0.7	8148.9
27.50	701.9	-38773.0	0.7	8328.3
27.74	701.9	-37014.9	0.7	8487.7
27.98	701.9	-34997.2	0.7	8667.0
28.23	701.9	-33168.2	0.6	8826.4
28.47	701.9	-31070.6	0.6	9005.7
28.71	701.9	-29170.7	0.6	9165.1
28.96	701.9	-26993.4	0.6	9344.5
29.20	701.9	-24773.9	0.5	9523.8
29.44	701.9	-22765.5	0.5	9683.2
29.69	701.9	-20466.2	0.5	9862.5
29.93	701.9	-18386.9	0.5	10021.9
30.17	-3598.7	-16055.6	0.4	9469.9
30.42	-3618.4	-14148.1	0.4	8650.1
30.66	-3627.7	-12194.1	0.4	7933.0
30.90	-3627.7	-10390.0	0.3	7320.0
31.15	-3627.7	-8907.4	0.3	6775.2
31.39	-3627.7	-7375.9	0.3	6162.3
31.63	-3627.7	-6135.8	0.3	5617.5
31.88	-3627.7	-4876.9	0.2	5004.6
32.12	-3627.7	-3879.1	0.2	4459.8
32.36	-3627.7	-2892.9	0.2	3846.9
32.61	-3627.7	-2051.1	0.2	3234.0
32.85	-3627.7	-1423.9	0.1	2689.2
33.09	-3627.7	-854.8	0.1	2076.3
33.34	-3627.7	-470.0	0.1	1531.4
33.58	-3627.7	-173.5	0.1	918.5
33.82	-3627.7	-31.1	0.0	373.7
34.07	-3627.7	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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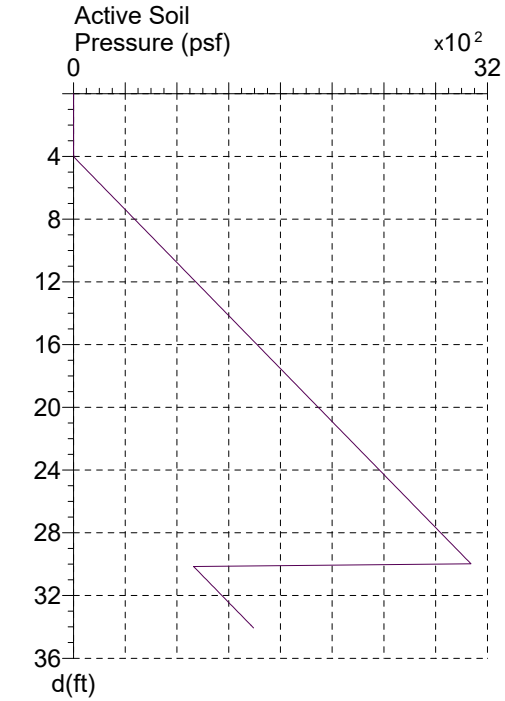
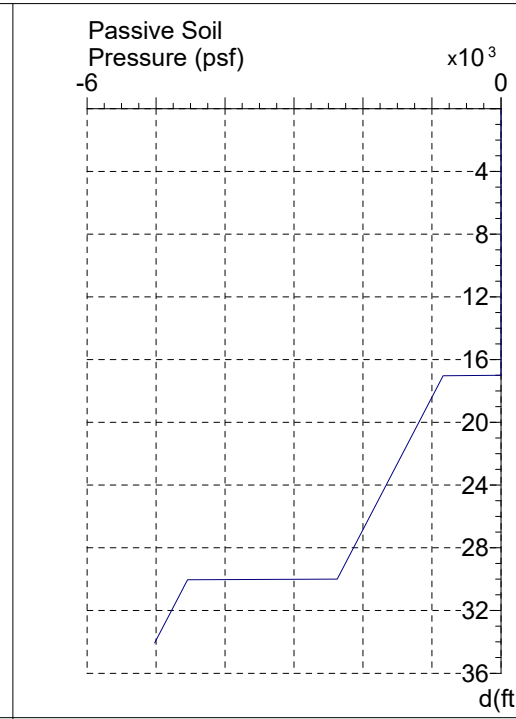
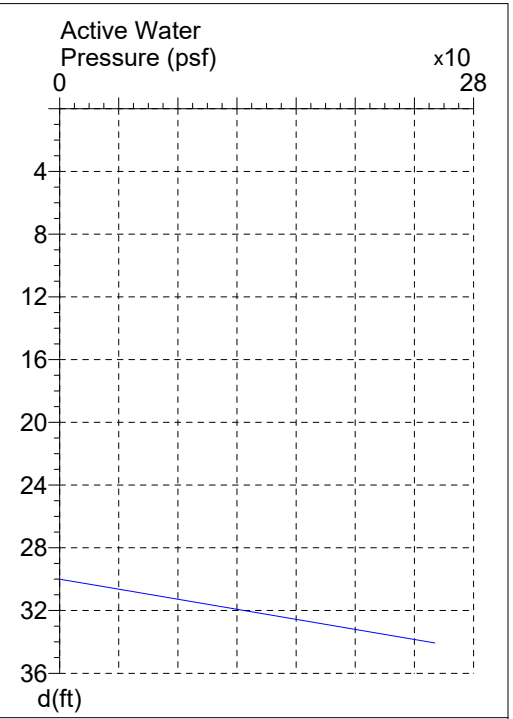
Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.50

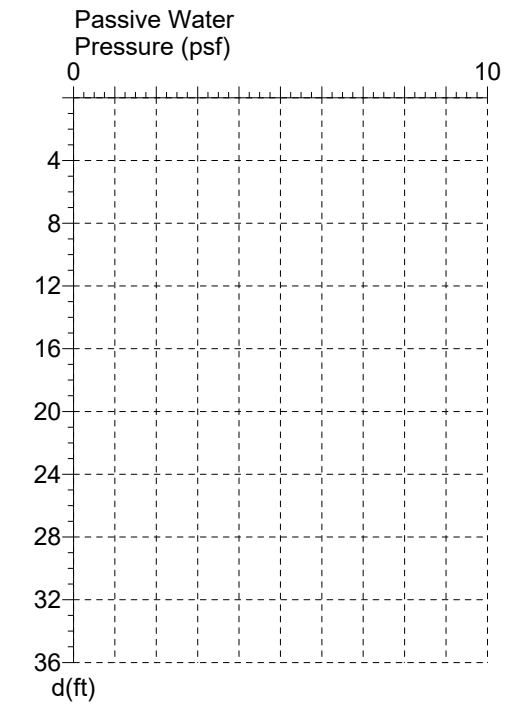
Page: 5
Date: 3.11.19

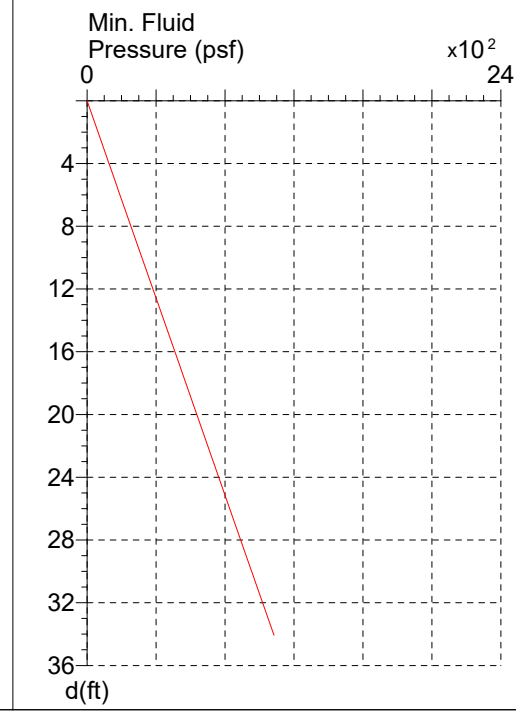
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

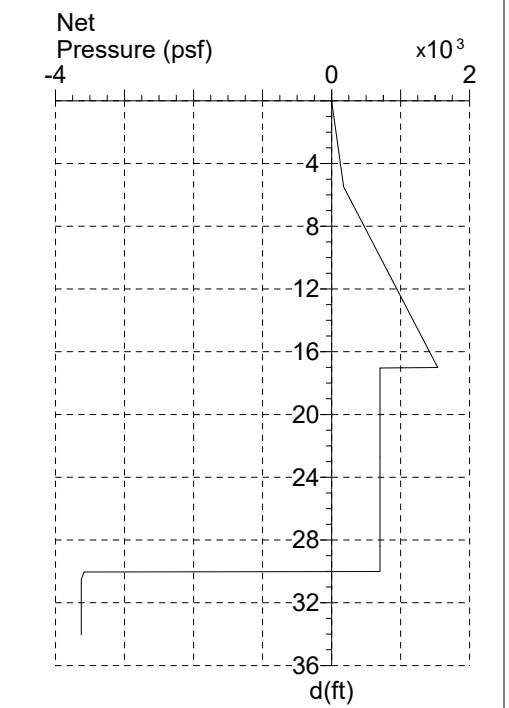












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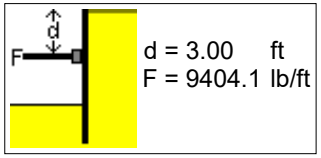
Client: Case 8 Braced - Clay - Stage 2
Site: FOS = 1.50

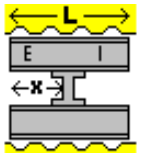
Page: 6
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

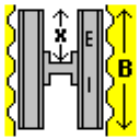


d = 3.00 ft
F = 9404.1 lb/ft

Shore/Shore



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

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Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 83887.9ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 40.32in³/ft (= M/f). Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

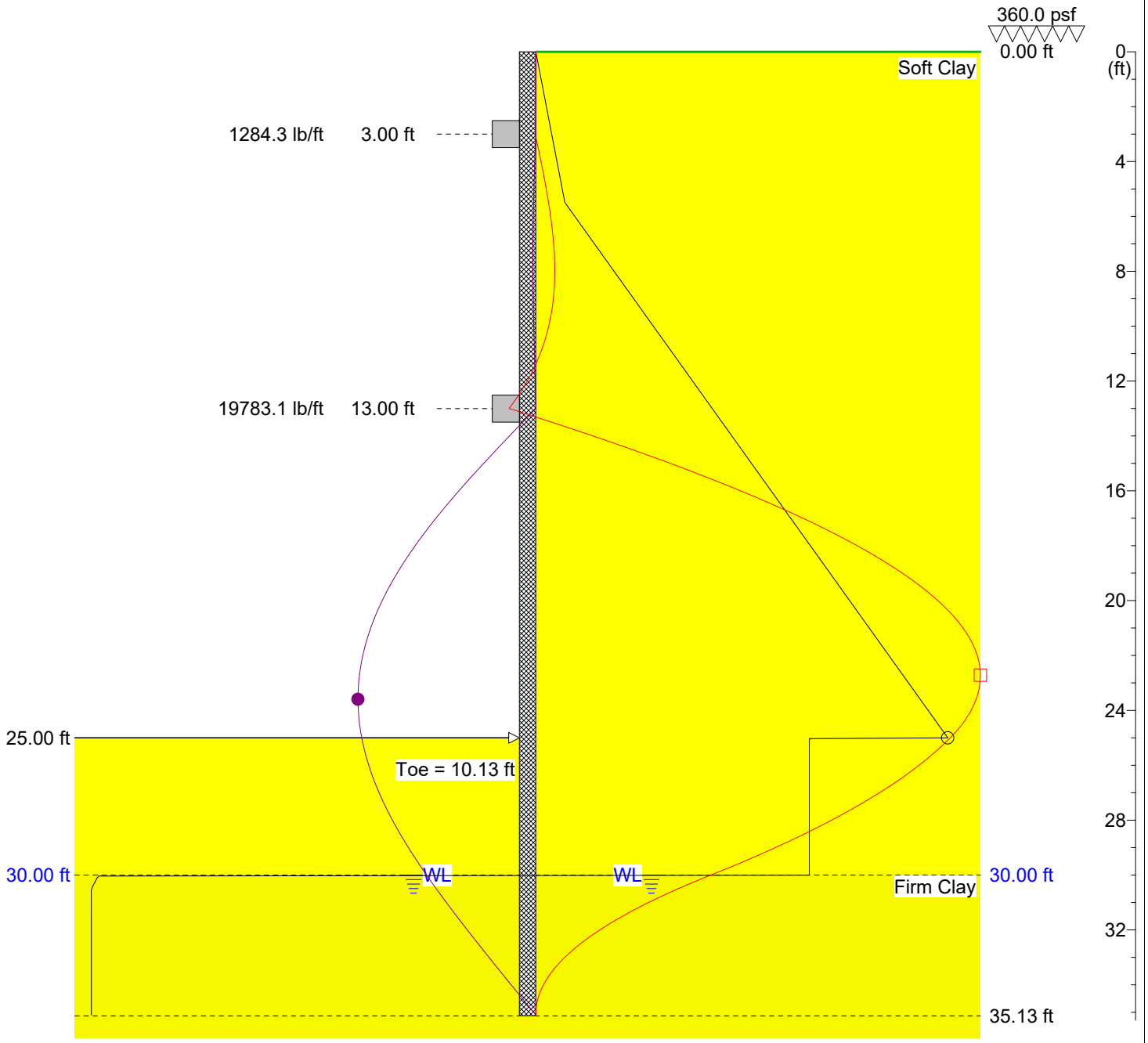
5. FOS = 1.49 (Net Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.0

Page: 1
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
○ 2484.1 psf	25.00
□ 81633.2 ftlb/ft	22.72
● 0.6 in	23.60



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Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.0

Page: 2
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Input Data

Depth Of Excavation = 25.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	10.13	35.13

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	1284.3
13.00	Brace	19783.1

Maxima

	Maximum	Depth (ft)
Pressure	2484.1 psf	25.00
Bending Moment	81633.2 ftlb/ft	22.72
Deflection	0.6 in	23.60
Shear Force	15924.2 lb/ft	13.00

MDOT Sheetpile Manual

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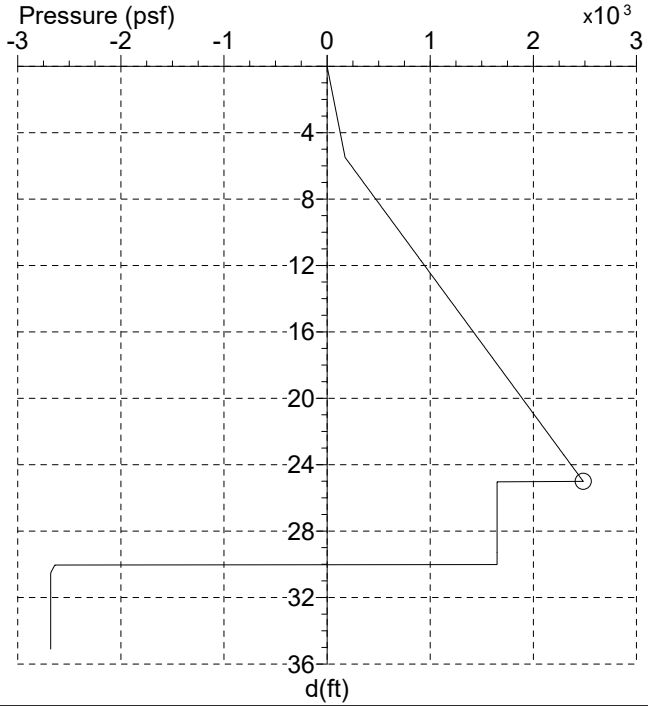
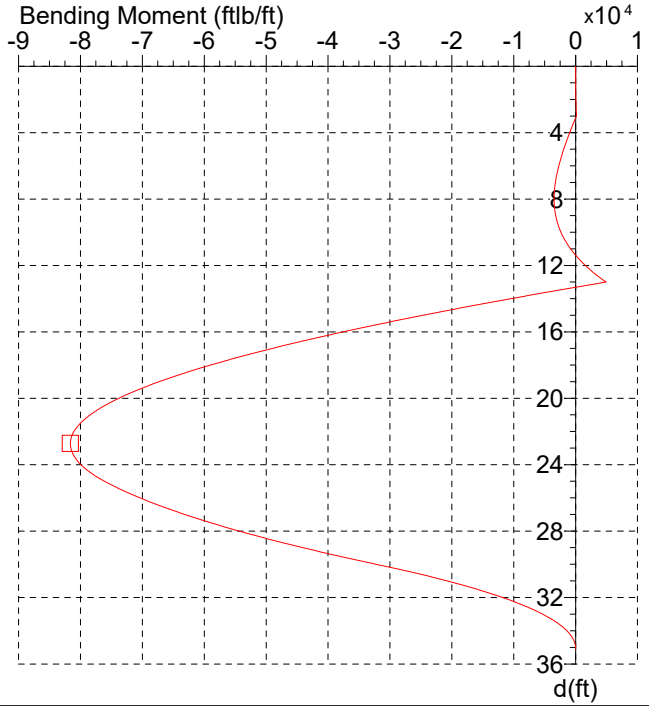
Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.0

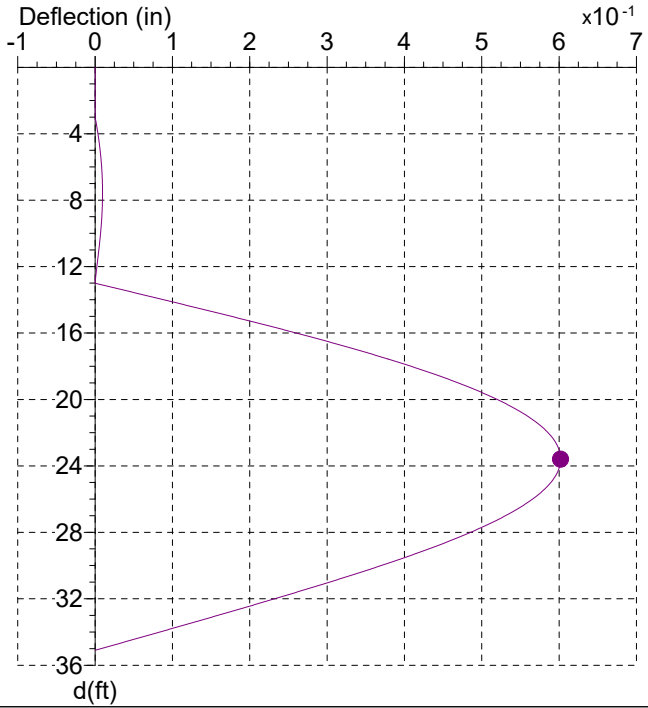
Page: 3
Date: 3.11.19

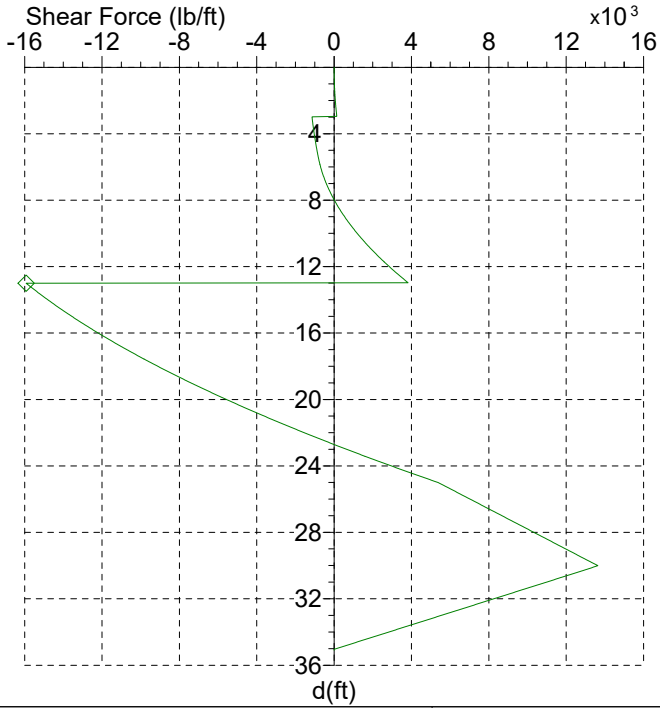
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
2484.1 psf	25.00
81633.2 ftlb/ft	22.72
15924.2 lb/ft	13.00
0.6 in	23.60









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Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.0

Page: 4
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	0.0	0.0
0.25	8.4	0.1	0.0	1.2
0.50	15.8	0.6	0.0	4.2
0.75	24.2	2.3	0.0	9.6
1.00	31.7	5.2	0.0	16.2
1.25	40.1	10.6	0.0	25.8
1.51	47.5	17.6	0.0	36.2
1.76	55.9	28.7	0.0	49.9
2.01	64.3	43.7	0.0	65.9
2.26	71.8	60.8	0.0	82.0
2.51	80.2	84.7	0.0	102.1
2.76	87.6	110.6	0.0	121.9
3.01	96.0	108.0	0.0	-1138.1
3.26	103.5	-154.8	0.0	-1114.6
3.51	111.9	-443.8	0.0	-1086.1
3.76	120.3	-725.0	0.0	-1055.4
4.01	127.7	-968.1	0.0	-1026.3
4.27	136.1	-1233.1	0.0	-991.4
4.52	143.6	-1460.9	0.0	-958.5
4.77	152.0	-1707.7	0.0	-919.5
5.02	159.4	-1918.3	0.0	-882.9
5.27	167.8	-2144.8	0.0	-839.7
5.52	179.7	-2359.7	0.0	-794.1
5.77	207.5	-2540.2	0.0	-748.4
6.02	238.6	-2729.7	0.0	-689.1
6.27	266.4	-2884.3	0.0	-629.6
6.52	297.6	-3040.9	0.0	-554.8
6.78	325.3	-3162.8	0.0	-481.5
7.03	356.5	-3278.7	0.0	-391.2
7.28	387.7	-3370.0	0.0	-292.8
7.53	415.4	-3428.7	0.0	-198.3
7.78	446.6	-3467.6	0.0	-84.3
8.03	474.3	-3476.4	0.0	23.9
8.28	505.5	-3455.2	0.0	153.5
8.53	533.2	-3406.8	0.0	275.5
8.78	564.4	-3317.4	0.0	420.5
9.03	595.6	-3188.9	0.0	573.8
9.28	623.3	-3039.9	0.0	716.9
9.54	654.5	-2831.5	0.0	885.7
9.79	682.2	-2608.1	0.0	1042.7
10.04	713.4	-2311.9	0.0	1227.0
10.29	741.1	-2007.2	0.0	1397.7
10.54	772.3	-1615.7	0.0	1597.5
10.79	803.5	-1170.6	0.0	1805.6
11.04	831.2	-728.2	0.0	1997.4
11.29	862.4	-176.0	0.0	2221.0
11.54	890.1	365.1	0.0	2426.6
11.79	921.3	1032.3	0.0	2665.7
12.04	949.0	1679.0	0.0	2885.1
12.30	980.2	2468.7	0.0	3139.7
12.55	1011.4	3326.6	0.0	3402.6
12.80	1039.1	4148.0	0.0	3643.1
13.05	1070.3	3982.3	0.0	-15861.6
13.30	1098.0	295.1	0.0	-15607.3
13.55	1129.2	-3781.1	0.0	-15313.5
13.80	1156.9	-7338.6	0.1	-15045.3
14.05	1188.1	-11264.9	0.1	-14735.9
14.30	1219.3	-15108.8	0.1	-14418.3
14.55	1247.0	-18454.6	0.1	-14129.1
14.80	1278.2	-22136.8	0.2	-13796.0
15.06	1306.0	-25335.5	0.2	-13493.0
15.31	1337.1	-28848.4	0.2	-13144.3
15.56	1364.9	-31893.1	0.2	-12827.5
15.81	1396.1	-35228.9	0.2	-12463.3
16.06	1427.2	-38467.9	0.3	-12091.0
16.31	1455.0	-41263.8	0.3	-11753.0
16.56	1486.1	-44313.9	0.3	-11365.1
16.81	1513.9	-46938.6	0.3	-11013.4
17.06	1545.1	-49792.0	0.3	-10610.0
17.31	1572.8	-52238.5	0.4	-10244.5
17.56	1604.0	-54887.6	0.4	-9825.5
17.82	1635.2	-57425.4	0.4	-9398.4
18.07	1662.9	-59586.1	0.4	-9011.8
18.32	1694.1	-61907.8	0.4	-8569.1
18.57	1721.8	-63872.9	0.4	-8168.7
18.82	1753.0	-65970.8	0.5	-7710.5
19.07	1780.7	-67733.5	0.5	-7296.3
19.32	1811.9	-69599.8	0.5	-6822.5
19.57	1843.1	-71340.3	0.5	-6340.6
19.82	1870.8	-72780.2	0.5	-5905.3
20.07	1902.0	-74277.3	0.5	-5407.8
20.33	1929.7	-75497.4	0.5	-4958.7
20.58	1960.9	-76743.5	0.5	-4445.7
20.83	1988.6	-77737.0	0.6	-3982.8
21.08	2019.8	-78724.2	0.6	-3454.3
21.33	2051.0	-79571.3	0.6	-2917.6
21.58	2078.7	-80204.8	0.6	-2433.6
21.83	2109.9	-80781.3	0.6	-1881.3
22.08	2137.6	-81170.8	0.6	-1383.5
22.33	2168.8	-81468.9	0.6	-815.8
22.58	2196.5	-81607.6	0.6	-304.2
22.83	2227.7	-81620.5	0.6	279.1
23.09	2258.9	-81488.4	0.6	870.6
23.34	2286.6	-81248.9	0.6	1403.3
23.59	2317.8	-80840.6	0.6	2010.3
23.84	2345.5	-80352.5	0.6	2556.8
24.09	2376.7	-79660.8	0.6	3179.4
24.34	2404.4	-78917.6	0.6	3739.7
24.59	2435.6	-77935.4	0.6	4377.7
24.84	2466.8	-76796.5	0.6	5024.0
25.09	1648.9	-75653.0	0.6	5531.5
25.34	1648.9	-74255.2	0.6	5966.0
25.59	1648.9	-72923.7	0.6	6352.1
25.85	1648.9	-71325.5	0.6	6786.6
26.10	1648.9	-69815.9	0.6	7172.7
26.35	1648.9	-68017.4	0.6	7607.2
26.60	1648.9	-66112.8	0.5	8041.6
26.85	1648.9	-64330.8	0.5	8427.8
27.10	1648.9	-62225.8	0.5	8862.2
27.35	1648.9	-60265.7	0.5	9248.3
27.60	1648.9	-57960.4	0.5	9682.8
27.85	1648.9	-55822.1	0.5	10068.9
28.10	1648.9	-53316.5	0.5	10503.4
28.35	1648.9	-50704.7	0.5	10937.8
28.61	1648.9	-48294.1	0.5	11323.9
28.86	1648.9	-45482.0	0.4	11758.4
29.11	1648.9	-42893.2	0.4	12144.5
29.36	1648.9	-39880.7	0.4	12578.9
29.61	1648.9	-37113.9	0.4	12965.1
29.86	1648.9	-33901.1	0.4	13399.5
30.11	-2647.2	-30602.6	0.4	13331.4
30.36	-2667.5	-27768.2	0.3	12708.8
30.61	-2680.8	-24741.8	0.3	11998.6
30.86	-2680.8	-22197.9	0.3	11363.0
31.12	-2680.8	-19501.0	0.3	10647.9
31.37	-2680.8	-17250.4	0.3	10012.2
31.62	-2680.8	-14883.3	0.3	9297.1
31.87	-2680.8	-12690.8	0.2	8582.1
32.12	-2680.8	-10888.5	0.2	7946.4
32.37	-2680.8	-9025.8	0.2	7231.3
32.62	-2680.8	-7516.6	0.2	6595.7
32.87	-2680.8	-5983.8	0.2	5880.6
33.12	-2680.8	-4767.8	0.2	5245.0
33.37	-2680.8	-3564.7	0.1	4529.9
33.62	-2680.8	-2536.3	0.1	3814.8
33.88	-2680.8	-1768.7	0.1	3179.1
34.13	-2680.8	-1070.0	0.1	2464.1
34.38	-2680.8	-595.6	0.1	1828.4
34.63	-2680.8	-226.7	0.0	1113.3
34.88	-2680.8	-45.4	0.0	477.7
35.13	-2680.8	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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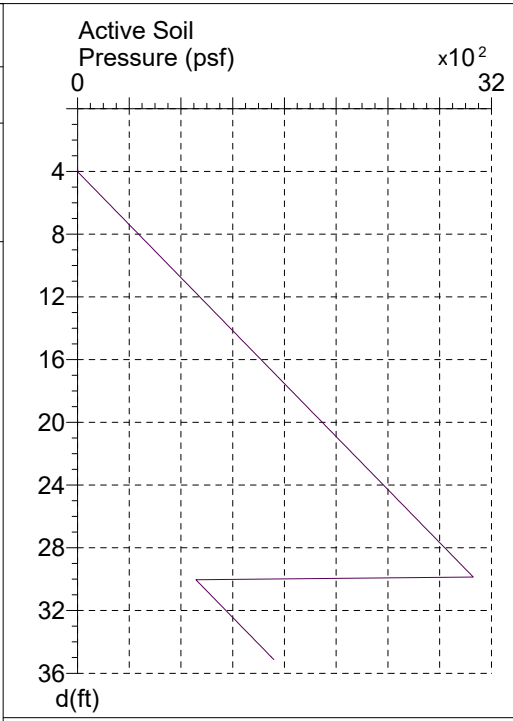
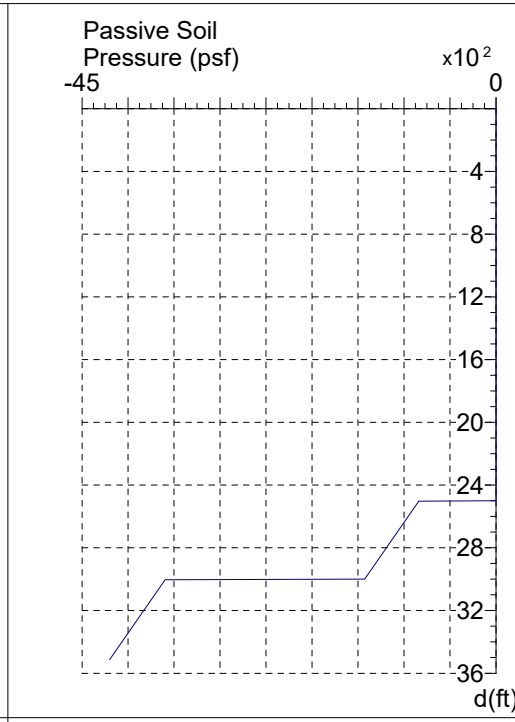
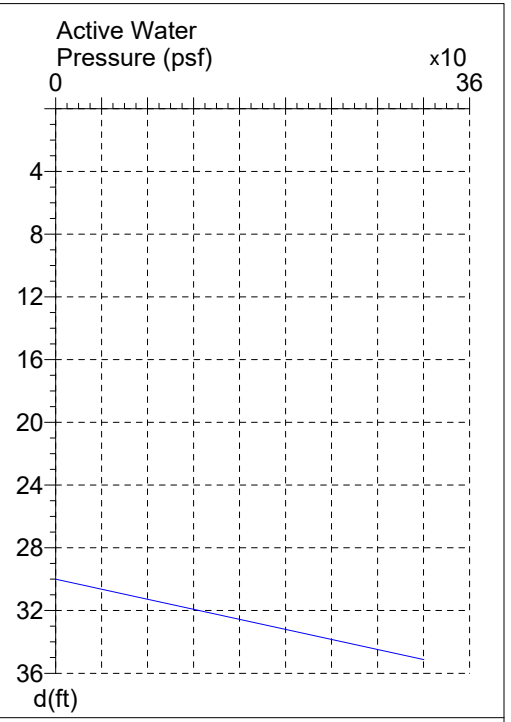
Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.0

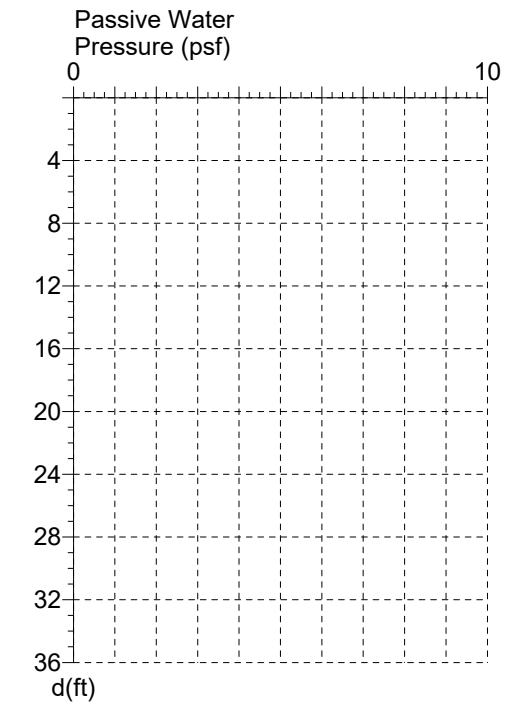
Page: 5
Date: 3.11.19

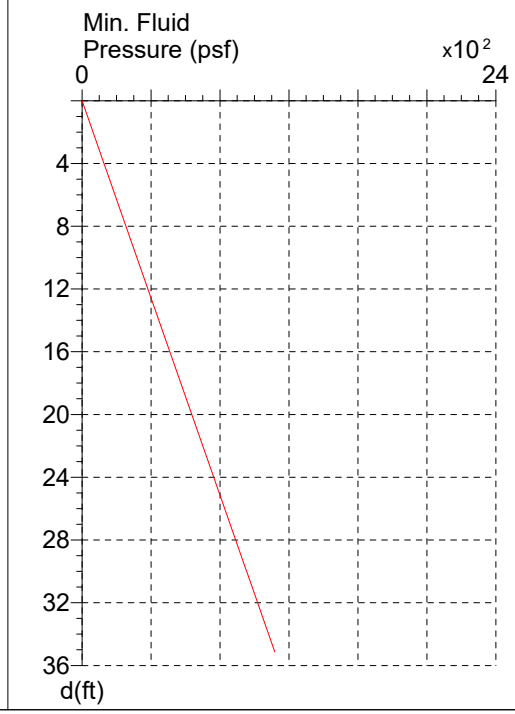
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

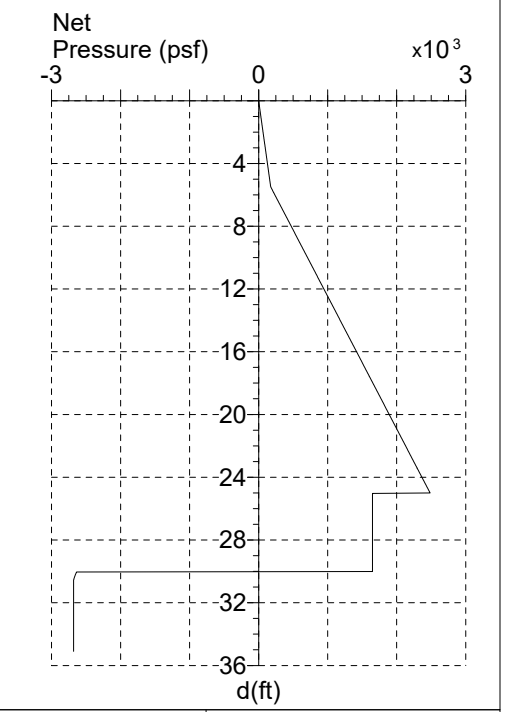












MDOT Sheetpile Manual

SupportIT, v2.37

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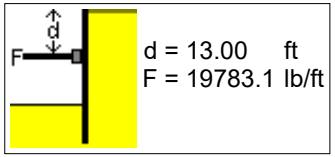
Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.0

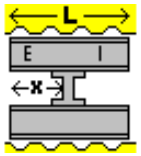
Page: 6
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

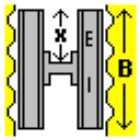


d = 13.00 ft
F = 19783.1 lb/ft

Shore/Shore



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

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Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 81633.2ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 39.24in³/ft (= M/f). Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

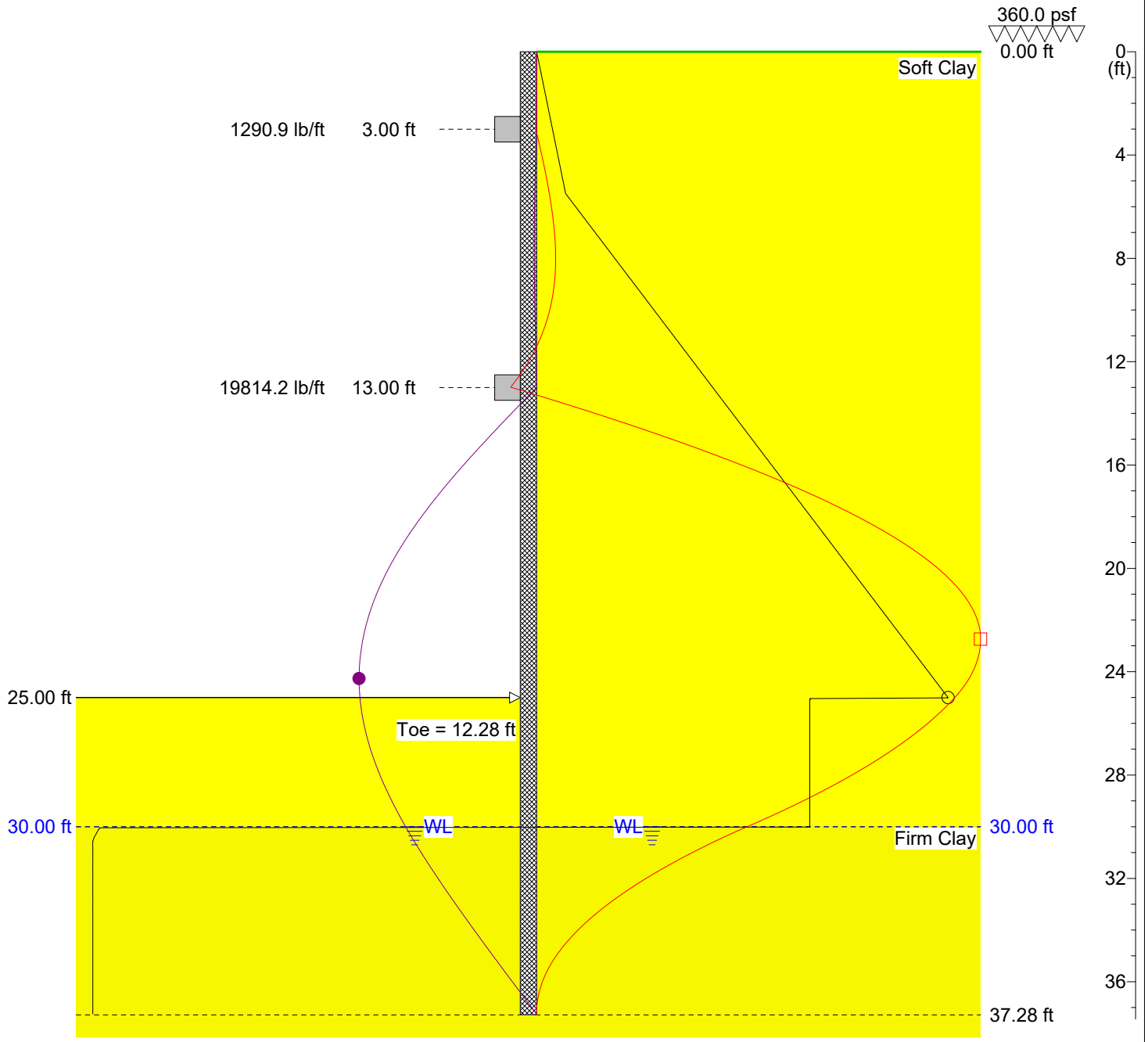
5. FOS = 1.01 (Net Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.50

Page: 1
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
2485.0 psf	25.00
82067.4 ftlb/ft	22.74
0.7 in	24.26



MDOT Sheetpile Manual

SupportIT, v2.37

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Email: GTSoftLtd@aol.com
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Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.50

Page: 2
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Input Data

Depth Of Excavation = 25.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	12.28	37.28

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	1290.9
13.00	Brace	19814.2

Maxima

	Maximum	Depth (ft)
Pressure	2485.0 psf	25.00
Bending Moment	82067.4 ftlb/ft	22.74
Deflection	0.7 in	24.26
Shear Force	15974.4 lb/ft	13.00

MDOT Sheetpile Manual

SupportIT, v2.37

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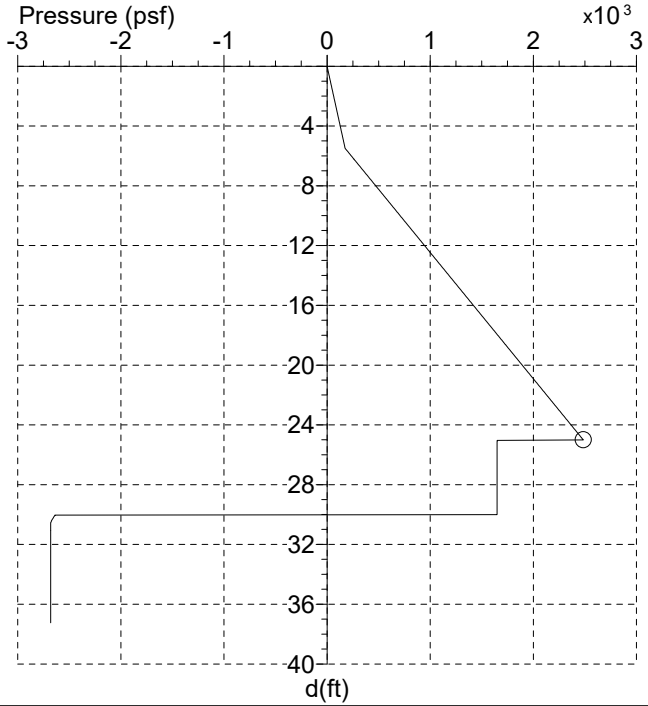
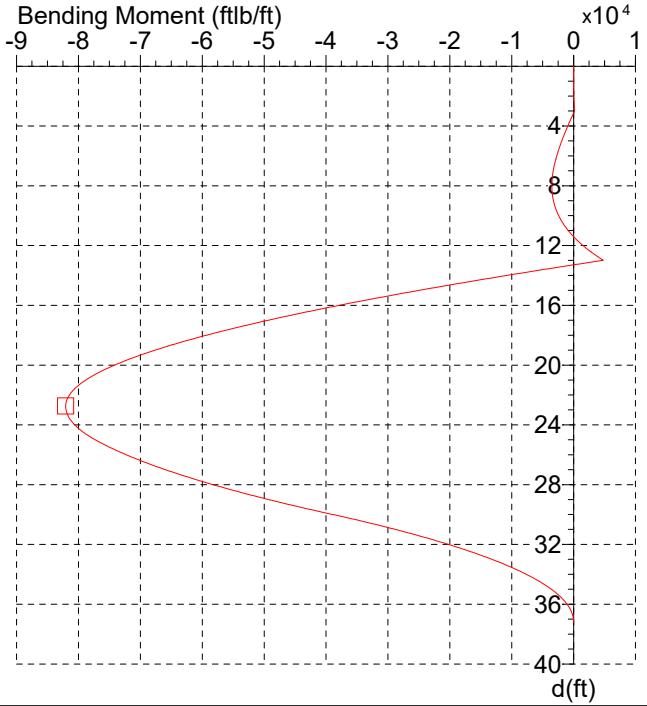
Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.50

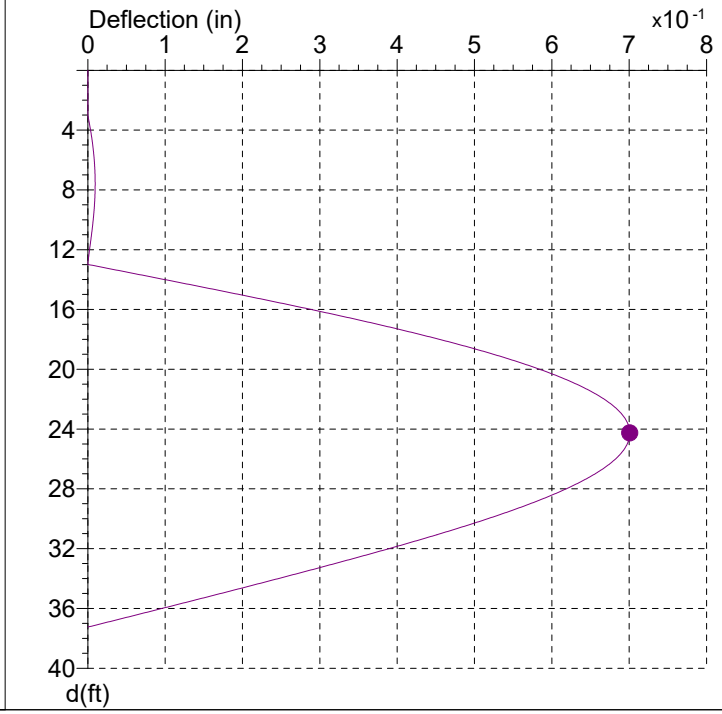
Page: 3
Date: 3.11.19

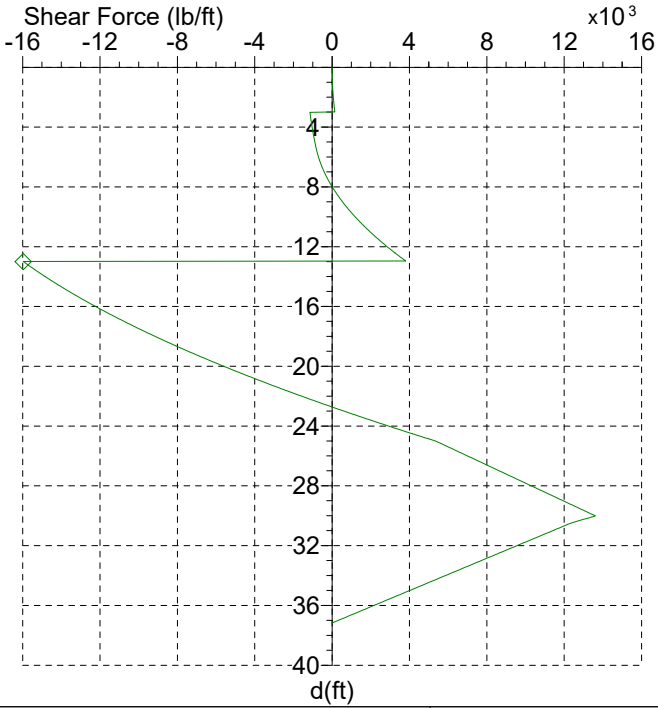
Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
2485.0 psf	25.00
82067.4 ftlb/ft	22.74
15974.4 lb/ft	13.00
0.7 in	24.26









MDOT Sheetpile Manual

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Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.50

Page: 4
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	0.0	0.0
0.27	8.9	0.1	0.0	1.4
0.53	16.8	0.8	0.0	4.7
0.80	25.7	2.8	0.0	10.8
1.07	33.6	6.2	0.0	18.3
1.33	42.5	12.6	0.0	29.1
1.60	50.5	21.1	0.0	40.8
1.86	59.4	34.3	0.0	56.2
2.13	68.3	52.2	0.0	74.2
2.40	76.2	72.6	0.0	92.3
2.66	85.1	101.2	0.0	115.0
2.93	93.0	132.1	0.0	137.2
3.20	101.9	-67.8	0.0	-1126.3
3.46	109.8	-346.2	0.0	-1099.8
3.73	118.7	-651.2	0.0	-1067.8
3.99	127.6	-946.9	0.0	-1033.2
4.26	135.5	-1201.4	0.0	-1000.4
4.53	144.4	-1477.5	0.0	-961.1
4.79	152.4	-1713.5	0.0	-924.1
5.06	161.3	-1967.7	0.0	-880.1
5.33	169.2	-2183.0	0.0	-838.9
5.59	186.7	-2412.7	0.0	-789.7
5.86	219.8	-2627.6	0.0	-732.3
6.12	249.2	-2804.2	0.0	-673.6
6.39	282.3	-2984.3	0.0	-598.8
6.66	311.7	-3125.8	0.0	-524.5
6.92	344.8	-3261.9	0.0	-432.2
7.19	374.3	-3360.1	0.0	-342.4
7.46	407.3	-3442.8	0.0	-232.6
7.72	440.4	-3493.5	0.0	-113.6
7.99	469.9	-3509.8	0.0	0.0
8.25	503.0	-3493.0	0.0	136.5
8.52	532.4	-3445.2	0.0	265.6
8.79	565.5	-3352.0	0.0	419.6
9.05	594.9	-3232.1	0.0	564.3
9.32	628.0	-3053.3	0.0	735.7
9.59	661.1	-2825.3	0.0	916.4
9.85	690.5	-2579.4	0.0	1084.9
10.12	723.6	-2251.7	0.0	1283.1
10.38	753.0	-1913.0	0.0	1467.0
10.65	786.1	-1476.2	0.0	1682.7
10.92	815.5	-1036.5	0.0	1882.2
11.18	848.6	-481.5	0.0	2115.3
11.45	881.7	139.9	0.0	2357.7
11.72	911.1	749.9	0.0	2581.0
11.98	944.2	1503.6	0.0	2840.9
12.25	973.6	2235.5	0.0	3079.6
12.52	1006.7	3130.8	0.0	3357.0
12.78	1036.2	3992.6	0.0	3611.3
13.05	1069.3	3810.5	0.0	-15908.1
13.31	1102.4	-585.2	0.0	-15604.0
13.58	1131.8	-4420.5	0.1	-15325.9
13.85	1164.9	-8651.8	0.1	-15004.3
14.11	1194.3	-12336.9	0.1	-14710.7
14.38	1227.4	-16394.6	0.1	-14371.7
14.65	1256.8	-19921.3	0.2	-14062.5
14.91	1289.9	-23796.2	0.2	-13706.0
15.18	1323.0	-27570.6	0.2	-13340.2
15.44	1352.4	-30839.2	0.2	-13007.3
15.71	1385.5	-34416.7	0.3	-12624.0
15.98	1414.9	-37506.2	0.3	-12275.6
16.24	1448.0	-40877.7	0.3	-11874.9
16.51	1477.4	-43779.9	0.3	-11510.9
16.78	1510.5	-46936.1	0.4	-11092.7
17.04	1543.6	-49974.6	0.4	-10665.2
17.31	1573.0	-52574.6	0.4	-10277.4
17.57	1606.1	-55383.7	0.4	-9832.5
17.84	1635.6	-57775.8	0.4	-9429.2
18.11	1668.7	-60346.4	0.5	-8966.8
18.37	1698.1	-62522.3	0.5	-8548.0
18.64	1731.2	-64845.2	0.5	-8068.1
18.91	1764.3	-67033.2	0.5	-7578.9
19.17	1793.7	-68862.7	0.5	-7136.3
19.44	1826.8	-70788.9	0.6	-6629.7
19.70	1856.2	-72381.6	0.6	-6171.6
19.97	1889.3	-74036.8	0.6	-5647.4
20.24	1918.7	-75384.5	0.6	-5173.8
20.50	1951.8	-76759.4	0.6	-4632.2
20.77	1984.9	-77982.3	0.6	-4081.3
21.04	2014.3	-78939.5	0.6	-3583.9
21.30	2047.4	-79868.1	0.6	-3015.6
21.57	2076.8	-80559.6	0.7	-2502.7
21.83	2109.9	-81184.7	0.7	-1916.9
22.10	2139.3	-81602.4	0.7	-1388.4
22.37	2172.4	-81914.8	0.7	-785.1
22.63	2205.5	-82057.9	0.7	-172.5
22.90	2235.0	-82045.7	0.7	379.7
23.17	2268.0	-81896.0	0.7	1009.7
23.43	2297.5	-81642.0	0.7	1577.5
23.70	2330.6	-81218.4	0.7	2225.0
23.97	2360.0	-80717.6	0.7	2808.3
24.23	2393.1	-80012.5	0.7	3473.3
24.50	2426.2	-79155.4	0.7	4147.5
24.76	2455.6	-78264.3	0.7	4754.6
25.03	1648.9	-77114.3	0.7	5420.2
25.30	1648.9	-75983.3	0.7	5830.1
25.56	1648.9	-74612.1	0.7	6291.1
25.83	1648.9	-73305.3	0.7	6700.9
26.10	1648.9	-71736.2	0.7	7161.9
26.36	1648.9	-70062.4	0.7	7622.9
26.63	1648.9	-68486.6	0.7	8032.7
26.89	1648.9	-66614.9	0.7	8493.7
27.16	1648.9	-64863.3	0.7	8903.5
27.43	1648.9	-62793.7	0.6	9364.5
27.69	1648.9	-60866.2	0.6	9774.3
27.96	1648.9	-58598.8	0.6	10235.3
28.23	1648.9	-56226.7	0.6	10696.3
28.49	1648.9	-54030.2	0.6	11106.1
28.76	1648.9	-51460.1	0.6	11567.1
29.02	1648.9	-49087.8	0.6	11976.9
29.29	1648.9	-46319.9	0.6	12437.9
29.56	1648.9	-43771.7	0.5	12847.7
29.82	1648.9	-40806.0	0.5	13308.7
30.09	-2645.4	-37745.6	0.5	13369.8
30.36	-2666.9	-35103.6	0.5	12709.4
30.62	-2680.8	-32284.8	0.5	12090.2
30.89	-2680.8	-29883.6	0.5	11630.8
31.15	-2680.8	-27293.1	0.4	11114.0
31.42	-2680.8	-25089.0	0.4	10654.7
31.69	-2680.8	-22720.4	0.4	10137.9
31.95	-2680.8	-20469.1	0.4	9621.1
32.22	-2680.8	-18566.5	0.4	9161.7
32.49	-2680.8	-16537.1	0.4	8644.9
32.75	-2680.8	-14831.7	0.3	8185.5
33.02	-2680.8	-13024.0	0.3	7668.7
33.28	-2680.8	-11515.8	0.3	7209.3
33.55	-2680.8	-9929.9	0.3	6692.5
33.82	-2680.8	-8461.5	0.3	6175.7
34.08	-2680.8	-7254.8	0.2	5716.4
34.35	-2680.8	-6008.1	0.2	5199.6
34.62	-2680.8	-4998.6	0.2	4740.2
34.88	-2680.8	-3973.7	0.2	4223.4
35.15	-2680.8	-3161.3	0.2	3764.0
35.42	-2680.8	-2358.3	0.1	3247.2
35.68	-2680.8	-1672.7	0.1	2730.4
35.95	-2680.8	-1161.8	0.1	2271.0
36.21	-2680.8	-698.0	0.1	1754.2
36.48	-2680.8	-384.3	0.1	1294.9
36.75	-2680.8	-142.3	0.0	778.1
37.01	-2680.8	-25.7	0.0	318.7
37.28	-2680.8	0.0	0.0	0.0

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Page: 5
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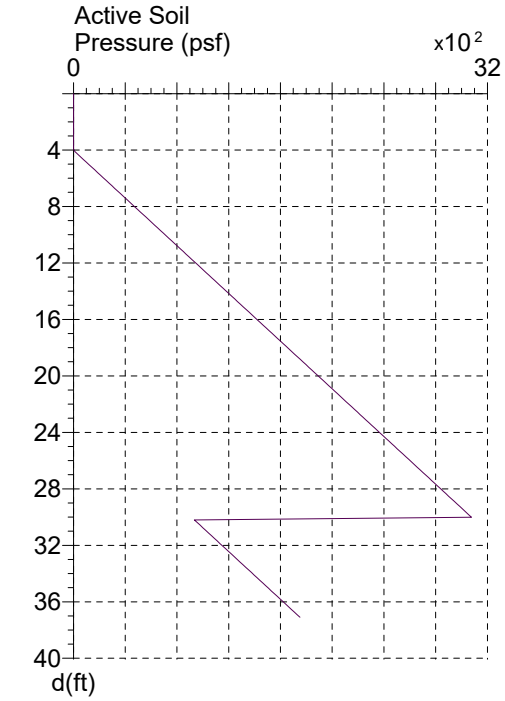
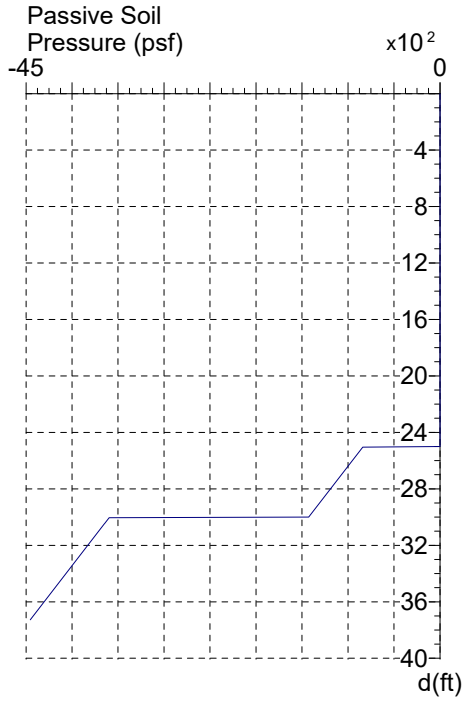
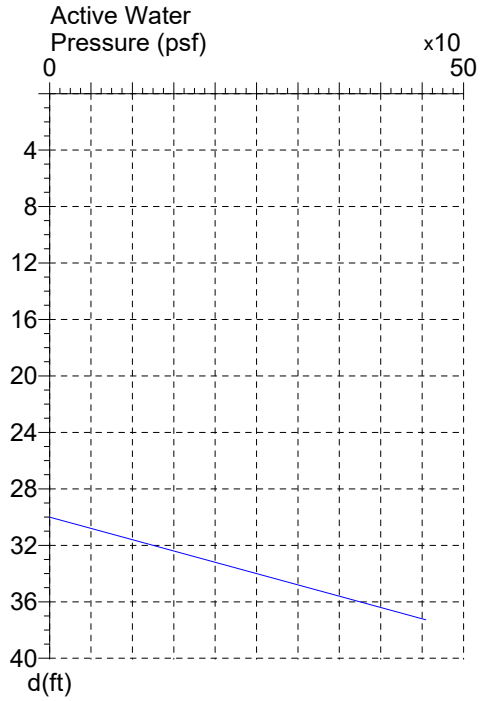
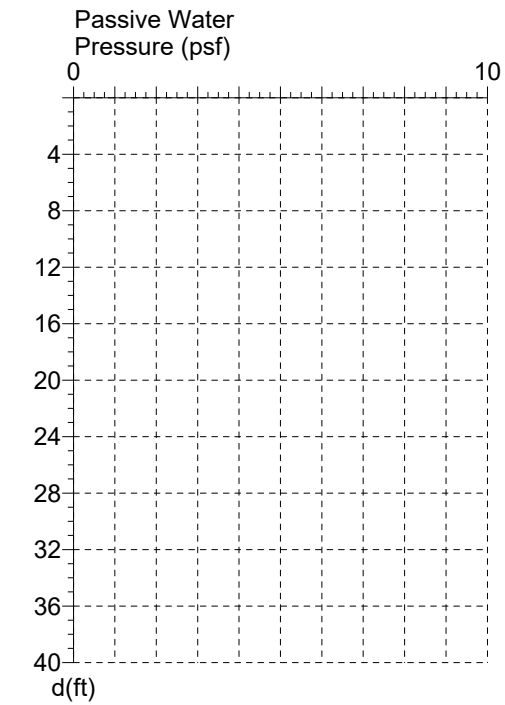
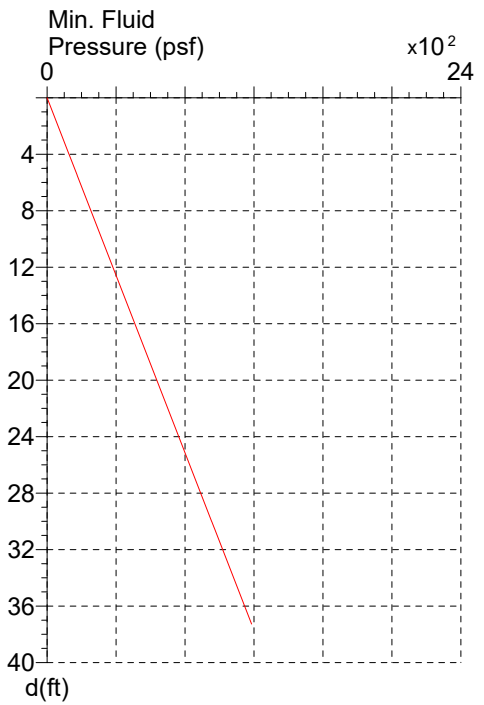
Pressure: Rankine
Analysis: Net Pressure

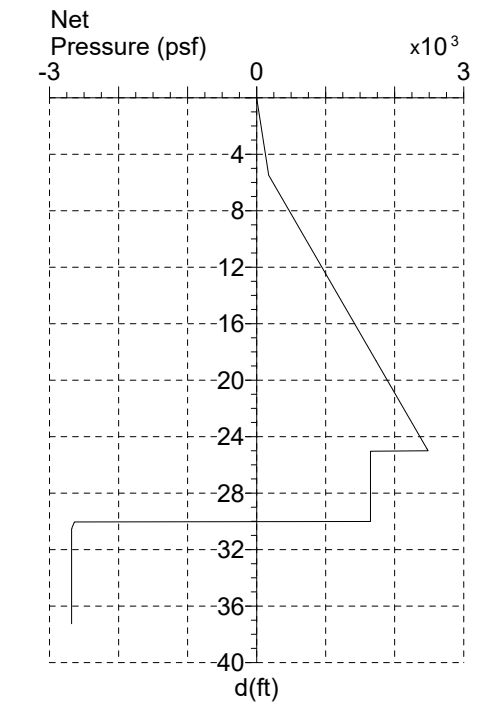












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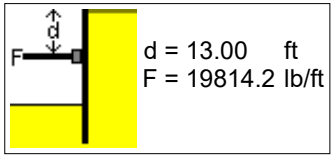
Client: Case 8 Braced - Clay - Stage 3
Site: FOS = 1.50

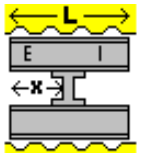
Page: 6
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

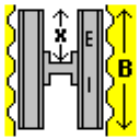


d = 13.00 ft
F = 19814.2 lb/ft

Shore/Shore



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

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Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 82067.4ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 39.44in³/ft (= M/f). Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

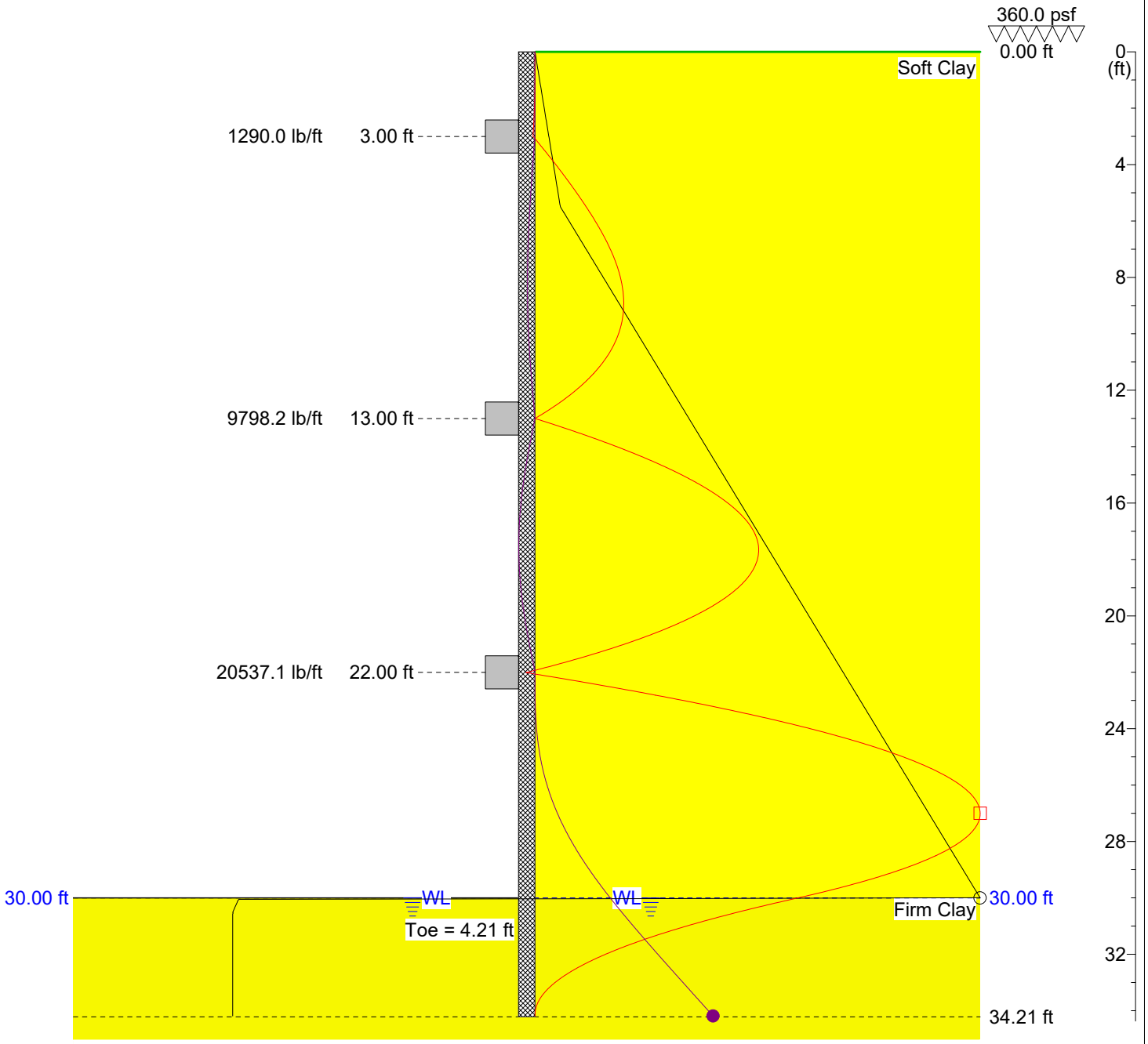
5. FOS = 1.51 (Net Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.00

Page: 1
Date: 3.11.19

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Toe: No Earth Support

Maximum	d (ft)
3075.9 psf	30.00
30950.6 ftlb/ft	27.00
0.4 in	34.19



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Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.00

Page: 2
Date: 3.11.19

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Toe: No Earth Support

Input Data

Depth Of Excavation = 30.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ27	3.04E+07	187.50	24966.8	31.00	64497.5	17.99	7.93	40.5	0.00	4.21	34.21

Load Model: Area Distribution (Hinge Method used for Shear Force, Bending Moment and Deflection)

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	1290.0
13.00	Brace	9798.2
22.00	Brace	20537.1

Maxima

	Maximum	Depth (ft)
Pressure	3075.9 psf	30.00
Bending Moment	30950.6 ftlb/ft	27.00
Deflection	0.4 in	34.19
Shear Force	12103.6 lb/ft	22.00

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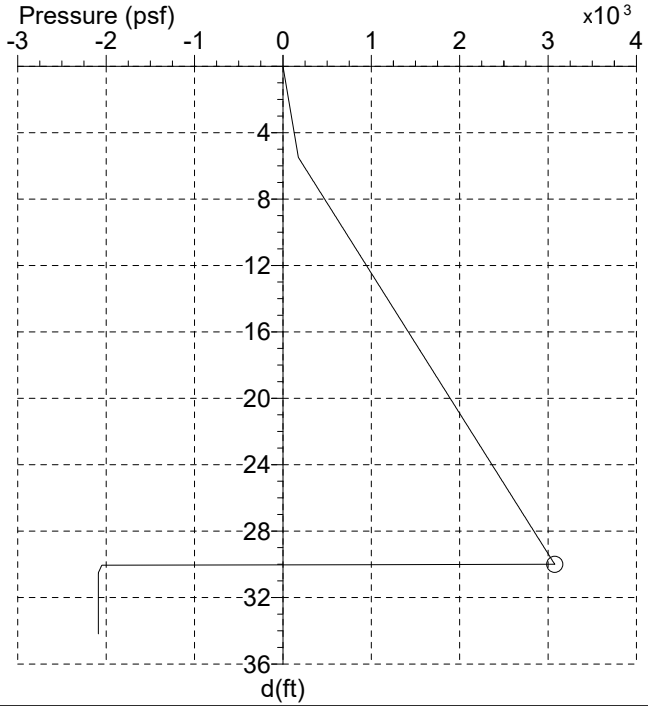
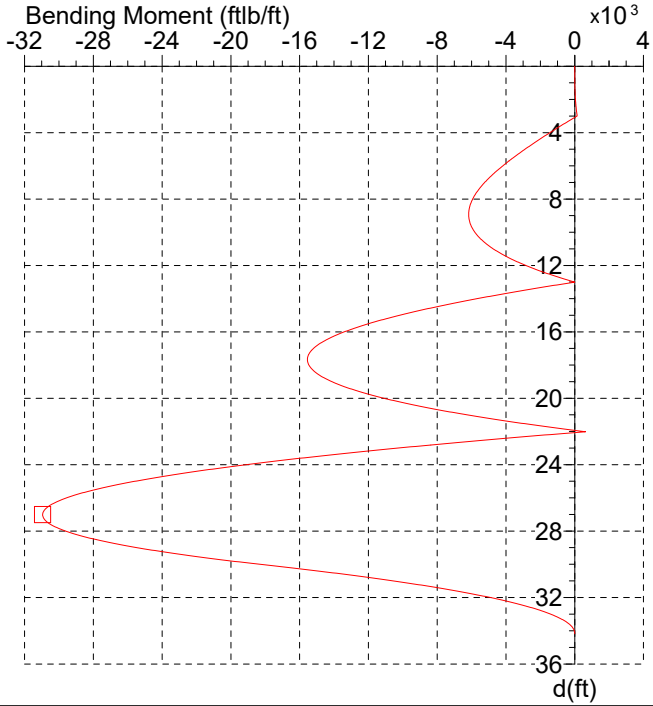
Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.00

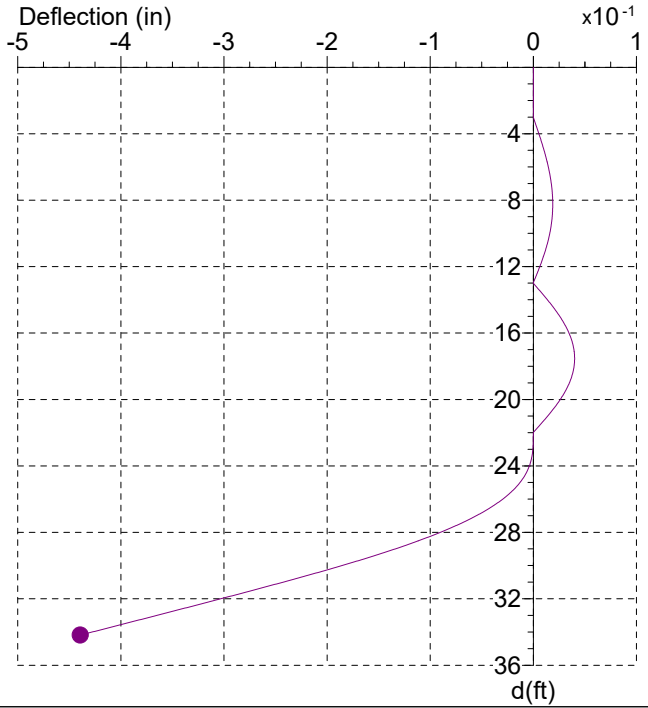
Page: 3
Date: 3.11.19

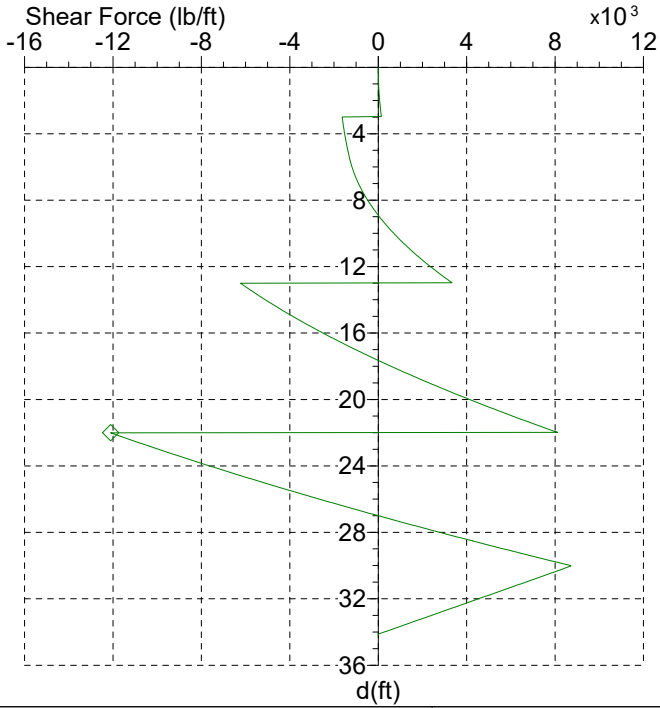
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Toe: No Earth Support

Maximum	d (ft)
○ 3075.9 psf	30.00
□ 30950.6 ftlb/ft	27.00
◇ 12103.6 lb/ft	22.00
● 0.4 in	34.19









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Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.00

Page: 4
Date: 3.11.19

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Toe: No Earth Support

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	0.0	0.0
0.24	8.2	0.1	0.0	1.2
0.49	15.4	0.6	0.0	4.0
0.73	23.6	2.1	0.0	9.1
0.98	30.9	4.8	0.0	15.4
1.22	39.0	9.8	0.0	24.5
1.47	46.3	16.3	0.0	34.3
1.71	54.5	26.5	0.0	47.4
1.96	62.7	40.4	0.0	62.5
2.20	69.9	56.1	0.0	77.7
2.44	78.1	78.2	0.0	96.8
2.69	85.4	102.1	0.0	115.6
2.93	93.5	134.4	0.0	138.7
3.18	100.8	-135.2	0.0	-1615.4
3.42	109.0	-546.0	0.0	-1588.4
3.67	117.1	-949.6	0.0	-1559.3
3.91	124.4	-1301.9	0.0	-1531.6
4.15	132.6	-1690.5	0.0	-1498.5
4.40	139.8	-2028.7	0.0	-1467.4
4.64	148.0	-2400.4	0.0	-1430.3
4.89	155.3	-2722.6	0.0	-1395.6
5.13	163.4	-3075.5	0.0	-1354.6
5.38	171.6	-3417.7	0.0	-1311.5
5.62	189.7	-3712.3	0.0	-1270.6
5.87	220.0	-4031.9	0.0	-1217.6
6.11	247.0	-4304.0	0.0	-1164.0
6.35	277.4	-4594.6	0.0	-1096.2
6.60	304.4	-4837.6	0.0	-1029.5
6.84	334.8	-5092.1	0.0	-947.0
7.09	365.2	-5324.6	0.0	-856.8
7.33	392.2	-5511.2	0.0	-770.0
7.58	422.5	-5696.7	0.0	-665.1
7.82	449.5	-5838.3	0.0	-565.2
8.06	479.9	-5969.6	0.0	-445.6
8.31	506.9	-6059.9	0.0	-332.6
8.55	537.3	-6130.0	0.0	-198.2
8.80	567.7	-6164.7	0.0	-56.0
9.04	594.7	-6164.4	0.0	76.9
9.29	625.0	-6127.0	0.0	233.9
9.53	652.0	-6059.2	0.0	379.9
9.78	682.4	-5942.3	0.0	551.5
10.02	709.4	-5800.7	0.0	710.7
10.26	739.8	-5597.3	0.0	897.0
10.51	770.2	-5345.1	0.0	1091.2
10.75	797.2	-5078.4	0.0	1270.3
11.00	827.5	-4728.8	0.0	1479.2
11.24	854.5	-4372.3	0.0	1671.5
11.49	884.9	-3918.1	0.0	1895.1
11.73	911.9	-3465.4	0.0	2100.4
11.98	942.3	-2899.4	0.0	2338.7
12.22	972.7	-2271.4	0.0	2584.8
12.46	999.7	-1659.4	0.0	2810.2
12.71	1030.0	-908.7	0.0	3071.0
12.95	1057.0	-184.6	0.0	3309.4
13.20	1087.4	-1220.5	0.0	-6011.6
13.44	1114.4	-2568.0	0.0	-5760.1
13.69	1144.8	-4014.4	0.0	-5469.8
13.93	1175.2	-5385.5	0.0	-5171.7
14.17	1202.2	-6539.2	0.0	-4900.2
14.42	1232.5	-7762.3	0.0	-4587.4
14.66	1259.5	-8781.3	0.0	-4302.8
14.91	1289.9	-9849.2	0.0	-3975.3
15.15	1316.9	-10727.2	0.0	-3677.6
15.40	1347.3	-11632.8	0.0	-3335.3
15.64	1377.7	-12449.7	0.0	-2985.3
15.89	1404.7	-13099.6	0.0	-2667.5
16.13	1435.0	-13743.3	0.0	-2302.8
16.37	1462.0	-14236.1	0.0	-1972.0
16.62	1492.4	-14699.5	0.0	-1592.5
16.86	1519.4	-15028.8	0.0	-1248.6
17.11	1549.8	-15304.7	0.0	-854.4
17.35	1580.2	-15478.4	0.0	-452.4
17.60	1607.2	-15545.4	0.0	-88.5
17.84	1637.5	-15522.1	0.0	328.3
18.08	1664.5	-15414.6	0.0	705.2
18.33	1694.9	-15194.6	0.0	1136.7
18.57	1721.9	-14909.5	0.0	1526.8
18.82	1752.3	-14486.3	0.0	1973.0
19.06	1782.7	-13952.7	0.0	2426.9
19.31	1809.7	-13384.2	0.0	2837.0
19.55	1840.0	-12636.9	0.0	3305.7
19.80	1867.0	-11875.4	0.0	3728.9
20.04	1897.4	-10907.7	0.0	4212.3
20.28	1924.4	-9947.2	0.0	4648.6
20.53	1954.8	-8752.1	0.0	5146.7
20.77	1985.2	-7433.8	0.0	5652.7
21.02	2012.2	-6157.2	0.0	6108.9
21.26	2042.5	-4601.2	0.0	6629.6
21.51	2069.5	-3110.2	0.0	7098.9
21.75	2099.9	-1309.6	0.0	7634.3
21.99	2126.9	401.9	0.0	8116.8
22.24	2157.3	-2087.2	0.0	-11614.3
22.48	2187.6	-5004.1	0.0	-11056.4
22.73	2214.6	-7476.0	0.0	-10553.9
22.97	2245.0	-10119.0	0.0	-9981.3
23.22	2272.0	-12344.4	0.0	-9465.7
23.46	2302.4	-14706.5	0.0	-8878.4
23.71	2329.4	-16679.0	0.0	-8349.7
23.95	2359.8	-18753.1	0.0	-7747.7
24.19	2390.1	-20671.9	0.0	-7137.8
24.44	2417.1	-22245.3	0.0	-6589.2
24.68	2447.5	-23865.1	0.0	-5964.6
24.93	2474.5	-25169.7	0.0	-5402.8
25.17	2504.9	-26483.3	0.0	-4763.5
25.42	2531.9	-27512.6	0.0	-4188.7
25.66	2562.3	-28513.1	0.0	-3534.7
25.91	2592.6	-29344.8	0.0	-2872.8
26.15	2619.6	-29940.8	0.0	-2278.0
26.39	2650.0	-30448.4	0.0	-1601.4
26.64	2677.0	-30753.1	0.0	-993.5
26.88	2707.4	-30929.4	-0.1	-302.2
27.13	2734.4	-30936.4	-0.1	318.8
27.37	2764.8	-30774.3	-0.1	1024.8
27.62	2795.1	-30430.1	-0.1	1738.6
27.86	2822.1	-29969.7	-0.1	2379.6
28.10	2852.5	-29276.1	-0.1	3108.1
28.35	2879.5	-28502.0	-0.1	3762.2
28.59	2909.9	-27452.0	-0.1	4505.4
28.84	2936.9	-26357.9	-0.1	5172.6
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29.33	2997.6	-23335.2	-0.2	6696.4
29.57	3024.6	-21739.4	-0.2	7383.6
29.82	3055.0	-19755.8	-0.2	8164.1
30.06	-2045.7	-17825.6	-0.2	8657.7
30.30	-2071.3	-15664.2	-0.2	8128.7
30.55	-2085.5	-13857.4	-0.2	7652.7
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31.77	-2088.9	-6038.5	-0.3	5041.5
32.01	-2088.9	-4807.2	-0.3	4494.9
32.26	-2088.9	-3830.4	-0.3	4009.1
32.50	-2088.9	-2864.0	-0.3	3462.6
32.75	-2088.9	-2037.8	-0.4	2916.0
32.99	-2088.9	-1421.1	-0.4	2430.2
33.24	-2088.9	-859.8	-0.4	1883.7
33.48	-2088.9	-478.6	-0.4	1397.9
33.73	-2088.9	-182.3	-0.4	851.3
33.97	-2088.9	-36.6	-0.4	365.5
34.21	-2088.9	0.0	-0.4	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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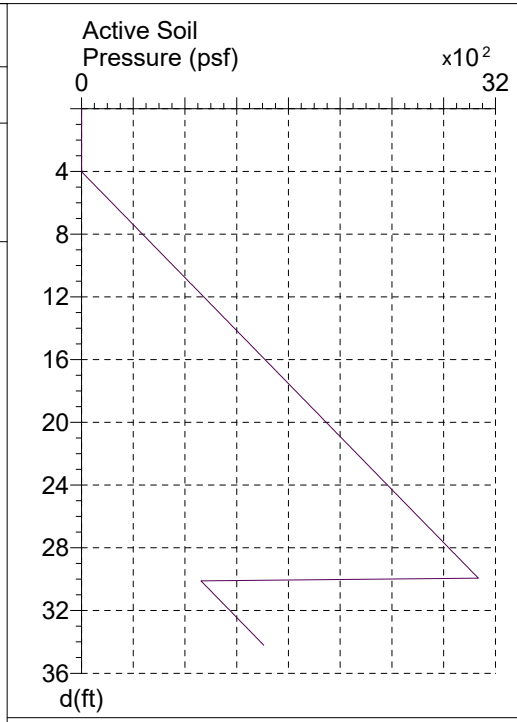
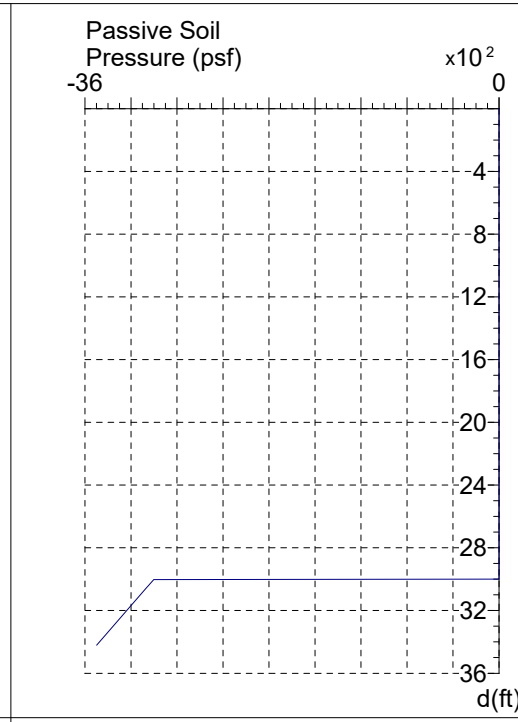
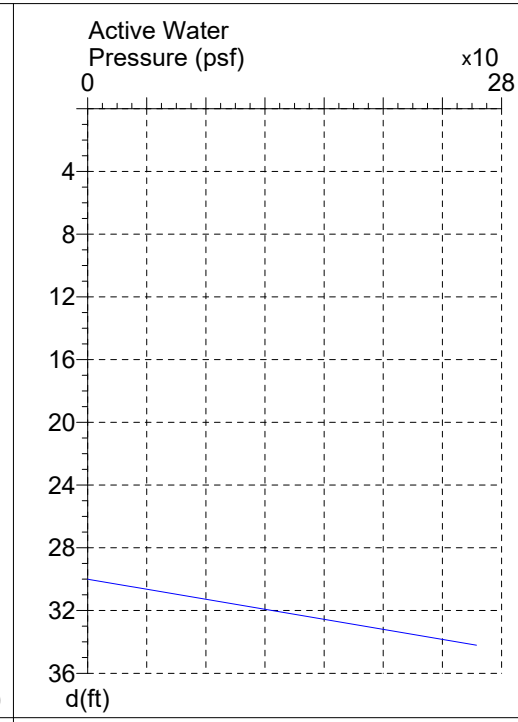
Site: FOS = 1.00

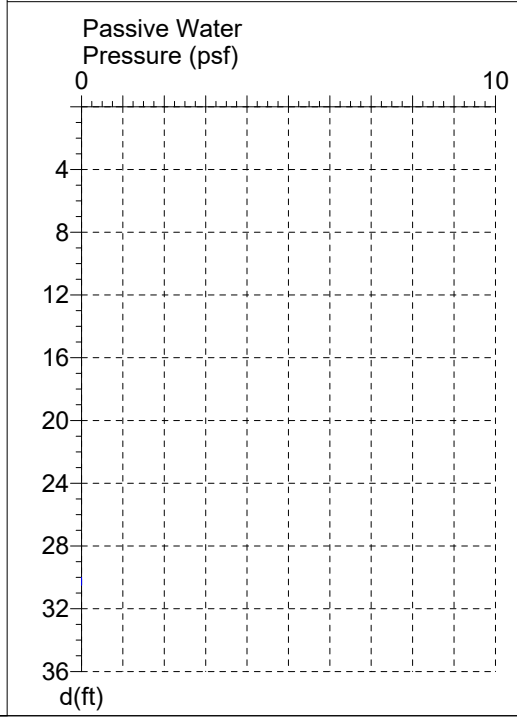
Page: 5
Date: 3.11.19

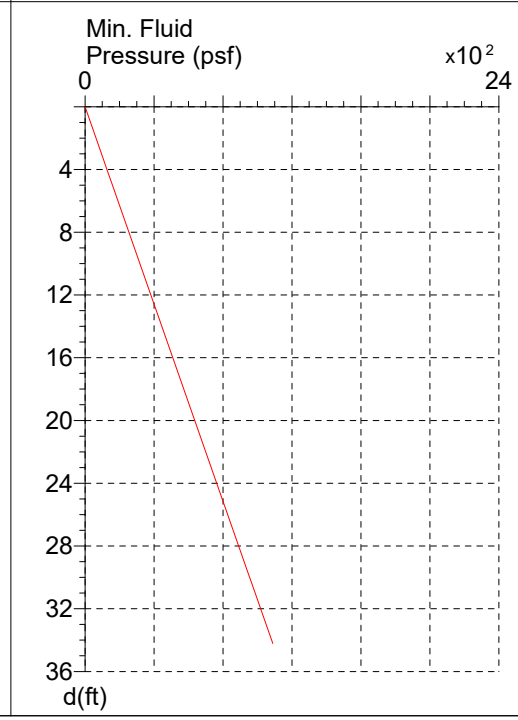
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Toe: No Earth Support

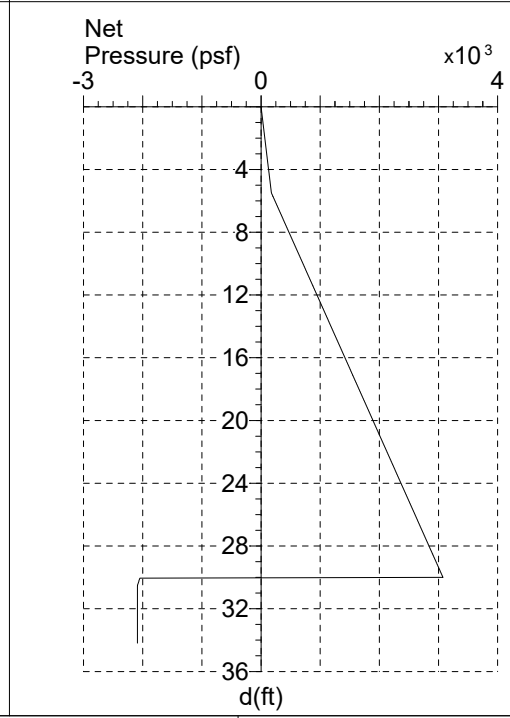












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Page: 6
Date: 3.11.19

Sheet: PZ27
Works: Temporary
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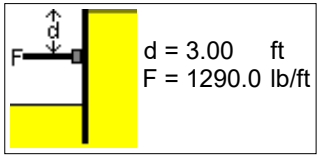
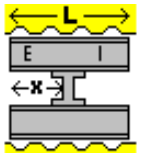
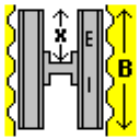


d = 3.00 ft
F = 1290.0 lb/ft

Shore/Shore



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

MDOT Sheetpile Manual

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Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 30950.6ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 14.88in³/ft (= M/f). Sheet section modulus in this design is Z = 31.00in³/ft, and is satisfactory.

4. FOS is less than requested FOS (1.0).

5. No Toe Design: Area Load Method selected and used for frame loads; Hinge Method used for Shear Force, Bending Moment and Deflection.

6. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

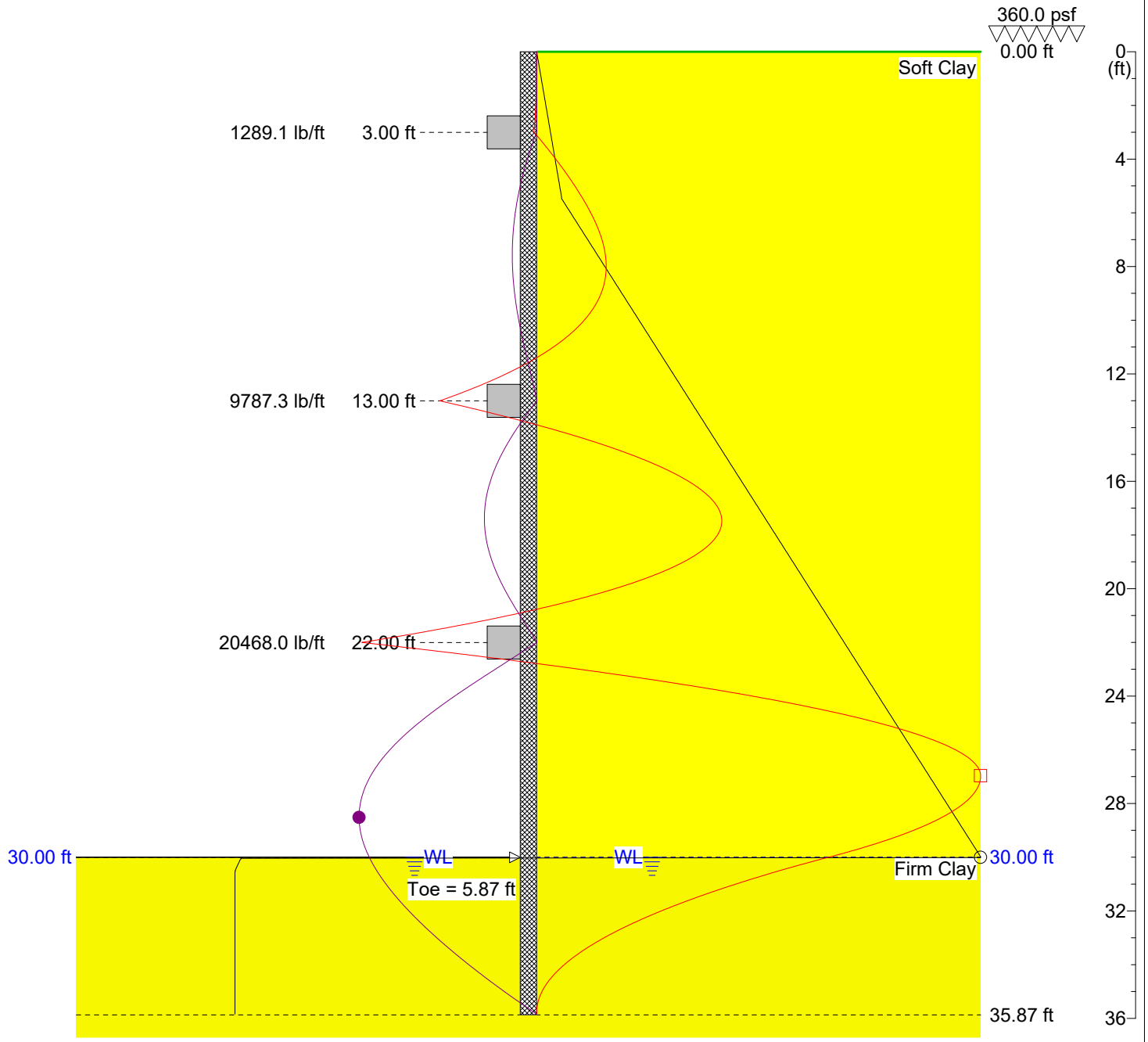
7. FOS undefined (No Toe case)
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.50

Page: 1
Date: 3.11.19

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
○ 3073.5 psf	30.00
□ 22354.2 ftlb/ft	26.96
● 0.1 in	28.52



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Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.50

Page: 2
Date: 3.11.19

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Input Data

Depth Of Excavation = 30.00ft
Surcharge = 360.0psf

Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ27	3.04E+07	187.50	24966.8	31.00	64497.5	17.99	7.93	40.5	0.00	5.87	35.87

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	1289.1
13.00	Brace	9787.3
22.00	Brace	20468.0

Maxima

	Maximum	Depth (ft)
Pressure	3073.5 psf	30.00
Bending Moment	22354.2 ftlb/ft	26.96
Deflection	0.1 in	28.52
Shear Force	12018.1 lb/ft	22.00

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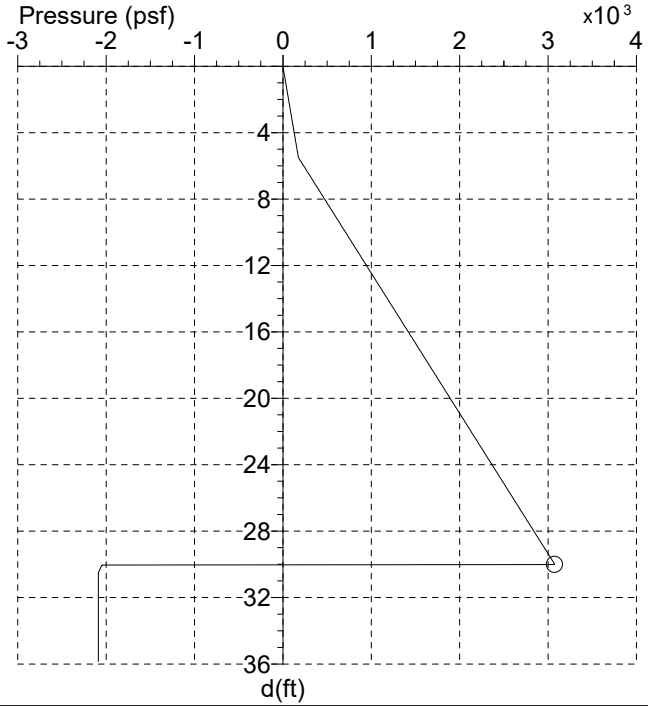
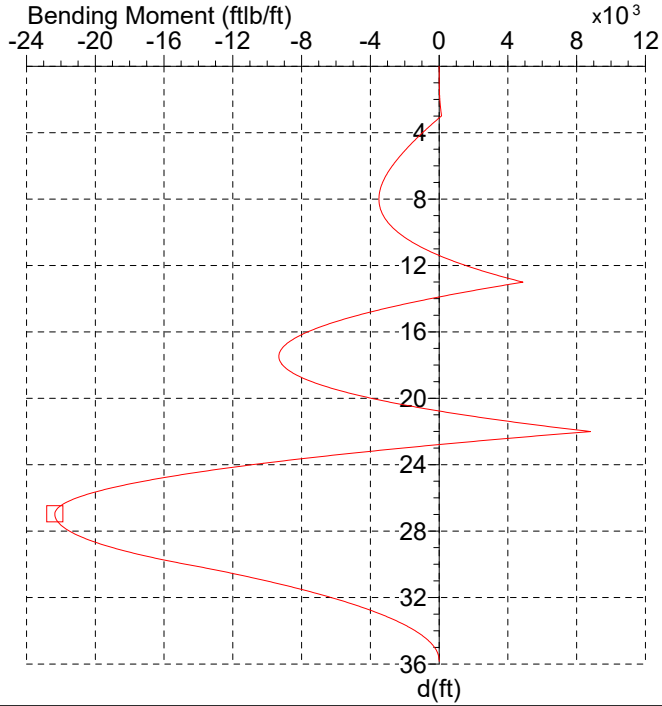
Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.50

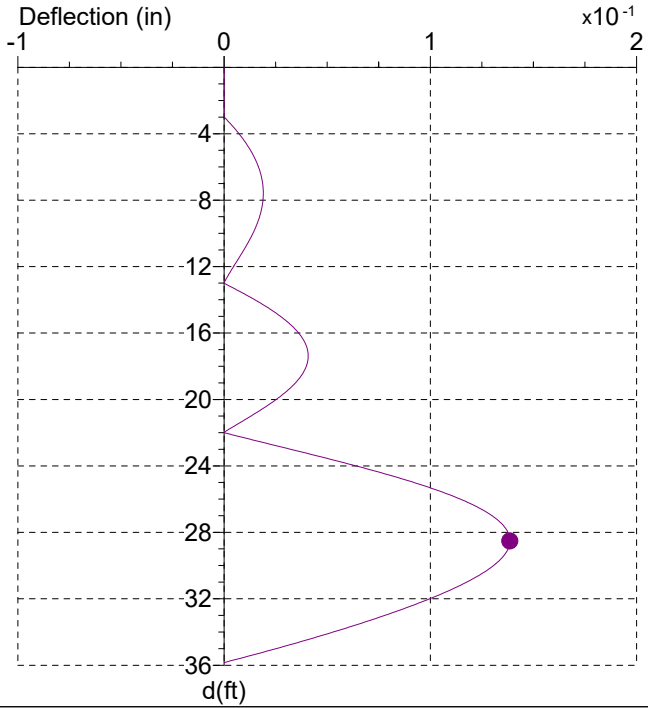
Page: 3
Date: 3.11.19

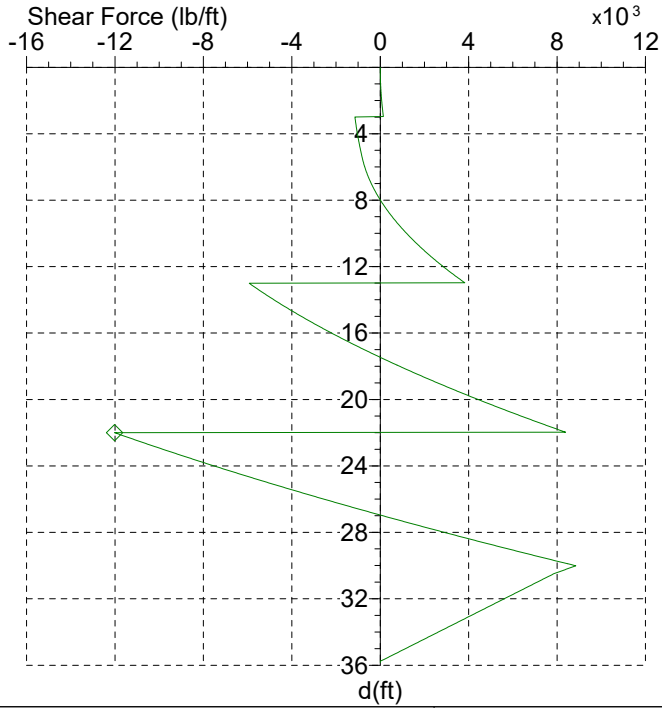
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

Maximum	d (ft)
○ 3073.5 psf	30.00
□ 22354.2 ftlb/ft	26.96
◇ 12018.1 lb/ft	22.00
● 0.1 in	28.52









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Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.50

Page: 4
Date: 3.11.19

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	0.0	0.0	0.0	0.0
0.26	8.6	0.1	0.0	1.3
0.51	16.2	0.7	0.0	4.4
0.77	24.7	2.5	0.0	10.0
1.02	32.4	5.5	0.0	16.9
1.28	40.9	11.2	0.0	26.9
1.54	48.5	18.8	0.0	37.7
1.79	57.1	30.6	0.0	52.1
2.05	65.7	46.5	0.0	68.7
2.31	73.3	64.7	0.0	85.4
2.56	81.9	90.1	0.0	106.4
2.82	89.5	117.7	0.0	127.0
3.07	98.0	39.6	0.0	-1136.7
3.33	105.7	-228.6	0.0	-1112.2
3.59	114.2	-523.2	0.0	-1082.5
3.84	122.8	-809.5	0.0	-1050.5
4.10	130.4	-1056.6	0.0	-1020.1
4.36	139.0	-1325.7	0.0	-983.8
4.61	146.6	-1556.5	0.0	-949.5
4.87	155.2	-1806.1	0.0	-908.8
5.12	162.8	-2018.7	0.0	-870.7
5.38	171.3	-2246.7	0.0	-825.6
5.64	193.5	-2462.3	0.0	-777.0
5.89	221.8	-2642.3	0.0	-726.9
6.15	253.7	-2829.6	0.0	-662.5
6.41	282.0	-2980.8	0.0	-598.0
6.66	313.8	-3131.6	0.0	-517.4
6.92	342.1	-3246.8	0.0	-438.6
7.17	373.9	-3353.0	0.0	-341.8
7.43	405.8	-3432.2	0.0	-236.4
7.69	434.1	-3478.1	0.0	-135.6
7.94	465.9	-3500.2	0.0	-14.0
8.20	494.2	-3491.7	0.0	101.2
8.45	526.1	-3448.2	0.0	238.9
8.71	554.4	-3377.7	0.0	368.5
8.97	586.2	-3260.3	0.0	522.4
9.22	618.1	-3100.6	0.0	684.9
9.48	646.4	-2921.1	0.0	836.5
9.74	678.2	-2674.9	0.0	1015.1
9.99	706.5	-2414.9	0.0	1181.1
10.25	738.4	-2074.1	0.0	1375.9
10.50	766.7	-1726.3	0.0	1556.3
10.76	798.5	-1282.6	0.0	1767.3
11.02	830.4	-781.1	0.0	1986.9
11.27	858.7	-285.0	0.0	2189.2
11.53	890.5	331.9	0.0	2425.0
11.79	918.8	934.3	0.0	2641.7
12.04	950.7	1674.9	0.0	2893.7
12.30	979.0	2390.9	0.0	3124.8
12.55	1010.8	3263.4	0.0	3392.9
12.81	1042.6	4209.0	0.0	3669.6
13.07	1071.0	4527.4	0.0	-5864.6
13.32	1102.8	2982.1	0.0	-5571.7
13.58	1131.1	1675.6	0.0	-5304.2
13.83	1162.9	283.3	0.0	-4995.1
14.09	1191.2	-883.6	0.0	-4713.3
14.35	1223.1	-2114.8	0.0	-4388.0
14.60	1254.9	-3257.3	0.0	-4054.2
14.86	1283.2	-4196.6	0.0	-3750.4
15.12	1315.1	-5165.3	0.0	-3400.4
15.37	1343.4	-5946.5	0.0	-3082.1
15.63	1375.2	-6733.3	0.0	-2716.0
15.88	1403.5	-7349.0	0.0	-2383.3
16.14	1435.4	-7945.6	0.0	-2001.0
16.40	1467.2	-8438.1	0.0	-1610.1
16.65	1495.5	-8786.7	0.0	-1255.4
16.91	1527.4	-9076.4	0.0	-848.4
17.17	1555.7	-9241.1	0.0	-479.3
17.42	1587.5	-9319.7	0.0	-56.1
17.68	1615.8	-9293.3	0.0	327.3
17.93	1647.7	-9152.9	0.0	766.8
18.19	1679.5	-8893.2	0.0	1214.8
18.45	1707.8	-8560.5	0.0	1620.2
18.70	1739.7	-8069.3	0.0	2084.4
18.96	1768.0	-7527.1	0.0	2504.2
19.22	1799.8	-6796.2	0.0	2984.5
19.47	1828.1	-6037.3	0.0	3418.7
19.73	1860.0	-5058.4	0.0	3915.2
19.98	1891.8	-3945.0	0.0	4420.4
20.24	1920.1	-2840.4	0.0	4876.5
20.50	1951.9	-1466.4	0.0	5397.8
20.75	1980.2	-126.5	0.0	5868.4
21.01	2012.1	1516.2	0.0	6405.9
21.26	2040.4	3098.6	0.0	6890.8
21.52	2072.2	5018.3	0.0	7444.4
21.78	2104.1	7088.0	0.0	8006.7
22.03	2132.4	8443.7	0.0	-11954.4
22.29	2164.2	5298.4	0.0	-11376.0
22.55	2192.5	2634.0	0.0	-10854.6
22.80	2224.4	-213.7	0.0	-10260.1
23.06	2252.7	-2610.0	0.0	-9724.4
23.31	2284.5	-5151.8	0.0	-9113.6
23.57	2316.4	-7528.4	0.1	-8494.3
23.83	2344.7	-9500.3	0.1	-7936.6
24.08	2376.5	-11558.5	0.1	-7301.1
24.34	2404.8	-13243.8	0.1	-6729.0
24.60	2436.7	-14975.3	0.1	-6077.3
24.85	2465.0	-16366.6	0.1	-5490.8
25.11	2496.8	-17763.3	0.1	-4823.0
25.36	2528.7	-18979.5	0.1	-4146.5
25.62	2557.0	-19907.0	0.1	-3538.1
25.88	2588.8	-20775.7	0.1	-2845.5
26.13	2617.1	-21390.8	0.1	-2222.6
26.39	2648.9	-21903.9	0.1	-1513.8
26.65	2677.3	-22199.2	0.1	-876.6
26.90	2709.1	-22348.4	0.1	-151.6
27.16	2740.9	-22322.8	0.1	581.9
27.41	2769.2	-22200.3	0.1	1241.1
27.67	2801.1	-21951.0	0.1	1990.9
27.93	2829.4	-21629.2	0.1	2664.5
28.18	2861.2	-21153.3	0.1	3430.4
28.44	2889.5	-20627.9	0.1	4118.4
28.69	2921.4	-19920.6	0.1	4900.4
28.95	2953.2	-19088.7	0.1	5691.1
29.21	2981.5	-18243.6	0.1	6401.1
29.46	3013.4	-17172.8	0.1	7207.9
29.72	3041.7	-16113.3	0.1	7932.3
29.98	3073.5	-14798.8	0.1	8755.3
30.23	-2063.6	-13577.3	0.1	8417.1
30.49	-2086.9	-12283.1	0.1	7858.5
30.74	-2088.9	-11066.3	0.1	7458.1
31.00	-2088.9	-10038.0	0.1	7102.1
31.26	-2088.9	-8941.1	0.1	6701.6
31.51	-2088.9	-8019.3	0.1	6345.6
31.77	-2088.9	-7042.2	0.1	5945.1
32.03	-2088.9	-6227.0	0.1	5589.1
32.28	-2088.9	-5369.7	0.1	5188.6
32.54	-2088.9	-4576.0	0.1	4788.1
32.79	-2088.9	-3923.7	0.1	4432.1
33.05	-2088.9	-3249.7	0.1	4031.6
33.31	-2088.9	-2703.9	0.1	3675.6
33.56	-2088.9	-2149.8	0.1	3275.1
33.82	-2088.9	-1710.6	0.1	2919.1
34.07	-2088.9	-1276.3	0.1	2518.6
34.33	-2088.9	-905.5	0.0	2118.1
34.59	-2088.9	-629.2	0.0	1762.1
34.84	-2088.9	-378.3	0.0	1361.6
35.10	-2088.9	-208.5	0.0	1005.6
35.36	-2088.9	-77.4	0.0	605.1
35.61	-2088.9	-14.1	0.0	249.1
35.87	-2088.9	0.0	0.0	0.0

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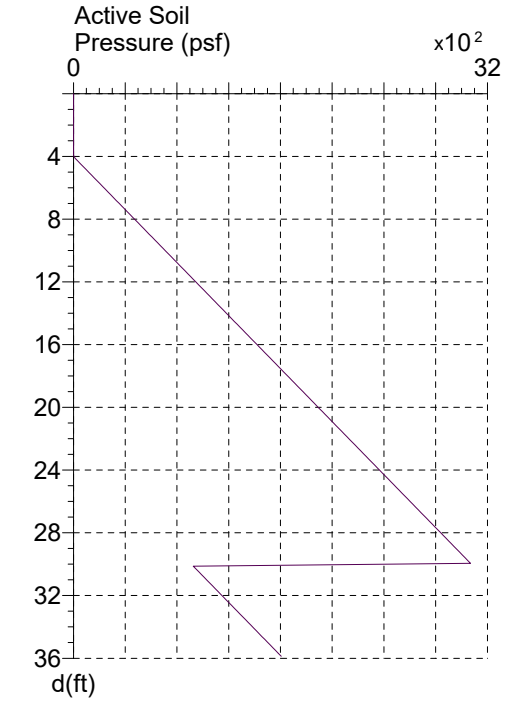
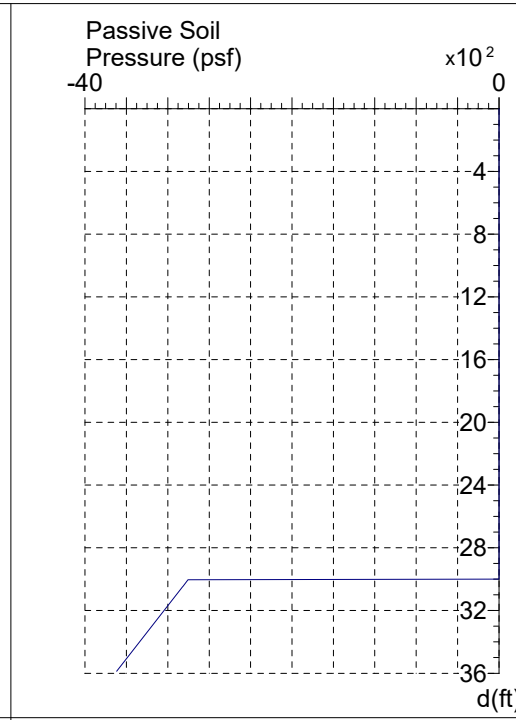
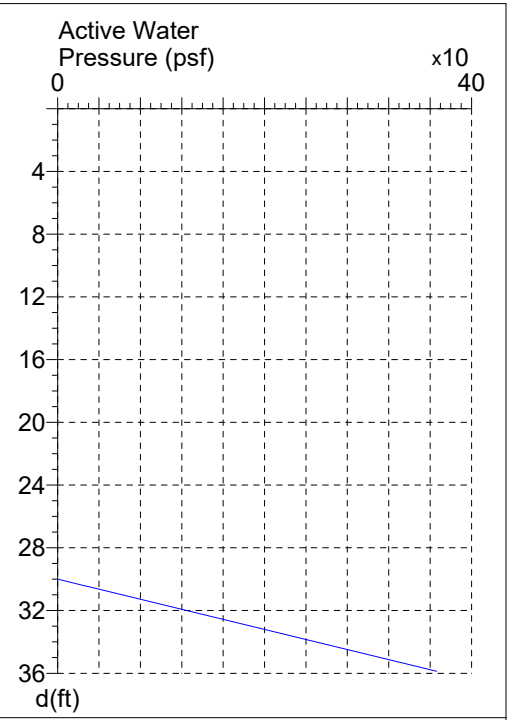
Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.50

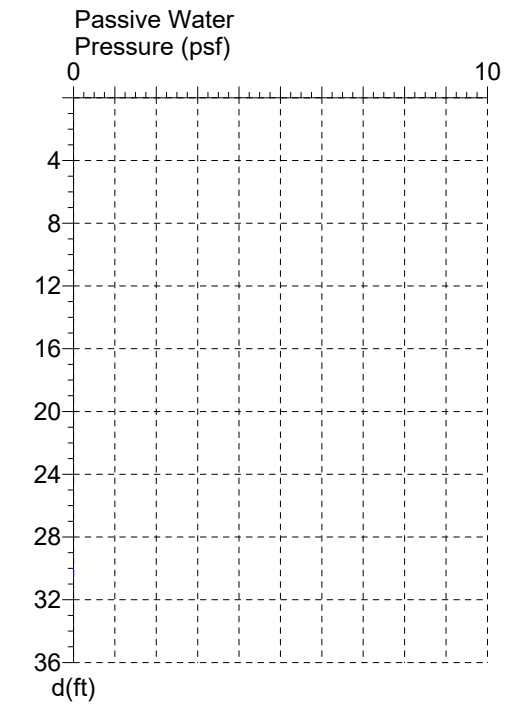
Page: 5
Date: 3.11.19

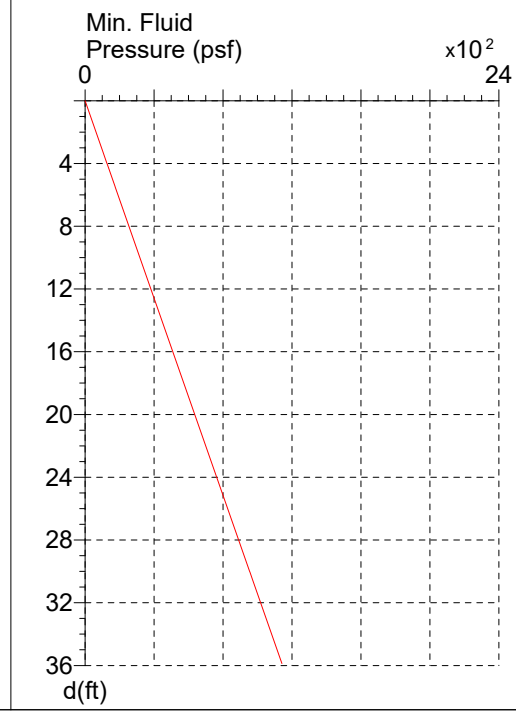
Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

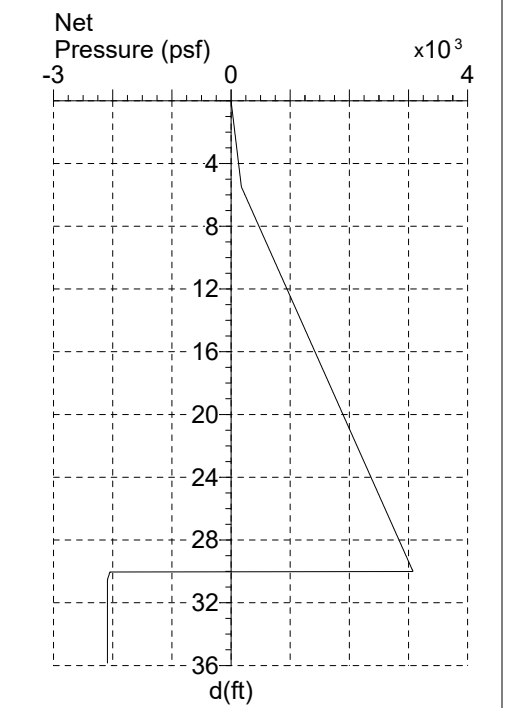












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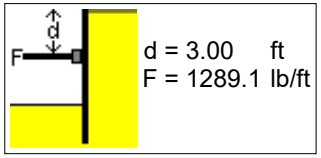
Client: Case 8 Braced - Clay - Stage 4
Site: FOS = 1.50

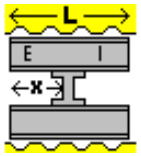
Page: 6
Date: 3.11.19

Sheet: PZ27
Works: Temporary
Pressure: Rankine
Analysis: Net Pressure

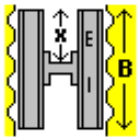


d = 3.00 ft
F = 1289.1 lb/ft

Shore/Shore



Waler/brace inadequately specified.
(Define L, E and I.)



Waler/brace inadequately specified.
(Define B, I and E.)

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Design Report

1. Cohesive soil exists below the active water table. MEFD is being applied. Select 'Full Hydrostatic Head' in the 'Pressure' page to apply full hydrostatic pressure.

2. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

3. Maximum bending moment = 22354.2ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 10.74in³/ft (= M/f). Sheet section modulus in this design is Z = 31.00in³/ft, and is satisfactory.

4. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

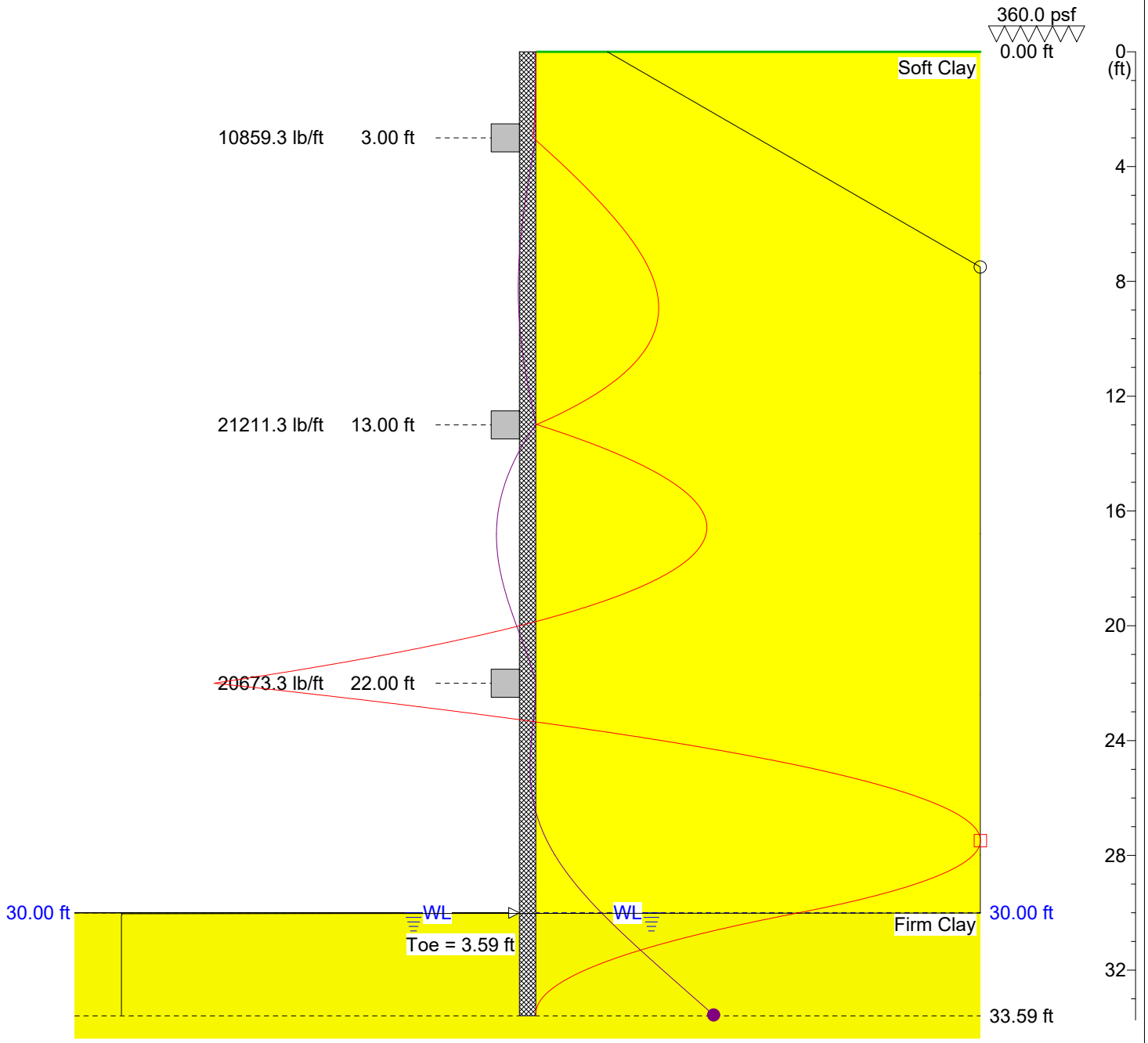
5. FOS = 1.49 (Net Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Client: Case 8 Braced - Clay - Strut Loads Terzaghi-Peck

Page: 1
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Terzaghi (m = 1.0; a = 0.4)
Analysis: Net Pressure

Maximum		d (ft)
○	2240.7 psf	7.50
□	22325.7 ftlb/ft	27.49
●	0.1 in	33.56



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Client: Case 8 Braced - Clay - Strut Loads Terzaghi-Peck
Page: 2
Date: 3.11.19
Sheet: PZ35
Works: Temporary
Pressure: Terzaghi (m = 1.0; a = 0.4)
Analysis: Net Pressure

Input Data

Depth Of Excavation = 30.00ft
Surcharge = 360.0psf
Depth Of Active Water = 30.00ft
Depth Of Passive Water = 30.00ft
Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft Clay	118.37	56.00	417.6	0.0	0.0	0.0	1.00	2.00	1.00	2.00
30.00	Firm Clay	118.37	56.00	1500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
PZ35	3.04E+07	369.40	24966.8	48.90	101739.5	22.64	10.28	66.0	0.00	3.59	33.59

Pressure Model: Terzaghi (m = 1.0; a = 0.4); Ignore hydrostatic pressure in cohesive soils; Rankine used on active side below excavation depth; Rankine used for bending moment

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
3.00	Brace	10859.3
13.00	Brace	21211.3
22.00	Brace	20673.3

Maxima

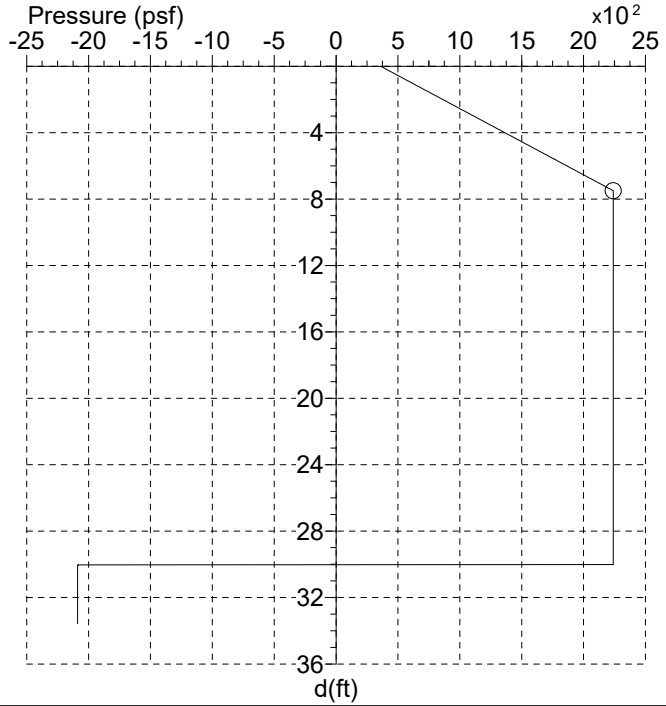
	Maximum	Depth (ft)
Pressure	2240.7 psf	7.50
Bending Moment	22325.7 ftlb/ft	27.49
Deflection	0.1 in	33.56
Shear Force	13418.9 lb/ft	22.00

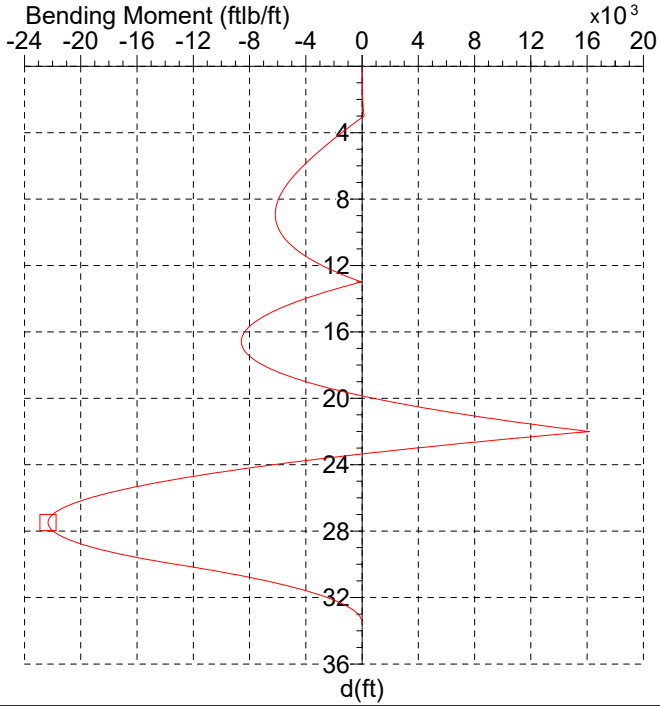
Client: Case 8 Braced - Clay - Strut Loads Terzaghi-Peck

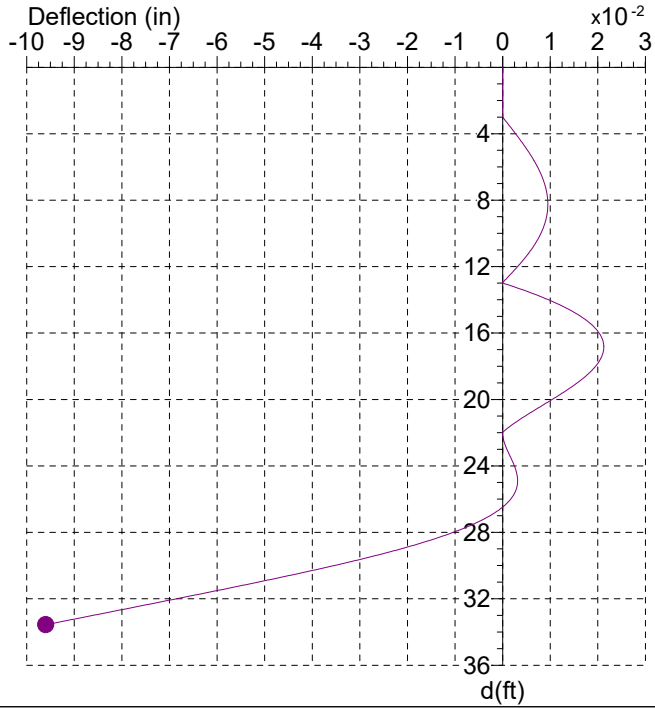
Page: 3
Date: 3.11.19

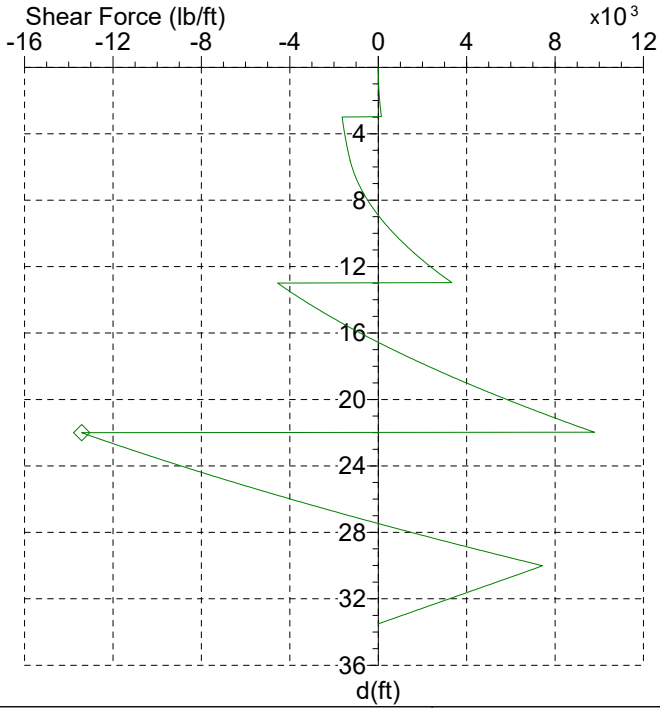
Sheet: PZ35
Works: Temporary
Pressure: Terzaghi (m = 1.0; a = 0.4)
Analysis: Net Pressure

	Maximum	d (ft)
○	2240.7 psf	7.50
□	22325.7 ftlb/ft	27.49
◇	13418.9 lb/ft	22.00
●	0.1 in	33.56









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Client: Case 8 Braced - Clay - Strut Loads Terzaghi-Peck

Page: 4
Date: 3.11.19

Sheet: PZ35
Works: Temporary
Pressure: Terzaghi (m = 1.0; a = 0.4)
Analysis: Net Pressure

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	360.0	0.0	0.0	0.0
0.24	423.2	0.1	0.0	1.1
0.48	479.3	0.6	0.0	3.8
0.72	542.5	2.0	0.0	8.8
0.96	598.7	4.6	0.0	14.8
1.20	661.8	9.2	0.0	23.6
1.44	718.0	15.4	0.0	33.1
1.68	781.2	25.1	0.0	45.7
1.92	844.3	38.2	0.0	60.3
2.16	900.5	53.1	0.0	74.9
2.40	963.7	74.0	0.0	93.3
2.64	1019.8	96.7	0.0	111.4
2.88	1083.0	127.2	0.0	133.6
3.12	1139.1	-39.5	0.0	-1621.3
3.36	1202.3	-444.5	0.0	-1595.2
3.60	1265.5	-842.7	0.0	-1567.1
3.84	1321.6	-1190.6	0.0	-1540.5
4.08	1384.8	-1574.6	0.0	-1508.6
4.32	1441.0	-1909.1	0.0	-1478.6
4.56	1504.1	-2277.1	0.0	-1442.9
4.80	1560.3	-2596.6	0.0	-1409.4
5.04	1623.5	-2946.8	0.0	-1369.9
5.28	1686.6	-3286.8	0.0	-1328.4
5.52	1742.8	-3580.1	0.0	-1289.7
5.76	1806.0	-3899.3	0.0	-1240.8
6.00	1862.1	-4172.0	0.0	-1191.0
6.24	1925.3	-4464.8	0.0	-1127.9
6.48	1981.4	-4711.0	0.0	-1065.5
6.72	2044.6	-4970.6	0.0	-988.3
6.96	2107.8	-5209.9	0.0	-903.5
7.20	2163.9	-5404.0	0.0	-821.8
7.44	2227.1	-5599.9	0.0	-722.8
7.68	2240.7	-5752.4	0.0	-628.5
7.92	2240.7	-5898.0	0.0	-515.3
8.16	2240.7	-6002.9	0.0	-408.4
8.40	2240.7	-6091.6	0.0	-281.1
8.64	2240.7	-6147.4	0.0	-146.2
8.88	2240.7	-6167.8	0.0	-20.0
9.12	2240.7	-6156.4	0.0	129.1
9.36	2240.7	-6114.0	0.0	267.9
9.60	2240.7	-6028.4	0.0	431.2
9.84	2240.7	-5917.1	0.0	582.6
10.08	2240.7	-5750.6	0.0	760.0
10.32	2240.7	-5538.6	0.0	945.0
10.56	2240.7	-5310.4	0.0	1115.7
10.80	2240.7	-5007.2	0.0	1314.9
11.04	2240.7	-4694.9	0.0	1498.2
11.28	2240.7	-4293.7	0.0	1711.5
11.52	2240.7	-3891.3	0.0	1907.5
11.76	2240.7	-3385.5	0.0	2135.0
12.00	2240.7	-2821.4	0.0	2370.1
12.24	2240.7	-2269.7	0.0	2585.3
12.48	2240.7	-1590.7	0.0	2834.5
12.72	2240.7	-933.7	0.0	3062.4
12.96	2240.7	-132.9	0.0	3325.8
13.20	2240.7	-905.7	0.0	-4342.2
13.44	2240.7	-1957.1	0.0	-4064.5
13.68	2240.7	-2938.5	0.0	-3779.4
13.92	2240.7	-3750.5	0.0	-3519.7
14.16	2240.7	-4594.5	0.0	-3220.3
14.40	2240.7	-5281.5	0.0	-2948.0
14.64	2240.7	-5981.5	0.0	-2634.5
14.88	2240.7	-6537.5	0.0	-2349.5
15.12	2240.7	-7086.8	0.0	-2021.8
15.36	2240.7	-7553.6	0.0	-1686.6
15.60	2240.7	-7897.8	0.0	-1382.3
15.84	2240.7	-8203.7	0.0	-1032.9
16.08	2240.7	-8401.9	0.0	-716.0
16.32	2240.7	-8540.2	0.0	-352.4
16.56	2240.7	-8586.5	0.0	-22.9
16.80	2240.7	-8550.6	0.0	354.9
17.04	2240.7	-8419.9	0.0	740.2
17.27	2240.7	-8222.7	0.0	1089.0
17.51	2240.7	-7907.8	0.0	1488.4
17.75	2240.7	-7543.9	0.0	1849.9
17.99	2240.7	-7038.2	0.0	2263.5
18.23	2240.7	-6501.7	0.0	2637.6
18.47	2240.7	-5798.5	0.0	3065.4
18.71	2240.7	-4988.1	0.0	3500.8
18.95	2240.7	-4176.2	0.0	3894.1
19.19	2240.7	-3158.1	0.0	4343.7
19.43	2240.7	-2158.6	0.0	4749.6
19.67	2240.7	-926.2	0.0	5213.4
19.91	2240.7	266.8	0.0	5631.9
20.15	2240.7	1720.2	0.0	6109.9
20.39	2240.7	3293.4	0.0	6595.3
20.63	2240.7	4793.8	0.0	7033.2
20.87	2240.7	6598.2	0.0	7532.8
21.11	2240.7	8307.0	0.0	7983.2
21.35	2240.7	10349.3	0.0	8497.1
21.59	2240.7	12272.5	0.0	8960.2
21.83	2240.7	14559.3	0.0	9488.2
22.07	2240.7	15035.6	0.0	-13239.6
22.31	2240.7	12118.0	0.0	-12757.2
22.55	2240.7	8965.5	0.0	-12207.5
22.79	2240.7	6280.2	0.0	-11712.5
23.03	2240.7	3392.5	0.0	-11148.6
23.27	2240.7	945.6	0.0	-10641.0
23.51	2240.7	-1670.6	0.0	-10062.9
23.75	2240.7	-4140.3	0.0	-9477.3
23.99	2240.7	-6211.1	0.0	-8950.4
24.23	2240.7	-8398.9	0.0	-8350.6
24.47	2240.7	-10216.1	0.0	-7811.1
24.71	2240.7	-12115.4	0.0	-7197.1
24.95	2240.7	-13673.1	0.0	-6645.0
25.19	2240.7	-15276.9	0.0	-6016.8
25.43	2240.7	-16721.7	0.0	-5381.1
25.67	2240.7	-17870.8	0.0	-4809.7
25.91	2240.7	-19009.9	0.0	-4159.8
26.15	2240.7	-19884.3	0.0	-3575.8
26.39	2240.7	-20710.9	0.0	-2911.7
26.63	2240.7	-21304.6	0.0	-2315.1
26.87	2240.7	-21812.0	0.0	-1636.8
27.11	2240.7	-22147.7	0.0	-951.0
27.35	2240.7	-22300.5	0.0	-335.1
27.59	2240.7	-22306.7	0.0	364.9
27.83	2240.7	-22163.5	0.0	993.4
28.07	2240.7	-21833.4	0.0	1707.6
28.31	2240.7	-21388.3	0.0	2348.8
28.55	2240.7	-20715.2	0.0	3077.1
28.79	2240.7	-19857.7	0.0	3813.0
29.03	2240.7	-18939.3	0.0	4473.4
29.27	2240.7	-17728.5	0.0	5223.5
29.51	2240.7	-16492.9	0.0	5896.5
29.75	2240.7	-14922.0	0.0	6660.8
29.99	2240.7	-13363.4	0.0	7346.5
30.23	-2088.9	-11538.3	0.0	6972.1
30.47	-2088.9	-9840.3	0.0	6449.0
30.71	-2088.9	-8443.0	0.0	5971.5
30.95	-2088.9	-6998.7	-0.1	5434.2
31.19	-2088.9	-5828.6	-0.1	4956.6
31.43	-2088.9	-4640.1	-0.1	4419.2
31.67	-2088.9	-3697.3	-0.1	3941.6
31.91	-2088.9	-2764.4	-0.1	3404.3
32.15	-2088.9	-1967.0	-0.1	2867.0
32.39	-2088.9	-1371.8	-0.1	2389.3
32.63	-2088.9	-830.0	-0.1	1852.0
32.87	-2088.9	-462.0	-0.1	1374.4
33.11	-2088.9	-176.0	-0.1	837.1
33.35	-2088.9	-35.3	-0.1	359.4
33.59	-2088.9	0.0	-0.1	0.0

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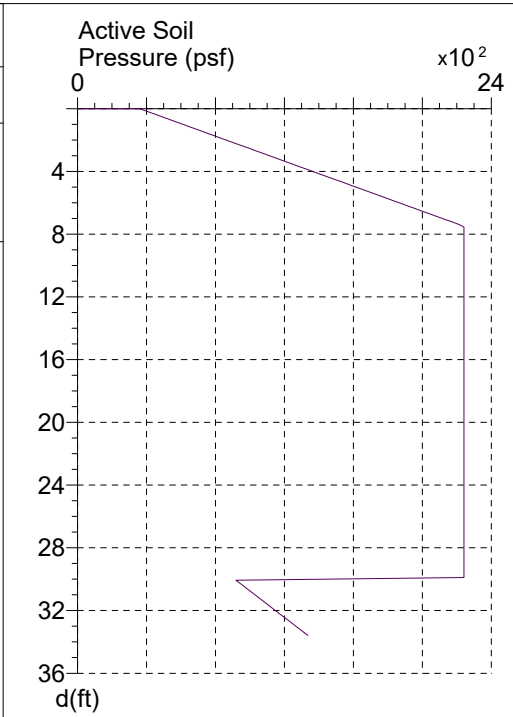
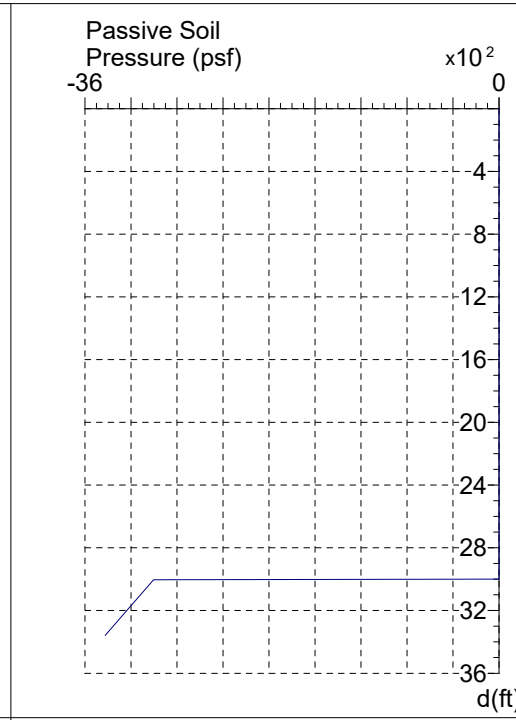
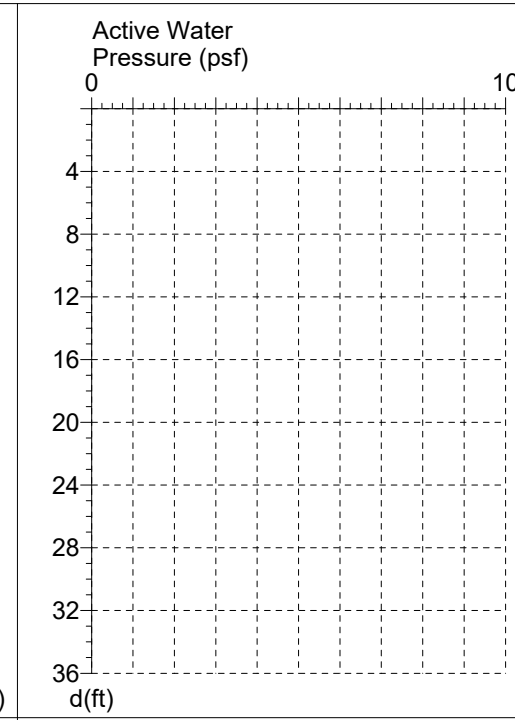
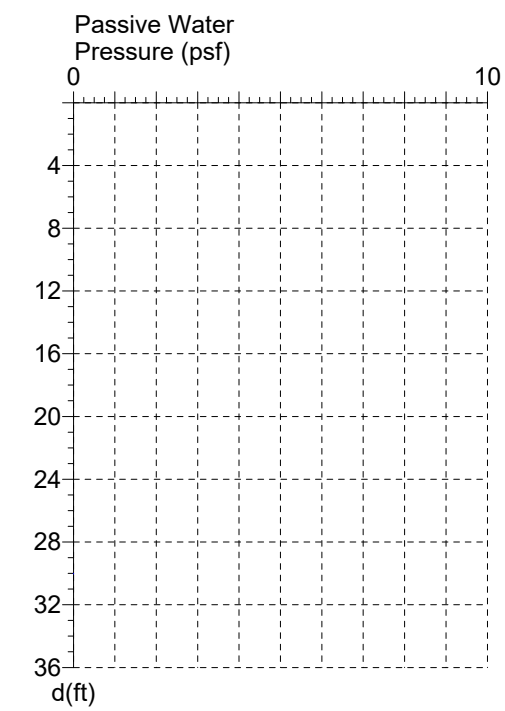
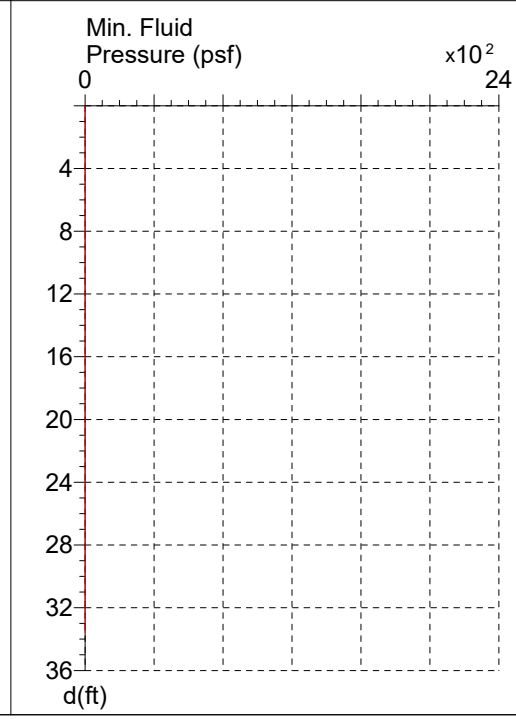
Client: Case 8 Braced - Clay - Strut Loads Terzaghi-Peck
Page: 5
Date: 3.11.19
Sheet: PZ35
Works: Temporary
Pressure: Terzaghi (m = 1.0; a = 0.4)
Analysis: Net Pressure

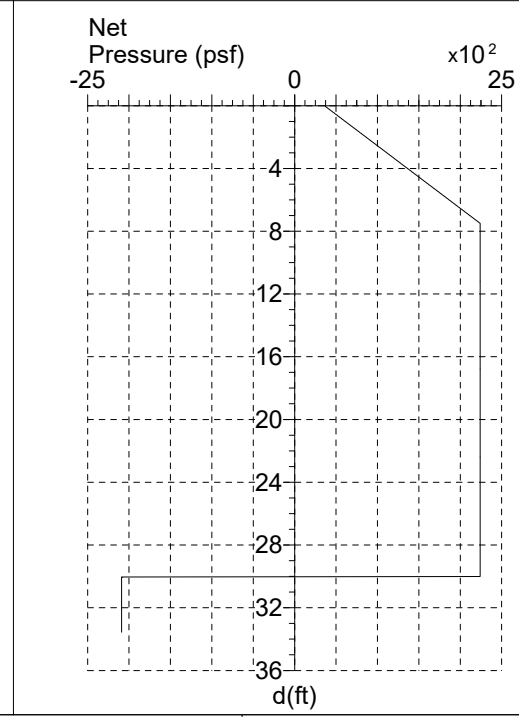












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Client: Case 8 Braced - Clay - Strut Loads Terzaghi-Peck

Page: 6

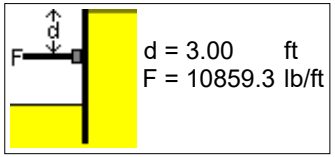
Date: 3.11.19

Sheet: PZ35

Works: Temporary

Pressure: Terzaghi (m = 1.0; a = 0.4)

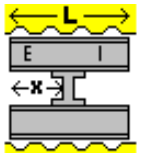
Analysis: Net Pressure



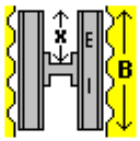
d = 3.00 ft

F = 10859.3 lb/ft

Shore/Shore



Waler/brace inadequately specified. (Define L, E and I.)



Waler/brace inadequately specified. (Define B, I and E.)

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Design Report

1. Cohesive soil exists below the active water table. Hydrostatic pressure is being ignored in cohesive soils. Select 'Apply Hydrostatic' in the 'Pressure' page for full hydrostatic pressure.

2. Terzaghi was used for the active pressure down to the excavation depth. Rankine was used for the active pressure below the excavation depth and the passive pressure.

3. Terzaghi was used for the frame load calculation. Rankine was used for the bending moment.

4. Total stress values are being used (i.e. C > 0). Note that the Piling Handbook and CIRIA SP95 recommend that effective stress values be used in 'long term' excavations.

5. Maximum bending moment = 22325.7ftlb/ft and f = 24966.8psi. MINIMUM required sheet section modulus is: Z = 10.73in³/ft (= M/f). Sheet section modulus in this design is Z = 48.90in³/ft, and is satisfactory.

6. Frame primary axis bending moments checked. Users should manually check the axial load capacities and the effects of combined axial and bending stresses to confirm frames are suitable.

7. FOS = 1.01 (Net Pressure)
   This is the factor of safety against rotation about the lowest frame.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Appendix B.9 – SupportIT Output, Case 9

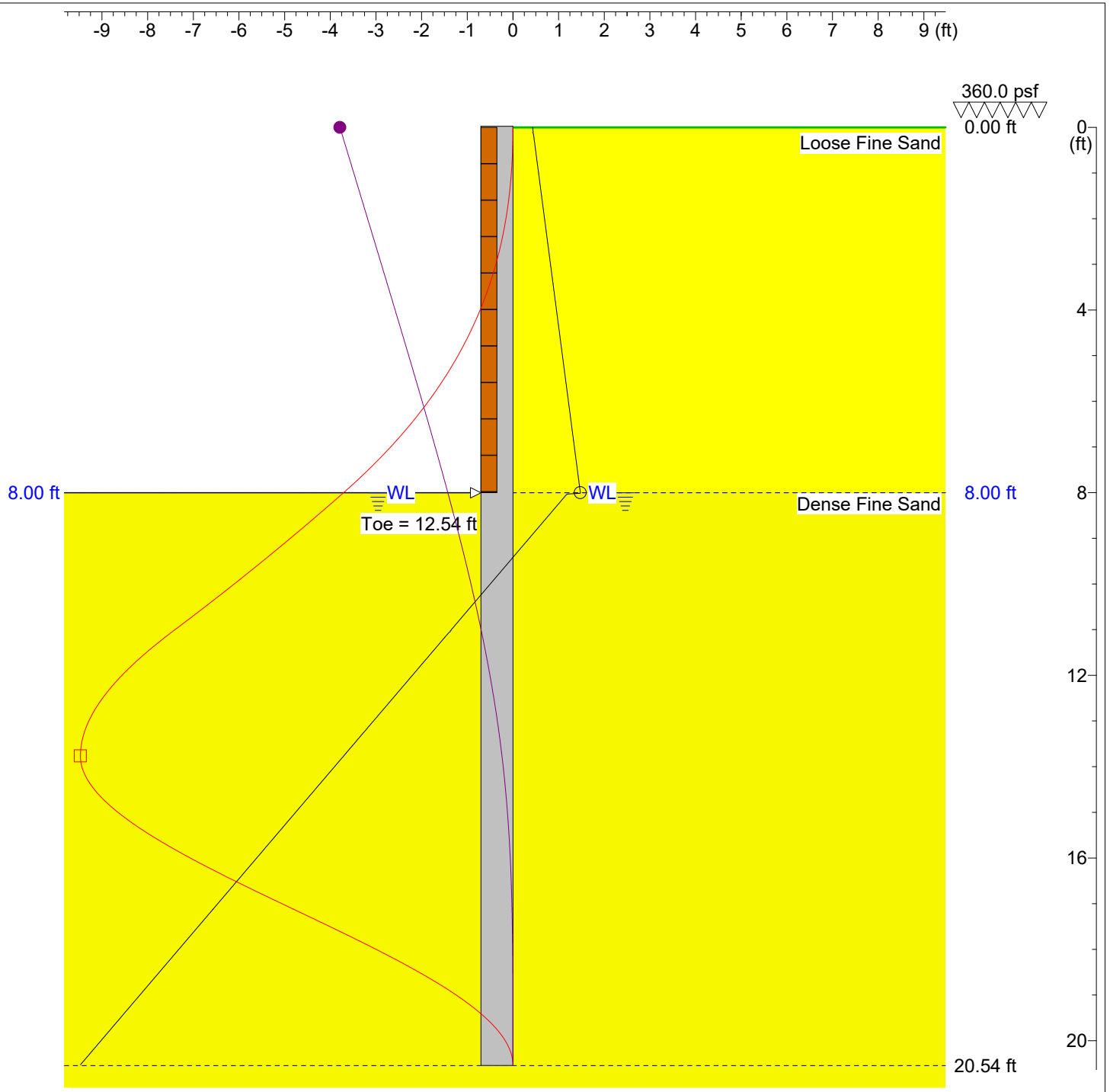
Case 9 – Cantilevered Soldier Pile TERS in Coarse-grained soil

Title: Case 9 Soldier Pile
Page: 1
Date: 3.11.19

FOS = 1.0

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
406.9 psf	8.00
105226.4 ftlb	13.76
0.7 in	0.00



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Title: Case 9 Soldier Pile
Page: 2
Date: 3.11.19
FOS = 1.0

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 8.00ft
Surcharge = 360.0psf
Depth Of Active Water = 8.00ft
Depth Of Passive Water = 8.00ft
Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Loose Fine Sand	109.20	65.55	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
8.00	Dense Fine Sand	118.37	68.73	0.0	0.0	35.0	0.0	0.27	0.00	3.69	0.00

Solution

Wall

Description	E (psi)	I (in^4)	f (psi)	Z (in^3)	Allowed M_{max} (ftlb)	b (ft)	t (ft)	w (ft)	s (ft)	Arching	n	Upstand (ft)	Toe (ft)	Length (ft)
Steel Waler	3.04E+07	904.00	32500.0	146.00	395416.7	1.167	1.167	2.000	6.00	2.80	1.50	0.00	12.54	20.54
4" x 12" Lagging	1.23E+06	64.00	1498.2	32.00	3995.4	1.001	0.331	----	----	----	----	----	----	

Pressure Model: Rankine; Passive pressure ignored for depth n.w (= 3.00ft)

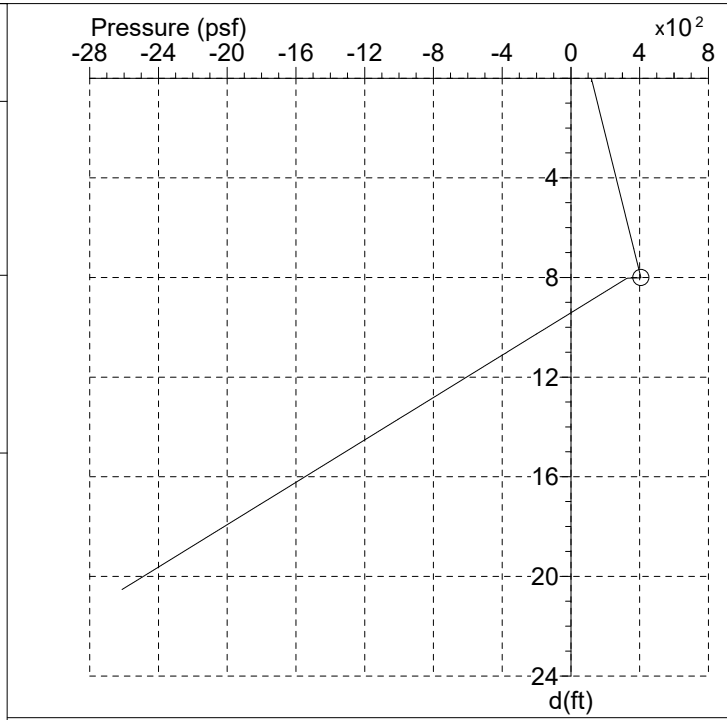
Maxima

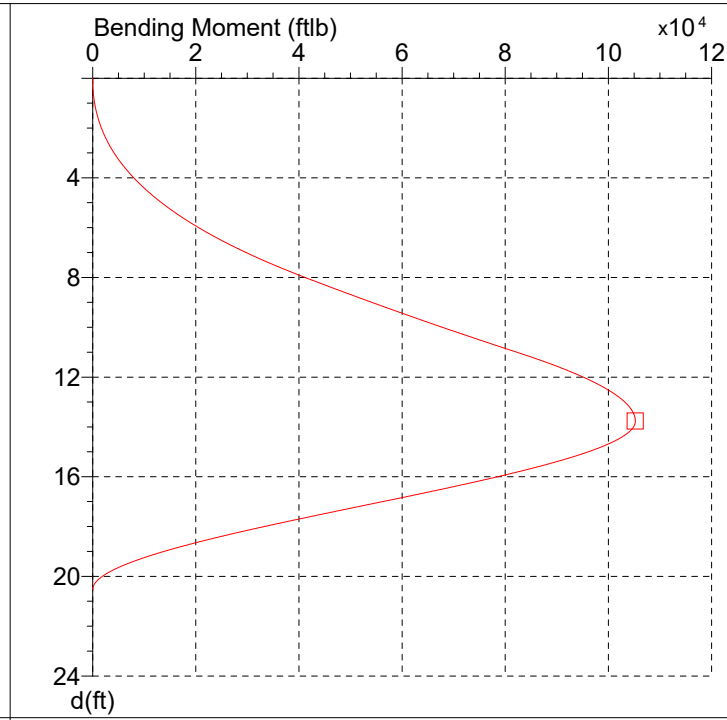
	Maximum	Depth (ft)
Pressure	406.9 psf	8.00
Bending Moment	105226.4 ftlb	13.76
Deflection	0.7 in	0.00
Shear Force	14813.8 lb	11.01

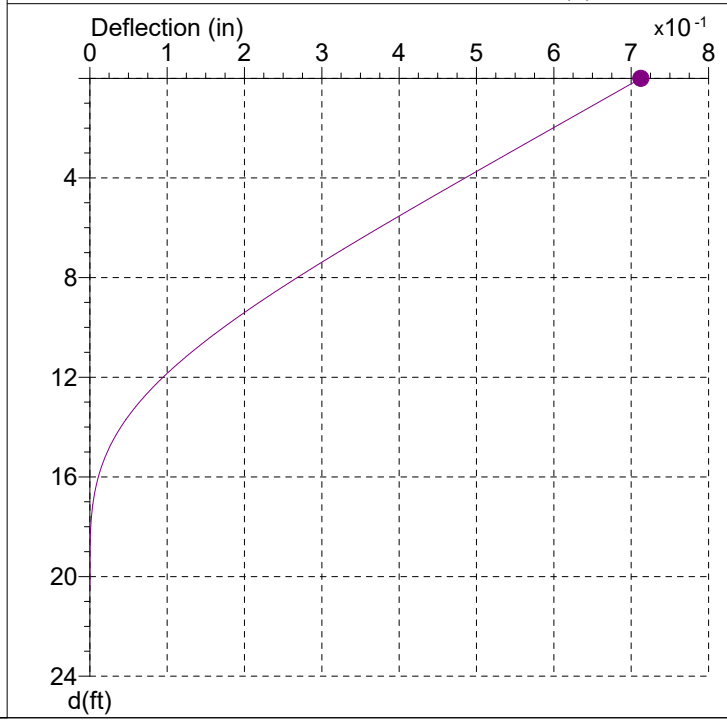
Title: Case 9 Soldier Pile
Page: 3
Date: 3.11.19
FOS = 1.0

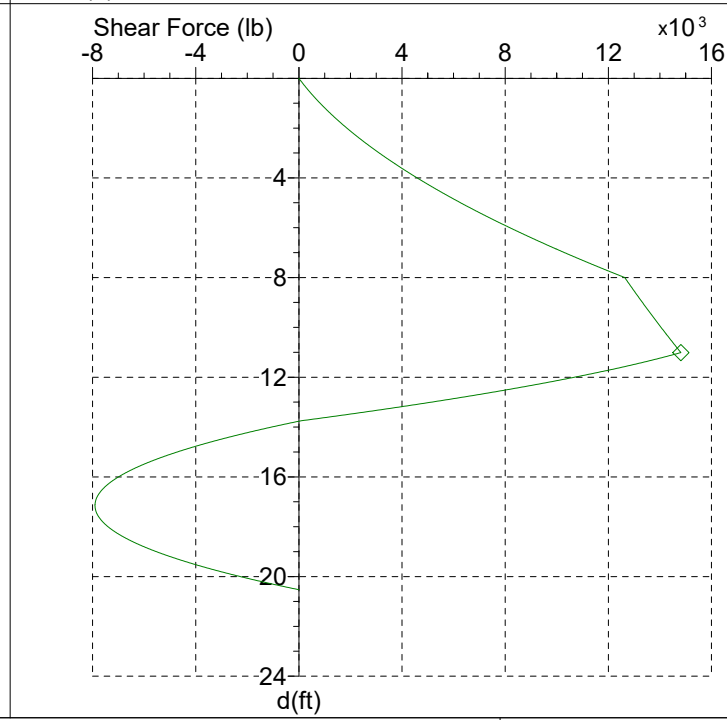
Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
406.9 psf	8.00
105226.4 ftlb	13.76
14813.8 lb	11.01
0.7 in	0.00









MDOT Sheetpile Manual

SupportIT, v2.37

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Title: Case 9 Soldier Pile
Page: 4
Date: 3.11.19

FOS = 1.0

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb)	D (in)	F (lb)
0.00	118.8	0.0	0.7	0.0
0.15	124.4	7.6	0.7	112.3
0.29	129.3	29.2	0.7	216.9
0.44	134.8	70.9	0.7	339.4
0.59	139.8	124.1	0.7	452.5
0.73	145.3	202.7	0.7	584.7
0.88	150.3	290.0	0.7	706.5
1.03	155.8	408.3	0.7	848.4
1.17	161.4	548.9	0.6	995.4
1.32	166.3	693.2	0.6	1130.4
1.47	171.9	877.8	0.6	1287.1
1.61	176.8	1062.5	0.6	1430.7
1.76	182.3	1294.0	0.6	1597.2
1.91	187.3	1521.6	0.6	1749.4
2.05	192.8	1802.9	0.6	1925.5
2.20	198.4	2111.6	0.6	2106.8
2.35	203.3	2409.7	0.6	2272.2
2.49	208.9	2772.5	0.6	2463.2
2.64	213.8	3119.9	0.6	2637.3
2.79	219.4	3539.5	0.6	2838.0
2.93	224.3	3938.7	0.5	3020.6
3.08	229.8	4418.0	0.5	3231.0
3.23	235.4	4930.0	0.5	3446.5
3.38	240.3	5413.2	0.5	3642.4
3.52	245.9	5989.2	0.5	3867.6
3.67	250.8	6530.6	0.5	4072.1
3.82	256.4	7173.4	0.5	4307.0
3.96	261.3	7775.4	0.5	4520.2
4.11	266.9	8487.9	0.5	4764.8
4.26	272.4	9238.3	0.5	5014.5
4.40	277.4	9937.9	0.5	5240.9
4.55	282.9	10762.3	0.5	5500.3
4.70	287.8	11528.9	0.4	5735.3
4.84	293.4	12430.0	0.4	6004.4
4.99	298.3	13266.1	0.4	6248.0
5.14	303.9	14246.9	0.4	6526.9
5.28	309.4	15270.9	0.4	6810.9
5.43	314.4	16218.1	0.4	7067.7
5.58	319.9	17326.0	0.4	7361.4
5.72	324.9	18349.1	0.4	7626.8
5.87	330.4	19543.7	0.4	7930.2
6.02	335.3	20645.1	0.4	8204.2
6.16	340.9	21929.3	0.4	8517.3
6.31	346.4	23262.1	0.4	8835.6
6.46	351.4	24488.1	0.3	9122.8
6.60	356.9	25914.7	0.3	9450.7
6.75	361.9	27225.5	0.3	9746.6
6.90	367.4	28748.8	0.3	10084.2
7.04	372.4	30146.7	0.3	10388.7
7.19	377.9	31769.5	0.3	10736.1
7.34	383.5	33446.1	0.3	11088.6
7.48	388.4	34982.2	0.3	11406.2
7.63	394.0	36762.7	0.3	11768.4
7.78	398.9	38392.3	0.3	12094.7
7.92	404.4	40279.4	0.3	12466.6
8.07	318.2	42002.1	0.3	12681.8
8.22	282.0	43961.3	0.3	12785.4
8.36	245.7	45936.4	0.2	12889.9
8.51	213.6	47705.6	0.2	12983.4
8.66	177.3	49711.4	0.2	13089.6
8.80	145.1	51508.0	0.2	13184.6
8.95	108.9	53544.8	0.2	13292.4
9.10	76.7	55369.3	0.2	13389.0
9.24	40.5	57437.7	0.2	13498.4
9.39	4.3	59523.0	0.2	13608.8
9.54	-27.9	61390.9	0.2	13707.6
9.68	-64.1	63508.5	0.2	13819.6
9.83	-96.3	65405.3	0.2	13919.9
9.98	-132.5	67555.7	0.2	14033.5
10.13	-164.7	69481.9	0.2	14135.3
10.27	-200.9	71665.6	0.2	14250.6
10.42	-237.1	73867.1	0.2	14366.9
10.57	-269.3	75839.0	0.1	14470.9
10.71	-305.6	78074.5	0.1	14588.8
10.86	-337.8	80076.9	0.1	14694.3
11.01	-372.1	82346.9	0.1	14813.8
11.15	-406.2	84344.7	0.1	14323.9
11.30	-442.4	86510.1	0.1	13741.8
11.45	-478.6	88583.7	0.1	13126.8
11.59	-510.8	90345.7	0.1	12552.6
11.74	-547.0	92231.9	0.1	11875.5
11.89	-579.2	93819.4	0.1	11246.2
12.03	-615.4	95500.3	0.1	10507.1
12.18	-647.6	96897.3	0.1	9822.7
12.33	-683.8	98354.8	0.1	9021.6
12.47	-720.0	99686.9	0.1	8187.7
12.62	-752.2	100761.4	0.1	7418.9
12.77	-788.5	101842.5	0.1	6523.0
12.91	-820.6	102685.9	0.1	5699.1
13.06	-856.9	103498.1	0.1	4741.1
13.21	-889.1	104094.4	0.1	3862.1
13.35	-925.3	104619.5	0.1	2842.1
13.50	-961.5	104985.4	0.1	1789.3
13.65	-993.7	105172.8	0.0	825.9
13.79	-1029.9	105222.3	0.0	-159.3
13.94	-1062.1	105047.2	0.0	-780.3
14.09	-1098.3	104556.0	0.0	-1448.0
14.23	-1130.5	103869.5	0.0	-2013.9
14.38	-1166.7	102829.8	0.0	-2619.5
14.53	-1202.9	101521.1	0.0	-3192.3
14.67	-1235.1	100144.3	0.0	-3673.9
14.82	-1271.3	98368.6	0.0	-4184.6
14.97	-1303.5	96600.2	0.0	-4611.1
15.11	-1339.8	94410.7	0.0	-5059.8
15.26	-1371.9	92298.2	0.0	-5431.1
15.41	-1408.2	89748.3	0.0	-5817.9
15.55	-1444.4	87029.0	0.0	-6171.8
15.70	-1476.6	84481.8	0.0	-6458.8
15.85	-1512.8	81483.5	0.0	-6750.6
15.99	-1545.0	78712.1	0.0	-6982.5
16.14	-1581.2	75488.1	0.0	-7212.3
16.29	-1613.4	72539.7	0.0	-7389.1
16.43	-1649.6	69143.3	0.0	-7556.9
16.58	-1685.8	65677.2	0.0	-7691.9
16.73	-1718.0	62549.8	0.0	-7784.3
16.88	-1754.2	58992.7	0.0	-7857.3
17.02	-1786.4	55808.2	0.0	-7894.6
17.17	-1822.6	52213.6	0.0	-7905.5
17.32	-1854.8	49019.3	0.0	-7887.7
17.46	-1891.1	45440.3	0.0	-7836.6
17.61	-1927.3	41891.3	0.0	-7752.7
17.76	-1959.5	38773.7	0.0	-7650.5
17.90	-1995.7	35321.8	0.0	-7504.6
18.05	-2027.9	32314.3	0.0	-7347.3
18.20	-2064.1	29012.8	0.0	-7139.4
18.34	-2096.3	26162.8	0.0	-6927.0
18.49	-2132.5	23065.1	0.0	-6657.0
18.64	-2168.7	20096.9	0.0	-6354.2
18.78	-2200.9	17579.2	0.0	-6057.4
18.93	-2237.1	14896.3	0.0	-5692.6
19.08	-2269.3	12655.9	0.0	-5340.7
19.22	-2305.5	10311.5	0.0	-4913.9
19.37	-2337.7	8395.7	0.0	-4506.9
19.52	-2374.0	6443.1	0.0	-4018.0
19.66	-2410.2	4719.6	0.0	-3496.3
19.81	-2442.4	3391.9	0.0	-3005.0
19.96	-2478.6	2141.8	0.0	-2421.3
20.10	-2510.8	1258.5	0.0	-1874.8
20.25	-2547.0	535.0	0.0	-1229.1
20.40	-2579.2	143.6	0.0	-627.5
20.54	-2611.4	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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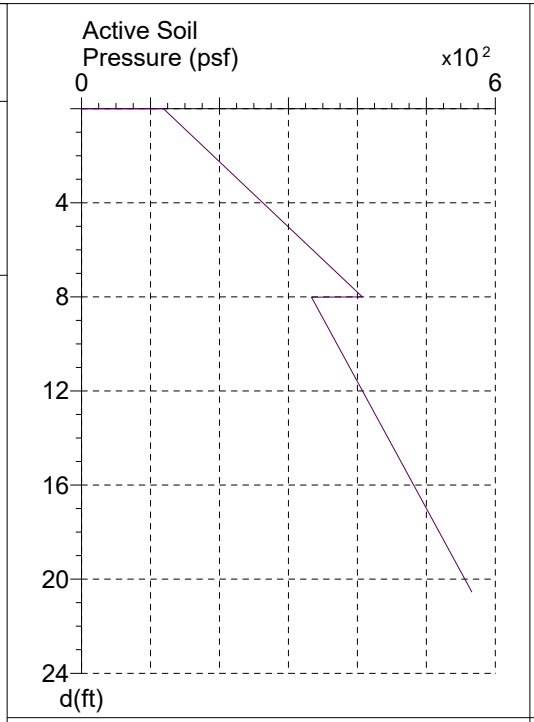
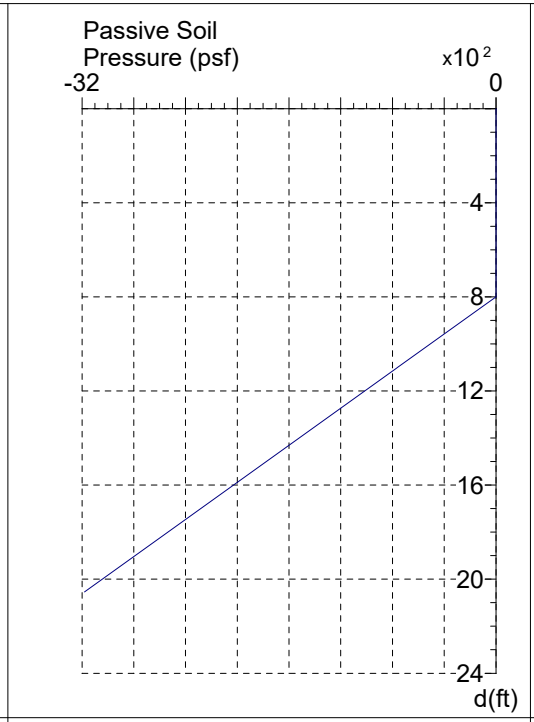
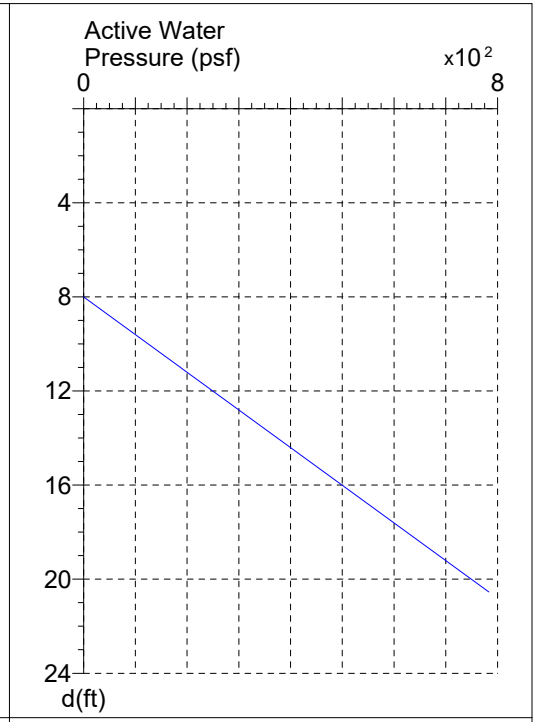
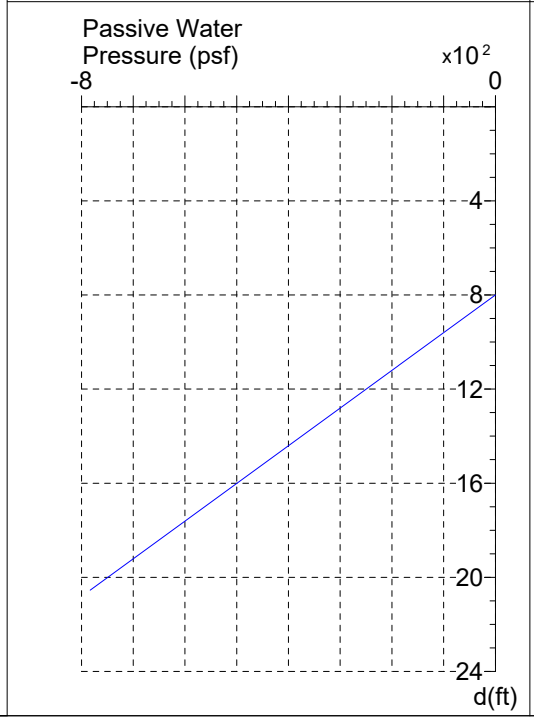
Title: Case 9 Soldier Pile
Page: 5
Date: 3.11.19
FOS = 1.0

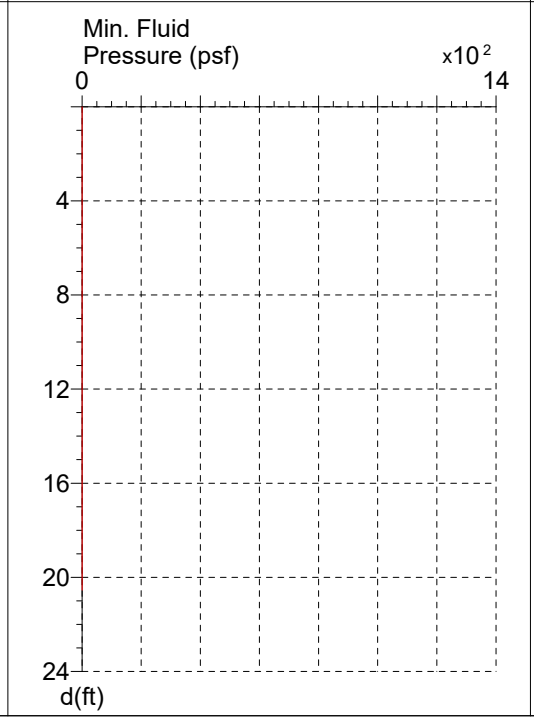
Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

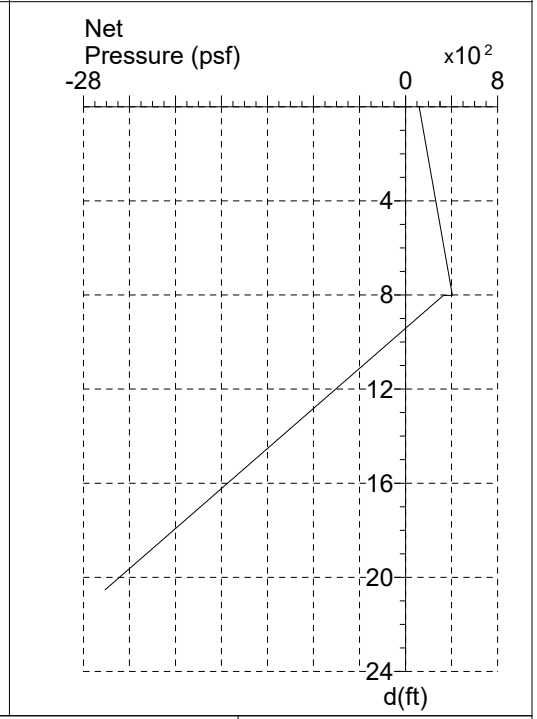












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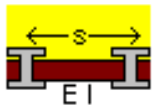
Title: Case 9 Soldier Pile
Page: 6
Date: 3.11.19
FOS = 1.0

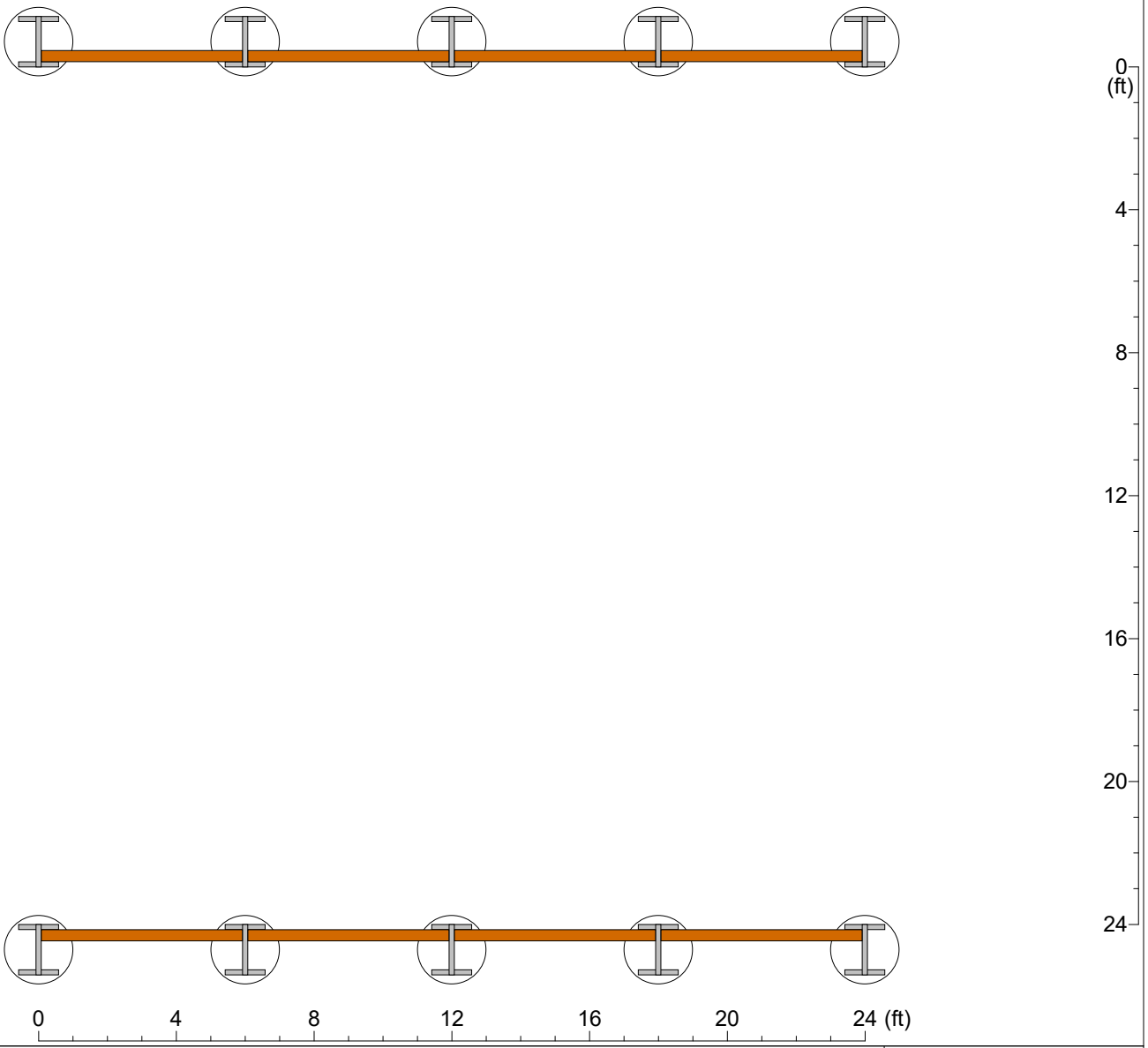
Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever



4" x 12" Lagging:
s = 6.00 ft f = 1498.2 psi
E = 1.23E+06 psi Z = 32.00 in³
I = 64.00 in⁴ M_x = 3995.4 ftlb

	Maximum	x (ft)
Pressure (psf)	406.9	8.00
Bending Moment (ftlb)	1831.0	2.99
Shear Force (lb)	1220.7	5.99
Deflection (in)	0.0	3.00

Min. section modulus required, Z = 14.7in³



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Title: Case 9 Soldier Pile
Page: 7
Date: 3.11.19

FOS = 1.0

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Maximum bending moment = 105226.4ftlb and f = 32500.0psi. MINIMUM required soldier section modulus is: Z = 38.85in³ (= M/f).
   Soldier pile section modulus in this design is Z = 146.00in³, and is satisfactory.

2. Arching factor, A = 2.80. Are you sure this is correct? Minimum phi on passive side is 30°, and A = 0.08phi (= 2.40).

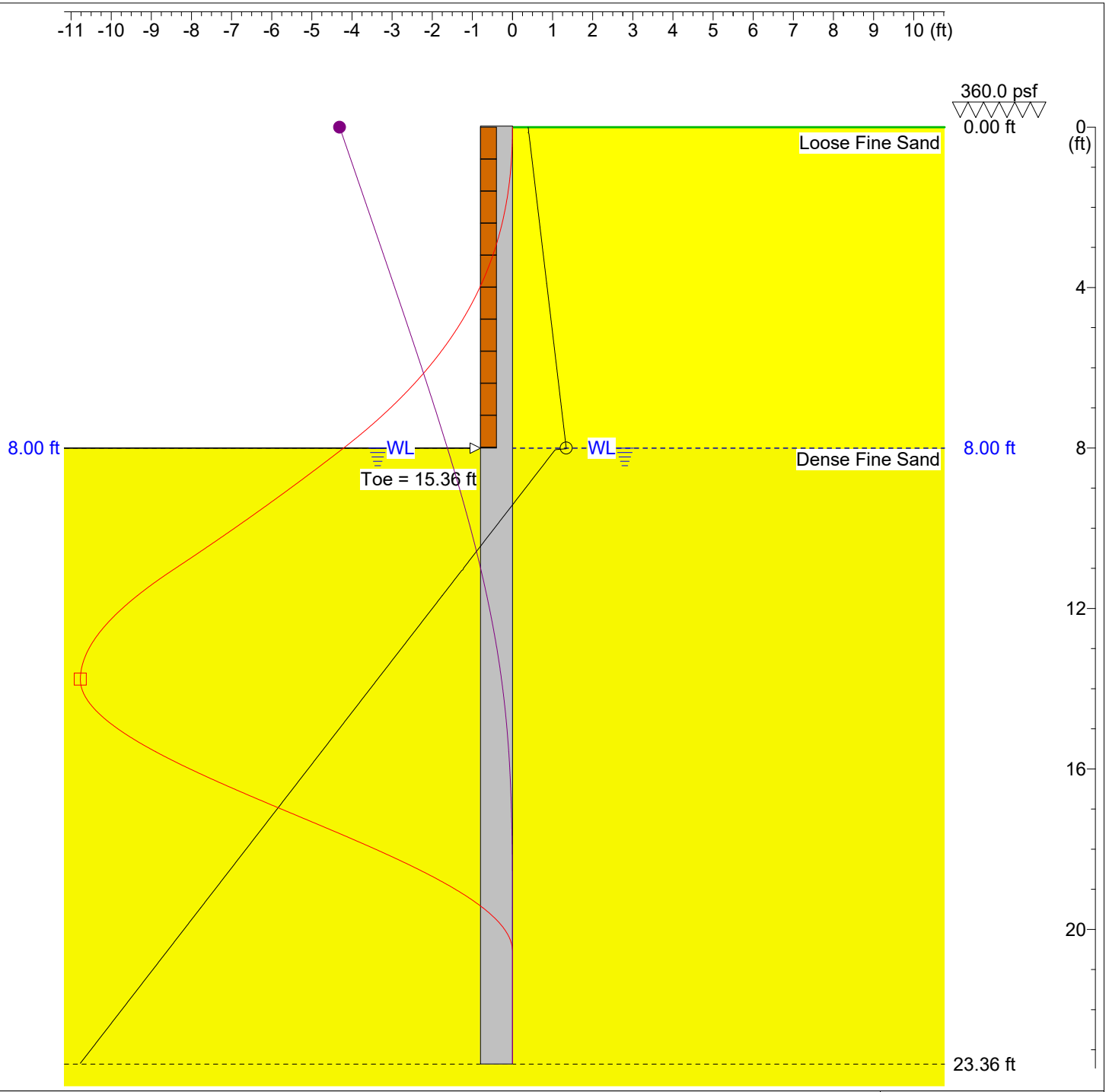
3. FOS = 1.00 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Title: Case 9 Soldier Pile
Page: 1
Date: 3.11.19

FOS = 1.5

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
○ 407.1 psf	8.00
□ 105397.5 ftlb	13.76
● 0.7 in	0.00



MDOT Sheetpile Manual

SupportIT, v2.37

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Title: Case 9 Soldier Pile
Page: 2
Date: 3.11.19
FOS = 1.5

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Input Data

Depth Of Excavation = 8.00ft
Surcharge = 360.0psf
Depth Of Active Water = 8.00ft
Depth Of Passive Water = 8.00ft
Water Density = 62.43pcf
Minimum Fluid Density = 31.82pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Loose Fine Sand	109.20	65.55	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
8.00	Dense Fine Sand	118.37	68.73	0.0	0.0	35.0	0.0	0.27	0.00	3.69	0.00

Solution

Wall

Description	E (psi)	I (in^4)	f (psi)	Z (in^3)	Allowed M_{max} (ftlb)	b (ft)	t (ft)	w (ft)	s (ft)	Arching	n	Upstand (ft)	Toe (ft)	Length (ft)
Steel Waler	3.04E+07	904.00	32500.0	146.00	395416.7	1.167	1.167	2.000	6.00	2.80	1.50	0.00	15.36	23.36
4" x 12" Lagging	1.23E+06	64.00	1498.2	32.00	3995.4	1.001	0.331	----	----	----	----	----	----	

Pressure Model: Rankine; Passive pressure ignored for depth n.w (= 3.00ft)

Maxima

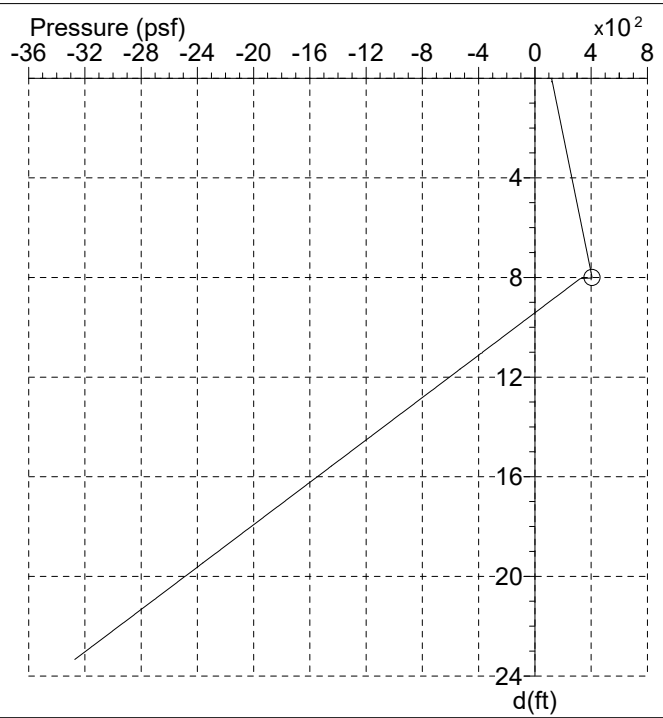
	Maximum	Depth (ft)
Pressure	407.1 psf	8.00
Bending Moment	105397.5 ftlb	13.76
Deflection	0.7 in	0.00
Shear Force	14832.5 lb	11.02

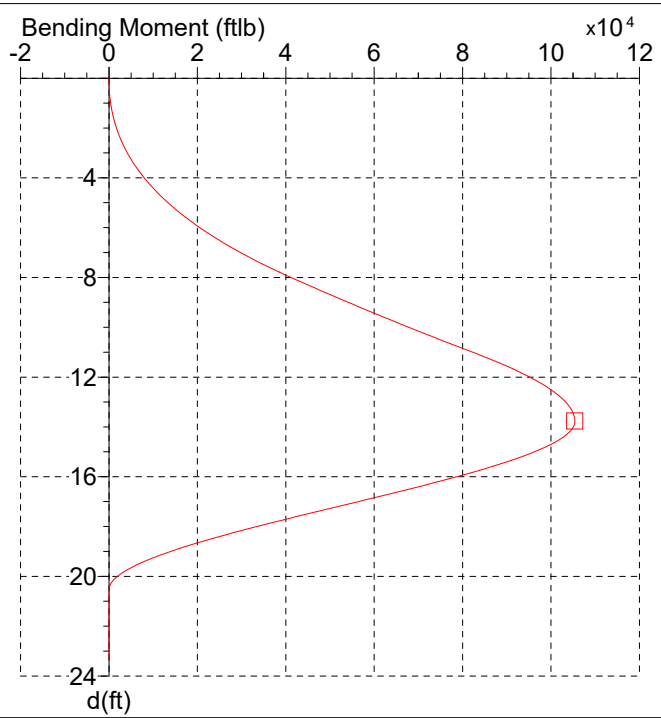
Title: Case 9 Soldier Pile
Page: 3
Date: 3.11.19

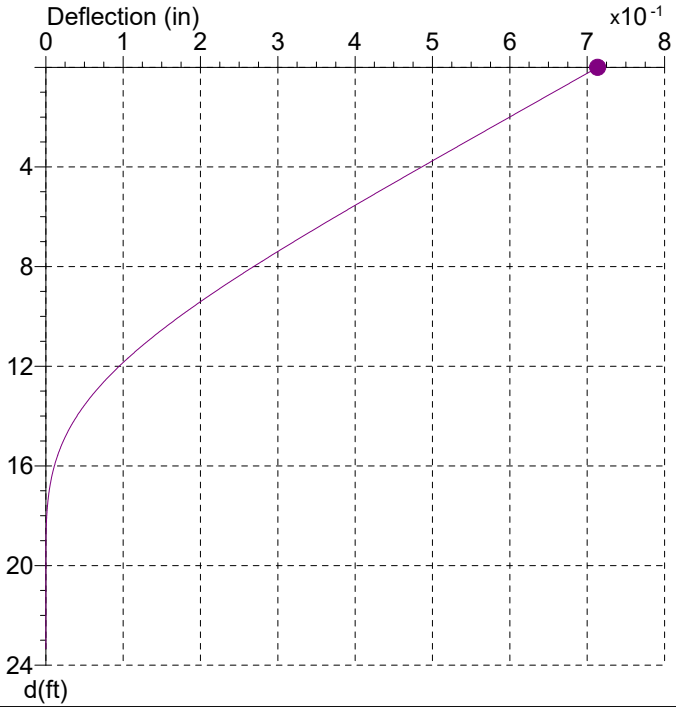
FOS = 1.5

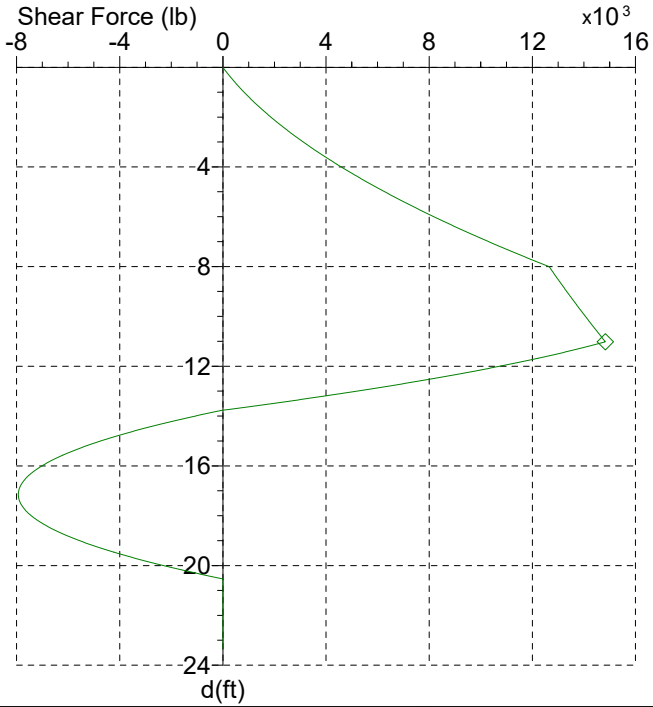
Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Maximum	d (ft)
407.1 psf	8.00
105397.5 ftlb	13.76
14832.5 lb	11.02
0.7 in	0.00









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SupportIT, v2.37

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Title: Case 9 Soldier Pile
Page: 4
Date: 3.11.19

FOS = 1.5

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

depth (ft)	P (psf)	M (ftlb)	D (in)	F (lb)
0.00	118.8	0.0	0.7	0.0
0.17	125.1	9.9	0.7	128.1
0.33	130.7	37.9	0.7	248.0
0.50	137.0	92.2	0.7	389.3
0.67	142.6	161.6	0.7	520.3
0.83	149.0	264.5	0.7	674.1
1.00	154.6	379.0	0.7	816.3
1.17	160.9	534.6	0.6	982.6
1.33	167.2	719.9	0.6	1155.6
1.50	172.8	910.4	0.6	1314.9
1.67	179.1	1154.8	0.6	1500.4
1.84	184.7	1399.7	0.6	1670.8
2.00	191.0	1707.4	0.6	1868.8
2.17	196.7	2010.3	0.6	2050.4
2.34	203.0	2385.4	0.6	2261.0
2.50	209.3	2797.8	0.6	2478.2
2.67	214.9	3196.7	0.6	2676.9
2.84	221.2	3682.9	0.6	2906.6
3.00	226.8	4149.1	0.5	3116.4
3.17	233.1	4713.2	0.5	3358.7
3.34	238.7	5250.6	0.5	3579.6
3.50	245.1	5896.6	0.5	3834.5
3.67	251.4	6587.8	0.5	4096.0
3.84	257.0	7241.0	0.5	4334.0
4.00	263.3	8020.5	0.5	4608.0
4.17	268.9	8754.1	0.5	4857.1
4.34	275.2	9626.2	0.5	5143.7
4.50	280.8	10443.9	0.5	5404.0
4.67	287.1	11412.6	0.4	5703.1
4.84	293.4	12434.2	0.4	6008.9
5.00	299.1	13387.6	0.4	6286.2
5.17	305.4	14512.2	0.4	6604.5
5.34	311.0	15559.0	0.4	6893.1
5.51	317.3	16790.7	0.4	7223.9
5.67	322.9	17934.6	0.4	7523.5
5.84	329.2	19277.7	0.4	7866.9
6.01	335.5	20681.3	0.4	8217.0
6.17	341.1	21980.8	0.4	8533.7
6.34	347.5	23502.1	0.4	8896.2
6.51	353.1	24908.0	0.3	9224.1
6.67	359.4	26551.1	0.3	9599.2
6.84	365.0	28067.1	0.3	9938.2
7.01	371.3	29836.1	0.3	10325.9
7.17	377.6	31673.4	0.3	10720.2
7.34	383.2	33364.9	0.3	11076.2
7.51	389.5	35334.5	0.3	11483.1
7.67	395.1	37145.5	0.3	11850.3
7.84	401.5	39251.5	0.3	12269.7
8.01	407.1	41185.5	0.3	12648.0
8.17	292.0	43408.2	0.3	12768.3
8.34	250.8	45651.5	0.3	12886.9
8.51	214.2	47663.1	0.2	12993.2
8.68	173.1	49946.0	0.2	13114.0
8.84	136.5	51993.0	0.2	13222.2
9.01	95.3	54316.1	0.2	13345.1
9.18	58.7	56399.2	0.2	13455.3
9.34	17.5	58763.2	0.2	13580.3
9.51	-23.7	61149.3	0.2	13706.5
9.68	-60.3	63288.8	0.2	13819.6
9.84	-101.4	65716.8	0.2	13947.9
10.01	-138.0	67894.0	0.2	14062.9
10.18	-179.2	70364.8	0.2	14193.4
10.34	-215.8	72580.3	0.2	14310.3
10.51	-257.0	75094.5	0.2	14442.9
10.68	-298.2	77632.1	0.1	14576.7
10.84	-334.8	79907.4	0.1	14696.6
11.01	-372.1	82489.5	0.1	14832.5
11.18	-412.5	84758.8	0.1	14272.5
11.34	-453.7	87204.6	0.1	13601.8
11.51	-490.3	89277.5	0.1	12970.0
11.68	-531.5	91489.2	0.1	12219.1
11.84	-572.7	93566.2	0.1	11425.8
12.01	-609.3	95293.3	0.1	10685.0
12.18	-650.4	97095.6	0.1	9811.6
12.35	-687.0	98566.8	0.1	8999.5
12.51	-728.2	100067.9	0.1	8045.9
12.68	-764.8	101259.7	0.1	7162.6
12.85	-806.0	102433.2	0.1	6128.8
13.01	-847.2	103422.5	0.1	5052.6
13.18	-883.8	104141.2	0.1	4060.3
13.35	-924.9	104762.3	0.1	2903.9
13.51	-961.5	105142.1	0.1	1840.3
13.68	-1002.7	105368.5	0.0	603.8
13.85	-1039.3	105366.4	0.0	-360.5
14.01	-1080.5	105000.0	0.0	-1140.9
14.18	-1121.7	104241.0	0.0	-1878.9
14.35	-1158.3	103254.4	0.0	-2499.3
14.51	-1199.4	101813.5	0.0	-3157.1
14.68	-1236.0	100255.5	0.0	-3706.2
14.85	-1277.2	98210.8	0.0	-4283.9
15.01	-1313.8	96150.8	0.0	-4761.8
15.18	-1355.0	93580.4	0.0	-5259.3
15.35	-1396.2	90763.2	0.0	-5714.3
15.52	-1432.8	88069.6	0.0	-6083.2
15.68	-1473.9	84846.1	0.0	-6458.1
15.85	-1510.5	81826.0	0.0	-6755.7
16.02	-1551.7	78274.2	0.0	-7050.4
16.18	-1588.3	74996.9	0.0	-7276.7
16.35	-1629.5	71194.9	0.0	-7491.3
16.52	-1670.7	67291.9	0.0	-7663.4
16.68	-1707.3	63755.6	0.0	-7780.8
16.85	-1748.4	59721.8	0.0	-7872.8
17.02	-1785.0	56103.9	0.0	-7918.9
17.18	-1826.2	52017.3	0.0	-7930.6
17.35	-1862.8	48387.1	0.0	-7905.5
17.52	-1904.0	44325.8	0.0	-7837.1
17.68	-1945.2	40309.4	0.0	-7726.3
17.85	-1981.8	36794.7	0.0	-7592.2
18.02	-2022.9	32923.0	0.0	-7401.2
18.18	-2059.5	29571.5	0.0	-7195.8
18.35	-2100.7	25922.5	0.0	-6924.7
18.52	-2137.3	22803.7	0.0	-6648.0
18.68	-2178.5	19455.4	0.0	-6296.7
18.85	-2219.7	16297.9	0.0	-5902.9
19.02	-2256.3	13669.1	0.0	-5517.3
19.19	-2297.4	10931.8	0.0	-5043.4
19.35	-2334.0	8711.2	0.0	-4586.5
19.52	-2375.2	6472.0	0.0	-4032.4
19.69	-2411.8	4728.9	0.0	-3504.2
19.85	-2453.0	3066.1	0.0	-2870.0
20.02	-2494.2	1739.8	0.0	-2193.3
20.19	-2530.8	861.3	0.0	-1556.2
20.35	-2571.9	230.7	0.0	-799.3
20.52	-2608.5	5.2	0.0	-90.9
20.69	-2649.7	0.0	0.0	0.0
20.85	-2686.3	0.0	0.0	0.0
21.02	-2727.5	0.0	0.0	0.0
21.19	-2768.7	0.0	0.0	0.0
21.35	-2805.3	0.0	0.0	0.0
21.52	-2846.4	0.0	0.0	0.0
21.69	-2883.0	0.0	0.0	0.0
21.85	-2924.2	0.0	0.0	0.0
22.02	-2960.8	0.0	0.0	0.0
22.19	-3002.0	0.0	0.0	0.0
22.36	-3043.2	0.0	0.0	0.0
22.52	-3079.8	0.0	0.0	0.0
22.69	-3120.9	0.0	0.0	0.0
22.86	-3157.5	0.0	0.0	0.0
23.02	-3198.7	0.0	0.0	0.0
23.19	-3235.3	0.0	0.0	0.0
23.36	-3271.9	0.0	0.0	0.0

MDOT Sheetpile Manual

SupportIT, v2.37

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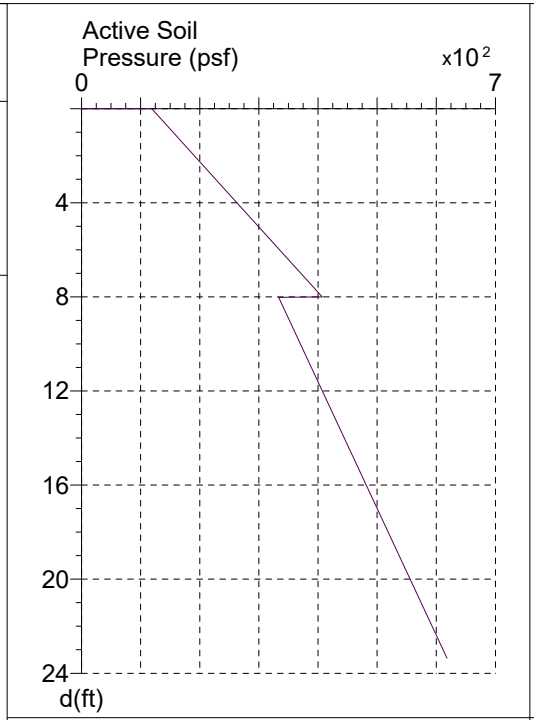
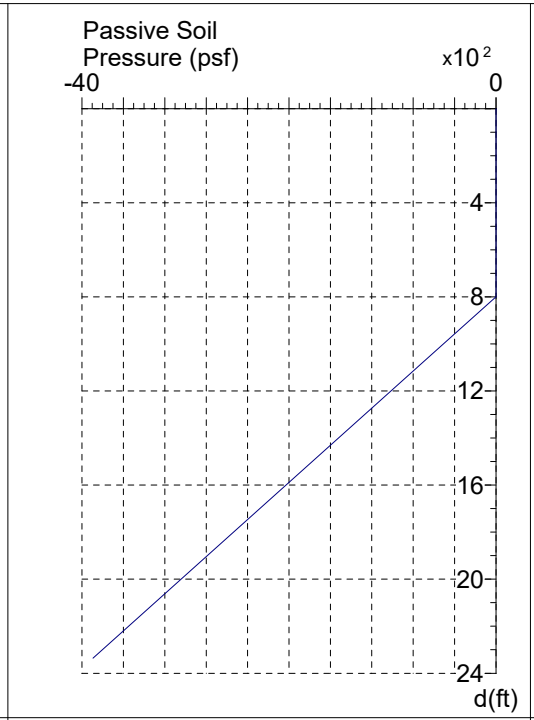
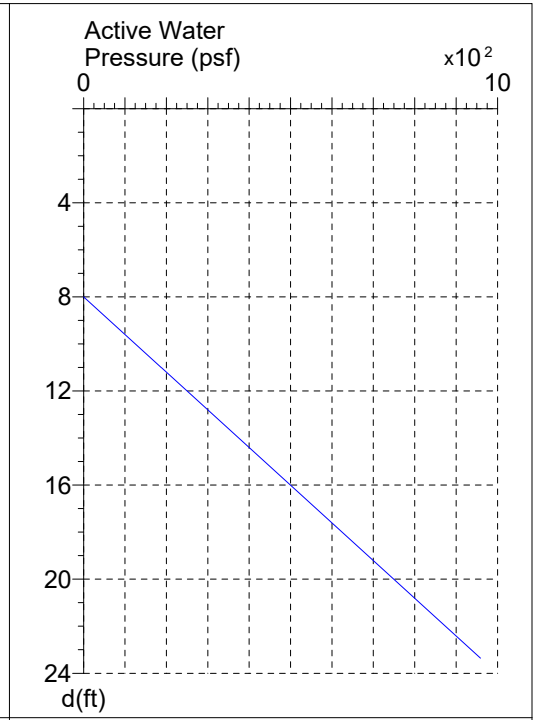
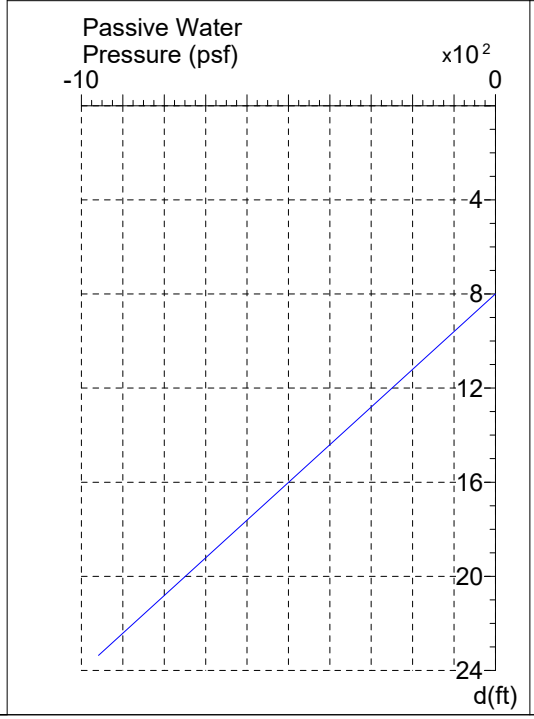
Title: Case 9 Soldier Pile
Page: 5
Date: 3.11.19
FOS = 1.5

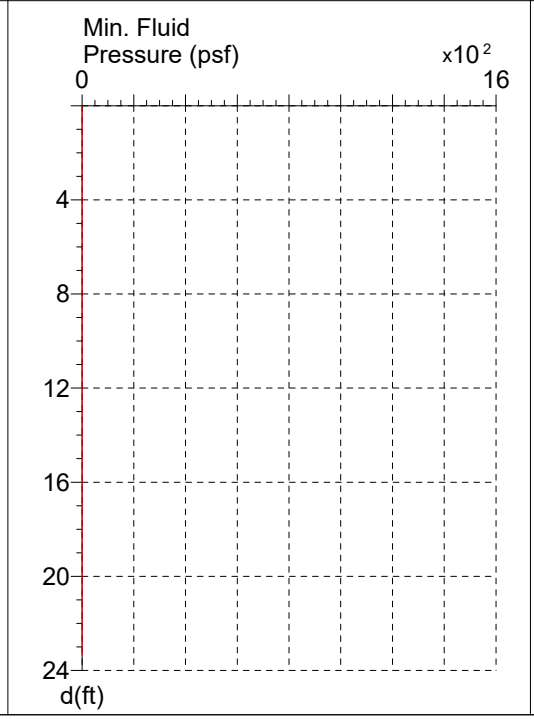
Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

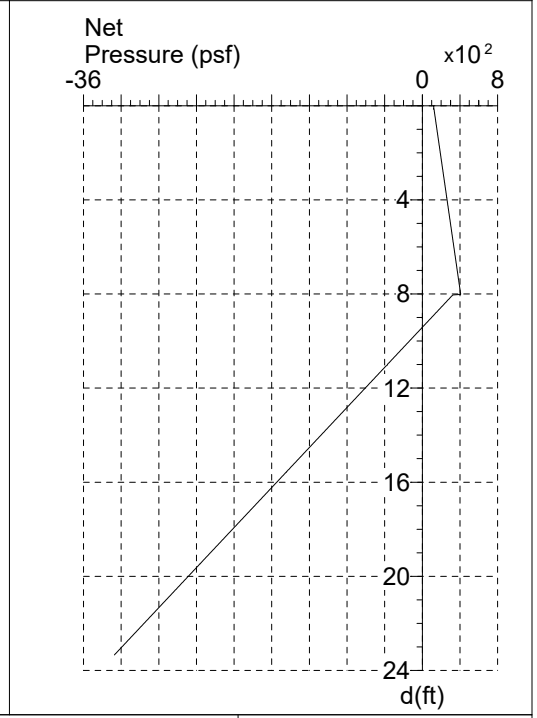












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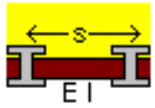
Title: Case 9 Soldier Pile
Page: 6
Date: 3.11.19

FOS = 1.5

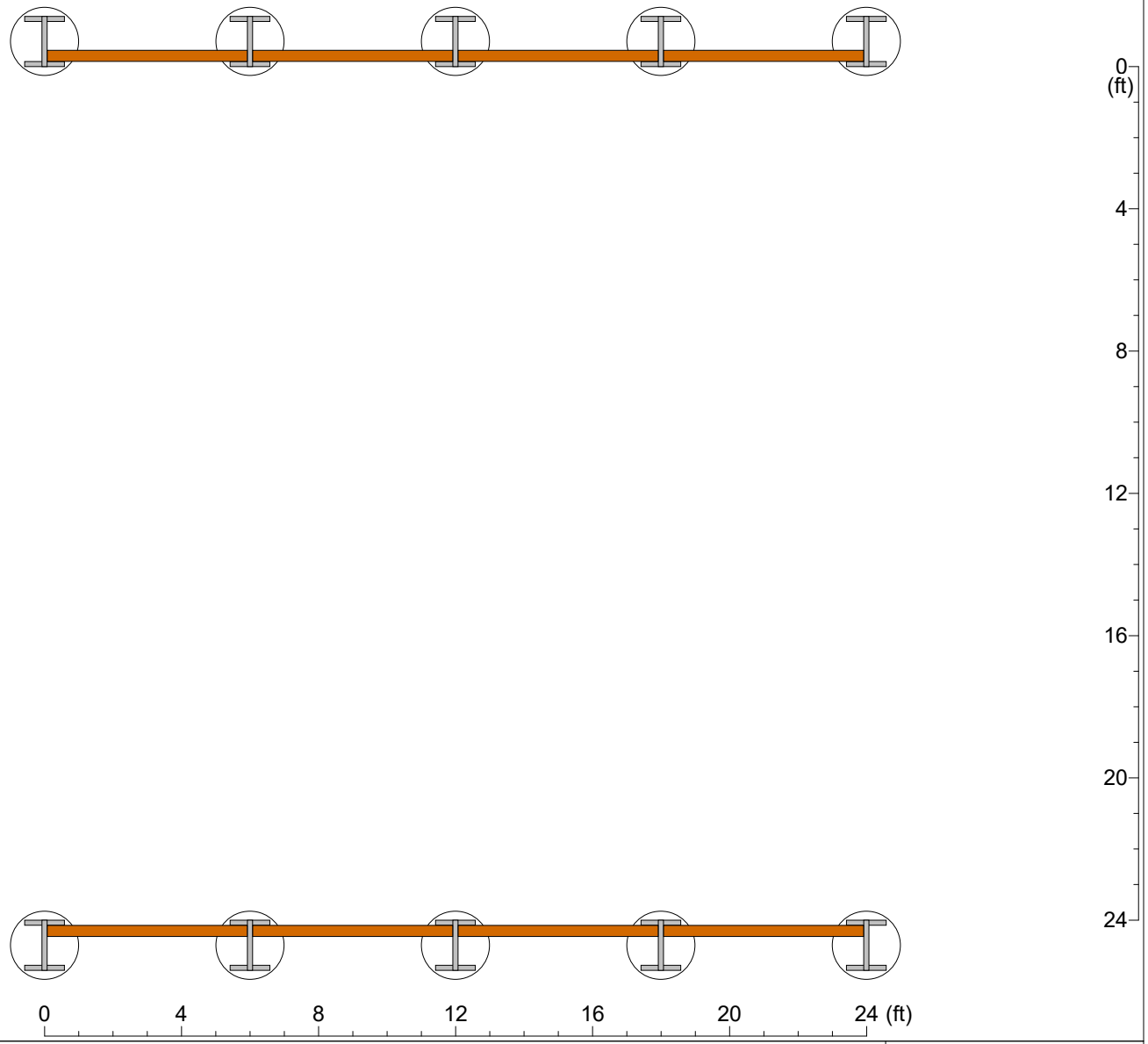
Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever



4" x 12" Lagging:
s = 6.00 ft
E = 1.23E+06 psi
I = 64.00 in⁴
f = 1498.2 psi
Z = 32.00 in³
M_x = 3995.4 ftlb

	Maximum	x (ft)
Pressure (psf)	407.1	8.00
Bending Moment (ftlb)	1831.8	2.99
Shear Force (lb)	1221.2	0.00
Deflection (in)	0.0	3.00

Min. section modulus required, Z = 14.7in³



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Title: Case 9 Soldier Pile
Page: 7
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FOS = 1.5

Pile: Steel Waler
Lagging: 4" x 12" Lagging
Works: Temporary
Pressure: Rankine
Analysis: Gross Pressure
Toe: Cantilever

Design Report

1. Maximum bending moment = 105397.5ftlb and f = 32500.0psi. MINIMUM required soldier section modulus is: Z = 38.92in³ (= M/f).
   Soldier pile section modulus in this design is Z = 146.00in³, and is satisfactory.

2. Arching factor, A = 2.80. Are you sure this is correct? Minimum phi on passive side is 30°, and A = 0.08phi (= 2.40).

3. FOS = 1.49 (Gross Pressure)
   This is the factor of safety against rotation about the toe.
   The FOS can be changed using 'Defined FOS' or 'Manual' in the 'Wall' page.

Report No. RC-1633

A Manual for the
Design of Temporary Earth Retention Systems (TERS)
for the Michigan Dept. of Transportation

Center for Structural Durability at Michigan Tech – a MDOT Center of Excellence

FINAL REPORT

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