CUY-77-11.41
(PID 105743)
Cuyahoga County, Ohio

RECONSTRUCTION OF INTERSTATE 77
GRANT AVENUE TO BROADWAY AVENUE

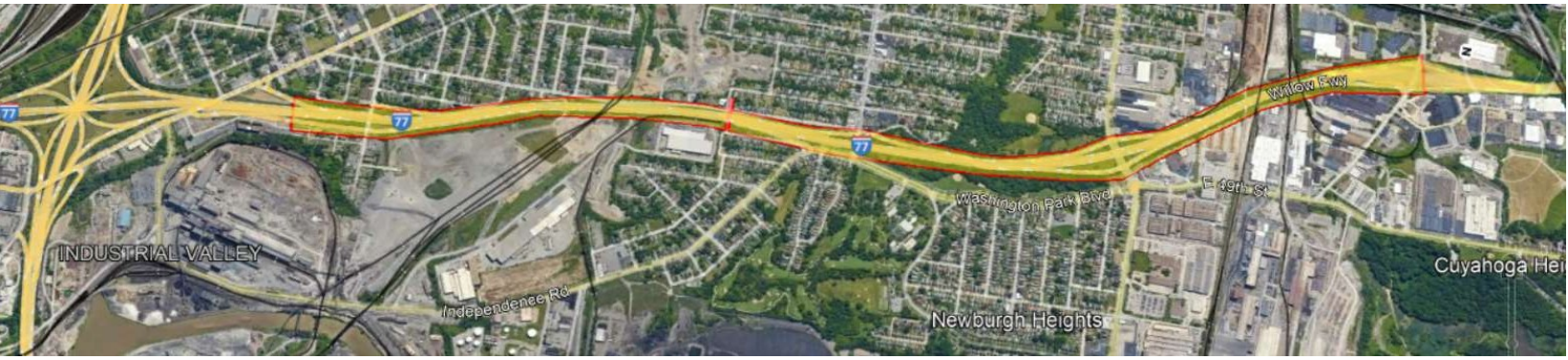
(APPROX. STA. 76+31.74 AND STA. 220+83.50)
City of Cleveland, City of Cuyahoga Heights,
City of Newburgh Heights

Cuyahoga County, Ohio

STRUCTURE FOUNDATION EXPLORATION REPORT

Prepared for:

Ohio Department of Transportation, District 12
5500 Transportation Boulevard, Garfield Heights, OH 44125



Stage 3 Submittal – May 1, 2026 (Revised June 29, 2026)

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ACRONYM LIST

AASHTO	American Association of State Highway and Transportation Officials
AER	Alternatives Evaluation Report
ASTM	ASTM International
bgs	below existing ground surface
bpf	Blows per Foot
BDM	Bridge Design Manual
BDS	Bridge Design Specifications
BMP	Best Management Practices
CIP	Cast In Place
FE	Finite Element
ft	feet
GDM	Geotechnical Design Manual
GER	Geotechnical Exploration Report
lbs	pounds
LRFD	Load and Resistance Factor Design
MSE	Mechanically Stabilized Earth
ODOT	Ohio Department of Transportation
pcf	pounds per cubic foot
pci	pounds per cubic inch
PGD	Prefabricated Geocomposite Drain
psf	pounds per square foot
SGE	Specifications for Geotechnical Explorations
SPT	Standard Penetration Test
Sta.	Station

1. EXECUTIVE SUMMARY

This Geotechnical Exploration Report (Report) contains the subsurface exploration, engineering analyses, and geotechnical design recommendations for thirteen (13) retaining walls, drainage facilities (storm sewers and BMP detention basins), slope stability of the new embankment slopes as a result of the lane widening, as well as the Morgana Run Trail Culvert underpass that are planned as part of the Interstate I-77 improvements between Grant Avenue and Broadway Avenue (STA. 74+50 and STA. 225+40) in the Cities of Cleveland, Cuyahoga Heights, and Newburgh Heights in Cuyahoga County, Ohio (Site) for the CUY-77-11.41 (PID 105743) project.

The investigation was planned based on the finding of the "Retaining Wall Justification Study" and the "Preliminary Engineering/Structure Type Study Report for AER" prepared by AECOM, both dated Novembers 10, 2020, as well as the Alternatives Evaluation Report prepared by HNTB, dated November 2020. The retaining wall type study recommended nine (9) soldier pile walls and four (4) cast-in-place (CIP) cantilever reinforced concrete walls on spread footings.

The analysis and design recommendations are based on the requirements of the 2026 ODOT Bridge Design Manual, 2026 ODOT Geotechnical Design Manual and the 2020 AASHTO LRFD Bridge Design Specifications (BDS). Recommendations are provided for the different wall types, underpass culvert structure in addition to slope stability verifications and proposed excavations for storm water pipes.

The foundation design recommendations are based on 8 historic borings, 2 borings completed by AECOM in 2018 (one roadway and one bridge boring), and 29 additional borings coordinated by TRC: two (2) bridge borings that were 110-foot deep, each, and twenty-seven (27) borings that were drilled to depths ranging from 15 to 60 feet below existing ground surface (bgs). The borings revealed general similarity and uniformity of the existing soil profiles, dominantly composed of silt (A-4b), sandy silt (A-4a), and with areas featuring thick uncontrolled and existing fill mostly of the A-2-4 and A-1b designations. Based on the engineering interpretation and analyses, this report provided recommendations for design of the walls, the bridge replacement, slope stability of the proposed slopes due to lane widening, in addition to the excavations and tranches for the planned stormwater drainage pipes. Walls 1A, 1B, 1C, 1D, 2, 2A, 5B, 5C, and 7 are recommended to be soldier beam walls with cast in place concrete lagging. The steel beams are to be embedded in concrete drilled shafts. Walls 3, 4, 5A, and 6 are CIP walls on spread footings. For Walls 5B and 7, due to the limited space for the wall and the significant heights of the walls, geofoam backfill is recommended to be used within the upper 13.15 feet of the wall (from 3.15 to 13.15 feet below top of pavement). The report included design calculations and verifications for the proposed soldier pile walls, including L-Pile analyses for the solider pile foundations (drilled shafts) in addition to global stability based on the calculated lateral pressures within the design heights of the walls. For the CIP walls, the report included geotechnical design calculations for sizing of the walls based on external stability (bearing capacity, sliding stability and eccentricity), global (deep seated) stability as well as service limit settlement predictions. The report also included recommendations for design of the proposed replacement bridge, excavations for storm water management as well as general recommendations for construction.

2. INTRODUCTION

This report presents the results and interpretations of our geotechnical exploration and recommendations for design of the proposed retaining walls, drainage facility and replacement bridge that are planned as part of the Interstate I-77 upgrades between Grant Avenue and Broadway Avenue in Cuyahoga County, Ohio. The proposed upgrades are planned between STA. 74+50 and STA. 225+40 of the I-77.

The report provides detailed description of field sampling, observations and in-situ (SPT) testing, laboratory testing for material characterization on disturbed and undisturbed soil samples. The report also provides recommendations related to:

- Soil parameters and lateral pressures for design of the culvert foundations.
- Soil parameters for design of the retaining walls, including lateral earth pressure coefficients and the foundation substrata.
- Soil profiles and material properties for slope stability and excavations for the drainage systems as well as recommended excavations side slopes.
- Provide design soil parameters (both above and below ground water table) for active, at rest and passive conditions and construction considerations for retaining walls and below-grade walls.
- Site preparation including placement, compaction, and testing of fills.

Detailed description of the tasks and procedures used in geotechnical exploration, exploration findings as well as the engineering analyses, recommendations for design of the bridge foundations, retaining walls and recommendations for design and construction are provided in this report. This includes presentation of soil borings, subsurface profiles, and material properties for design of the proposed retaining walls, pedestrian access underpass, and excavations for drainage sewer and detention basins.

2.1 Site Location

The project site is located in Cuyahoga Heights, Newburgh Heights and within the city limits of Cleveland, Cuyahoga County, Ohio. The general site location, showing approximate limits of the project is shown in Figure 1 below.

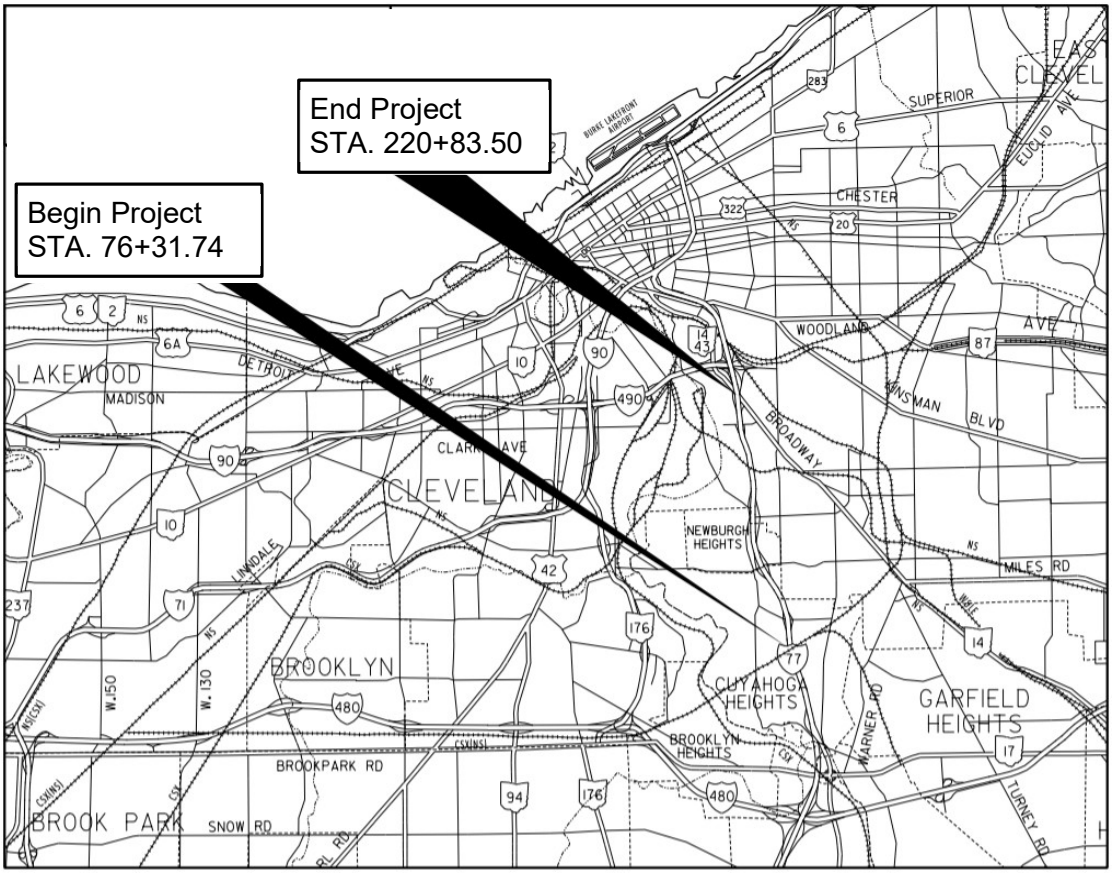

Figure 1: Site Location and Approximate Project Limits

2.2 Project Understanding

The project involves the design of upgrades (improvement) of existing Interstate I-77 between Grant Avenue at the approximate STA. 76+31.74 and Broadway Avenue at the approximate STA. 220+83.50. The existing I-77 is a 6-lane divided highway, 3 lanes in each direction, with substandard drainage and shoulder widths. The inside shoulders are 3.0-foot wide, and the outside shoulders are 8 to 10-foot wide. The proposed improvements include increasing the width of inside and outside shoulders shoulder to 10 feet, each, in addition to incorporating Best Management Practices (BMP) drainage by addition of storm sewer and detention basins. The project also involves the design of a replacement culvert-type underpass to be used as pedestrian access below I-77 at the Morgan Run Trail. The proposed upgrades also include thirteen (13) retaining walls, drainage facilities (storm sewers and BMP detention basins), subsurface profiles and recommended parameters for slope stability in addition to the Morgana Run Trail underpass culvert. Based on available workspace limitations, boundary conditions, geometric constraints and subsurface conditions cast-in-place (CIP) reinforced concrete walls on spread footings as well as soldier pile walls are considered the most feasible for this project. A summary of all retaining walls with locations, maximum design heights and types is provided in Table 1.

Table 1: Proposed Walls, Walls Heights, Types and Locations

Wall	I-77 Station			Max. Total Height, ft	Horizontal or Slopping Backfill	Wall Type
	From	To	Side			
1A	84+30.13	89+38.73	LT	22.56(1)	Slopping	Soldier Pile
1B	89+79.58	90+88.27	LT	22.65(1)	Slopping	Soldier Pile
1C	91+31.67	94+94.40	LT	21.48(1)	Slopping	Soldier Pile
1D	96+81.19	106+00.55	LT	18.46(1)	Slopping	Soldier Pile
2	90+80.84	93+96.38	RT	19.12(1)	Slopping	Soldier Pile
2A	89+02.52	89+31.99	RT	9.27(1)	Slopping	Soldier Pile
3	100+57.43	105+70.22	RT	12.14(1,2)	Slopping	Cast-in-place (CIP)
4	129+28.04	131+35.36	LT	9.52(1)	Slopping	Cast-in-Place (CIP)
5A	163+17.43	170+40.04	LT	28.55(1)	Horizontal(4)	Cast-in-Place (CIP)
5B	170+98.01	175+33.50	LT	27.46	Horizontal(4)	Soldier Pile(5)
5C	175+86.55	176+13.00	LT	18.31	Horizontal(4)	Soldier Pile
6	156+33.75	161+89.07	LT	5.15(3)	Slopping	Cast-in-place (CIP)
7	169+27.50	169+80.14	RT	26.23	Horizontal(4)	Soldier Pile(5)

(1) Maximum total height includes 1.0-foot-tall parapet or copping.
(2) Maximum grade difference on both sides of wall is less than 7.5 ft.
(3) Maximum grade difference on both sides of wall is less than 1.0 ft.
(4) Horizontal with Traffic Surcharge
(5) Solider pile wall with geofoam is being considered due to presence of nearby utilities and soft and compressible soils and fill materials encountered during the field exploration.

3. GEOLOGY AND OBSERVATIONS OF THE PROJECT

3.1 Existing Site Conditions and Project Observations

The project is between Cuyahoga Heights and Newburgh Heights within the Cleveland area. The existing I-77 is a six-lane, divided highway providing three traffic lanes in each direction with an asphalt shoulder on each side. The inside shoulders are approximately 3-foot wide, and the outside shoulders are 8 to 10 feet wide. This segment of the highway is bound by commercial, industrial and residential areas with many on-ramps and off-ramps, railroad overpasses, and local access roads. Power lines, gas lines, water supply and storm pipes are present within the site limits, and the water and storm pipes crosses under the existing highway. More information about the existing highway and pavement are available in the geotechnical Subgrade Exploration report for pavement upgrades by AECOM, dated July 23, 2019.

3.2 Regional Geology

The project site is located within the Ohio glaciated Huron-Erie Lake Physiographic region which is characterized by major streams in deep gorges with elevations ranging from 570 feet to 800 feet (Brockman, 1998). IR-77 in this location was constructed in a trench at about elevation 661 ft. The new Frontage Rd will be constructed in the western slope of IR-77 with current

elevations ranging from 660.0 feet to 680.0 feet.

ODNR map entitled "Surficial Geology of the Cleveland South Quadrangle, 2000," reveals 40 feet of sand and gravel over Wisconsinan age lacustrine silt and clay reported to be 290 feet thick. Close to the surface, the lacustrine till soils consist of up to 50 percent clay and 8 to 30 percent sand to the South and East of the site, it shows shallow sand and Wisconsinan age lacustrine silt and clay over Devonian age Ohio Shale. The local bedrock is Ohio Shale, which rises in elevation north to south from 450 feet at the IR-490 ramp to approximately 625 feet MSL at the South-eastern end of the project (Vormelker, et al, 1996).

4. EXPLORATION

4.1 Historic Boring Information

Historic subsurface information was reviewed from six (6) prior geotechnical explorations conducted at the Site between 2001 and 2014. However, only the borings summarized in Table 2 below were incorporated into the current evaluations. The remaining historic borings from this time period were not utilized as the borings performed under the present contract were deemed sufficient to adequately characterize the subsurface conditions and to support the development of design recommendations. Copies of referenced historic logs are included in **Appendix B**.

Table 2: Summary of Historical Borings (ODOT GeoMS online database)

Project ID	Boring	Ref. Alignment	Station	Offset	Surface Elev. (ft)	Boring Depth (ft)	Used for
CUY-77-11.69	B-001-0-02	I-77	89+49.82	64.13' LT	718.89	75.0	Walls 1A, 1B
CUY-77-11.69	B-002-0-02	I-77	89+62.37	72.11' LT	720.14	74.4	Wall 2A
CUY-77-11.11	N-001-S-01	I-77	91+20.92	91.96' LT	716.19	74.4	Wall 1C
CUY-77-11.78	N-003-N-01	I-77	93+82.88	77.15' RT	718.03	80.0	Wall 2
CUY-77.11.78	N-001-N-01	I-77	95+62.07	85.49' LT	714.46	75.0	Wall 1D
CUY-77-13.31	B-004-0-12	I-77	174+75	45' LT	682.2	75.0	Wall 5B
CUY-77-13.31	B-006-0-12	I-77	175+71	65' LT	665.1	110.0	Wall 5C
CUY-77-13.75	B-002-0-11	Pershing Ave.	9+07*	23' LT*	679.8	125.0	CCTV Pole Foundation

4.2 Field Exploration

During an early phase of the project, AECOM completed a roadway exploration in 2018 that consisted of 34 pavement borings (up to 7.6 feet bgs) and one (1) structure borings (50 feet deep) and are summarized in Table 3. The information presented by AECOM in borings B-022-0-18 and B-026-0-18 was considered by TRC in the structural evaluation of Retaining Walls 6 and 5B, respectively. The results are presented in an AECOM's Subgrade Exploration Report (Stage 2 Submittal date July 31, 2024).

Table 3: Roadway and Structure Borings from the Subgrade Exploration Report by AECOM (CUY-77-11.21 report dated July 23, 2019) for CUY-77-11.41

Boring Type	Boring	Station to Existing CL	Offset	Station to New Alignment	Offset to New Alignment	Surface Elevation (ft)	Boring Depth (ft)	Used for
Structure	B-026-0-18	171+20	74' LT	170+96.27	55.50 LT	653.6	50.0	Wall 58
Roadway	B-022-0-18	159+05	40' LT	159+01.95	34.46 LT	682.2	7.5	Wall 6

TRC completed an additional 29 structure borings within areas of interest and as close as possible to the proposed structures and facilities. Each of the two culvert underpass borings (Borings B-070-0-20 and B-071-0-20) were drilled to 110-feet bgs, whereas the remaining borings, for the walls, slopes and drainage facilities, were drilled to depths ranging from 15 to 60 feet bgs. The boring program is summarized in Table 4, whereas the boring locations were marked on the plan of borings provided in **Appendix B**.

The geotechnical subsurface exploration program was performed in accordance with ODOT's Specifications for Geotechnical Explorations (SGE). At the request of ODOT during preliminary planning stages of the geotechnical exploration program, historic borings were considered in determining locations of the additional boring locations to comply with the minimum required frequency of borings per the SGE. Section 303.7.3 of the SGE requires a minimum of one boring for each retaining wall. For walls over 100 feet in length, a minimum of two borings is recommended. For walls over 300 feet in length, borings are to be spaced a maximum of 150 feet apart. Table 5 below provides a summary of the borings utilized for the structural design of each retaining wall.

Table 4: Summary of Soil Borings

Boring No.	Location[1]		STA. [1,2]	Offset[1,2]	GS Elev.[1]	Boring Depth, ft bgs	Purpose
	Lat	Long					
B-040-0-20	41.439859	-81.650141	79+50.89	49.742 LT	694.72	15	Storm sewer/ slope
B-041-0-20	41.441468	-81.650749	85+70.12	61.718 LT	694.26	30	Wall 1A / storm sewer
B-042-0-20	41.442102	-81.651046	88+18.52	53.957 LT	696.56	35	
B-043-0-20	41.442584	-81.651305	90+10.50	45.403 LT	697.79	30	Wall 1B / storm sewer
B-044-0-20	41.443278	-81.651798	93+00.55	45.068 LT	697.51	30	Wall 1C / storm sewer
B-048-0-20	41.444193	-81.652595	97+04.21	44.287 LT	693.00	35	Wall 1D / storm sewer
B-049-0-20	41.444583	-81.652998	98+84.35	47.855 LT	691.71	35	
B-050-0-20	41.444898	-81.653352	100+34.30	57.303 LT	689.96	35	
B-051-0-20	41.445349	-81.653847	102+47.35	67.941 LT	688.69	30	
B-046-0-20	41.443288	-81.651430	92+53.31	43.972 RT	699.59	40	Wall 2
B-052-0-20	41.445564	-81.653482	102+50.43	59.193 RT	686.08	25	Storm sewer / slope
B-053-0-20	41.445952	-81.653844	104+24.37	62.723 RT	684.22	25	Wall 3
B-054-0-20	41.446344	-81.654205	106+00.62	61.67 RT	681.23	25	Wall 3
B-055-0-20	41.446732	-81.654370	107+46.75	98.678 RT	680.39	25	Wall 3
B-056-0-20	41.447223	-81.654614	109+40.09	130.745 RT	684.00	25	
B-059-0-20	41.450204	-81.656910	121+92.54	66.791 LT	661.15	30	Storm sewer / slope
B-060-0-20	41.452133	-81.657261	128+93.63	53.071 LT	651.36	30	Wall 4 / storm sewer / slope
B-061-0-20	41.452751	-81.657304	131+16.34	52.347 LT	650.56	30	

Table 4: Summary of Soil Borings

Boring No.	Location[1]		STA. [1,2]	Offset[1,2]	GS Elev.[1]	Boring Depth, ft bgs	Purpose
	Lat	Long					
B-062-0-20	41.454228	-81.657598	136+56.41	118.361 LT	649.98	25	BMP Detention Basin / Storm sewer/Slope
B-063-0-20	41.454629	-81.657604	138+02.61	115.979 LT	661.05	30	
B-064-0-20	41.461446	-81.657368	162+93.19	71.016 LT	672.08	35	Solider Wall 5A / storm sewer
B-065-0-20	41.461975	-81.657453	164+89.75	72.28 LT	667.15	35	
B-066-0-20	41.462524	-81.657512	166+91.31	59.53 LT	662.10	40	
B-067-0-20	41.463050	-81.657630	168+85.69	63.379 LT	657.24	50	
B-070-0-20	41.468505	-81.659955	189+94.15	182.523 LT	656.82	110	Wall 5A/ Morgana Run Trail Underpass
B-068-0-20	41.464014	-81.657974	172+46.80	105.145 LT	662.04	60	Solider Wall 5B
B-071-0-20	41.463548	-81.657747	170+69.69	68.436 RT	654.37	110	Morgana Run Trail Underpass
B-072-0-20	41.463258	-81.656963	169+33.57	128.539 LT	656.55	25	Storm sewer
B-073-0-20	41.466303	-81.658850	181+37.42	173.794 LT	656.57	25	Storm sewer

1. Based on field survey of “as-drilled” locations provided by AECOM.
2. Based on existing alignment.

Table 5: Retaining Wall Soil Boring Summary

Retaining Wall	Borings Considered in Wall Design	Approximate Length of Retaining Wall (feet)	Minimum Number of Borings Required by SGE	Number of Borings Considered in Wall Design
Wall 1A	B-041-0-20 B-042-0-20 B-001-0-02(3)	500.0	3	3
Wall 1B	B-043-0-20 B-001-0-02	106.94	2	2
Wall 1C	B-044-0-20 N-001-S-01(3)	356.91	2	2
Wall 1D(1)	B-048-0-20 B-049-0-20 B-050-0-20 B-051-0-20 B-052-0-20 (3) N-001-N-01(3)	923.83	6	6
Wall 2A	B-002-0-02	30.0	1	1
Wall 2	B-046-0-20 N-003-N-01	321.1	2	2
Wall 3	B-053-0-20 B-054-0-20 B-055-0-20 B-056-0-20 (3)	510.0	3	4
Wall 4	B-060-0-20 B-061-0-20	210.0	2	2

Table 5: Retaining Wall Soil Boring Summary

Retaining Wall	Borings Considered in Wall Design	Approximate Length of Retaining Wall (feet)	Minimum Number of Borings Required by SGE	Number of Borings Considered in Wall Design
Wall 5A	B-064-0-20 B-065-0-20 B-066-0-20 B-067-0-20	720.0	4	4
Wall 5B	B-070-0-20 B-026-0-18 B-068-0-20 B-004-0-12 (3)	435.5	2	4
Wall 5C	B-006-0-12	26.0	1	1
Wall 6(2)	B-022-0-18	550.0	4	1
Wall 7	B-071-0-20	52.64	1	1

(1) Four borings are representative of the majority of the wall length, particularly the zones of wall with maximum height (most critical).
(2) Wall 6 retains grade difference of less than 1.5 ft, stability of the wall is of no concern. Analyses were conveniently performed based one boring within the wall length.
(3) Borings were reviewed but not utilized in wall design.

Approximate test boring locations were selected by TRC geotechnical personnel based on the site concept plan at that time and field located using a hand-held GPS unit based on google earth coordinates. Test borings were drilled by CTL Engineering, Inc. (CTL). The Ohio811 One-Call dig notification service was notified to avoid conflict and damage to utilities prior to the start of drilling activities, and boring locations were confirmed as clear of utility conflicts. The boring locations were surveyed by AECOM after completion of the field drilling activities. Work zone clearance and traffic control measures were provided by TRC's drilling subcontractor (CTL).

The borings were drilled using CME 45 track mounted and CME 550X ATV drill rigs between December 1 and 17, 2021. All borings were drilled using a 3.25-inch inner-diameter hollow stem auger to advance the hole between sampling points. During drilling, representative soil samples were collected from the borings for visual inspection and laboratory testing. The samples were obtained by performing Standard Penetration Testing (SPT) with a split-spoon, in general accordance with ODOT SGE and ASTM D 1586. In this test, the split spoon sampler is driven into the soil using a 140-pound automatic hammer falling 30 inches. The hammer for the CME 45 drill rig had an energy rating of 89.3% based on the calibration dated August 5, 2021, whereas the hammer for the CME 550X rig had an energy rating of 85.6% based on the calibration dated October 19, 2021. Split spoon sampling with SPT testing were performed at maximum intervals of 2.5 feet for the upper 20 feet bgs of the borings, and at 5.0-foot-intervals for the remaining depth. The SPT blow counts presented on the logs of borings, enclosed in **Appendix A**, are automatically corrected to reflect the blow counts at 60% energy efficiency rating (N_{60}).

Groundwater was monitored during the drilling and water depth measurements were made during

and at completion of drilling. The logs of borings are enclosed in **Appendix B** with detailed description of substrata, condition and consistency in addition to the types of sampling, and laboratory test results**.**

4.3 Laboratory Testing

The soil samples were visually inspected by CTL and TRC's drilling inspectors and selective soil samples representative of different soil types were then delivered to TRC's AASHTO accredited laboratory for laboratory testing. At the laboratory, the samples were subjected for additional inspection of TRC personnel and representative samples were selected for laboratory tests including classification and index properties, strength and compressibility in addition to soil corrosivity and aggressivity in accordance with applicable ASTM, AASHTO standards and ODOT SGE. The laboratory-testing program included the type and number of tests presented in Table 6 below.

Pertinent test results are summarized in Section 5 of this report. Complete laboratory tests result sheets are presented in **Appendix C**. These lab testing forms include the information that satisfy the requirements of the SGE, therefore, the ODOT forms were not used.

Table 6: Summary of Laboratory Tests

Test Specification	Reference Standard	Number of Tests
Natural Moisture Content	AASHTO T265	252
Liquid Limit	AASHTO T89	73
Plastic Limit and Plasticity Index	AASHTO T90	73
Particle Size Analysis – Sieve	AASHTO T88	80
1-D Consolidation	AASHTO T216	5
Direct Simple Shear	AASHTO T236	6
Unconsolidated Undrained Strength	AASHTO T296	5
Unconfined Compressive Strength	AASHTO T208	2
pH	AASHTO T289	9
Water Soluble Sulfates	AASHTO T290	9
Chlorides	AASHTO T291	9
Resistivity	AASHTO T288	9

5. FINDINGS

5.1 Subsurface Stratigraphy

The logs of soil borings, enclosed in Appendix B, show general similarity and uniformity of the subsurface profiles. Based on these borings, the subsurface materials are dominantly granular composed of sand (A-3 and A-3a), sandy silt (A-4a), silt (A-4b) in addition to the gravel and stone fragments with sand and silt (A-2-4) and stone fragments with varying percentages of sand (A-1-a and A-1-b) at shallow depths. The logs descriptions for each structure are provided in more

detail below:

Wall 1A

Under the pavement and granular base, borings B-041-0-20 and B-042-0-20 encountered granular material composed of approximately 10-feet of gravel with stone fragments and sand (A-1-b) and sand (A-3 and A-3a). Boring B-041-0-20 then encountered 5.0 feet of very stiff silt (A-4b), followed by a thin layer of hard sandy silt (A-4b). The boring finally encountered 11.5 feet of medium dense to dense silt. Under the 2.0-foot-thick aggregate base, historic boring B-001-0-02 encountered 6.0 feet of dense to very dense sandy silt (A-4a), underlain by 8.0 feet of very stiff to hard sandy silt (A-4a), followed by 3.5 feet of medium dense coarse and fine sand (A-3a). The boring then exhibited dense to very dense sand (A-3 and A-3a), extending to the termination depth of the boring. Borings B-041-0-20 and B-042-0-20 as well as the historic Boring B-001-0-02 which is located just before the wall were used for design calculations of this wall.

Wall 1B

Under the pavement and granular base, boring B-043-0-20 exhibited mostly a medium dense, brown gravel and stone fragments with sand (A-1-b) to approximate 16 feet bgs followed by hard, gray silt layer (A-4b) to the boring's termination depth. Under the 2.0-foot-thick aggregate base, historic boring B-001-0-00 encountered 6.0 feet of dense to very dense sandy silt (A-4a), underlain by 8.0 feet of very stiff to hard sandy silt (A-4a), followed by 3.5 feet of medium dense coarse and fine sand (A-3a). The boring then exhibited dense to very dense sand (A-3 and A-3a), extending to the termination depth of the boring. Boring B-043-0-20 and the historic Boring B-001-0-02 which is located just before the wall were used for design calculations of this wall.

Wall 1C

Under the asphalt layer, boring B-044-0-20 exhibited approximately 15.5 feet of medium dense layers of gravel and stone fragments with sand (A-1-b) and medium dense fine sand (A-3) followed by 12.0 feet very stiff to hard gray silt, some clay (A-4b). the boring finally exhibited 1.0 foot of dense fine sand (A-3) before being terminated. Historic borings N-001-S-01, which was drilled before Wall 1C, initially encountered 5.0 feet of loose to medium dense silt (A-4b), underlain by 8.5 feet of stiff sandy silt with some clay (A-4a) followed by 1.5 feet of medium dense fine sand. The boring then encountered 20.0 feet of medium stiff silt and clay (A-6a) followed by 7.5 feet of loose to medium dense gravel with sand (A-1-b). The boring then exhibited 10.0 feet of very stiff silt and clay (A-6a) and sandy silt (A-4a). The boring then encountered 30.0 feet of dense to very dense coarse and fine sand (A-3a) and was terminated after encountering 0.9 feet of very dense silt, little clay of the A-4b formation. The boring was terminated after encountering 1.0 foot of very dense silt of the A-4b formation. Borings B-044-0-20 and N-001-S-01 were used for design calculations for this wall.

Wall 1D

For wall 1D, borings B-048-0-20 through B-051-0-20 as well as historic borings N-001-N-01 and N-002-N-01 generally revealed granular soils of the A-1-b, A-2-4, A-3 and A-3a formation within

the upper 6.0 to 9.0 feet of the borings underlain by mostly cohesive soils of silt (A-4b), and sandy silt clay (A-4a).

Under the asphalt and aggregate base, Boring B-048-0-20 encountered 6.6 feet of very loose to loose gravel and stone fragments with sand (A-1-b), underlain by 15.0 feet of medium stiff to stiff silt, and clay of the A-4b formation followed by 11.0 feet of hard sandy silt (A-4a) extending to the termination depth of the boring.

Under the 1.5-foot thick asphalt, Boring B-049-0-20 encountered 5.0 feet of medium dense gravel and stone fragments with silt (A-2-4), underlain by 2.5 feet if loose coarse and fine sand of the A-3 formation. The boring then encountered 14.5 feet of very stiff silt with some clay (A-4b) underlain by medium dense silt (A-4b) extending to the termination depth of the boring.

Under the asphalt and aggregate base, Boring B-050-0-20 encounter the 5.0 feet of medium dense coarse and fine sand (A-3a), underlain by 12.5 feet of very stiff silt with clay of the A-4b formation. The boring then exhibited 16.5 feet of hard sandy silt (A-4a) extending to the termination depth of the boring.

Under the thin asphalt layer, Boring B-051-0-20 encounters the 5.7 feet of stiff silt with some clay of the A-4b formation, underlain by 17.5 of hard, turning into very stiff sandy silt (A-4a). The boring then exhibited 5.0 feet of medium dense silt (A-4b), followed by 1.5 hard sandy silt (A-4a) before the boring was terminated.

Borings B-052-0-20 and N-001-N-01 generally demonstrated similar stratigraphy, however only Borings B-048-020 through B-051-0-20 were utilized in the wall design.

Wall 2A

Within the influence depth of the wall, under the 1.0-foot-thick aggregate base, Boring B-002-0-02 encountered approximately 14 foot layers of sandy silt and silty clay (A-4a and A-6a), underlain by 10 feet of medium dense to loose fine sand (A-3a). The boring then exhibited 4.0 feet of medium stiff silt and clay, 7.0 feet of medium dense gravel with sand (A-1-b), followed by 8.0 feet of very stiff silt and clay (A-6a) and silt (A-4b). The boring then encountered 17 feet of medium dense to dense coarse and fine sand (A-3a), underlain by very dense sand layers (A-3 and A-3a) extending to the termination depth of the boring (74.4 feet). Design calculations for this wall are based on this boring.

Wall 2

Under the aggregate base, Boring B-046-0-20 encountered approximately 13.1 feet of fill described as medium dense sandy silt (A-4a) for the upper 3.7 feet, very stiff sandy silt (A-4a) for the next 2.0 feet and very stiff silt and clay (A-6a) for the remaining fill thickness. The boring then encountered, 9.8 feet of loose to medium dense fine sand (A-3a), followed by 3.9 feet of medium stiff silt and clay. The boring then encountered 7.2 feet oof medium dense gravel with sand of the A-1-b formation followed by 8.0 feet of very stiff silt and clay (a-6a) and silt (A-4b). The boring then encountered 17.0 feet of medium dense to dense coarse and fine sand (A-3a) followed by very dense fine sand (A-3) and coarse to fine sand (A-3a), which extended to the termination depth of the boring.

Under the 2.0-foot-thick aggregate base, Boring N-003-N-01 encountered 6.5 feet of stiff to very still sandy silt (A-4a), underlain by 15 feet of stiff silt (A-4b) followed by 12.5 feet of medium dense sand (A-3a) and gravel with sand (A-1-b). The boring then encountered 7.5 feet of hard to very

stiff silt and clay (A-6a), 5.0 feet of dense coarse and fine sand (A-3a) and 31.5 feet of medium dense to very dense, non-cohesive silt (A-4b), extending to the termination depth of the boring.

Boring B-046-0-20 and N-003-N-01 were utilized for design of this wall.

Wall 3

Borings B-053-0-20 through B-055-0-20 that were drilled as close as possible to Wall-3 alignment revealed mostly stiff to very stiff silt (A-4b), sandy silt (A-4a), and coarse and fine sands (A-3a). Detailed descriptions of the encountered soils in each formation are provided below:

Under the 0.5-foot-thick topsoil, Boring B-053-0-20 encountered approximately 15.5 feet of very stiff silt, and clay of the A-4b formation followed by 9.0 feet of very stiff to hard sandy silt (A-4a), extending to the termination depth of the boring.

Under the 0.5 feet of topsoil, Boring B-054-0-20 encountered 5.5 feet of fill described as dense gravel and stone fragments with sand (A-1-b), underlain by 8.5 feet of hard silt, some clay of the A-4b formation. The boring then exhibited 4.0 feet of medium dense sandy silt (A-4a) underlain by dense coarse and fine sand, which extended to the termination depth of the boring at 25 feet bgs.

Under the 0.5 feet of topsoil, Boring B-055-0-20 encountered 3.0 feet of fill described as hard sandy silt (A-4a), followed by stiff to very stiff silt, some clay of the A-4b formation. The boring finally encountered 10.0 feet of medium dense coarse and fine sand (a-3a) that extended to the termination depth of the boring.

Wall 4

Boring B-060-0-20 and B-061-0-20 were used for design calculations related to this wall. Under the thin top soil, Boring B-060-0-20 encountered approximately 16 feet of fill composed of 8.3 feet of very still silt (A-4b), 5.0 feet of very stiff sandy silt of the A-4a formation, underlain by 2.5 feet of very dense gravel and stone fragments with sand and concrete fragments (A-1-b). The boring then exhibited 2.5 feet of very stiff silt (A-4b) followed by 11.5 feet of medium stiff silt (A-4b) which extended to the termination depth of the boring.

Under the thin topsoil, Boring B-061-0-20 encountered approximately 5.7 feet of fill composed of medium dense gravel and stone fragments with sand and silt (A-2-4), followed by 7.5 feet of loose gravel and stone fragments with sand (A-1-b). The boring then encountered 5.0 feet of medium dense fine sand (A-3), 5.0 feet of loose coarse and fine sand (A-3a), followed by 6.5 feet of stiff sandy silt (A-4a).

Walls 5A

Boring B-064-0-20 and B-065-0-20 encountered fill material for the entire depths of the borings (35.0 feet). The fill material in Boring B-064-0-20 consisted of 2.5 feet of medium dense gravel and stone (A-1-a), 10.0 feet of medium dense sandy silt (A-4a), underlain by 7.5 feet of very loose to loose coarse and fine sand (A-3a), followed by 14.0 feet of medium dense to dense gravel and stone fragments, extending to the termination depth of the boring.

The fill in Boring B-065-0-20 consisted of 6.0 feet of very dense gravel and stone fragments (A-1-a), underlain by 5.0 feet of stiff silt (A-4a) and 5.0 feet if gravel and stone fragments (A-1-b). The boring finally encountered 19.0 feet of stiff sandy silt (A-4a) extending o the termination depth of the boring.

Boring B-066-0-20 encountered 11.0 feet of slag fill composed of medium dense to dense gravel and stone fragments with sand (A-1-b) underlain by 20.0 feet of loose to medium dense coarse and fine sand (A-3a). The boring then encountered 9.0 feet of very stiff to hard sandy silt (A-4a), which extended to the termination depth of the boring.

Boring B-067-0-20 initially encountered 3.5 feet of fill, composed of medium dense gravel and stone fragments (A-1-a), followed by 2.5 feet of hard silt (A-4b) and 7.5 feet of loose coarse and fine sand (A-3a). The boring then encountered 15.0 feet of stiff to very stiff silt (A-4b), underlain by 10.0 feet of medium dense silt (A-4b). The boring then exhibited 11.5 feet of stiff to very stiff sandy silt (A-4a) extending to the boring termination depth.

Walls 5B

Boring B-068-0-20 initially encountered 6.0 feet of very loose gravel and stone fragments with sand and silt (A-2-4), followed by 10.0 feet of loose to medium dense silt (A-4b). The boring then encountered 27.5 feet of very stiff to hard silt, little clay (A-4b) followed by 16.5 feet of stiff to very stiff sandy silt (A-4a) which continued to the termination depth of the boring.

Boring B-070-0-20 initially encountered 8.5 feet of gravel and stone fragments with sand and silt (A-2-4) underlain by 5.0 feet of soft sandy silt (A-4a). The boring then encountered 75.0 feet of stiff to very stiff silt with some clay (A-4b), followed by 21.5 feet of stiff sandy silt (A-4a) extending to the termination depth of the borings.

Under the thin topsoil, Boring B-026-0-18 encountered 16.8 feet of fill consisting of approximately 1.6 feet of medium dense gravel with sand (A-1-b), 2.1 feet of very stiff sandy silt (A-4a), 0.6 feet of loose coarse and fine sand (A-3a), 1.1 feet of very stiff silt (A-4b), loose coarse and fine sand (A-3a) and 2.9 feet of hard silt (A-4b and A-4a). The boring then encountered 2.3 feet of loose sandy silt (A-4a), turning into medium stiff elastic silt and clay (A-4a) over the next 3.7 feet. The boring then exhibited a zone of possible cobbles for the next 1.3 feet (between approximate elevations 638.1 and 636.8). The boring then encountered 18.7 feet of very stiff silt (A-4b), 11.3 feet of stiff silt and clay (A-6a), followed by 2.5 feet of medium dense silt (A-4b) and 0.7 feet of very stiff silt (A-4a) extending to the termination depth of the boring at 50.0 feet.

Under the pavement and granular base, B-004-0-12 encountered fill layers consisting of 1.8 feet of medium dense coarse and fine sand (A-3a), 2.5 feet of medium dense sandy silt (A-4b) and 2.5 feet of stiff clay and silt (A-7-6). The boring then encountered 5.0 feet of stiff to very stiff silty clay (A-6b), 28.7 feet of looses to medium dense, becoming dense coarse and fine sand (A-3a) which included 4.0-foot-thick band of fine sand (A-3). The boring then encountered 33.3 feet of dense to very dense silt (A-4b) which extended to the termination depth of the boring.

Walls 5C

Under the concrete and granular base, Boring B-006-00-12 encountered 7.0 feet of medium dense fine sand (A-3), 2.5 feet of loose sandy silt (A-4a), underlain by 15.2 feet of medium dense to dense coarse and find sand (A-3a). The boring then exhibited 21.5 feet of medium dense to dense silt with some clay (A-4b), 50.0 feet of stiff to very stiff silt and clay (A-6a), followed by 4.5 feet of medium stiff to stiff silt and clay (A-4b) and 8.5 feet of silt and clay, extending to the termination depth of the borings.

Walls 6

Under the 8-inch-thick asphalt, 9-inch-thick concrete and the 1.1-thick granular base (A-1-b), the

roadway boring B-022-0-18 encountered 0.8-foot-thick medium dense sandy silt, followed by 1.2 feet of stiff silt and clay (A-6a) and 1.5 feet of medium stiff silty clay (A-6b). The boring was terminated after exhibiting 1.5 feet of medium dense sandy silt.

Given the small grade difference on both sides of the wall (less than 2.0 feet), this shallow boring can be considered adequate for evaluating the stability of the wall with a level of conservatism.

Wall 7 and Morgana Run Trail Culvert Structure

Borings B-070-0-20 and B-071-0-20 initially observed 5.0 and 2.5 feet, respectively, of slag fill with sizes ranging from silt to gravel. Boring B-070-0-20 then exhibited 3.5 feet of gravel and stone fragments with sand (A-1-b) followed by 5.5 feet of medium stiff to stiff sandy silt (A-4a), whereas Boring B-071-0-20 encountered 3.5 feet of fine sand (A-3) and 2.5 feet of gravel and stone fragments with sand and silt (A-2-4). For the mainlining depths, the two borings encountered alternating layers of silt (A-4b), clayey or sandy silt (A-4a).

Boring at CCTV Pole location

The historic boring (Boring B-002-0-11) was drilled close to the location of the proposed CCTV pole foundation from the existing bridge deck and existing slope concrete protection. Within the estimated depth of influence for the CCTV pole foundation, the boring encountered 7.5 feet of fill and possible fill of mostly loose slag and coarse and fine sand (A-3a) underlain by 2.0 feet of very loose coarse and fine sand (A-3a). the boring then encountered 11.5 feet of loose silt (A-4b), 5.5 feet of very stiff to hard silt and clay (A-6a), followed by 16.0 feet of stiff to very stiff silt, some to “and” clay (A-4b). The boring then exhibited 4.5 feet of very dense silt, little clay (A4b) and 4.5 Feet of very dense coarse and fine sand (A-3), underlain by 18.5 feet of very dense to dense silt (A-4b). The boring continued to the termination depth of 125 feet in very stiff to hard silt and clay (A-6a) and silty clay (A-6b).

Borings For Slope Stability

Boring B-040-0-20 which was drilled at the approximate STA. 79+50, left side of the I-77, revealed 1.0 foot of asphalt and granular base underlain by 10.0 feet of loose gravel with stone fragments and sand (A-1-b), followed by 4.0 feet of stiff sandy silt of the A-4a formation. The boring then exhibited 7.0 feet stiff to very stiff clayey silt (A-4a) followed by 3.0 feet of medium dense silt with some sand (A-4b) reaching the termination depth of the boring.

Boring B-052-0-20, which was drilled at the approximate STA. 102+75 on the right side of I-77 within Wall 1D limits, encounter the 2.0 feet of gravel and stone fragments (A-1-b), followed by 5.0 feet of medium stiff silt (A-4b). The boring then encountered 10.0 feet of medium stiff clayey silt (A-4a), followed by 5.0 feet of coarse and fine sand (A-3a) and 1.5 feet of very stiff silt (A-4b) which marked the end of exploration depth for the boring,

Boring B-059-0-20 which was drilled at the approximate STA. 122+00 on the left side of the I-77, initially exhibited 1.0 foot of asphalt underlain by 9.0 feet of fill composed of gravel and stone fragments with sand and gravel sized slag (A-1-b) and sandy silt (A-4a). The boring then encountered 13.5 feet of stiff silt (A-4b), 4.0 feet of stiff clayey silt (A-4a) followed by 1.5 feet of medium stiff sandy silt (A-4a) which marked the termination depth of the boring.

Boring B-061-0-20 was drilled within the area of Wall 4 at the approximate STA. 131+25 on the left side of I-77. This boring initially encountered approximately 6.0 feet of uncontrolled fill

composed of gravel and stone fragments with sand and silt (A-2-4), followed by 7.5 feet of gravel and stone fragments with sand (A-1-b). The boring then exhibited 5.0 feet of loose fine sand (A-3) and 5.0 feet of loose coarse and fine sand (A-3a), followed by 6.5 feet of very stiff clayey silt (A-4b).

Boring B-063-0-20 was completely drilled through existing fill materials for the entire boring depth of 30 feet. In respective order of depth, the fill is composed of 3.0 feet of sandy silt (A-4a), 3.0 feet of slag of gravel and sand size (A-1-b), 6.5 feet of sandy silt (A-4a), and 17.5 feet of silt sized slag (A-4b).

Borings For Stormwater and BMP Detention

Under the 7-inch-thick topsoil, Boring B-062-0-20 encountered 2.9 feet of very dense gravel and stone fragments with silt (A-2-4), underlain by 10.0 feet dense sandy silt (A-4a) and hard sandy silt (A-4a). The boring finally encountered 6.5 feet of hard silt (A-4b) before the boring was terminated at 25.0 feet bgs.

Boring B-072-0-20 (STA. 181+50, Left of I-77) encountered approximately 15.0 feet of fill composed of hard or dense sandy silt, slab and rock fragment (A-4a), underlain by 10.0 feet of very dense fine sand with silt of the A-3 formation to reach the termination depth of the boring.

Under the 4-inch-thick topsoil, Boring B-073-0-20 encountered 3.1 feet of stiff silt (A-4b), underlain by 15.0 feet of very dense sandy silt (A-4a), followed by 6.5 feet of dense to very dense coarse and fine sand with some silt (A-3a), extending to the termination depth of the boring.

Remaining borings for the storm water lines and BMP basins were described earlier as they coincided with locations of walls or slope stability.

5.2 Groundwater Observations

Groundwater observations, during drilling and at completion are reported on the logs of borings and are summarized in Table 7 below. Based on these measurements, water levels are shown to vary from Elev. 633.2 to 686.7 between approximate stations from STA. 79+50 and STA. 167+00.

Based on the relatively permeable soils, the measurement made at completion of drilling are considered representative of the static water table. However, groundwater conditions are influenced by seasonal variations and periods of rain or snow. The water measurements are presentative of the conditions at the date and time of this study and may not represent daily, seasonal, long-term fluctuations, development of perched conditions, or ponding of water in low lying areas during wet periods. Accordingly, for design purposes, groundwater was safely taken at the bottom of each wall, as requested by ODOT.

Table 7: Summary of Water Observations (2020 TRC Borings)

Boring No.	GS Elev.	Water Elev.	
		Drilling	Completion
B-040-0-20	694.72	688.7	686.7
B-041-0-20	694.255	686.3	677.3
B-042-0-20	696.558	688.6	684.6
B-043-0-20	697.789	686.5	NR

Table 7: Summary of Water Observations (2020 TRC Borings)

Boring No.	GS Elev.	Water Elev.	
		Drilling	Completion
B-044-0-20	697.514	685.5	NR
B-046-0-20	699.588	695.1	NR
B-048-0-20	692.997	684.5	NR
B-049-0-20	691.708	685.2	686.2
B-050-0-20	689.959	686.0	672.0
B-051-0-20	688.692	670.7	668.7
B-052-0-20	686.082	667.6	675.9
B-053-0-20	684.221	668.2	668.2
B-054-0-20	681.231	665.2	665.2
B-055-0-20	680.388	674.4	664.4
B-056-0-20	683.999	678.0	667.0
B-059-0-20	661.15	633.2	633.2
B-060-0-20	651.361	NR	NR
B-061-0-20	650.556	644.6	649.6
B-062-0-20	649.978	626.0	635.0
B-063-0-20	661.046	638.0	638.5
B-064-0-20	672.077	654.1	656.1
B-065-0-20	667.148	646.1	646.5
B-066-0-20	662.098	636.1	636.8
B-067-0-20	657.239	NR	NR
B-068-0-20	662.044	NR	NR
B-070-0-20	656.82	NR	NR
B-071-0-20	654.37	NR	NR
B-072-0-20	656.552	NR	NR
B-073-0-20	656.57	NR	NR

5.3 Laboratory Tests Results

Based on the laboratory tests results enclosed in **Appendix C**, the following summary of findings is provided:

1. Based on the classification and Atterberg limits tests, the dominant formations within the project site are the sandy silt and silt (A-4a and A-4b, respectively), gravel with sand and silt of the A-2-4 formation in addition to more granular (A-1-a and A-1b) formations, mostly within shallow depths below existing ground.
2. The laboratory tests revealed some samples with increased clay fraction, however, the soils are vastly of low to no plasticity, ranging from non-plastic (NP) up to maximum Plasticity Index (PI) of 12%, mostly under 9%.
3. The existing fill which was encountered in many of the drilled boring contained high

percentage of fines, which, based on the laboratory tests results appear to be silt and clay sized slag, resulting in low to very low permeability even with high fines content.

4. Based on the soil plasticity, the existing soils are anticipated to behave like granular soil using effective stresses (drained analyses). However, some of the soil samples with significant fines contents were tested for Unconfined Compression (UC) and Unconsolidated Undrained (UU), indicating very stiff to hard consistencies. Direct simple shear tests were also performed on the soils described as clayey silt or silt with some clay of the A-4b formation. The results are provided in **Appendix C** of the report.
5. The consolidation tests results shows that long-term consolidation settlements are not a concern and the existing clayey soils, as well as other soils will likely experience short-term (elastic) settlements, most of which will be completed during conduction.

6. ENGINEERING ANALYSES

The engineering analyses for the walls, replacement bridge/culvert, slope stability and excavations are based on the deduced subsurface profiles and the soil parameters that were interpreted from the logs of available borings (enclosed in **Appendix B**). The laboratory tests results (**Appendix C**) related to Consolidation and Atterberg limits demonstrate that the existing soils will likely behave as drained, cohesionless material. Undrained behavior and consolidation settlements are not likely.

The proposed replacement bridge is a single span bridge supported by two abutment walls integrally connected through the reinforced concrete mat foundation to form a U-shaped frame. For this structure, the vertical loads are anticipated to be very low compare to the recommended factored bearing capacity. The abutment walls shall be designed based on the lateral pressure exerted from the retained backfill.

Three types of retaining walls are recommended in accordance with the summary in **Table 1.** The Site shows general similarity in the subsurface materials and conditions with slag and soil fill mixtures and uncontrolled fill noted at variable thickness, increasing towards the former Morgana Run in northern part of the project, with maximum thickness of 28.5 feet around STA. 165+00. Conservative parameters were considered for the existing fill materials for design of retaining walls and for slope stability. Similar to existing natural soils, the fill is anticipated to experience short-term (elastic) settlements, the majority of which occur during construction and backfilling, before pavement layers are constructed.

The engineering also included slope stability evaluations for selected representative sections of the proposed roadway with cut or new additional fill. The stability analyses were performed using the computer program SLIDE2 by Rocscience based on the deduced soil profiles and conservative soil parameters. Recommendations are also provided for proposed excavation or trenches that may be needed for installation of storm water pipes.

The engineering analyses and recommendations for the retaining walls and culvert structure, as well as slope stability are provided as follows:

6.1 Retaining Walls

Based on the proposed geometries, site limitations, presence of existing and proposed utilities, and subsurface conditions, the recommended types of retaining wall are:

(1) Soldier Pile Walls retaining existing soils and retaining fill (Walls 5B and 7 to include geofoam backfill for portion of wall height).

(2) Cast in Place (CIP) wall.

The list of walls and recommended types are listed in Table 1 and recommendations for each wall are provided in the next subsections. The recommendations are based on the deduced subsurface stratigraphy with material properties for each boring, enclosed in **Appendix D**.

6.1.1 Soldier Pile Walls 1A, 1B, 1C, 1D, 2, 2A, 5B, 5C, and 7

Retaining Walls 1A, 1B, 1C, 1D, 2, 2A, 5B, 5C, and 7 are recommended to be soldier pile walls founded into drilled shafts. Walls 1A, 1B, 1C, 1D, 2 and 2A have temporary wood lagging and Cast-In-Place (CIP) reinforced concrete permanent facing. Precast lagging is proposed for Walls 5B and 5C. Wall 7 will use CIP facing without temporary wood lagging. The design of the non-gravity cantilever (solider pile walls) based on the proposed geometries, groundwater levels and the properties of fill. The engineering analyses for these walls were performed in accordance with the 2020 AASHTO LRFD Bridge Design Specification, 2026 Ohio DOT Geotechnical Design manual (GDM) and 2026 Bridge Design Manual (BDM).

The engineering analyses for the soldier pile walls consisted of evaluating the walls and drilled shaft foundations under the calculated lateral loads. The analyses were performed using the computer program LPILE (Ensoft, Inc.) and incorporated the calculated earth pressures and applied loads for both service-limit and strength-limit conditions, based on the predefined pile spacing specified above.

For these analyses, soil profiles and engineering properties within the drilled shaft embedment depths were established using the available subsurface information presented in **Appendix D**. Lateral forces acting along the wall heights above the drilled shafts were calculated based on wall geometry, pile/drilled shaft spacing, boundary conditions, and applied loads, as summarized in **Appendix E**.

Service-limit loads were used to evaluate wall and shaft deformations (deflections), while strength-limit loads were used to check factored bending moments and shear forces, as well as to identify the locations of maximum bending moments within the drilled shaft foundations. The analyses, presented in Appendix E, were conducted using an iterative design process to select appropriate soldier pile (steel beam) sections, considering pile/drilled shaft spacing, drilled shaft diameter, and minimum embedment depth. The deflections at top of the wall shall not exceed 1% of the design height ($\leq$0.01 H) and that the maximum factored shear and moments do not exceed the factored resistance values. The maximum factored shear and moments were provided for the structural engineer for evaluation and structural design. Although fixity was not required, the drilled shaft embedment depth was refined to reduce lateral movement at the shaft tip.

The engineering analyses and geotechnical design for these walls consisted of the following steps:

(1) Determination of design heights of each wall. The design heights were taken as the maximum of the following:

- Difference between top of retained fill elevation (behind the wall) and the lower grade elevation in front of the wall plus the 3.5 feet frost depth, and
- Difference between top of retained fill elevation (behind the wall) and the top of shaft

elevation.

(2) Determination of subsurface profile and material properties within the foundation depth of each wall based on the logs of boring that are considered representative of the subsoil conditions at each wall. The deduced subsurface stratigraphy and material properties for analyses of piles under lateral loading are provided in **Appendix D**.

(3) Calculating the lateral earth pressures within the design heights of the walls. The lateral earth pressures were calculated based on the design height of each wall, backslope inclination angle, traffic surcharge of 250 psf- when applicable, soldier pile spacing and the following conservative properties for the retained soil:

Unit weight, γ = 120 pcf
Cohesion, c' = 0.0
Friction Angle, ϕ' = 30 degrees
Interface friction angle, δ = 0.0

Rankine's active lateral earth pressure coefficients were used for wall retaining horizontal backfill whereas Coulomb's active earth pressure coefficients were used for walls retaining sloping backfill, maintaining the interface friction angle at 0.0 (no vertical component of active pressure).

For walls 5B and 7, due to the significant walls heights, Expanded Polystyrene (EPS) geofoam will be used within upper zone of the wall, between the approximate depths 13.15 feet and 3.15 feet below top of pavement. Geofoam units (blocks) are 2.0-foot-thick, each, placed in 2.0 feet width increments to approximately 3.15 feet bgs. Accordingly, the fill behind the geofoam will be inclined at approximate slope of 1:1 for the stepping backside of the geofoam. As such, the fill behind the geofoam was analyzed as broken backfill, for which the equivalent backfill slope will taken based on an imaginary line (plane), from bottom of geofoam, intercepting upper fill surface at an a distance equivalent to 1.5 times the depth from bottom of geofoam to the bottom of wall. The equivalent slope shall be limited to the friction angle of the fill (30- degreed) for calculation of the lateral earth pressure coefficient.

For all walls, the lateral earth pressure calculations and distributions within the design heights are provided in **Appendix E** of this report.

(4) Analyses of the drilled shafts under lateral loads and moments using L-Pile computer program by Ensoft Inc. based on the subsurface profiles and material properties provided in **Appendix D** and the lateral earth pressures within the soldier pile walls design heights, enclosed in **Appendix E**. **Appendix E** also provides summaries of selected types/sizes of steel beam sections, horizontal spacing, selected drilled shafts foundation diameters and the Pm multiplier that are calculated based on the drilled shafts spacing to diameter ratios calculated as per item Ohio DOT GDM Section 903.2 for all walls. For LPile analyses of Walls 5B, 5C and 7, the upper modified section (copping or T section produced from the H-pile section) is also calculated in Appendix D, for each of these walls, based on equivalent moment of inertia and modulus of the modified section. L-Pile analyses results (graphical and detailed report) are provided in **Appendix F.** As described earlier, the service limit loads and moments were used to estimate the drilled shaft deflections, whereas the strength limit state loads and moments were used to determine the maximum moments and shear forces within the drilled shafts. Summaries of lateral load analyses results from the L-Pile software analyses are also provided at the beginning of **Appendix F.**

(5) Global Stability analyses of the soldier pile walls were also performed based on the most

critical sections within each soldier pile wall, based on the proposed geometry, deduced subsurface profiles and material properties as well as the proposed soldier piles (steel beam sections, beam spacing and embedment). The analyses included the soldier pile walls without the drilled shafts. The pile shear strength used was calculated by 0.6 times the yield strength (f_y) for the steel and the cross-sectional area of each pile was used. Drilled shafts foundations were not included in the analyses, since the most crucial slip surfaces, with minimum factors of safety, were located below the tip of the soldier piles. The properties for the EPS 22 and EPS 29 geofoam layers in Walls 5B and 7 are based on their estimated strength. However, with the exception of the unit weight of these materials, the properties of these layers do not affect the global stability results. For all walls, water table was assumed to be at least 1.0 foot above the bottom of wall for added safety.

Global stability was performed using the computer program SLIDE2 considering circular and non-circular slip surfaces. The analyses covered both short-term (total stress/undrained) and long-term (effective stress) conditions. The global stability results are provided in **Appendix G** with a summary of the predicted factors of safety summarized in Table 8 below. With the selected sections for analyses being the most critical ones within each wall, the factors of safety shown in this table represent the absolute minimum for each wall. According to these calculations, the computer program predicts factors of safety that exceed the required minimum value of 1.5 for all walls.

Table 8: Retaining Wall Soil Boring Summary for Most Critical Sections within the Walls.

Wall	Wall Station		H, ft	Factor of Safety			
				Total Stress		Effective Stress	
	From	To		Circular	Non-circular	Circular	Non-circular
1A	1+51	2+26	12.92	3.50	2.79	3.13	2.36
	2+26	3+01	15.11	4.47	4.06	2.36	2.22
	4+61.42	5+21	22.56	5.90	4.90	2.92	2.53
1B	10+00	10+75.65	22.65	4.18	3.81	3.42	2.92
1C	100+00	103+56.91	21.48	3.76	3.38	3.17	2.71
1D	1000+00	1000+57.6	18.46	5.66	4.73	5.66	3.28
	1000+30.29	1000+57.6	17.49	3.27	3.08	2.88	2.55
	1000+57.6	1002+07.58	16.38	4.88	4.18	2.59	2.35
	1002+97.6	1003+87.6	9.90	6.61	6.42	2.87	2.74
2	20+00.00	22+40	18.74	5.07	4.12	2.85	2.50
2A	200+00.00	200+30.00	9.27	4.04	3.10	2.45	2.28
5B	50+30.82	54+66.32	27.46	2.96	2.42	3.04	2.50
5C	60+00.00	60+26.00	18.31	5.04	4.05	5.04	4.06
7	70+00.00	70+59.29	26.23	3.41	2.99	3.10	2.60

(6) Temporary Timber Lagging

Temporary wood lagging will be used in construction of Walls 1A, 1B, 1C, 1D, 2 and 2A. The design thickness of the timber lagging was performed following the requirements of the ODOT BDM section 307.6.3, requirements of the AASHTO LTFD Section 8.4 and FHWA-RD-75-128. The design calculations, enclosed at end of Appendix F, included two cases (with and without soil arching). The FHWA-RD-75-128 publication indicated that a lateral

stress reduction of 50% was used by Armento (1972) and some state DOT's. The estimated wood lagging thicknesses in Table 4 of the FHWA-RD-75-128 and Table 12 of the FHWA-IF-99-015 50% appear to reflect the 50% stress reduction.

The calculations by end of Appendix F for the maximum state of stress (maximum retained height and spacing) and revealed that the temporary timber lagging shall have a total (nominal) thickness of 4.0 inches, which corresponds to a minimum net thickness of 3.5 inches for all of these walls. The lateral earth pressures are related to the geostatic (soil) pressure behind the walls, during construction before installation of the final facing.

6.1.2 CIP Retaining Walls 3, 4, 5A, and 6

(1) Retaining Walls 3, 4, 5A, and 6 are recommended as a CIP wall on spread footings.

(2) The geotechnical design of Walls 3, 4, 5A, and 6 are based on the soil stratigraphy and material properties included in **Appendix D** of the report.

(3) The retained fill behind the walls shall meet the minimum design fill parameters per Table 307-1 of ODOT's Bridge Design Manual (BDM). The retained fill parameters used in design of cast in place walls are as follows:

Unit Weight, γ = 120.0 pcf
Friction Angle, φ'= 30 deg.
Cohesion, c'= 0.0 psf.

(4) The design of the foundations of these walls is based on the deduced subsurface profiles and material properties obtained from borings that were drilled within the walls. The material properties and the geotechnical wall design calculations for sliding stability, overturning (eccentricity) as well as bearing capacity are provided in **Appendix H** of this report. As applicable, the bearing capacity analyses included short-term (undrained) and long-term (drained), based on conservatively estimated parameters are shown in Appendix G.

The engineering calculations in **Appendix H** also included estimated foundation settlements. The results of the analyses and settlement calculations, also summarized in Table 9, verify the stability and performance of the proposed walls and proposed foundation sizing. Given the granular nature of foundation soils, only short-term (elastic) settlement is anticipated, and the majority of the settlement will be completed during conduction and backfilling. Consolidation settlements are not a concern and, with the exception of Wall 5A (Sta 12+60 to 14+86.25), the total elastic (short-term) settlements were estimated to be less than 2.0 inches. For Wall 5A ((Sta 12+60 to 14+86.25), the total settlement is estimated be on the order of 3.7 inches. However, based on the encountered soils at all walls, foundations settlements are mostly short-term- expected to be nearly completed by end of construction, and long-term settlements are not of concern.

(5) The walls have min embedment depth of 4.0 feet to ensure the foundation extends below the frost depth while maintaining a minimum of 1 foot of cover below the ground surface.

(6) The engineering evaluations also included global stability of selected section of proposed CIP walls that are considered most critical based on wall heights, soil profiles, material properties and using the computer program SLIDE2 by Rocscience. Global stability was performed on most critical sections with walls 3, 4, 5A considered both

circular and non-circular slip surfaces for undrained and drained soil conditions. Given the grade difference of 2.0 feet in Wall 6, global stability of this wall is not of concern. The results of the global stability for selected sections within Walls 3, 4, and 5A are enclosed in **Appendix I** and summarized in Table 10. The calculated factors of safety exceed the required minimum factor of 1.5 and are satisfactory.

Table 9: Summary of CIP Design (see Appendix H)

Wall	Wall Sta.		Max. Wall Height, Ht (ft)	Found. Width, B (ft)	Vertical Bearing Pressure (ksf)		Factored Bearing Resistance (ksf)	Eccent-ricity, e/B (-)*	Sliding CDR	Settl. (in)
	From	To			Service	Strength				
3	30+00	32+20	11.19	9.0	1.51	1.99	5.40	0.0118	2.58	0.67
	32+20	34+00	12.12	9.0	1.70	2.19	7.10	0.0365	2.32	0.66
	34+00	35+10	11.52	9.0	1.60	2.06	6.40	0.0279	2.48	0.55
4	41+11.9	43+21.9	9.52	7.5	1.30	1.77	7.10	0.0171	2.18	0.40
							4.20	0.0321	2.33	0.32
5A	7+66.28	8+60	13.29	8.50	1.49	2.02	4.50	0.0573	2.41	0.52
	8+60	10+80	20.18	11.00	2.54	3.51	4.80	0.0511	1.81	1.21
	10+80	12+60	27.41	15.00	3.56	4.93	5.50	0.0612	1.81	1.41
	12+60	14+86.25	31.97	18.00	3.78	5.21	8.80	0.0424	1.61	3.73
6	6+00	11+50	8.5	7.00	1.06	1.37	2.80	0.0056	2.04	0.77

* Calculated (e/B) values are confirmed to be less than maximum permissible value of 1/3.

Table 10: Summary of Global Slope Stability Results of CIP Walls

Wall	H, ft	Total Stress (Undrained)		Effective Stress (Drained)	
		Circular	Non-Circular	Circular	Non-Circular
3	12.12	3.19	2.69	2.24	1.92
4	9.52	1.77	1.66	1.77	1.66
5A	16.68	4.23	3.53	2.41	2.15
	23.91	1.73	1.60	1.73	1.58
	28.47	2.16	1.76	1.68	1.57

6.2 Morgana Run Trail Replacement Bridge

(1) A new, three-sided arch top, 20-foot-span precast concrete units on concrete pedestals and spread mat footing will be constructed to replace the existing simple span bridge. The spread mat foundation will be 23.0-foot-wide.

(2) The bridge will be constructed in phases to replace the existing bridge. The abutment walls of the proposed replacement will be constructed inside the existing bridge consisting of an arch culvert, leaving a clear space of approximately 6.75 feet between the back of the new culvert wall and the existing abutment wall.

(3) The area between the arch culvert and the existing abutment walls, above the buried

frame, will be backfilled using ODOT Type C granular material. The backfill shall be placed in layers of not more than 6.0-inch in compacted thickness compacted to a minimum relative compaction of 95% of the Modified Proctor.

(4) The proposed bridge abutment walls will be supported on a single combined (rigid mat) supporting both abutment walls.

(5) Based on the soils encountered in the boring B-071-0-20, the reinforced concrete mat foundation will be supported mostly on approximately 18.0-foot-thick granular soil (medium dense sand, medium dense gravel and stone fragments and loose to dense silt), underlain by very stiff silt with some clay underlain by stiff to very stiff clay.

(6) Based on the soils encountered in the boring, the reinforced concrete slab foundation shall be designed based on the following parameters for the foundation soils:

Average SPT blow counts within the influence depth of the boring,
N_{60} = 15 bpf
Unit Weight = 120 pcf
Friction Angle, φ' = 32 degrees
Cohesion, c' = 0.0 psf

(7) Using these parameters, the factored bearing resistance is 20.9 ksf (see Appendix M), with a subgrade reaction modulus, conservatively taken as 200 pci. Given the geometry (dimensions and depths) of the proposed underpass and the calculation in Appendix M, the service and strength bearing pressures are 2.5 and 3.3 ksf, respectively. The factored bearing resistance is significantly higher than the estimated factored bearing pressure. Foundation bearing resistance and settlement of the mat supporting the arch underpass are of no concern.

(8) The underpass (culvert) walls will be subjected to lateral earth pressures produced by the retained fill. The lateral pressures shall be calculated based on a fill unit weight of 120 pcf, angle of internal friction (φ') of 30.0 degrees, interface friction angle of 14-degrees and zero cohesion. Based on these parameters, the recommended lateral earth pressure coefficient is Ka=0.303.

(9) All exposed foundation subgrades should be densified in-place by at least 4 to 6 overlapping passes with a minimum 10-ton drum roller operating vibratory mode. Any soft, loose, or otherwise unstable areas or unsuitable materials should be over-excavated to more competent material and replaced with a compacted load bearing fill.

(10) A temporary wire faced mechanically stabilized earth wall will be installed above the Type C backfill and Morgana Run Trail structure, and between the existing bridge abutments, with a height of 8 feet. As shown in the external stability calculations of the temporary wire wall in **Appendix M,** the minimum geogrid reinforcement length is 8 feet.

6.3 Foundation for CCTV

A 70-foot-tall CCTV pole is planned to be constructed at the approximate Sta. 197+35, 125 feet to the left side the IR 77, with an approximate ground surface elevation of 678.0. The pole material and foundation detailed are not available at the time this report was prepared. According to section 1203 of the ODOT Geotechnical Design Manual (GDM), the CCTV pole may consist of either (1)

metal pole bolted to a 30-inch diameter drilled shaft foundation or (2) precast fiber-reinforced spun concrete poles with the pole embedded into predrilled hole, backfilled with concrete, low strength mortar or polyurethan expanded foam (PEF) in accordance with Supplemental Provision 809. According to Section 1203 of ODOT GDM, if the soils within the pole foundation consist of cohesive soil with average SPT blow counts of 12 blow per foot or higher for a distance of 12 feet below proposed ground surface, then a 12-foot foundation embedment can be used by inspection.

Historic Boring B-002-0-11, which was drilled near the proposed pole revealed loose to medium dense granular soil within the upper 29 feet below existing ground surface. Accordingly, a custom foundation length shall be determined based on p-y (L-Pile) analyses given the standard loads provided in Section 1203 of the ODOT GDM. For this purpose, two sets of analyses were performed; one for the steel pole on 30-inch diameter drilled shaft and a second for the precast fiber-reinforced spin concrete option, considering service and strength limit loads. The deduced subsurface profile and material properties as well as the L-Pile analyses results and foundation fixity calculations, for the two alternatives, are provided in **Appendix L** of this report. The upper 3.5 feet of the foundation were ignored to account for frost depth. The analyses results L-Pile analysis results show that a 20-foot embedment depth does not achieve tip fixity. Increasing the embedment depth to 25 feet (including the 3.5 feet frost depth) results in negligible lateral movement at the ground surface level, with rigid pole conditions. However, the deformation at the tip of the pole foundation or shaft are insignificant. Accordingly, a 25-foot embedment is recommended for both pole options.

6.4 Excavations for Storm Water Pipes

(1) Based on the investigation finding, the encountered soils within anticipated storm water drainage depths are classified as Type C soils according to OSHA 29 CFR 1926. Open excavations in the natural soils should not be steeper than 1.5H:1V if dry and 2H:1V if submerged or where considerable wetness is observed.

(2) Permanent slopes on the order of 2H:1V or flatter are typically stable when adequately protected from erosion and surficial instability. Any proposed slopes steeper than 2H to 1V should be evaluated for global stability. If existing slopes need to be extended horizontally then the existing slopes should be benched prior to placing new fill to extend the existing slopes.

(3) The sidewalls of any confined excavations deeper than 4 ft must be sloped, benched or adequately shored per OSHA 29 CFR 1926 regulations. Trench boxes and/or sheeting could be used in conjunction with open cut slopes to permit access to confined excavations.

(4) Trenches and/or temporary excavations shall be designed based on a unit weight of 120 pcf with a friction angle of 30 degrees and zero cohesion.

6.5 Global Slope Stability of Proposed Grading

(1) Additional slope stability evaluations were performed for different areas of concern involving excavation or new fill at the following stations: STA. 78+00, 105+00, 122+00, 124+00 and 140+00. STA. 78+00, 105+00, and 140+00 were completed to analyze areas of the project where the existing slope requires a cut that will steepen a portion of the slope to a 2H:1V to facilitate the shoulder widening. STA. 122+00 and 124+00 were completed in areas where the existing slopes would receive additional fill to facilitate the shoulder widening - as a conservative approach, the fill benches were not

included for the embankment fill.

(2) Slope stability was performed using the computer program SLIDE2 by Rocscience which is based on the limiting equilibrium analyses methods. The analyses are based on the soil stratigraphy and material properties shown on the analyzed sections in **Appendix D**.

(3) The stability of the proposed embankments was performed using the limit equilibrium method to estimate a factor of safety (FS) against failure. The embankment is considered to be stable if the estimated FS meets or exceeds 1.3 (FS ≥ 1.3).

(4) For the fine grained (cohesive) soils, the "Drained-Undrained" strength type (model) was used, in which case Slide program would perform analyses considering both, undrained and drained strength parameters and provides the minimum factor of safety achieved from both cases.

The results of slope stability are provided in **Appendix J** and the minimum FS calculated for each section are summarized in **Table 11.**

Table 11: Summary of Predicted Minimum FOS for Slope Stability Analyses

Station	Factor of Safety		Min. Allowed FS
	Circular	Non-circular	
77+25	1.8	1.7	1.3
78+00	1.8	1.7	
105+00	2.5	2.4	
122+00	2.0	2.0	
124+00	2.2	2.2	
140+00	1.9	1.8	
141+75	1.5	1.4	

6.6 Sidehill Fill Benching

Because sidehill fills are planned on the face of existing flatter slopes in portions of the project steeper than 4H:1V (e.g., at STA. 122+00 and 124+00 as previously discussed), it is recommended that benching be used to assure the embankment is "knitted" together and to prevent creation of a potentially weak continuous plane at the sloping interface between the existing surface and the new fill. Although the slope stability analysis presented above indicate that special benching is not required in order to achieve acceptable FS, as good engineering practice it is recommended that the new fill be benched into the existing slope to create a "stair-stepping" surface to improve stability by inhibiting the development of a contiguous shear plane along the interface.

The guidance for standard specification benched embankment construction provided in the ODOT Construction and Material Specifications, Item 203.05 and ODOT's GDM Section 800 "Special Benching and Sidehill Embankment Fills" should be followed. Regarding standard specification

benched embankment construction, Item 203.05 states the following:

1. Scalp the existing slope according to Item 201.
2. Cut horizontal benches in the existing slope to a sufficient width to blend the new embankment with the existing embankment and to accommodate the placement, and compaction operations and equipment.
3. Bench the slope as the embankment is placed and compact into layers.
4. Begin each bench at the intersection of the existing slope and the vertical cut of the previous bench. Recompact the cut materials along with the new embankment.

The top of each bench – the horizontal distance between the top of the back slope and the final reconstructed slope face – shall be at least 8 feet wide to allow compaction and grading equipment to work on a level surface at any elevation from the bottom to the top of each bench. Note that the bottom bench should have the narrowest top.

6.7 Soil Corrosivity and Resistivity Potential

To evaluate the corrosion potential of the subsurface soils behind the proposed retaining walls, portions of composite soil samples encountered near the surface (0-10 ft bgs) were collected in several of the test borings and submitted to an accredited laboratory for corrosivity testing (including electrical resistivity, pH, chlorides, redox potential, sulfides, and sulfates). [This corrosion testing was originally completed as the type of retaining walls and the need for metal reinforcement straps were unknown at the time of drilling.] The results are summarized in Table 12 below.

Table 12: Results of Corrosivity Testing

Sample	Chloride (mg/kg)	Water Soluble Sulfates (mg/kg)	pH	Resistivity (ohm-cm)	Estimated Corrosivity Based on Resistivity	Estimated Corrosivity Based on Sulfates
B-042-0-20	505	50	8.55	715	Very Severely Corrosive	Negligible
B-043-0-20	390	4390	8.02	360	Very Severely Corrosive	Severe
B-044-0-20	1605	2410	8.01	145	Very Severely Corrosive	Severe
B-050-0-20	1665	1238	11.48	275	Very Severely Corrosive	Moderate
B-054-0-20	360	776	11.15	755	Very Severely Corrosive	Negligible
B-060-0-20	765	347	9.13	330	Very Severely Corrosive	Negligible
B-063-0-20	45	190	7.86	1960	Severely Corrosive	Negligible
B-067-0-20	135	80	7.95	1665	Severely Corrosive	Negligible

Table 12: Results of Corrosivity Testing

Sample	Chloride (mg/kg)	Water Soluble Sulfates (mg/kg)	pH	Resistivity (ohm-cm)	Estimated Corrosivity Based on Resistivity	Estimated Corrosivity Based on Sulfates
B-066-0-20	200	523	7.87	1470	Severely Corrosive	Negligible

mg/kg = milligrams per kilogram.

Many factors can affect the corrosion potential of soil including soil moisture content, resistivity, permeability and pH, as well as chloride and sulfate concentration. In general, soil resistivity, which is a measure of how easily electrical current flows through soils, is the most influential factor. Based on classification developed by William J. Ellis (1978), the approximate relationship between soil corrosiveness was developed as shown in Table 13 below.

Table 13: Relationship Between Soil Resistivity and Soil Corrosivity

Soil Resistivity (ohm-cm)	Classification of Soil Corrosiveness
0 to 900	Very Severely Corrosive
900 to 2,300	Severely Corrosive
2,300 to 5,000	Moderately Corrosive
5,000 to 10,000	Mildly Corrosive
10,000 to >100,000	Very Mildly Corrosive

Chloride and sulfate ion concentrations and pH appear to play secondary roles in affecting corrosion potential. High chloride levels tend to reduce soil resistivity and break down otherwise protective surface deposits, which can result in corrosion of buried metallic improvements or reinforced concrete structures. Sulfate ions in the soil can lower the soil resistivity and can be highly aggressive to Portland cement concrete (PCC) by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. Soils containing high sulfate content could also cause corrosion of the reinforcing steel in concrete. Table 4.2.1 of the American Concrete Institute (ACI, 2008) provides requirements for concrete exposed to sulfate-containing solutions as summarized in Table 14 below.

Table 14: Relationship Between Sulfate Concentration and Sulfate Exposure (Table 4.2.1 of ACI)

Water-Soluble Sulfate (SO_4) in soil, ppm	Sulfate Exposure
0 to 1,000	Negligible
1,000 to 2,000	Moderate
2,000 to 20,000	Severe
over 20,000	Very Severe

(For soil, 1 ppm = 1 mg/kg)

Acidity is an important factor of soil corrosivity. The lower the pH (the more acidic the environment), the higher the corrosivity will be with respect to buried metallic structures. As soil

pH increases above 7 (the neutral value), the soil is increasingly more alkaline and less corrosive to buried steel structures due to protective surface films which form on steel in high pH environments. A pH between 5 and 8.5 is generally considered relatively passive from a corrosion standpoint.

The laboratory electrical resistivity tests completed on the samples collected determined values of 145 and 1,960 ohm-centimeters, which indicates that the soil has a Severely Corrosive to Very Severely Corrosive potential to corrosivity to buried metal and uncoated steel.

Based on our previous experience and Table 4.2.1 of the ACI, it is our opinion that sulfate exposure to PCC may be considered negligible to severe for the soils sampled.

Because permanent CIP facing is proposed, design of the soldier pile beams when considering section loss due to corrosion is not required. However, protective coating will be applied to the soldier beam from the top of wall to a depth of 3 feet below the top of drilled shaft.

7. LIMITATIONS

This work has been done in accordance with our authorized scope of work and in accordance with generally accepted practice in the fields of geotechnical and foundation engineering. This warranty is in lieu of all other warranties either expressed or implied. Our conclusions and recommendations are based on the data revealed by this investigation. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project discussed herein and any changes in loads, structures, or locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review the relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problem, which may arise, from the misunderstanding or misinterpretation of this report or failure to comply with our recommendations.

8. REFERENCES

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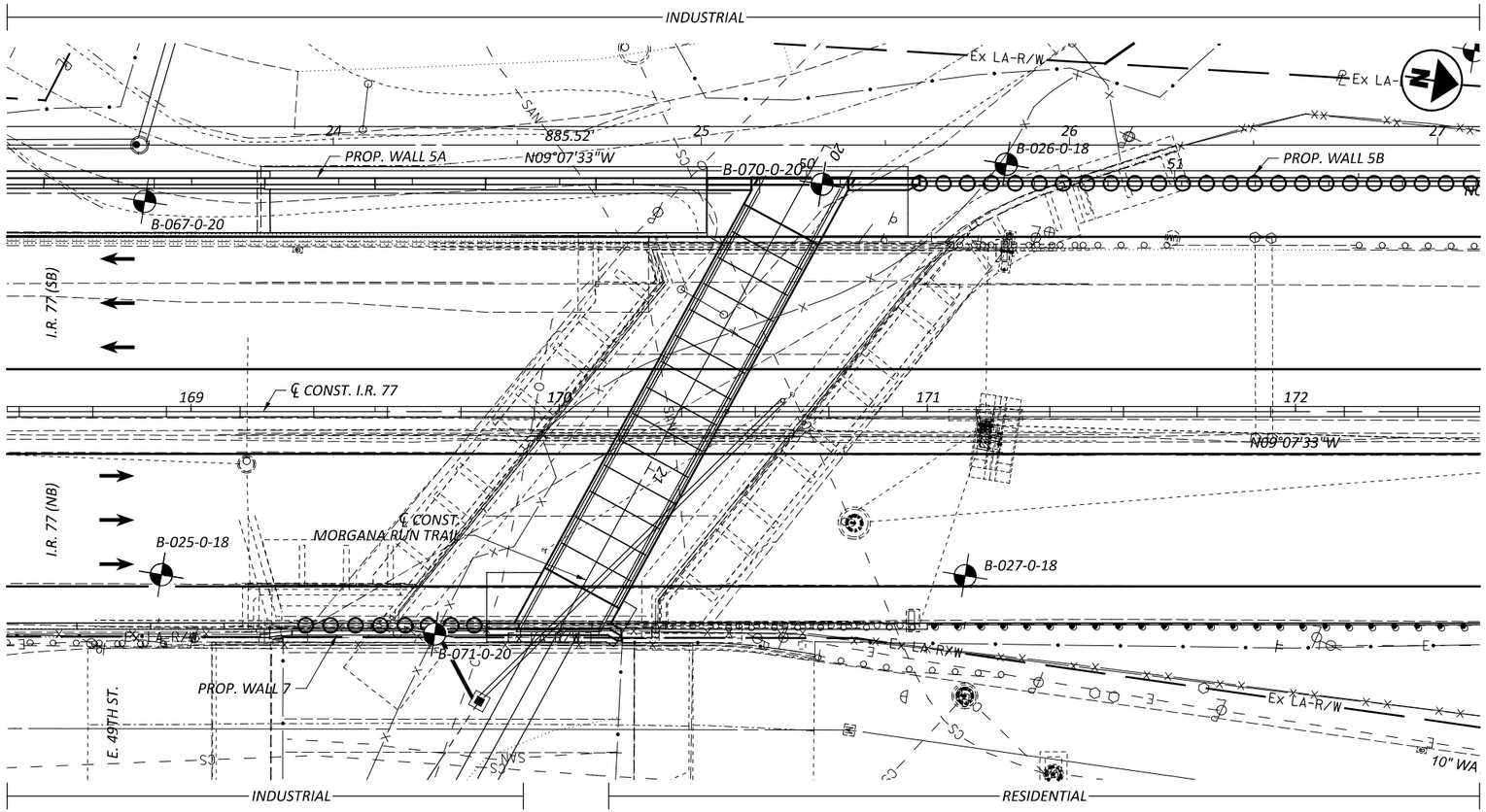
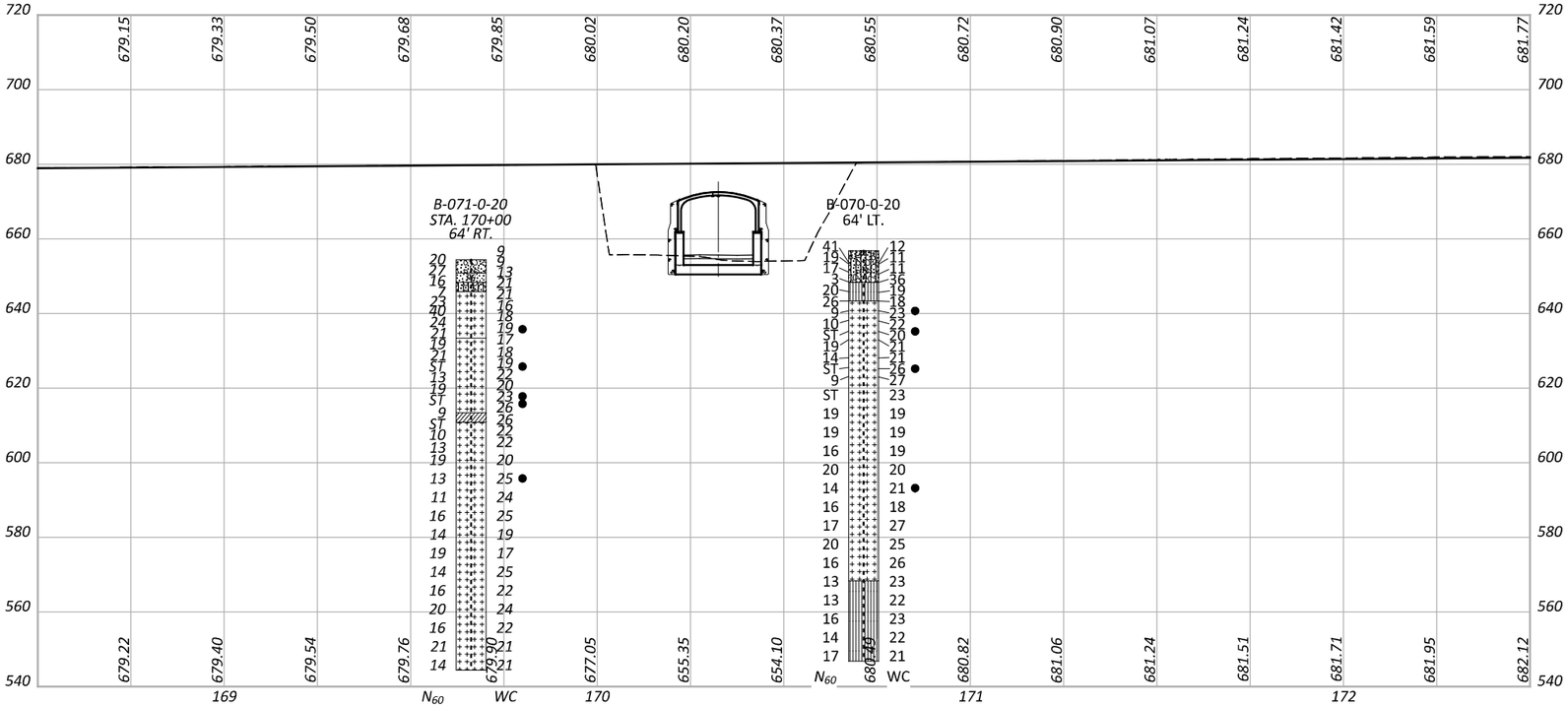
APPENDIX A
SOIL PROFILE SHEETS





NOTES

FOR BORING B-025-0-18 PROFILE, SEE SHEET 16.
FOR BORING B-026-0-18 PROFILE, SEE SHEET 35.
FOR BORING B-027-0-18 PROFILE, SEE SHEET 17.
FOR BORING B-067-0-20 PROFILE, SEE SHEET 34.

HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
BRIDGE NO. CUY-77-1322 OVER ABAND. W&LE RR (FUTURE MORGANA TRAIL)

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	21
TOTAL	85
SHEET	P.1210
TOTAL	P.1274

CUY-77-11.41

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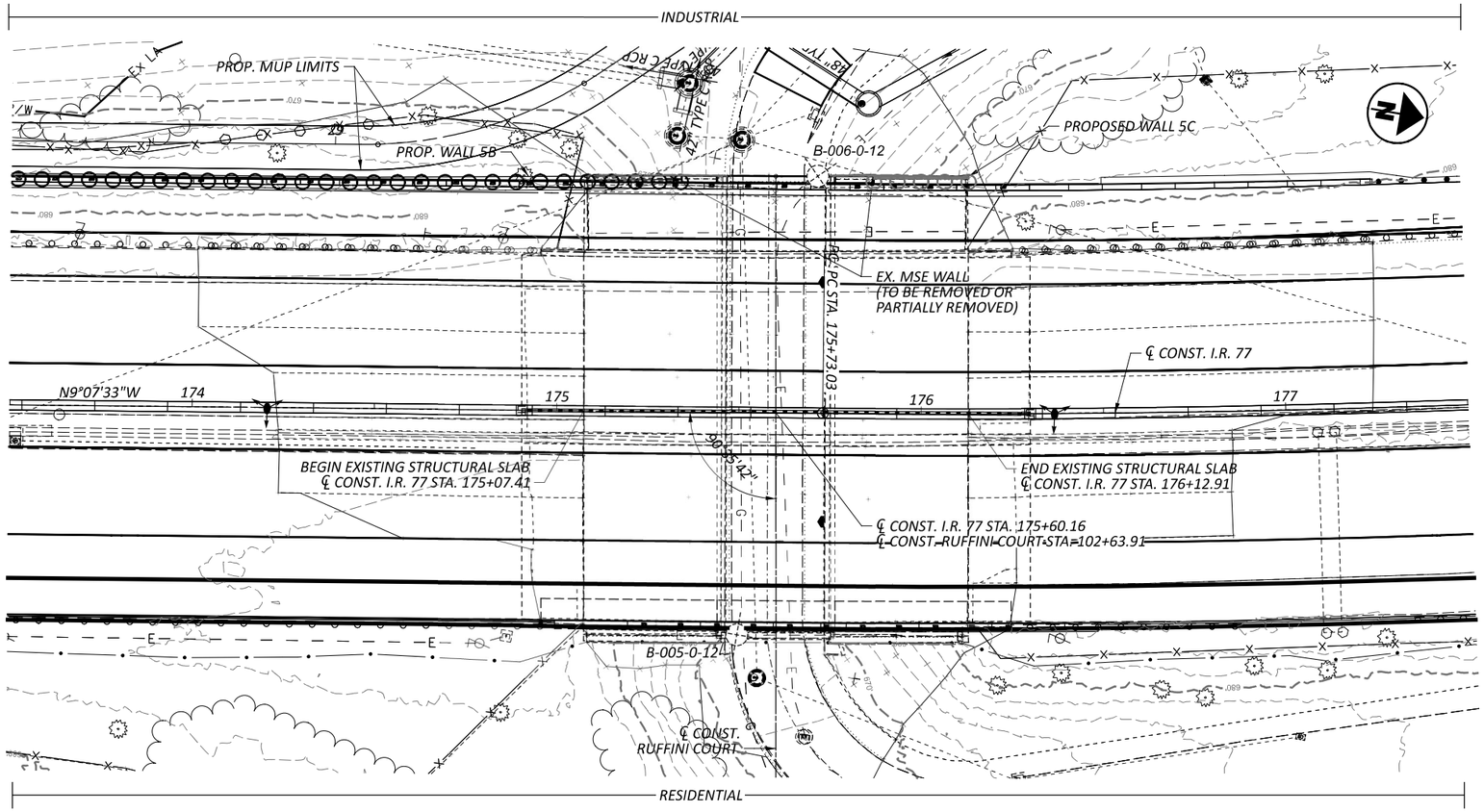
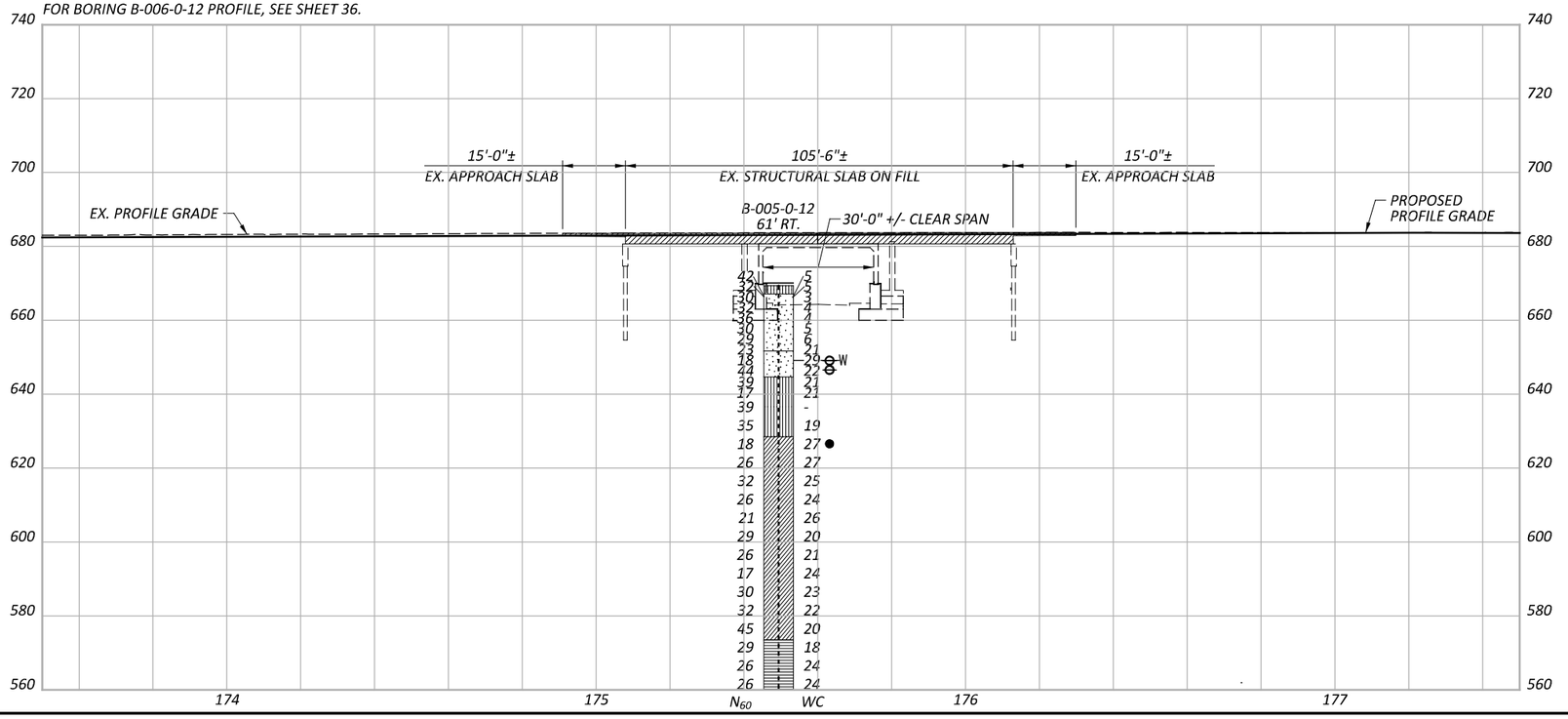


FOR BORING B-006-0-12 PROFILE, SEE SHEET 36.



HORIZONTAL
SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
BRIDGE NO. CUY-77-1331 OVER RUFFINI COURT

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET / TOTAL	22 / 85
SHEET / TOTAL	P.1211 / P.1274

CUY-77-11.41

MODEL: Sheet PAPERSIZE: 34x22 (in.) DATE: 7/1/2026 TIME: 5:08:05 PM PLTDRV: OHDOT_PDF.pltcfg PENTBL: OHDOT_Pen.tbl USER: NCaiazzo@trcsolutions.com WORKSPACE: OHDOTCE\02 WORKSET: 105743 PRODUCT: OpenRoadsDesigner 24.00.02.25
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INDUSTRIAL/COMMERCIAL

Ex Ex LA R/W
CONST. LIMITS
Ex LA
Ex LA R/W
Ex LA
Ex LA R/W
Ex LA
Ex LA R/W
Ex LA
BEGIN WALL 1A
℄ CONST. I.R. 77 STA. 84+30.13, 92.77' LT
℄ WALL 1A STA. 0+24.75
PROP. GRADING LIMITS
POT WALL 1A STA. 4+24.75
℄ CONST. I.R. 77 STA. 88+37.31, 69.30' LT
END WALL 1A
℄ CONST. I.R. 77 STA. 89+38.73, 61.33' LT
℄ WALL 1A STA. 5+24.75
B-001-0-02
℄ CONST. RAMP A3 AND E/P
N20°18'09"W
℄ WALL 1A
B-041-0-20
B-042-0-20
B-004-0-18
EX. ABUTMENT OF BRIDGE CUY-77-1169 (TO REMAIN)
℄ CONST. I.R. 77
307
308
309
310
311
85
86
87
88
89
700
710
720

FOR BORING B 004-0-18 PROFILE, SEE SHEET 10.

PROPOSED PAVEMENT ELEVATIONS AT TOE OF BARRIER
692.24 692.28 692.41 692.59 692.90 693.20 693.48 693.76 694.02 694.27 694.49 694.70 694.87 695.03 695.16 695.28 695.37 695.54 695.70 695.84 695.98

WALL 1A = 500.00' SOLDIER PILE RETAINING WALL
MEASURED ALONG FRONT FACE

PROPOSED GRADE AT BACK OF WALL
PROPOSED GRADE AT TOE OF BARRIER
EXISTING GROUND AT BACK OF WALL
TOP OF WALL
WALL 1A STA. 4+24.75
TOP OF WALL EL. 711.05
PROPOSED GRADE EL. 710.05
PROPOSED GRADE EL. 714.20
B-001-0-02
STA. 89+50
64' LT.

B-041-0-20
67' LT.
7'' ASPHALT
4.8'' AGGREGATE BASE

B-042-0-20
63' LT.
9'' ASPHALT

PROPOSED GRADE EL. 693.74
BOTTOM OF WALL 1A EL. 690.69
BOTTOM OF WALL 1A EL. 691.01
BOTTOM OF WALL 1A EL. 691.37
BOTTOM OF WALL 1A EL. 692.40
BOTTOM OF WALL 1A EL. 692.69
BOTTOM OF WALL 1A EL. 692.96
BOTTOM OF WALL 1A EL. 693.20
BOTTOM OF WALL 1A EL. 693.57
BOTTOM OF WALL 1A EL. 694.10
BOTTOM OF WALL 1A EL. 694.28
EXISTING ABUTMENT BOTTOM OF FOOTING EL. 689.4 +/-

N_{60} WC

EXISTING GROUND ELEVATIONS AT BACK OF WALL
694.55 694.45 694.43 694.46 694.89 695.66 696.44 696.74 696.63 697.28 697.42 697.51 698.13 699.35 700.70 702.19 703.26 702.97 703.60 703.30

780 760 740 720 700 680 660 640 620 600

0 1 2 3 4 5

HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 1A

DESIGN AGENCY
TRC

DESIGNER NMC
REVIEWER SDM 05/01/26
PROJECT ID 105743
SUBSET 23 | TOTAL 85
SHEET P.1212 | TOTAL P.1274

CUY-77-11.41

MODEL: Sheet PAPERSIZE: 34x22 (in.) DATE: 7/1/2026 TIME: 5:08:36 PM PLTDRV: OHDOT_PDF.pltcfg PENTBL: OHDOT_Pen.tbl USER: NCalazzo@trcsolutions.com WORKSPACE: OHDOTCEv02 WORKSET: 105743 PRODUCT: OpenRoadsDesigner 24.00.02.25
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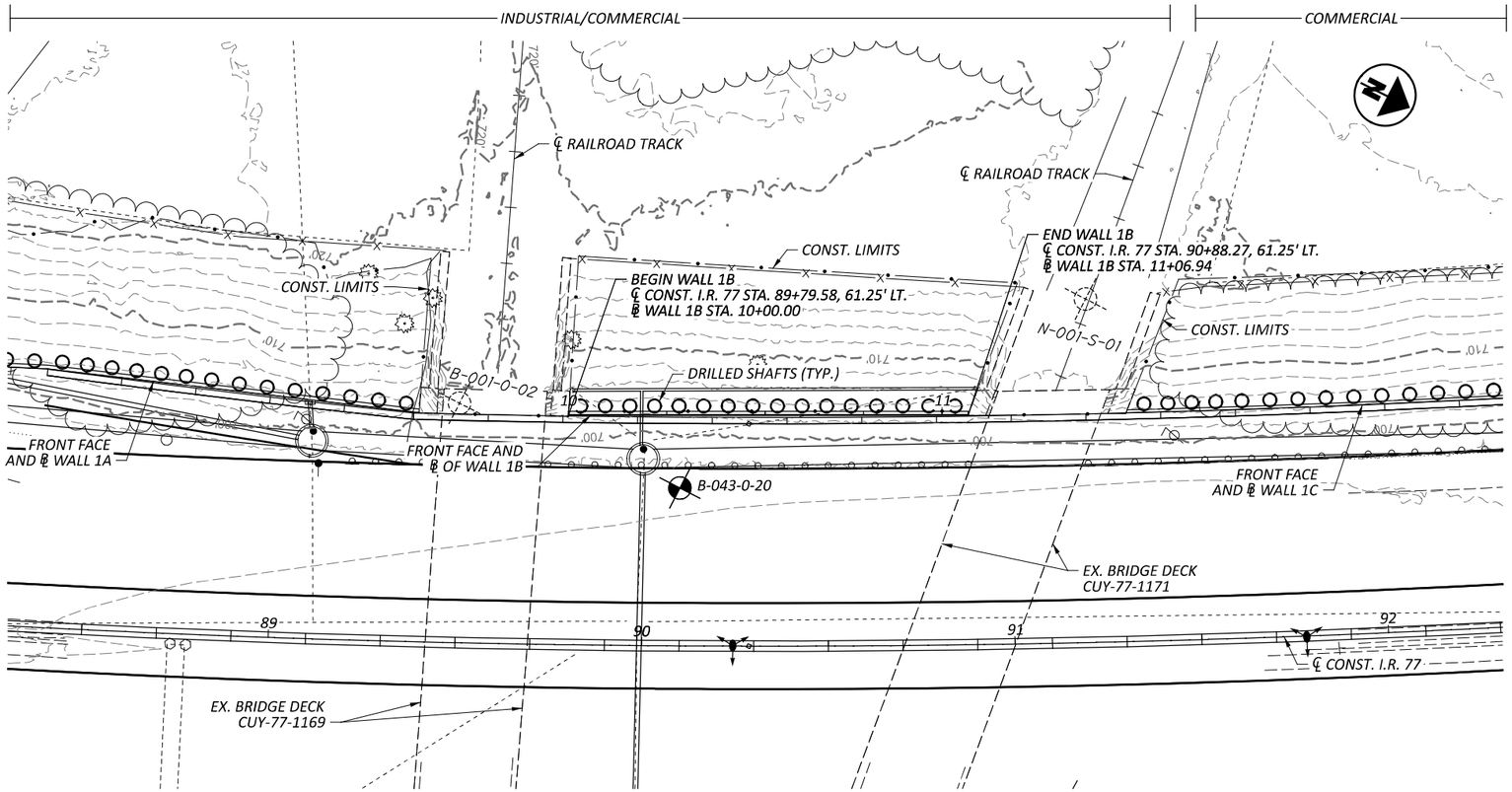
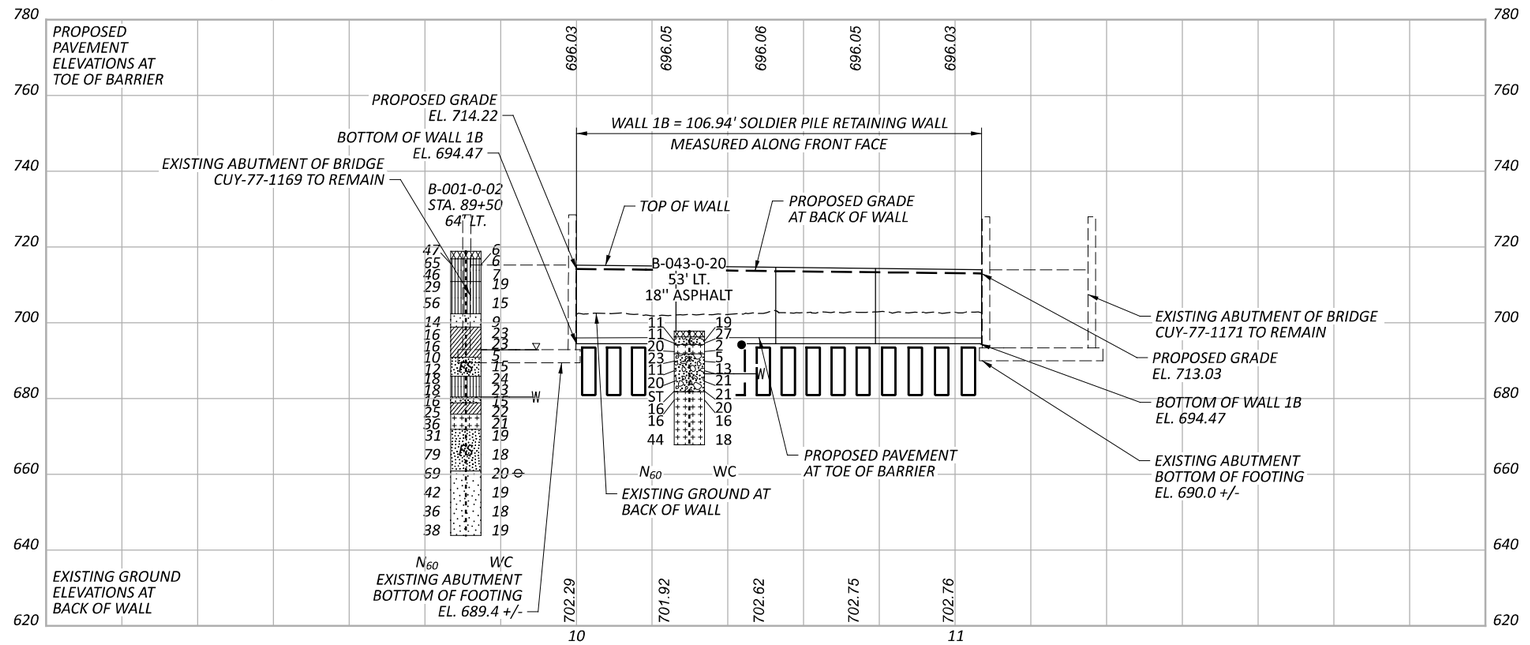


FOR BORING N-001-2-01 PROFILE, SEE SHEET 25.



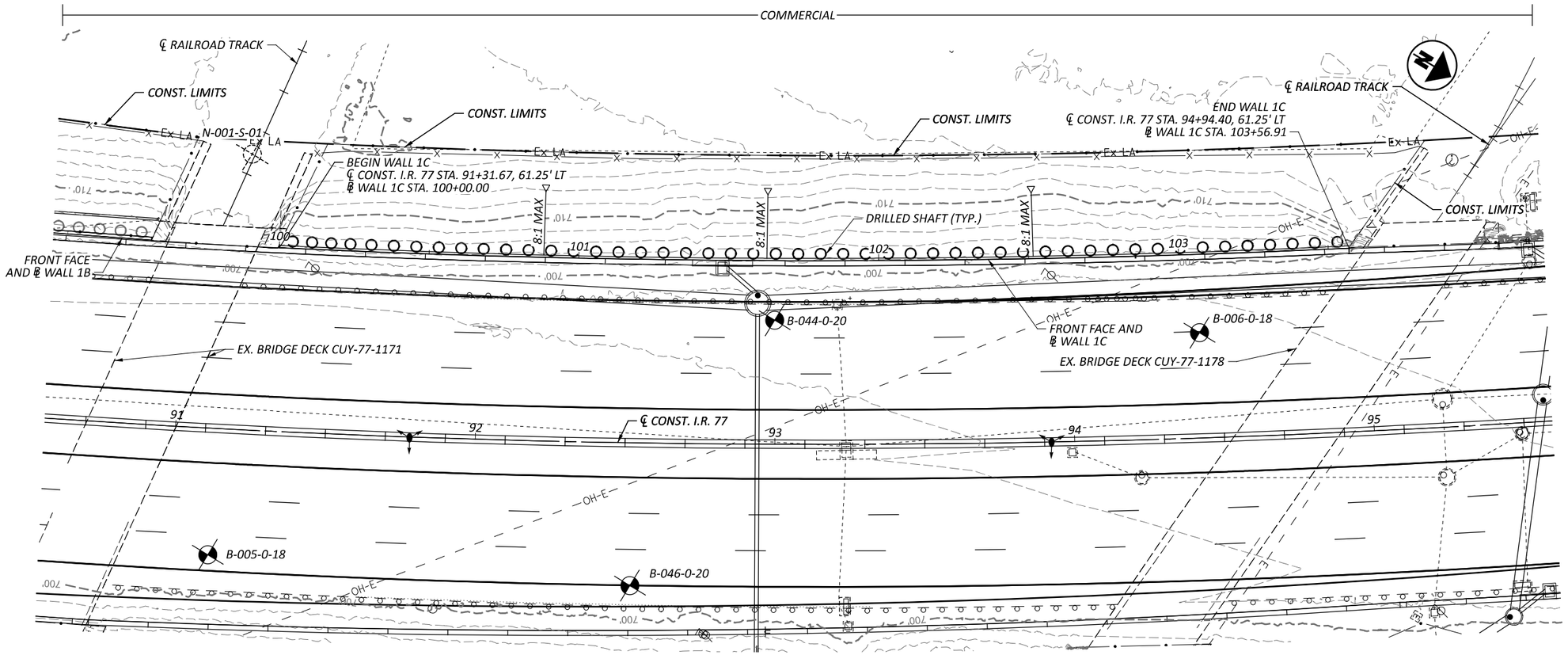
GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 1B

HORIZONTAL SCALE IN FEET
0 10 20 40

CUY-77-11.41

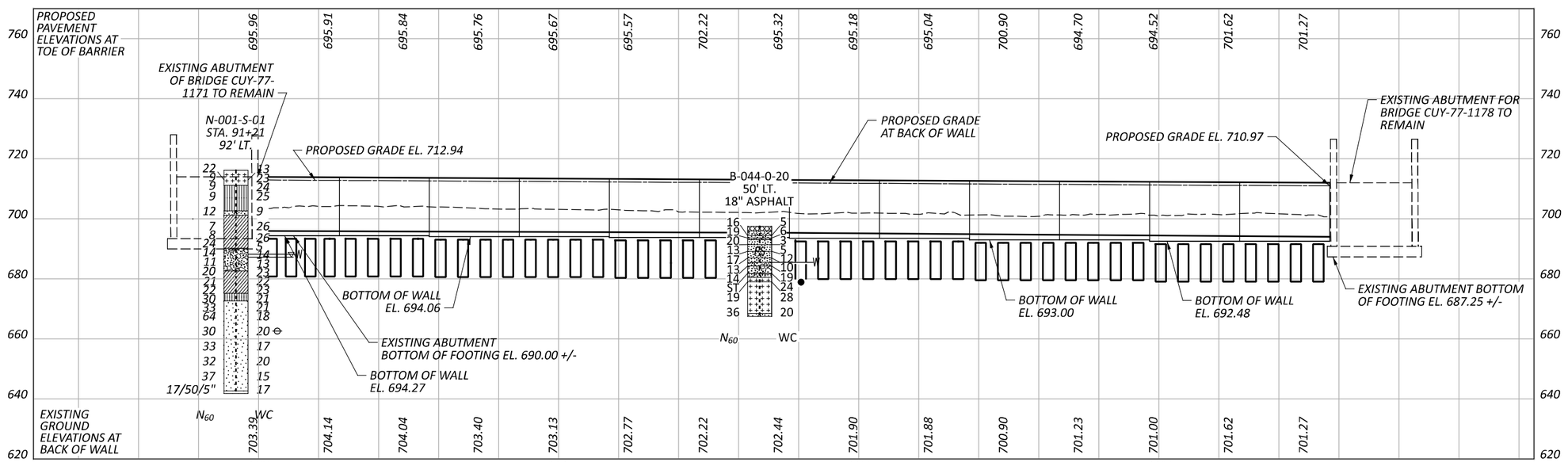
DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET / TOTAL	24 / 85
SHEET / TOTAL	P.1213 / P.1274



PLAN

FOR BORING B-005-0-18 AND B-006-0-18 PROFILES, SEE SHEET 10.
FOR BORING B-046-0-20 PROFILE, SEE SHEET 29.



PROFILE

HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE RETAINING WALL 1C

DESIGN AGENCY TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET / TOTAL	25 / 85
SHEET / TOTAL	P.1214 / P.1274

CUY-77-11.41

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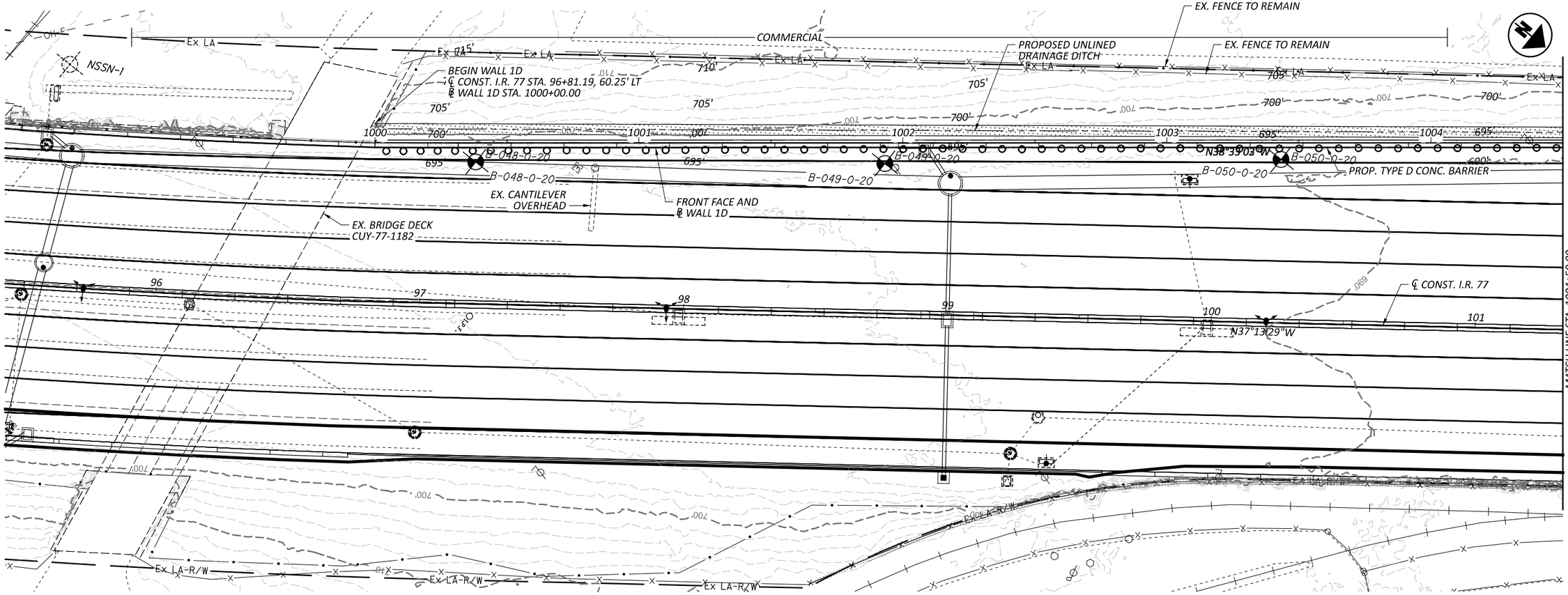
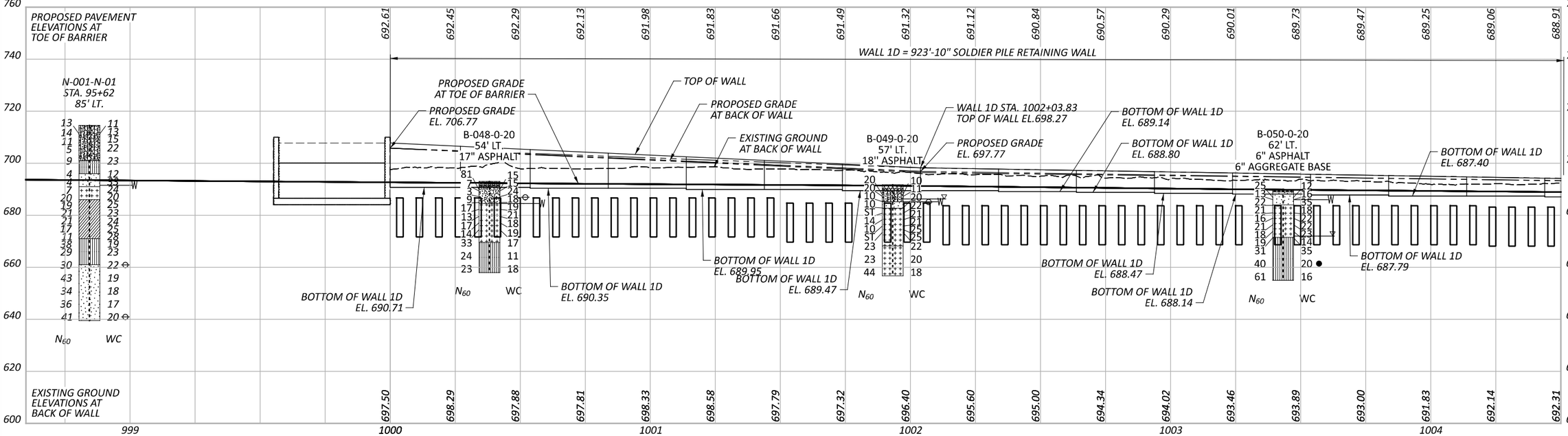
CUY-77-11.41



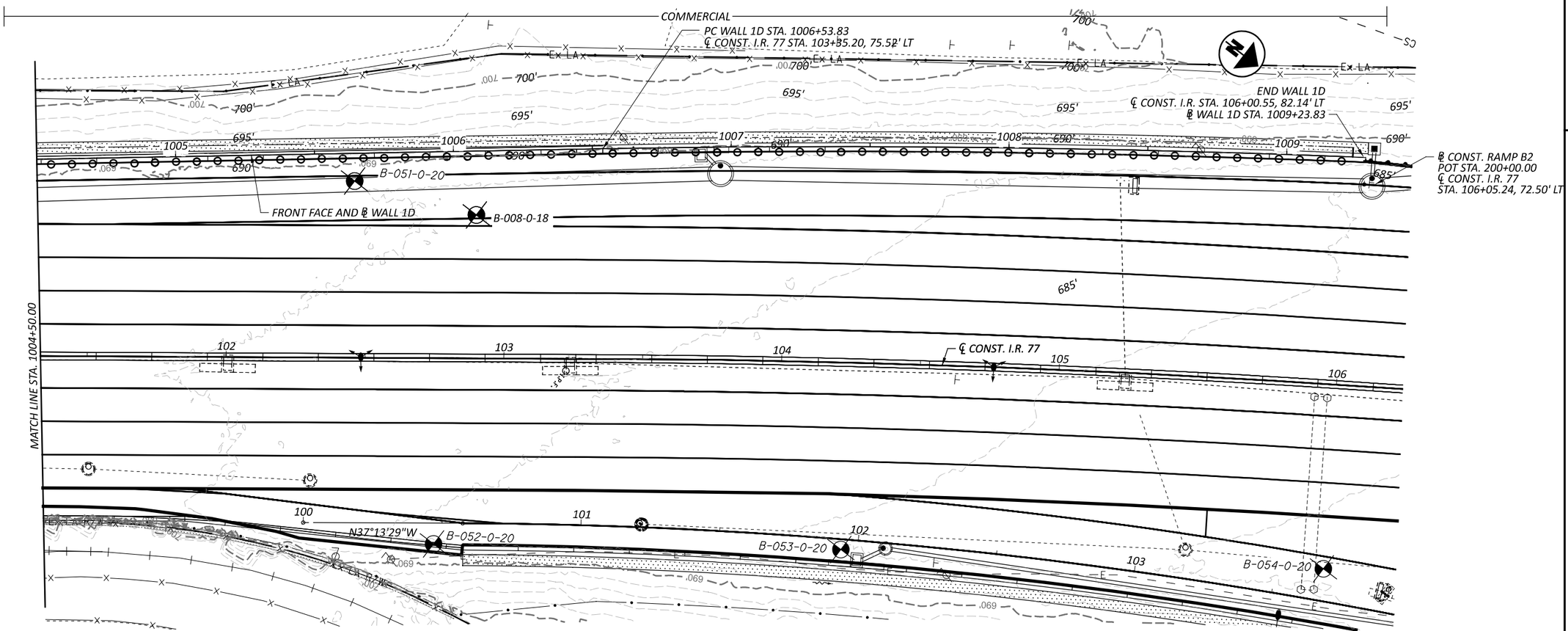


HORIZONTAL SCALE IN FEET
0 10 20 40

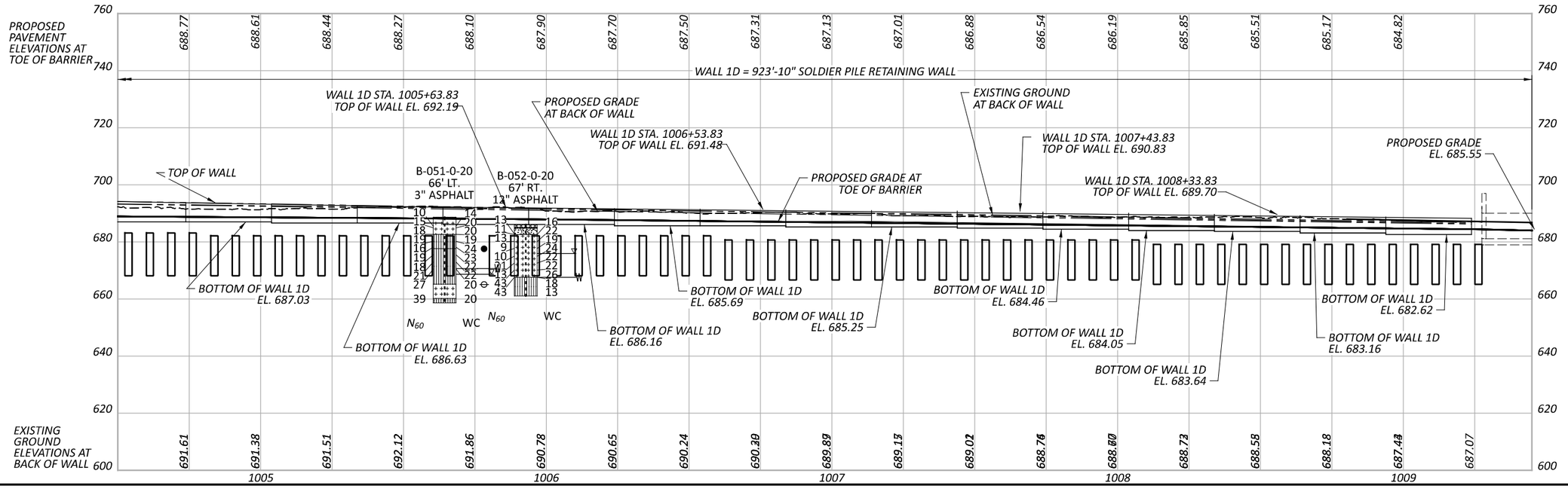
GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 1D

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	26
TOTAL	85
SHEET	P.1215
TOTAL	P.1274



FOR BORING B-008-0-18 PROFILE, SEE SHEET 11.
FOR BORING B-053-0-20 AND B-054-0-20 PROFILES, SEE SHEET 30.



HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE -STRUCTURE
RETAINING WALL 1D

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	TOTAL
27	85
SHEET	TOTAL
P.1216	P.1274

CUY-77-11.41

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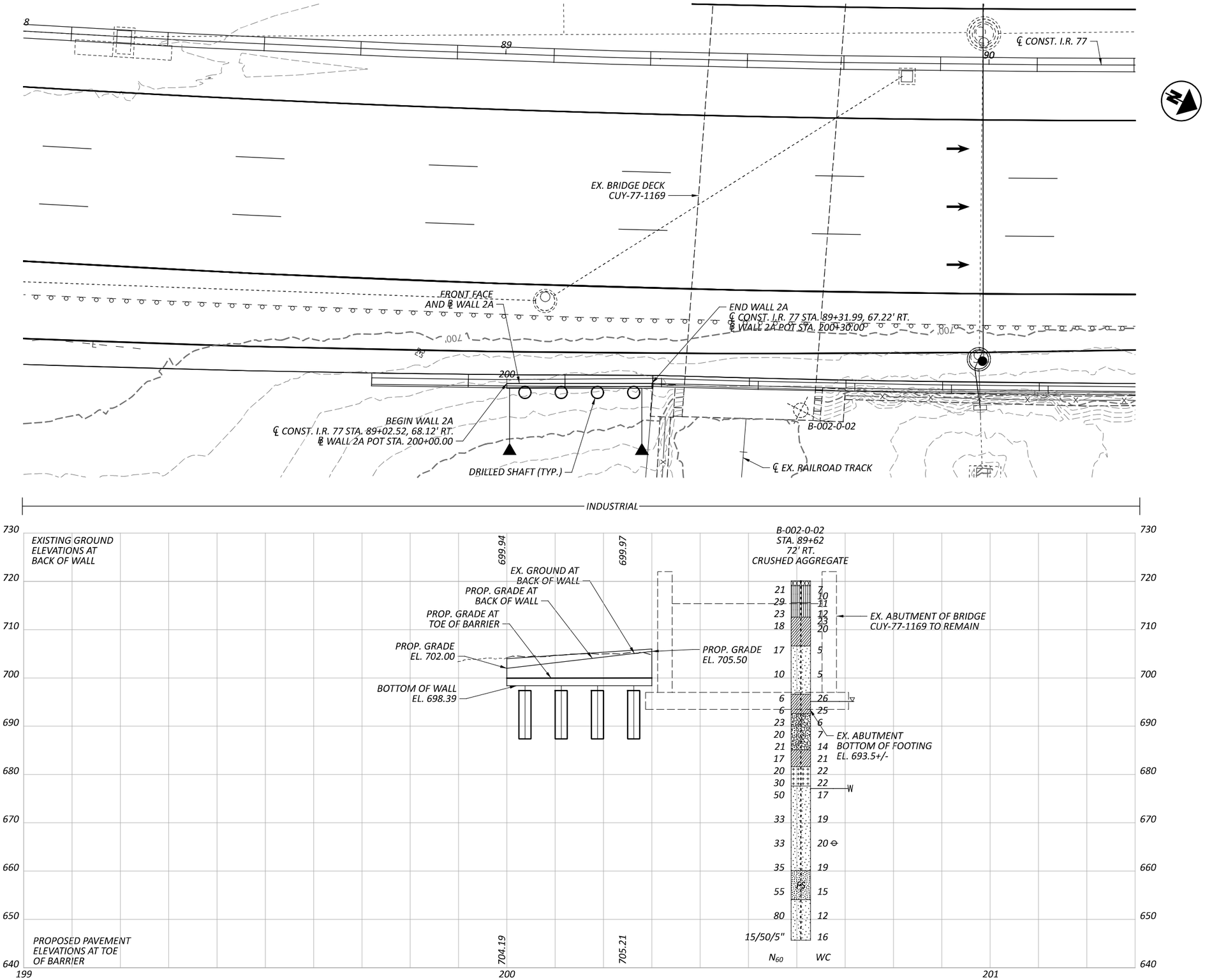
CUY-77-11.41



HORIZONTAL
SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 2A

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET / TOTAL	28 / 85
SHEET / TOTAL	P.1217 / P.1274

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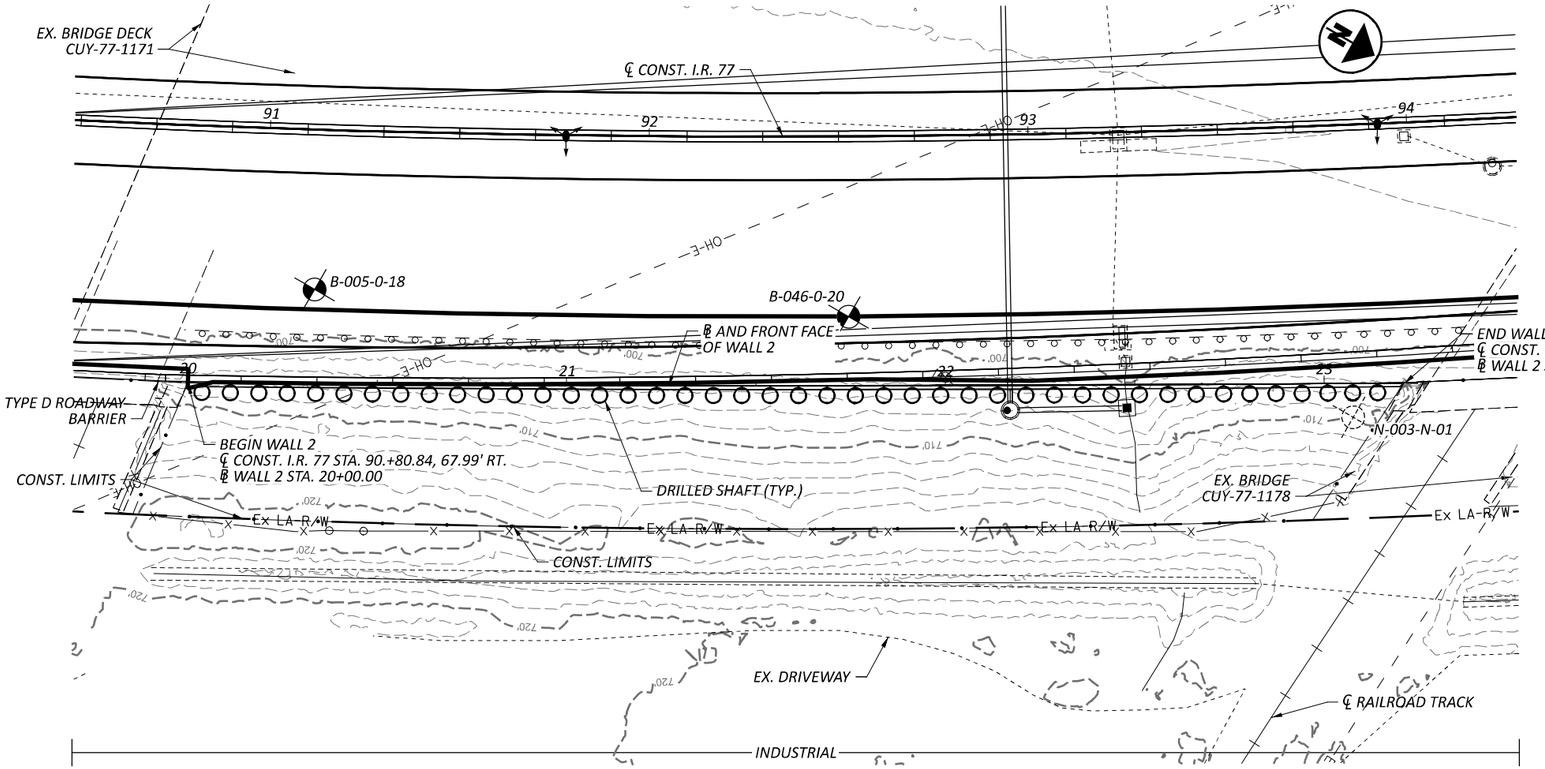
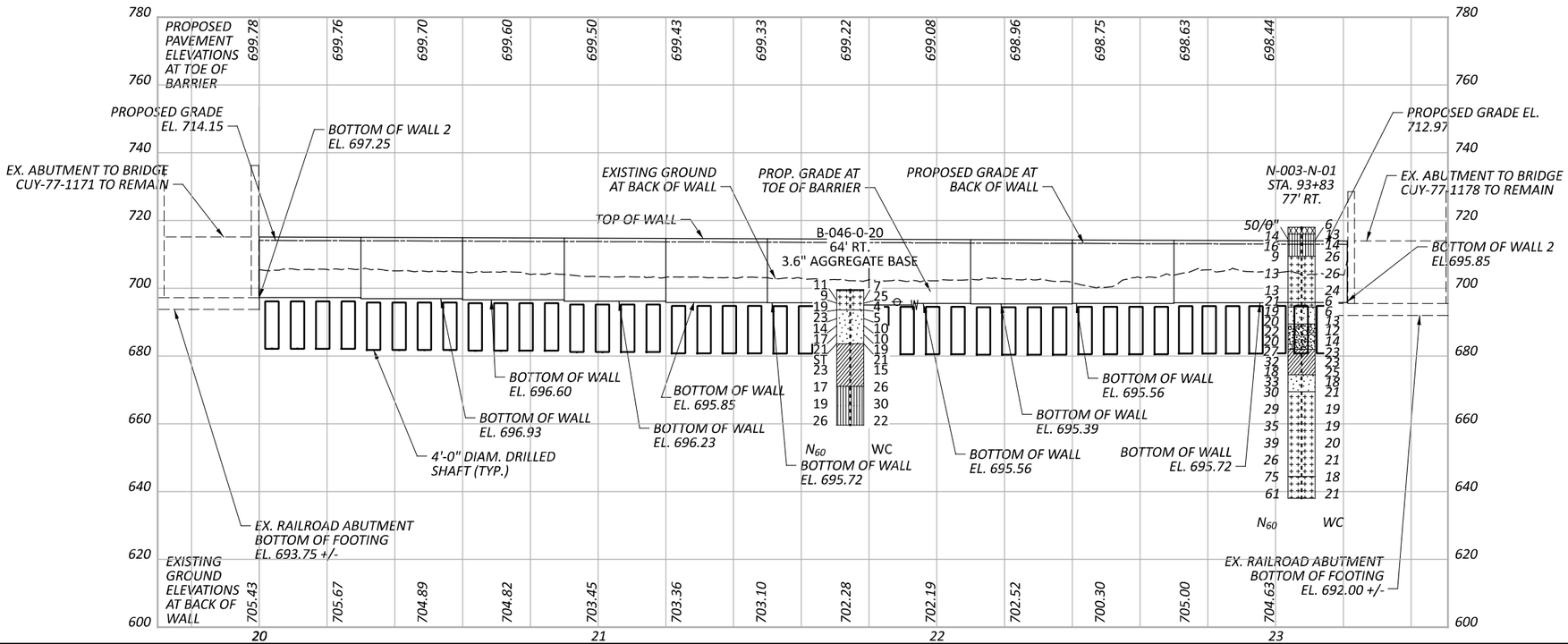


FOR BORING B-005-0-18 PROFILE, SEE SHEET 10.

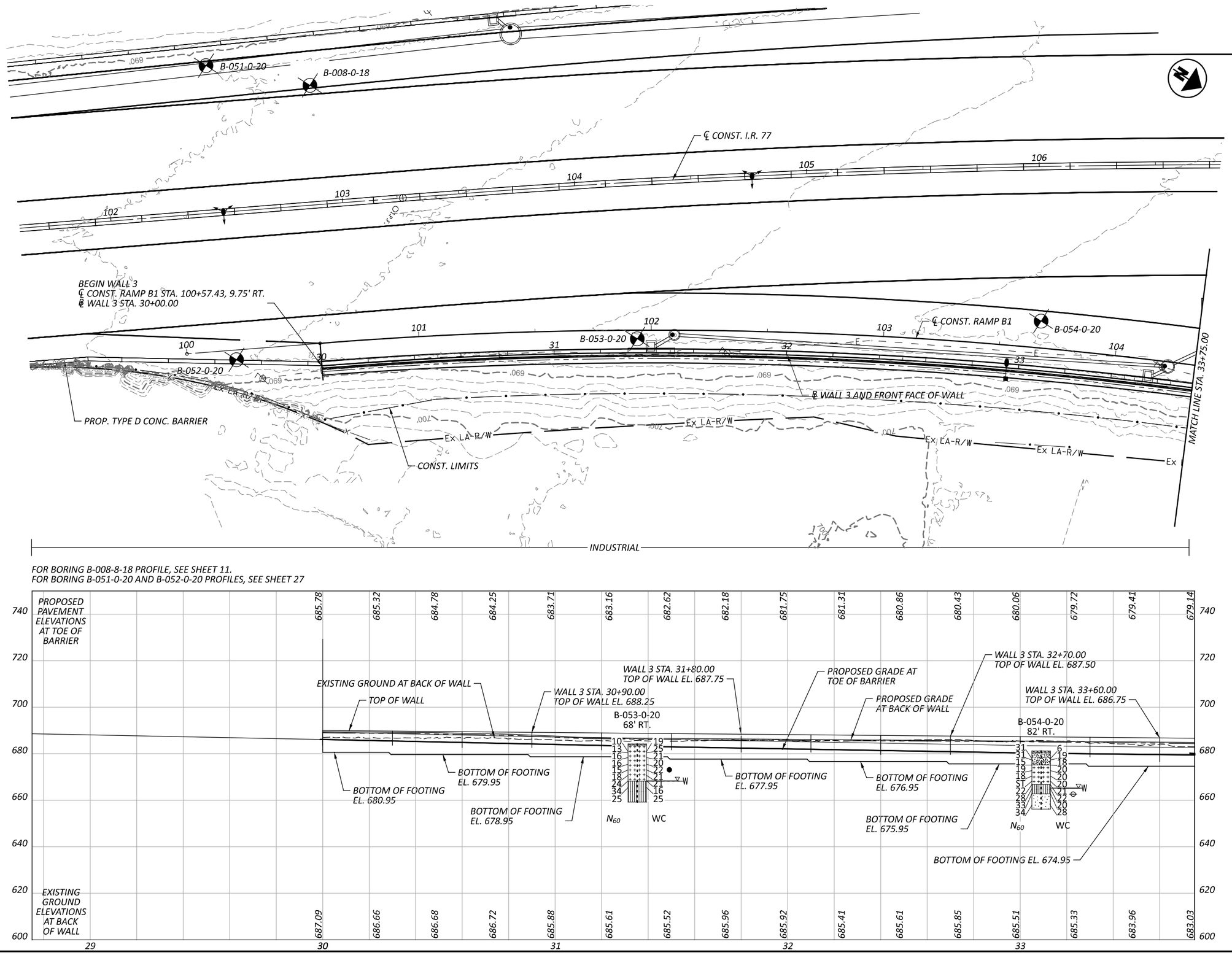


HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE RETAINING WALL 2

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	29
TOTAL	85
SHEET	P.1218
TOTAL	P.1274



HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 3

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	30
TOTAL	85
SHEET	P.1219
TOTAL	P.1274

CUY-77-11.41

MODEL: Sheet PAPERSIZE: 34x22 (in.) DATE: 7/1/2026 TIME: 5:11:14 PM PLTDRV: OHDOT_PDF.pltcfg PENTBL: OHDOT_Pen.tbl USER: NCaiazzo@trcsolutions.com WORKSPACE: OHDOTCEv02 WORKSET: 105743 PRODUCT: OpenRoadsDesigner 24.00.02.25
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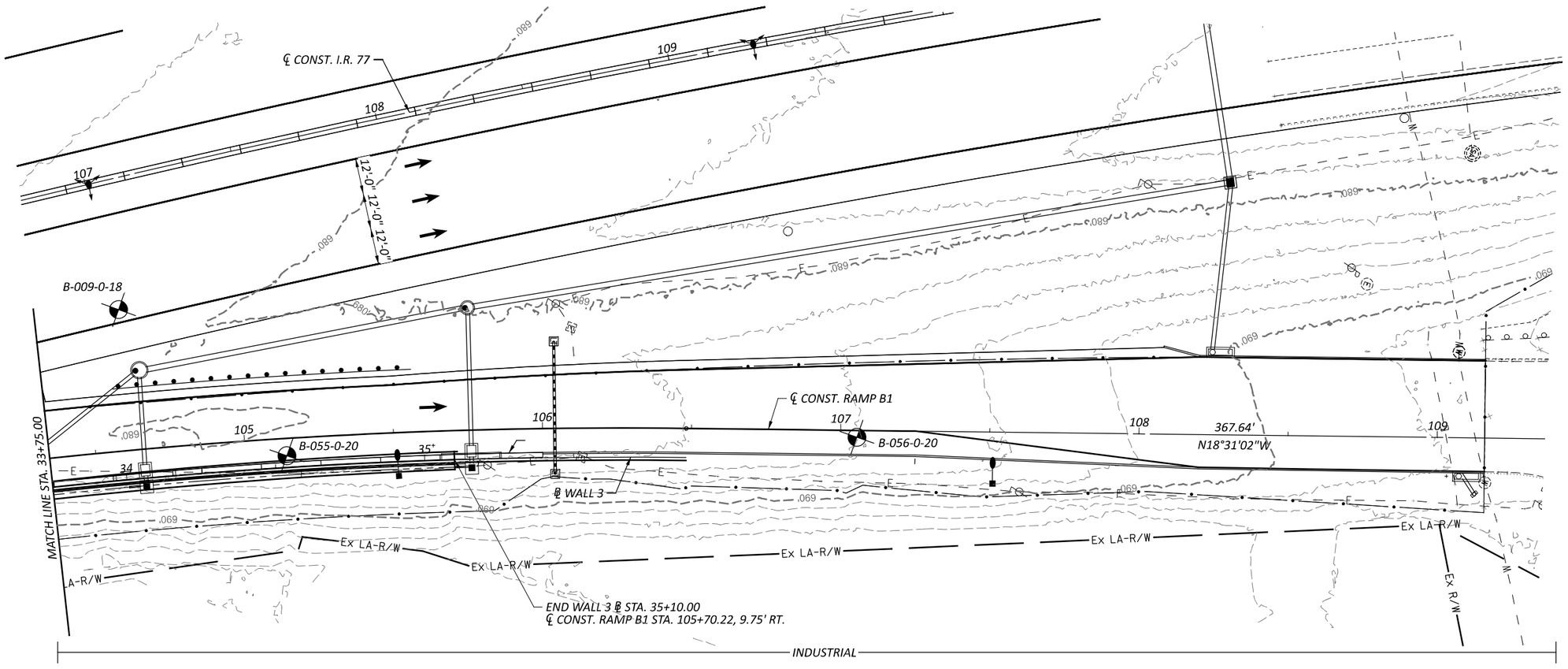
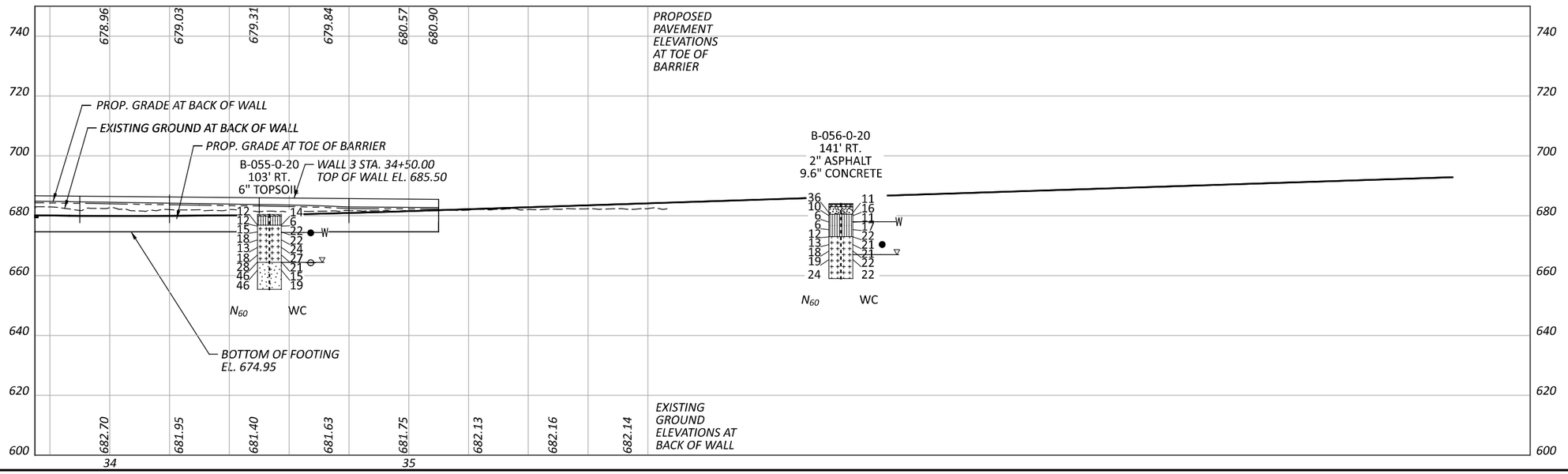


FOR BORING B-009-0-18 PROFILE, SEE SHEET 11.



HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 3

DESIGN AGENCY
TRC

DESIGNER NMC
REVIEWER SDM 05/01/26
PROJECT ID 105743
SUBSET 31 | TOTAL 85
SHEET P.1220 | TOTAL P.1274

CUY-77-11.41

MODEL: Sheet PAPERSIZE: 34x22 (in.) DATE: 7/1/2026 TIME: 5:11:32 PM PLTDRV: OHDOT_PDF.pltcfg PENTBL: OHDOT_Pen.tbl USER: NCaiazzo@trcsolutions.com WORKSPACE: OHDOTCE\02 WORKSET: 105743 PRODUCT: OpenRoadsDesigner 24.00.02.25
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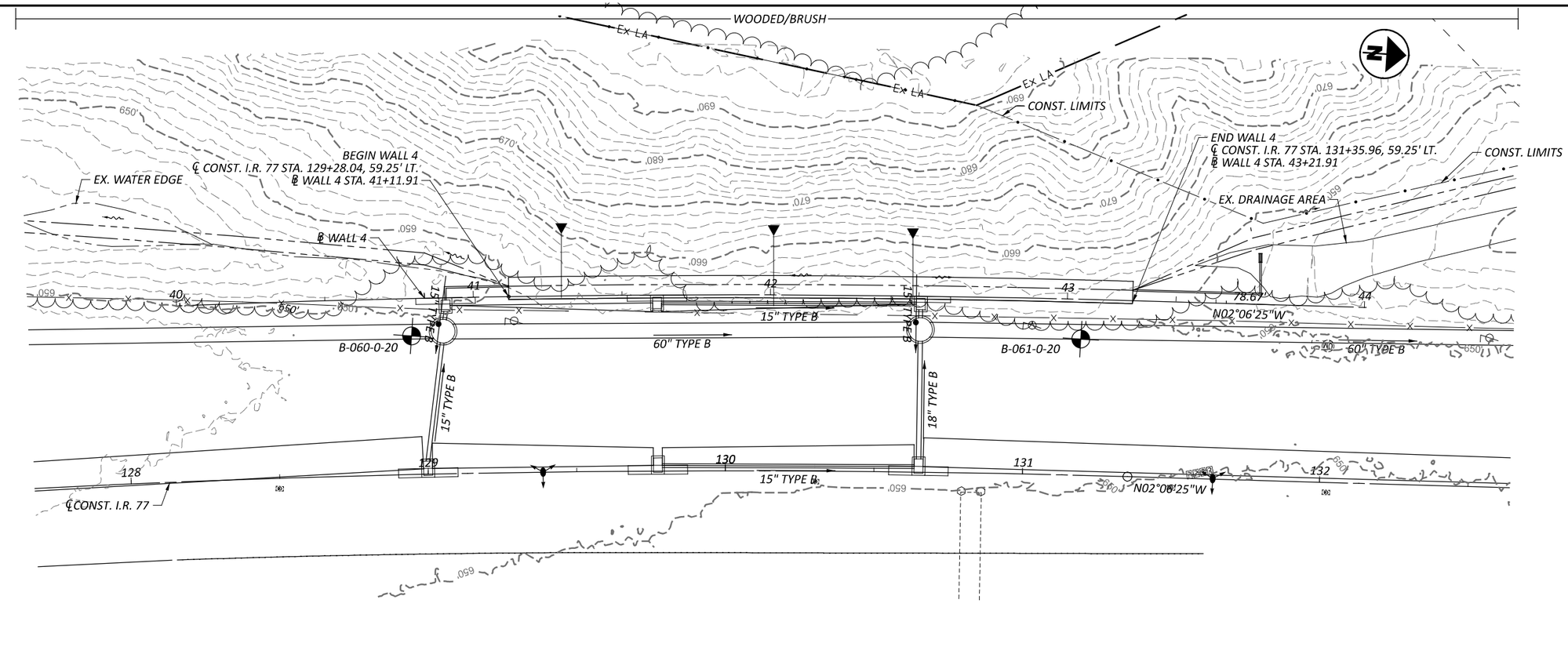

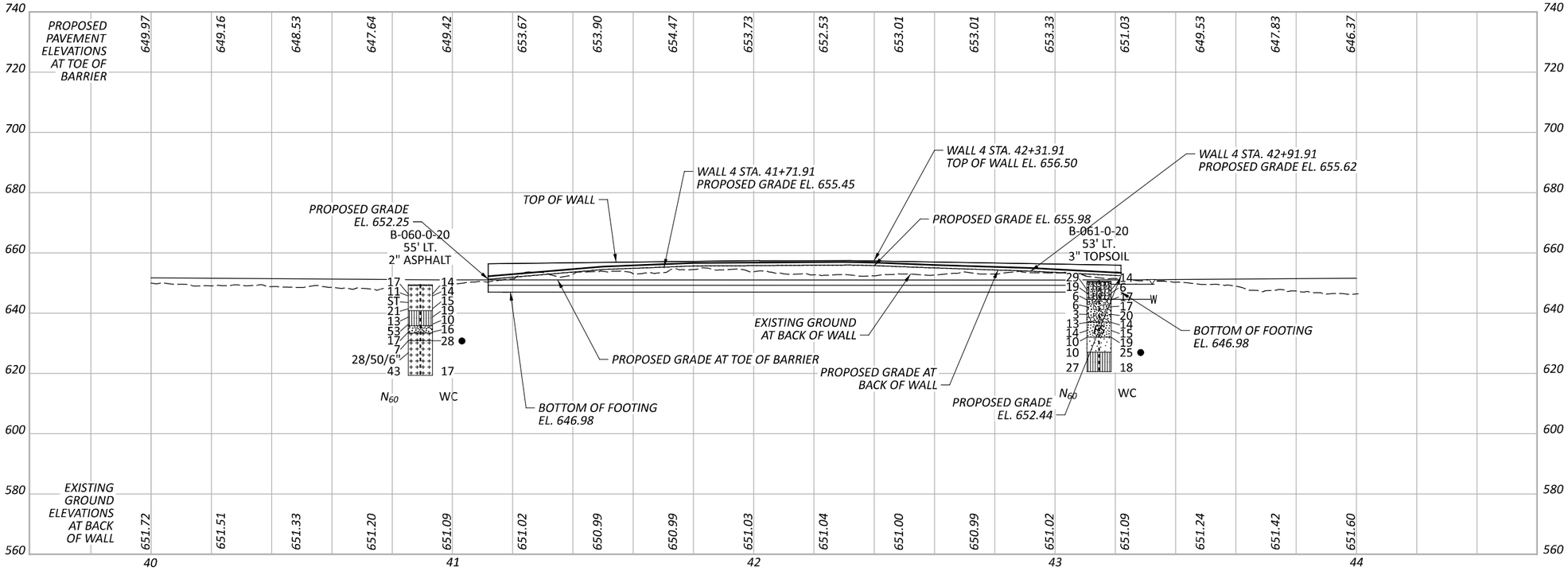

HORIZONTAL
SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 4

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	32
TOTAL	85
SHEET	P.1221
TOTAL	P.1274

CUY-77-11.41

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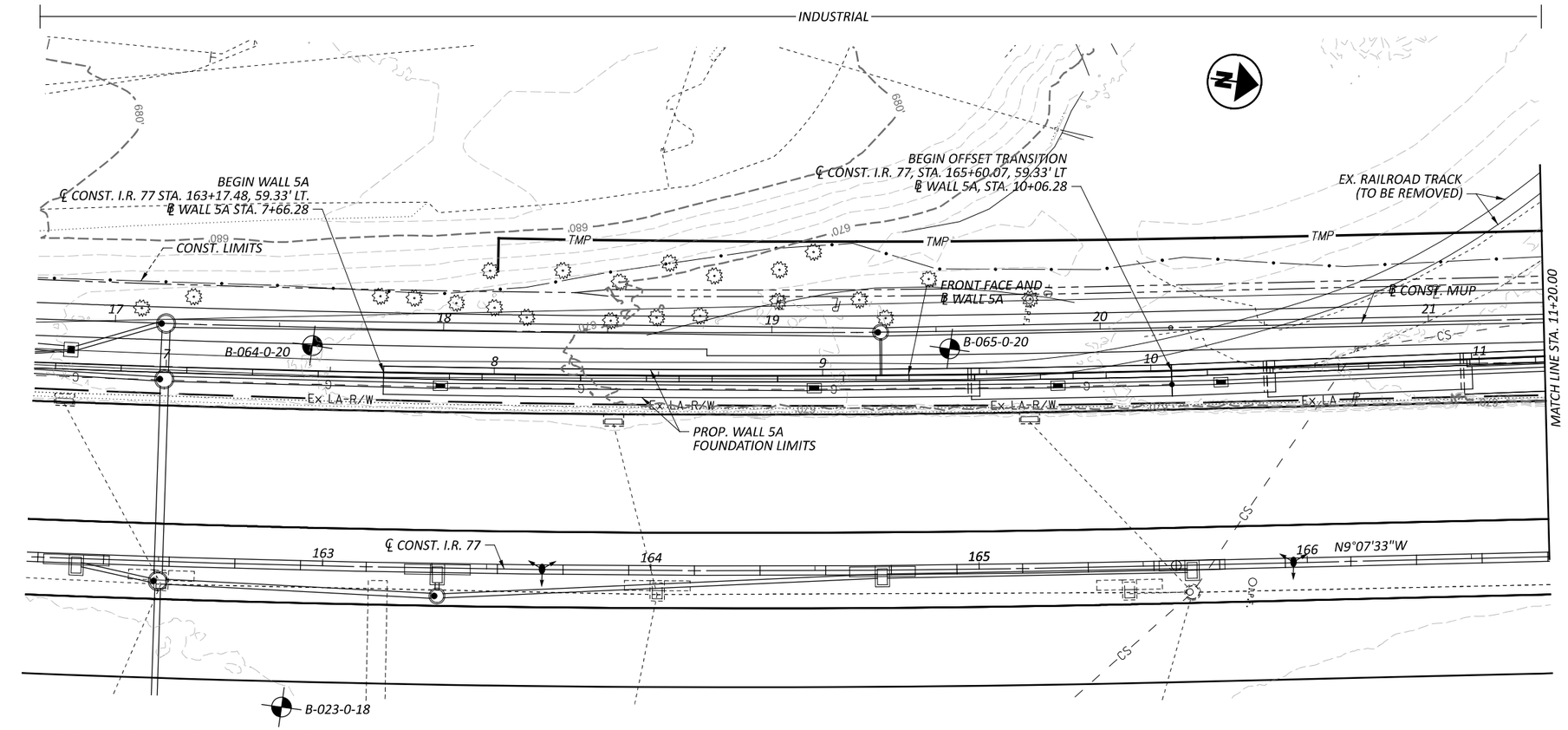

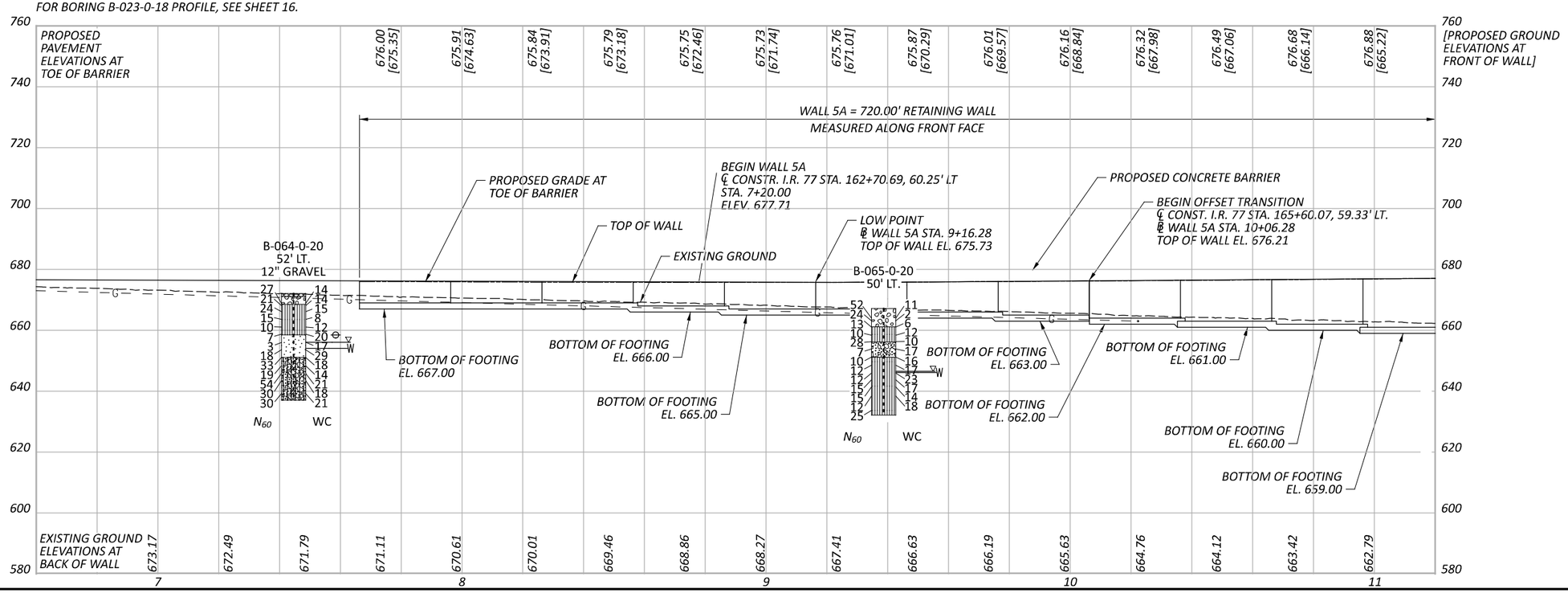

HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 5A

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	33
TOTAL	85
SHEET	P.1222
TOTAL	P.1274

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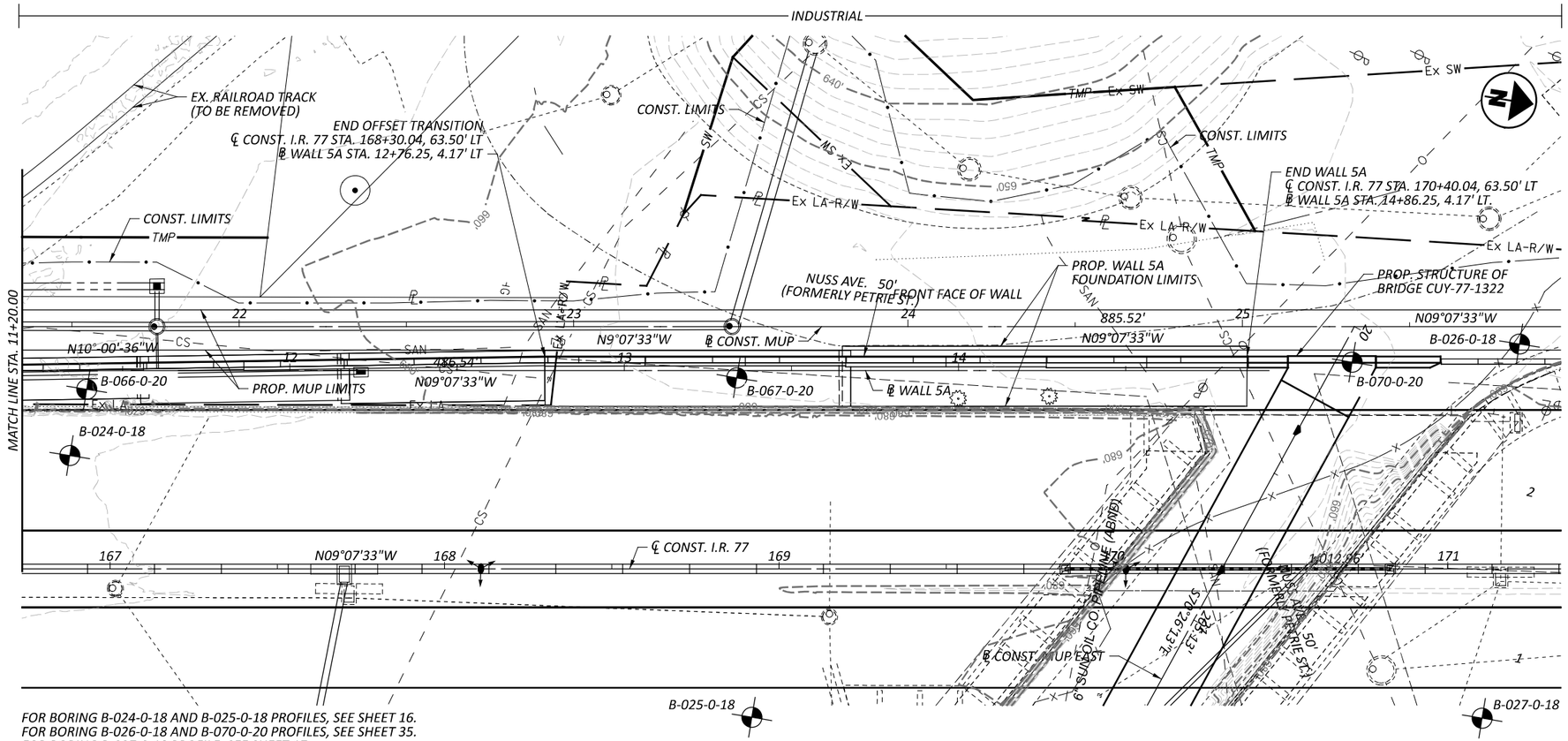

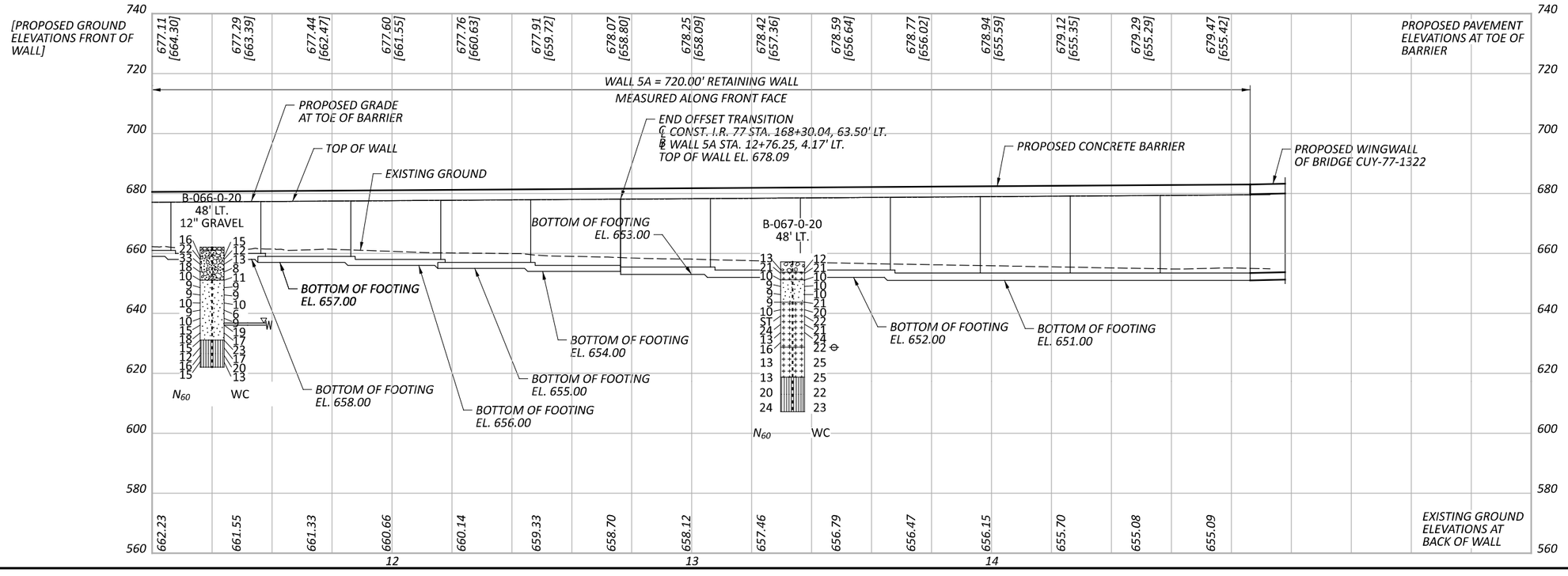

HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE RETAINING WALL 5A

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	34
TOTAL	85
SHEET	P.1223
TOTAL	P.1274

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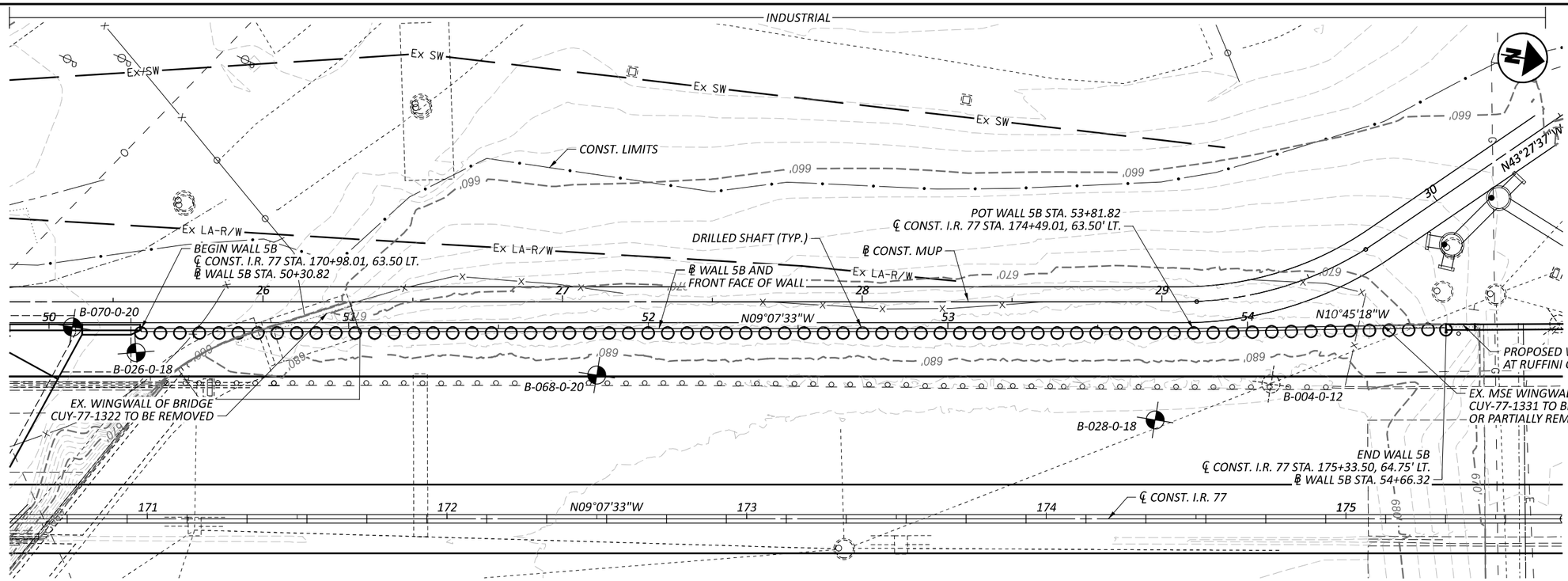
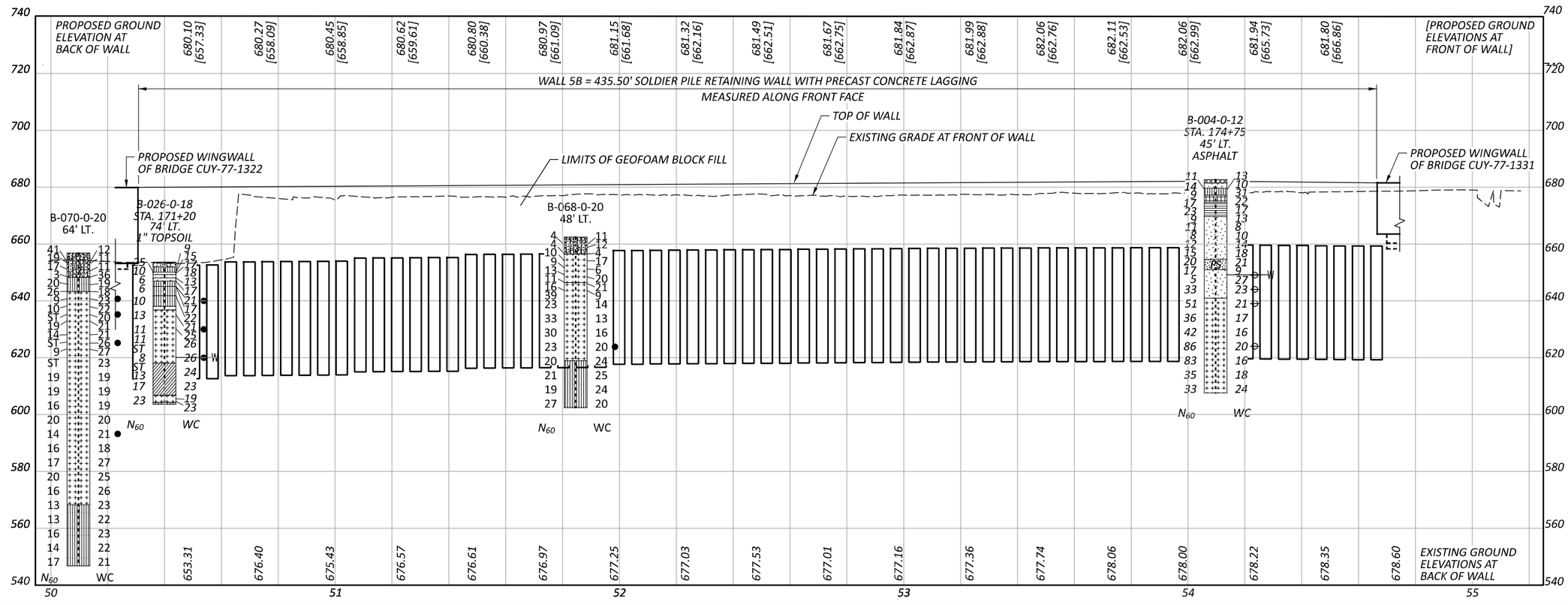


FOR BORING B-028-0-18 PROFILE, SEE SHEET 17.

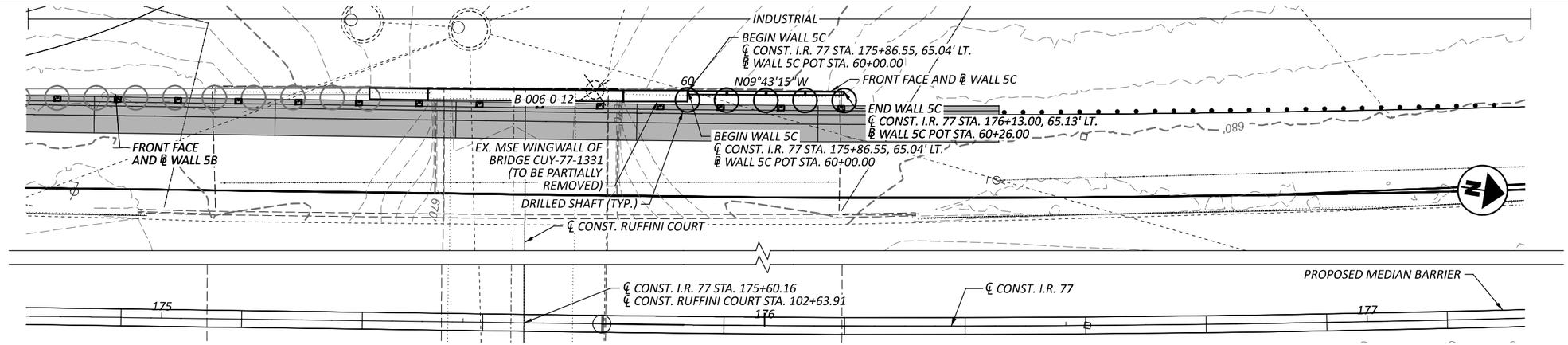


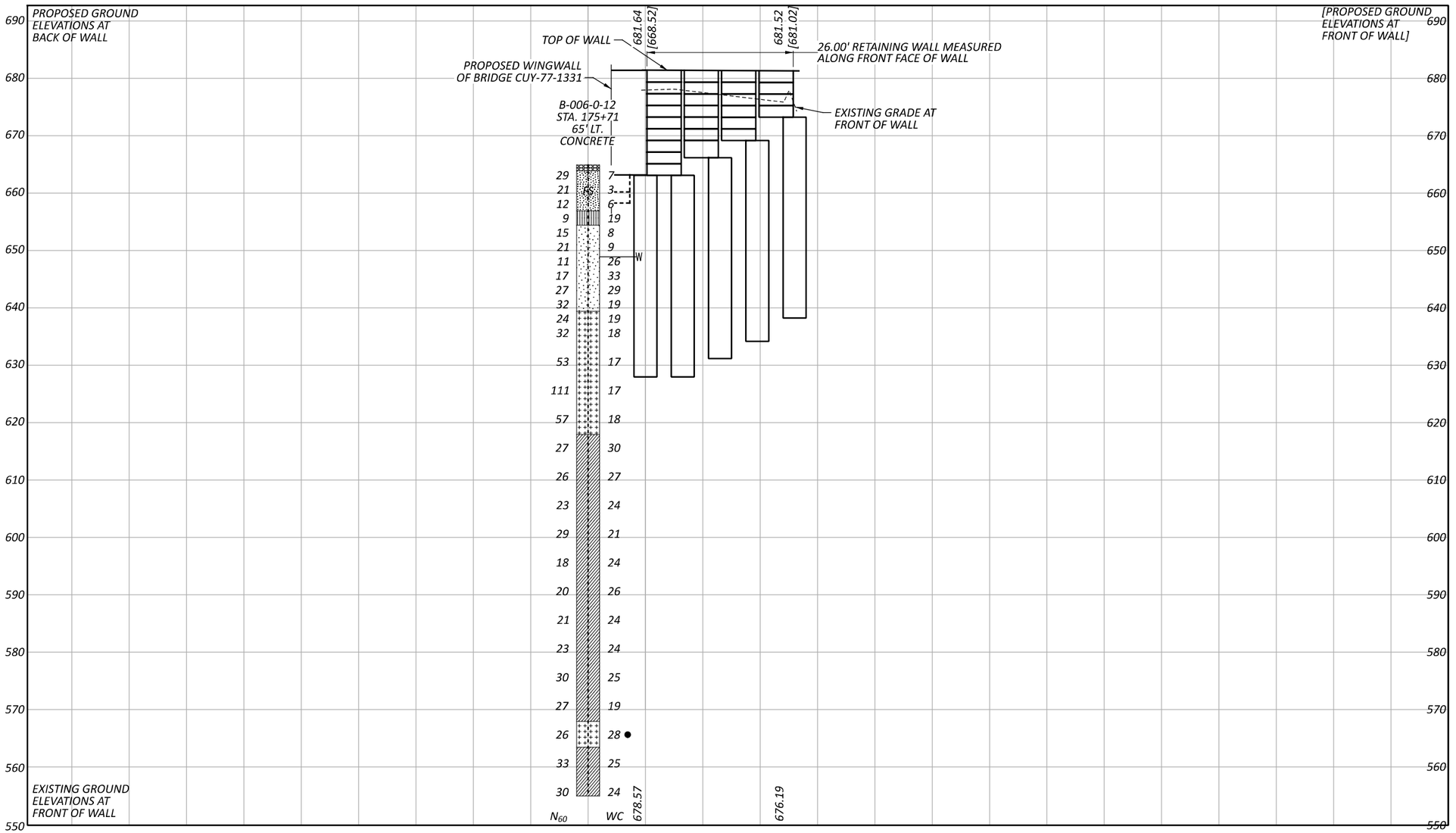
HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 5B

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET	35
TOTAL	85
SHEET	P.1224
TOTAL	P.1274





HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 5C

CUY-77-11.41

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DESIGN AGENCY
TRC

DESIGNER
NMC

REVIEWER
SDM 05/01/26

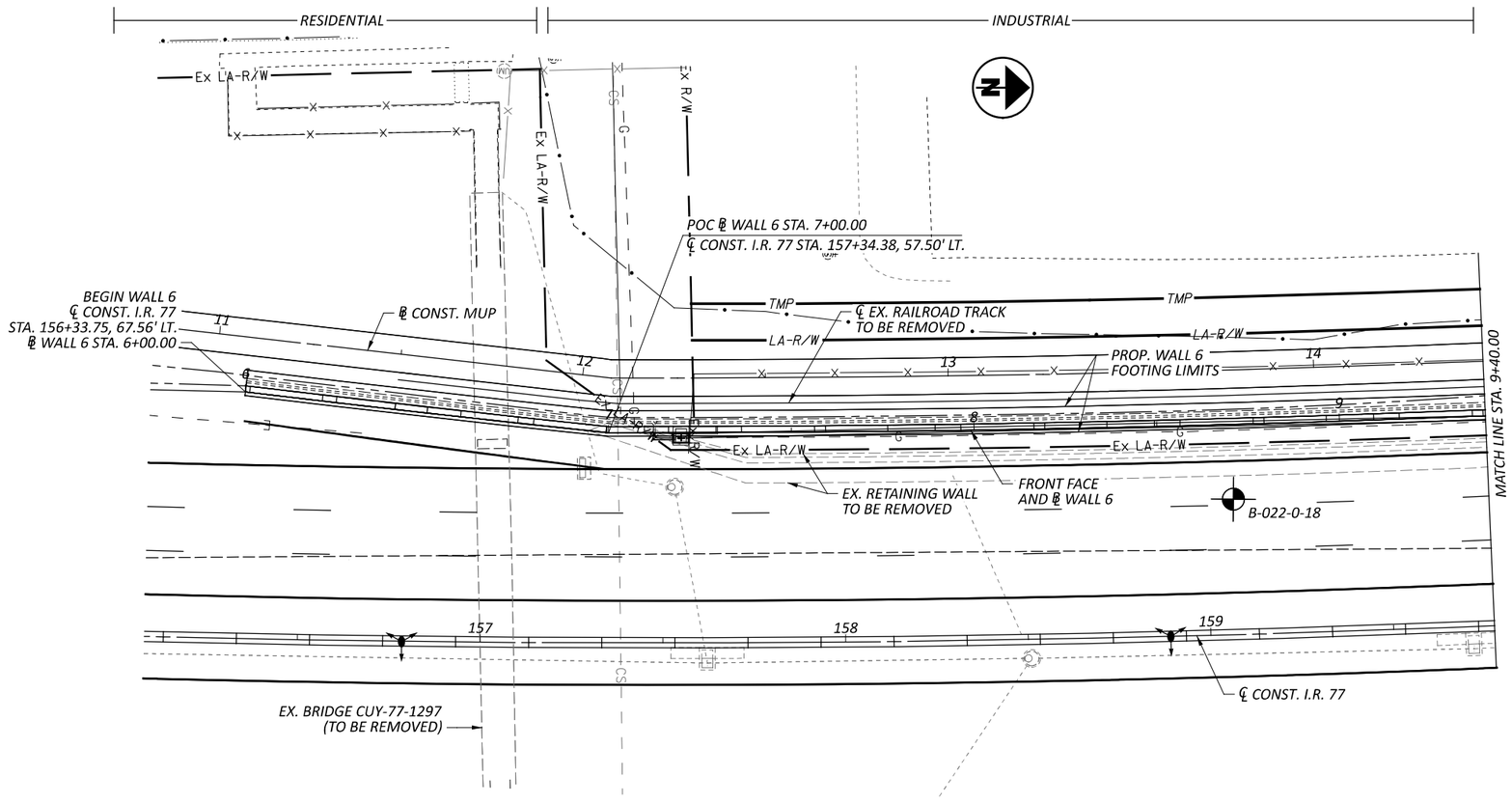
PROJECT ID
105743

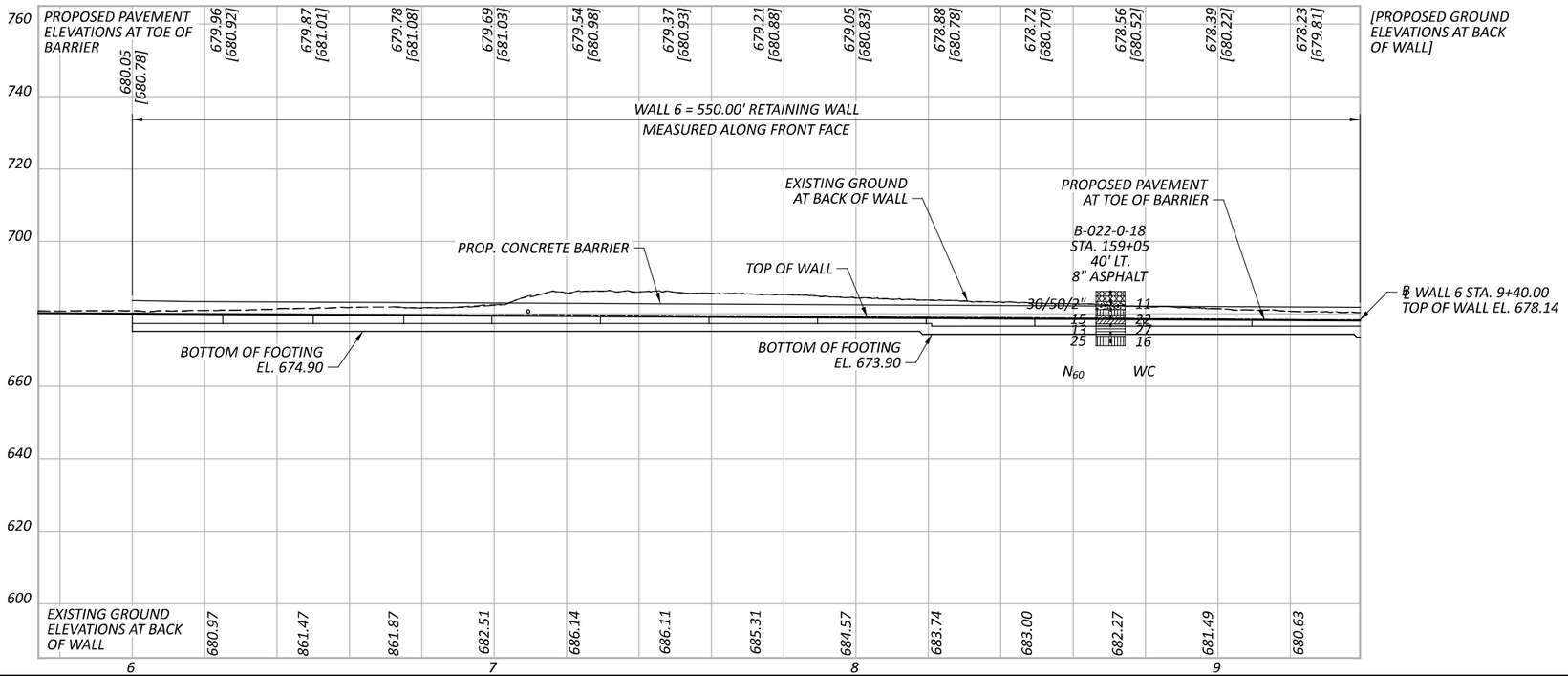
SUBSET 36 | TOTAL 85

SHEET P.1225 | TOTAL P.1274

MODEL: Sheet PAPERSIZE: 34x22 (in.) DATE: 7/1/2026 TIME: 5:13:48 PM PLTDRV: OHDOT_PDF.plctg PENTBL: OHDOT_Pen.tbl USER: NCaiazzo@trcsolutions.com WORKSPACE: OHDOTCE\02 WORKSET: 105743 PRODUCT: OpenRoadsDesigner 24.00.02.25
pw:\\trc-pw.bentley.com:trc-pw-01\Documents\5 - Projects - External\Ohio Department of Transportation (ODOT)\301525 - CUY-77-11.21\105743\400-Engineering\Geotechnical\Sheets\105743_ZP017.dgn

CUY-77-11.41

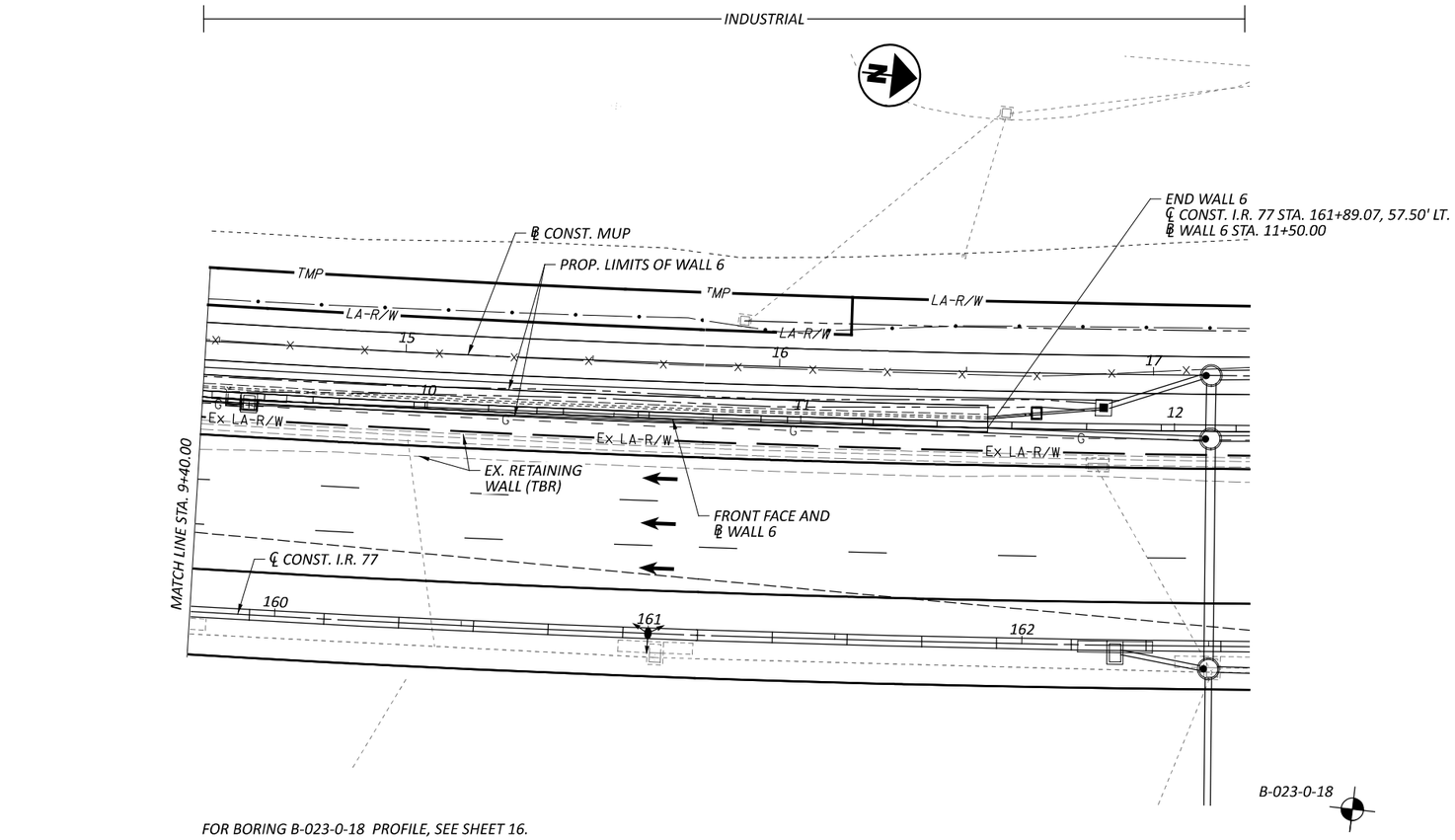




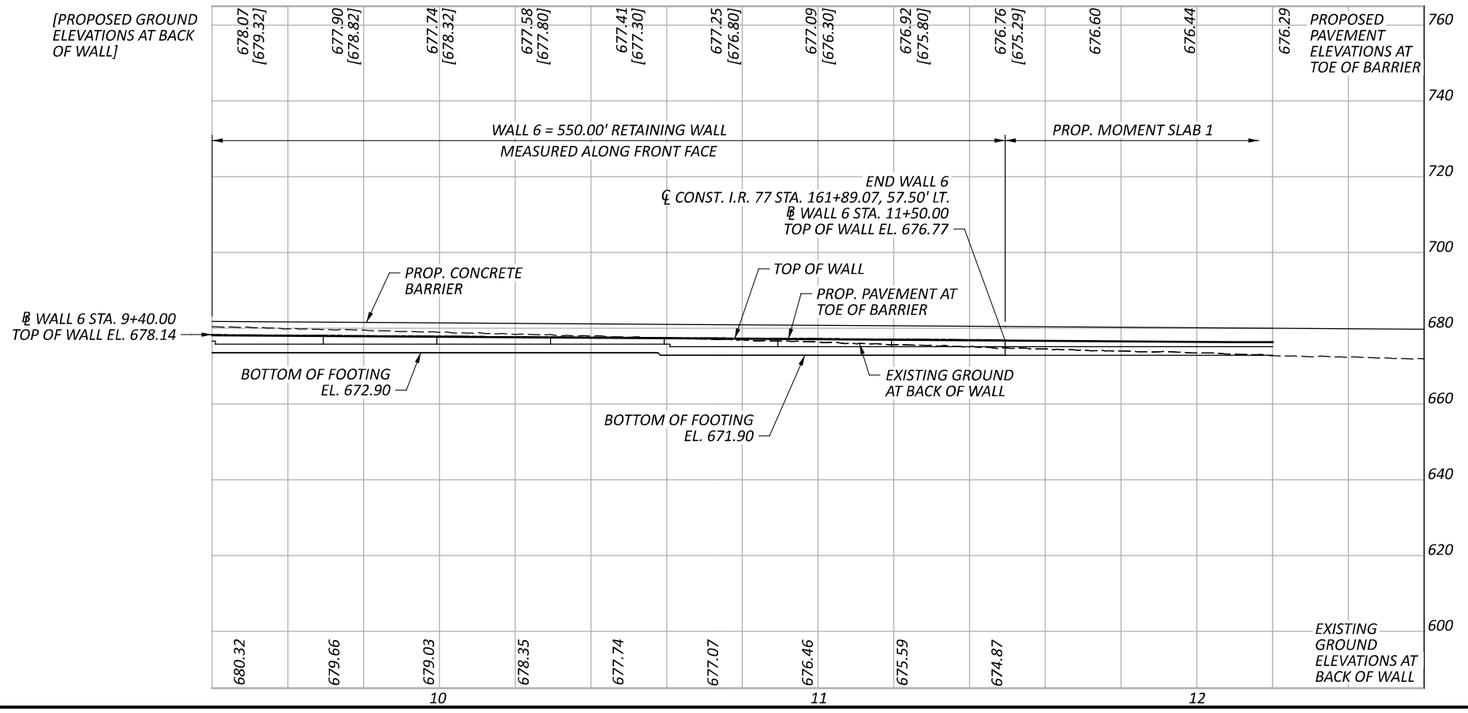
HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE RETAINING WALL 6

DESIGN AGENCY	TRC
DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET / TOTAL	37 / 85
SHEET / TOTAL	P.1226 / P.1274



FOR BORING B-023-0-18 PROFILE, SEE SHEET 16.



HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE RETAINING WALL 6

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET / TOTAL	38 / 85
SHEET / TOTAL	P.1227 / P.1274

CUY-77-11.41

MODEL: Sheet PAPERSIZE: 34x22 (in.) DATE: 7/1/2026 TIME: 5:14:11 PM PLTDRV: OHDOT_PDF.pltcfg PENTBL: OHDOT_Pen.tbl USER: NCaiazzo@trcsolutions.com WORKSPACE: OHDOTCEv02 WORKSET: 105743 PRODUCT: OpenRoadsDesigner 24.00.02.25
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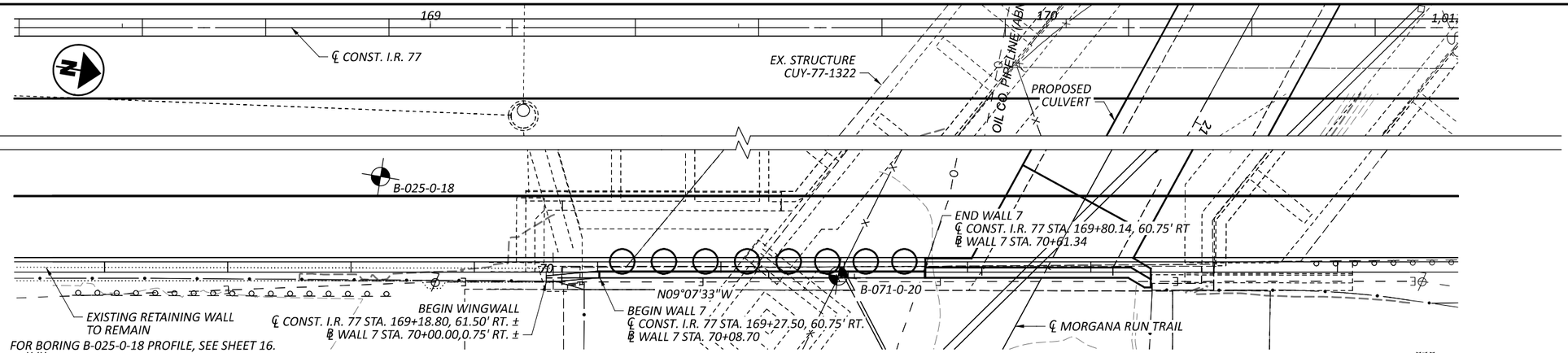
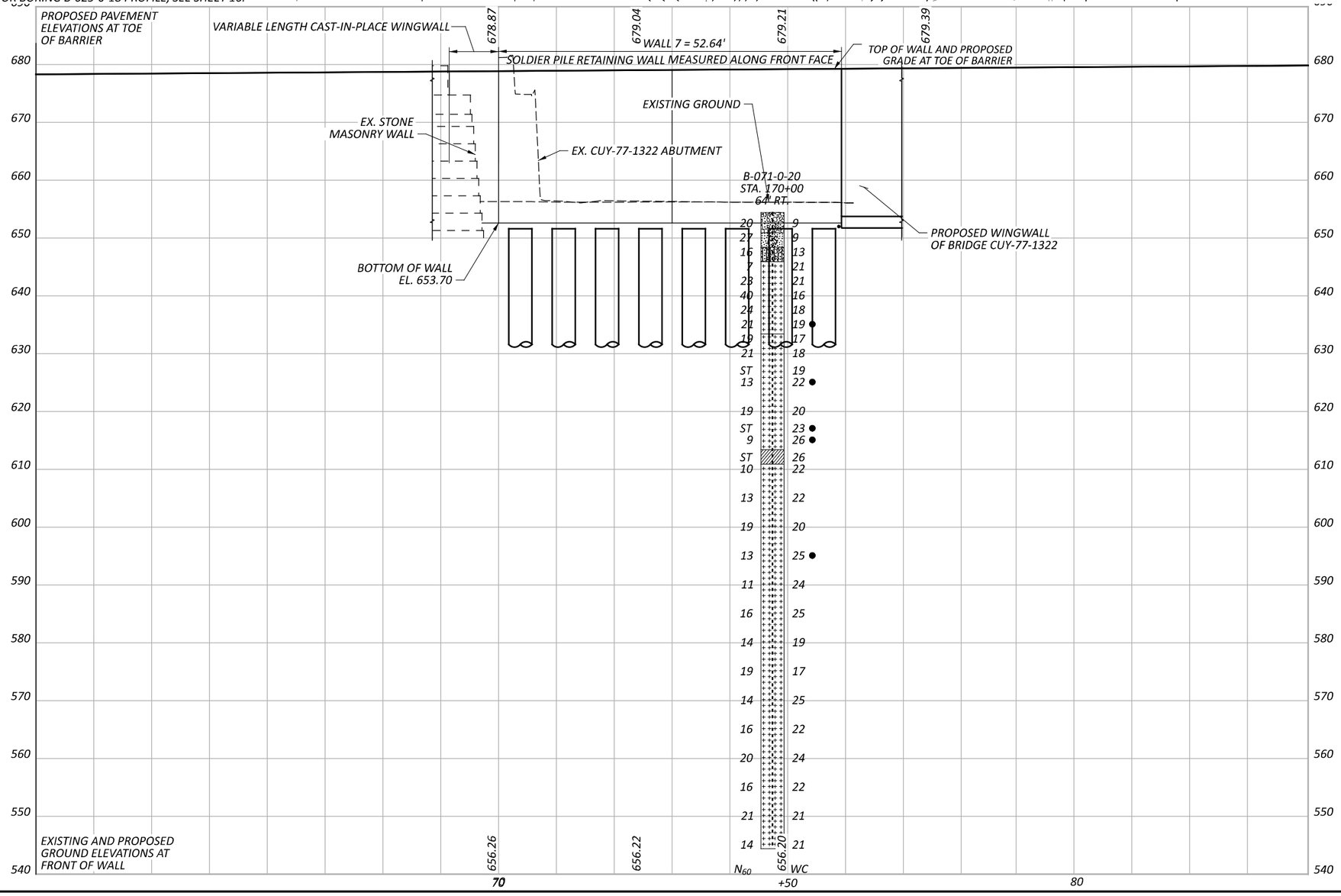




HORIZONTAL
SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - STRUCTURE
RETAINING WALL 7

DESIGN AGENCY
TRC

DESIGNER	NMC
REVIEWER	SDM 05/01/26
PROJECT ID	105743
SUBSET / TOTAL	39 / 85
SHEET / TOTAL	P.1228 / P.1274

CUY-77-11.41

MODEL: Sheet PAPERSIZE: 34x22 (in.) DATE: 7/1/2026 TIME: 5:14:31 PM PLTDRV: OHDOT_PDF.pltcfg PENTBL: OHDOT_Pen.tbl USER: NCaiazzo@trcsolutions.com WORKSPACE: OHDOTCE\02 WORKSET: 105743 PRODUCT: OpenRoadsDesigner 24.00.02.25
pw:\\trc-pw.bentley.com:trc-pw-01\Documents\5 - Projects - External\Ohio Department of Transportation (ODOT)\301525 - CUY-77-11.21\105743\400-Engineering\Geotechnical\Sheets\105743_ZP019.dgn

APPENDIX B
LOGS OF BORINGS

APPENDIX B-1
TRC LOGS OF BORINGS (COMPLETED IN 2020)

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:02 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 79+50, 78' LT.	EXPLORATION ID B-040-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 694.7 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/7/21 END: 12/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.439859, -81.650141	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (7")	694.7 / 694.1																	
AGGREGATE BASE, DRY	693.7																	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, DAMP		1	8 3 5	12	100	SS-1	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
		2																
		3																
		4	4 3 5	12	100	SS-2	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
		5																
	W 688.7	6																
		7	4 4 5	13	100	SS-3	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
	▽ 686.7	8																
		9	4 6 5	16	100	SS-4	-	41	38	17	-	4 -	NP	NP	NP	14	A-1-b (0)	
	683.7	10																
HARD, GRAY, **SANDY SILT**, AND CLAY,TRACE SAND,TRACE GRAVEL, WET		11	3 4 5	13	100	SS-5	-	-	-	-	-	-	-	-	-	28	A-4a (V)	
		12																
		13																
		14	5 6 8	21	100	SS-6	>4.5	0	0	0	46	54	29	20	9	24	A-4a (8)	
		15																
		16																
		17	5 7 8	22	100	SS-7	>4.5	-	-	-	-	-	-	-	-	20	A-4a (V)	
		18																
		19	6 10 11	31	100	SS-8	-	-	-	-	-	-	-	-	-	17	A-4a (V)	
		20																
@21' VERY STIFF		21																
		22	4 7 12	28	100	SS-9	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
	671.2	23																
DENSE, GRAY, **FINE SAND**, WET	F.S	24	7 12 14	39	100	SS-10	-	-	-	-	-	-	-	-	-	25	A-3 (V)	
	669.7 EOB	25																

NOTES: DUE TO GRANULAR NATURE OF SOILS, UNABLE TO RETRIEVE A SHELBY TUBES.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 85+65, 67' LT.	EXPLORATION ID B-041-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 694.3 (ft) EOB: 30.0 ft.	PAGE 1 OF 1
START: 12/7/21 END: 12/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.441468, -81.650749	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (7")	694.3																	
AGGREGATE BASE, DRY	693.7																	
MEDIUM DENSE, GRAY AND BROWN, **FINE SAND**, SOME SILT, TRACE FINE GRAVEL, DAMP	693.3	1	3 4 6	15	100	SS-1	-	-	-	-	-	-	-	-	-	9	A-3 (V)	
		2																
	690.8	3																
MEDIUM DENSE TO DENSE, BROWN AND GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, MOIST		4	7 10 11	31	78	SS-2	-	31	45	17	7	-	NP	NP	NP	5	A-1-b (0)	
		5																
		6																
		7	3 3 6	13	100	SS-3	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
W 686.3		8																
		9	4 7 7	21	100	SS-4	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
	683.3	10																
VERY STIFF, GRAY, **SILT**, "AND" CLAY, MOIST		11	3 4 4	12	100	SS-5	2.25	-	-	-	-	-	-	-	-	25	A-4b (V)	
@12.5-14.5: DD=94.9-99.1 PCF, SEE DIRECT SHEAR TEST RESULTS		12			100	ST-6	-	0	0	0	60	40	29	21	8	26	A-4b (8)	
		13																
		14																
		15	3 4 5	13	100	SS-7	2.50	-	-	-	-	-	-	-	-	24	A-4b (V)	
	678.3	16																
HARD, GRAY, **SANDY SILT**, MOIST		17	7 10 14	36	100	SS-8	>4.5	-	-	-	-	-	-	-	-	15	A-4a (V)	
▽ 677.3	675.8	18																
MEDIUM DENSE TO DENSE, GRAY, **SILT**, LITTLE FINE SAND, TRACE COARSE SAND, MOIST		19	7 10 13	34	100	SS-9	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		20																
		21																
		22																
		23																
		24	5 6 8	21	100	SS-10	-	0	1	13	86	-	NP	NP	NP	23	A-4b (8)	
		25																
		26																
		27																
		28																
	664.3	29	4 7 10	25	100	SS-11	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		EOB																

NOTES: BOREHOLE CAVED IN AT 14.4 FT BGS. FINE CONTENT REPORTED AS SILT IN SS-2, SS-9

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:27 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:02 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 88+24, 63' LT.	EXPLORATION ID B-042-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 696.6 (ft) EOB: 35.0 ft.	PAGE 1 OF 2
START: 12/7/21 END: 12/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.442102, -81.651046	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (9")	696.6 / 695.8																	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, DAMP		1	12 11 7	27	72	SS-1	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		2																
		3																
		4	3 5 4	13	78	SS-2	-	48	30	15	-	7 -	NP	NP	NP	5	A-1-b (0)	
	690.6	5																
MEDIUM DENSE, GRAY, **COARSE AND FINE SAND**, TRACE FINE GRAVEL, TRACE SILT, DAMP		6																
		7	3 4 6	15	100	SS-3	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
	688.1	W 688.6 8																
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, MOIST		9	3 4 5	13	100	SS-4	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
	685.6	10																
VERY STIFF, GRAY, **SANDY SILT**, TRACE GRAVEL, AND CLAY, MOIST TO WET		▽ 684.6 11	5 8 8	24	100	SS-5	3.50	-	-	-	-	-	-	-	-	20	A-4a (V)	
		12																
		13																
		14	4 6 7	19	100	SS-6	4.00	0	0	1	42	57	26	21	5	21	A-4a (8)	
	680.6	15																
HARD, GRAY, **SANDY SILT**, TRACE GRAVEL, AND CLAY, MOIST TO WET		16																
		17	5 8 10	27	100	SS-7	>4.5	-	-	-	-	-	-	-	-	20	A-4a (V)	
		18																
		19	9 12 14	39	100	SS-8	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
		20																
		21																
		22																
		23																
		24	6 12 15	40	100	SS-9	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
		25																
		26																
		27																
		28																
		29	9 12 16	42	100	SS-10	-	-	-	-	-	-	-	-	-	18	A-4a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:02 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 88+24, 63' LT.	START: 12/7/21	END: 12/7/21	PG 2 OF 2	B-042-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SANDY SILT**, TRACE GRAVEL, AND CLAY, MOIST TO WET *(continued)*	666.6	31																
		32																
		33																
		34	12 20 22	63	100	SS-11	-	-	-	-	-	-	-	-	-	20	A-4a (V)	
	661.6	EOB 35																

NOTES: BOREHOLE CAVED IN AT 19.6 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 90+25, 53' LT.
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 697.8 (ft) EOB: 30.0 ft.
START: 12/7/21 END: 12/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.442584, -81.651305

EXPLORATION ID B-043-0-20

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 697.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (18")	696.3	1																
MEDIUM DENSE, BROWN AND GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, DRY	694.3	2	6 4 4	11	100	SS-1	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	
MEDIUM DENSE, GRAY, **SILT**, TRACE GRAVEL, LITTLE COARSE TO FINE SAND, TRACE CLAY, MOIST	691.8	3	2 3 5	11	100	SS-2	-	1	1	18	76	4	20	22	NP	27	A-4b (8)	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, DAMP	681.8	4	9 8 6	20	100	SS-3	-	-	-	-	-	-	-	-	-	2	A-1-b (V)	
		5																
		6																
		7																
		8	8 9 7	23	100	SS-4	-	29	34	30	-	7 -	NP	NP	NP	5	A-1-b (0)	
		W 686.5 9																
		10																
		11	4 4 4	11	100	SS-5	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		12																
		13																
		14	4 7 7	20	100	SS-6	-	-	-	-	-	-	-	-	-	21	A-1-b (V)	
		15																
HARD, GRAY, **SILT**, "AND" CLAY, TRACE GRAVEL, TRACE SAND, DAMP @16.0 - 18.0': DD = 101.2-106.1 PCF, SEE DIRECT SHEAR RESULTS		16																
		17			100	ST-7	>4.5	1	1	1	61	36	29	20	9	21	A-4b (8)	
		18																
@18.5' VERY STIFF		19	4 5 6	16	100	SS-8	4.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
		20																
		21																
		22																
		23																
		24	4 5 6	16	89	SS-9	-	-	-	-	-	-	-	-	-	16	A-4b (V)	
		25																
		26																
		27																
		28																
@28.5' HARD	667.8	29 EOB	11 14 17	44	100	SS-10	-	-	-	-	-	-	-	-	-	18	A-4b (V)	

NOTES: BOREHOLE CAVED IN AT 9.9 FT BGS. FINE CONTENT REPORTED AS SILT IN SS-4

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:29 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 93+00, 50' LT.
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 697.5 (ft) EOB: 30.0 ft.
START: 12/7/21 END: 12/7/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.443278, -81.651798

EXPLORATION ID B-044-0-20

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (18")	697.5																	
	696.0																	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, DAMP			8 5 6	16	33	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	
	693.0		3 4 9	19	89	SS-2A	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	
						SS-2B	-	-	-	-	-	-	-	-	-	-	A-3 (0)	
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE GRAVEL, TRACE SILT, DAMP			7 7 7	20	100	SS-3	-	4	36	51	9	-	NP	NP	NP	3	A-3 (0)	
			3 4 5	13	100	SS-4	-	8	13	71	8	-	NP	NP	NP	5	A-3 (0)	
	685.5	W 685.5	4 6 6	17	89	SS-5A	-	-	-	-	-	-	-	-	-	12	A-3 (V)	
						SS-5B	-	-	-	-	-	-	-	-	-	-	A-1-b (V)	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, WET			3 5 4	13	100	SS-6	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
	680.5		6 4 6	14	100	SS-7A	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	
						SS-7B	>4.5	-	-	-	-	-	-	-	-	-	A-4b (V)	
VERY STIFF TO HARD, GRAY, **SILT**, SOME CLAY, MOIST @18.0-20.0': DD=94.4 - 98.7 PCF, SEE DIRECT SHEAR RESULTS					100	ST-8	-	0	0	0	63	37	27	21	6	24	A-4b (8)	
	668.5		4 6 7	19	78	SS-9	2.00	-	-	-	-	-	-	-	-	28	A-4b (V)	
						SS-10A	-	-	-	-	-	-	-	-	-	-	A-4b (V)	
DENSE, GRAY, **FINE SAND**, LITTLE SILT, DAMP	667.5	EOB	7 10 15	36	100	SS-10B	-	-	-	-	-	-	-	-	-	20	A-3 (V)	

NOTES: BOREHOLE CAVED IN AT 10.3 FT BGS. FINE CONTENT REPORTED AS SILT IN SS-3, SS-4

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:34 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 92+50, 64' RT.	EXPLORATION ID B-046-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 699.6 (ft) EOB: 40.0 ft.	PAGE 1 OF 2
START: 12/8/21 END: 12/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.443288, -81.651430	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
AGGREGATE BASE, DRY	699.6																	
MEDIUM DENSE, BROWN AND GRAY, **SILT**, SOME CLAY, TRACE FINE SAND, DAMP	699.3		3 4 4	11	67	SS-1	-	-	-	-	-	-	-	-	-	7	A-4b (V)	
@3.5' LOOSE		W 695.1	3 2 4	9	72	SS-2	-	0	0	1	73	26	NP	NP	NP	25	A-4b (8)	
MEDIUM DENSE, BROWN AND GRAY, **COARSE AND FINE SAND**, LITTLE GRAVEL, LITTLE SILT, DAMP	693.6		4 6 7	19	100	SS-3	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
			8 9 7	23	100	SS-4	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
			6 6 4	14	78	SS-5	-	12	28	49	- 11 -		NP	NP	NP	10	A-3a (0)	
			4 5 7	17	78	SS-6	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
HARD, BROWN AND GRAY, **SILT AND CLAY**, TRACE SAND, DAMP	683.6		4 5 10	21	100	SS-7	>4.5	-	-	-	-	-	-	-	-	19	A-6a (V)	
@20.0-22.0': QU = 3942.7 PSF @ 12.8% STRAIN, DD=109.4 PCF					100	ST-8	-	0	0	0	60	40	33	21	12	21	A-6a (9)	
@23.5' VERY STIFF			3 7 9	23	89	SS-9	-	-	-	-	-	-	-	-	-	15	A-6a (V)	
VERY STIFF, BROWN AND GRAY, **SANDY SILT**, MOIST	671.1		6 6 6	17	100	SS-10	-	-	-	-	-	-	-	-	-	26	A-4a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:34 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:34 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 92+50, 64' RT.	START: 12/8/21	END: 12/8/21	PG 2 OF 2	B-046-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, BROWN AND GRAY, **SANDY SILT**, MOIST *(continued)*	669.6	31 32 33																
		34	7 6 7	19	100	SS-11	-	-	-	-	-	-	-	-	-	30	A-4a (V)	
		35 36 37 38																
@38.5 HARD		39	6 8 10	26	100	SS-12	>4.5	-	-	-	-	-	-	-	-	22	A-4a (V)	
	659.6	EOB 40																

NOTES: BOREHOLE CAVED IN AT 13.4 FT BGS FINE CONTENT REPORTED AS SILT IN SS-5

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:02 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 97+20, 54' LT.	EXPLORATION ID B-048-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 693.0 (ft) EOB: 35.0 ft.	PAGE 1 OF 2
START: 12/6/21 END: 12/6/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.444193, -81.652595	

MATERIAL DESCRIPTION AND NOTES	ELEV. 693.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (17")																		
	691.6																	
AGGREGATE BASE, DRY	691.1																	
VERY LOOSE TO LOOSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, FILL, DRY			4 7 50	81	39	SS-1A	-	-	-	-	-	-	-	-	-	-		
						SS-1B	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	
			4 2 3	7	72	SS-2	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	
			1 1 1	3	67	SS-3	-	19	43	28	-	10 -	NP	NP	NP	24	A-1-b (0)	
	684.5	W 684.5																
MEDIUM STIFF TO STIFF, BROWN TO GRAY, **SILT**, AND CLAY, TRACE SAND, DRY			3 2 4	9	72	SS-4	2.50	-	-	-	-	-	-	-	-	18	A-4b (V)	
			4 5 7	17	100	SS-5	3.50	-	-	-	-	-	-	-	-	19	A-4b (V)	
			4 4 5	13	100	SS-6	3.00	-	-	-	-	-	-	-	-	21	A-4b (V)	
@16' HARD,DAMP TO MOIST			4 5 7	17	100	SS-7	>4.5	0	0	3	58	39	25	19	6	18	A-4b (8)	
			3 4 6	14	100	SS-8	>4.5	-	-	-	-	-	-	-	-	19	A-4b (V)	
	669.5																	
HARD, BROWN TO GRAY, **SANDY SILT**, AND CLAY, TRACE SAND, DAMP TO MOIST			5 9 14	33	100	SS-9	-	-	-	-	-	-	-	-	-	17	A-4a (V)	
@28.5' VERY STIFF			6 7 10	24	100	SS-10	-	-	-	-	-	-	-	-	-	11	A-4a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:02 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 97+20, 54' LT.	START: 12/6/21	END: 12/6/21	PG 2 OF 2	B-048-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, BROWN TO GRAY, **SANDY SILT**, AND CLAY, TRACE SAND, DAMP TO MOIST *(continued)*	663.0	31																
		32																
		33																
		34	7 7 9	23	100	SS-11	-	-	-	-	-	-	-	-	-	18	A-4a (V)	
	658.0	EOB 35																

NOTES: BOREHOLE CAVED IN AT 2.6 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 98+75, 57' LT.
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 691.7 (ft) EOB: 35.0 ft.
START: 12/6/21 END: 12/6/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.444583, -81.652998

EXPLORATION ID B-049-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 691.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (18")	690.2																	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, DAMP			4 6 8	20	67	SS-1	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
			6 7 7	20	83	SS-2	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
	685.2	▽ 686.2 W 685.2																
LOOSE, GRAY, **COARSE AND FINE SAND**, TRACE GRAVEL, LITTLE SILT, TRACE CLAY, DAMP	682.7		4 4 3	10	89	SS-3	-	8	23	59	-	10 -	NP	NP	NP	20	A-3a (0)	
VERY STIFF, GRAY, **SILT**, "AND" CLAY, TRACE SAND, TRACE GRAVEL, MOIST @10.0-12.0': QU = 4246.6 PSF @ 7.9% STRAIN, DD=105.9 PCF, Cc= 0.10, Cr=0.03			4 3 4	10	78	SS-4	2.75	-	-	-	-	-	-	-	-	22	A-4b (V)	
					100	ST-5	2.25	1	2	1	55	41	30	20	10	21	A-4b (8)	
@13.5' STIFF			4 4 6	14	100	SS-6	2.00	-	-	-	-	-	-	-	-	21	A-4b (V)	
			4 4 3	10	100	SS-7	-	-	-	-	-	-	-	-	-	25	A-4b (V)	
@17.5-19.5': DD=94.0-96.4 PCF, SEE DIRECT SHEAR RESULTS					100	ST-8	-	1	0	0	66	33	31	21	10	25	A-4b (8)	
	668.2																	
MEDIUM DENSE, GRAY, **SILT**, TRACE FINE SAND, MOIST			6 7 9	23	83	SS-9	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
			8 9 7	23	100	SS-10	-	-	-	-	-	-	-	-	-	20	A-4b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:38 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:38 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 98+75, 57' LT.	START: 12/6/21	END: 12/6/21	PG 2 OF 2	B-049-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, GRAY, **SILT**, TRACE FINE SAND, MOIST *(continued)*	661.7	31 32 33																
@33.5' DENSE	656.7	34 EOB 35	9 14 17	44	100	SS-11	-	-	-	-	-	-	-	-	-	18	A-4b (V)	

NOTES: BOREHOLE CAVED IN AT 6.1 FT BGS. FINE CONTENT REPORTED AS SILT IN SS-3

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:02 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 100+25, 62' LT.	EXPLORATION ID B-050-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 690.0 (ft) EOB: 35.0 ft.	PAGE 1 OF 2
START: 12/6/21 END: 12/6/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.444898, -81.653352	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (6")	690.0																	
AGGREGATE BASE, DRY	689.5																	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, SOME GRAVEL,LITTLE SILT, WET	689.0	1	12 8 9	25	78	SS-1	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
		2																
		3																
		W 686.0 4	3 5 4	13	100	SS-2	-	21	22	45	- 12 -		NP	NP	NP	16	A-3a (0)	
		5																
	684.0	6																
VERY STIFF, GRAY, **SILT**, AND CLAY,TRACE SAND, DAMP		7	4 6 9	22	100	SS-3	3.50	-	-	-	-	-	-	-	-	35	A-4b (V)	
		8																
		9	6 6 8	21	100	SS-4	4.00	-	-	-	-	-	-	-	-	18	A-4b (V)	
		10																
		11	4 5 6	16	100	SS-5	2.50	0	0	1	61	38	29	21	8	22	A-4b (8)	
		12																
		13																
		14	5 6 8	21	100	SS-6	2.75	-	-	-	-	-	-	-	-	22	A-4b (V)	
		15																
		16																
		17	4 5 7	18	100	SS-7	2.50	-	-	-	-	-	-	-	-	23	A-4b (V)	
		▽ 672.0 18																
	671.5	19																
HARD, GRAY, **SANDY SILT**, TRACE GRAVEL,LITTLE CLAY, MOIST TO WET		20	4 6 7	19	100	SS-8	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	
		21																
		22																
		23																
		24	8 11 10	31	100	SS-9	-	-	-	-	-	-	-	-	-	35	A-4a (V)	
		25																
		26																
		27																
		28																
@28.5' MEDIUM STIFF		29	8 11 16	40	100	SS-10	0.50	4	6	28	46	16	15	13	2	20	A-4a (5)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:02 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 100+25, 62' LT.	START: 12/6/21	END: 12/6/21	PG 2 OF 2	B-050-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **SANDY SILT**, TRACE GRAVEL,LITTLE CLAY, MOIST TO WET *(continued)*	660.0	31 32 33																
@33.5' HARD	655.0	34 EOB 35	11 20 21	61	100	SS-11	-	-	-	-	-	-	-	-	-	16	A-4a (V)	

NOTES: BOREHOLE CAVED IN AT 17.4 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 102+50, 66' LT.	EXPLORATION ID B-051-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 688.7 (ft) EOB: 30.0 ft.	PAGE 1 OF 1
START: 12/6/21 END: 12/6/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.445349, -81.653847	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (3")	688.4																	
STIFF, BROWN, **SILT**, SOME CLAY ,LITTLE GRAVEL,LITTLE SAND, ROCK FRAGMENTS, FILL,SLAG, DRY	682.7		7 4 3	10	78	SS-1	-	-	-	-	-	-	-	-	-	14	A-4b (V)	
			4 4 6	15	67	SS-2	-	15	4	8	53	20	24	20	4	20	A-4b (8)	
HARD, GRAY, **SANDY SILT**, DAMP	677.7		3 4 8	18	100	SS-3	4.00	-	-	-	-	-	-	-	-	20	A-4a (V)	
			4 5 8	19	100	SS-4	4.50	-	-	-	-	-	-	-	-	19	A-4a (V)	
VERY STIFF, GRAY, **SANDY SILT**, AND CLAY, DAMP	665.2		5 4 7	16	100	SS-5	3.00	0	1	1	48	50	26	19	7	24	A-4a (8)	
			4 6 7	19	100	SS-6	3.50	-	-	-	-	-	-	-	-	23	A-4a (V)	
			4 5 7	18	100	SS-7	3.50	-	-	-	-	-	-	-	-	22	A-4a (V)	
		W 670.7																
		▽ 668.7	5 6 8	21	100	SS-8	2.50	-	-	-	-	-	-	-	-	22	A-4a (V)	
MEDIUM DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, MOIST TO WET	660.2		4 7 11	27	100	SS-9	-	0	6	12	66	16	NP	NP	NP	20	A-4b (8)	
HARD, GRAY, **SANDY SILT**, MOIST TO WET	658.7	EOB	11 12 14	39	100	SS-10	-	-	-	-	-	-	-	-	-	20	A-4a (V)	

NOTES: BOREHOLE CAVED IN AT 14.2 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 102+75, 67' RT.	EXPLORATION ID B-052-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 686.1 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/9/21 END: 12/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.445564, -81.653482	

MATERIAL DESCRIPTION AND NOTES	ELEV. 686.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (12")	685.1																	
AGGREGATE BASE, DRY	684.8		3 4 5	13	44	SS-1A	-	-	-	-	-	-	-	-	-	-		
MEDIUM DENSE, BROWN AND GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, FILL, DAMP	682.6					SS-1B	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
VERY STIFF, GRAY, **SILT**, TRACE GRAVEL, TRACE COARSE TO FINE SAND, SOME CLAY, MOIST			4 3 5	11	78	SS-2	3.25	-	-	-	-	-	-	-	-	22	A-4b (V)	
			3 4 5	13	28	SS-3	-	4	3	2	60	31	25	20	5	19	A-4b (8)	
		▽ 675.9	4 3 3	9	100	SS-4	3.00	-	-	-	-	-	-	-	-	24	A-4b (V)	
			3 3 4	10	100	SS-5	2.50	-	-	-	-	-	-	-	-	22	A-4b (V)	
@13.5' AND CLAY			6 7 8	21	72	SS-6	2.00	0	0	1	52	47	27	20	7	22	A-4b (8)	
			4 4 5	13	100	SS-7	3.25	-	-	-	-	-	-	-	-	26	A-4b (V)	
	667.6	W 667.6																
DENSE, GRAY, **SANDY SILT**, SOME SAND, WET			6 15 15	43	100	SS-8	-	-	-	-	-	-	-	-	-	18	A-4a (V)	
	661.1	EOB	9 15 15	43	100	SS-9	-	-	-	-	-	-	-	-	-	13	A-4a (V)	

NOTES: BOREHOLE CAVED IN AT 10.3 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 104+25, 68' RT.	EXPLORATION ID B-053-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 684.2 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/8/21 END: 12/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.445952, -81.653844	

MATERIAL DESCRIPTION AND NOTES	ELEV. 684.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL (6")	683.7																	
VERY STIFF, BROWN TO GRAY, **SILT**, AND CLAY, TRACE FINE SAND, MOIST		1	3 3 4	10	100	SS-1	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		2																
		3																
		4	4 4 5	13	100	SS-2	2.00	-	-	-	-	-	-	-	-	25	A-4b (V)	
		5																
		6	3 5 6	16	100	SS-3	2.75	0	0	1	54	45	25	19	6	21	A-4b (8)	
		7																
		8	4 4 7	16	100	SS-4	4.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
		9																
		10	4 4 6	15	100	SS-5	3.50	0	0	0	62	38	23	18	5	22	A-4b (8)	
		11																
		12	5 4 8	18	100	SS-6	2.75	-	-	-	-	-	-	-	-	21	A-4b (V)	
	668.2	13																
	▽ 668.2	14																
VERY STIFF TO HARD, GRAY, **SANDY SILT**, SOME FINE SAND, DAMP		15																
		16	4 7 9	24	100	SS-7	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
		17																
		18																
		19	7 10 13	34	100	SS-8	-	-	-	-	-	-	-	-	-	16	A-4a (V)	
		20																
		21																
		22																
		23																
	659.2	24	5 6 11	25	100	SS-9	-	-	-	-	-	-	-	-	-	25	A-4a (V)	
	EOB	25																

NOTES: BOREHOLE CAVED IN AT 12.5 FT BGS

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 106+00, 82' RT.	EXPLORATION ID B-054-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 681.2 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/8/21 END: 12/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.446344, -81.654205	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL (6")	681.2 / 680.7																	
DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, BRICK FRAGMENTS, FILL, DAMP			7 10 11	31	67	SS-1	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	
			7 12 9	31	100	SS-2	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	
	675.2																	
HARD, BROWN AND GRAY, **SILT**, SOME CLAY, TRACE GRAVEL, TRACE SAND, DAMP TO MOIST			3 4 6	15	100	SS-3	>4.5	-	-	-	-	-	-	-	-	18	A-4b (V)	
@8.5' VERY STIFF			7 6 7	19	100	SS-4	3.50	-	-	-	-	-	-	-	-	20	A-4b (V)	
			4 6 6	18	100	SS-5	2.75	-	-	-	-	-	-	-	-	20	A-4b (V)	
@12.5-14.5': DD=100.2-105.5 PCF, SEE DIRECT SHEAR RESULTS	666.7				100	ST-6	-	2	0	2	61	35	26	20	6	20	A-4b (8)	
MEDIUM DENSE, BROWN, **SANDY SILT**, WET		▽ 665.2	4 6 9	22	100	SS-7	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
			7 7 12	28	100	SS-8	-	-	-	-	-	-	-	-	-	22	A-4a (V)	
	662.7																	
DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, WET			7 9 13	33	100	SS-9	-	0	0	78	-	22 -	NP	NP	NP	20	A-3a (0)	
			8 9 14	34	100	SS-10	-	-	-	-	-	-	-	-	-	28	A-3a (V)	
	656.2	EOB																

NOTES: BOREHOLE CAVED IN AT 14.2 FT BGS. FINE CONTENT REPORTED AS SILT IN SS-8

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:44 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 107+50, 103' RT.	EXPLORATION ID B-055-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 680.4 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/8/21 END: 12/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.446732, -81.654370	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL (6")	680.4																	
	679.9																	
HARD, BROWN, **SANDY SILT**, FILL, DAMP		1	3 4 4	12	100	SS-1	>4.5	-	-	-	-	-	-	-	-	14	A-4a (V)	
	676.9	2																
STIFF TO VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, DAMP		3																
		4	5 4 4	12	100	SS-2	-	-	-	-	-	-	-	-	-	6	A-4b (V)	
		5																
W 674.4		6	4 5 5	15	100	SS-3	2.25	0	0	1	73	26	20	19	1	22	A-4b (8)	
		7																
		8																
		9	4 6 6	18	100	SS-4	4.00	-	-	-	-	-	-	-	-	22	A-4b (V)	
		10																
		11																
		12	3 4 5	13	100	SS-5	1.25	-	-	-	-	-	-	-	-	24	A-4b (V)	
		13																
		14	4 5 7	18	100	SS-6	2.25	-	-	-	-	-	-	-	-	27	A-4b (V)	
	664.4	15																
▽ 664.4		16																
MEDIUM DENSE, BROWN AND GRAY, **COARSE AND FINE SAND**, SOME SILT, TRACE GRAVEL, DAMP		17	6 9 10	28	100	SS-7	-	0	1	67	22	10	NP	NP	NP	21	A-3a (0)	
		18																
@18.5' DENSE		19	7 13 18	46	100	SS-8	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
		20																
		21																
		22																
		23																
		24	7 12 19	46	100	SS-9	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
	655.4	25																
EOB																		

NOTES: BOREHOLE CAVED IN AT 13.6 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 109+50, 141' RT.	EXPLORATION ID B-056-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 684.0 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/8/21 END: 12/8/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.447223, -81.654614	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (2")	684.0																	
CONCRETE	683.8																	
DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, SOME SILT, LITTLE CLAY, FILL, DAMP	683.0	1	12 14 10	36	56	SS-1	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
	680.5	2																
LOOSE, BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, DAMP		3	3 3 4	10	28	SS-2	-	29	12	22	26	11	NP	NP	NP	16	A-4a (0)	
		4																
		5																
		W 678.0 6																
		7	2 2 2	6	28	SS-3	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
		8																
		9	2 2 2	6	33	SS-4	-	-	-	-	-	-	-	-	-	17	A-4a (V)	
	673.0	10																
MEDIUM DENSE, GRAY, **SILT**, TRACE FINE SAND, SOME CLAY, MOIST TO DAMP		11	3 4 4	12	100	SS-5	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		12																
		13																
		14	4 4 5	13	100	SS-6	-	0	0	1	68	31	21	21	NP	21	A-4b (8)	
		15																
		16																
		▽ 667.0 17	5 6 6	18	100	SS-7	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		18																
		19	5 6 7	19	100	SS-8	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		20																
		21																
		22																
		23																
		24	5 7 9	24	89	SS-9	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
	659.0	EOB 25																

NOTES: BOREHOLE CAVED IN AT 16.9 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 122+00, 69' LT.	EXPLORATION ID B-059-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 661.2 (ft) EOB: 30.0 ft.	PAGE 1 OF 1
START: 12/9/21 END: 12/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.450204, -81.656910	

MATERIAL DESCRIPTION AND NOTES	ELEV. 661.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (12")	660.2																	
DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, FILL, DAMP			17 10 14	36	56	SS-1	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	
@3.5' VERY DENSE	655.2		12 18 22	60	100	SS-2	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	
HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP			6 5 5	15	100	SS-3	>4.5	3	3	26	48	20	18	15	3	12	A-4a (7)	
			7 8 8	24	100	SS-4	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	
@11.0' VERY STIFF			7 5 6	16	100	SS-5	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
			6 8 10	27	100	SS-6	-	9	24	22	28	17	18	15	3	15	A-4a (2)	
@18.5' HARD	637.7		5 7 7	21	100	SS-7	>4.5	-	-	-	-	-	-	-	-	14	A-4a (V)	
MEDIUM DENSE, BROWN AND GRAY, **SILT**, LITTLE CLAY,LITTLE SAND, TRACE GRAVEL, DAMP		▽ 633.2	3 4 6	15	100	SS-8	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
	631.2	EOB	4 4 7	16	89	SS-9	-	3	3	15	65	14	NP	NP	NP	30	A-4b (8)	

NOTES: BOREHOLE CAVED IN AT 21.4 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 129+30, 55' LT.	EXPLORATION ID B-060-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 651.4 (ft) EOB: 30.0 ft.	PAGE 1 OF 1
START: 12/9/21 END: 12/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.452133, -81.657261	

MATERIAL DESCRIPTION AND NOTES	ELEV. 651.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL (2")	651.2																	
VERY STIFF, BROWN TO GRAY, **SILT**, FILL, DAMP		1	3 5 7	17	72	SS-1	3.50	-	-	-	-	-	-	-	-	14	A-4b (V)	
		2																
		3																
@3.5' HARD		4	3 4 4	11	100	SS-2	4.50	-	-	-	-	-	-	-	-	14	A-4b (V)	
		5																
		6			0	ST-3	-	-	-	-	-	-	-	-	-	-	A-4b (V)	
		7																
	642.9	8																
VERY STIFF, GRAY, **SANDY SILT**, FILL, DAMP		9	5 7 8	21	100	SS-4	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
		10																
		11																
		12	5 4 5	13	100	SS-5	2.50	-	-	-	-	-	-	-	-	19	A-4a (V)	
	637.9	13																
VERY DENSE, BROWN AND GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, CONCRETE FRAGMENTS, FILL, DAMP		14	21 23 14	53	78	SS-6	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
	635.4	15																
VERY STIFF, BROWN AND GRAY, **SILT**, TRACE SAND, DAMP		16																
		17	19 7 5	17	28	SS-7	3.50	-	-	-	-	-	-	-	-	16	A-4b (V)	
	632.9	18																
MEDIUM STIFF, BROWN AND GRAY, **SILT**, AND CLAY, TRACE SAND, DAMP		19	9 2 3	7	72	SS-8	1.00	0	0	1	59	40	22	19	3	28	A-4b (8)	
		20																
		21																
		22																
		23																
@23.5' HARD,OCCATIONAL COBBLES		24	28 50	-	0	SS-9	-	-	-	-	-	-	-	-	-	-	A-4b (V)	
		25																
		26																
		27																
		28																
	621.4	29	36 13 17	43	33	SS-10	-	-	-	-	-	-	-	-	-	17	A-4b (V)	
		EOB																

NOTES: BOREHOLE CAVED IN AT 12.8 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH BENTONITE CHIPS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 131+25, 53' LT.	EXPLORATION ID B-061-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 650.6 (ft) EOB: 30.0 ft.	PAGE 1 OF 1
START: 12/9/21 END: 12/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.452751, -81.657304	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL (3")	650.6																	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, FILL, DAMP	650.3	▽ 649.6	7 5 15	29	33	SS-1	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	
@2.5' COBBLES																		
@3.5' TRACE ORGANIC			11 7 6	19	28	SS-2	-	-	-	-	-	-	-	-	-	6	A-2-4 (V)	
LOOSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT,TRACE CLAY, MOIST TO WET	644.6	W 644.6	4 2 2	6	72	SS-3	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	
			3 2 2	6	67	SS-4	-	23	39	22	-	16 -	NP	NP	NP	17	A-1-b (0)	
@11.0' VERY LOOSE	637.1		2 1 1	3	100	SS-5	-	-	-	-	-	-	-	-	-	20	A-1-b (V)	
MEDIUM DENSE, BROWN, **FINE SAND**, LITTLE SILT, MOIST			4 3 6	13	100	SS-6	-	-	-	-	-	-	-	-	-	14	A-3 (V)	
			4 6 4	14	89	SS-7	-	-	-	-	-	-	-	-	-	15	A-3 (V)	
LOOSE, BROWN, **COARSE AND FINE SAND**, WET	632.1		5 4 3	10	100	SS-8	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
STIFF, BROWN AND GRAY, **SANDY SILT**, AND CLAY, TRACE GRAVEL, DAMP	627.1		4 3 4	10	56	SS-9	2.00	1	0	1	48	50	25	18	7	25	A-4a (8)	
@28.5' VERY STIFF	620.6	EOB	6 7 12	27	39	SS-10	-	-	-	-	-	-	-	-	-	18	A-4a (V)	

NOTES: BOREHOLE CAVED IN AT 7.3 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 136+50, 107' LT.	EXPLORATION ID B-062-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / JASON	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 650.0 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/9/21 END: 12/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.454228, -81.657598	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL (7")	650.0 / 649.4																	
VERY DENSE, BROWN GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, SLAG, FILL, DRY	646.5		38 50/2"	-	125	SS-1	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
DENSE, BROWN GRAY, **SANDY SILT**, FILL, DAMP			11 9 16	36	100	SS-2	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
@8.5' MEDIUM DENSE	636.5		6 5 7	17	100	SS-3	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
HARD, BROWN GRAY, **SANDY SILT**, AND CLAY, WET	631.5	▽ 635.0	6 5 8	19	100	SS-4	>4.5	0	1	4	44	51	32	23	9	19	A-4a (8)	
HARD, BROWN GRAY, **SILT**, AND CLAY, WET	625.0	EOB	17 12 16	40	100	SS-5	-	-	-	-	-	-	-	-	-	10	A-4b (V)	
			5 6 8	20	56	SS-6	>4.5	-	-	-	-	-	-	-	-	15	A-4b (V)	

NOTES: BOREHOLE CAVED IN AT 12.6 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 138+18, 154' LT.	EXPLORATION ID B-063-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 661.0 (ft) EOB: 30.0 ft.	PAGE 1 OF 1
START: 12/9/21 END: 12/9/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.454629, -81.657604	

MATERIAL DESCRIPTION AND NOTES	ELEV. 661.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL (6")	660.5																	
MEDIUM DENSE, BROWN, **SANDY SILT**, AND GRAVEL, FILL, DAMP	657.5		3 5 6	16	100	SS-1	-	-	-	-	-	-	-	-	-	18	A-4a (V)	
MEDIUM DENSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, SLAG, FILL, DAMP	655.0		7 6 7	19	100	SS-2	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL,FILL, DAMP			3 4 7	16	100	SS-3	2.00	5	12	36	36	11	16	14	2	14	A-4a (2)	
			4 4 7	16	100	SS-4	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
			3 3 4	10	100	SS-5	2.50	-	-	-	-	-	-	-	-	17	A-4a (V)	
@13.5' AND CLAY, FIINE SLAG, MOIST	642.5		4 3 5	12	100	SS-6	2.25	3	4	16	41	36	22	16	6	19	A-4a (8)	
STIFF, BROWN AND GRAY, **SILT**, AND CLAY, FINE SLAG, WET		▽ 638.5 W 638.0	3 3 3	9	100	SS-7	1.25	-	-	-	-	-	-	-	-	31	A-4b (V)	
			3 4 5	13	100	SS-8	1.50	0	0	0	59	41	23	20	3	28	A-4b (8)	
	631.0	EOB	4 4 5	13	100	SS-9	1.50	-	-	-	-	-	-	-	-	26	A-4b (V)	

NOTES: BOREHOLE CAVED IN AT 19.0 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 163+00, 52' LT.
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 672.1 (ft) EOB: 35.0 ft.
START: 12/2/21 END: 12/2/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.461446, -81.657368

EXPLORATION ID B-064-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 672.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
GRAVEL	671.1																	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS**, SOME SAND, FILL, DRY	668.6		7 8 10	27	100	SS-1	-	-	-	-	-	-	-	-	-	14	A-1-a (V)	
MEDIUM DENSE, BROWN, **SANDY SILT**, TRACE GRAVEL, SOME CLAY, DRY			5 6 8	21	100	SS-2	-	0	3	45	- 52 -		NP	NP	NP	14	A-4a (3)	
			7 8 8	24	100	SS-3	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
			4 4 6	15	100	SS-4	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
@11.0' LOOSE	658.6		3 3 4	10	89	SS-5	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
VERY LOOSE TO LOOSE, GRAY, **COARSE AND FINE SAND**, SOME GRAVEL,LITTLE CLAY, LITTLE SILT,FILL, WET		▽ 656.1	2 2 3	7	67	SS-6	-	27	34	25	- 14 -		NP	NP	NP	20	A-3a (0)	
			6 1 1	3	11	SS-7	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
@18.5' MEDIUM DENSE	651.1	W 654.1	6 4 8	18	67	SS-8	-	-	-	-	-	-	-	-	-	29	A-3a (V)	
MEDIUM DENSE TO DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, SLAG, FILL, WET			7 12 10	33	78	SS-9	-	-	-	-	-	-	-	-	-	18	A-2-4 (V)	
			12 4 9	19	56	SS-10	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	
@26.0' VERY DENSE			7 5 31	54	78	SS-11	-	-	-	-	-	-	-	-	-	21	A-2-4 (V)	
@28.5' MEDIUM DENSE			7 8 12	30	78	SS-12	-	25	9	39	- 27 -		NP	NP	NP	18	A-2-4 (0)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 163+00, 52' LT.	START: 12/2/21	END: 12/2/21	PG 2 OF 2	B-064-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE TO DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, SLAG, FILL, WET *(continued)*	642.1	31 32 33 34																
	637.1	EOB 35	4 9 11	30	100	SS-13	-	-	-	-	-	-	-	-	-	21	A-2-4 (V)	

NOTES: BOREHOLE CAVED IN AT 14.2 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 165+00, 50' LT.	EXPLORATION ID B-065-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 667.1 (ft) EOB: 35.0 ft.	PAGE 1 OF 2
START: 12/2/21 END: 12/2/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.461975, -81.657453	

MATERIAL DESCRIPTION AND NOTES	ELEV. 667.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY DENSE, DARK BROWN, **GRAVEL AND/OR STONE FRAGMENTS**, SOME SAND,TRACE SILT, TRACE CLAY,FILL, MOIST			12 14 21	52	100	SS-1	-	69	19	9	- 3 -		NP	NP	NP	11	A-1-a (0)	
@3.5' MEDIUM DENSE			8 7 9	24	78	SS-2	-	-	-	-	-	-	-	-	-	2	A-1-a (V)	
	661.1																	
STIFF, BROWN, **SANDY SILT**, FILL, DRY			8 5 4	13	100	SS-3	-	-	-	-	-	-	-	-	-	6	A-4a (V)	
	656.1		2 3 4	10	100	SS-4	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, SOME SILT SEAM, FILL, DAMP			8 6 13	28	100	SS-5	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
@13.5' LOOSE			17 2 3	7	17	SS-6	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	
	651.1																	
STIFF, BROWN AND DARK GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, WITH BRICK FRAGMENTS,FILL, DAMP			2 3 4	10	100	SS-7	-	-	-	-	-	-	-	-	-	16	A-4a (V)	
			3 4 4	12	100	SS-8	-	5	8	21	- 66 -		22	19	3	17	A-4a (6)	
		▽ 646.5 W 646.1																
			5 4 4	12	100	SS-9	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
@23.5' AND CLAY			3 4 6	15	100	SS-10	-	1	15	14	- 70 -		24	18	6	17	A-4a (7)	
			4 3 7	15	100	SS-11	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
			4 4 4	12	100	SS-12	-	-	-	-	-	-	-	-	-	18	A-4a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 165+00, 50' LT.	START: 12/2/21	END: 12/2/21	PG 2 OF 2	B-065-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, BROWN AND DARK GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, WITH BRICK FRAGMENTS,FILL, DAMP *(continued)*	637.1	31 32 33																
@33.5' VERY STIFF	632.1	34 EOB 35	4 7 10	25	100	SS-13	-	-	-	-	-	-	-	-	-	-	A-4a (V)	

NOTES: BOREHOLE CAVED IN AT 17.5 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / DONOVAN	DRILL RIG: CME 45 TRACKED	STATION / OFFSET: 167+00, 48' LT.	EXPLORATION ID B-066-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / DONOVAN	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/5/20	ELEVATION: 662.1 (ft) EOB: 40.0 ft.	PAGE 1 OF 2
START: 12/2/21 END: 12/2/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89.3	LAT / LONG: 41.462524, -81.657512	

MATERIAL DESCRIPTION AND NOTES	ELEV. 662.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
GRAVEL, FILL	661.1																	
MEDIUM DENSE TO DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, FILL, MOIST		1	3 4 7	16	100	SS-1	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	
		2																
		3																
		4	12 7 8	22	78	SS-2	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
		5																
		6																
		7	12 8 14	33	78	SS-3	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		8																
		9	12 5 7	18	67	SS-4	-	-	-	-	-	-	-	-	-	8	A-1-b (V)	
	651.1	10																
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE GRAVEL, TRACE SILT, DAMP		11																
		12	3 3 4	10	100	SS-5	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
		13																
		14	3 3 3	9	100	SS-6	-	0	6	70	- 24 -		NP	NP	NP	9	A-3a (0)	
		15																
		16																
		17	3 2 4	9	100	SS-7	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
		18																
		19	3 4 3	10	67	SS-8	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		20																
		21																
		22	3 3 3	9	100	SS-9	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
		23																
		24	3 4 3	10	100	SS-10	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
		25																
	▽ 636.8	26																
	W 636.1	27	3 4 6	15	100	SS-11	-	0	11	79	- 10 -		NP	NP	NP	19	A-3a (0)	
		28																
		29	3 4 8	18	100	SS-12	-	-	-	-	-	-	-	-	-	17	A-3a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 167+00, 48' LT.	START: 12/2/21	END: 12/2/21	PG 2 OF 2	B-066-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
	632.1																	
	631.1																	
VERY STIFF TO HARD, GRAY, **SANDY SILT**, WET		31	3 4 6	15	100	SS-13	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
		32																
		33																
		34	4 4 4	12	100	SS-14	3.75	-	-	-	-	-	-	-	-	17	A-4a (V)	
		35																
		36	3 5 6	16	100	SS-15	4.50	-	-	-	-	-	-	-	-	20	A-4a (V)	
		37																
		38																
		39	4 3 7	15	100	SS-16	3.75	-	-	-	-	-	-	-	-	13	A-4a (V)	
	622.1	EOB 40																

NOTES: BOREHOLE CAVED IN AT 16.9 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:48 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 169+00, 48' LT.	EXPLORATION ID B-067-0-20	
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / KENTON F.	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77		
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 657.2 (ft) EOB: 50.0 ft.	PAGE 1 OF 2	
START: 12/14/21 END: 12/14/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.463050, -81.657630		

MATERIAL DESCRIPTION AND NOTES	ELEV. 657.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, BLACK AND BROWN, **GRAVEL**, DRY	653.7	1–3	4 4 5	13	75	SS-1	-	-	-	-	-	-	-	-	-	12	A-1-a (V)	
HARD, BROWN, **SILT**, TRACE FINE SAND, DRY	651.2	4–5	17 9 6	21	75	SS-2	>4.5	-	-	-	-	-	-	-	-	21	A-4b (V)	
LOOSE, GRAY, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, TRACE GRAVEL, DAMP	643.7	6–7	3 3 4	10	75	SS-3	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		9–10	3 3 3	9	75	SS-4	-	3	8	68	21	-	NP	NP	NP	10	A-3a (0)	
		11–12	2 3 3	9	100	SS-5	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
STIFF TO VERY STIFF, BROWN, **SILT**, SOME CLAY, TRACE GRAVEL, TRACE SAND, MOIST		14–15	3 3 3	9	50	SS-6	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		16–17	3 4 3	10	75	SS-7	3.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
@17.5-19.5: DD= 98.7-102.0 PCF, SEE DIRECT SHEAR RESULTS		18–19			81	ST-8	-	0	1	2	70	27	26	19	7	22	A-4b (8)	
@21.0' HARD		21–22	4 8 9	24	100	SS-9	>4.5	-	-	-	-	-	-	-	-	21	A-4b (V)	
@23.5' STIFF	628.7	24–25	3 4 5	13	100	SS-10	2.00	-	-	-	-	-	-	-	-	24	A-4b (V)	
MEDIUM DENSE, BROWN, **SILT**, LITTLE CLAY, LITTLE SAND, MOIST		29	3 4 7	16	100	SS-11	-	0	0	12	78	10	NP	NP	NP	22	A-4b (8)	

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 169+00, 48' LT.	START: 12/14/21	END: 12/14/21	PG 2 OF 2	B-067-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, BROWN, **SILT**, LITTLE CLAY, LITTLE SAND, MOIST *(continued)*	627.2	31 32 33																
		34	4 4 5	13	100	SS-12	-	-	-	-	-	-	-	-	-	25	A-4b (V)	
		35 36 37 38																
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, MOIST	618.7	39	3 5 4	13	100	SS-13	1.75	-	-	-	-	-	-	-	-	25	A-4a (V)	
		40 41 42 43																
		44	6 6 8	20	100	SS-14	2.00	-	-	-	-	-	-	-	-	22	A-4a (V)	
		45 46 47 48																
	607.2	EOB 49 50	5 7 10	24	100	SS-15	3.75	-	-	-	-	-	-	-	-	23	A-4a (V)	

NOTES: FINE CONTENT REPORTED AS SILT IN SS-4

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:48 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 172+00, 48' LT.	EXPLORATION ID B-068-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / KENTON F.	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 662.0 (ft) EOB: 60.0 ft.	PAGE 1 OF 2
START: 12/14/21 END: 12/14/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.464014, -81.657974	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY LOOSE, BLACK, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, SLAG, FILL, DRY	662.0	1	2 2 1	4	5	SS-1	-	23	16	32	- 29 -		NP	NP	NP	11	A-2-4 (0)	
		2																
		3																
		4	2 2 1	4	20	SS-2	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	
		5																
	656.0	6																
LOOSE TO MEDIUM DENSE, BROWN, **SILT**, TRACE CLAY, AND COARSE TO FINE SAND,TRACE GRAVEL, DRY		7	4 3 4	10	75	SS-3	-	-	-	-	-	-	-	-	-	4	A-4b (V)	
		8																
		9	3 3 3	9	75	SS-4	-	1	0	36	- 63 -		NP	NP	NP	17	A-4b (6)	
		10																
		11	4 4 5	13	75	SS-5	-	-	-	-	-	-	-	-	-	6	A-4b (V)	
		12																
		13																
		14	4 4 4	11	100	SS-6	-	-	-	-	-	-	-	-	-	20	A-4b (V)	
	646.0	15																
VERY STIFF TO HARD, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, DAMP		16	2 5 6	16	80	SS-7	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		17																
		18																
		19	8 12 15	39	70	SS-8	-	-	-	-	-	-	-	-	-	9	A-4b (V)	
		20																
		21																
		22																
		23																
		24	6 7 9	23	100	SS-9	>4.5	0	0	11	69	20	20	18	2	14	A-4b (8)	
		25																
		26																
		27																
		28																
		29	8 11 12	33	100	SS-10	>4.5	-	-	-	-	-	-	-	-	13	A-4b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 172+00, 48' LT.	START: 12/14/21	END: 12/14/21	PG 2 OF 2	B-068-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, DAMP *(continued)*	632.0	31																
		32																
		33																
		34	9 10 11	30	50	SS-11	>4.5	-	-	-	-	-	-	-	-	16	A-4b (V)	
		35																
		36																
		37																
		38																
		39	10 7 9	23	100	SS-12	3.50	0	0	1	68	31	22	20	2	20	A-4b (8)	
		40																
		41																
		42																
		43																
	618.5																	
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, DAMP TO MOIST		44	5 6 8	20	100	SS-13	3.00	-	-	-	-	-	-	-	-	24	A-4a (V)	
		45																
		46																
		47																
		48																
		49	5 7 8	21	100	SS-14	2.25	-	-	-	-	-	-	-	-	25	A-4a (V)	
		50																
		51																
		52																
		53																
		54	4 6 7	19	100	SS-15	1.50	-	-	-	-	-	-	-	-	24	A-4a (V)	
		55																
		56																
		57																
		58																
		59	6 8 11	27	100	SS-16	3.25	-	-	-	-	-	-	-	-	20	A-4a (V)	
	602.0	EOB 60																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 170+75, 64' LT.	EXPLORATION ID B-070-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / KENTON F.	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 656.8 (ft) EOB: 110.0 ft.	PAGE 1 OF 4
START: 12/15/21 END: 12/15/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.468506, -81.659955	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
DENSE, BLACK, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, LITTLE SILT, SLAG, FILL, DAMP	656.8	1	15 14 15	41	100	SS-1	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	
@3.5' MEDIUM DENSE		4	9 8 5	19	50	SS-2	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
		7	9 9 3	17	33	SS-3	-	35	11	39	15	-	NP	NP	NP	11	A-2-4 (0)	
SOFT, BROWN, **SANDY SILT**, MOIST	648.3	9	3 1 1	3	100	SS-4	-	-	-	-	-	-	-	-	-	36	A-4a (V)	
@11.0' VERY STIFF		12	4 7 7	20	70	SS-5	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
STIFF TO VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, MOIST	643.3	14	7 7 11	26	70	SS-6	1.50	-	-	-	-	-	-	-	-	18	A-4b (V)	
		17	4 3 3	9	100	SS-7	2.00	0	0	1	70	29	22	20	2	23	A-4b (8)	
		19	3 3 4	10	75	SS-8	3-3.25	-	-	-	-	-	-	-	-	22	A-4b (V)	
@21.0' LITTLE CLAY @ 21.0-23.0: QU=6480 PSF @ 20.6% STRAIN, DD= 110.1 PCF, Cc=0.07, Cr=0.01		22			100	ST-9	-	0	0	1	80	19	22	19	3	20	A-4b (8)	
		24	3 7 6	19	100	SS-10	3.50	-	-	-	-	-	-	-	-	21	A-4b (V)	
		29	3 4 6	14	100	SS-11	2.75	-	-	-	-	-	-	-	-	21	A-4b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:50 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

MATERIAL DESCRIPTION AND NOTES	ELEV. 626.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, MOIST *(continued)*		31																
@ 31.0-33.0: QU=2016 PSF @ 14.0% STRAIN, DD= 99.6 PCF @ 31.0-33.0: QU=1627 PSF @ 11.3% STRAIN, DD= 98.7 PCF @ 31.0-33.0: QU=2534 PSF @ 17.6% STRAIN, DD= 99.7 PCF		32			100	ST-12	-	0	0	0	80	20	25	21	4	26	A-4b (8)	
		33																
		34	2 3 3	9	100	SS-13	1.25	-	-	-	-	-	-	-	-	27	A-4b (V)	
		35																
		36																
		37																
		38																
@ 38.0-40.0: QU=2736 PSF @ 8.9% STRAIN, DD= 103.0 PCF @ 38.0-40.0: QU=4608 PSF @ 8.9% STRAIN, DD= 98.2 PCF, Cc=0.13, Cr=0.03		39			100	ST-14	-	0	0	1	62	37	29	20	9	23	A-4b (8)	
		40																
		41																
		42																
		43																
@43.5' SOFT		44	3 6 7	19	100	SS-15	0.25	-	-	-	-	-	-	-	-	19	A-4b (V)	
		45																
		46																
		47																
		48																
@48.5' STIFF		49	4 7 6	19	100	SS-16	1.50	-	-	-	-	-	-	-	-	19	A-4b (V)	
		50																
		51																
		52																
		53																
@53.5' MEDIUM STIFF		54	4 5 6	16	100	SS-17	0.50	-	-	-	-	-	-	-	-	19	A-4b (V)	
		55																
		56																
		57																
		58																
@58.5' STIFF, "AND" CLAY		59	4 6 8	20	100	SS-18	1-1.5	0	0	0	60	40	24	19	5	20	A-4b (8)	
		60																
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:50 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, MOIST *(continued)*	594.7	63																
		64	4 4 6	14	100	SS-19	1.5-2	-	-	-	-	-	22	20	2	21	A-4b (V)	
		65																
		66																
		67																
		68																
		69	4 5 6	16	100	SS-20	1-1.5	-	-	-	-	-	-	-	-	18	A-4b (V)	
		70																
		71																
		72																
		73																
		74	3 5 7	17	100	SS-21	1-2.5	-	-	-	-	-	-	-	-	27	A-4b (V)	
		75																
		76																
		77																
		78																
		79	4 7 7	20	100	SS-22	1.50	-	-	-	-	-	-	-	-	25	A-4b (V)	
		80																
		81																
		82																
		83																
		84	4 5 6	16	100	SS-23	1.50	-	-	-	-	-	-	-	-	26	A-4b (V)	
		85																
		86																
		87																
		88																
STIFF, GRAY, **SANDY SILT**, "AND" CLAY, TRACE GRAVEL, MOIST	568.3	89	3 3 6	13	100	SS-24	1-1.5	1	2	3	40	54	29	19	10	23	A-4a (8)	
		90																
		91																
		92																
		93																
		94	1															

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:50 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:50 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 170+75, 64' LT.	START: 12/15/21	END: 12/15/21	PG 4 OF 4	B-070-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, GRAY, **SANDY SILT**, "AND" CLAY, TRACE GRAVEL, MOIST *(continued)*	562.6	95	3 6	13	100	SS-25	1-1.5	-	-	-	-	-	-	-	-	22	A-4a (V)	
		96																
		97																
		98																
		99	3 4 7	16	100	SS-26	1-1.5	-	-	-	-	-	-	-	-	23	A-4a (V)	
		100																
		101																
		102																
		103																
		104	3 4 6	14	100	SS-27	1-1.5	-	-	-	-	-	-	-	-	22	A-4a (V)	
		105																
		106																
		107																
		108																
		109	3 4 8	17	100	SS-28	1-1.5	-	-	-	-	-	-	-	-	21	A-4a (V)	
	546.8	EOB 110																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 170+00, 64' RT.
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / KENTON F.	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 654.4 (ft) EOB: 110.0 ft.
START: 12/17/21 END: 12/17/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.463548, -81.657747

EXPLORATION ID B-071-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 654.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, BLACK, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, SLAG, FILL, DRY		1	15 6 8	20	33	SS-1	-	64	16	11	9	-	NP	NP	NP	9	A-1-b (0)	
	650.9	2																
MEDIUM DENSE, BROWN, **FINE SAND**, LITTLE SILT, DAMP		3																
	648.4	4	5 10 9	27	75	SS-2	-	-	-	-	-	-	-	-	-	9	A-3 (V)	
MEDIUM DENSE, DARK BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT**, DAMP		5																
	645.9	6	4 6 5	16	5	SS-3	-	-	-	-	-	-	-	-	-	13	A-2-4 (V)	
LOOSE TO MEDIUM DENSE, BROWN, **SILT**, LITTLE CLAY, TRACE FINE SAND, MOIST TO DAMP		7																
		8	2 2 3	7	50	SS-4	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		9																
		10	2 6 10	23	80	SS-5	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
@13.5' DENSE		11																
		12	10 14 14	40	75	SS-6	-	-	-	-	-	-	-	-	-	16	A-4b (V)	
@16.0' MEDIUM DENSE		13																
		14	8 8 9	24	100	SS-7	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		15																
		16	3 5 10	21	100	SS-8	-	0	0	2	79	19	19	19	NP	19	A-4b (8)	
	633.4	17																
VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST		18																
		19	6 6 7	19	100	SS-9	3.50	-	-	-	-	-	-	-	-	17	A-4b (V)	
		20																
		21	6 8 7	21	100	SS-10	3.50	-	-	-	-	-	-	-	-	18	A-4b (V)	
		22																
@ 26.0-28.0: QU=5760 PSF @ 20.4% STRAIN, DD= 109.4 PCF @ 26.0-28.0: QU=7632 PSF @ 20.4% STRAIN, DD= 108.7 PCF @ 26.0-28.0: QU=8784 PSF @ 19.2% STRAIN, DD= 110.6 PCF, Cc=0.08, Cr=0.01		23			100	ST-11	-	0	1	3	69	27	23	19	4	19	A-4b (8)	
		24																
		25	3 4 5	13	100	SS-12	3.50	0	0	1	67	32	21	19	2	22	A-4b (8)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:51 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECH\NICALTRC LOGS\CUY LOGS

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, GRAY, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST *(continued)*	624.4	31																
		32																
		33																
		34	4 7 6	19	100	SS-13	3.50	-	-	-	-	-	-	-	-	20	A-4b (V)	
		35																
		36																
@ 36.0-38.0: QU=3629 PSF @ 21.3% STRAIN, DD= 110.0 PCF @ 36.0-38.0: QU=4320 PSF @ 21.3% STRAIN, DD= 103.7 PCF @ 36.0-38.0: QU=3038 PSF @ 20.0% STRAIN, DD= 103.4 PCF		37			100	ST-14	-	0	0	1	77	22	22	19	3	23	A-4b (8)	
		38																
@38.5' STIFF, "AND" CLAY		39	2 2 4	9	100	SS-15	2.00	0	0	0	50	50	25	19	6	26	A-4b (8)	
		40																
	613.4	41																
GRAY, **SILT AND CLAY**, TRACE FINE SAND @ 41.0-43.0: QU=5040 PSF @ 15.2% STRAIN, DD= 104.7 PCF @ 41.0-43.0: QU=5472 PSF @ 11.8% STRAIN, DD= 105.0 PCF, Cc= 0.12, Cr = 0.03	610.9	42			100	ST-16	-	0	0	0	68	32	33	21	12	26	A-6a (9)	
		43																
STIFF TO VERY STIFF, GRAY, **SILT**, "AND" CLAY, MOIST TO DAMP		44	3 3 4	10	100	SS-17	1.5-2	-	-	-	-	-	-	-	-	22	A-4b (V)	
		45																
		46																
		47																
		48																
		49	4 3 6	13	100	SS-18	1.50	-	-	-	-	-	-	-	-	22	A-4b (V)	
		50																
		51																
		52																
		53																
		54	4 6 7	19	100	SS-19	3.00	-	-	-	-	-	-	-	-	20	A-4b (V)	
		55																
		56																
		57																
		58																
		59	2 4 5	13	100	SS-20	2.00	0	0	0	59	41	27	20	7	25	A-4b (8)	
		60																
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:51 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 170+00, 64' RT.	START: 12/17/21	END: 12/17/21	PG 3 OF 4	B-071-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 592.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, **SILT**, "AND" CLAY, MOIST TO DAMP *(continued)*		63																
@63.5' MEDIUM STIFF		64	2 3 5	11	100	SS-21	0.5-1	-	-	-	-	-	-	-	-	24	A-4b (V)	
		65																
		66																
		67																
		68																
		69	3 4 7	16	100	SS-22	1.00	-	-	-	-	-	-	-	-	25	A-4b (V)	
		70																
		71																
		72																
		73																
@73.5' VERY STIFF		74	3 4 6	14	100	SS-23	2.50	0	0	1	65	34	23	21	2	19	A-4b (8)	
		75																
		76																
		77																
		78																
@78.5' STIFF		79	5 5 8	19	100	SS-24	1.25	0	0	1	34	65	-	-	-	17	A-4b (V)	
		80																
		81																
		82																
		83																
		84	3 4 6	14	100	SS-25	1.50	-	-	-	-	-	-	-	-	25	A-4b (V)	
		85																
		86																
		87																
		88																
		89	3 4 7	16	100	SS-26	1.50	-	-	-	-	-	-	-	-	22	A-4b (V)	
		90																
		91																
		92																
		93																
		94	3															

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:51 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:51 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 170+00, 64' RT.	START: 12/17/21	END: 12/17/21	PG 4 OF 4	B-071-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, **SILT**, "AND" CLAY, MOIST TO DAMP *(continued)*	560.1	95	8 6	20	100	SS-27	1.50	-	-	-	-	-	-	-	-	24	A-4b (V)	
		96																
		97																
		98																
		99	4 4 7	16	100	SS-28	1.50	-	-	-	-	-	-	-	-	22	A-4b (V)	
		100																
		101																
		102																
		103																
		104	3 6 9	21	100	SS-29	1.5-2	-	-	-	-	-	-	-	-	21	A-4b (V)	
		105																
		106																
		107																
		108																
		109	3 4 6	14	100	SS-30	1.00	-	-	-	-	-	-	-	-	21	A-4b (V)	
	544.4	EOB 110																

NOTES: FINE CONTENT REPORTED AS SILT IN SS-1

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 22:57 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOGS

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 181+50, 150' LT.	EXPLORATION ID B-072-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / KENTON F.	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 656.6 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/1/21 END: 12/1/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.463258, -81.656963	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
TOPSOIL (4")	656.6																	
VERY STIFF TO HARD, BROWN TO BLACK, **SANDY SILT**, SLAG, ROCK FRAGMENTS, FILL, DRY	656.2		4 8 10	26	75	SS-1	-	-	-	-	-	-	-	-	-	-	A-4a (V)	
			15 14 11	36	100	SS-2	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
			32 18 22	57	25	SS-3	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
			60/2"	-	5	SS-4	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
VERY DENSE, GRAY, **FINE SAND**, SOME SILT, MOIST TO WET	641.6	▽ 640.6	13 24 23	67	100	SS-5	-	0	1	75	- 24 -		NP	NP	NP	17	A-3 (0)	
VERY DENSE, GRAY, **COARSE AND FINE SAND**, SOME SILT, MOIST TO WET	633.1		9 20 24	63	100	SS-6	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
	631.6	EOB																

NOTES: FINE CONTENT REPORTED AS SILT IN SS-5

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/10/24 14:03 - I:\PROJECTS\ODOT\301525_CUY-77-11.21\GEOTECHNICAL\GEOTECH REPORT\STAGE 2 GER\LOGS-AND-LAB-TE

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: CTL / JASON	DRILL RIG: CME 550X ATV	STATION / OFFSET: 190+00, 150' LT.	EXPLORATION ID B-073-0-20
TYPE: RETAINING WALL	SAMPLING FIRM / LOGGER: CTL / KENTON F.	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/19/21	ELEVATION: 656.6 (ft) EOB: 25.0 ft.	PAGE 1 OF 1
START: 12/1/21 END: 12/1/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 85.6	LAT / LONG: 41.466303, -81.658850	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL (4")	656.6																	
STIFF, DARK BROWN, **SILT**, AND SAND, DAMP	656.2	1	3 3 5	11	100	SS-1	1.50	-	-	-	-	-	-	-	-	-	A-4b (V)	
	653.1	2																
VERY DENSE, BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, MOIST TO WET		3																
		4	15 13 19	46	100	SS-2	-	3	13	41	- 43 -		NP	NP	NP	11	A-4a (2)	
		5																
		6																
		7																
		8																
		9	8 14 18	46	100	SS-3	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
		10																
		11																
		12																
		13																
@13.5' DENSE		14	8 10 12	31	50	SS-4	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
		15																
		16																
		17																
	638.1	18																
VERY DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, DAMP		19	8 20 23	61	75	SS-5	-	0	0	66	- 34 -		NP	NP	NP	24	A-3a (0)	
		20																
		21																
		22																
		23																
		24	14 18 28	66	100	SS-6	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
	631.6	EOB 25																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MIXED WITH BENTONITE CHIPS

APPENDIX B-2
LOGS OF BORINGS (COMPLETED IN 2018)

PROJECT: CUY-77-11.21
TYPE: SUBGRADE
PID: 105743 SFN:
START: 3/19/18 END: 3/19/18

DRILLING FIRM / OPERATOR: OHIO TESTBOR / CS
SAMPLING FIRM / LOGGER: AECOM / TG
DRILLING METHOD: 4" SSA
SAMPLING METHOD: SPT

DRILL RIG: SIMCO 2800 (062012)
HAMMER: AUTOMATIC HAMMER
CALIBRATION DATE: 11/13/18
ENERGY RATIO (%): 84.5

STATION / OFFSET: 159+05, 40' LT.
ALIGNMENT: I-77 EX CL
ELEVATION: 678.7 (MSL) EOB: 7.5 ft.
LAT / LONG: 41.460410, -81.657160

EXPLORATION ID B-022-0-18

MATERIAL DESCRIPTION AND NOTES	ELEV. 678.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
8" ASPHALT	678.0																	
9" CONCRETE	677.3																	
VERY DENSE, DARK BROWN, **STONE FRAGMENTS WITH SAND**, STONE FRAGMENTS AS SLAG, FILL, MOIST	676.2	1	30 50/2"	-	100	SS-1	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
VERY STIFF, BROWN, **SANDY SILT**, MOIST	675.4	2																
STIFF, GRAYISH BROWN, **SILT AND CLAY**, INTERBEDDED SILT LAMINAE, MOIST	674.2	3				SS-2A	-	-	-	-	-	-	-	-	-	-	A-4a (V)	
		4	5 5 6	15	56	SS-2B	2.88	0	0	1	50	49	31	19	12	22	A-6a (9)	
MEDIUM STIFF, GRAYISH BROWN, **SILTY CLAY**, MOIST	672.5	5	4 4 5	13	78	SS-3	0.58	0	0	1	30	69	39	23	16	27	A-6b (10)	
		6				SS-4A	1.00	-	-	-	-	-	-	-	-	16	A-6b (V)	
MEDIUM DENSE, GRAYISH BROWN, **SANDY SILT**, MOIST @ 6.9' - OXIDIZED @ 7.1' - BECOMES MOIST TO WET, DILATANT	671.2 EOB	7	7 9 9	25	83	SS-4B	-	-	-	-	-	-	-	-	-	-	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PATCHED AT SURFACE WITH 8 IN. ASPHALT PATCH; PLACED 9 IN. CONCRETE; BACKFILLED WITH 6.1 FT. SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/26/26 19:08 - C:\USERS\TGWILLIAMS\ONEDRIVE - TRC\CUY-77\CUY-77-11.21 BORING LOGS REV NOV 2025.GPJ

PROJECT: CUY-77-11.21	DRILLING FIRM / OPERATOR: OHIO TESTBOR / CS	DRILL RIG: SIMCO 2800 (062012)	STATION / OFFSET: 171+20, 74' LT.
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: AECOM / TG	HAMMER: AUTOMATIC HAMMER	ALIGNMENT: I-77 EX CL
PID: 105743 SFN: CUY-77-11.21	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/13/18	ELEVATION: 653.6 (MSL) EOB: 50.0 ft.
START: 3/15/19 END: 3/15/19	SAMPLING METHOD: SPT	ENERGY RATIO (%): 84.5	LAT / LONG: 41.463700, -81.657880

EXPLORATION ID B-026-0-18

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
	653.6																	
1" TOPSOIL	653.5																	
MEDIUM DENSE, BROWN AND GRAY, **GRAVEL WITH SAND**, FILL, MOIST	651.9	1	6 13 5	25	78	SS-1A	-	23	39	22	12	4	NP	NP	NP	17	A-1-b (0)	
		2				SS-1B	2.25	1	16	26	35	22	17	14	3	15	A-4a (4)	
VERY STIFF, BROWN, **SANDY SILT**, TRACE GRAVEL, FILL, MOIST	650.1	3																
LOOSE, BROWN, **COARSE AND FINE SAND**, FILL, MOIST	649.2	4	3 3 4	10	78	SS-2A	-	3	43	31	14	9	NP	NP	NP	9	A-3a (0)	
						SS-2B	-	-	-	-	-	-	-	-	-	-	A-3a (V)	
STIFF, BROWN, **SILT**, LITTLE SAND, FILL, MOIST	648.1	5				SS-2C	-	0	3	7	58	32	26	18	8	18	A-4b (8)	
LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE TO SOME SILT, FILL, MOIST	647.0	6	2 2 2	6	67	SS-3A	-	3	24	52	11	10	NP	NP	NP	13	A-3a (0)	
STIFF TO HARD, BROWN, **SANDY SILT**, FILL, MOIST	645.1	7				SS-3B	4.5+	-	-	-	-	-	-	-	-	17	A-4a (V)	
		8																
LOOSE, BROWN, **SANDY SILT**, FILL, MOIST	641.8	9	1 2 2	6	78	SS-4A	1.00	5	10	17	37	31	27	17	10	21	A-4a (7)	
		10				SS-4B	-	-	-	-	-	-	-	-	-	17	A-4a (V)	
		11																
MEDIUM STIFF, GRAY WITH BLACK MOTTLING, **SANDY SILT**, TRACE ORGANICS, POSSIBLE FILL, MOIST		12																
		13																
		14	1 4 3	10	78	SS-5	0.70	0	5	34	31	30	25	15	10	22	A-4a (5)	
	638.1	15																
POSSIBLE COBBLEY ZONE	636.8	16																
VERY STIFF, BROWNISH GRAY, **SILT**, MOIST		17																
		18																
		19	3 4 5	13	83	SS-6	2.67	-	-	-	-	-	-	-	-	21	A-4b (V)	
		20																
		21																
		22																
		23																
@ 23.5' BECOMES MEDIUM STIFF		24	2 3 5	11	100	SS-7	0.60	0	0	1	68	31	27	21	6	25	A-4b (8)	
		25																
		26																
		27																
		28																
@ 28.5' - WITH INTERBEDDED NON-COHESIVE SILT LAYERS, 1/16" TO 2" THICK		29	2 4 4	11	94	SS-8	0.65	-	-	-	-	-	-	-	-	26	A-4b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/27/26 13:51 - C:\USERS\TGWILLIAMS\ONEDRIVE - TRC\CUY-77\CUY-77-11.21 BORING LOGS REV NOV 2025.GPJ

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.21	STATION / OFFSET: 171+20, 74' LT.	START: 3/15/19	END: 3/15/19	PG 2 OF 2	B-026-0-18

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
VERY STIFF, BROWNISH GRAY, **SILT**, MOIST *(continued)*	623.6																	
		31			0	ST-1	-	-	-	-	-	-	-	-	-	-		
		32																
		33																
		W 620.1																
@ 33.5' - BECOMES WET, DILATANT		34	2 2 4	8	100	SS-9	0.83	0	0	0	67	33	28	20	8	26	A-4b (8)	
	618.1	35																
STIFF, BROWNISH GRAY, **SILT AND CLAY**, WITH SILT LAMINAE, MOIST		36																
		37			100	ST-2	2.13	-	-	-	-	-	-	-	-	-	A-6a (V)	
		38																
		39	2 4 5	13	100	SS-10	1.75	1	0	0	53	46	31	20	11	24	A-6a (8)	
		40																
		41																
		42																
		43																
		44	2 5 7	17	100	SS-11	1.92	-	-	-	-	-	-	-	-	23	A-6a (V)	
		45																
		46																
	606.8	47																
MEDIUM DENSE, BROWNISH GRAY, **SILT**, MOIST		48																
	604.3	49	7 8 8	23	100	SS-12A	-	0	0	0	90	10	NP	NP	NP	19	A-4b (8)	
VERY STIFF, BROWNISH GRAY, **SILT AND CLAY**, WITH SILT LAMINAE, MOIST	603.6	EOB 50				SS-12B	2.13	-	-	-	-	-	-	-	-	23	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH CEMENT; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/27/26 13:51 - C:\USERS\TGWILLIAMS\ONEDRIVE - TRC\CUY-77\CUY-77-11.21 BORING LOGS REV NOV 2025.GPJ

APPENDIX B-3
HISTORIC LOGS OF BORINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:03 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037_H

PROJECT: CUY-77-11.69	DRILLING FIRM / OPERATOR: ODOT / -	DRILL RIG: MOBILE B-53 R TRAILER	STATION / OFFSET: 89+50, 64' LT.
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: ODOT / -	HAMMER: SAFETY HAMMER	ALIGNMENT: I-77
PID: G01037 SFN: CUY-77-11.69	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 718.9 (ft) EOB: 75.0 ft.
START: 9/24/02 END: 9/24/02	SAMPLING METHOD: SPT	ENERGY RATIO (%): 60	COORD: 2201334.5490 N, 648128.8920 E

EXPLORATION ID: B-001-0-02

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
AGGREGATE BASE, RAILROAD BEDDING	718.9																	
	716.9																	
DENSE TO VERY DENSE, BROWN, **SANDY SILT**, LITTLE ROCK FRAGMENTS, SOME CLAY, RAILROAD EMBANKMENT FILL, MOIST			10 20 27	47	-	SS-1	-	-	-	-	-	-	-	-	-	6		
			27 31 34	65	-	SS-2	-	6	11	46	13	24	NP	NP	NP	6	A-4a (0)	
			17 22 24	46	-	SS-3	-	-	-	-	-	-	-	-	-	7	A-4a (V)	
	710.9																	
VERY STIFF TO HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE ROCK/COAL FRAGMENTS, RAILROAD EMBANKMENT FILL, MOIST			7 12 17	29	-	SS-4	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
			17 34 22	56	-	SS-5	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
	702.4																	
MEDIUM DENSE, GRAY AND BROWN, **COARSE AND FINE SAND**, LITTLE SILT, NATURAL SOIL, MOIST			3 6 8	14	-	SS-6	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
	698.9																	
VERY STIFF, GRAY, **SILT AND CLAY**, TRACE GRAVEL, TRACE SAND, MOIST			5 6 10	16	-	SS-7	-	1	1	6	- 92 -		33	19	14	23	A-6a (10)	
NOTE: GROUNDWATER MEASURED AT 26.0 FEET UPON COMPLETION OF DRILLING AFTER BORE HOLE HAD CAVED-IN			8 7 9	16	-	SS-8	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
	690.9																	
LOOSE TO MEDIUM DENSE, BROWN, **FINE SAND**, TRACE SILT, MOIST			7 5 5	10	-	SS-9	-	-	-	-	-	-	-	-	-	5	A-3 (V)	

PID: G01037	SFN: CUY-77-11.69	PROJECT: CUY-77-11.69	STATION / OFFSET: 89+50, 64' LT.	START: 9/24/02	END: 9/24/02	PG 2 OF 3	B-001-0-02

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
LOOSE TO MEDIUM DENSE, BROWN, **FINE SAND**, TRACE SILT, MOIST *(continued)*	688.9	31	6 7 5	12	-	SS-10	-	2	40	52	- 6 -		NP	NP	NP	15	A-3 (0)	
	685.9	32																
VERY STIFF, GRAY, **SANDY SILT**, AND CLAY, MOIST		33																
		34	6 8 10	18	-	SS-11	-	-	-	-	-	-	-	-	-	24	A-4a (V)	
		35																
		36	8 6 12	18	-	SS-12	-	0	0	1	40	59	28	19	9	23	A-4a (8)	
	680.4	37																
	W 680.4	38																
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND**, TRACE SILT, WET		39	10 6 10	16	-	SS-13	-	30	49	18	- 3 -		NP	NP	NP	15	A-1-b (0)	
NOTE: GROUNDWATER ENCOUNTERED AT 38.5 FEET DURING DRILLING	678.9	40																
VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, MOIST		41																
		42	12 13 12	25	-	SS-14	-	0	1	1	- 98 -		30	19	11	22	A-6a (8)	
	675.9	43																
DENSE, GRAY, **SILT**, SOME SAND, LITTLE CLAY, WET		44	14 18 18	36	-	SS-15	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		45																
	671.9	46																
DENSE TO VERY DENSE, GRAY, **FINE SAND**, TRACE SILT, TRACE GRAVEL, WET		47																
		48																
		49	12 14 17	31	-	SS-16	-	1	12	77	- 10 -		NP	NP	NP	19	A-3 (0)	
		50																
		51																
		52																
		53																
		54	24 37 42	79	-	SS-17	-	-	-	-	-	-	-	-	-	18	A-3 (V)	
		55																
		56																
		57																
NOTE: APPROXIMATELY 1.5 FEET OF HEAVING SAND UP TO 58.0 FEET	660.9	58																
DENSE TO VERY DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, TRACE TO NO GRAVEL, WET		59	17 32 37	69	-	SS-18	-	4	4	78	- 14 -		NP	NP	NP	20	A-3a (0)	
		60																
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:03 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037_H

PID: G01037	SFN: CUY-77-11.69	PROJECT: CUY-77-11.69	STATION / OFFSET: 89+50, 64' LT.	START: 9/24/02	END: 9/24/02	PG 3 OF 3	B-001-0-02

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
DENSE TO VERY DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, TRACE TO NO GRAVEL, WET *(continued)*	656.8	63																
		64	10 17 25	42	-	SS-19	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
		65																
		66																
		67																
		68																
		69	15 18 18	36	-	SS-20	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		70																
		71																
		72																
		73																
		74	21 18 20	38	-	SS-21	-	0	4	84	-	12 -	NP	NP	NP	19	A-3a (0)	
	643.9	EOB 75																

NOTES: HISTORICAL BORING LOG RETYPED FROM BORING NO. B-1 COMPLETED ON 9/24/2002 FOR PROJECT NO. G01037 [BRIDGE NO. CUY-77-11.69]

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:03 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037_H

PROJECT: CUY-77-11.69	DRILLING FIRM / OPERATOR: ODOT / -	DRILL RIG: MOBILE B-53 R TRAILER	STATION / OFFSET: 89+62, 72' RT.	EXPLORATION ID B-002-0-02
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: ODOT / -	HAMMER: SAFETY HAMMER	ALIGNMENT: I-77	
PID: G01037 SFN: CUY-77-11.69	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 720.1 (ft) EOB: 74.4 ft.	PAGE 1 OF 3
START: 9/23/02 END: 9/23/02	SAMPLING METHOD: SPT	ENERGY RATIO (%): 60	COORD: 2201451.6580 N, 648199.6360 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 720.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
RAILROAD BEDDING CRUSHED AGGREGATE	719.1																	
MEDIUM DENSE, BROWN, **SANDY SILT**, LITTLE ROCK FRAGMENTS, LITTLE TO TRACE CLAY, EMBANKMENT FILL, MOIST NON-COHESIVE	715.6	1 2 3 4	5 10 11	21	-	SS-1	-	-	-	-	-	-	-	-	-	7	A-4a (V)	
			8 13 16	29	-	SS-2A	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
						SS-2B	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
VERY STIFF, BROWN, **SANDY SILT**, LITTLE ROCK FRAGMENTS, LITTLE TO SOME CLAY, EMBANKMENT FILL, MOIST COHESIVE	712.6	5 6 7	3 10 13	23	-	SS-3	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
VERY STIFF, GRAY AND BROWN, **SILT AND CLAY**, TRACE SAND, EMBANKMENT FILL, MOIST	706.6	8 9 10	2 8 10	18	-	SS-4A	-	0	1	2	97	-	36	25	11	23	A-6a (8)	
						SS-4B	-	-	-	-	-	-	-	-	-	20	A-6a (V)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, POSSIBLE NATURAL SOIL, MOIST	696.6	11 12 13 14 15 16 17 18 19 20 21 22 23	5 8 9	17	-	SS-5	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
			4 5 5	10	-	SS-6	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
MEDIUM STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, MOIST	692.6	24 25 26 27	2 2 4	6	-	SS-7	-	0	0	2	98	-	35	22	13	26	A-6a (9)	
			1 2 4	6	-	SS-8	-	-	-	-	-	-	-	-	-	25	A-6a (V)	
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND**, LITTLE SILT AND CLAY, MOIST		28 29	11 14 9	23	-	SS-9	-	19	35	30	16	-	NP	NP	NP	6	A-1-b (0)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:41 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037_H

PID: G01037	SFN: CUY-77-11.69	PROJECT: CUY-77-11.69	STATION / OFFSET: 89+62, 72' RT.	START: 9/23/02	END: 9/23/02	PG 2 OF 3	B-002-0-02

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND**, LITTLE SILT AND CLAY, MOIST *(continued)*	690.1	31	8 9 11	20	-	SS-10	-	-	-	-	-	-	-	-	-	7	A-1-b (V)	
		32																
		33																
		34	14 11 10	21	-	SS-11	-	40	39	13	8	-	NP	NP	NP	14	A-1-b (0)	
	685.1	35																
VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, MOIST COHESIVE		36	8 7 10	17	-	SS-12	-	0	1	1	98	-	30	19	11	21	A-6a (8)	
	681.6	37																
VERY STIFF, GRAY, **SILT**, AND CLAY, TRACE SAND, MOIST COHESIVE		38																
		39	8 9 11	20	-	SS-13	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		40																
		41	9 14 16	30	-	SS-14	-	0	1	1	50	48	28	21	7	22	A-4b (8)	
	677.6	42																
MEDIUM DENSE TO DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, WET		W 677.1 43																
		44	13 21 29	50	-	SS-15	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
		45																
NOTE: WET AT 43.0 FEET DURING DRILLING		46																
		47																
		48																
		49	9 16 17	33	-	SS-16	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
		50																
		51																
		52																
		53																
		54	12 17 16	33	-	SS-17	-	0	1	82	17	-	NP	NP	NP	20	A-3a (0)	
		55																
		56																
		57																
		58																
		59	10 17 18	35	-	SS-18	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
	660.1	60																
VERY DENSE, GRAY, **FINE SAND**, TRACE SILT, TRACE GRAVEL, WET		F.S. 61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:41 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037_H

PID: G01037	SFN: CUY-77-11.69	PROJECT: CUY-77-11.69	STATION / OFFSET: 89+62, 72' RT.	START: 9/23/02	END: 9/23/02	PG 3 OF 3	B-002-0-02

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
VERY DENSE, GRAY, **FINE SAND**, TRACE SILT, TRACE GRAVEL, WET *(continued)*	658.0	63																
		64	14 24 31	55	-	SS-19	-	2	19	69	- 10 -		NP	NP	NP	15	A-3 (0)	
		65																
	654.1	66																
VERY DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, WET		67																
		68																
		69	27 37 43	80	-	SS-20	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
		70																
		71																
		72																
		73																
	645.7	74 EOB	15 50/5"	-	-	SS-21	-	0	3	78	- 19 -		NP	NP	NP	16	A-3a (0)	

NOTES: HISTORICAL BORING LOG RETYPED FROM BORING NO. B-2 COMPLETED ON 9/23/2002 FOR PROJECT NO. G01037 [BRIDGE NO. CUY-77-11.69]

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:41 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037_H

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:20 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\22891_HIS

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: OTB / D. HEPNER	DRILL RIG: OTB TRUCK 2800	STATION / OFFSET: 9+07, 23' LT.	EXPLORATION ID B-002-0-11
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: S&ME / E. KODRICH	HAMMER: CME AUTOMATIC	ALIGNMENT: PERSHING AVENUE	
PID: 22891 SFN: CUY-77-13.75	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 10/24/11	ELEVATION: 679.8 (ft) EOB: 125.0 ft.	PAGE 1 OF 4
START: 12/7/11 END: 12/8/11	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	COORD: 2198652.2970 N, 658427.8180 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 679.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
BRIDGE DECK - 9 INCHES	679.0																	
AIR	671.1																	
SLOPE PROTECTION - 9 INCHES	670.3																	
LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE FINE GRAVEL, FILL, MOIST	669.1		1 2 6	11	-	SS-1A	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
FILL SLAG AND CONCRETE RUBBLE	666.3					SS-1B	-	-	-	-	-	-	-	-	-	-	UCF (V)	
LOOSE, DARK BROWN, **COARSE AND FINE SAND**, LT FINE TO COARSE GRAVEL, TR SILT, TR CLAY, POSSIBLE FILL, MOIST	662.8		3 2 2	5	-	SS-2	-	-	-	-	-	-	-	-	-	9	A-3a (V)	
VERY LOOSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, MOIST	660.8		3 4 3	10	-	SS-3A	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
						SS-3B	-	0	1	11	80	8	NP	NP	NP	28	A-4b (8)	
LOOSE, BROWN, **SILT**, LITTLE FINE TO COARSE SAND, TRACE CLAY, WET CONTAINS FEW VERY STIFF CLAYEY SILT SEAMS NOTE: SEEPAGE ENCOUNTERED AT 19.3 FT NOTE: GROUNDWATER ENCOUNTERED AT 22.5 FT DURING DRILLING	656.0	W 657.3																
LOOSE, GRAY, **SILT**, LT FINE SAND, LT CLAY, TR C/ SAND, TR F/ GRAVEL, WET CONTAINS FEW STIFF SILTY CLAY SEAMS			3 2 2	5	-	SS-4A	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
						SS-4B	-	-	-	-	-	-	-	-	-	26	A-4b (V)	
			2 3 3	8	-	SS-5	-	1	1	19	62	17	18	18	NP	25	A-4b (8)	
			3 3 3	8	-	SS-6	-	-	-	-	-	-	-	-	-	23	A-4b (V)	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
	649.8																	
	649.3																	
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, LITTLE FINE TO COARSE SAND, TRACE FINE GRAVEL, DAMP TO MOIST		31	3 5 8	18	-	SS-7	2.0-4.2	-	-	-	-	-	-	-	-	20	A-6a (V)	
		32																
		33																
		34			-	ST-8	2.0-2.5	2	4	9	46	39	28	17	11	19	A-6a (8)	
		35																
NOTE: USED 3-1/4" HSA TO A DEPTH OF 35.5 FT	643.8																	
STIFF TO VERY STIFF, GRAY, **SILT**, SM TO AND CLAY, LT F/C SAND, TR F/ GRAVEL, DAMP TO MOIST CONTAINS FEW HARD ZONES		36	4 5 6	15	-	SS-9	1.0-2.0	4	8	8	56	24	23	16	7	17	A-4b (8)	
NOTE: MUD ROTARY DRILLING USING A 3-1/8" TRICONE ROLLER-BIT WAS USED FROM 35.5 FT TO 125.0 FT		37																
		38																
		39	3 5 8	18	-	SS-10	1.3-2.0	-	-	-	-	-	-	-	-	21	A-4b (V)	
		40																
		41																
		42	4 9 8	23	-	SS-11	1.0-2.5	0	8	3	51	38	27	17	10	20	A-4b (8)	
		43																
		44	4 6 8	19	-	SS-12	1.2-2.8	-	-	-	-	-	-	-	-	20	A-4b (V)	
		45																
		46																
		47																
		48																
		49	4 8 13	29	-	SS-13	2.1-4.2	-	-	-	-	-	-	-	-	19	A-4b (V)	
		50																
		51																
	627.8	52																
VERY DENSE, GRAY, **SILT**, LT CLAY, LT TO TR F/C SAND, TR FINE GRAVEL, MOIST		53																
		54	11 25 36	83	-	SS-14	-	1	1	16	62	20	19	17	2	15	A-4b (8)	
		55																
		56																
	623.3	57																
VERY DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, WET		58																
		59	18 20 26	63	-	SS-15	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
		60																
	618.8	61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:20 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\22891_HIS

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
VERY DENSE, BROWNISH-GRAY, **SILT**, LITTLE CLAY, TRACE TO LITTLE FINE TO COARSE SAND, MOIST TO WET CONTAINS FEW HARD CLAYEY SILT SEAMS *(continued)*	617.7	63																
		64	17 25 24	67	-	SS-16	-	-	-	-	-	-	-	-	-	16	A-4b (V)	
		65																
		66																
		67																
		68																
		69	14 22 32	74	-	SS-17	-	0	1	10	76	13	20	21	NP	20	A-4b (8)	
		70																
		71																
		72																
		73																
		74	14 18 28	63	-	SS-18	-	0	1	4	78	17	22	20	2	16	A-4b (8)	
	602.8	75																
DENSE, BROWNISH-GRAY, **SILT**, SOME CLAY, LITTLE FINE TO COARSE SAND, MOIST TO WET		76																
		77																
		78																
	600.3	79	11 15 17	44	-	SS-19A	-	-	-	-	-	-	-	-	-	24	A-4b (V)	
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, TRACE FINE TO COARSE SAND, MOIST CONTAINS FEW SILT LENSES		80				SS-19B	3.2-4.2	-	-	-	-	-	-	-	-	22	A-6a (V)	
		81																
		82																
		83																
	595.1	84	8 13 16	40	-	SS-20A	4.5+	0	1	1	56	42	29	17	12	22	A-6a (9)	
VERY STIFF TO HARD, GRAYISH-BROWN, **SILT AND CLAY**, TRACE FINE TO COARSE SAND, DAMP TO MOIST CONTAINS FEW SILT AND FINE SAND LENSES AND ZONES OF FINE TO COARSE GRAVEL		85				SS-20B	3.7-4.2	-	-	-	-	-	-	-	-	22	A-6a (V)	
		86																
		87																
		88																
		89	7 12 14	36	-	SS-21	2.4-4.5+	17	1	1	46	35	32	20	12	19	A-6a (V)	
		90																
		91																
		92																
		93																
		94	6															

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:20 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\22891_HIS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:20 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\22891_HIS

PID: 22891	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 9+07, 23' LT.	START: 12/7/11	END: 12/8/11	PG 4 OF 4	B-002-0-11

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
VERY STIFF TO HARD, GRAYISH-BROWN, **SILT AND CLAY**, TRACE FINE TO COARSE SAND, DAMP TO MOIST CONTAINS FEW SILT AND FINE SAND LENSES AND ZONES OF FINE TO COARSE GRAVEL *(continued)*	585.5	95	11 15	36	-	SS-22	2.6-4.5+	-	-	-	-	-	-	-	-	22	A-6a (V)	
		96																
		97																
		98																
		99	6 10 15	34	-	SS-23	2.0-4.5+	-	-	-	-	-	-	-	-	22	A-6a (V)	
		100																
		101																
		102																
		103																
		104	7 11 16	37	-	SS-24	2.0-4.5+	-	-	-	-	-	-	-	-	22	A-6a (V)	
		105																
		106																
		107																
		108																
		109	7 11 16	37	-	SS-25	2.6-4.5+	0	1	1	58	40	30	19	11	22	A-6a (8)	
NOTE: BOREHOLE CAVED IN AT 110.0 FT		110																
		111																
		112																
		113																
		114	6 8 13	29	-	SS-26	2.5-4.0	-	-	-	-	-	-	-	-	18	A-6a (V)	
		115																
	562.8	116																
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, TRACE FINE TO COARSE SAND, TRACE FINE GRAVEL, DAMP TO MOIST		117																
		118																
		119	8 12 17	40	-	SS-27	3.6-4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
		120																
		121																
		122																
		123																
		124	6 8 11	26	-	SS-28	2.0-4.5+	1	2	3	35	59	33	17	16	23	A-6b (10)	
	554.8	EOB 125																

NOTES: HISTORICAL BORING LOG RETYPED FROM BORING NO. B-002-0-11 COMPLETED ON 12/8/2011 FOR PROJECT NO. 22891 [CUY-77-11.69]

ABANDONMENT METHODS, MATERIALS, QUANTITIES: TREMIED 70 GAL. CEMENT; PLACED 1.5 BAGS QUICKCRETE

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:30 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\85188_HIS

PROJECT: CUY-77-13.31	DRILLING FIRM / OPERATOR: B&P / R. WEBB	DRILL RIG: MOBILE B57 ORV	STATION / OFFSET: 174+75, 45' LT.	EXPLORATION ID B-004-0-12
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: B&P / R. BLASKO	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: I-77	
PID: 85188 SFN: CUY-77-13.31	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 6/30/11	ELEVATION: 682.2 (ft) EOB: 75.0 ft.	PAGE 1 OF 3
START: 8/14/12 END: 8/14/12	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	COORD: 2199441.4960 N, 656216.6670 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 682.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
ASPHALT	681.0	1	12 3 4	11	-	SS-1	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, LITTLE CLAY, TRACE GRAVEL, FILL, MOIST CONTAINS BRICK FRAGMENTS	679.2	2																
MEDIUM DENSE, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, FILL, DAMP	676.7	3	4 4 5	14	-	SS-2	3.5-3.7	6	21	37	18	18	NP	NP	NP	10	A-4a (0)	
STIFF, BROWN AND GRAY, **CLAY**, AND SILT, LITTLE SAND, TRACE GRAVEL, FILL, MOIST	674.2	4																
STIFF TO VERY STIFF, BROWN MOTTLED WITH GRAY AND DARK BROWN, **SILTY CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST	669.2	5	5 3 3	9	-	SS-3	1.5-1.7	2	7	13	36	42	42	24	18	31	A-7-6 (12)	
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LT TO SM SILT, TR TO LT CLAY, TR GRAVEL, MOIST TO WET		6																
		7	2 4 7	17	-	SS-4	1.3-3.9	-	-	-	-	-	-	-	-	22	A-6b (V)	
		8																
		9																
		10																
		11	4 6 9	23	-	SS-5	2.9-4.3	-	-	-	-	-	-	-	-	17	A-6b (V)	
		12																
		13																
		14	3 3 3	9	-	SS-6	-	1	15	55	22	7	NP	NP	NP	13	A-3a (0)	
		15																
		16																
		17	3 3 4	11	-	SS-7	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		18																
		19	3 2 3	8	-	SS-8	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		20																
		21																
		22	4 3 5	12	-	SS-9	-	-	-	-	-	-	-	-	-	14	A-3a (V)	
		23																
		24	5 5 5	15	-	SS-10	-	0	1	73	14	12	NP	NP	NP	18	A-3a (0)	
		25																
CHANGES TO ORANGE-BROWN		26																
		27	4 6 7	20	-	SS-11	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
	654.2	28																
MEDIUM DENSE, BROWN TO ORANGE-BROWN, **FINE SAND**, LITTLE COARSE SAND, TRACE SILT, TRACE CLAY, DAMP		29	4 5 6	17	-	SS-12	-	0	17	73	5	5	NP	NP	NP	9	A-3 (0)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:30 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\85188_HIS

PID: 85188	SFN: CUY-77-13.31	PROJECT: CUY-77-13.31	STATION / OFFSET: 174+75, 45' LT.	START: 8/14/12	END: 8/14/12	PG 2 OF 3	B-004-0-12

MATERIAL DESCRIPTION AND NOTES	ELEV. 652.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
FS	650.5																	
DENSE, BROWN WITH ORANGE-BROWN AND DARK GRAY, **COARSE AND FINE SAND**, LITTLE SILT, TRACE CLAY, TRACE GRAVEL, WET		W 648.7	6 2 1	5	-	SS-13	-	2	13	63	12	10	NP	NP	NP	27	A-3a (0)	
			7 10 12	33	-	SS-14	-	0	0	77	18	5	NP	NP	NP	23	A-3a (0)	
	640.5																	
DENSE TO VERY DENSE, GRAY, **SILT**, SOME TO TRACE CLAY, LITTLE TO TRACE SAND, MOIST TO WET			20 17 17	51	-	SS-15	-	0	0	20	66	14	NP	NP	NP	21	A-4b (8)	
			9 10 14	36	-	SS-16	-	0	0	5	71	24	22	17	5	17	A-4b (8)	
			8 12 16	42	-	SS-17	-	-	-	-	-	-	-	-	-	16	A-4b (V)	
SS-18 CHANGES TO "AND SAND"; CONTAINS FEW DECAYED ROOTS			20 28 29	86	-	SS-18	-	0	0	38	53	9	NP	NP	NP	20	A-4b (5)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:30 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\85188_HIS

PID: 85188	SFN: CUY-77-13.31	PROJECT: CUY-77-13.31	STATION / OFFSET: 174+75, 45' LT.	START: 8/14/12	END: 8/14/12	PG 3 OF 3	B-004-0-12

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
DENSE TO VERY DENSE, GRAY, **SILT**, SOME TO TRACE CLAY, LITTLE TO TRACE SAND, MOIST TO WET *(continued)*	620.1	63																
		64	40 50 5	83	-	SS-19	-	-	-	-	-	-	-	-	-	16	A-4b (V)	
		65																
		66																
		67																
		68																
		69	5 11 12	35	-	SS-20	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		70																
		71																
		72																
		73																
		74	6 10 12	33	-	SS-21	2.2-3.0	0	0	1	52	47	28	18	10	24	A-4b (8)	
	607.2	EOB 75																

NOTES: HISTORICAL BORING LOG RETYPED FROM BORING NO. B-004-0-12 COMPLETED ON 8/14/2012 FOR PROJECT NO. 85188 [BRIDGE NO. CUY-77-11.69]

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 1 BAG ASPHALT PATCH; PUMPED 2 BAGS BENTONITE GROUT; PLACED 2 BAGS QUICKCRETE

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 17:48 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY-77-

PROJECT: CUY-77-13.31	DRILLING FIRM / OPERATOR: ODOT / R.WEBB	DRILL RIG: MOBIL B57 ORV	STATION / OFFSET: 175+00, 61' RT.	EXPLORATION ID B-005-0-12	
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: ODOT / R. BLASKO	HAMMER: SAFETY HAMMER	ALIGNMENT: IR 77		
PID: 85188 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 670.2 (MSL) EOB: 110.0 ft.	PAGE 1 OF 4	
START: 8/7/12 END: 8/7/12	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	LAT / LONG: 2199534.825000, 656305.845000		

MATERIAL DESCRIPTION AND NOTES	ELEV. 670.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
2.0" ASPHALT	670.0																	
10" CONCRETE	669.4																	
DENSE, BROWN, SANDY SILT, LITTLE CLAY, TRACE GRAVEL, CONTAINS BRICK AND CONCRETE FRAGMENTS AND FEW ROOTS, DRY (FILL)	667.2	1	15 15 13	42	89	SS-1	-	0	22	41	19	18	NP	NP	NP	5	A-4a (0)	
DENSE, BROWN, COARSE AND FINE SAND TRACE TO SOME SILT, TRACE CLAY, TRACE GRAVEL, DRY TO DAMP		2																
		3																
		4	8 10 11	32	83	SS-2	-	1	16	51	22	10	NP	NP	NP	5	A-3a (0)	
		5																
		6																
		7	12 10 10	30	94	SS-3	-	-	-	-	-	-	-	-	-	3	A-3a (V)	
		8																
		9	7 10 11	32	100	SS-4	-	-	-	-	-	-	-	-	-	4	A-3a (V)	
		10																
		11																
		12	9 11 13	36	100	SS-5	-	1	23	65	6	5	NP	NP	NP	4	A-3a (0)	
		13																
		14	9 12 8	30	100	SS-6	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
		15																
		16																
		17	8 10 9	29	100	SS-7	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
	651.7	18																
@18.5'; SS-8 TO SS-10 CHANGES TO MEDIUM DENSE, BROWN AND DARK BROWN, WET		19	6 8 7	23	94	SS-8	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
		20																
W 649.2		21																
		22	2 5 7	18	100	SS-9	-	0	0	77	18	5	NP	NP	NP	29	A-3a (V)	
		23																
		24	5 11 18	44	100	SS-10	-	0	1	80	14	5	NP	NP	NP	22	A-3a (0)	
	644.7	25																
DENSE TO MEDIUM DENSE, GRAY, SANDY SILT, TRACE CLAY, TRACE GRAVEL, WET		26																
		27	8 12 14	39	100	SS-11	-	-	-	-	-	-	-	-	-	21	0 ()	
		28																
		29	3 5 6	17	100	SS-12	-	-	-	-	-	-	-	-	-	21	A-4a (V)	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
DENSE TO MEDIUM DENSE, GRAY, SANDY SILT, TRACE CLAY, TRACE GRAVEL, WET *(continued)*	640.2	31 32 33																
		34 35	6 10 16	39	100	SS-13	-	-	-	-	-	-	20	15	5	-	A-4b (V)	
		36 37 38																
@38.5'; CHANGES TO HARD		39	11 10 13	35	83	SS-14	-	0	0	1	73	26	NP	NP	NP	19	A-4b (8)	
	628.5	40 41																
STIFF TO VERY STIFF, GRAY, SILT AND CLAY, TRACE SAND, MOIST		42 43 44	3 6 6	18	94	SS-15	-	0	0	1	59	40	30	17	13	27	A-6a (9)	
		45 46 47 48																
		49 50	5 7 10	26	100	SS-16	-	-	-	-	-	-	-	-	-	27	A-6a (V)	
		51 52 53																
		54 55	6 10 11	32	94	SS-17	-	-	-	-	-	-	-	-	-	25	A-6a (V)	
		56 57 58																
@58.5'; SS-18 SILTY LENSES		59 60	5 8 9	26	94	SS-18	-	0	0	1	52	47	32	18	14	24	A-6a (10)	
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 17:48 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY-77-

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 17:48 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY-77-

MATERIAL DESCRIPTION AND NOTES	ELEV. 608.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, SILT AND CLAY, TRACE SAND, MOIST *(continued)*		63																
		64	6 6 8	21	100	SS-19	-	-	-	-	-	-	-	-	-	26	A-6a (V)	
		65																
		66																
		67																
		68																
		69	5 8 11	29	100	SS-20	-	-	-	-	-	-	-	-	-	20	A-6a (V)	
		70																
		71																
		72																
		73																
		74	5 7 10	26	100	SS-21	-	-	-	-	-	-	-	-	-	21	A-6a (V)	
		75																
		76																
		77																
		78																
@78.5'; SS-22 GRAY WITH BROWN MOTTLES		79	4 5 6	17	100	SS-22	-	0	0	0	44	56	30	17	13	24	A-6a (9)	
		80																
		81																
		82																
		83																
@83.5'; SS-23 TO SS-24 CONTAINS SILT LENSES		84	5 8 12	30	94	SS-23	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		85																
		86																
		87																
		88																
		89	7 9 12	32	100	SS-24	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		90																
		91																
		92																
		93																
		94	10															

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 17:48 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY-77-

PID: 85188	SFN:	PROJECT: CUY-77-13.31	STATION / OFFSET: 175+00, 61' RT.	START: 8/7/12	END: 8/7/12	PG 4 OF 4	B-005-0-12

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF TO VERY STIFF, GRAY, SILT AND CLAY, TRACE SAND, MOIST *(continued)*	575.9	95	12 18	45	94	SS-25	-	0	1	2	39	58	30	17	13	20	A-6a (9)	
	573.5	96																
STIFF TO VERY STIFF, GRAY MOTTLED WITH RED-BROWN, SILTY CLAY, LITTLE SAND, TRACE SAND, MOIST		97																
		98																
		99	7 8 11	29	100	SS-26	-	-	-	-	-	-	-	-	-	18	A-6b (V)	
		100																
		101																
		102																
		103																
		104	5 7 10	26	94	SS-27	-	-	-	-	-	-	-	-	-	24	A-6b (V)	
		105																
		106																
		107																
		108																
		109	6 7 10	26	100	SS-28	-	-	-	-	-	-	-	-	-	24	A-6b (V)	
	560.2	EOB 110																

NOTES: GROUNDWATER ENCOUNTERED AT 21.0' DURING DRILLING. CAVE DEPTH 25.0'. SWITCH TO TRICONE AT 35.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 3 BAG BENTONITE GROUT; PLACED 1 BAG QUICKCRETE

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 16:25 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOG

PROJECT: CUY-77-11.2	DRILLING FIRM / OPERATOR: B&P / R. WEBB	DRILL RIG: MOBILE B57 ORV	STATION / OFFSET: 175+71, 65' LT.	EXPLORATION ID B-006-0-12
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: B&P / R. BLASKO	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: CL IR 77	
PID: 105743 SFN: CUY-77-13.31	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 6/30/11	ELEVATION: 665.1 (ft) EOB: 110.0 ft.	PAGE 1 OF 4
START: 8/1/12 END: 8/2/12	SAMPLING METHOD: SPT	ENERGY RATIO (%): 90*	LAT / LONG: 41.465018, -81.657489	

MATERIAL DESCRIPTION AND NOTES	ELEV. 665.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
CONCRETE	664.6																	
GRANULAR BASE	664.1																	
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE COARSE SAND, TRACE CLAY, TRACE SILT, DAMP		1	12 9 10	29	-	SS-1	-	-	-	-	-	-	-	-	-	7	A-3 (V)	
		2																
		3																
		4	5 6 8	21	-	SS-2	-	0	9	83	3	5	NP	NP	NP	3	A-3 (0)	
		5																
		6																
		7	3 4 4	12	-	SS-3	-	-	-	-	-	-	-	-	-	6	A-3 (V)	
	657.1	8																
LOOSE, BROWN, **SILTY SAND**, LITTLE CLAY, WET		9	3 3 3	9	-	SS-4	-	0	1	48	40	11	NP	NP	NP	19	A-4a (3)	
	654.6	10																
MEDIUM DENSE TO DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, MOIST TO WET		11	5 5 5	15	-	SS-5	-	3	6	75	9	7	NP	NP	NP	8	A-3a (0)	
		12																
		13																
		14	5 7 7	21	-	SS-6	-	0	9	79	6	6	NP	NP	NP	9	A-3a (0)	
		15																
W 649.1		16																
NOTE: GROUNDWATER ENCOUNTERED AT 16.0 FT DURING DRILLING		17	3 3 4	11	-	SS-7	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
		18																
		19	3 2 9	17	-	SS-8	-	-	-	-	-	-	-	-	-	33	A-3a (V)	
		20																
		21																
		22	7 8 10	27	-	SS-9	-	-	-	-	-	-	-	-	-	29	A-3a (V)	
		23																
		24	4 8 13	32	-	SS-10	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
	639.6	25																
MEDIUM DENSE TO DENSE, GRAY, **SILT**, SOME CLAY, LITTLE SAND, MOIST TO WET		26																
		27	4 7 9	24	-	SS-11	-	0	0	13	62	25	NP	NP	NP	19	A-4b (8)	
		28																
		29	5 8 13	32	-	SS-12	-	-	-	-	-	-	-	-	-	18	A-4b (V)	

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 175+71, 65' LT.	START: 8/1/12	END: 8/2/12	PG 2 OF 4	B-006-0-12

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
MEDIUM DENSE TO DENSE, GRAY, **SILT**, SOME CLAY, LITTLE SAND, MOIST TO WET *(continued)*	635.1	31																
		32																
		33																
CHANGES TO VERY DENSE		34	11 16 19	53	-	SS-13	-	0	0	2	74	24	NP	NP	NP	17	A-4b (8)	
		35																
		36																
		37																
		38																
		39	20 29 45	111	-	SS-14	-	-	-	-	-	-	-	-	-	17	A-4b (V)	
		40																
		41																
		42																
		43																
		44	13 18 20	57	-	SS-15	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		45																
		46																
		47																
		48																
	618.1	49	4 8 10	27	-	SS-16	1.5-2.0	-	-	-	-	-	-	-	-	30	A-6a (V)	
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE GRAVEL, MOIST		50																
		51																
		52																
		53																
		54	5 7 10	26	-	SS-17	1.25-1.5	1	0	0	54	45	31	18	13	27	A-6a (9)	
		55																
		56																
		57																
		58																
		59	5 6 9	23	-	SS-18	1.25-1.5	-	-	-	-	-	-	-	-	24	A-6a (V)	
		60																
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 16:25 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOG

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 16:25 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LOG

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 175+71, 65' LT.	START: 8/1/12	END: 8/2/12	PG 3 OF 4	B-006-0-12

MATERIAL DESCRIPTION AND NOTES	ELEV. 603.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE GRAVEL, MOIST *(continued)*		63																
		64	7 8 11	29	-	SS-19	2.25-2.75	-	-	-	-	-	-	-	-	21	A-6a (V)	
		65																
		66																
		67																
		68																
		69	5 5 7	18	-	SS-20	1.00	0	0	0	46	54	29	15	14	24	A-6a (10)	
		70																
		71																
		72																
		73																
		74	5 6 7	20	-	SS-21	1.25	-	-	-	-	-	-	-	-	26	A-6a (V)	
		75																
		76																
		77																
		78																
		79	5 6 8	21	-	SS-22	1.25-2.0	0	0	0	47	53	29	17	12	24	A-6a (9)	
		80																
		81																
		82																
		83																
		84	5 6 9	23	-	SS-23	0.6-0.75	-	-	-	-	-	-	-	-	24	A-6a (V)	
		85																
		86																
		87																
		88																
		89	7 9 11	30	-	SS-24	1.75-2.0	-	-	-	-	-	-	-	-	25	A-6a (V)	
		90																
		91																
		92																
		93																
		94	6															

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 5/1/26 16:25 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\CUY LO

PID: 105743	SFN: CUY-77-11.21	PROJECT: CUY-77-11.2	STATION / OFFSET: 175+71, 65' LT.	START: 8/1/12	END: 8/2/12	PG 4 OF 4	B-006-0-12

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE GRAVEL, MOIST *(continued)*	570.8	95	8 10	27	-	SS-25	0.75-1.0	-	-	-	-	-	-	-	-	19	A-6a (V)	
	568.1	96																
MEDIUM STIFF TO STIFF, GRAY, **SILT**, "AND" CLAY, TRACE GRAVEL, WET		97																
		98																
		99	10 8 9	26	-	SS-26	0.5-2.0	1	0	0	57	42	26	17	9	28	A-4b (8)	
	563.6	100																
SOFT TO MEDIUM STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		101																
		102																
		103																
		104	8 10 12	33	-	SS-27	0.5-0.75	1	2	3	29	65	33	18	15	25	A-6a (10)	
		105																
		106																
		107																
		108																
		109	8 9 11	30	-	SS-28	0.5-0.75	-	-	-	-	-	-	-	-	24	A-6a (V)	
	555.1	EOB 110																

NOTES: CAVE DEPTH 34.0 FT BGS. SWITCH TO TRICONE AT 55.0 FT BGS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 3 BAGS BENTONITE GROUT; PLACED 0.5 BAG QUICKCRETE

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:53 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NN

PROJECT: CUY-77-11.78	DRILLING FIRM / OPERATOR: ODOT / -	DRILL RIG: MOBILE B-53 R TRAILER	STATION / OFFSET: 95+62, 85' LT.	EXPLORATION ID N-001-N-01
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: ODOT / -	HAMMER: SAFETY HAMMER	ALIGNMENT: I-77	
PID: G01037nn SFN: CUY-77-11.78	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 714.5 (ft) EOB: 75.0 ft.	PAGE 1 OF 3
START: 9/14/01 END: 9/14/01	SAMPLING METHOD: SPT	ENERGY RATIO (%): 60	COORD: 2201013.8900 N, 648636.0660 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 714.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
LOOSE TO MEDIUM DENSE, BROWN AND BLACK, **GRAVEL WITH SAND AND SILT**, AND ROCK FRAGMENTS, SM ASPHALT FRAGMENTS, SM SLAG, RAILROAD EMBANKMENT FILL, MOIST			4 4 9	13	-	SS-1	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
			5 7 7	14	-	SS-2	-	-	-	-	-	-	-	-	-	13	A-2-4 (V)	
			3 5 6	11	-	SS-3	-	-	-	-	-	-	-	-	-	15	A-2-4 (V)	
			2 2 3	5	-	SS-4	-	-	-	-	-	-	-	-	-	22	A-2-4 (V)	
	701.0																	
STIFF, BROWN AND GRAY, **SANDY SILT**, POSSIBLE NATURAL SOIL, MOIST			4 4 5	9	-	SS-5	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
	696.0																	
VERY LOOSE, BROWN, **COARSE AND FINE SAND**, LITTLE GRAVEL, SOME SILT, MOIST TO WET			2 2 2	4	-	SS-6	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
	691.0	W 691.5																
NOTE: ENCOUNTERED GROUNDWATER AT 23.0 FEET DURING DRILLING																		
VERY LOOSE TO LOOSE, BROWN, **SILT**, TRACE CLAY, TRACE GRAVEL, MOIST NON-COHESIVE			2 2 2	4	-	SS-7	-	-	-	-	-	-	-	-	-	33	A-4b (V)	
			2 3 4	7	-	SS-8	-	-	-	-	-	-	-	-	-	24	A-4b (V)	
	686.0																	
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE TO NO SAND, MOIST			7 9 11	20	-	SS-9	-	-	-	-	-	-	-	-	-	20	A-6a (V)	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE TO NO SAND, MOIST *(continued)*	684.5	31	6 10 9	19	-	SS-10	-	-	-	-	-	-	-	-	-	25	A-6a (V)	
		32																
		33																
		34	5 9 12	21	-	SS-11	-	0	1	0	99	-	31	19	12	23	A-6a (9)	
		35																
		36	5 7 14	21	-	SS-12	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		37																
		38																
		39	4 7 10	17	-	SS-13	-	-	-	-	-	-	-	-	-	25	A-6a (V)	
		40																
		41																
		42	3 5 6	11	-	SS-14	-	0	0	0	100	-	34	20	14	28	A-6a (10)	
	671.0	43																
MEDIUM DENSE TO DENSE, GRAY, **SANDY SILT**, TRACE CLAY, MOIST NON-COHESIVE		44	9 18 20	38	-	SS-15	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
		45																
		46																
		47																
		48																
		49	10 13 16	29	-	SS-16	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
		50																
		51																
		52																
	661.0	53																
MEDIUM DENSE TO DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE TO SOME SILT AND CLAY, WET		54	9 15 15	30	-	SS-17	-	0	1	81	18	-	NP	NP	NP	22	A-3a (0)	
		55																
		56																
		57																
		58																
		59	15 18 25	43	-	SS-18	-	-	-	-	-	-	-	-	-	19	A-3a (V)	
		60																
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:53 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NN

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 12:53 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NN

PID: G01037nn	SFN: CUY-77-11.78	PROJECT: CUY-77-11.78	STATION / OFFSET: 95+62, 85' LT.	START: 9/14/01	END: 9/14/01	PG 3 OF 3	N-001-N-01

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
MEDIUM DENSE TO DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE TO SOME SILT AND CLAY, WET *(continued)*	652.3	63																
		64	10 15 19	34	-	SS-19	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		65																
		66																
		67																
		68																
		69	12 16 20	36	-	SS-20	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
		70																
		71																
		72																
		73																
		74	10 18 23	41	-	SS-21	-	0	2	75	-	23 -	NP	NP	NP	20	A-3a (0)	
	639.5	EOB 75																

NOTES: HISTORICAL BORING LOG RETYPED FROM BORING NO. NSSN-1 COMPLETED ON 9/14/2001 FOR PROJECT NO. G01037NN [CUY-77-11.78 (N&SS NORTH BRIDGE)]

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 11:21 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NS

PROJECT: CUY-77-11.11	DRILLING FIRM / OPERATOR: ODOT / -	DRILL RIG: MOBILE B-53 R TRAILER	STATION / OFFSET: 91+21, 92' LT.	EXPLORATION ID N-001-S-01
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: ODOT / -	HAMMER: SAFETY HAMMER	ALIGNMENT: I-77	
PID: G01037ns SFN: CUY-77-11.11	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 716.2 (ft) EOB: 74.4 ft.	PAGE 1 OF 3
START: 9/17/01 END: 9/17/01	SAMPLING METHOD: SPT	ENERGY RATIO (%): 60	COORD: 2201233.5410 N, 648265.4850 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 716.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
LOOSE TO MEDIUM DENSE, BROWN AND GRAY, **SILT**, TRACE CLAY, TRACE SLAG, RAILROAD EMBANKMENT FILL, MOIST NON-COHESIVE		1	6 10 12	22	-	SS-1	-	-	-	-	-	-	-	-	-	13	A-4b (V)	
		2																
		3																
		4	3 4 5	9	-	SS-2	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
	711.2	5																
STIFF, GRAY TO BROWN, **SANDY SILT**, SOME CLAY, RAILROAD EMBANKMENT FILL, MOIST COHESIVE		6																
		7	3 3 6	9	-	SS-3	-	-	-	-	-	-	-	-	-	24	A-4a (V)	
		8																
		9	4 4 5	9	-	SS-4	-	-	-	-	-	-	-	-	-	25	A-4a (V)	
	702.7	10																
		11																
		12																
		13																
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE SILT AND CLAY, RAILROAD EMBANKMENT FILL, MOIST	701.2	14	3 5 7	12	-	SS-5	-	-	-	-	-	-	-	-	-	9	A-3 (V)	
MEDIUM STIFF, BROWN, **SILT AND CLAY**, TRACE SAND, POSSIBLE NATURAL SOIL, MOIST		15																
		16																
		17																
		18																
		19	3 3 4	7	-	SS-6	-	-	-	-	-	-	-	-	-	26	A-6a (V)	
		20																
		21																
		22																
		23																
		24	4 4 4	8	-	SS-7	-	-	-	-	-	-	-	-	-	26	A-6a (V)	
	690.2	25																
LOOSE TO MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT AND CLAY, MOIST TO WET		26	9 12 12	24	-	SS-8	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	
		27																
W 688.2		28																
NOTE: ENCOUNTERED GROUNDWATER AT 28.0 FEET DURING DRILLING AND AT 29.0 FEET UPON COMPLETION ▽ 687.2		29	4 5 9	14	-	SS-9	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 11:21 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NS

PID: G01037ns	SFN: CUY-77-11.11	PROJECT: CUY-77-11.11	STATION / OFFSET: 91+21, 92' LT.	START: 9/17/01	END: 9/17/01	PG 2 OF 3	N-001-S-01

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
LOOSE TO MEDIUM DENSE, BROWN, **GRAVEL WITH SAND**, TRACE SILT AND CLAY, MOIST TO WET *(continued)*	686.2	31	4 4 7	11	-	SS-10	-	32	38	22	- 8 -		NP	NP	NP	13	A-1-b (0)	
	682.7	33																
VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, MOIST		34	4 10 10	20	-	SS-11	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		36	5 9 12	21	-	SS-12	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		39	5 7 15	22	-	SS-13	-	0	0	1	- 99 -		32	19	13	23	A-6a (9)	
	675.2	41	8 15 15	30	-	SS-14	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
VERY STIFF, GRAY, **SANDY SILT**, MOIST COHESIVE	672.7																	
DENSE TO VERY DENSE, GRAY TO BROWN, **COARSE AND FINE SAND**, LITTLE SILT AND CLAY, MOIST		44	18 15 18	33	-	SS-15	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
		49	20 29 35	64	-	SS-16	-	-	-	-	-	-	-	-	-	18	A-3a (V)	
		54	9 14 16	30	-	SS-17	-	0	4	79	- 17 -		NP	NP	NP	20	A-3a (0)	
		59	12 15 18	33	-	SS-18	-	-	-	-	-	-	-	-	-	17	A-3a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 11:21 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NS

PID: G01037ns	SFN: CUY-77-11.11	PROJECT: CUY-77-11.11	STATION / OFFSET: 91+21, 92' LT.	START: 9/17/01	END: 9/17/01	PG 3 OF 3	N-001-S-01

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
DENSE TO VERY DENSE, GRAY TO BROWN, **COARSE AND FINE SAND**, LITTLE SILT AND CLAY, MOIST *(continued)*	654.1	63																
		64	10 15 17	32	-	SS-19	-	-	-	-	-	-	-	-	-	20	A-3a (V)	
		65																
		66																
		67																
		68																
		69	12 17 20	37	-	SS-20	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
		70																
		71																
		72																
		73																
	642.7																	
VERY DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE GRAVEL, TRACE SAND, MOIST NON-COHESIVE	641.8	EOB 74	17 50/5"	-	-	SS-21	-	3	1	3	79	14	NP	NP	NP	17	A-4b (8)	

NOTES: HISTORICAL BORING LOG RETYPED FROM BORING NO. NSSS-1 COMPLETED ON 9/17/2001 FOR PROJECT NO. G01037NS [CUY-77-11.11]

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:00 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NN

PROJECT: CUY-77-11.78	DRILLING FIRM / OPERATOR: ODOT / -	DRILL RIG: MOBILE B-53 R TRAILER	STATION / OFFSET: 93+83, 77' RT.
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: ODOT / -	HAMMER: SAFETY HAMMER	ALIGNMENT: I-77
PID: G01037nn SFN: CUY-77-11.78	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: N/A	ELEVATION: 718.0 (ft) EOB: 80.0 ft.
START: 9/14/01 END: 9/15/01	SAMPLING METHOD: SPT	ENERGY RATIO (%): 60	COORD: 2201247.5570 N, 648576.4490 E

EXPLORATION ID: N-003-N-01

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
AGGREGATE BASE, RAILROAD BEDDING	718.0	1	50/0"	-	-	SS-1	-	-	-	-	-	-	-	-	-	6	UCF (V)	
	716.0	2																
STIFF TO VERY STIFF, BROWN TO GRAY, **SANDY SILT**, SOME GRAVEL, SOME CLAY, TRACE ASPHALT FRAGMENTS, RAILROAD EMBANKMENT FILL, MOIST COHESIVE		3																
		4	6 7 7	14	-	SS-2	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
		5																
		6																
		7	8 9 7	16	-	SS-3	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
	709.5	8																
STIFF, GRAY TO BROWN, **SILT**, SOME CLAY, TRACE GRAVEL, TRACE SAND, POSSIBLY NATURAL SOIL, MOIST		9	2 4 5	9	-	SS-4	-	-	-	-	-	-	-	-	-	26	A-4b (V)	
		10																
		11																
		12																
		13																
		14	5 6 7	13	-	SS-5	-	-	-	-	-	-	-	-	-	26	A-4b (V)	
		15																
		16																
		17																
		18																
		19	4 6 7	13	-	SS-6	-	-	-	-	-	-	-	-	-	24	A-4b (V)	
		20																
		21																
		22																
		23																
	694.5	24																
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE GRAVEL, MOIST		25	4 10 11	21	-	SS-7	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
		26																
		27	4 7 12	19	-	SS-8	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
	689.5	28																
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND**, LITTLE SILT AND CLAY, MOIST TO WET		29	9 10 10	20	-	SS-9	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:00 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NN

PID: G01037nn	SFN: CUY-77-11.78	PROJECT: CUY-77-11.78	STATION / OFFSET: 93+83, 77' RT.	START: 9/14/01	END: 9/15/01	PG 2 OF 3	N-003-N-01

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
MEDIUM DENSE, GRAY, **GRAVEL WITH SAND**, LITTLE SILT AND CLAY, MOIST TO WET *(continued)* NOTE: WET AT 32.0 FEET DURING DRILLING	688.0	31	8 9 13	22	-	SS-10	-	44	27	18	- 11 -		NP	NP	NP	12	A-1b (0)	
		32																
		33																
		34	5 9 11	20	-	SS-11	-	-	-	-	-	-	-	-	-	14	A-1b (V)	
		35																
	682.0	36																
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND, MOIST		37	7 10 17	27	-	SS-12	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		38																
		39	8 14 18	32	-	SS-13	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		40																
		41																
		42	4 8 10	18	-	SS-14	-	0	0	1	- 99 -		35	20	15	25	A-6a (10)	
	674.5	43																
DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT AND CLAY, TRACE GRAVEL, WET		44	16 18 15	33	-	SS-15	-	1	10	76	- 13 -		NP	NP	NP	18	A-3a (0)	
		45																
		46																
		47																
		48																
	669.5	49																
MEDIUM DENSE TO DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, TRACE TO NO GRAVEL, MOIST NON-COHESIVE		50	4 11 19	30	-	SS-16	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		51																
		52																
		53																
		54	7 12 17	29	-	SS-17	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		55																
		56																
		57																
		58																
		59	8 15 20	35	-	SS-18	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		60																
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 6/29/26 13:00 - \\CLEVELAND-VFP\SYS\PROJECTS\ODOT\301525_CUY-77-11.41_PID_105743\GEOTECHNICAL\TRC LOGS\G01037NN

PID: G01037nn	SFN: CUY-77-11.78	PROJECT: CUY-77-11.78	STATION / OFFSET: 93+83, 77' RT.	START: 9/14/01	END: 9/15/01	PG 3 OF 3	N-003-N-01

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	ABAN-DONED
MEDIUM DENSE TO DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, TRACE TO NO GRAVEL, MOIST NON-COHESIVE *(continued)*	655.9	63																
		64	10 17 22	39	-	SS-19	-	-	-	-	-	-	-	-	-	20	A-4b (V)	
		65																
		66																
		67																
		68																
		69	5 12 14	26	-	SS-20	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		70																
		71																
		72																
		73																
VERY DENSE		74	17 29 46	75	-	SS-21	-	0	0	14	69	17	NP	NP	NP	18	A-4b (8)	
		75																
		76																
		77																
		78																
		79	15 22 39	61	-	SS-22	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
	638.0	EOB 80																

NOTES: HISTORICAL BORING LOG RETYPED FROM BORING NO. NSSN-3 COMPLETED ON 9/15/2001 FOR PROJECT NO. G01037NN [CUY-77-11.78 (N&SS NORTH BRIDGE)]

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

APPENDIX C
LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-040-0-20	SS-4	8.5-10.0	SW	A-1-b	13.7	40.1	38.1	17.5	4.3		NP	NP	NP	-
B-040-0-20	SS-6	13.5-15.0	CL	A-4a	23.9	0.1	0.1	0.2	45.9	53.7	29	20	9	0.4
B-041-0-20	SS-2	3.5-5.0	SW-SM	A-1-b	5.2	31.1	44.8	17.4	6.7		NP	NP	NP	-
B-041-0-20	ST-6	12.5-14.5	CL	A-4b	26.4	0.0	0.0	0.1	60.1	39.8	29	21	8	0.7
B-041-0-20	SS-9	23.5-25.0	ML	A-4b	23.0	0.0	0.9	13.0	86.1		NP	NP	NP	-
B-042-0-20	SS-2	3.5-5.0	SW-SM	A-1-b	5.4	47.8	30.2	14.9	7.1		NP	NP	NP	-
B-042-0-20	SS-6	13.5-15.0	CL-ML	A-4a	21.4	0.4	0.4	0.5	41.6	57.1	26	21	5	0.1
B-043-0-20	SS-2	3.5-5.0	ML	A-4b	26.8	0.3	1.4	17.9	76.6	3.8	20	22	NP	-
B-043-0-20	SS-4	8.5-10.0	SP-SM	A-1-b	5.4	27.8	34.4	30.4	7.4		NP	NP	NP	-

DRAWN BY: TBT REV 11/15/22

CHECKED BY: SM REV 11/15/22

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-043-0-20	ST-7	16.0-18.0	CL	A-4b	20.8	0.8	1.4	1.0	60.6	36.2	29	20	9	0.1
B-044-0-20	SS-3	6.0-7.5	SP-SM	A-3	3.1	4.7	35.8	50.5	9.0		NP	NP	NP	-
B-044-0-20	SS-4	8.5-10.0	SP-SM	A-3	4.7	8.2	13.4	70.7	7.7		NP	NP	NP	-
B-044-0-20	ST-8	18.0-20.0	CL-ML	A-4b	23.7	0.0	0.2	0.2	63.0	36.3	27	21	6	0.4
B-046-0-20	SS-2	3.5-5.0	ML	A-4b	25.3	0.0	0.2	0.6	72.8	26.4	NP	NP	NP	-
B-046-0-20	SS-5	11.0-12.5	SP-SM	A-3a(0)	10.0	11.5	28.2	49.0	11.3		NP	NP	NP	-
B-046-0-20	ST-8	20.0-22.0	CL	A-6a	20.9	0.0	0.0	0.2	59.3	40.5	33	21	12	0.0
B-048-0-20	SS-3	6.0-7.5	SP-SM	A-1-b	23.6	19.0	43.1	27.7	10.2		NP	NP	NP	-
B-048-0-20	SS-7	16.0-17.5	CL-ML	A-4b	18.3	0.1	0.4	2.5	58.7	38.3	25	19	6	-0.1

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-049-0-20	SS-3	6.5-8.0	SP-SM	A-3a	20.4	7.4	22.9	59.3	10.4		NP	NP	NP	-
B-049-0-20	ST-5	10.5-12.5	CL	A-4b	20.9	0.3	2.3	1.2	54.7	41.5	30	20	10	0.1
B-049-0-20	ST-8	17.5-19.5	CL	A-4b	25.3	0.1	0.3	0.4	66.5	32.7	31	21	10	0.4
B-050-0-20	SS-2	3.5-5.0	SM	A-3a	15.7	21.1	21.7	44.9	12.3		NP	NP	NP	-
B-050-0-20	SS-5	11.0-12.5	CL	A-4b	22.2	0.1	0.3	0.9	61.5	37.2	29	21	8	0.1
B-050-0-20	SS-10	28.5-30.0	ML	A-4a	17.5	4.0	6.1	28.0	45.8	16.1	15	13	2	2.2
B-051-0-20	SS-2	3.5-5.0	CL-ML	A-4b	19.7	15.3	4.2	7.6	52.2	20.7	24	20	4	-0.1
B-051-0-20	SS-5	11.0-12.5	CL-ML	A-4a	23.7	0.5	0.7	1.1	46.5	51.2	26	19	7	0.7
B-051-0-20	SS-9	23.5-25.0	ML	A-4b	19.6	0.4	5.5	11.7	66.2	16.2	NP	NP	NP	-

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-052-0-20	SS-3	6.0-7.5	CL-ML	A-4b	19.2	4.6	2.5	2.2	59.9	30.8	25	20	5	-0.2
B-052-0-20	SS-6	13.5-15.0	CL-ML	A-4b	22.3	0.7	0.2	0.6	51.2	47.3	27	20	7	0.3
B-053-0-20	SS-3	6.0-7.5	CL-ML	A-4b	21.1	0.2	0.2	0.6	54.3	44.7	25	19	6	0.4
B-053-0-20	SS-5	11.0-12.5	CL-ML	A-4b	21.6	0.0	0.1	0.3	62.4	37.2	23	18	5	0.7
B-054-0-20	ST-6	12.5-14.5	CL-ML	A-4b	19.8	2.0	0.0	2.0	61.4	34.6	26	20	6	0.0
B-054-0-20	SS-9	18.5-20.0	SM	A-3a	19.7	0.0	0.1	77.9	22.0		NP	NP	NP	-
B-055-0-20	SS-3	6.0-7.5	ML	A-4b	22.4	0.1	0.1	0.6	73.7	25.5	20	19	1	3.4
B-055-0-20	SS-7	16.0-17.5	SM	A-2-4	21.4	0.6	0.6	66.7	21.9	10.2	NP	NP	NP	-
B-056-0-20	SS-2	3.5-5.0	SM	A-4a	15.7	29.3	11.9	22.1	25.4	11.3	NP	NP	NP	-

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-056-0-20	SS-6	18.5-20.0	ML	A-4b	21.2	0.0	0.1	0.8	68.2	30.9	21	21	NP	-
B-059-0-20	SS-3	6.0-7.5	ML	A-4b	11.6	2.9	3.3	25.6	48.1	20.1	18	15	3	-1.1
B-059-0-20	SS-6	13.5-15.0	SM	A-4a	12.1	9.0	23.6	22.1	28.2	17.1	18	15	3	-1.0
B-059-0-20	SS-9	28.5-30.0	ML	A-4b	29.8	2.9	2.5	15.3	65.0	14.3	NP	NP	NP	-
B-060-0-20	SS-8	16.0-17.5	ML	A-4b	27.6	0.1	0.2	0.6	59.0	40.1	22	19	3	2.9
B-061-0-20	SS-4	8.5-10.0	SM	A-1-b	17.2	23.1	39.4	21.7	15.8		NP	NP	NP	-
B-061-0-20	SS-9	23.5-25.0	CL-ML	A-4b	24.6	0.5	0.4	0.9	48.4	49.8	25	18	7	0.9
B-062-0-20	SS-4	13.5-15.0	CL	A-4b	19.2	0.4	1.2	3.6	43.1	51.7	32	23	9	-0.4
B-063-0-20	SS-3	6.0-7.5	SM	A-4a	14.0	6.0	11.6	35.5	35.3	11.6	16	14	2	0.0

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-063-0-20	SS-6	13.5-15.0	CL-ML	A-4b	19.4	3.3	3.9	16.2	40.0	36.6	22	16	6	0.6
B-063-0-20	SS-8	23.5-25.0	ML	A-4b	27.9	0.0	0.1	0.4	58.4	41.1	23	20	3	2.6
B-064-0-20	SS-2	3.5-5.0	ML	A-4a	14.0	0.8	3.1	44.5	51.6		-	-	-	-
B-064-0-20	SS-6	13.5-15.0	SM	A-3a	20.0	27.6	33.5	25.4	13.5		-	-	-	-
B-064-0-20	SS-12	28.5-30.0	SM	A-2-4	18.0	25.0	8.7	38.9	27.4		NP	NP	NP	-
B-065-0-20	SS-1	1.0-2.5	GW	A-1-a	14.0	68.7	18.9	9.1	3.3		-	-	-	-
B-065-0-20	SS-8	18.5-20.0	ML	A-4a	20.0	4.7	8.0	21.3	66.0		22	19	3	0.3
B-065-0-20	SS-10	23.5-25.0	CL-ML	A-4a	17.6	0.8	14.7	14.2	70.3		24	18	6	-0.1
B-066-0-20	SS-6	13.5-15.0	SM	A-3a	9.3	0.5	5.5	70.1	23.9		-	-	-	-
B-066-0-20	SS-11	26.0-27.5	SP-SM	A-3a	18.2	0.5	10.9	78.9	9.7		-	-	-	-

DRAWN BY: TBT REV 11/15/22

CHECKED BY: SM REV 11/15/22

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-067-0-20	SS-4	8.5-10.0	SM	A-3a	10.0	3.6	7.5	68.3	20.6		NP	NP	NP	-
B-067-0-20	ST-8	17.5-19.5	CL-ML	A-4b	21.8	0.7	0.7	1.8	70.0	26.8	26	19	7	0.4
B-067-0-20	SS-11	28.5-30.0	ML	A-4b	21.9	0.0	0.0	12.5	77.5	10.0	NP	NP	NP	-
B-068-0-20	SS-1	1.0-2.5	SM	A-2-4	11.0	23.3	16.2	32.0	28.5		NP	NP	NP	-
B-068-0-20	SS-4	8.5-10.0	ML	A-4b	17.1	0.2	0.2	36.2	63.4		NP	NP	NP	-
B-068-0-20	SS-9	23.5-25.0	ML	A-4b	14.0	0.1	0.0	11.2	68.4	20.3	20	18	2	-2.0
B-068-0-20	SS-12	35.5-40.0	ML	A-4b	19.6	0.1	0.0	0.5	68.5	30.9	22	20	2	-0.2
B-070-0-20	SS-3	6.0-7.5	SM	A-2-4	11.3	36.3	10.7	38.5	14.5		NP	NP	NP	-
B-070-0-20	SS-7	16.0-17.5	ML	A-4b	23.2	0.0	0.1	0.9	69.8	29.2	22	20	2	1.6
B-070-0-20	ST-9	21.0-23.0	ML	A-4b	20.2	0.0	0.2	0.6	80.6	18.6	22	19	3	0.4

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-070-0-20	ST-12	31.0-33.0	CL-ML	A-4b	26.1	0.0	0.2	0.2	80.1	19.5	25	21	4	1.3
B-070-0-20	ST-14	38.0-40.0	CL	A-4b	23.4	0.1	0.2	0.5	62.0	37.2	29	20	9	0.4
B-070-0-20	SS-18	58.5-60.0	CL-ML	A-4b	20.2	0.0	0.1	0.3	59.6	40.0	24	19	5	0.2
B-070-0-20	SS-24	88.5-90.5	CL	A-4b	22.9	0.8	1.6	3.2	39.8	54.6	29	19	10	0.4
B-071-0-20	SS-1	1.0-2.5	GW-GM	A-1-a	9.3	64.5	15.9	10.7	8.9		NP	NP	NP	-
B-071-0-20	SS-8	18.5-20.0	ML	A-4b	19.3	0.0	0.0	2.0	79.1	18.9	19	19	NP	-
B-071-0-20	ST-11	26.0-28.0	CL-ML	A-4b	18.9	0.7	0.6	3.2	68.4	27.1	23	19	4	0.0
B-071-0-20	SS-12	28.5-30.0	ML	A-4b	22.1	0.0	0.1	0.5	67.6	31.8	21	19	2	1.6
B-071-0-20	ST-14	36.0-38.0	ML	A-4b	22.6	0.1	0.1	0.9	77.2	21.7	22	19	3	1.2
B-071-0-20	SS-15	38.5-40.0	CL-ML	A-4b	26.3	0.0	0.1	0.2	49.6	50.1	25	19	6	1.2

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Soil Group (USCS System)	AASHTO/ODOT GROUP	Moisture Content (%)	ODOT GRAIN SIZE DISTRIBUTION					PLASTICITY			
Source #	Sample #	Depth (ft)				Gravel (%)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-071-0-20	ST-16	41.0-43.0	CL	A-6a	25.7	0.1	0.0	0.4	67.2	32.3	33	21	12	0.4
B-071-0-20	SS-20	58.5-60.0	CL-ML	A-4b	25.4	0.0	0.0	0.2	59.2	40.6	27	20	7	0.8
B-071-0-20	SS-23	73.5-75.0	ML	A-4b	19.1	0.2	0.2	0.6	65.0	34.0	23	21	2	-0.9
B-072-0-20	S-5	18.5-20.0	SM	A-3a	17.1	0.1	1.3	74.6	24.0		-	-	-	-
B-073-0-20	S-2	3.5-5.0	SM	A-4a	10.7	2.4	12.9	41.4	43.3		-	-	-	-
B-073-0-20	S-5	18.5-20.0	SM	A-3a	23.5	0.0	0.1	65.7	34.2		NP	NP	NP	-

NP = Non-Plastic

DRAWN BY: TBT REV 11/15/22

CHECKED BY: SM REV 11/15/22

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Assumed Specific Gravity	Moisture Content (%)	VOLUMETRIC PROPERTIES			SHEAR STRENGTH PROPERTIES						Unconfined Compressive Strength (PSI)
Source #	Sample #	Depth (ft)			Dry Unit Weight, PCF	Void Ratio	Degree of Saturation (%)	Type of Test	Normal Stress (PSI)	Failure Stress (PSI)	Strain (%)	Angle of Internal Friction (Degrees)	Cohesion (PSI)	
B-041-0-20	ST-6	12.5-14.5	2.79	26.3 28.2 28.7	99.1 94.9 95.7	0.76 0.84 0.82	96.8 94.0 97.5	DS	6.9 14.0 28.0	3.9 6.1 11.0	4.0 11.6 8.0	18.6	1.53	-
B-043-0-20	ST-7	16.0-18.0	2.79	22.5 22.1 23.1	104.9 101.2 106.1	0.66 0.72 0.64	94.9 85.6 100.4	DS	10.4 17.4 34.7	6.8 8.7 17.2	3.9 9.6 7.0	23.7	1.72	-
B-044-0-20	ST-8	18.0-20.0	2.79	25.6 26.8 27.9	98.7 96.4 94.4	0.76 0.81 0.84	93.3 92.7 92.2	DS	7.2 20.8 41.8	3.3 10.0 16.3	2.5 5.3 18.1	20.4	1.22	-
B-046-0-20	ST-8	18.0-20.0	2.79	20.9	109.4	0.59	98.6	-	-	-	-	-	-	27.4
B-049-0-20	ST-5	10.0-12.0	2.79	21.9	105.9	0.64	94.7	-	-	-	-	-	-	29.5
B-049-0-20	ST-8	17.5-19.5	2.79	29.0 27.6 29.0	95.9 94.0 96.4	0.82 0.85 0.81	99.1 90.4 100.3	DS	10.4 17.4 21.0	5.5 7.0 8.0	2.2 5.1 5.1	13.1	3.09	-

DRAWN BY: TBT REV 11/15/22

CHECKED BY: SM REV 11/15/22

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Assumed Specific Gravity	Moisture Content (%)	VOLUMETRIC PROPERTIES			SHEAR STRENGTH PROPERTIES						Unconfined Compressive Strength (PSI)
Source #	Sample #	Depth (ft)			Dry Unit Weight, PCF	Void Ratio	Degree of Saturation (%)	Type of Test	Normal Stress (PSI)	Failure Stress (PSI)	Strain (%)	Angle of Internal Friction (Degrees)	Cohesion (PSI)	
B-054-0-20	ST-6	12.5-14.5	2.79	20.4	105.5	0.62	87.5	DS	6.9	4.4	4.4	23.8	1.34	-
				21.3	101.2	0.65	82.4		13.9	7.5	11.6			
				23.2	100.2	0.59	87.6		27.8	13.6	13.9			
B-067-0-20	ST-8	17.5-19.5	2.79	24.8	98.7	0.77	90.4	DS	10.4	5.1	11.8	24.7	0.78	-
				23.2	102.5	0.70	92.6		17.6	9.4	18.0			
				24.5	102.0	0.71	96.8		34.7	16.6	16.5			
B-070-0-20	ST-9	21.0-23.0	2.79	20.8	110.1	0.58	99.8	UU	17.4	45.0	20.6	-	-	-
B-070-0-20	ST-12	31.0-33.0	2.79	26.3	99.6	0.75	98.0	UU	13.9	30.9	14.0	-	-	-
				26.5	98.7	0.76	96.8		27.8	34.6	11.3			
				28.1	99.7	0.75	105.1		55.4	30.3	17.6			
B-070-0-20	ST-14	38.0-40.0	2.79	23.9	103.0	0.69	96.3	UU	35.0	19.0	19.9	-	-	-
				24.1	98.2	0.77	86.9		69.0	32.0	8.9			
B-071-0-20	ST-11	26.0-28.0	2.79	20.7	109.4	0.59	97.4	UU	10.0	40.0	20.4	-	-	-
				20.7	108.7	0.60	95.7		24.0	53.0	20.4			
				20.1	110.6	0.58	97.3		49.0	61.0	19.2			

DRAWN BY: TBT REV 11/15/22

CHECKED BY: SM REV 11/15/22

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			Assumed Specific Gravity	Moisture Content (%)	VOLUMETRIC PROPERTIES			SHEAR STRENGTH PROPERTIES						Unconfined Compressive Strength (PSI)
Source #	Sample #	Depth (ft)			Dry Unit Weight, PCF	Void Ratio	Degree of Saturation (%)	Type of Test	Normal Stress (PSI)	Failure Stress (PSI)	Strain (%)	Angle of Internal Friction (Degrees)	Cohesion (PSI)	
B-071-0-20	ST-14	36.0-38.0	2.79	21.4	110.0	0.58	102.2	UU	17.5	25.2	21.3	-	-	-
				23.1	103.7	0.68	94.9		31.3	30.0	21.3			
				24.1	103.4	0.68	98.5		62.6	21.1	20.0			

DRAWN BY: TBT REV 11/15/22

CHECKED BY: SM REV 11/15/22

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

SAMPLE IDENTIFICATION			ASSUMED SPECIFIC GRAVITY	INITIAL MOISTURE CONTENT (%)	VOLUMETRIC PROPERTIES (BEFORE TEST)			CONSOLIDATION PROPERTIES		
Source #	Sample #	Depth (ft)			Dry Unit, PCF	Void Ratio	Degree of Saturation (%)	Estimated Preconsolidation Pressure, P_c (tsf)	Estimated Compression Index, C_c	Estimated Recompression Index, C_r
B-049-0-20	ST-1	10.0-12.0	2.79	24.2	101.0	0.73	93.0	0.8	0.10	0.03
B-070-0-20	ST-1	21.0-23.0	2.79	21.7	106.6	0.63	95.3	0.9	0.07	0.01
B-070-0-20	ST-3	38.0-40.0	2.79	26.0	95.7	0.82	88.6	1.2	0.13	0.03
B-071-0-20	ST-1	26.0-28.0	2.79	19.8	106.3	0.64	86.4	1.2	0.08	0.01
B-071-0-20	ST-3	41.0-43.0	2.79	24.9	98.5	0.77	90.4	1.6	0.12	0.03

SUMMARY OF LABORATORY TEST DATA

Project Name: CUY-77-11.21 (PID 105743)
Cleveland, OH
Client Name: Ohio Department of Transportation
TRC Project #: 301525

Source #	Sample #	Depth (ft)	pH, AASHTO T289	Water Soluble Sulfates, AASHTO T290 (mg/kg)	Chlorides, AASHTO T291 (mg/kg)	Resistivity, AASHTO T288 (ohm-cm)
B-042-0-20	SS-1 to SS-4	0.0-10.0	8.6	50	505	715
B-043-0-20	SS-1 to SS-4	0.0-10.0	8.0	4,390	390	360
B-044-0-20	SS-1 to SS-4	0.0-10.0	8.0	2,410	1,605	145
B-050-0-20	SS-1 to SS-4	0.0-10.0	11.5	1,238	1,665	275
B-054-0-20	SS-1 to SS-4	0.0-10.0	11.2	776	360	755
B-060-0-20	SS-1, SS-2 & SS-4	0.0-10.0	9.1	347	765	330
B-063-0-20	SS-1 to SS-4	0.0-10.0	7.9	190	45	1,960
B-066-0-20	SS-1 to SS-4	0.0-10.0	7.9	523	200	1,470
B-067-0-20	SS-1 to SS-4	0.0-10.0	8.0	80	135	1,665

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-040-0-20	SS-1	1.0-2.5	185.23	172.84	31.49	8.8%
B-040-0-20	SS-2	3.5-5.0	178.56	166.83	31.73	8.7%
B-040-0-20	SS-3	6.0-7.5	193.74	175.10	31.00	12.9%
B-040-0-20	SS-5	11.0-12.5	95.79	81.57	31.53	28.4%
B-040-0-20	SS-7	16.0-17.5	117.50	102.86	30.99	20.4%
B-040-0-20	SS-8	18.5-20.0	111.37	99.73	31.63	17.1%
B-040-0-20	SS-9	21.0-22.5	139.04	118.68	31.57	23.4%
B-040-0-20	SS-10	23.5-25.0	179.50	150.41	31.45	24.5%
B-041-0-20	SS-1	1.0-2.5	107.50	101.35	31.41	8.8%
B-041-0-20	SS-3	6.0-7.5	137.12	126.74	31.62	10.9%
B-041-0-20	SS-4	8.5-10.0	161.51	148.95	31.57	10.7%
B-041-0-20	SS-5	11.0-12.5	69.39	58.44	13.70	24.5%
B-041-0-20	SS-7	14.5-16.0	69.07	58.60	14.00	23.5%
B-041-0-20	SS-8	16.0-17.5	78.69	70.35	13.84	14.8%
B-041-0-20	SS-9	18.5-20.0	126.14	110.88	31.53	19.2%
B-041-0-20	SS-11	28.5-30.0	65.84	56.28	13.45	22.3%
B-042-0-20	SS-1	1.0-2.5	114.75	104.90	31.31	13.4%
B-042-0-20	SS-3	6.0-7.5	139.99	132.02	31.71	7.9%
B-042-0-20	SS-4	8.5-10.0	169.77	153.46	31.60	13.4%
B-042-0-20	SS-5	11.0-12.5	107.26	94.81	31.28	19.6%
B-042-0-20	SS-7	16.0-17.5	136.54	118.81	31.45	20.3%
B-042-0-20	SS-8	18.5-20.0	140.77	130.73	30.99	10.1%
B-042-0-20	SS-9	23.5-25.0	149.70	130.91	31.24	18.9%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-042-0-20	SS-10	28.5-30.0	146.97	128.98	31.00	18.4%
B-042-0-20	SS-11	33.5-35.0	129.29	113.12	31.63	19.8%
B-043-0-20	SS-1	1.5-3.0	61.63	54.08	13.91	18.8%
B-043-0-20	SS-3	6.0-7.5	139.47	136.93	31.14	2.4%
B-043-0-20	SS-5	11.0-12.5	156.29	141.51	31.42	13.4%
B-043-0-20	SS-6	13.5-15.0	61.17	52.92	13.63	21.0%
B-043-0-20	SS-8	18.5-20.0	77.02	66.47	13.60	20.0%
B-043-0-20	SS-9	23.5-25.0	65.44	58.32	13.62	15.9%
B-043-0-20	SS-10	28.5-30.0	73.40	64.42	13.66	17.7%
B-044-0-20	SS-1	1.5-3.0	131.84	127.08	31.48	5.0%
B-044-0-20	SS-2	3.5-5.0	75.51	72.04	13.60	5.9%
B-044-0-20	SS-5	11.0-12.5	111.81	101.34	13.86	12.0%
B-044-0-20	SS-6	13.5-15.0	128.59	118.25	13.38	9.9%
B-044-0-20	SS-7	16.0-17.5	65.60	57.51	13.81	18.5%
B-044-0-20	SS-9	23.5-25.0	66.46	55.01	13.90	27.9%
B-044-0-20	SS-10	28.5-30.0	72.60	62.75	13.69	20.1%
B-046-0-20	SS-1	1.5-3.0	89.12	84.37	13.65	6.7%
B-046-0-20	SS-3	6.0-7.5	133.42	129.53	31.89	4.0%
B-046-0-20	SS-4	8.5-10.0	74.44	71.50	14.16	5.1%
B-046-0-20	SS-7	13.5-15.0	140.87	131.36	31.95	9.6%
B-046-0-20	SS-9	16.0-17.5	65.71	57.35	13.59	19.1%
B-046-0-20	SS-10	23.5-25.0	95.67	85.23	13.37	14.5%
B-046-0-20	SS-11	28.5-30.0	78.18	64.90	13.77	26.0%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-046-0-20	SS-13	32.5-35.0	75.56	61.33	13.87	30.0%
B-046-0-20	SS-14	38.5-40.0	67.35	57.67	14.03	22.2%
B-048-0-20	SS-1	1.0-2.5	90.73	80.85	13.11	14.6%
B-048-0-20	SS-2	3.5-5.0	116.25	102.86	13.70	15.0%
B-048-0-20	SS-4	8.5-10.0	59.39	52.00	10.88	18.0%
B-048-0-20	SS-5	11.0-12.5	54.23	47.43	11.24	18.8%
B-048-0-20	SS-6	13.5-15.0	66.63	56.84	10.95	21.3%
B-048-0-20	SS-8	18.5-20.0	67.94	58.97	10.93	18.7%
B-048-0-20	SS-9	23.5-25.0	89.57	78.33	13.55	17.4%
B-048-0-20	SS-10	28.5-30.0	69.96	64.17	11.25	10.9%
B-048-0-20	SS-11	33.5-35.0	95.90	83.06	13.42	18.4%
B-049-0-20	SS-1	1.0-2.5	127.44	118.95	30.80	9.6%
B-049-0-20	SS-2	3.5-5.0	132.19	122.18	31.00	11.0%
B-049-0-20	SS-4	8.5-10.0	70.21	59.84	13.62	22.4%
B-049-0-20	SS-5	13.5-15.0	81.07	69.43	13.58	20.8%
B-049-0-20	SS-6	16.0-17.5	71.29	59.71	13.24	24.9%
B-049-0-20	SS-7	23.5-25.0	144.97	124.58	31.01	21.8%
B-049-0-20	SS-8	26.5-30.0	88.95	76.33	13.63	20.1%
B-049-0-20	SS-9	33.5-35.0	135.79	119.92	31.54	18.0%
B-050-0-20	SS-1	1.0-2.5	108.95	100.60	31.64	12.1%
B-050-0-20	SS-3	6.0-7.5	93.66	77.52	31.48	35.1%
B-050-0-20	SS-4	8.5-10.0	108.46	96.69	31.27	18.0%
B-050-0-20	SS-6	13.5-15.0	85.24	75.35	31.01	22.3%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-050-0-20	SS-7	16.0-17.5	96.07	84.08	31.28	22.7%
B-050-0-20	SS-8	23.5-25.0	104.25	95.33	30.97	13.9%
B-050-0-20	SS-9	28.5-30.0	127.67	111.72	31.54	19.9%
B-050-0-20	SS-11	33.5-35.0	131.81	118.31	31.66	15.6%
B-051-0-20	SS-1	1.0-2.5	139.76	126.21	31.26	14.3%
B-051-0-20	SS-3	6.0-7.5	73.78	63.81	14.16	20.1%
B-051-0-20	SS-4	8.5-10.0	67.52	59.07	13.90	18.7%
B-051-0-20	SS-6	13.5-15.0	78.80	66.86	13.77	22.5%
B-051-0-20	SS-7	16.0-17.5	92.35	78.04	13.51	22.2%
B-051-0-20	SS-8	18.5-20.0	56.73	48.99	13.74	22.0%
B-051-0-20	SS-10	28.5-30.0	95.89	82.32	13.49	19.7%
B-052-0-20	SS-1	1.0-2.5	96.11	85.02	13.65	15.5%
B-052-0-20	SS-2	3.5-5.0	47.38	40.84	11.30	22.1%
B-052-0-20	SS-4	8.5-10.0	64.54	54.36	10.95	23.5%
B-052-0-20	SS-5	11.0-12.5	71.11	60.32	10.88	21.8%
B-052-0-20	SS-7	16.0-17.5	53.58	44.73	10.88	26.1%
B-052-0-20	SS-8	18.5-20.0	99.74	86.99	14.16	17.5%
B-052-0-20	SS-9	23.5-25.0	81.17	73.69	13.89	12.5%
B-053-0-20	SS-1	1.0-2.5	138.27	121.01	31.53	19.3%
B-053-0-20	SS-2	3.5-5.0	81.66	68.00	13.30	25.0%
B-053-0-20	SS-4	8.5-10.0	99.48	85.40	13.50	19.6%
B-053-0-20	SS-6	13.5-15.0	76.98	66.12	14.02	20.8%
B-053-0-20	SS-7	16.0-17.3	79.80	68.32	13.90	21.1%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-053-0-20	SS-8	18.5-20.0	80.29	71.00	14.18	16.3%
B-053-0-20	SS-9	23.5-25.0	80.33	67.00	13.78	25.0%
B-054-0-20	SS-1	1.0-2.5	131.11	125.18	31.21	6.3%
B-054-0-20	SS-2	3.5-5.0	139.06	121.84	31.23	19.0%
B-054-0-20	SS-3	6.0-7.5	56.50	49.68	10.90	17.6%
B-054-0-20	SS-4	8.5-10.0	50.14	43.66	10.94	19.8%
B-054-0-20	SS-5	11.0-12.5	53.14	46.17	10.82	19.7%
B-054-0-20	SS-7	13.5-15.0	67.40	57.85	11.28	20.5%
B-054-0-20	SS-8	16.0-17.5	54.49	46.66	10.94	21.9%
B-054-0-20	SS-10	23.5-25.0	53.31	44.16	10.91	27.5%
B-055-0-20	SS-1	1.0-2.5	81.01	72.68	13.74	14.1%
B-055-0-20	SS-2	3.5-5.0	144.50	138.30	31.16	5.8%
B-055-0-20	SS-4	8.5-10.0	75.75	64.57	13.85	22.0%
B-055-0-20	SS-5	11.0-12.5	61.54	52.33	14.04	24.1%
B-055-0-20	SS-6	13.5-15.0	56.74	47.44	13.50	27.4%
B-055-0-20	SS-7	16.0-17.5	492.59	433.93	159.89	21.4%
B-055-0-20	SS-8	18.5-20.0	74.99	67.11	13.96	14.8%
B-055-0-20	SS-9	23.5-25.0	80.71	70.14	13.94	18.8%
B-056-0-20	SS-1	1.0-2.5	177.59	163.15	31.01	10.9%
B-056-0-20	SS-3	6.0-7.5	156.02	144.07	31.56	10.6%
B-056-0-20	SS-4	8.5-10.0	175.13	154.34	31.52	16.9%
B-056-0-20	SS-5	11.0-12.5	100.33	85.02	13.68	21.5%
B-056-0-20	SS-7	16.0-17.5	71.16	61.07	13.67	21.3%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-056-0-20	SS-8	18.5-20.0	86.62	73.55	13.70	21.8%
B-056-0-20	SS-9	23.5-25.0	69.48	59.57	13.45	21.5%
B-059-0-20	SS-1	1.0-2.5	122.44	117.07	31.56	6.3%
B-059-0-20	SS-2	3.5-5.0	129.98	116.03	31.52	16.5%
B-059-0-20	SS-4	8.5-10.0	119.47	110.65	31.64	11.2%
B-059-0-20	SS-5	13.5-15.0	129.57	116.46	31.49	15.4%
B-059-0-20	SS-7	16.0-17.5	115.61	105.48	31.74	13.7%
B-059-0-20	SS-8	18.5-20.0	85.40	74.05	13.86	18.9%
B-060-0-20	SS-1	1.0-2.5	118.36	107.79	31.21	13.8%
B-060-0-20	SS-2	3.5-5.0	100.94	92.38	31.25	14.0%
B-060-0-20	SS-3	8.5-10.0	112.10	101.45	31.77	15.3%
B-060-0-20	SS-4	11.0-12.5	62.13	54.28	13.18	19.1%
B-060-0-20	SS-5	13.5-15.0	113.75	106.28	31.56	10.0%
B-060-0-20	SS-6	16.0-17.5	98.82	89.70	31.24	15.6%
B-060-0-20	SS-9	28.5-30.0	72.05	63.41	13.66	17.4%
B-061-0-20	SS-1	1.0-2.5	116.29	105.97	31.53	13.9%
B-061-0-20	SS-2	3.5-5.0	110.35	105.66	31.45	6.3%
B-061-0-20	SS-3	6.0-7.5	138.69	123.39	31.60	16.7%
B-061-0-20	SS-5	11.0-12.5	153.51	133.41	31.01	19.6%
B-061-0-20	SS-6	13.5-15.0	148.35	134.05	31.53	13.9%
B-061-0-20	SS-7	16.0-17.5	129.06	116.44	31.11	14.8%
B-061-0-20	SS-8	18.5-20.0	117.50	103.86	31.76	18.9%
B-061-0-20	SS-10	28.5-30.0	66.89	58.92	13.44	17.5%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-062-0-20	SS-1	1.0-2.5	137.18	126.71	30.79	10.9%
B-062-0-20	SS-2	3.5-5.0	70.50	64.34	13.84	12.2%
B-062-0-20	SS-3	8.5-10.0	70.93	63.83	13.90	14.2%
B-062-0-20	SS-5	18.5-20.0	136.31	126.99	31.46	9.8%
B-062-0-20	SS-6	23.5-25.0	62.22	56.02	13.61	14.6%
B-063-0-20	SS-1	1.0-2.5	88.83	77.25	13.81	18.3%
B-063-0-20	SS-2	3.5-5.0	139.42	128.70	30.82	11.0%
B-063-0-20	SS-4	8.5-10.0	94.69	84.18	13.64	14.9%
B-063-0-20	SS-5	11.0-12.5	84.60	74.22	13.67	17.1%
B-063-0-20	SS-7	18.5-20.0	66.22	53.84	13.81	30.9%
B-063-0-20	SS-9	28.5-30.0	78.84	65.22	13.43	26.3%
B-064-0-20	SS-1	1.0-2.5	150.53	135.85	31.24	14.0%
B-064-0-20	SS-3	6.0-7.5	158.03	141.57	31.24	14.9%
B-064-0-20	SS-4	8.5-10.0	157.16	147.48	31.26	8.3%
B-064-0-20	SS-5	11.0-12.5	160.58	147.12	30.99	11.6%
B-064-0-20	SS-7	16.0-17.5	150.96	133.91	31.49	16.6%
B-064-0-20	SS-8	18.5-20.0	185.32	151.07	31.61	28.7%
B-064-0-20	SS-9	21.0-22.5	195.62	170.40	31.88	18.2%
B-064-0-20	SS-10	23.5-25.0	161.54	145.92	30.77	13.6%
B-064-0-20	SS-11	26.0-27.5	146.89	126.55	31.48	21.4%
B-064-0-20	SS-13	33.5-35.0	105.61	92.90	31.57	20.7%
B-065-0-20	SS-1	1.0-2.5	137.33	126.65	31.55	11.2%
B-065-0-20	SS-2	3.5-5.0	97.95	96.82	31.63	1.7%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-065-0-20	SS-3	6.0-7.5	91.80	88.58	31.74	5.7%
B-065-0-20	SS-4	8.5-10.0	120.64	111.24	31.55	11.8%
B-065-0-20	SS-5	11.0-12.5	128.86	120.00	31.19	10.0%
B-065-0-20	SS-6	13.5-15.0	145.94	129.64	31.60	16.6%
B-065-0-20	SS-7	16.0-17.5	177.33	157.28	30.95	15.9%
B-065-0-20	SS-8	18.5-20.0	114.80	102.95	32.07	16.7%
B-065-0-20	SS-9	21.0-22.5	163.36	138.97	31.26	22.6%
B-065-0-20	SS-10	23.5-25.0	92.06	83.37	31.00	16.6%
B-065-0-20	SS-11	26.0-27.5	79.75	73.71	31.12	14.2%
B-065-0-20	SS-12	28.5-30.0	193.51	168.79	31.47	18.0%
B-066-0-20	SS-8	18.5-20.0	169.30	156.99	31.57	9.8%
B-066-0-20	SS-9	21.0-22.5	124.40	119.53	31.09	5.5%
B-066-0-20	SS-10	23.5-25.0	290.81	277.22	125.00	8.9%
B-066-0-20	SS-11	26.0-27.5	111.29	98.42	30.99	19.1%
B-066-0-20	SS-12	28.5-30.0	108.91	97.60	31.49	17.1%
B-066-0-20	SS-13	31.0-32.5	83.04	73.35	30.96	22.9%
B-066-0-20	SS-14	33.5-35.0	92.87	83.71	31.12	17.4%
B-066-0-20	SS-15	36.0-37.5	76.43	66.21	13.70	19.5%
B-066-0-20	SS-16	38.5-40.0	83.03	74.98	13.16	13.0%
B-067-0-20	SS-1	1.0-2.5	49.55	45.57	13.48	12.4%
B-067-0-20	SS-2	3.5-5.0	69.13	59.59	13.95	20.9%
B-067-0-20	SS-3	6.0-7.5	93.19	86.17	13.91	9.7%
B-067-0-20	SS-5	11.0-12.5	88.67	81.99	13.82	9.8%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-067-0-20	SS-6	13.5-15.0	91.03	77.48	14.15	21.4%
B-067-0-20	SS-7	16.0-17.5	65.73	56.53	11.15	20.3%
B-067-0-20	SS-10	21.0-22.5	65.38	56.10	10.94	20.5%
B-067-0-20	SS-11	23.5-25.0	58.30	49.00	10.95	24.4%
B-067-0-20	SS-13	33.5-35.0	63.61	53.18	10.89	24.7%
B-067-0-20	SS-14	38.5-40.0	86.55	72.10	13.81	24.8%
B-067-0-20	SS-15	43.5-45.0	86.76	73.56	13.98	22.2%
B-067-0-20	SS-16	48.5-50.0	67.34	57.31	13.39	22.8%
B-068-0-20	SS-2	3.5-5.0	122.66	113.04	31.90	11.9%
B-068-0-20	SS-3	6.0-7.5	68.99	66.91	13.67	3.9%
B-068-0-20	SS-5	11.0-12.5	69.68	66.58	13.11	5.8%
B-068-0-20	SS-6	13.5-15.0	90.80	77.81	13.66	20.2%
B-068-0-20	SS-7	16.0-17.5	84.61	72.13	13.81	21.4%
B-068-0-20	SS-8	18.5-20.0	73.10	68.38	13.10	8.5%
B-068-0-20	SS-10	28.5-30.0	71.53	64.85	13.59	13.0%
B-068-0-20	SS-11	33.5-35.0	87.57	77.40	13.39	15.9%
B-068-0-20	SS-13	43.5-45.0	72.45	61.12	13.58	23.8%
B-068-0-20	SS-14	48.5-50.0	81.78	68.30	13.54	24.6%
B-068-0-20	SS-15	53.5-55.0	92.34	77.45	14.11	23.5%
B-068-0-20	SS-16	58.5-60.0	104.07	88.78	13.74	20.4%
B-070-0-20	SS-1	1.0-2.5	106.40	98.19	31.74	12.4%
B-070-0-20	SS-2	3.5-5.0	126.05	116.50	31.65	11.3%
B-070-0-20	SS-4	8.5-10.0	98.42	80.72	31.89	36.2%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-070-0-20	SS-5	11.0-12.5	123.07	108.36	30.97	19.0%
B-070-0-20	SS-6	13.5-15.0	105.94	94.78	31.03	17.5%
B-070-0-20	SS-8	18.5-20.0	102.39	89.78	31.13	21.5%
B-070-0-20	SS-11	23.5-25.0	93.71	82.99	31.49	20.8%
B-070-0-20	SS-13	28.5-30.0	115.52	101.09	31.26	20.7%
B-070-0-20	SS-15	33.5-35.0	96.11	82.56	31.61	26.6%
B-070-0-20	SS-17	43.5-45.0	101.46	90.59	31.77	18.5%
B-070-0-20	SS-18	48.5-50.0	101.20	90.30	31.47	18.5%
B-070-0-20	SS-19	53.5-55.0	121.46	106.87	31.13	19.3%
B-070-0-20	SS-21	63.5-65.0	122.90	106.85	31.45	21.3%
B-070-0-20	SS-22	68.5-70.0	79.19	69.00	13.76	18.4%
B-070-0-20	SS-23	73.5-75.0	59.68	49.96	14.09	27.1%
B-070-0-20	SS-24	78.5-80.0	69.08	58.04	13.61	24.8%
B-070-0-20	SS-25	83.5-85.0	68.91	57.63	13.65	25.6%
B-070-0-20	SS-27	93.5-95.0	64.28	54.98	13.34	22.3%
B-070-0-20	SS-28	98.5-100.0	58.01	49.37	10.90	22.5%
B-070-0-20	SS-29	103.5-105.0	64.70	55.10	11.39	22.0%
B-070-0-20	SS-30	108.5-110.0	71.71	61.40	11.39	20.6%
B-071-0-20	SS-2	3.5-5.0	68.82	64.14	14.00	9.3%
B-071-0-20	SS-3	6.0-7.5	115.21	105.23	31.00	13.4%
B-071-0-20	SS-4	6.5-10.0	82.31	70.45	13.51	20.8%
B-071-0-20	SS-5	11.0-12.5	86.53	73.85	13.75	21.1%
B-071-0-20	SS-6	13.5-15.0	71.18	63.24	13.64	16.0%

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

TRC

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-071-0-20	SS-7	16.0-17.5	75.37	66.15	13.79	17.6%
B-071-0-20	SS-9	21.0-22.5	77.55	68.21	13.66	17.1%
B-071-0-20	SS-10	23.5-25.0	66.24	58.14	13.39	18.1%
B-071-0-20	SS-13	33.5-35.0	87.00	74.77	13.89	20.1%
B-071-0-20	SS-17	43.5-45.0	83.69	71.27	13.71	21.6%
B-071-0-20	SS-18	48.5-50.0	61.40	52.90	13.83	21.8%
B-071-0-20	SS-19	53.5-55.0	62.32	54.29	13.66	19.8%
B-071-0-20	SS-21	63.5-65.0	64.34	54.68	13.95	23.7%
B-071-0-20	SS-22	68.5-70.0	91.49	75.94	13.44	24.9%
B-071-0-20	SS-24	78.5-80.0	78.39	69.18	13.77	16.6%
B-071-0-20	SS-25	83.5-85.0	65.10	54.92	13.90	24.8%
B-071-0-20	SS-26	88.5-90.0	75.40	64.49	13.81	21.5%
B-071-0-20	SS-27	93.5-95.0	63.63	54.02	13.90	24.0%
B-071-0-20	SS-28	98.5-100.0	113.18	98.50	31.61	21.9%
B-071-0-20	SS-29	103.5-105.0	129.43	112.75	31.44	20.5%
B-071-0-20	SS-30	108.5-110.0	132.68	115.26	31.50	20.8%
B-072-0-20	SS-2	3.5-5.0	382.64	362.91	138.4	8.8%
B-072-0-20	SS-3	8.5-10.0	462.52	410.51	131.85	18.7%
B-072-0-20	SS-4	13.5-15.0	382.86	345.71	131.3	17.3%
B-072-0-20	SS-6	23.5-25.0	395.02	349.03	132.74	21.3%
B-073-0-20	SS-3	8.5-10.0	384.77	363.25	134.29	9.4%
B-073-0-20	SS-4	13.5-15.0	402.82	352.75	136.17	23.1%
B-073-0-20	SS-6	23.5-25.0	395.2	354.04	127.29	18.2%

Drawn By: TBT REV 11/15/22

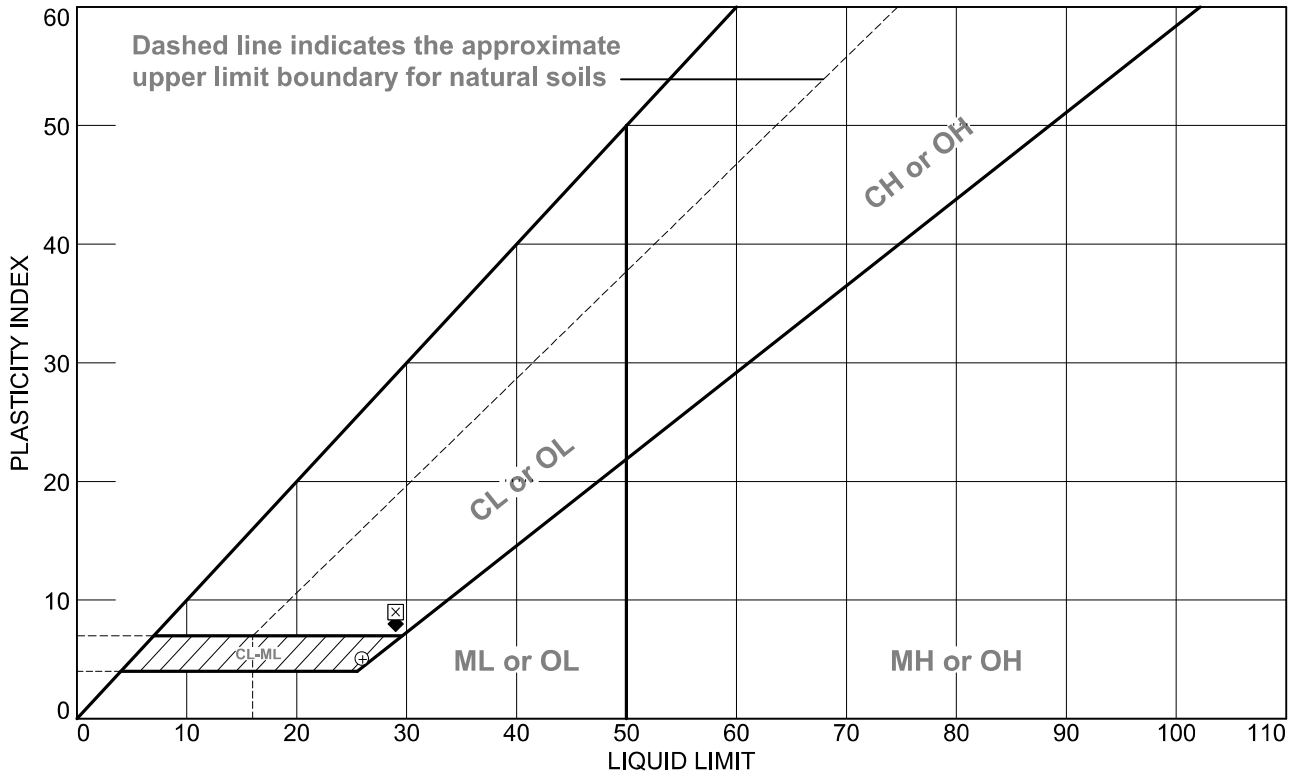
Checked By: SM REV 11/15/22

TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Drawn By: TBT REV 11/15/22

Checked By: SM REV 11/15/22

Atterberg Limits and Moisture Content Report



SOIL DATA

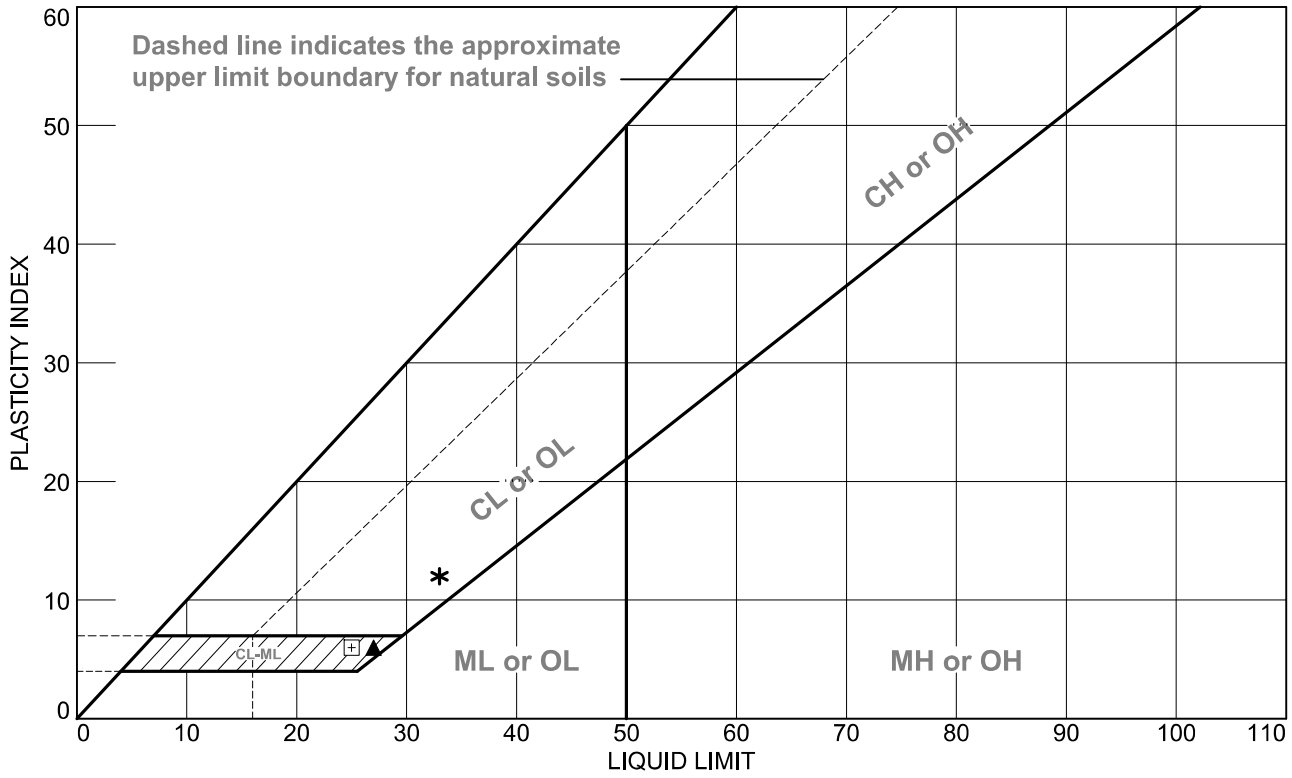
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-040-0-20	SS-4	8.5-10.0 FT	13.7	NP	NP	NP		SW
■	B-040-0-20	SS-6	13.5-15.0 FT	23.9	20	29	9	0.4	CL
▲	B-041-0-20	SS-2	3.5-5.0 FT	5.2	NP	NP	NP		SW-SM
◆	B-041-0-20	ST-6	12.5-14.5 FT	26.4	21	29	8	0.7	CL
▼	B-041-0-20	SS-9	23.5-25.0 FT	23.0	NP	NP	NP		ML
✱	B-042-0-20	SS-2	3.5-5.0 FT	5.4	NP	NP	NP		SW-SM
⊕	B-042-0-20	SS-6	13.5-15.0 FT	21.4	21	26	5	0.1	CL-ML
⊞	B-043-0-20	SS-2	3.5-5.0 FT	26.8	22	20	NP		ML
⊗	B-043-0-20	SS-4	8.5-10.0 FT	5.4	NP	NP	NP		SP-SM
⊠	B-043-0-20	ST-7	16.0-18.0 FT	20.8	20	29	9	0.1	CL

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 1

Atterberg Limits and Moisture Content Report



SOIL DATA

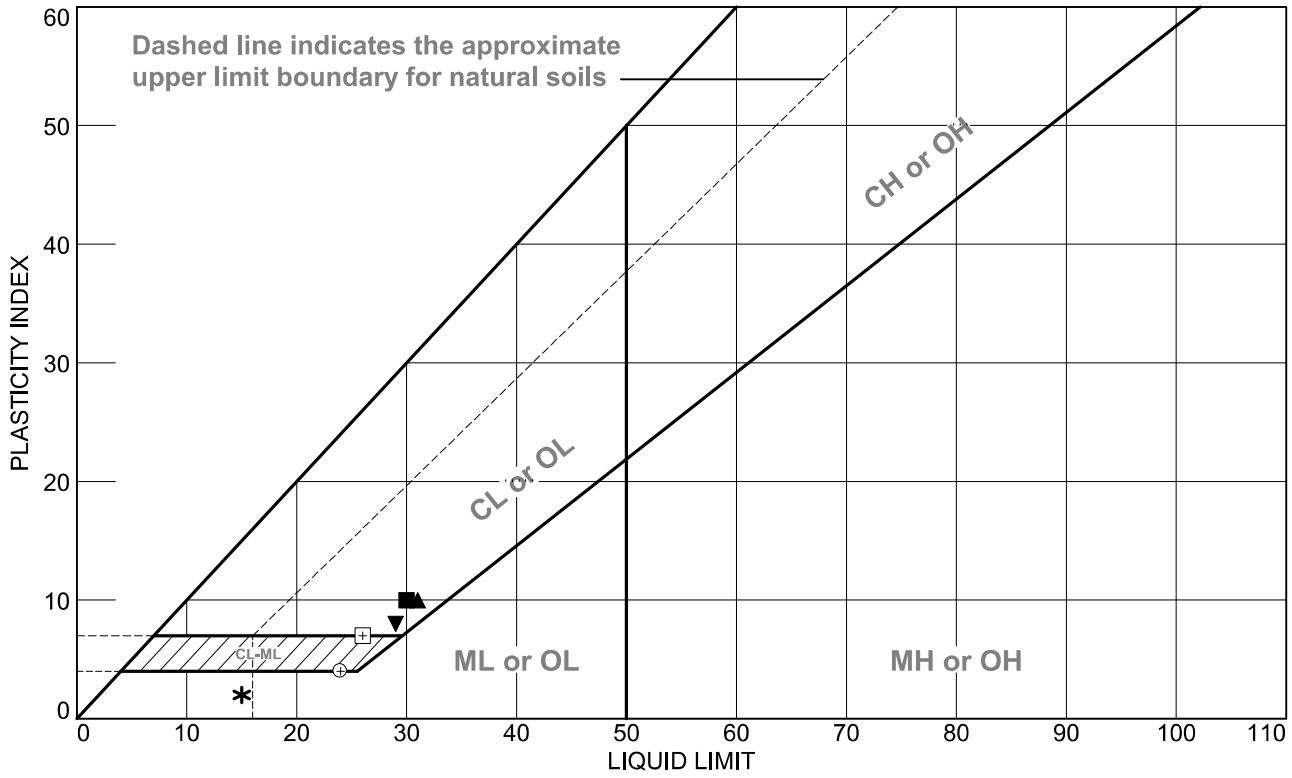
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-044-0-20	SS-3	6.0-7.5 FT	3.1	NP	NP	NP		SP-SM
■	B-044-0-20	SS-4	8.5-10.0 FT	4.7	NP	NP	NP		SP-SM
▲	B-044-0-20	ST-8	18.0-20.0 FT	23.7	21	27	6	0.4	CL-ML
◆	B-046-0-20	SS-2	3.5-5.0 FT	25.3	NP	NP	NP		ML
▼	B-046-0-20	SS-5	11.0-12.5 FT	10.0	NP	NP	NP		SP-SM
✱	B-046-0-20	ST-8	18.0-20.0 FT	20.9	21	33	12	0.0	CL
⊕	B-048-0-20	SS-3	6.0-7.5 FT	23.6	NP	NP	NP		SP-SM
⊞	B-048-0-20	SS-7	16.0-17.5 FT	18.3	19	25	6	-0.1	CL-ML

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 2

Atterberg Limits and Moisture Content Report



SOIL DATA

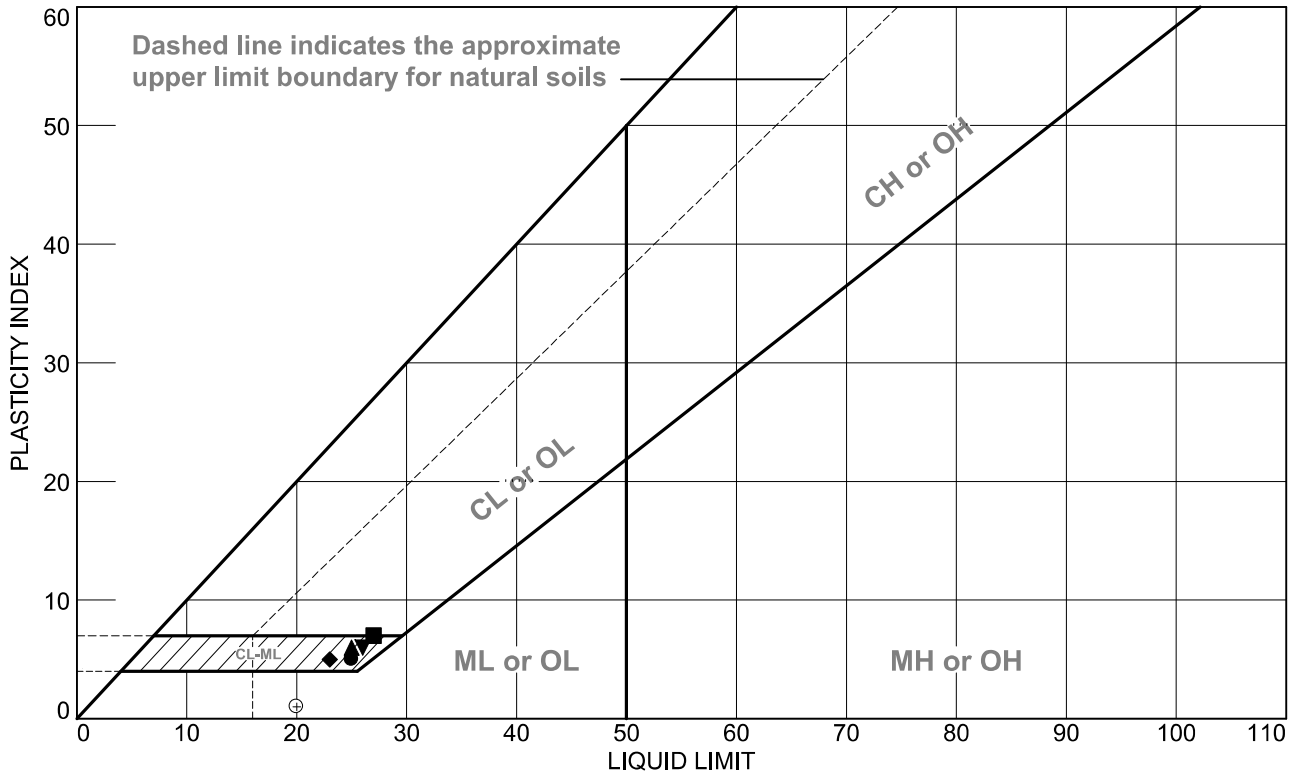
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-049-0-20	SS-3	6.0-7.5 FT	20.4	NP	NP	NP		SP-SM
■	B-049-0-20	ST-5	10.0-12.0 FT	20.9	20	30	10	0.1	CL
▲	B-049-0-20	ST-8	17.5-19.5 FT	25.3	21	31	10	0.4	CL
◆	B-050-0-20	SS-2	3.5-5.0 FT	15.7	NP	NP	NP		SM
▼	B-050-0-20	SS-5	11.0-12.5 FT	22.2	21	29	8	0.1	CL
✱	B-050-0-20	SS-10	28.5-30.0 FT	17.5	13	15	2	2.2	ML
⊕	B-051-0-20	SS-2	3.5-5.0 FT	19.7	20	24	4	-0.1	CL-ML
⊞	B-051-0-20	SS-5	11.0-12.3 FT	23.7	19	26	7	0.7	CL-ML
⊗	B-051-0-20	SS-9	23.5-25.0 FT	19.6	NP	NP	NP		ML

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 3

Atterberg Limits and Moisture Content Report



SOIL DATA

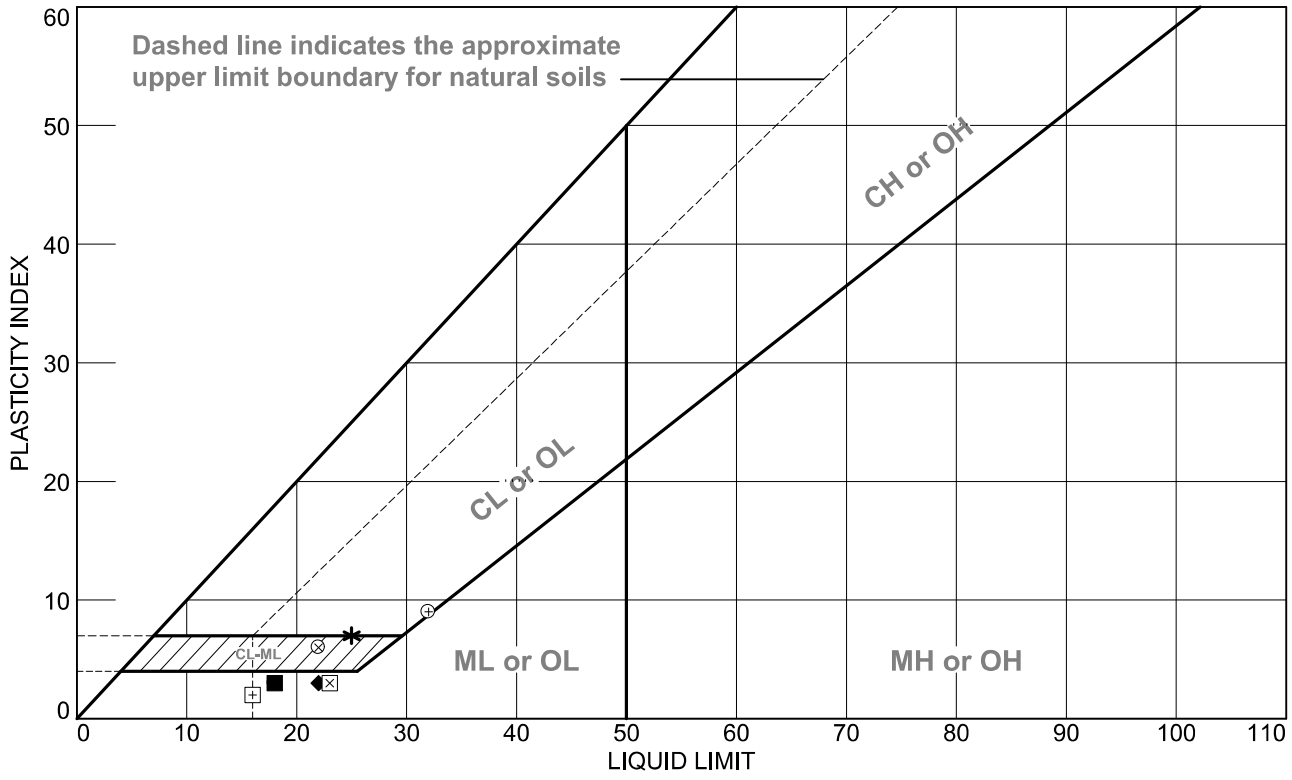
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-052-0-20	SS-3	6.0-7.5 FT	19.2	20	25	5	-0.2	CL-ML
■	B-052-0-20	SS-6	13.5-15.0 FT	22.3	20	27	7	0.3	CL-ML
▲	B-053-0-20	SS-3	6.0-7.5 FT	21.1	19	25	6	0.4	CL-ML
◆	B-053-0-20	SS-5	11.0-12.5 FT	21.6	18	23	5	0.7	CL-ML
▼	B-054-0-20	ST-6	12.5-14.5 FT	19.8	20	26	6	0.0	CL-ML
✱	B-054-0-20	SS-9	18.5-20.0 FT	19.7	NP	NP	NP		SM
⊕	B-055-0-20	SS-3	6.0-7.5 FT	22.4	19	20	1	3.4	ML
⊞	B-055-0-20	SS-7	16.0-17.5 FT	21.4	NP	NP	NP		SM
⊗	B-056-0-20	SS-2	3.5-5.0 FT	15.7	NP	NP	NP		SM
⊠	B-056-0-20	SS-6	13.5-15.0 FT	21.2	21	21	NP		ML

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 4

Atterberg Limits and Moisture Content Report



SOIL DATA

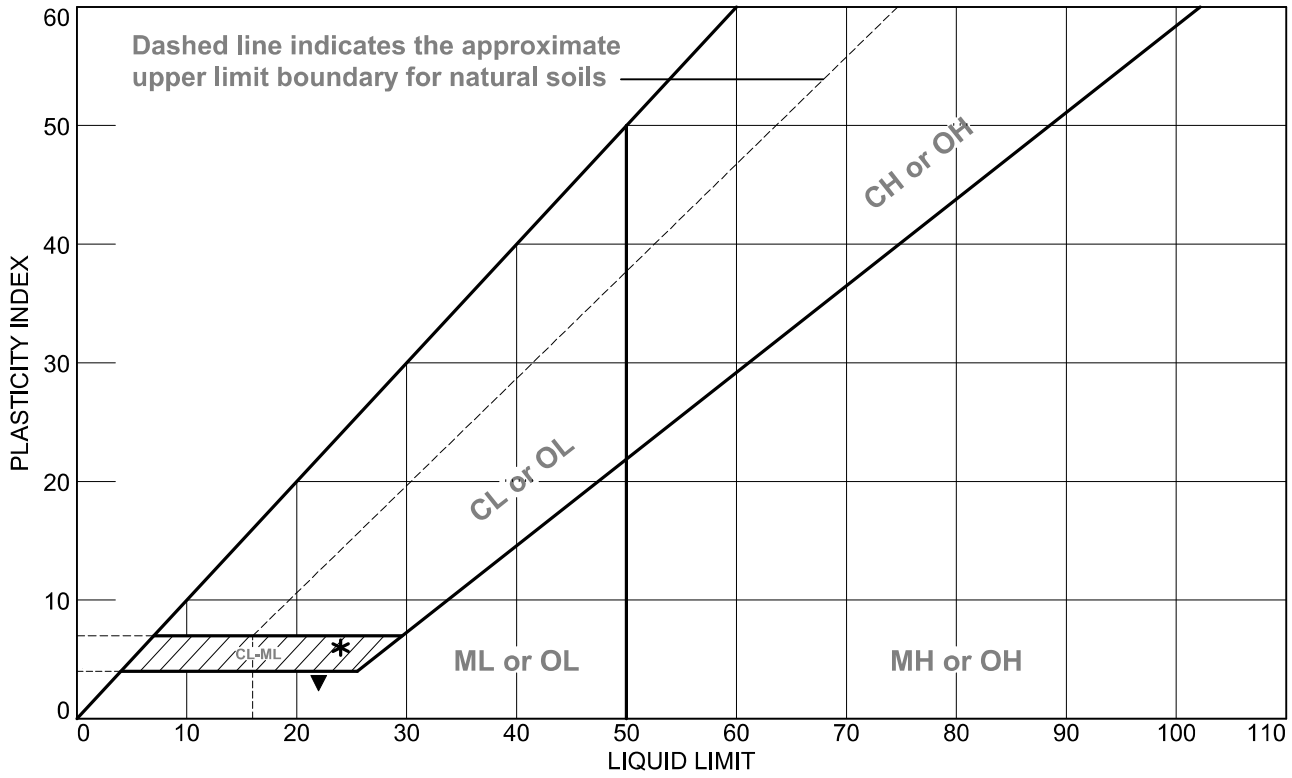
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-059-0-20	SS-3	6.0-7.5 FT	11.6	15	18	3	-1.1	ML
■	B-059-0-20	SS-6	13.5-15.0 FT	12.1	15	18	3	-1.0	SM
▲	B-059-0-20	SS-9	28.5-30.0 FT	29.8	NP	NP	NP		ML
◆	B-060-0-20	SS-7	16.0-17.5 FT	27.6	19	22	3	2.9	ML
▼	B-061-0-20	SS-4	8.5-10.0 FT	17.2	NP	NP	NP		SM
✱	B-061-0-20	SS-9	23.5-25.0 FT	24.6	18	25	7	0.9	CL-ML
⊕	B-062-0-20	SS-4	13.5-15.0 FT	19.2	23	32	9	-0.4	CL
⊞	B-063-0-20	SS-3	6.0-7.5 FT	14.0	14	16	2	0.0	SM
⊗	B-063-0-20	SS-6	13.5-15.0 FT	19.4	16	22	6	0.6	CL-ML
⊠	B-063-0-20	SS-8	23.5-25.0 FT	27.9	20	23	3	2.6	ML

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 5

Atterberg Limits and Moisture Content Report



SOIL DATA

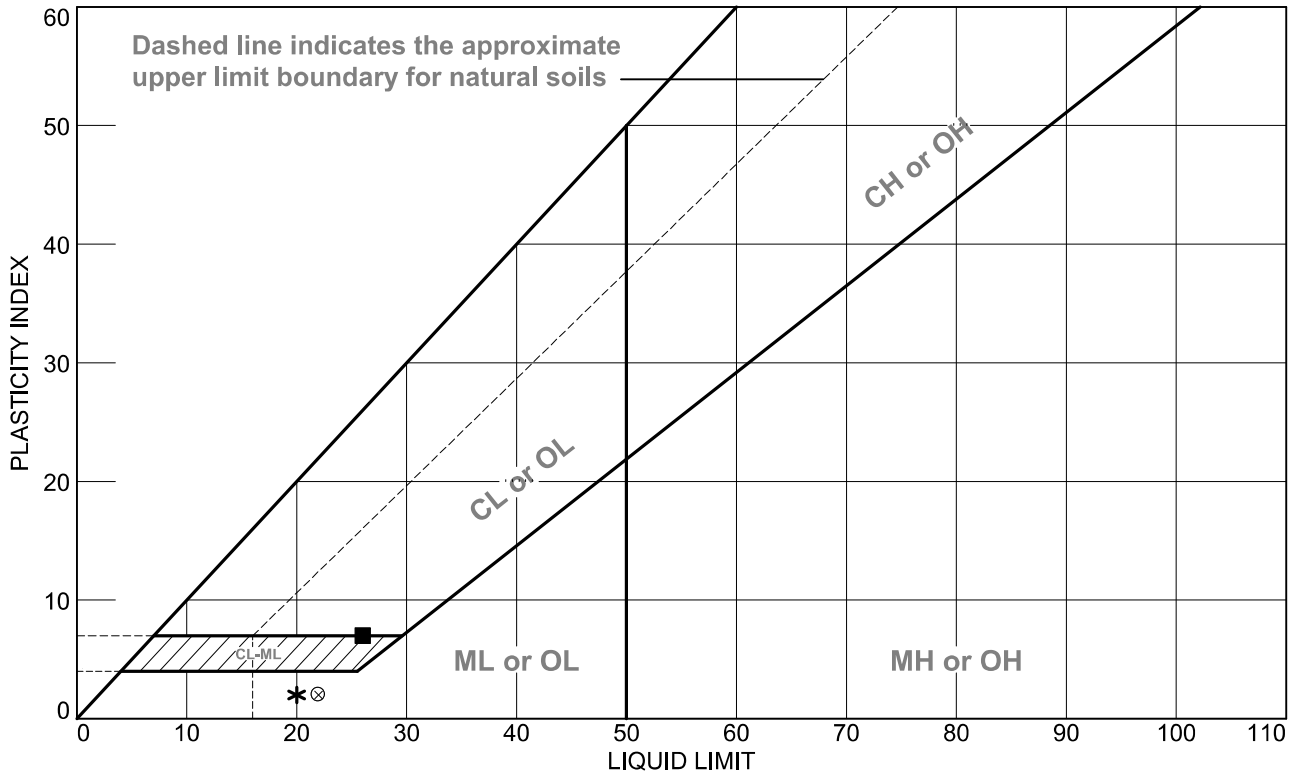
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-064-0-20	S-2	3.5-5.0 FT	14.0	NP	NP	NP		ML
■	B-064-0-20	S-6	13.5-15.0 FT	20.0	NP	NP	NP		SM
▲	B-064-0-20	S-12	28.5-30.0 FT	18.0	NP	NP	NP		SM
◆	B-065-0-20	S-1	1.0-2.5 FT	14.0	NP	NP	NP		GW
▼	B-065-0-20	S-8	18.5-20.0 FT	20.0	19	22	3	0.3	ML
✱	B-065-0-20	S-10	23.5-25.0 FT	17.6	18	24	6	-0.1	CL-ML
⊕	B-066-0-20	S-6	13.5-15.0 FT	9.3	NP	NP	NP		SM
⊞	B-066-0-20	S-11	26.0-27.5 FT	18.2	NP	NP	NP		SP-SM

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 6

Atterberg Limits and Moisture Content Report



SOIL DATA

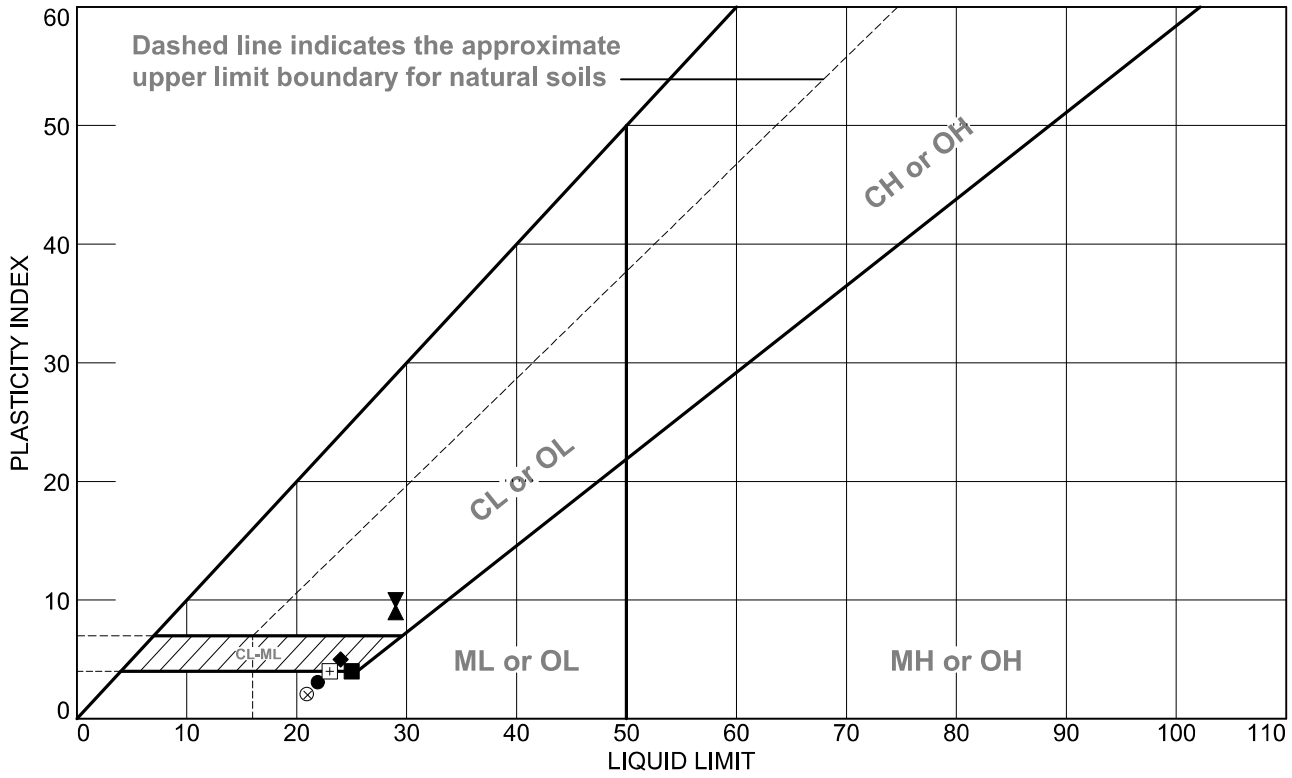
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-067-0-20	SS-4	8.5-10.0 FT	10.0	NP	NP	NP		SM
■	B-067-0-20	ST-8	17.5-19.5 FT	21.8	19	26	7	0.4	CL-ML
▲	B-067-0-20	SS-11	28.5-30.0 FT	21.9	NP	NP	NP		ML
◆	B-068-0-20	SS-1	1.0-2.5 FT	11.0	NP	NP	NP		SM
▼	B-068-0-20	SS-4	8.5-10.0 FT	17.1	NP	NP	NP		ML
✱	B-068-0-20	SS-9	23.5-25.0 FT	14.0	18	20	2	-2.0	ML
⊕	B-068-0-20	SS-12	35.5-40.0 FT	19.6	20	22	2	-0.2	ML
⊞	B-070-0-20	SS-3	6.0-7.5 FT	11.3	NP	NP	NP		SM
⊗	B-070-0-20	SS-7	16.0-17.5 FT	23.2	20	22	2	1.6	ML

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 7

Atterberg Limits and Moisture Content Report



SOIL DATA

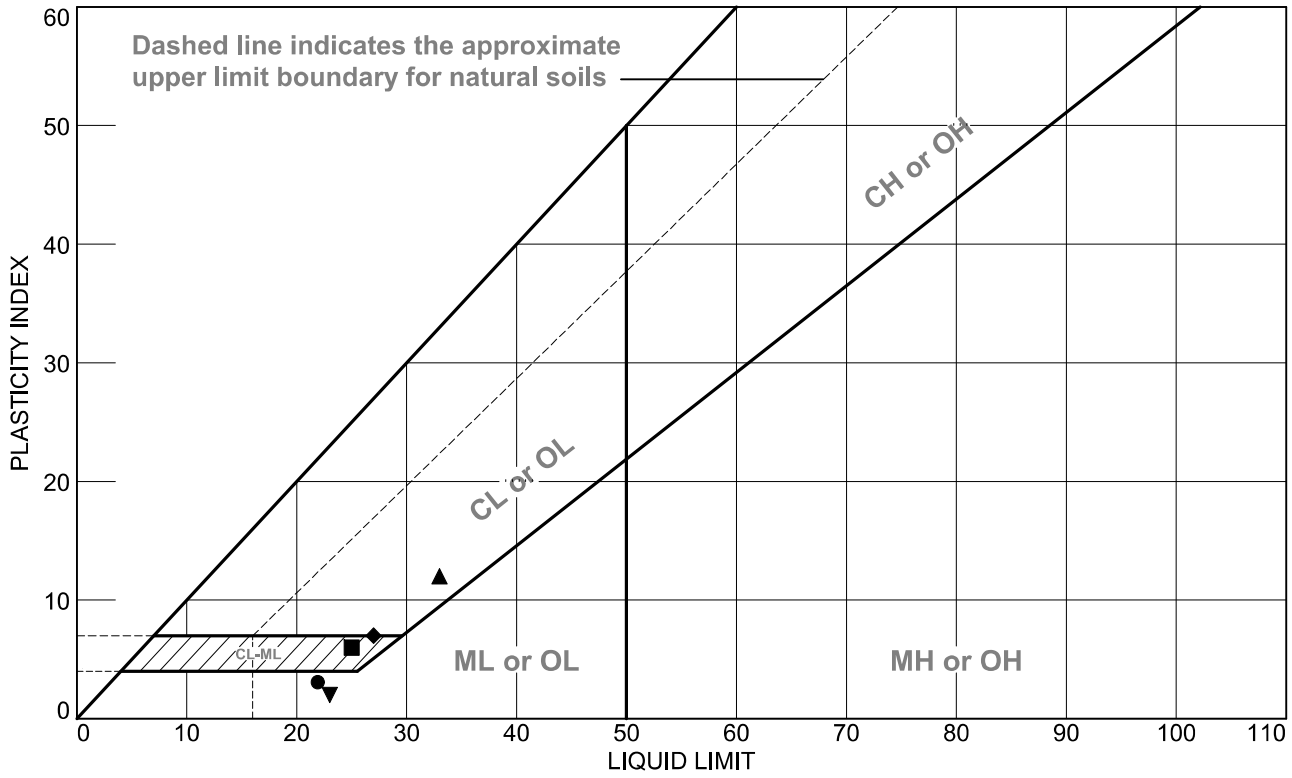
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-070-0-20	ST-9	21.0-23.0 FT	20.2	19	22	3	0.4	ML
■	B-070-0-20	ST-12	31.0-33.0 FT	26.1	21	25	4	1.3	CL-ML
▲	B-070-0-20	ST-14	38.0-40.0 FT	23.4	20	29	9	0.4	CL
◆	B-070-0-20	SS-18	58.5-60.0 FT	20.2	19	24	5	0.2	CL-ML
▼	B-070-0-20	SS-24	88.5-90.0 FT	22.9	19	29	10	0.4	CL
✱	B-071-0-20	SS-1	1.0-2.5 FT	9.3	NP	NP	NP		GW-GM
⊕	B-071-0-20	SS-8	18.5-20.0 FT	19.3	19	19	NP		ML
⊞	B-071-0-20	ST-11	26.0-28.0 FT	18.9	19	23	4	0.0	CL-ML
⊗	B-071-0-20	SS-12	28.5-30.0 FT	22.1	19	21	2	1.6	ML

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 8

Atterberg Limits and Moisture Content Report



SOIL DATA

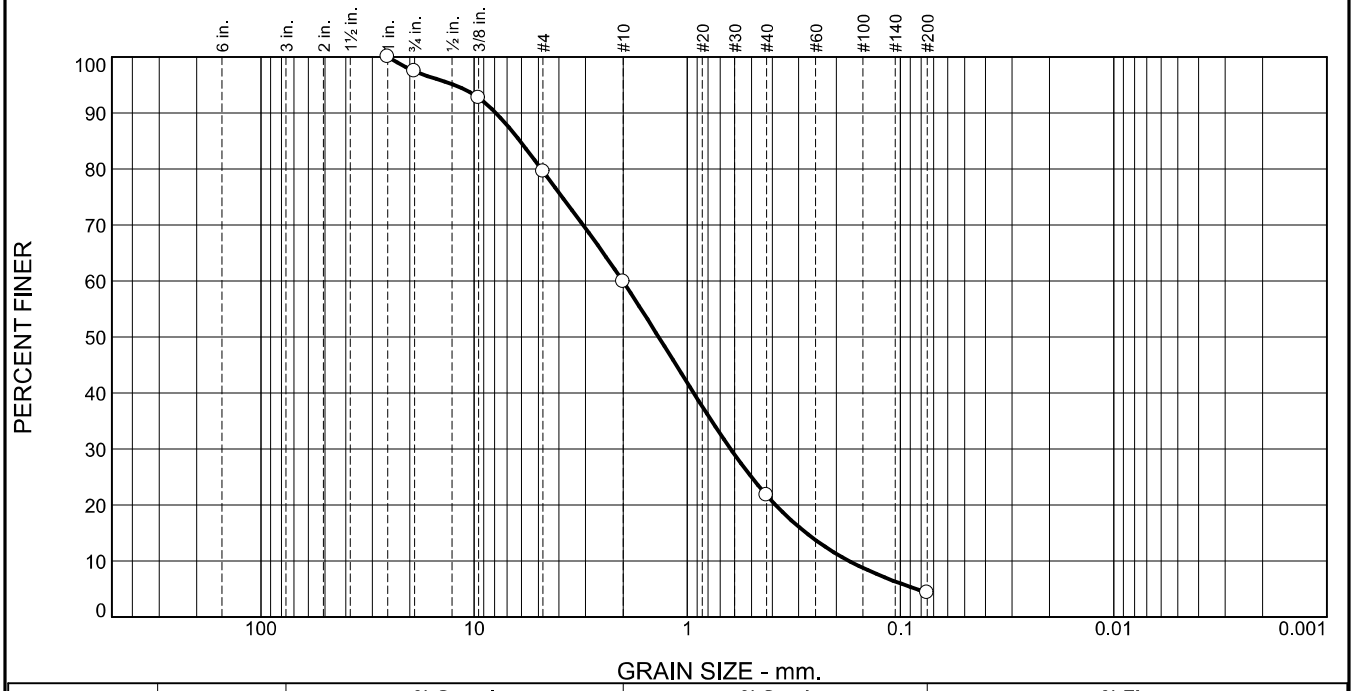
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-071-0-20	ST-14	36.0-38.0 FT	22.6	19	22	3	1.2	ML
■	B-071-0-20	SS-15	38.5-40.0 FT	26.3	19	25	6	1.2	CL-ML
▲	B-071-0-20	ST-16	41.0-43.0 FT	25.7	21	33	12	0.4	CL
◆	B-071-0-20	SS-20	58.5-60.0 FT	25.4	20	27	7	0.8	CL-ML
▼	B-071-0-20	SS-23	73.5-75.0 FT	19.1	21	23	2	-0.9	ML
✱	B-072-0-20	S-5	18.5-20.0 FT	17.1	NP	NP	NP		SM
⊕	B-073-0-20	S-2	3.5-5.0 FT	10.7	NP	NP	NP		SM
⊞	B-073-0-20	S-5	18.5-20.0 FT	23.5	NP	NP	NP		SM

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No.: 301525.1000 **Figure** 9

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	2.6	37.5	38.1	17.5	4.3	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.0"	100.0		
3/4"	97.4		
3/8"	92.7		
#4	79.5		
#10	59.9		
#40	21.8		
#200	4.3		

* (no specification provided)

Material Description

LOOSE TO MEDIUM DENSE, GRAY SAND AND GRAVEL, TRACE SILT, WET

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= SW AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 7.9128 D_{85}= 6.0987 D_{60}= 2.0100
D_{50}= 1.3623 D_{30}= 0.6253 D_{15}= 0.2767
D_{10}= 0.1740 C_u= 11.55 C_c= 1.12

Remarks

SAMPLE DESCRIPTION BASED ON USCS

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T.THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-040-0-20 **Depth:** 8.5-10.0 FT **Date Sampled:**

Sample Number: SS-4

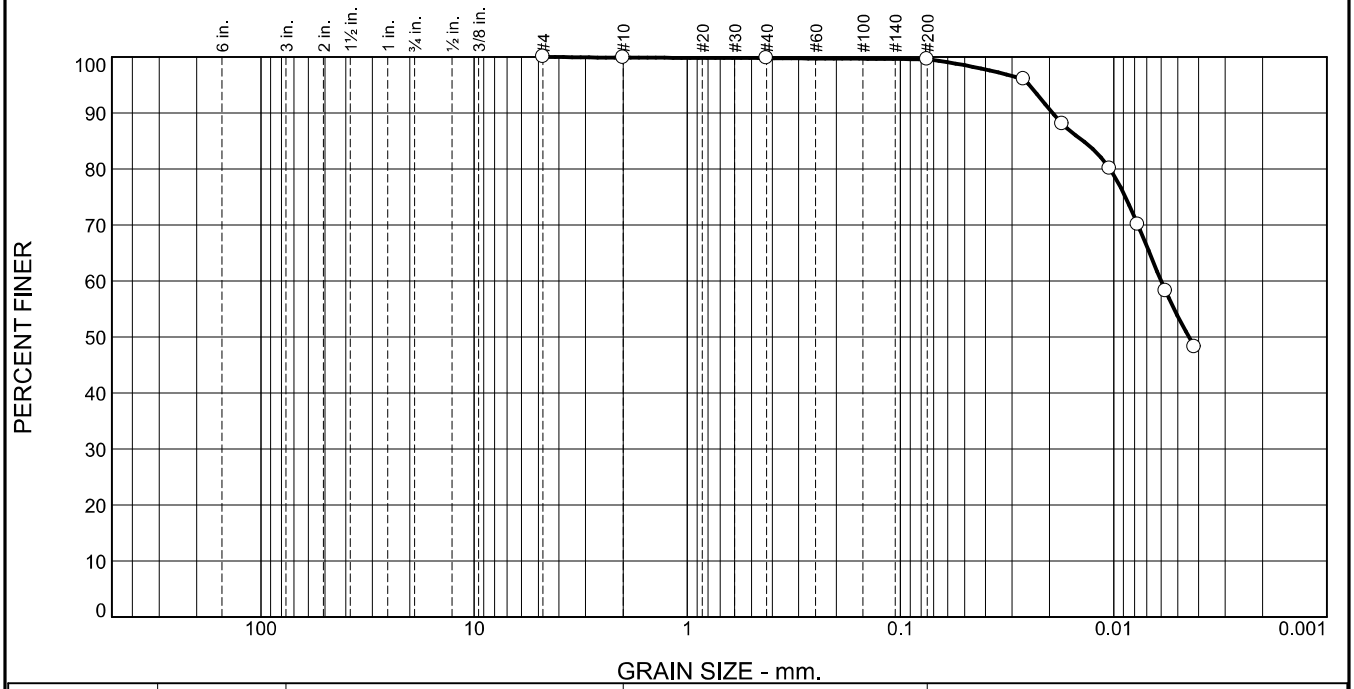
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 10

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.1	0.2	45.9	53.7

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.8		
#200	99.6		
0.0265 mm.	96.0		
0.0174 mm.	88.0		
0.0105 mm.	80.1		
0.0077 mm.	70.1		
0.0057 mm.	58.2		
0.0042 mm.	48.3		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN-GRAY CLAY AND SILT, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 LL= 29 PI= 9

Classification

USCS (D 2487)= CL AASHTO (M 145)= A-4b

Coefficients

D_{90}= 0.0194 D_{85}= 0.0139 D_{60}= 0.0060
D_{50}= 0.0044 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/09/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-040-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**

Sample Number: SS-6

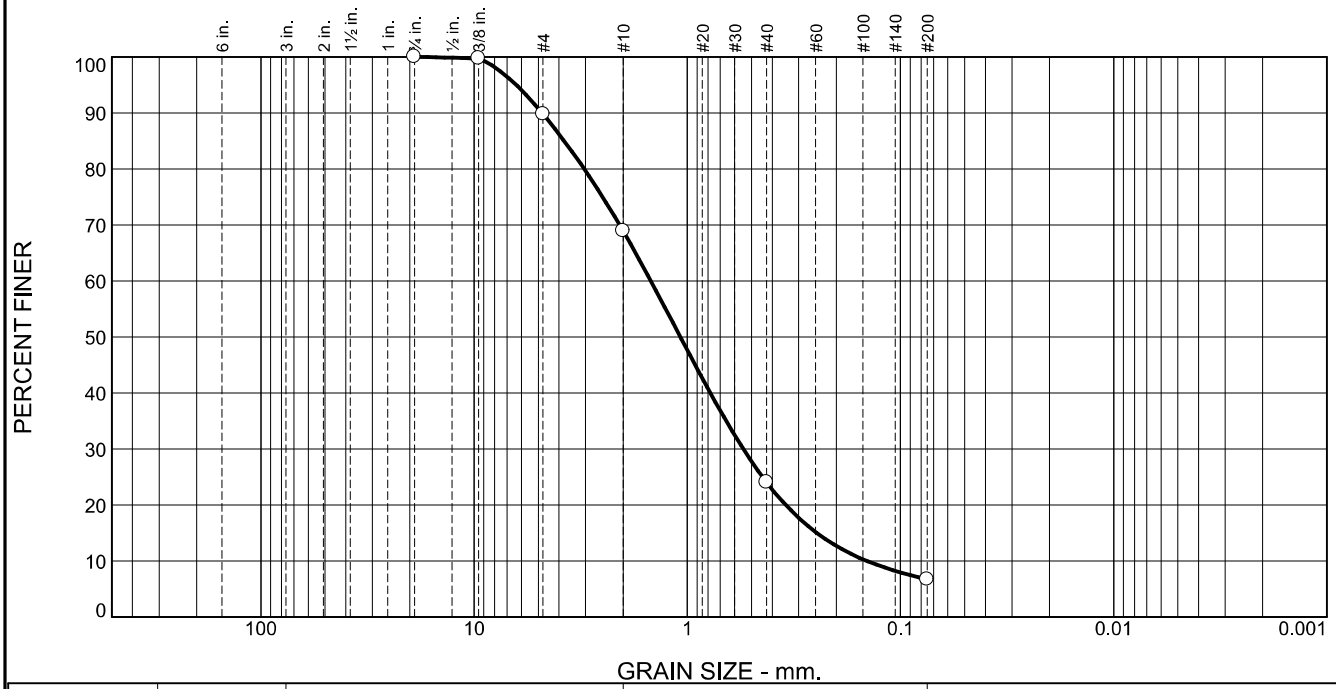
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 11

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	31.1	44.8	17.4	6.7	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.7		
#4	89.8		
#10	68.9		
#40	24.1		
#200	6.7		

* (no specification provided)

Material Description

BROWN COARSE AND FINE SAND, SOME FINE GRAVEL, TRACE SILT AND CLAY, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 4.8049 D_{85}= 3.7798 D_{60}= 1.4842
D_{50}= 1.0785 D_{30}= 0.5459 D_{15}= 0.2466
D_{10}= 0.1435 C_u= 10.34 C_c= 1.40

Remarks

SAMPLE DESCRIPTION BASED ON USCS

Date Received: _____ **Date Tested:** 04/02/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-041-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**

Sample Number: SS-2

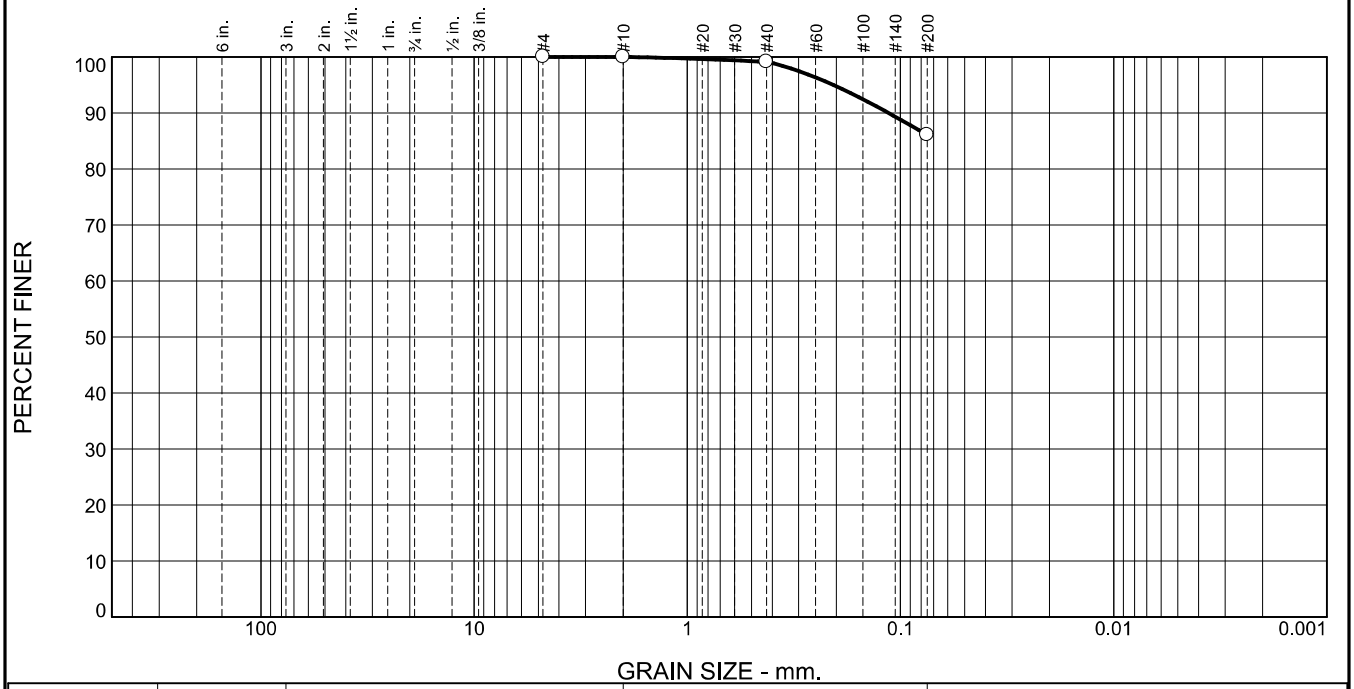
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 12

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.9	13.0	86.1	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.1		
#200	86.1		

* (no specification provided)

Material Description

GRAY-BROWN SILT, LITTLE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.1143 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON USCS

Date Received: _____ **Date Tested:** 03/24/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-041-0-20 **Depth:** 23.5-25.0 FT **Date Sampled:**

Sample Number: SS-9

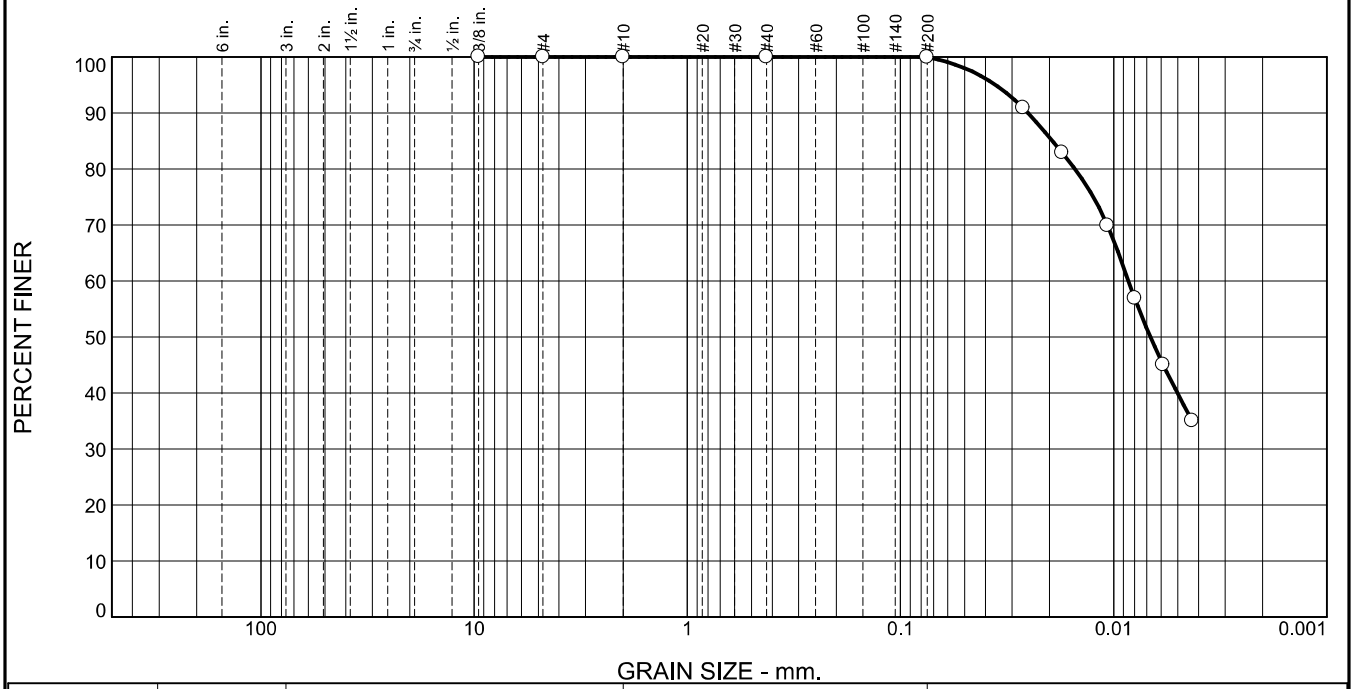
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 13

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	0.1	60.1	39.8

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	100.0		
#10	100.0		
#40	100.0		
#200	99.9		
0.0266 mm.	90.9		
0.0175 mm.	82.9		
0.0107 mm.	69.9		
0.0080 mm.	56.9		
0.0059 mm.	45.0		
0.0043 mm.	35.0		

* (no specification provided)

Material Description

GRAY-BROWN SILT AND CLAY

Atterberg Limits (ASTM D 4318)

PL= 21 LL= 29 PI= 8

Classification

USCS (D 2487)= CL AASHTO (M 145)= A-4b

Coefficients

D_{90}= 0.0253 D_{85}= 0.0194 D_{60}= 0.0085
D_{50}= 0.0067 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON USCS

Date Received: _____ **Date Tested:** 04/03/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-041-0-20 **Depth:** 12.5-14.5 FT **Date Sampled:**

Sample Number: ST-6

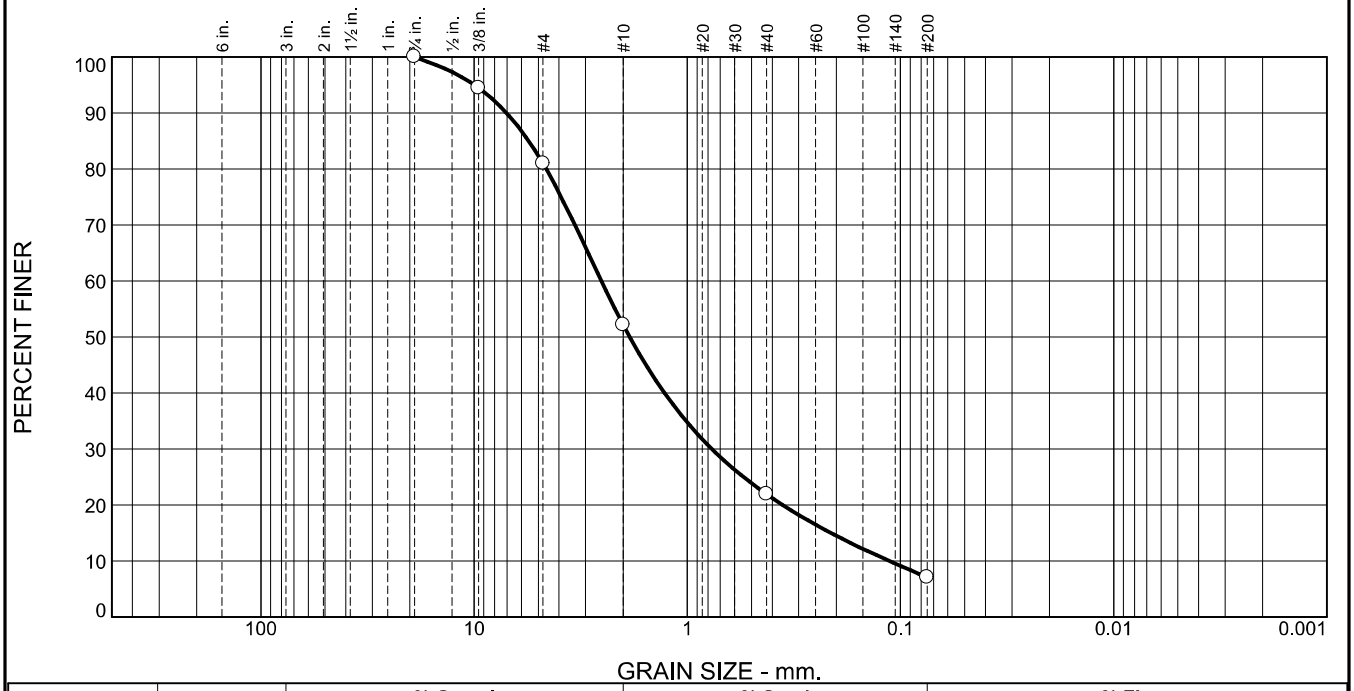
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 14

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	47.8	30.2	14.9	7.1	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	94.5		
#4	81.0		
#10	52.2		
#40	22.0		
#200	7.1		

* (no specification provided)

Material Description

BROWN FINE GRAVEL AND COARSE AND FINE SAND, TRACE SILT AND CLAY, DAMP

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 7.0592 D_{85}= 5.5521 D_{60}= 2.5290
D_{50}= 1.8634 D_{30}= 0.7666 D_{15}= 0.2119
D_{10}= 0.1125 C_u= 22.48 C_c= 2.07

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 03/24/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-042-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**

Sample Number: SS-2

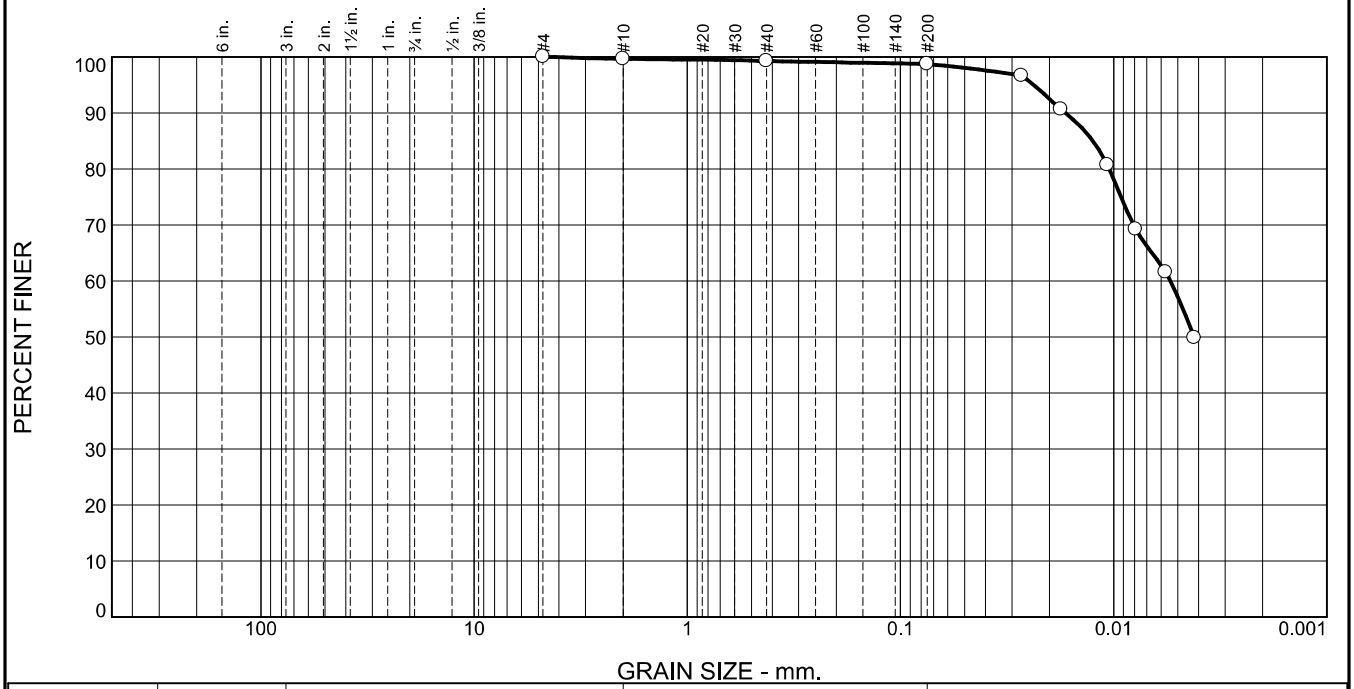
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 15

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.4	0.4	0.5	41.6	57.1

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.6		
#40	99.2		
#200	98.7		
0.0271 mm.	96.6		
0.0177 mm.	90.7		
0.0107 mm.	80.7		
0.0079 mm.	69.2		
0.0057 mm.	61.6		
0.0042 mm.	49.9		

* (no specification provided)

Material Description

MEDIUM STIFF, GRAY CLAY AND SILT, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 26 **PI=** 5

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0169 D_{85}= 0.0125 D_{60}= 0.0054
D_{50}= 0.0042 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

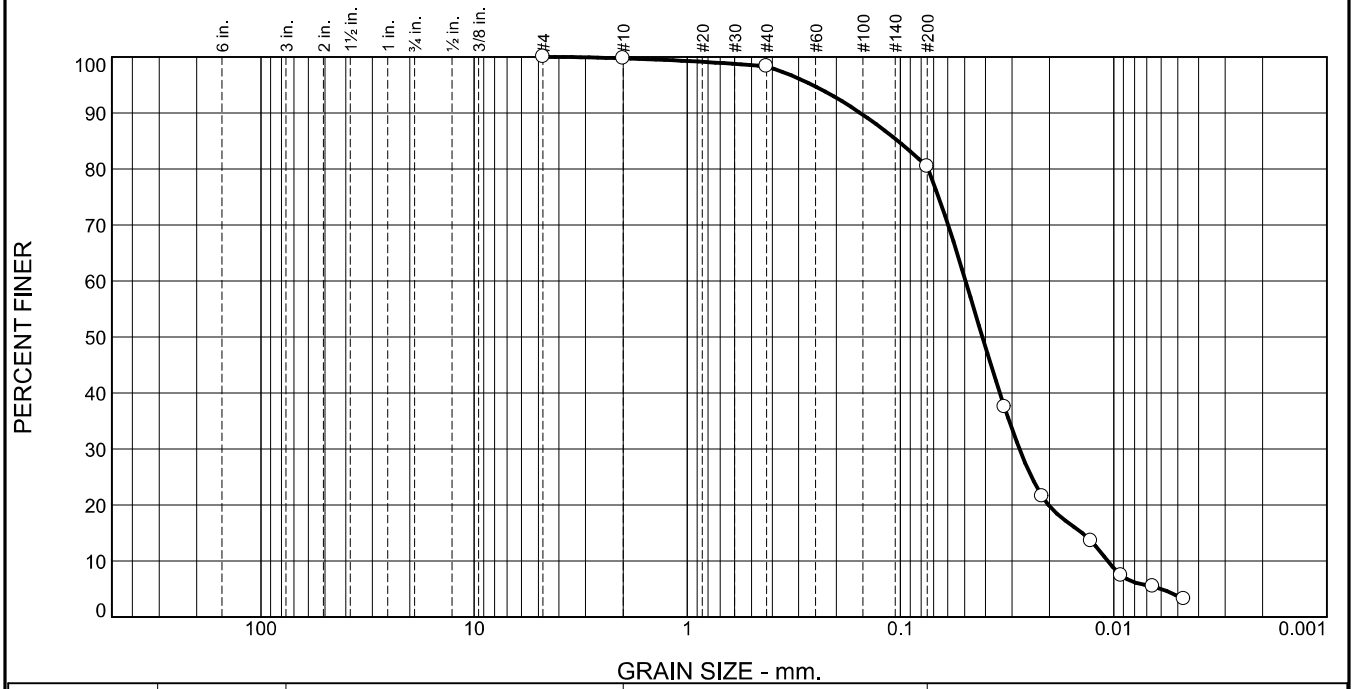
Source of Sample: B-042-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**
Sample Number: SS-6

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 16

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.3	1.4	17.9	76.6	3.8

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.7		
#40	98.3		
#200	80.4		
0.0326 mm.	37.5		
0.0217 mm.	21.6		
0.0128 mm.	13.6		
0.0092 mm.	7.5		
0.0066 mm.	5.5		
0.0047 mm.	3.3		

* (no specification provided)

Material Description

BROWN SILT, LITTLE COARSE AND FINE SAND, TRACE CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 22 **LL=** 20 **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.1547 D_{85}= 0.1030 D_{60}= 0.0495
D_{50}= 0.0413 D_{30}= 0.0277 D_{15}= 0.0140
D_{10}= 0.0107 C_u= 4.64 C_c= 1.45

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/05/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-043-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**

Sample Number: SS-2

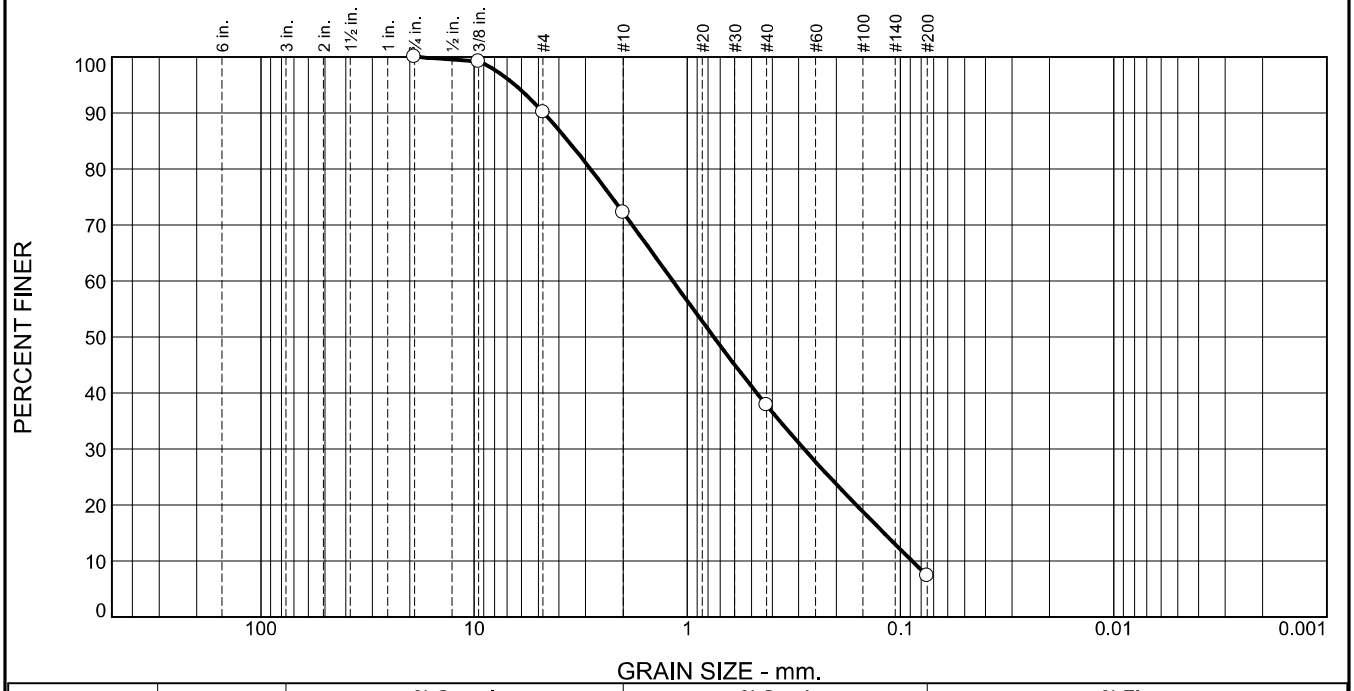
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 17

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	27.8	34.4	30.4	7.4	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.2		
#4	90.1		
#10	72.2		
#40	37.8		
#200	7.4		

* (no specification provided)

Material Description

LOOSE, BROWN COARSE AND FINE SAND, SOME FINE GRAVEL, TRACE SILT AND CLAY, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 4.7179 D_{85}= 3.6254 D_{60}= 1.1699
D_{50}= 0.7514 D_{30}= 0.2834 D_{15}= 0.1196
D_{10}= 0.0881 C_u= 13.28 C_c= 0.78

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 03/24/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-043-0-20 **Depth:** 8.5-10.0 FT **Date Sampled:**

Sample Number: SS-4

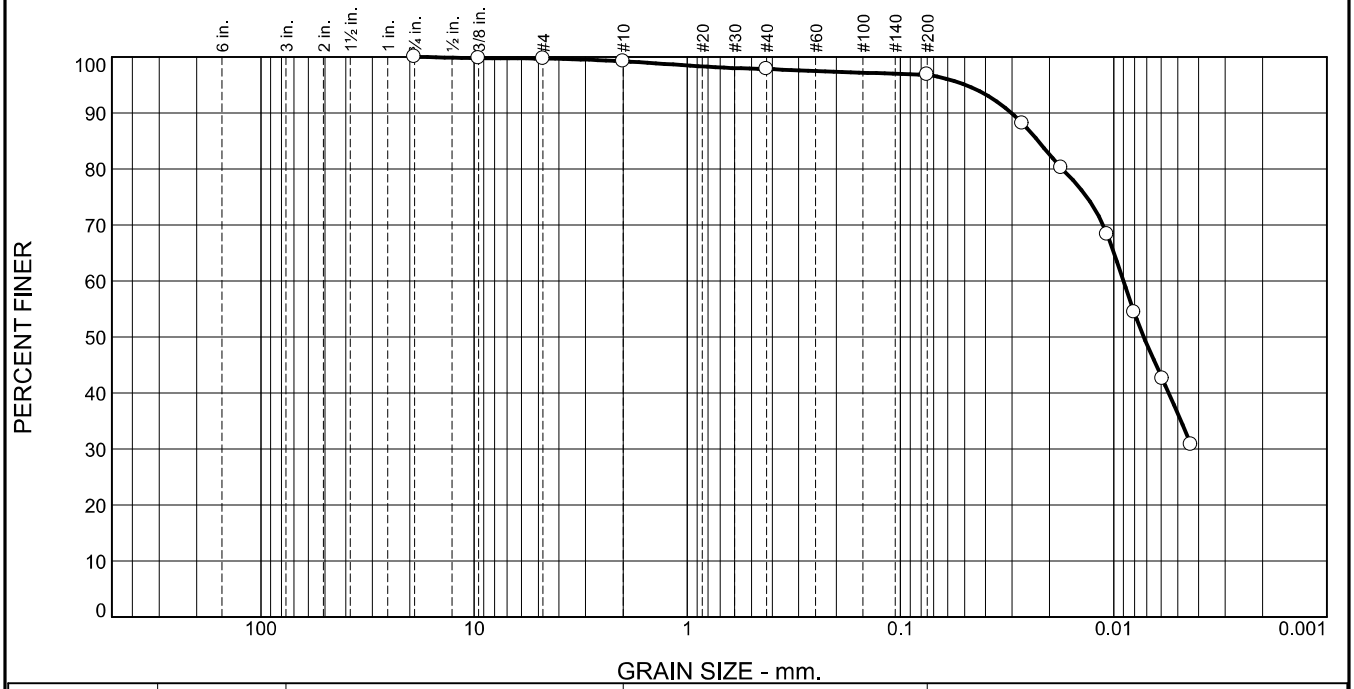
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 18

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.8	1.4	1.0	60.6	36.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.8		
#4	99.7		
#10	99.2		
#40	97.8		
#200	96.8		
0.0269 mm.	88.1		
0.0177 mm.	80.2		
0.0107 mm.	68.3		
0.0080 mm.	54.4		
0.0059 mm.	42.6		
0.0043 mm.	30.8		

* (no specification provided)

Material Description

BROWN-GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 29 **PI=** 9

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0302 D_{85}= 0.0227 D_{60}= 0.0090
D_{50}= 0.0072 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/03/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-043-0-20 **Depth:** 16.0-18.0 FT **Date Sampled:**

Sample Number: ST-7

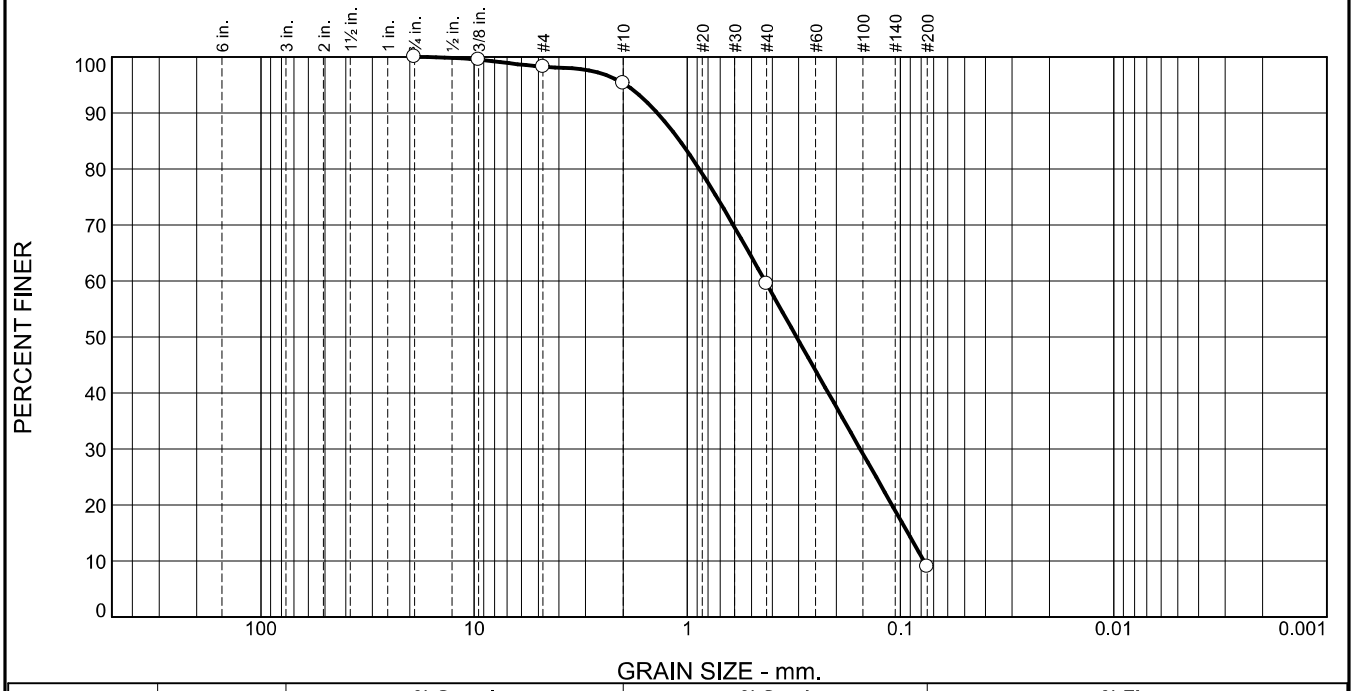
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 19

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	4.7	35.8	50.5	9.0	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.5		
#4	98.2		
#10	95.3		
#40	59.5		
#200	9.0		

* (no specification provided)

Material Description

LOOSE, BROWN COARSE AND FINE SAND, TRACE SILT AND CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 1.3837 D_{85}= 1.0843 D_{60}= 0.4320
D_{50}= 0.3073 D_{30}= 0.1547 D_{15}= 0.0922
D_{10}= 0.0776 C_u= 5.57 C_c= 0.71

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 03/25/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-044-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

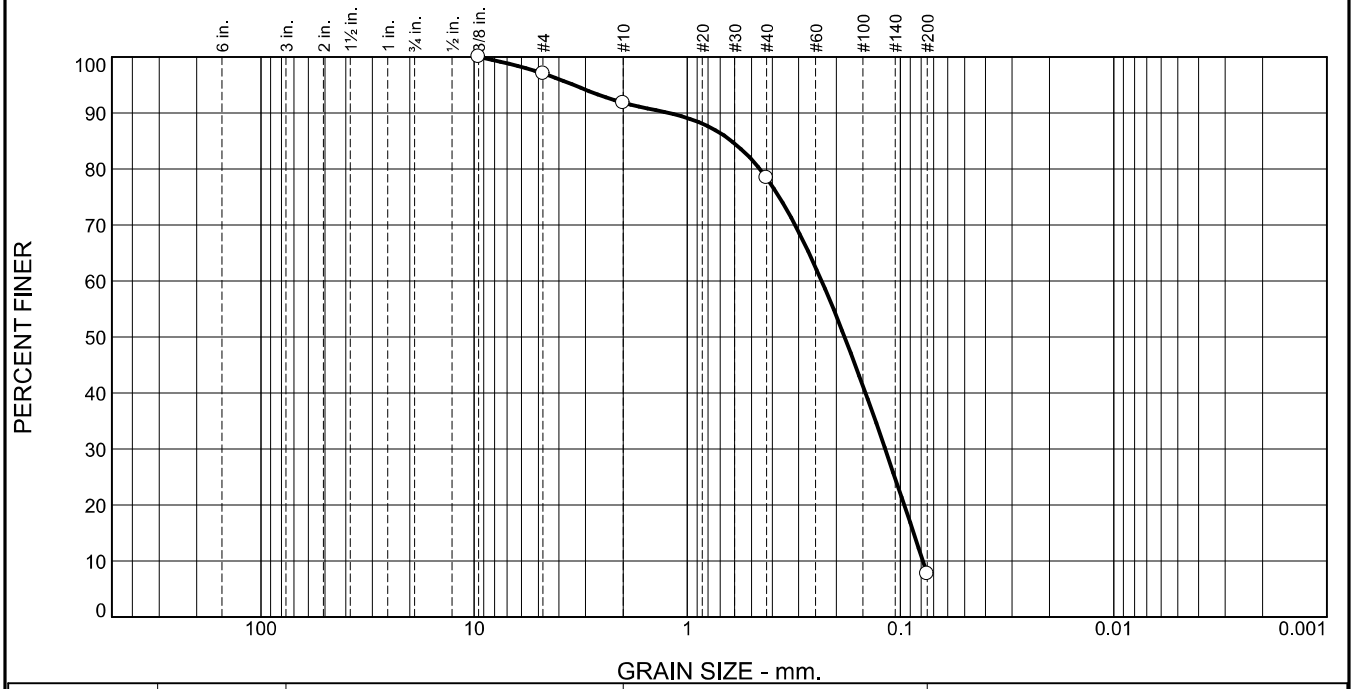
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 20

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	8.2	13.4	70.7	7.7	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	97.0		
#10	91.8		
#40	78.4		
#200	7.7		

* (no specification provided)

Material Description

VERY LOOSE, BROWN COARSE AND FINE SAND, TRACE FINE GRAVEL, TRACE SILT AND CLAY, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 1.2326 D_{85}= 0.6210 D_{60}= 0.2345
D_{50}= 0.1831 D_{30}= 0.1180 D_{15}= 0.0868
D_{10}= 0.0785 C_u= 2.99 C_c= 0.76

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 03/25/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-044-0-20 **Depth:** 8.5-10.0 FT **Date Sampled:**

Sample Number: SS-4

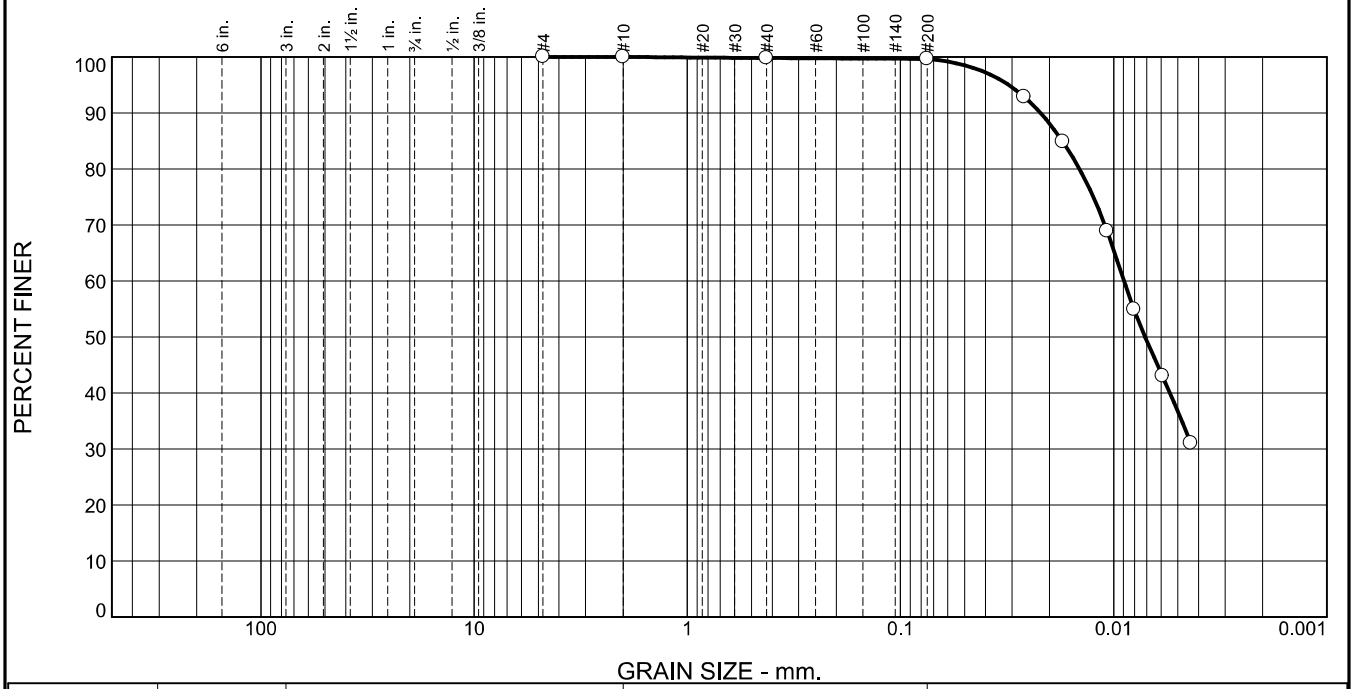
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 21

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	0.2	63.0	36.6

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.8		
#200	99.6		
0.0263 mm.	92.8		
0.0173 mm.	84.9		
0.0107 mm.	68.9		
0.0080 mm.	54.9		
0.0059 mm.	43.0		
0.0043 mm.	31.0		

* (no specification provided)

Material Description

GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 27 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0221 D_{85}= 0.0174 D_{60}= 0.0089
D_{50}= 0.0071 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/03/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-044-0-20 **Depth:** 18.0-20.0 FT **Date Sampled:**

Sample Number: ST-8

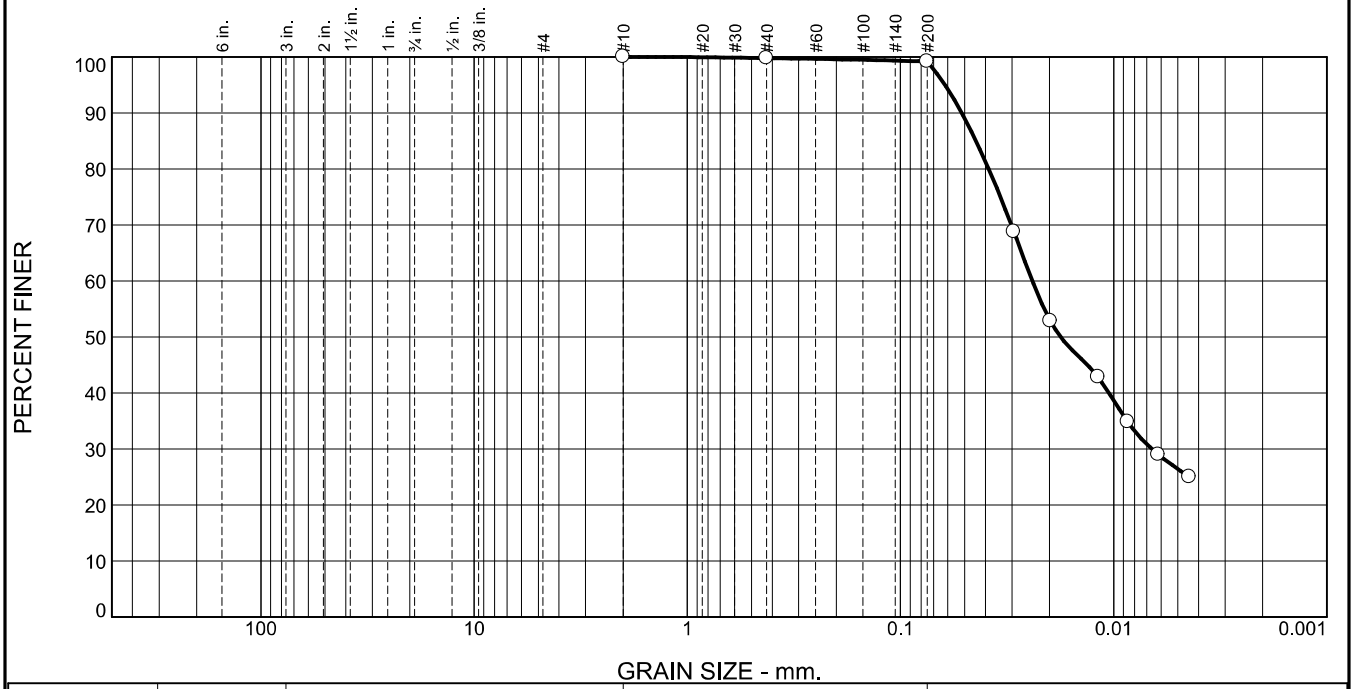
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 22

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	0.6	72.8	26.4

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#40	99.8		
#200	99.2		
0.0294 mm.	68.8		
0.0198 mm.	52.8		
0.0119 mm.	42.8		
0.0086 mm.	34.9		
0.0062 mm.	29.0		
0.0044 mm.	25.0		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4b

Coefficients

D_{90}= 0.0517 D_{85}= 0.0443 D_{60}= 0.0241
D_{50}= 0.0177 D_{30}= 0.0066 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/03/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-046-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**

Sample Number: SS-2

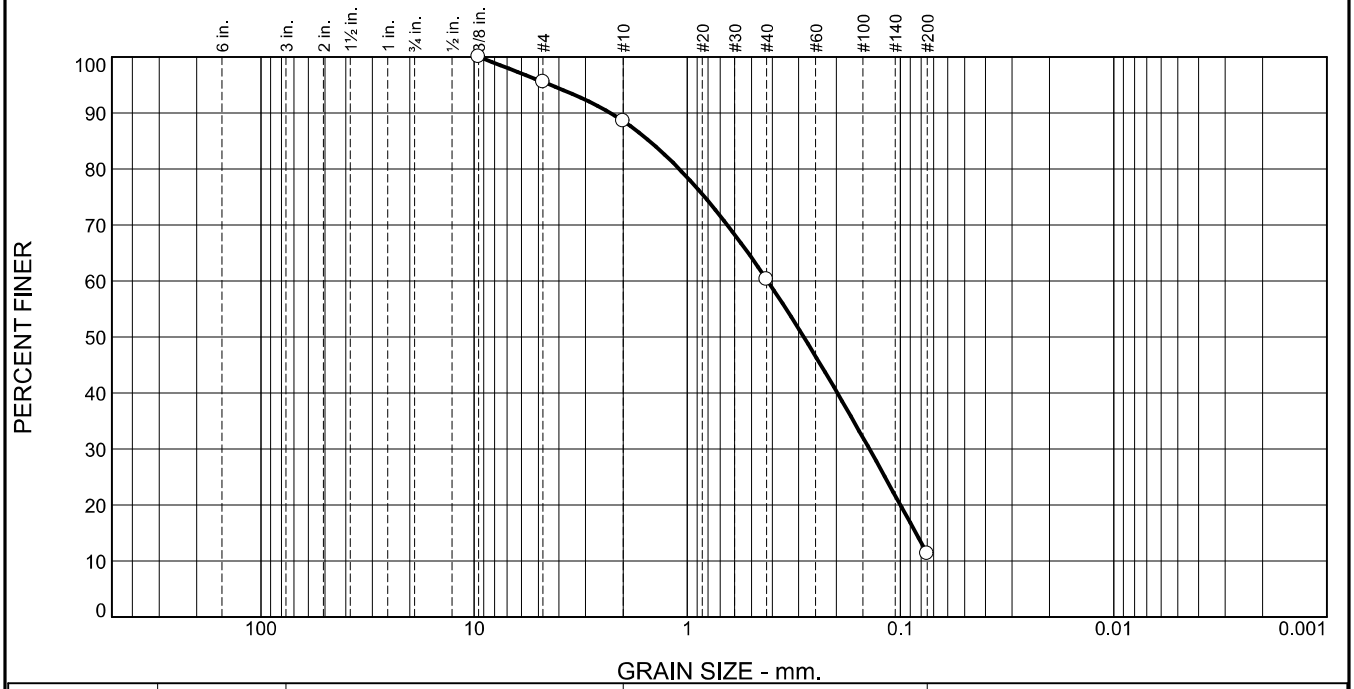
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 23

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	11.5	28.2	49.0	11.3	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	95.5		
#10	88.5		
#40	60.3		
#200	11.3		

* (no specification provided)

Material Description

LOOSE, BROWN-GRAY COARSE AND FINE SAND, LITTLE FINE GRAVEL, LITTLE SILT AND CLAY, DAMP

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 2.2993 D_{85}= 1.5080 D_{60}= 0.4200
D_{50}= 0.2844 D_{30}= 0.1401 D_{15}= 0.0847
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 03/25/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-046-0-20 **Depth:** 11.0-12.5 FT **Date Sampled:**

Sample Number: SS-5

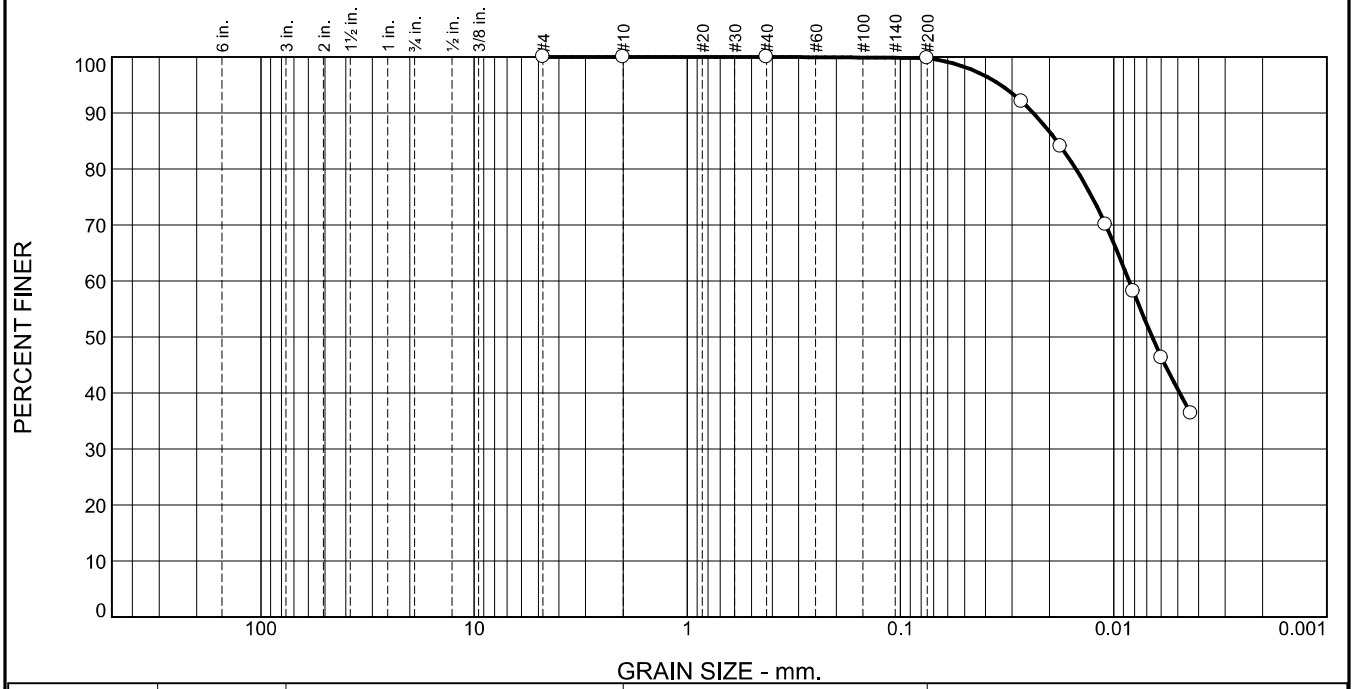
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 24

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	0.2	59.3	40.5

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	100.0		
#200	99.8		
0.0270 mm.	92.0		
0.0178 mm.	84.0		
0.0109 mm.	70.1		
0.0081 mm.	58.2		
0.0060 mm.	46.3		
0.0044 mm.	36.4		

* (no specification provided)

Material Description

MOIST, BROWN-GRAY SILT AND CLAY, TRACE FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 33 **PI=** 12

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-6(12)

Coefficients

D_{90}= 0.0239 D_{85}= 0.0186 D_{60}= 0.0085
D_{50}= 0.0066 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/09/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-046-0-20 **Depth:** 18.0-20.0 FT **Date Sampled:**

Sample Number: ST-8

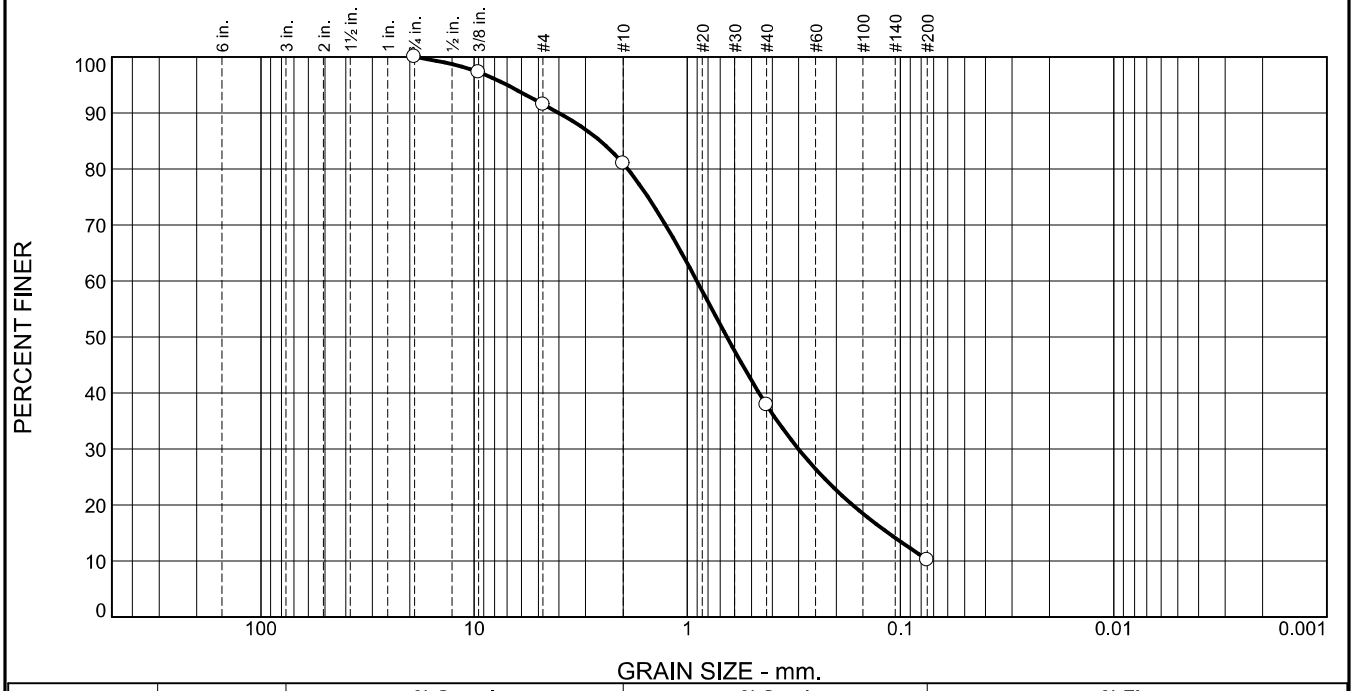
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 25

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	19.0	43.1	27.7	10.2	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	97.3		
#4	91.5		
#10	81.0		
#40	37.9		
#200	10.2		

* (no specification provided)

Material Description

VERY LOOSE, BROWN COARSE AND FINE SAND, LITTLE FINE GRAVEL, LITTLE SILT AND CLAY, WET

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 4.0175 D_{85}= 2.5577 D_{60}= 0.9021
D_{50}= 0.6512 D_{30}= 0.3013 D_{15}= 0.1141
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-048-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

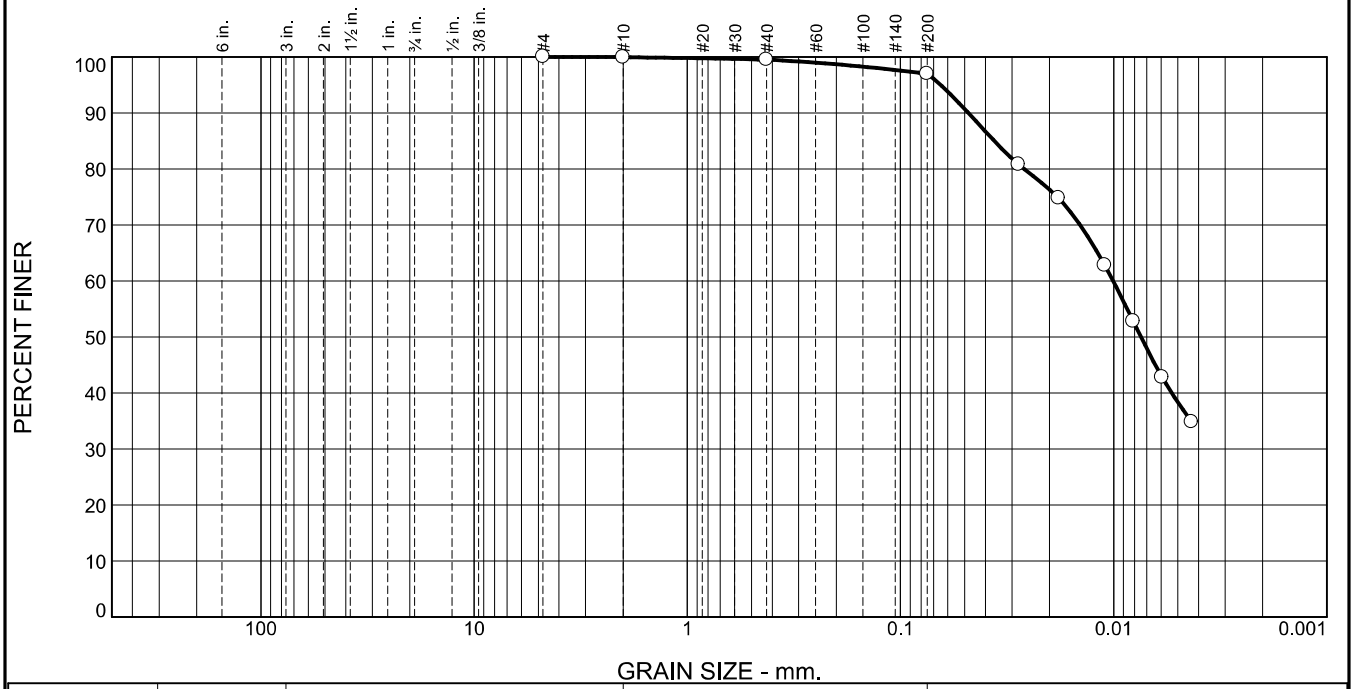
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 26

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.4	2.5	58.7	38.3

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.5		
#200	97.0		
0.0279 mm.	80.8		
0.0182 mm.	74.8		
0.0110 mm.	62.8		
0.0081 mm.	52.8		
0.0059 mm.	42.8		
0.0043 mm.	34.8		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 25 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0481 D_{85}= 0.0364 D_{60}= 0.0101
D_{50}= 0.0074 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/05/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-048-0-20 **Depth:** 16.0-17.5 FT **Date Sampled:**

Sample Number: SS-7

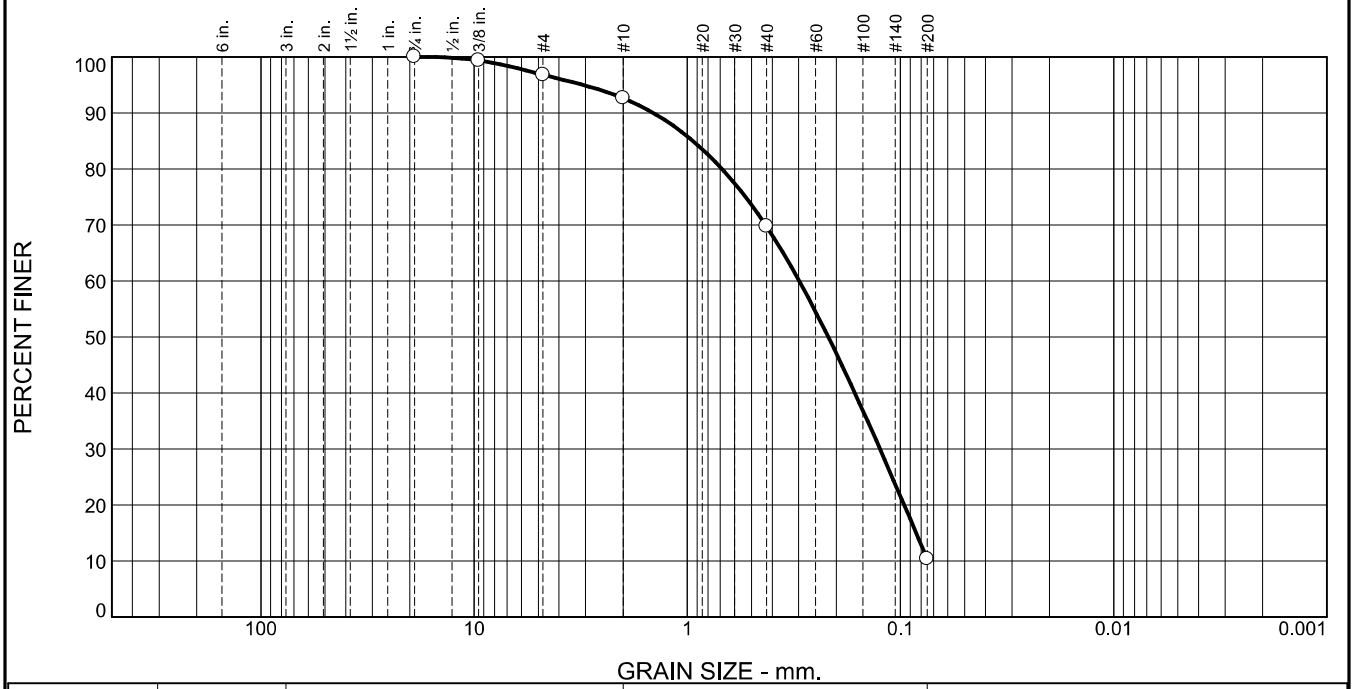
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 27

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	7.4	22.9	59.3	10.4	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.4		
#4	96.8		
#10	92.6		
#40	69.7		
#200	10.4		

* (no specification provided)

Material Description

VERY LOOSE, BROWN COARSE TO FINE SAND, LITTLE SILT AND CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-3

Coefficients

D_{90}= 1.4475 D_{85}= 0.9424 D_{60}= 0.2987
D_{50}= 0.2183 D_{30}= 0.1249 D_{15}= 0.0844
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-049-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

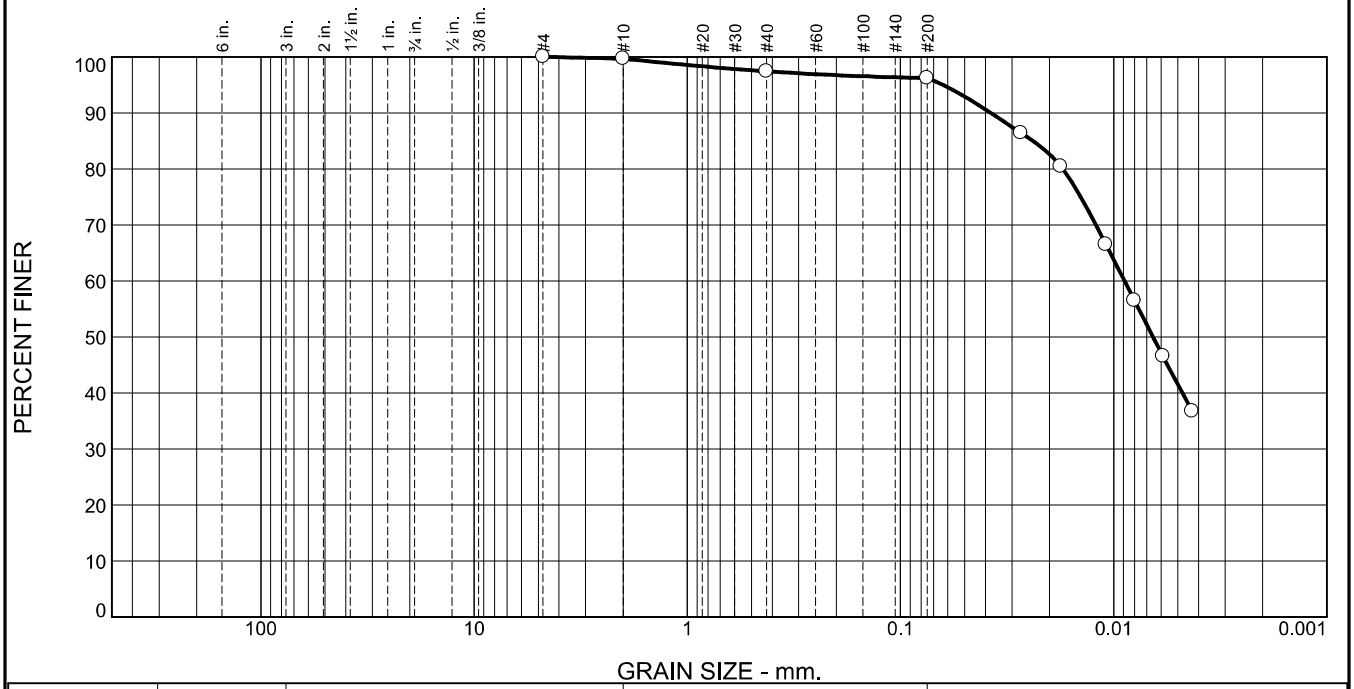
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 28

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.3	2.3	1.2	54.7	41.5

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.7		
#40	97.4		
#200	96.2		
0.0273 mm.	86.4		
0.0177 mm.	80.4		
0.0109 mm.	66.5		
0.0080 mm.	56.5		
0.0059 mm.	46.6		
0.0043 mm.	36.7		

* (no specification provided)

Material Description

GRAY-BROWN TO ORANGE-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 30 **PI=** 10

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0378 D_{85}= 0.0239 D_{60}= 0.0089
D_{50}= 0.0065 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-049-0-20 **Depth:** 10.0-12.0 FT **Date Sampled:**

Sample Number: ST-5

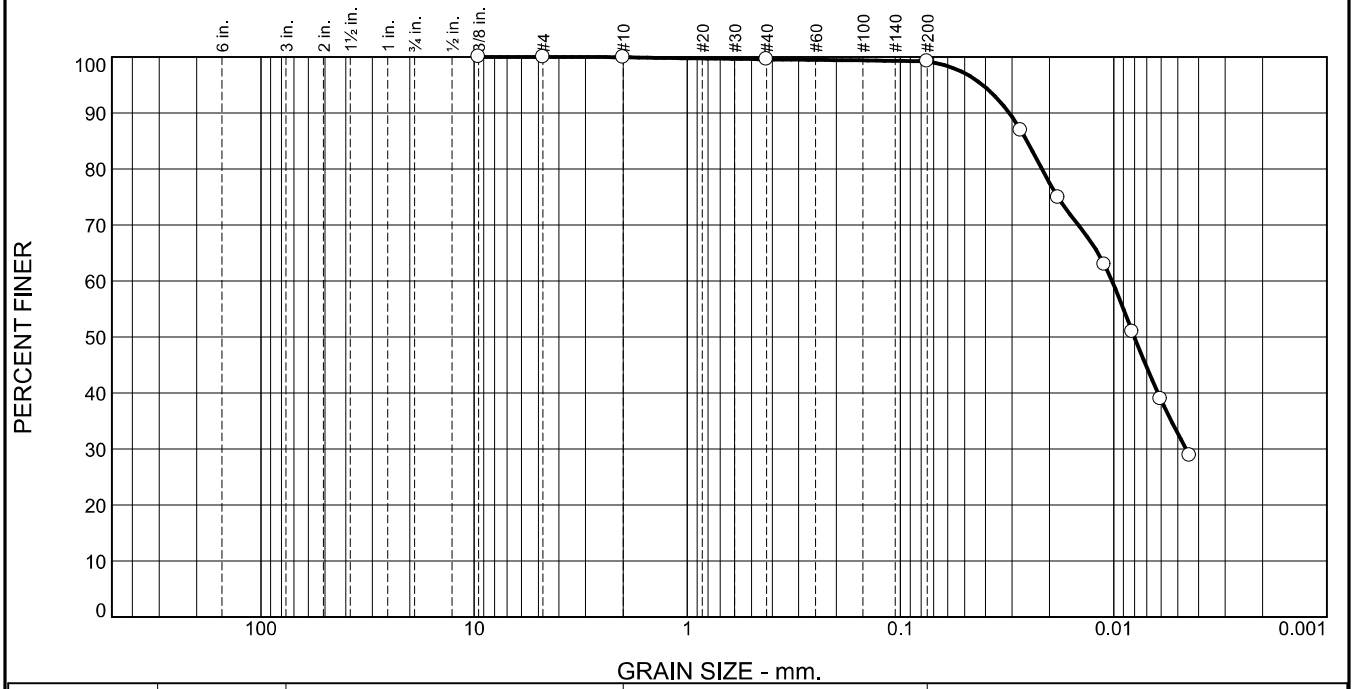
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 29

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.3	0.4	66.5	32.7

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	100.0		
#10	99.9		
#40	99.6		
#200	99.2		
0.0273 mm.	86.9		
0.0183 mm.	74.9		
0.0111 mm.	62.9		
0.0082 mm.	50.9		
0.0060 mm.	39.0		
0.0044 mm.	28.9		

* (no specification provided)

Material Description

GRAY-BROWN SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 31 **PI=** 10

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0310 D_{85}= 0.0256 D_{60}= 0.0102
D_{50}= 0.0080 D_{30}= 0.0046 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-049-0-20 **Depth:** 17.5-19.5 FT **Date Sampled:**

Sample Number: ST-8

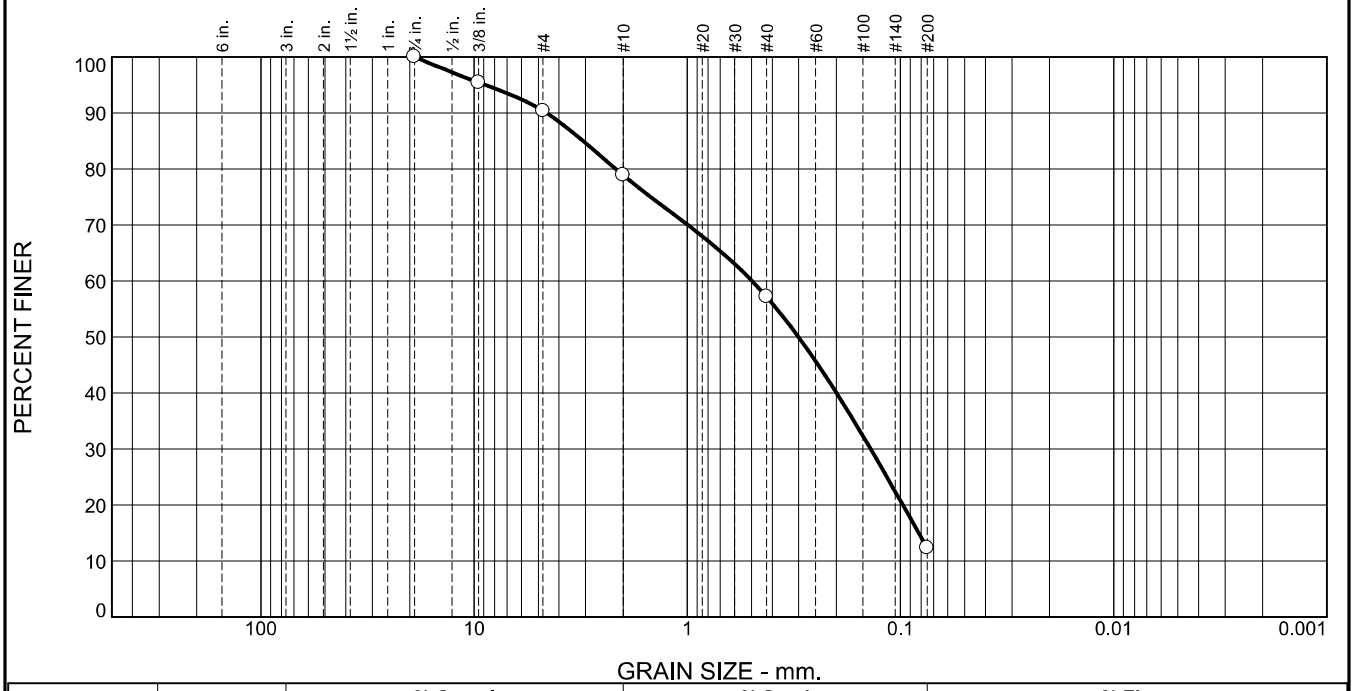
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 30

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	21.1	21.7	44.9	12.3	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	95.4		
#4	90.4		
#10	78.9		
#40	57.2		
#200	12.3		

* (no specification provided)

Material Description

LOOSE, BROWN COARSE AND FINE SAND, SOME FINE GRAVEL, LITTLE SILT AND CLAY, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 4.5902 D_{85}= 3.0844 D_{60}= 0.4974
D_{50}= 0.3010 D_{30}= 0.1381 D_{15}= 0.0821
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-050-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**

Sample Number: SS-2

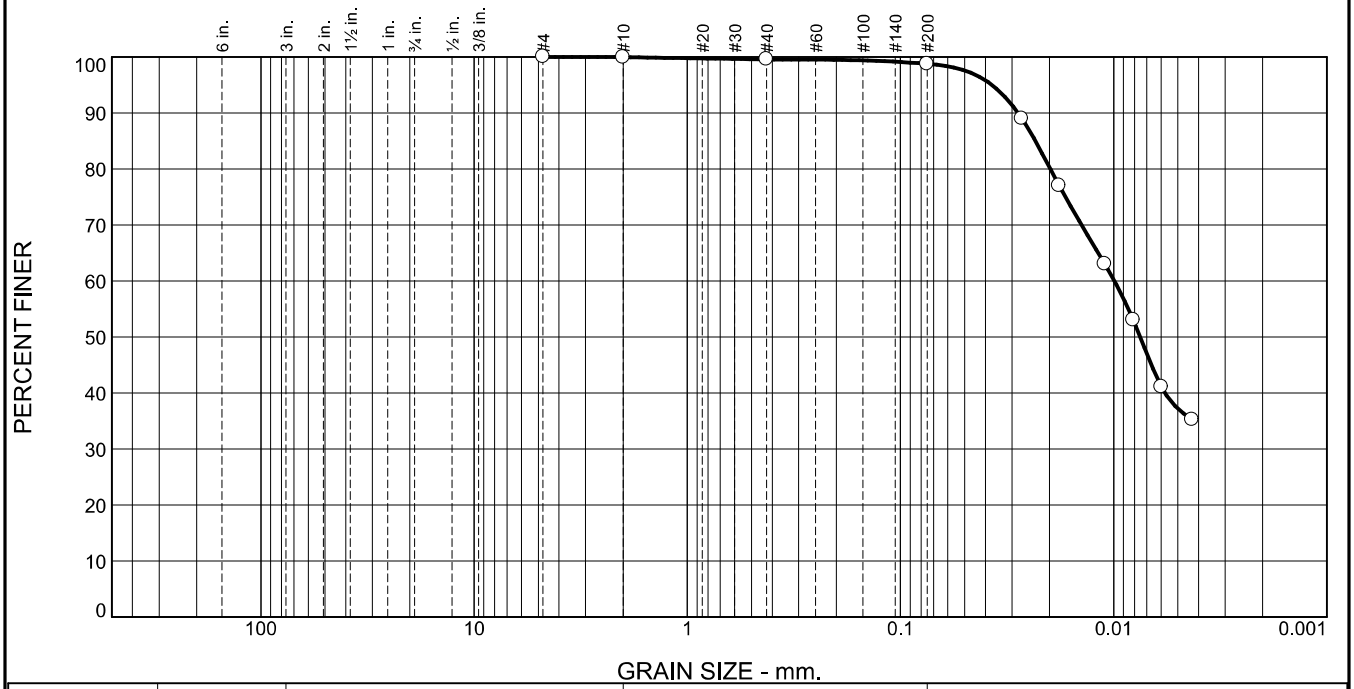
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 31

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.3	0.9	61.5	37.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.6		
#200	98.7		
0.0270 mm.	89.0		
0.0180 mm.	77.0		
0.0110 mm.	63.0		
0.0081 mm.	53.1		
0.0060 mm.	41.1		
0.0043 mm.	35.3		

* (no specification provided)

Material Description

MEDIUM-STIFF, GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 29 **PI=** 8

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0281 D_{85}= 0.0233 D_{60}= 0.0099
D_{50}= 0.0075 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/07/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

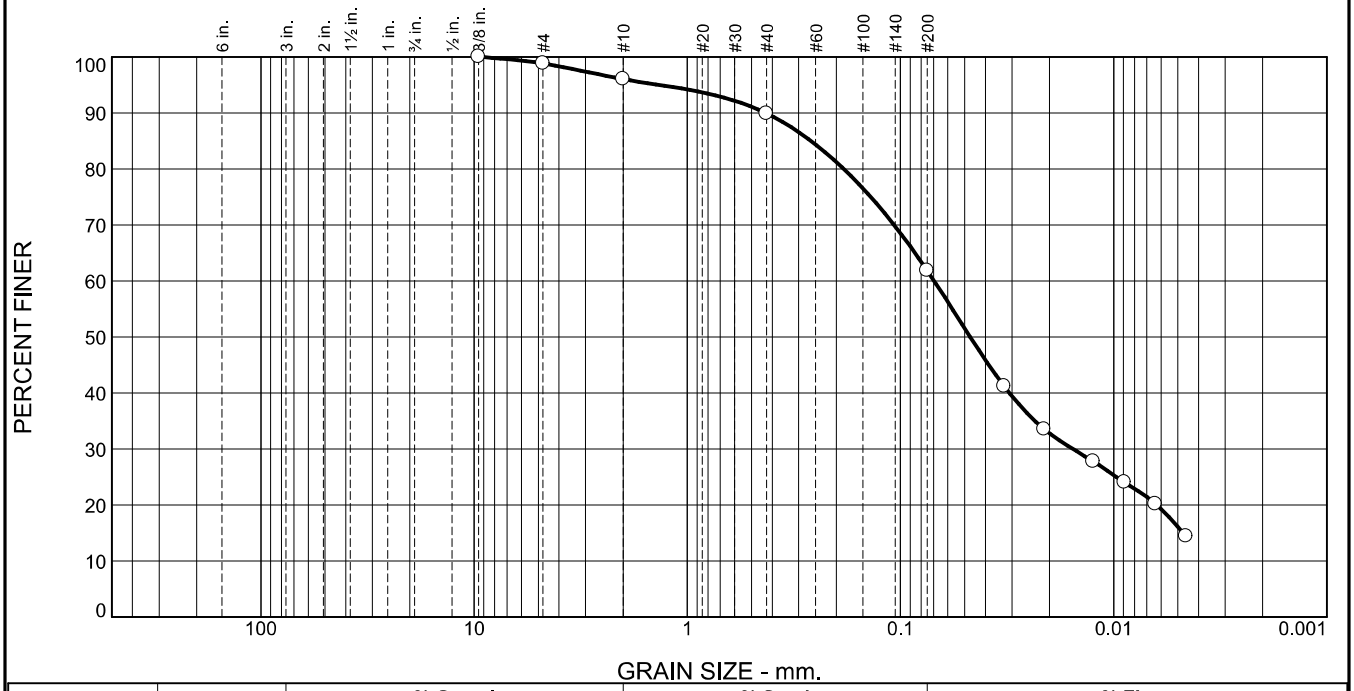
Source of Sample: B-050-0-20 **Depth:** 11.0-12.5 FT **Date Sampled:**
Sample Number: SS-5

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 32

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	4.0	6.1	28.0	45.8	16.1

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	98.8		
#10	96.0		
#40	89.9		
#200	61.9		
0.0326 mm.	41.2		
0.0212 mm.	33.5		
0.0125 mm.	27.8		
0.0089 mm.	24.0		
0.0064 mm.	20.2		
0.0046 mm.	14.5		

* (no specification provided)

Material Description

MEDIUM DENSE, BROWN SILT, SOME COARSE AND FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 13 **LL=** 15 **PI=** 2

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 0.4310 D_{85}= 0.2635 D_{60}= 0.0696
D_{50}= 0.0471 D_{30}= 0.0155 D_{15}= 0.0047
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

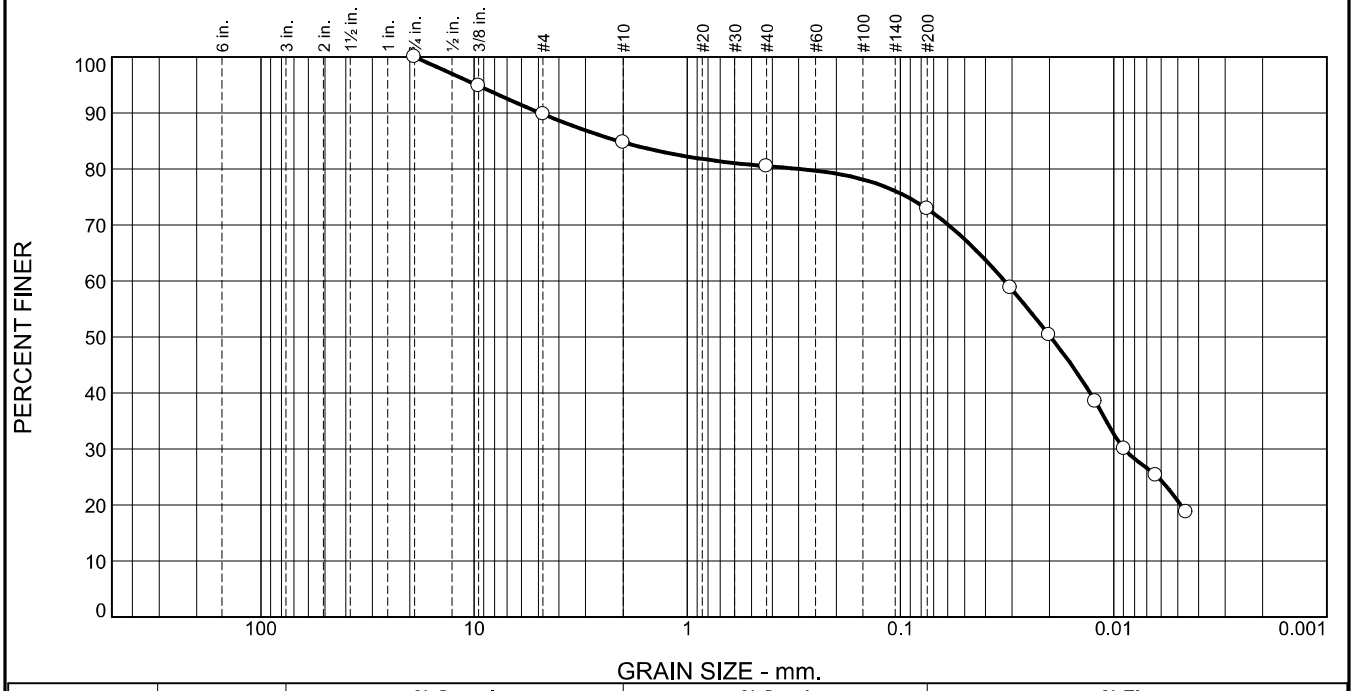
Source of Sample: B-050-0-20 **Depth:** 28.5-30.0 FT **Date Sampled:**
Sample Number: SS-10

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 33

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	15.3	4.2	7.6	52.2	20.7

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	94.8		
#4	89.8		
#10	84.7		
#40	80.5		
#200	72.9		
0.0306 mm.	58.8		
0.0201 mm.	50.4		
0.0122 mm.	38.5		
0.0089 mm.	30.1		
0.0064 mm.	25.3		
0.0046 mm.	18.8		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY SILT, SOME CLAY, LITTLE FINE GRAVEL, LITTLE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 24 **PI=** 4

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 4.9079 D_{85}= 2.1118 D_{60}= 0.0325
D_{50}= 0.0198 D_{30}= 0.0089 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-051-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**

Sample Number: SS-2

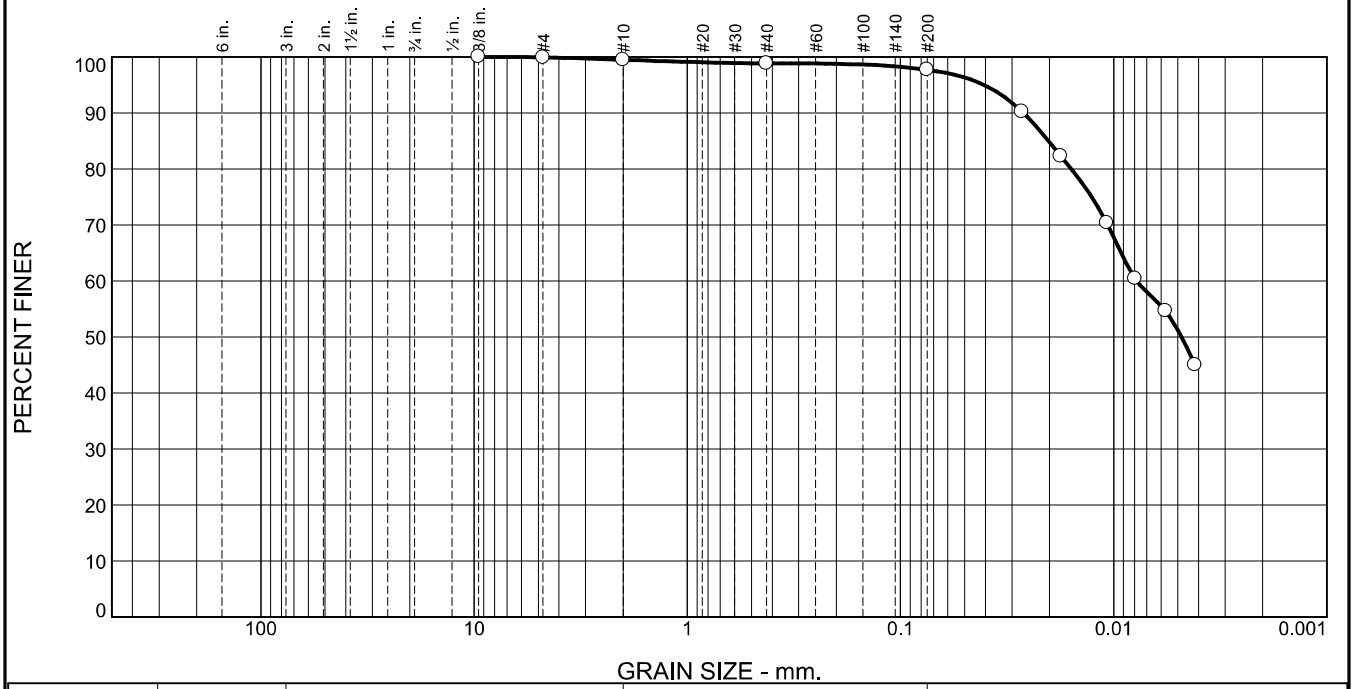
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 34

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.5	0.7	1.1	46.5	51.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.9		
#10	99.5		
#40	98.8		
#200	97.7		
0.0270 mm.	90.2		
0.0177 mm.	82.3		
0.0108 mm.	70.3		
0.0079 mm.	60.4		
0.0057 mm.	54.6		
0.0042 mm.	45.0		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY CLAY AND SILT, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 26 **PI=** 7

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0266 D_{85}= 0.0203 D_{60}= 0.0078
D_{50}= 0.0048 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/07/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-051-0-20 **Depth:** 11.0-12.3 FT **Date Sampled:**

Sample Number: SS-5

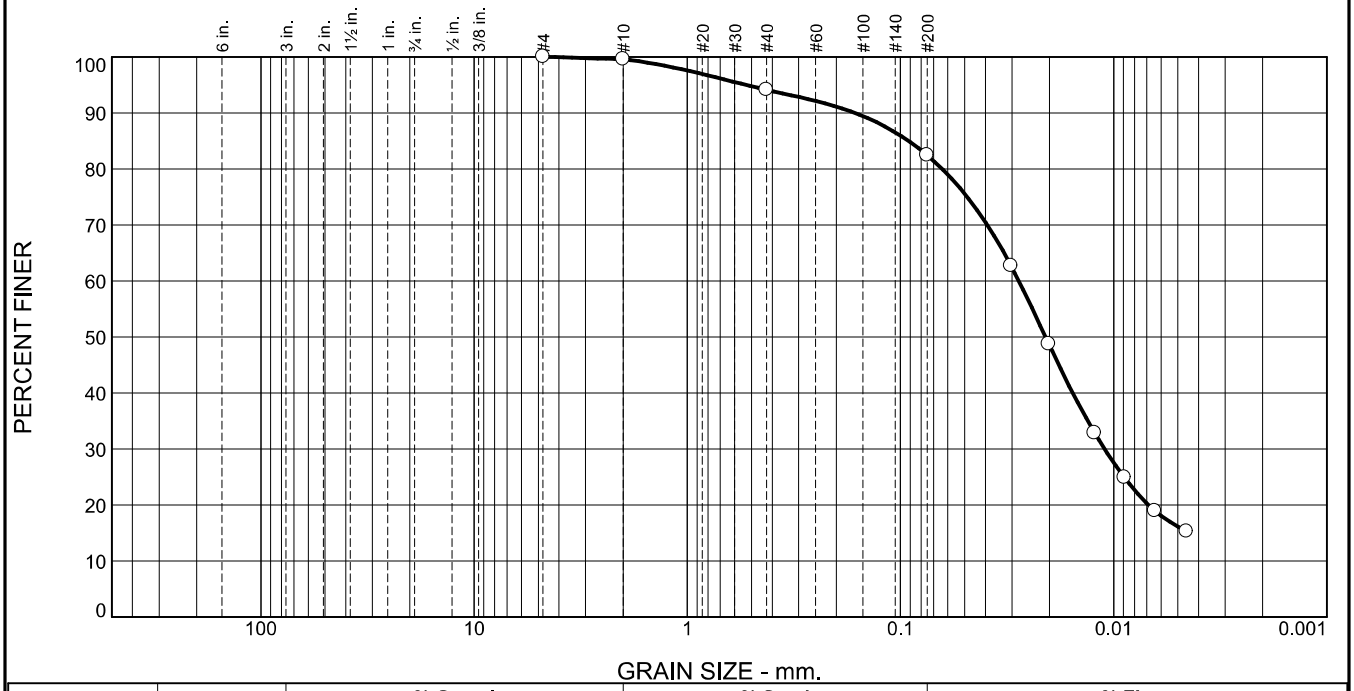
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 35

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.4	5.5	11.7	66.2	16.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.6		
#40	94.1		
#200	82.4		
0.0303 mm.	62.7		
0.0202 mm.	48.8		
0.0123 mm.	32.9		
0.0089 mm.	24.9		
0.0064 mm.	18.9		
0.0046 mm.	15.3		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN SILT, LITTLE COARSE AND FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.1646 D_{85}= 0.0918 D_{60}= 0.0279
D_{50}= 0.0209 D_{30}= 0.0110 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/07/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-051-0-20 **Depth:** 23.5-25.0 FT **Date Sampled:**

Sample Number: SS-9

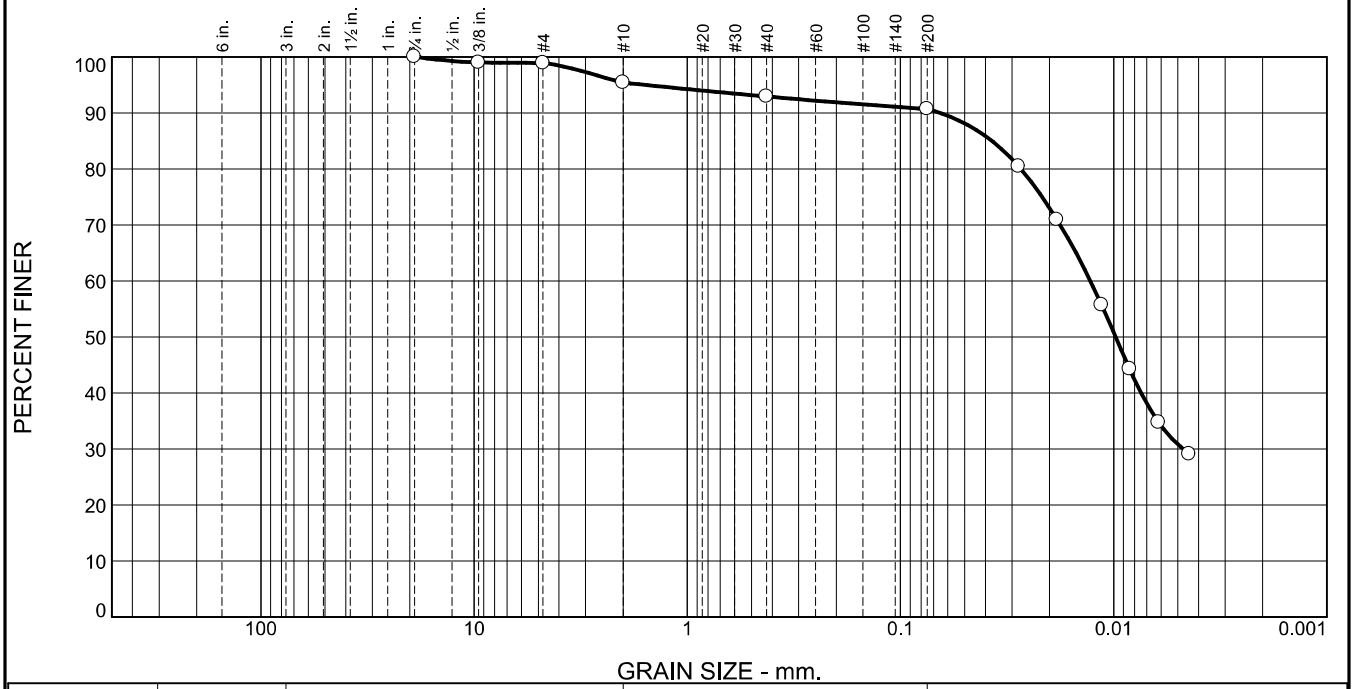
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 36

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	4.6	2.5	2.2	59.9	30.8

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.0		
#4	98.9		
#10	95.4		
#40	92.9		
#200	90.7		
0.0280 mm.	80.5		
0.0185 mm.	70.9		
0.0114 mm.	55.7		
0.0084 mm.	44.3		
0.0062 mm.	34.7		
0.0044 mm.	29.1		

* (no specification provided)

Material Description

BROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 25 **PI=** 5

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0657 D_{85}= 0.0373 D_{60}= 0.0129
D_{50}= 0.0098 D_{30}= 0.0047 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/09/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-052-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

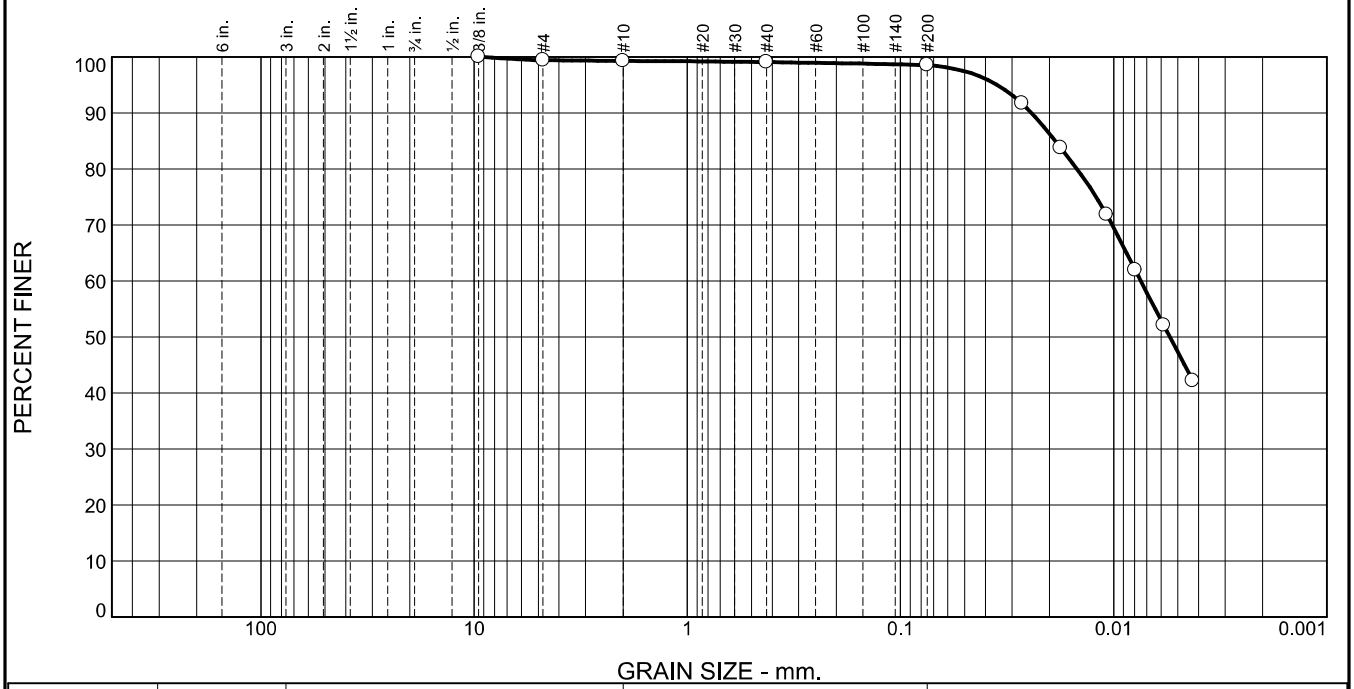
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 37

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.7	0.2	0.6	51.2	47.3

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.4		
#10	99.3		
#40	99.1		
#200	98.5		
0.0269 mm.	91.7		
0.0177 mm.	83.7		
0.0108 mm.	71.8		
0.0079 mm.	61.9		
0.0058 mm.	52.1		
0.0043 mm.	42.2		

* (no specification provided)

Material Description

GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 27 **PI=** 7

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0244 D_{85}= 0.0188 D_{60}= 0.0075
D_{50}= 0.0055 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/09/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-052-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**

Sample Number: SS-6

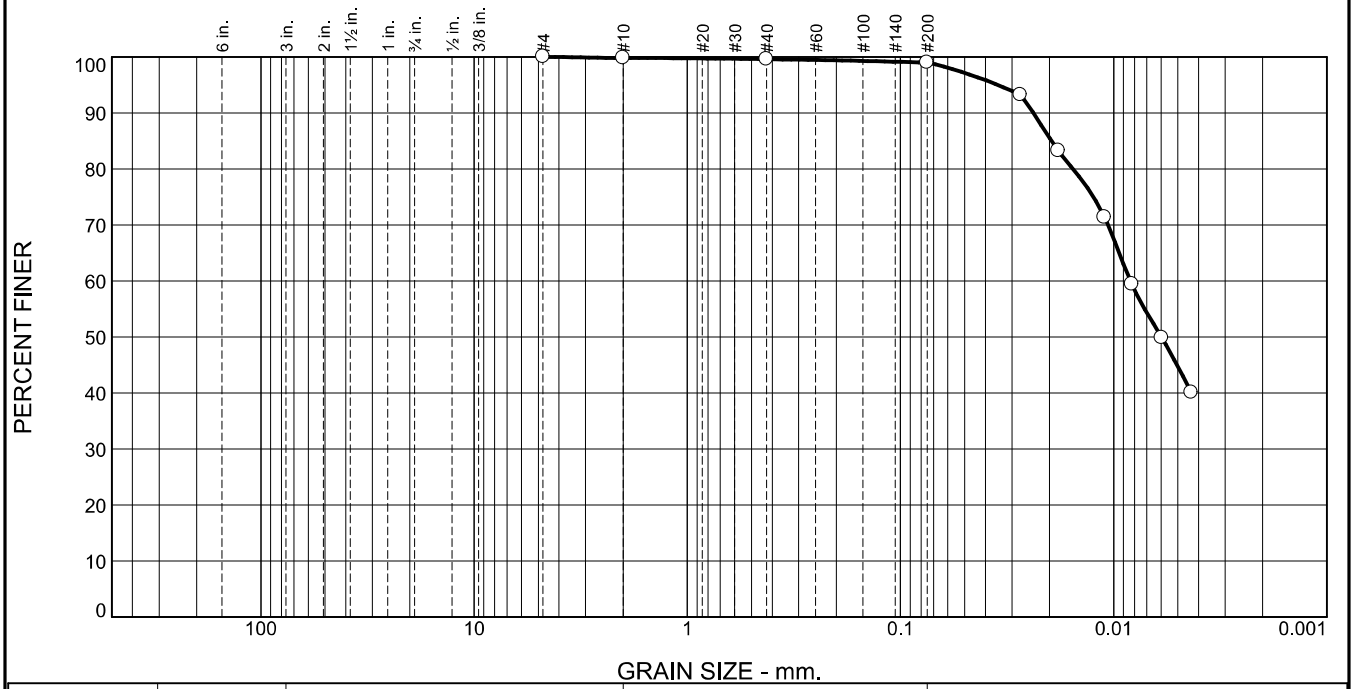
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 38

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.2	0.6	54.3	44.7

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.8		
#40	99.6		
#200	99.0		
0.0274 mm.	93.2		
0.0182 mm.	83.2		
0.0111 mm.	71.4		
0.0082 mm.	59.4		
0.0059 mm.	49.8		
0.0043 mm.	40.1		

* (no specification provided)

Material Description

MEDIUM STIFF, GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 25 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0238 D_{85}= 0.0196 D_{60}= 0.0083
D_{50}= 0.0060 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

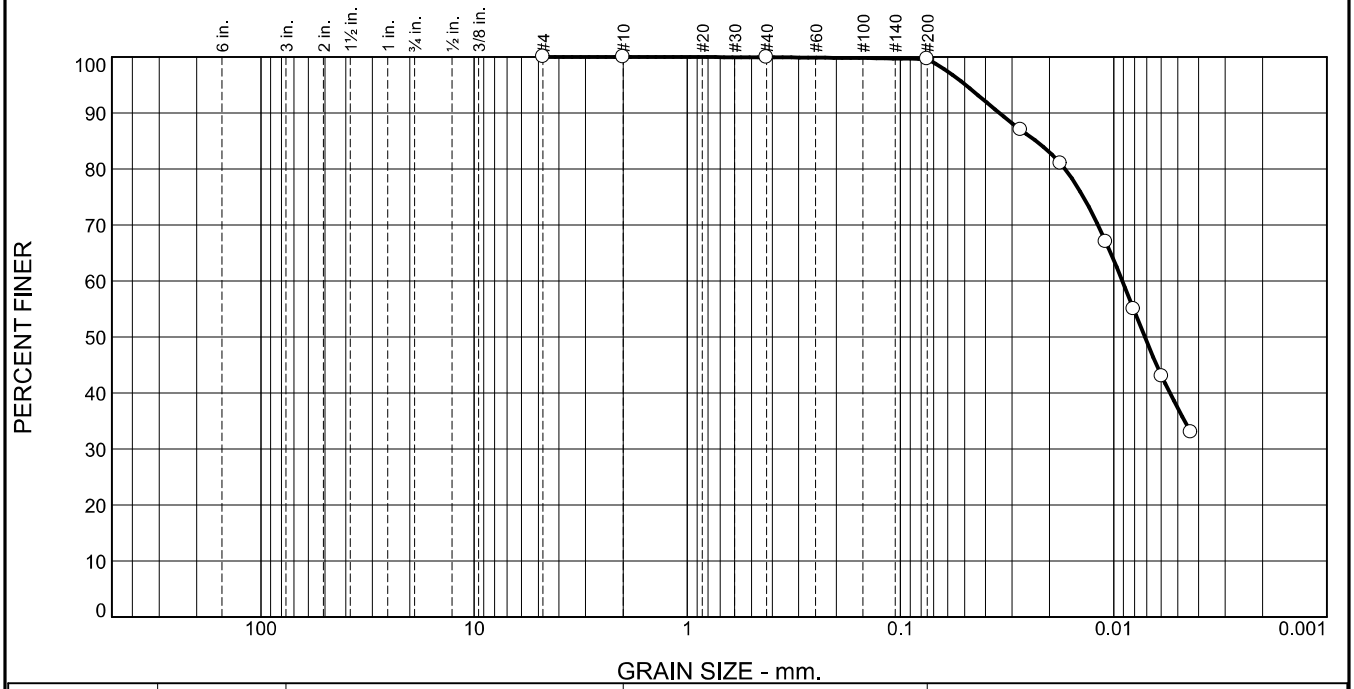
Source of Sample: B-053-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**
Sample Number: SS-3

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 39

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.3	62.4	37.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.9		
#200	99.6		
0.0273 mm.	87.0		
0.0178 mm.	81.0		
0.0109 mm.	67.0		
0.0081 mm.	55.0		
0.0060 mm.	43.0		
0.0043 mm.	33.0		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND

Atterberg Limits (ASTM D 4318)

PL= 18 **LL=** 23 **PI=** 5

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0345 D_{85}= 0.0232 D_{60}= 0.0091
D_{50}= 0.0071 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

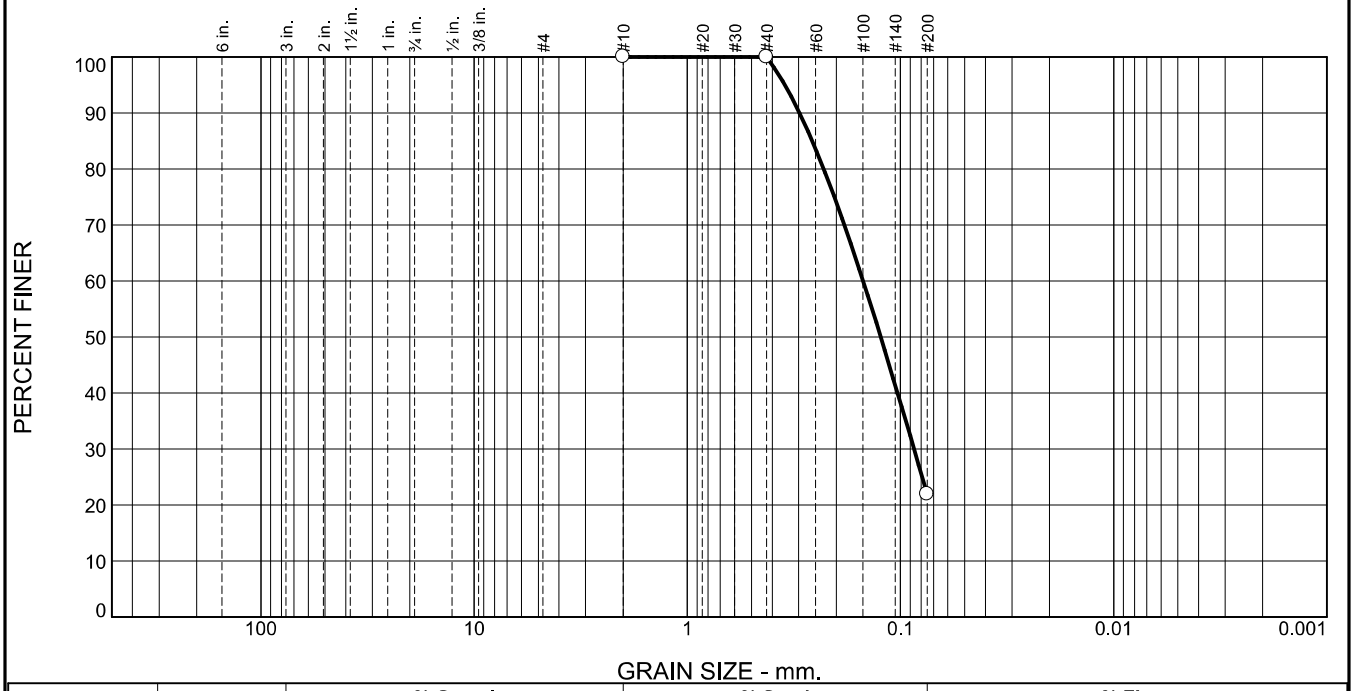
Source of Sample: B-053-0-20 **Depth:** 11.0-12.5 FT **Date Sampled:**
Sample Number: SS-5

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 40

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	77.9	22.0	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#40	99.9		
#200	22.0		

* (no specification provided)

Material Description

LOOSE, BROWN COARSE AND FINE SAND, LITTLE SILT AND CLAY

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.2980 D_{85}= 0.2598 D_{60}= 0.1499
D_{50}= 0.1239 D_{30}= 0.0864 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-054-0-20 **Depth:** 18.5-20.0 FT **Date Sampled:**

Sample Number: SS-9

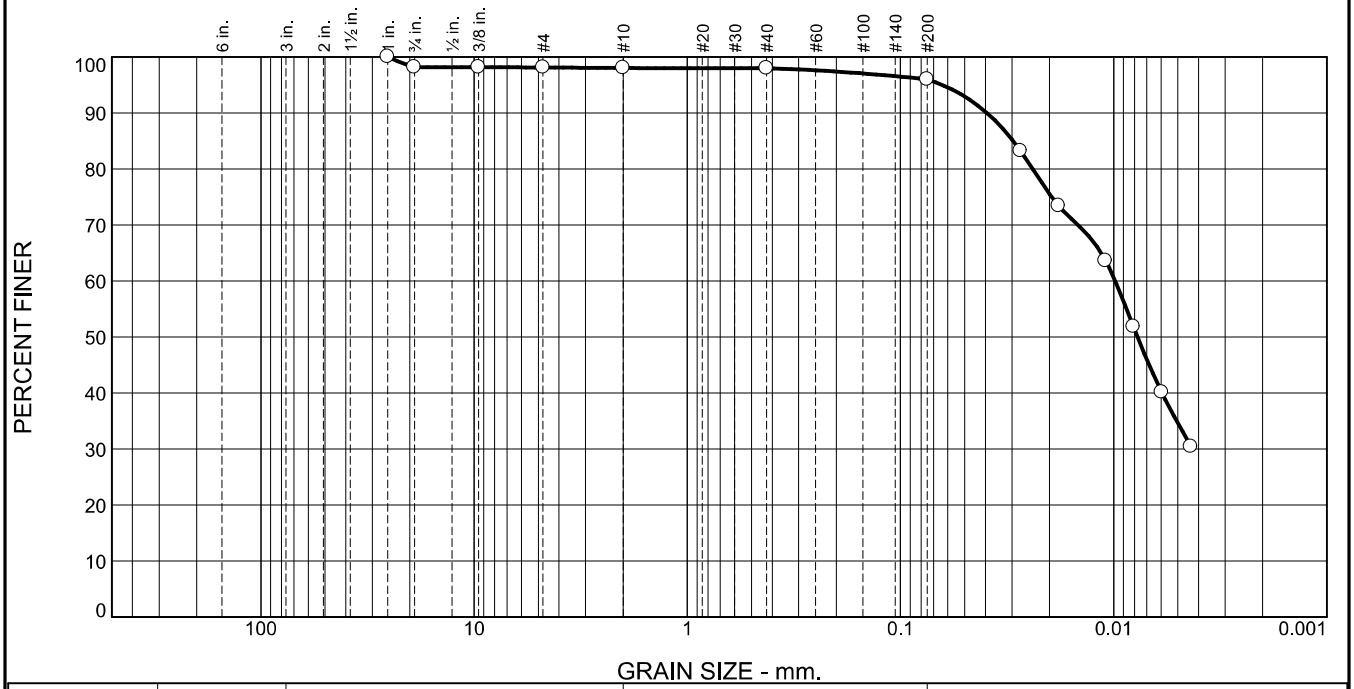
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 41

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	1.8	0.2	0.0	2.0	61.4	34.6

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.0"	100.0		
3/4"	98.2		
3/8"	98.2		
#4	98.1		
#10	98.0		
#40	98.0		
#200	96.0		
0.0274 mm.	83.2		
0.0181 mm.	73.4		
0.0109 mm.	63.6		
0.0081 mm.	51.9		
0.0060 mm.	40.1		
0.0043 mm.	30.4		

* (no specification provided)

Material Description

BROWN GRAY TO GRAY SILT AND CLAY, TRACE FINE SAND, TRACE COARSE AND FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 26 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0394 D_{85}= 0.0297 D_{60}= 0.0098
D_{50}= 0.0077 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/03/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-054-0-20 **Depth:** 12.5-14.5 FT **Date Sampled:**

Sample Number: ST-6

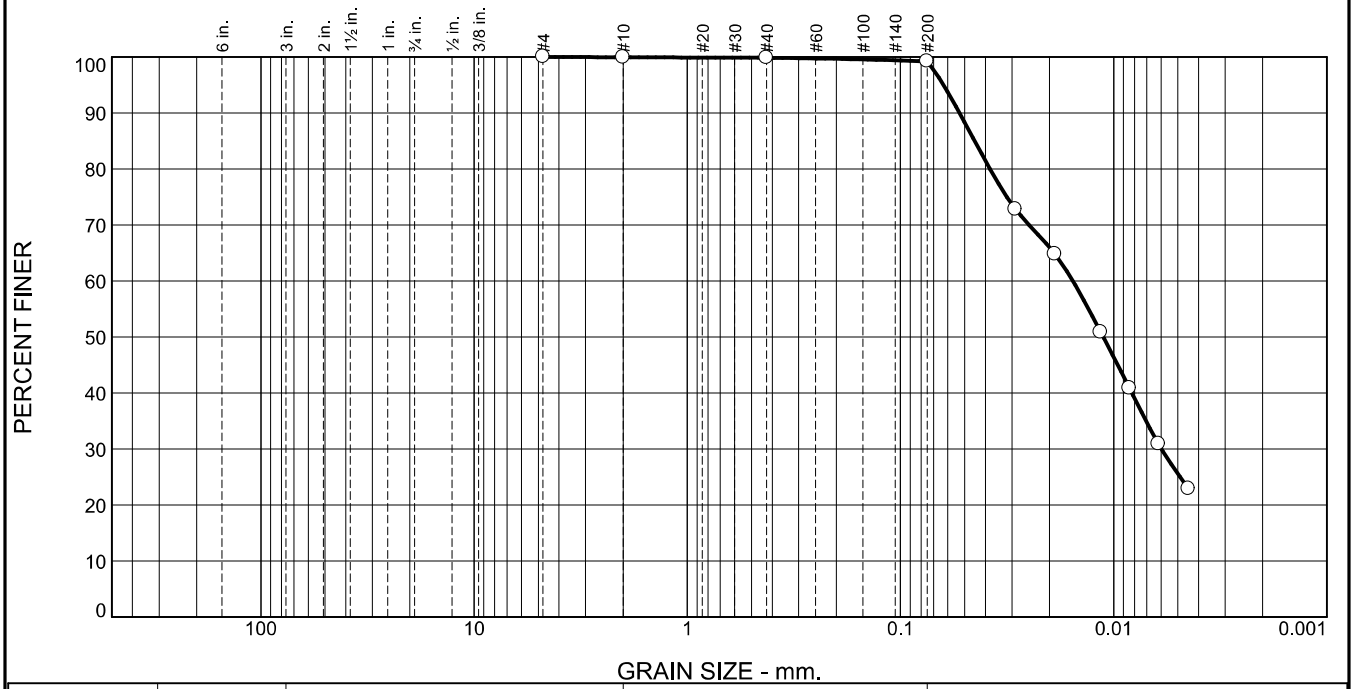
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 42

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.1	0.6	73.7	25.5

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.8		
#200	99.2		
0.0289 mm.	72.8		
0.0189 mm.	64.8		
0.0115 mm.	50.8		
0.0084 mm.	40.9		
0.0062 mm.	30.9		
0.0045 mm.	22.9		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN SILT, SOME CLAY, TRACE COARSE AND FINE SAND

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 20 **PI=** 1

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0529 D_{85}= 0.0449 D_{60}= 0.0156
D_{50}= 0.0112 D_{30}= 0.0060 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/05/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-055-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

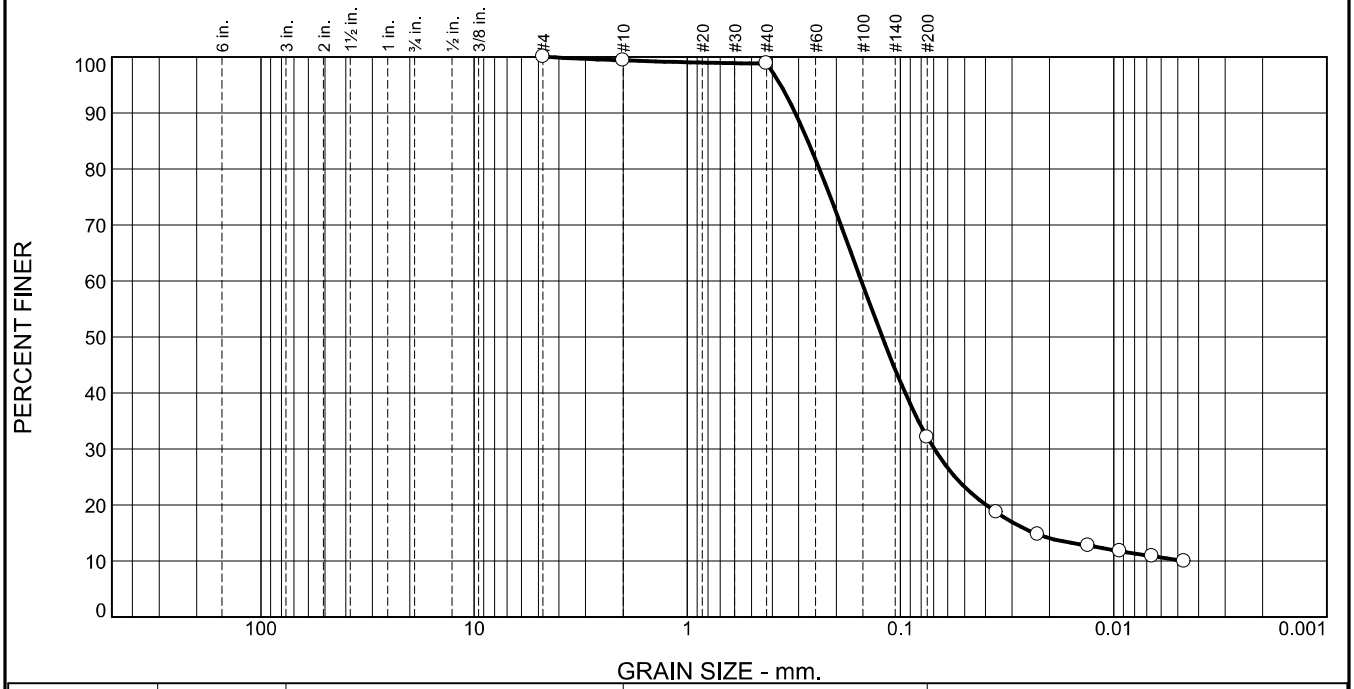
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 43

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.6	0.6	66.7	21.9	10.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.4		
#40	98.8		
#200	32.1		
0.0355 mm.	18.7		
0.0227 mm.	14.7		
0.0132 mm.	12.8		
0.0093 mm.	11.8		
0.0066 mm.	10.9		
0.0047 mm.	10.0		

* (no specification provided)

Material Description

LOOSE, BROWN COARSE AND FINE SAND, SOME SILT, LITTLE CLAY, TRACE FINE GRAVEL

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.3120 D_{85}= 0.2722 D_{60}= 0.1528
D_{50}= 0.1218 D_{30}= 0.0695 D_{15}= 0.0236
D_{10}= 0.0047 C_u= 32.48 C_c= 6.72

Remarks

SAMPLE DESCRIPTION BASED ON ODOT SPECIFICATIONS

Date Received: _____ **Date Tested:** 04/02/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-055-0-20 **Depth:** 16.0-17.5 FT **Date Sampled:**

Sample Number: SS-7

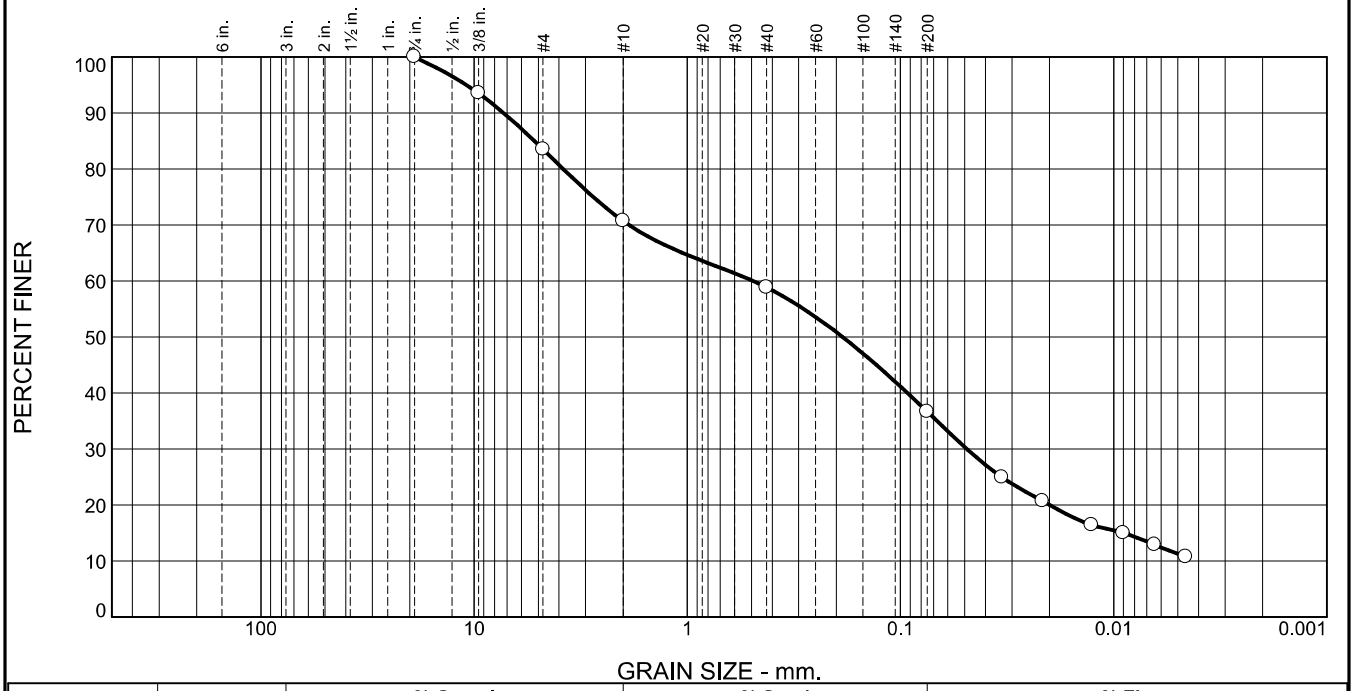
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 44

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	29.3	11.9	22.1	25.4	11.3

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	93.5		
#4	83.5		
#10	70.7		
#40	58.8		
#200	36.7		
0.0334 mm.	24.9		
0.0216 mm.	20.7		
0.0127 mm.	16.4		
0.0090 mm.	15.0		
0.0064 mm.	12.9		
0.0046 mm.	10.8		

* (no specification provided)

Material Description

VERY LOOSE, BROWN-GRAY COARSE AND FINE SAND, SOME FINE GRAVEL, SOME SILT, LITTLE CLAY

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 7.2769 D_{85}= 5.2265 D_{60}= 0.4924
D_{50}= 0.1871 D_{30}= 0.0489 D_{15}= 0.0090
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-056-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**

Sample Number: SS-2

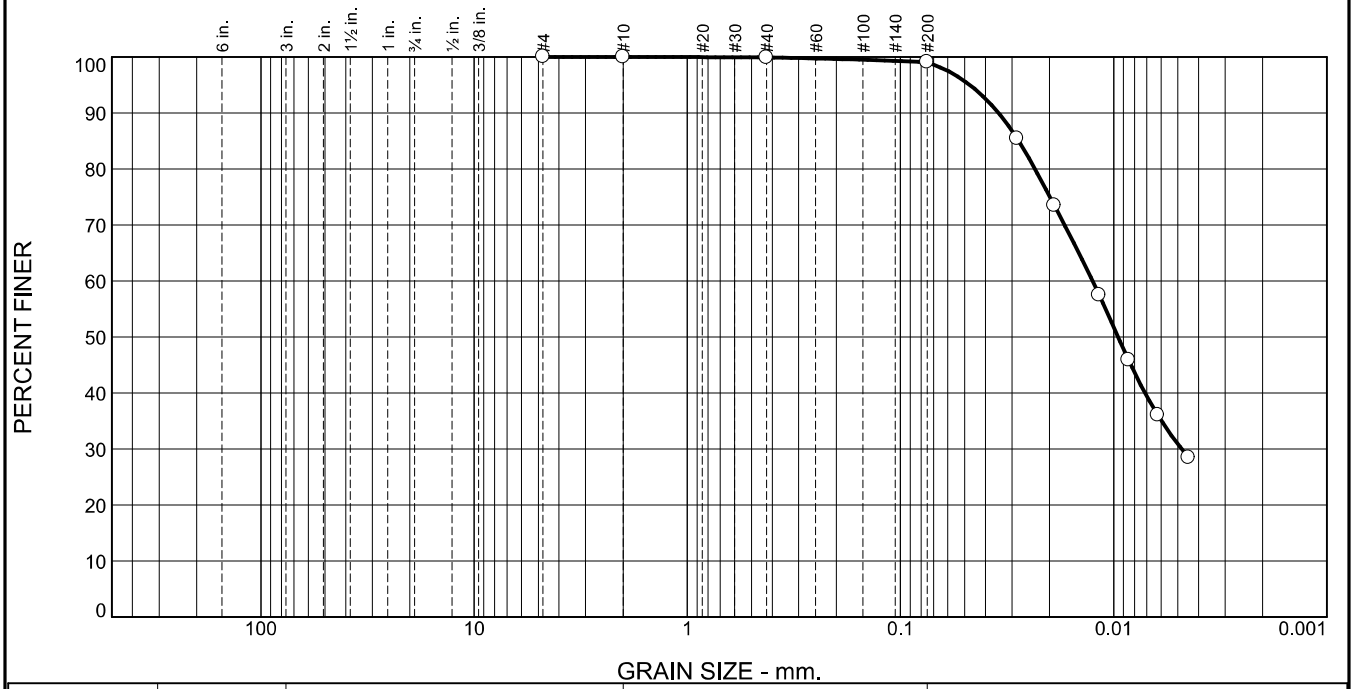
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 45

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.8	68.2	30.9

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.9		
#200	99.1		
0.0284 mm.	85.4		
0.0190 mm.	73.4		
0.0117 mm.	57.5		
0.0085 mm.	45.9		
0.0062 mm.	36.1		
0.0045 mm.	28.5		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 21 **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0348 D_{85}= 0.0280 D_{60}= 0.0126
D_{50}= 0.0095 D_{30}= 0.0048 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-056-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**

Sample Number: SS-6

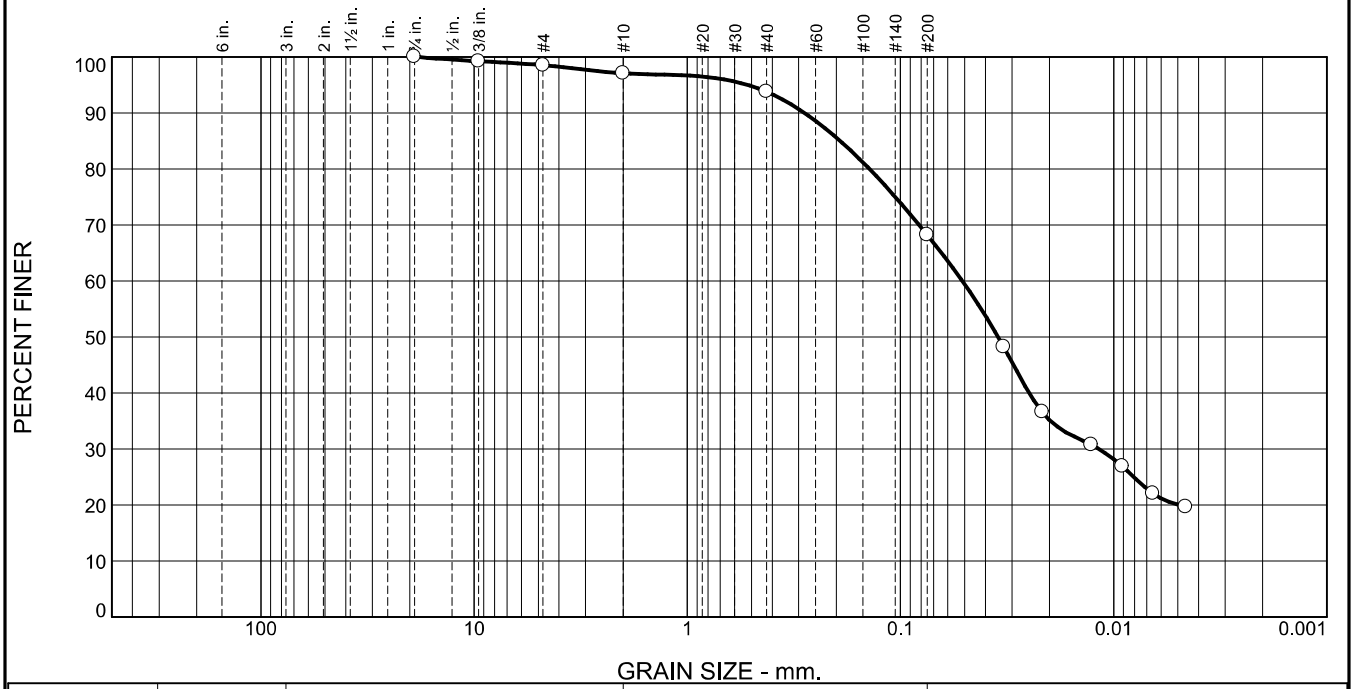
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 46

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	2.9	3.3	25.6	48.1	20.1

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.2		
#4	98.5		
#10	97.1		
#40	93.8		
#200	68.2		
0.0328 mm.	48.2		
0.0216 mm.	36.6		
0.0127 mm.	30.8		
0.0091 mm.	26.9		
0.0065 mm.	22.1		
0.0046 mm.	19.7		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN SILT, SOME COARSE AND FINE SAND, SOME SILT, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 15 **LL=** 18 **PI=** 3

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 0.2823 D_{85}= 0.1921 D_{60}= 0.0514
D_{50}= 0.0349 D_{30}= 0.0117 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-059-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

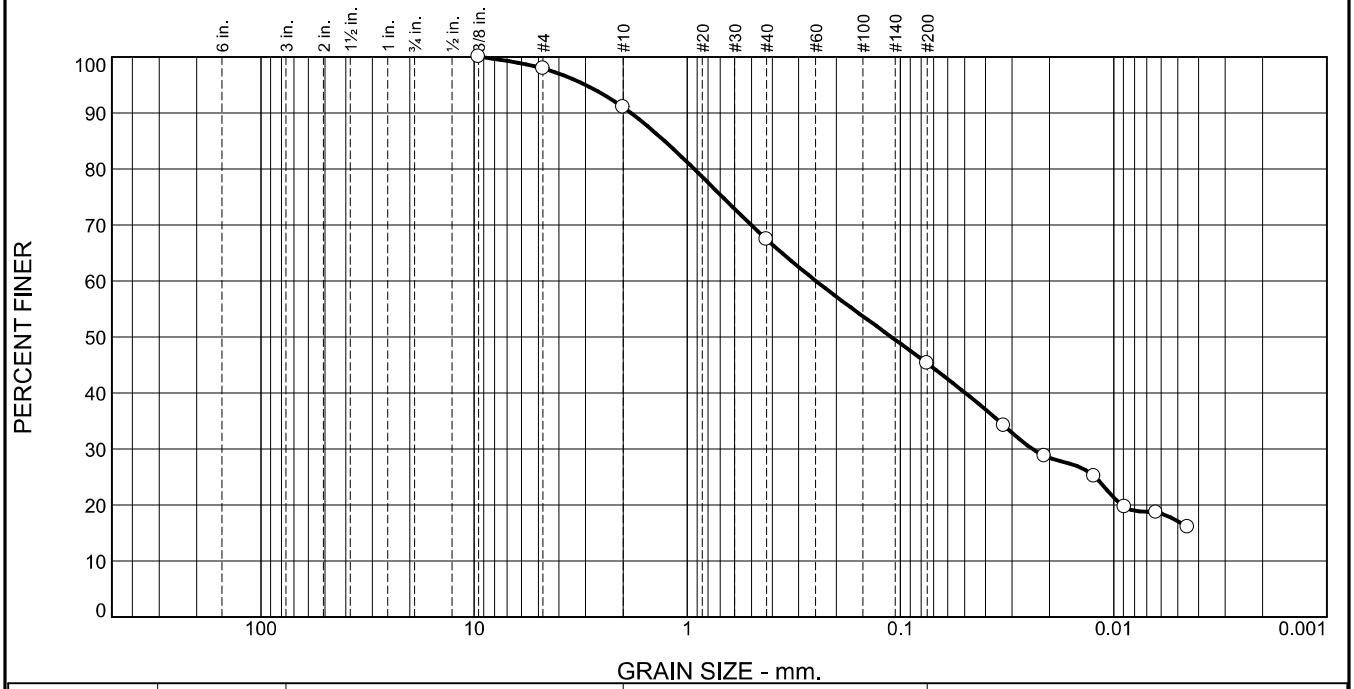
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 47

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	9.0	23.6	22.1	28.2	17.1

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	97.9		
#10	91.0		
#40	67.4		
#200	45.3		
0.0328 mm.	34.2		
0.0211 mm.	28.8		
0.0124 mm.	25.1		
0.0089 mm.	19.7		
0.0063 mm.	18.7		
0.0045 mm.	16.0		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN COARSE AND FINE SAND, SOME SILT, LITTLE CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 15 **LL=** 18 **PI=** 3

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 1.8404 D_{85}= 1.2804 D_{60}= 0.2494
D_{50}= 0.1103 D_{30}= 0.0241 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/07/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-059-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**

Sample Number: SS-6

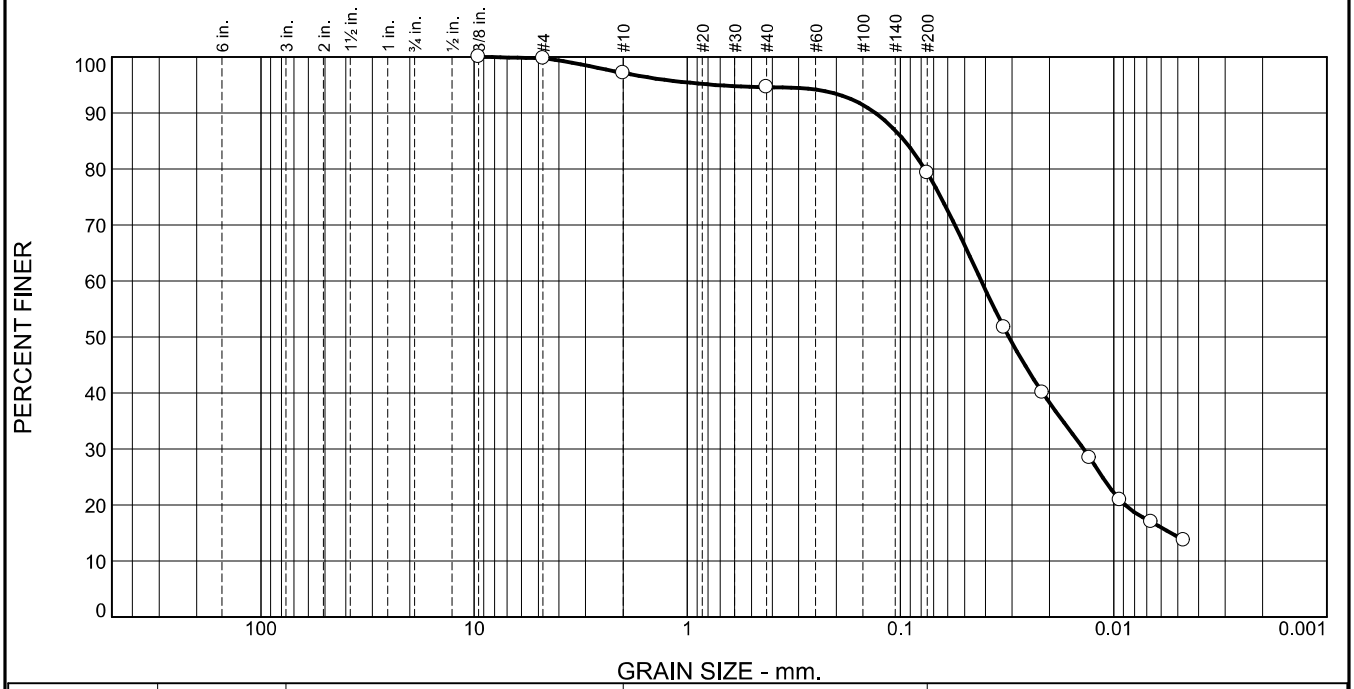
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 48

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	2.9	2.5	15.3	65.0	14.3

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.7		
#10	97.1		
#40	94.6		
#200	79.3		
0.0328 mm.	51.7		
0.0216 mm.	40.1		
0.0130 mm.	28.5		
0.0093 mm.	20.9		
0.0067 mm.	17.0		
0.0047 mm.	13.7		

* (no specification provided)

Material Description

SOFT, BROWN SILT, LITTLE COARSE AND FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.1315 D_{85}= 0.0957 D_{60}= 0.0418
D_{50}= 0.0310 D_{30}= 0.0139 D_{15}= 0.0054
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

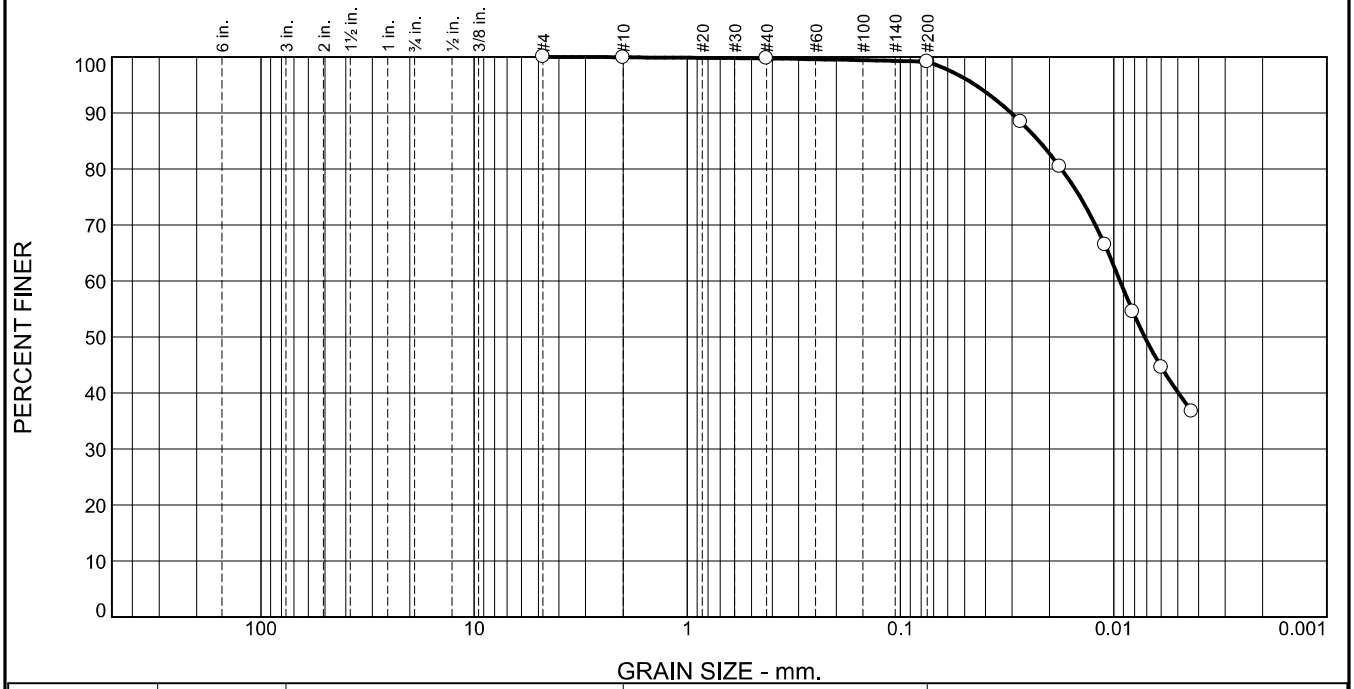
Source of Sample: B-059-0-20 **Depth:** 28.5-30.0 FT **Date Sampled:**
Sample Number: SS-9

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 49

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.2	0.6	59.0	40.1

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.7		
#200	99.1		
0.0273 mm.	88.4		
0.0179 mm.	80.4		
0.0110 mm.	66.4		
0.0081 mm.	54.5		
0.0060 mm.	44.6		
0.0043 mm.	36.7		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND, DAMP

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 22 **PI=** 3

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0303 D_{85}= 0.0225 D_{60}= 0.0093
D_{50}= 0.0072 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-060-0-20 **Depth:** 16.0-17.5 FT **Date Sampled:**

Sample Number: SS-7

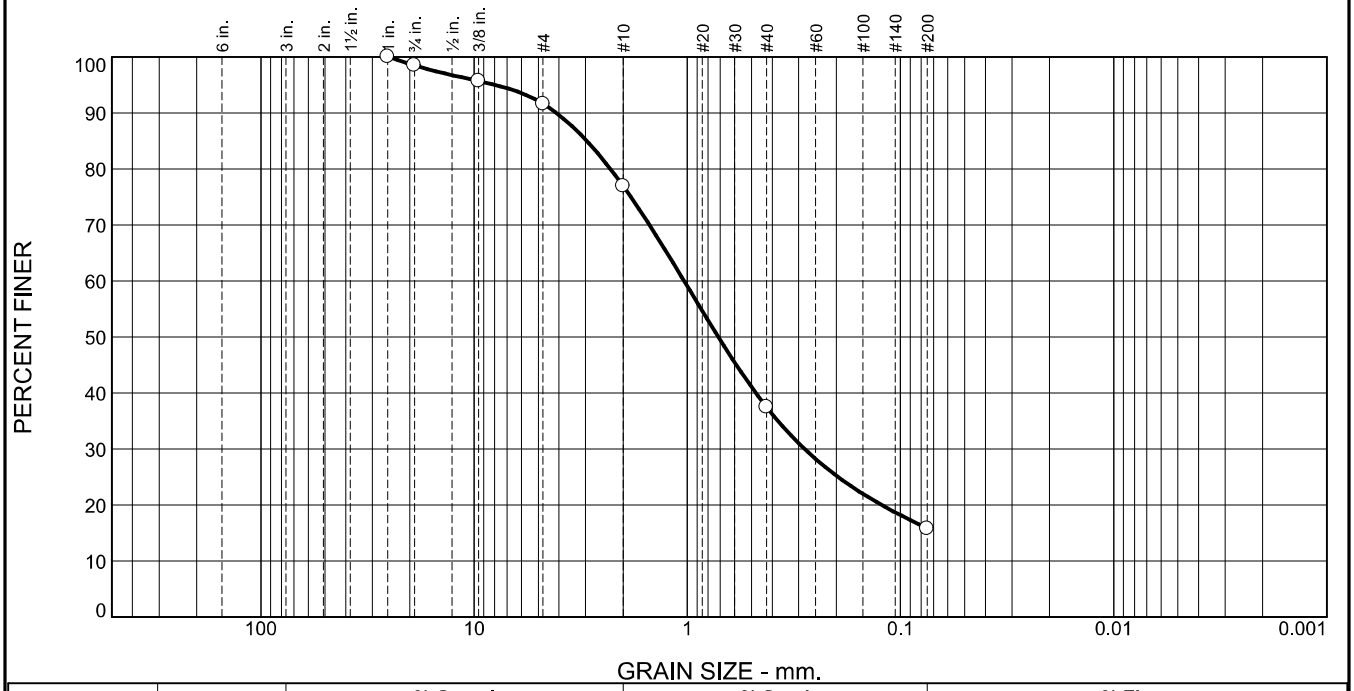
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 50

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	1.5	21.6	39.4	21.7	15.8	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.0"	100.0		
3/4"	98.5		
3/8"	95.7		
#4	91.6		
#10	76.9		
#40	37.5		
#200	15.8		

* (no specification provided)

Material Description

VERY LOOSE, BROWN COARSE AND FINE SAND, SOME COARSE AND FINE GRAVEL, LITTLE CLAY, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 4.1182 D_{85}= 2.9634 D_{60}= 1.0358
D_{50}= 0.7149 D_{30}= 0.2818 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-061-0-20 **Depth:** 8.5-10.0 FT **Date Sampled:**

Sample Number: SS-4

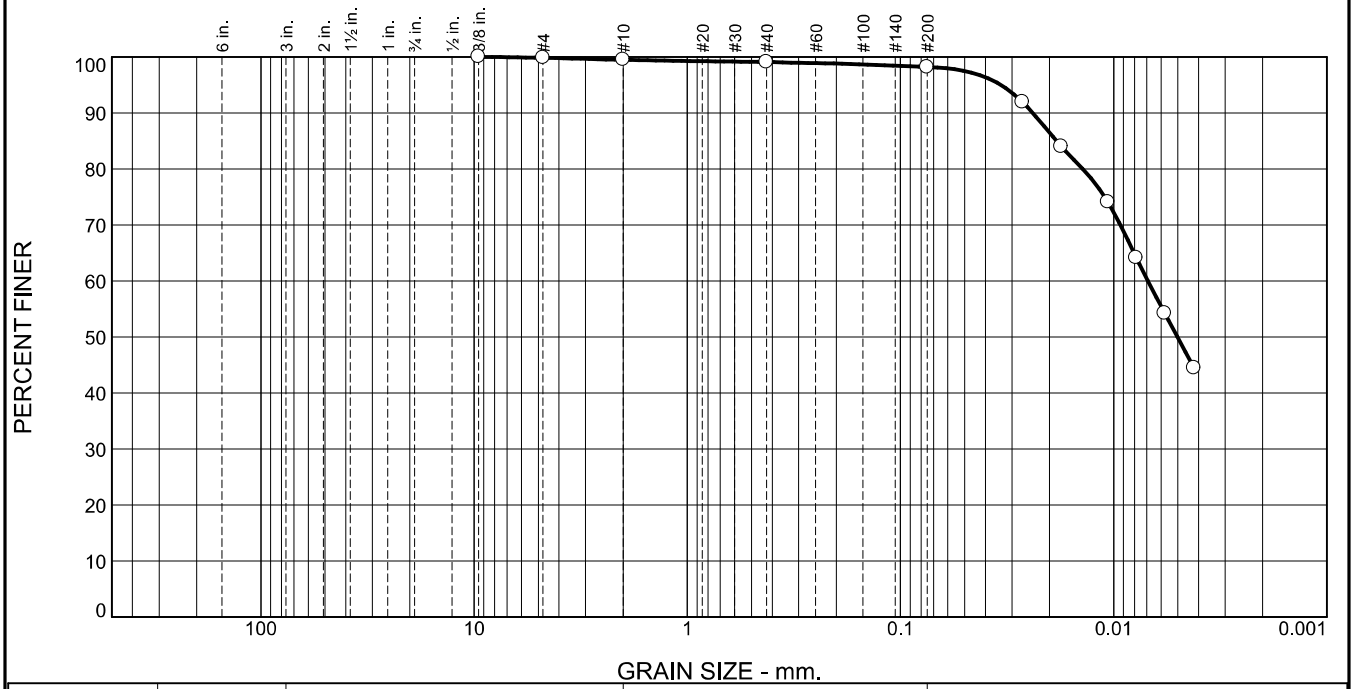
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 51

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.5	0.4	0.9	48.4	49.8

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.8		
#10	99.5		
#40	99.1		
#200	98.2		
0.0268 mm.	91.9		
0.0176 mm.	84.0		
0.0106 mm.	74.1		
0.0078 mm.	64.1		
0.0058 mm.	54.2		
0.0042 mm.	44.5		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY CLAY AND SILT, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL

Atterberg Limits (ASTM D 4318)

PL= 18 **LL=** 25 **PI=** 7

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0240 D_{85}= 0.0186 D_{60}= 0.0069
D_{50}= 0.0050 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-061-0-20 **Depth:** 23.5-25.0 FT **Date Sampled:**

Sample Number: SS-9

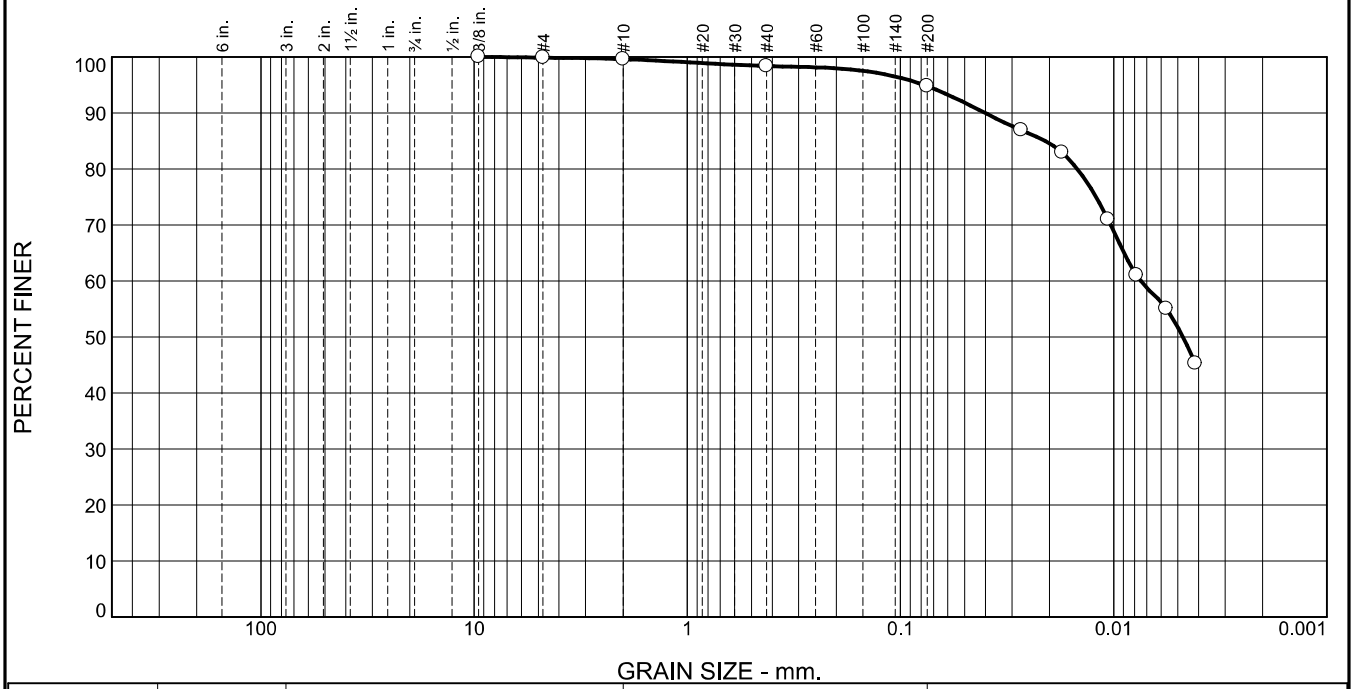
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 52

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.4	1.2	3.6	43.1	51.7

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.9		
#10	99.6		
#40	98.4		
#200	94.8		
0.0271 mm.	86.9		
0.0175 mm.	82.9		
0.0106 mm.	71.0		
0.0078 mm.	61.0		
0.0057 mm.	55.1		
0.0041 mm.	45.3		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN CLAY AND SILT, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 23 **LL=** 32 **PI=** 9

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0402 D_{85}= 0.0210 D_{60}= 0.0075
D_{50}= 0.0047 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/07/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-062-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**

Sample Number: SS-4

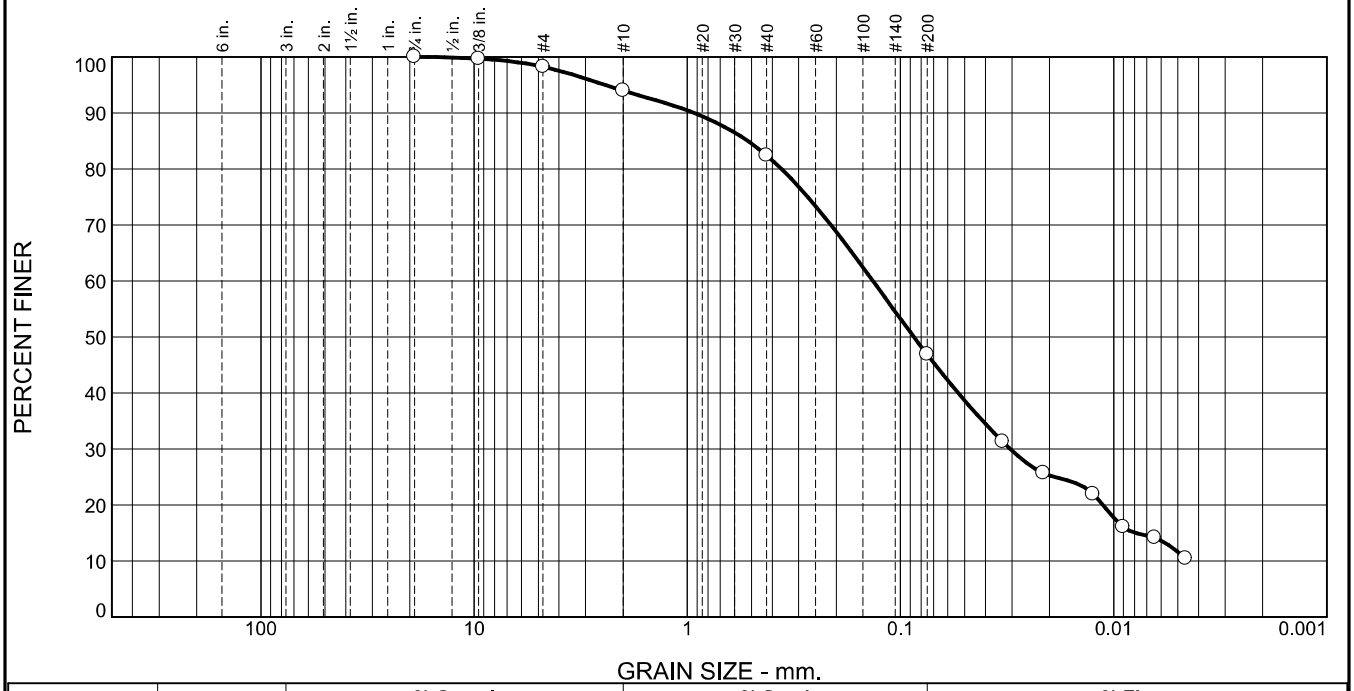
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 53

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	6.0	11.6	35.5	35.3	11.6

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.7		
#4	98.2		
#10	94.0		
#40	82.4		
#200	46.9		
0.0332 mm.	31.3		
0.0214 mm.	25.7		
0.0125 mm.	22.0		
0.0090 mm.	16.1		
0.0064 mm.	14.2		
0.0046 mm.	10.5		

* (no specification provided)

Material Description

SOFT, BROWN COARSE AND FINE SAND AND SILT, LITTLE CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 14 **LL=** 16 **PI=** 2

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 0.9333 D_{85}= 0.5214 D_{60}= 0.1348
D_{50}= 0.0865 D_{30}= 0.0305 D_{15}= 0.0079
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/05/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-063-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

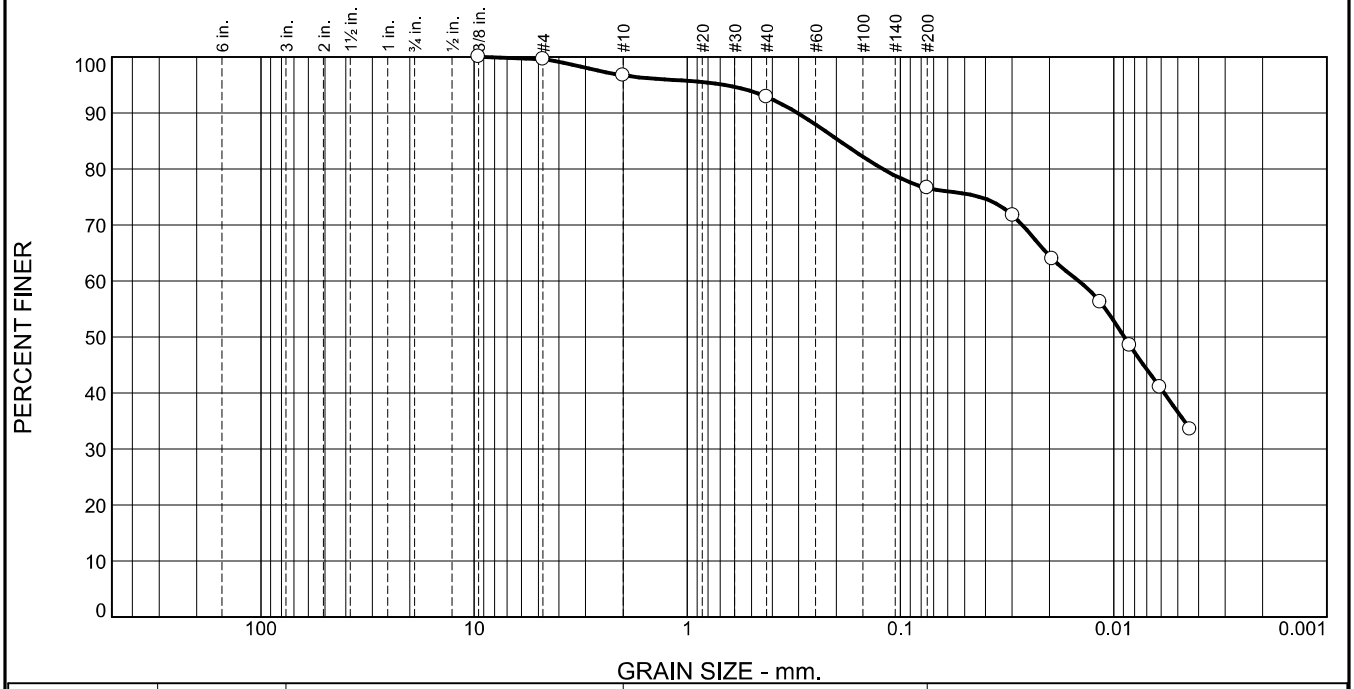
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 54

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	3.3	3.9	16.2	40.0	36.6

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.6		
#10	96.7		
#40	92.8		
#200	76.6		
0.0297 mm.	71.7		
0.0194 mm.	64.0		
0.0116 mm.	56.2		
0.0084 mm.	48.5		
0.0061 mm.	41.0		
0.0044 mm.	33.5		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY SILT AND CLAY, LITTLE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 16 **LL=** 22 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.3054 D_{85}= 0.1935 D_{60}= 0.0146
D_{50}= 0.0089 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-063-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**

Sample Number: SS-6

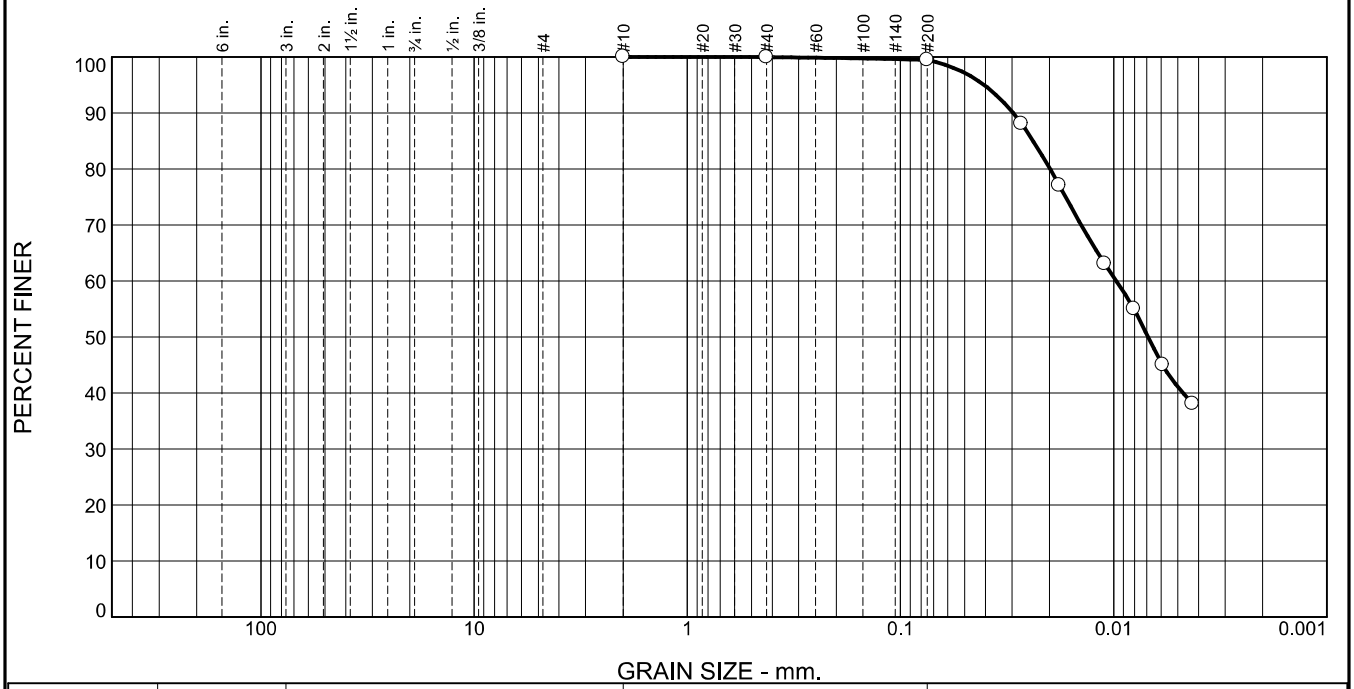
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 55

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.4	58.4	41.1

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#40	99.9		
#200	99.5		
0.0271 mm.	88.1		
0.0180 mm.	77.1		
0.0110 mm.	63.1		
0.0081 mm.	55.0		
0.0059 mm.	45.0		
0.0043 mm.	38.1		

* (no specification provided)

Material Description

SOFT, GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 23 **PI=** 3

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0297 D_{85}= 0.0239 D_{60}= 0.0097
D_{50}= 0.0069 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/05/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-063-0-20 **Depth:** 23.5-25.0 FT **Date Sampled:**

Sample Number: SS-8

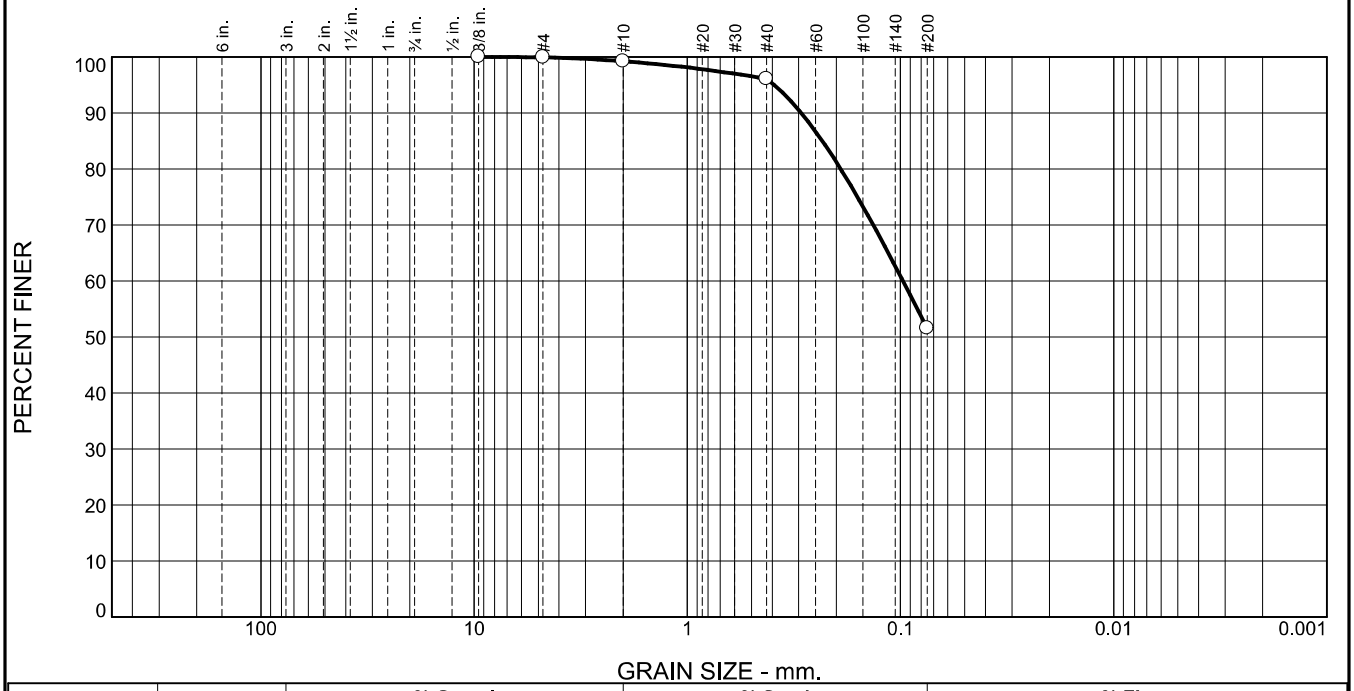
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 56

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.8	3.1	44.5	51.6	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.9		
#10	99.2		
#40	96.1		
#200	51.6		

* (no specification provided)

Material Description

BROWN SILT AND COARSE AND FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 0.2927 D_{85}= 0.2330 D_{60}= 0.0975
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

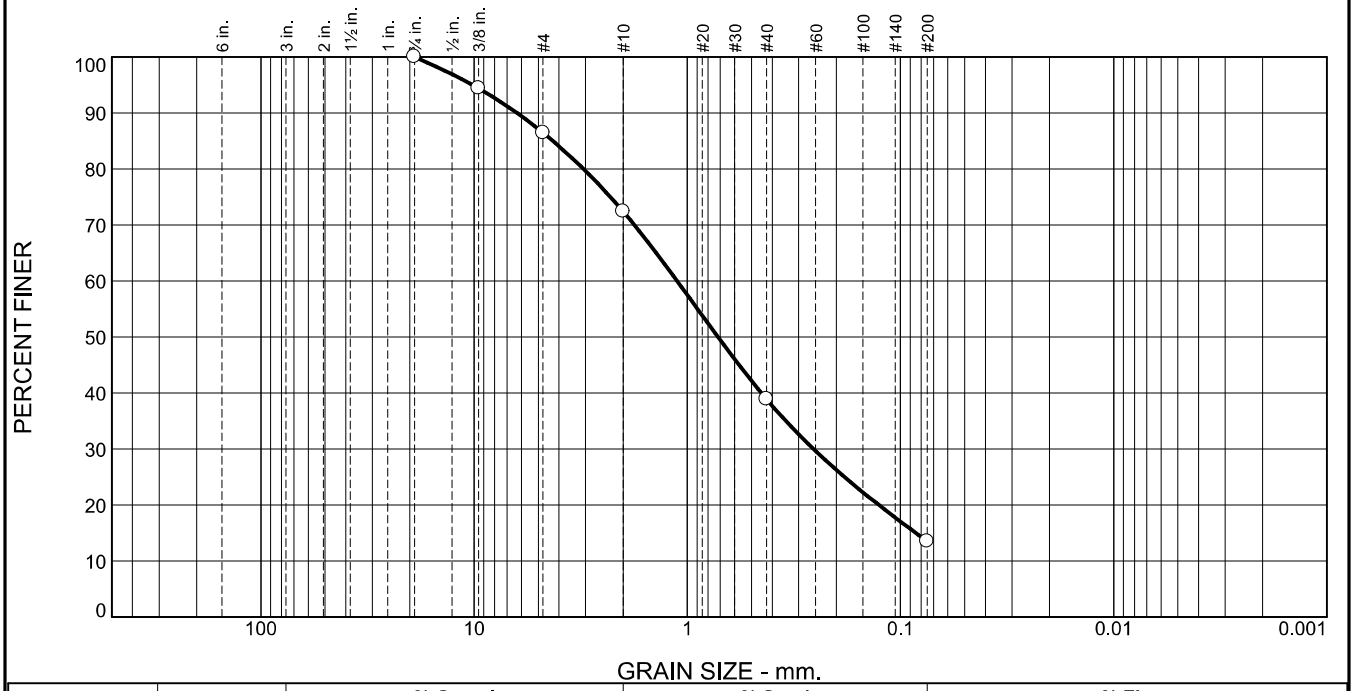
Source of Sample: B-064-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**
Sample Number: S-2

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 57

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	27.6	33.5	25.4	13.5	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	94.4		
#4	86.4		
#10	72.4		
#40	38.9		
#200	13.5		

* (no specification provided)

Material Description

DARK BROWN COARSE AND FINE SAND, SOME FINE GRAVEL, LITTLE SILT AND CLAY, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 6.3041 D_{85}= 4.2801 D_{60}= 1.1165
D_{50}= 0.7176 D_{30}= 0.2560 D_{15}= 0.0847
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-064-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**

Sample Number: S-6

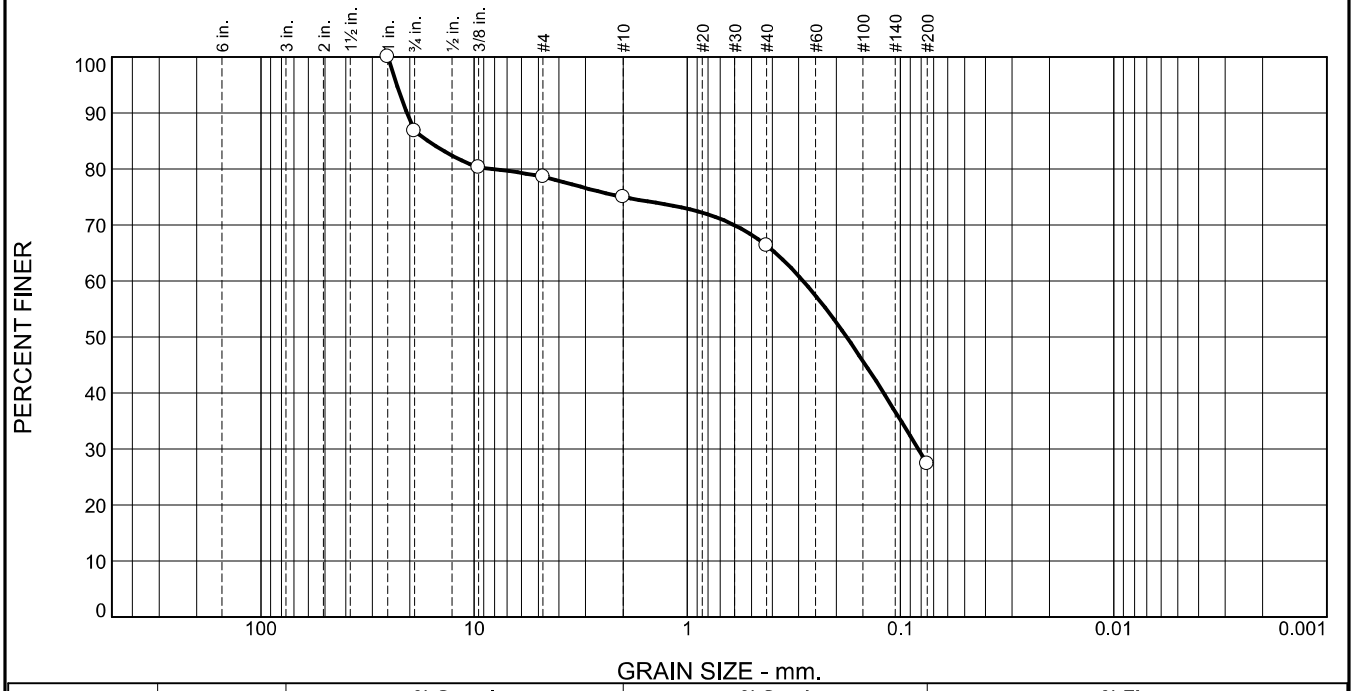
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 58

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	13.2	11.8	8.7	38.9	27.4	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.0"	100.0		
3/4"	86.8		
3/8"	80.3		
#4	78.6		
#10	75.0		
#40	66.3		
#200	27.4		

* (no specification provided)

Material Description

BROWN COARSE AND FINE SAND, SOME SILT AND CLAY, SOME COARSE AND FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 20.6756 D_{85}= 16.4315 D_{60}= 0.2862
D_{50}= 0.1791 D_{30}= 0.0826 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 12/22/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-064-0-20 **Depth:** 28.5-30.0 FT **Date Sampled:**

Sample Number: S-12

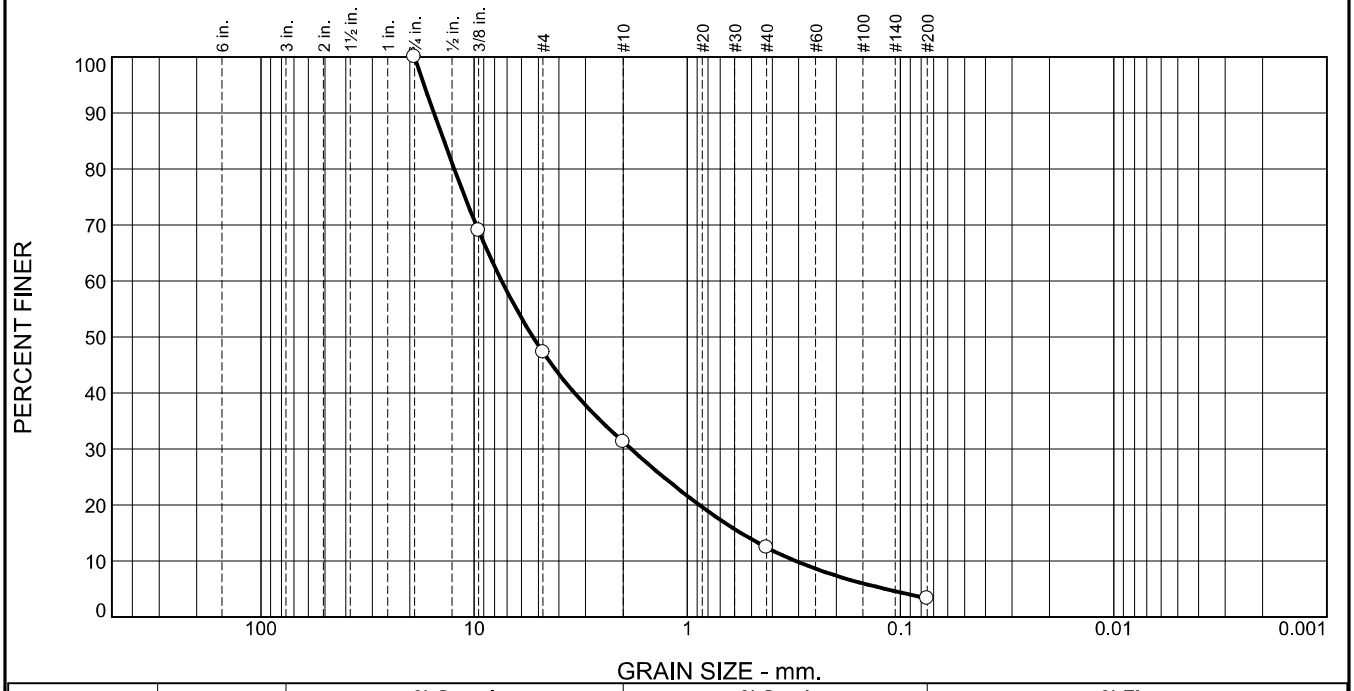
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 59

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	68.7	18.9	9.1	3.3	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	69.0		
#4	47.3		
#10	31.3		
#40	12.4		
#200	3.3		

* (no specification provided)

Material Description

GRAY FINE GRAVEL, SOME COARSE AND FINE SAND, TRACE SILT AND CLAY, DAMP

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 15.4176 D_{85}= 13.8384 D_{60}= 7.4209
D_{50}= 5.2953 D_{30}= 1.8322 D_{15}= 0.5599
D_{10}= 0.3099 C_u= 23.95 C_c= 1.46

Remarks

SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION

Date Received: _____ **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-065-0-20 **Depth:** 1.0-2.5 FT **Date Sampled:**

Sample Number: S-1

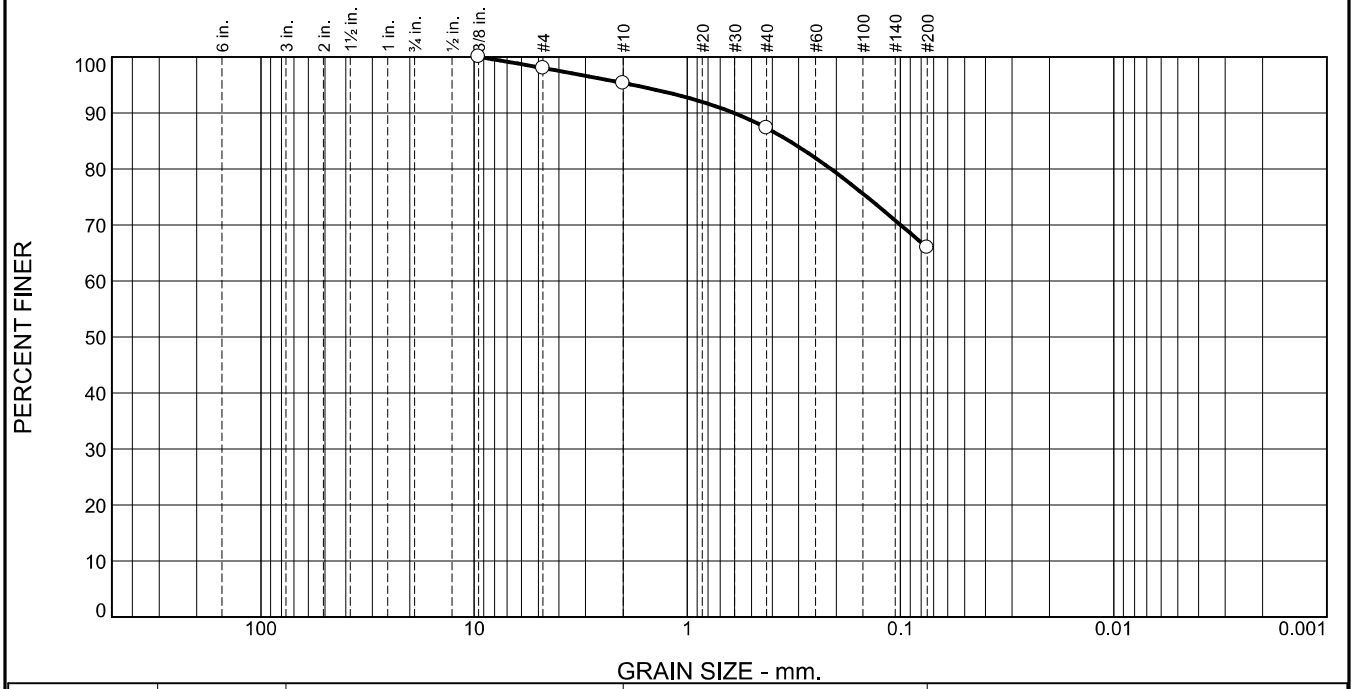
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 60

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	4.7	8.0	21.3	66.0	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	98.0		
#10	95.3		
#40	87.3		
#200	66.0		

* (no specification provided)

Material Description

BROWN SILT AND CLAY, SOME COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 22 **PI=** 3

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 0.6083 D_{85}= 0.3327 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/24/21

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-065-0-20 **Depth:** 18.5-20.0 FT **Date Sampled:**

Sample Number: S-8

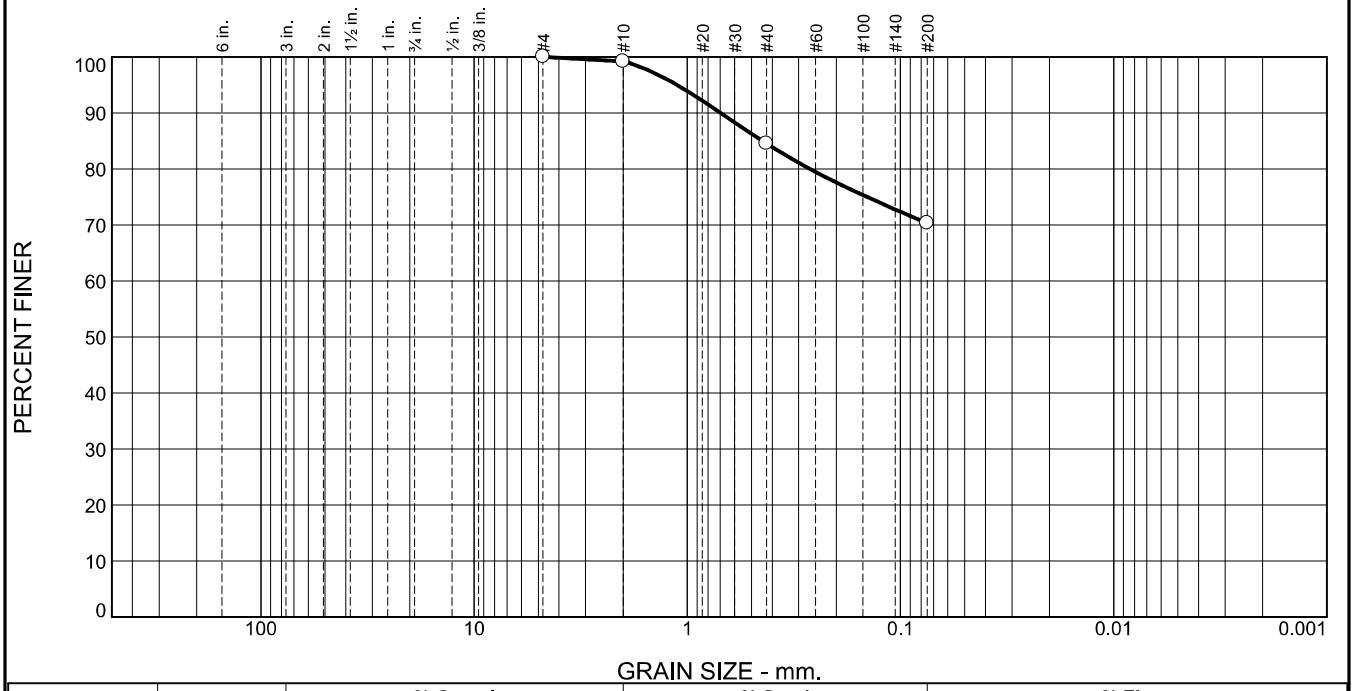
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 61

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.8	14.7	14.2	70.3	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.2		
#40	84.5		
#200	70.3		

* (no specification provided)

Material Description

BROWN SILT AND CLAY, SOME COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 18 **LL=** 24 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.6980 D_{85}= 0.4448 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/24/21

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

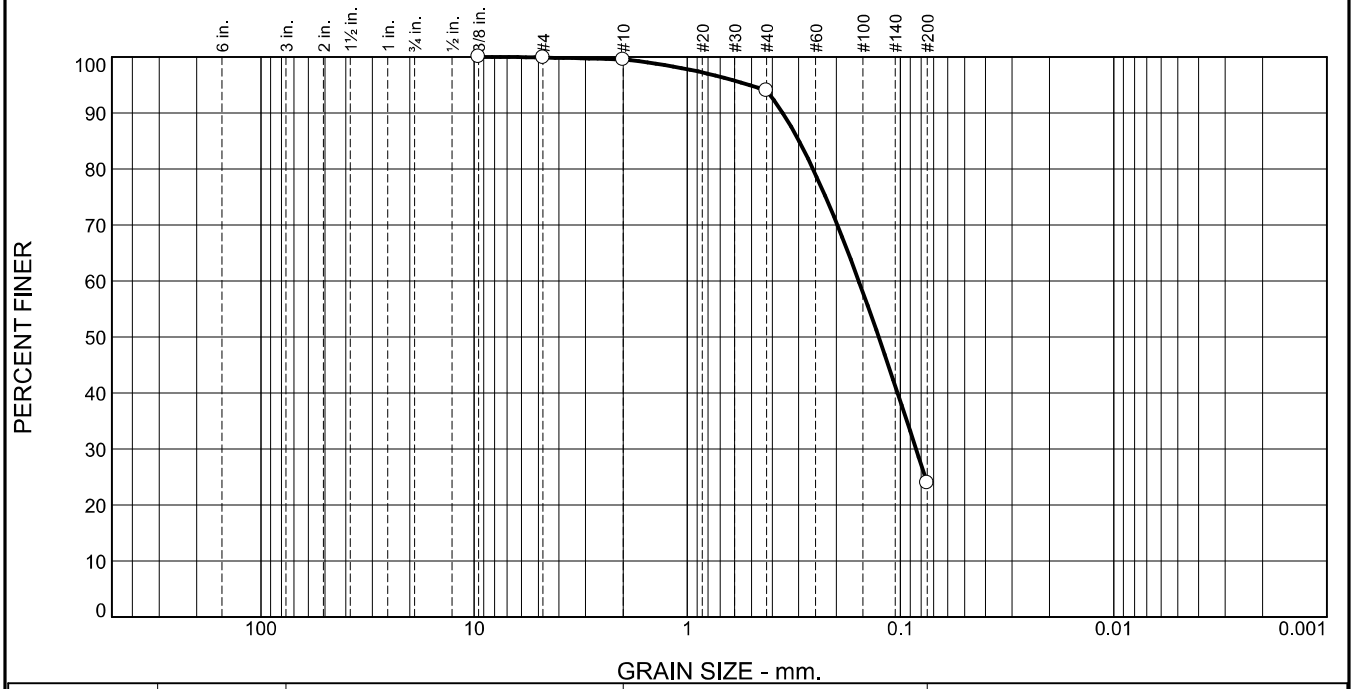
Source of Sample: B-065-0-20 **Depth:** 23.5-25.0 FT **Date Sampled:**
Sample Number: S-10

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 62

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.5	5.5	70.1	23.9	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.9		
#10	99.5		
#40	94.0		
#200	23.9		

* (no specification provided)

Material Description

BROWN COARSE AND FINE SAND, SOME SILT AND CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.3573 D_{85}= 0.2996 D_{60}= 0.1571
D_{50}= 0.1267 D_{30}= 0.0846 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

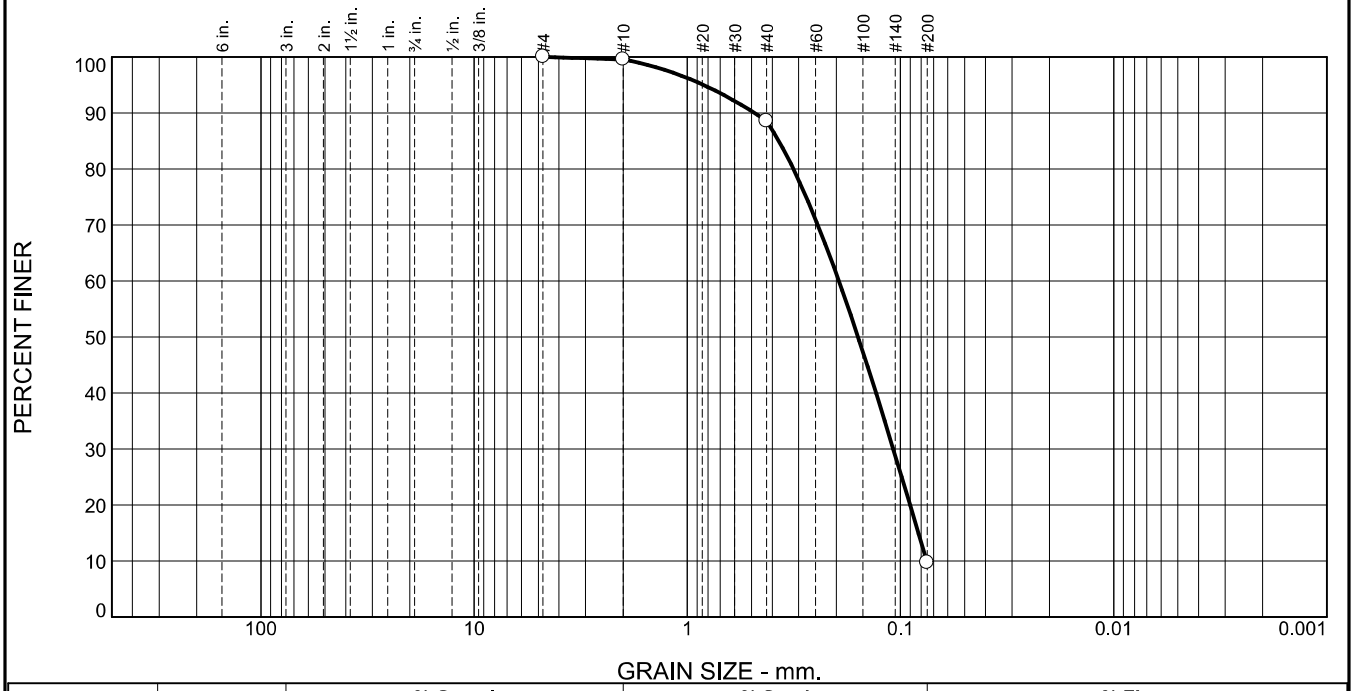
Source of Sample: B-066-0-20 **Depth:** 13.5-15.0 FT **Date Sampled:**
Sample Number: S-6

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 63

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.5	10.9	78.9	9.7	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.5		
#40	88.6		
#200	9.7		

* (no specification provided)

Material Description

BROWN COARSE AND FINE SAND, TRACE SILT AND CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 0.4851 D_{85}= 0.3726 D_{60}= 0.1948
D_{50}= 0.1583 D_{30}= 0.1082 D_{15}= 0.0824
D_{10}= 0.0754 C_u= 2.58 C_c= 0.80

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-066-0-20 **Depth:** 26.0-27.5 FT **Date Sampled:**

Sample Number: S-11

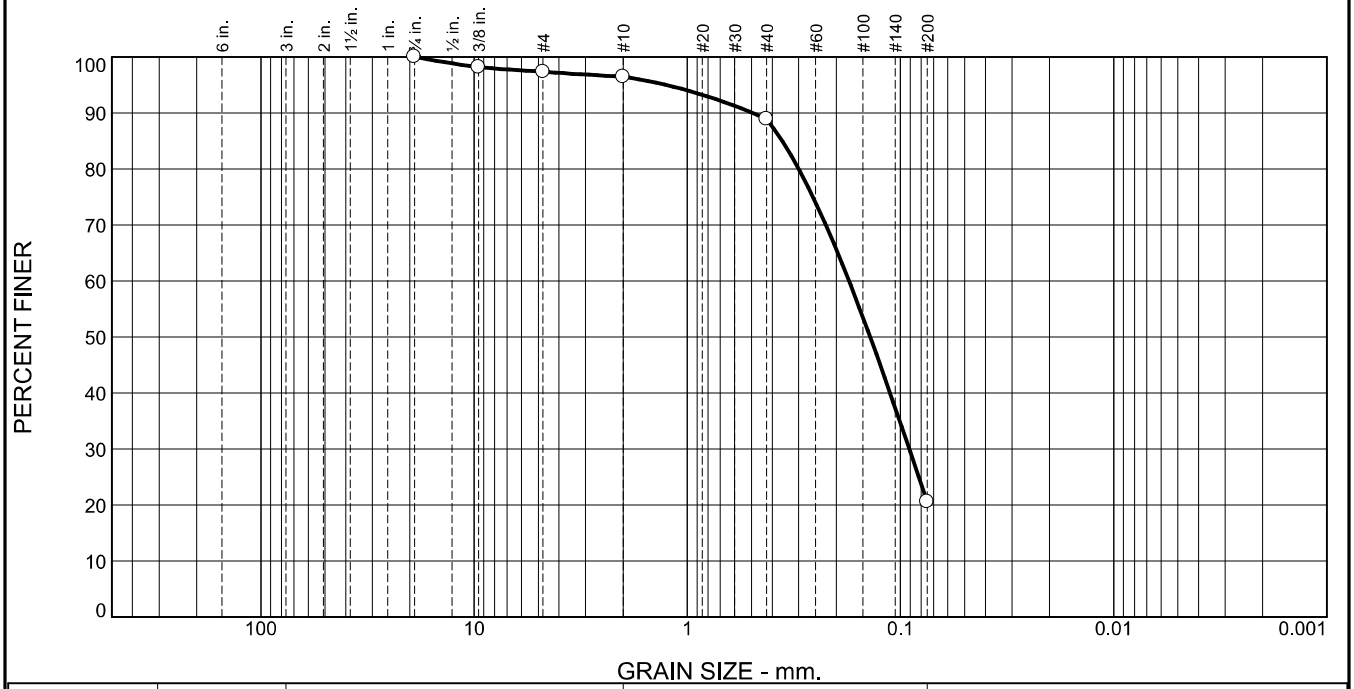
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 64

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	3.6	7.5	68.3	20.6	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	98.2		
#4	97.3		
#10	96.4		
#40	88.9		
#200	20.6		

* (no specification provided)

Material Description

VERY LOOSE, BROWN COARSE AND FINE SAND, SOME SILT AND CLAY, TRACE FINE GRAVEL, DRY

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 0.4964 D_{85}= 0.3588 D_{60}= 0.1746
D_{50}= 0.1389 D_{30}= 0.0910 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-067-0-20 **Depth:** 8.5-10.0 FT **Date Sampled:**

Sample Number: SS-4

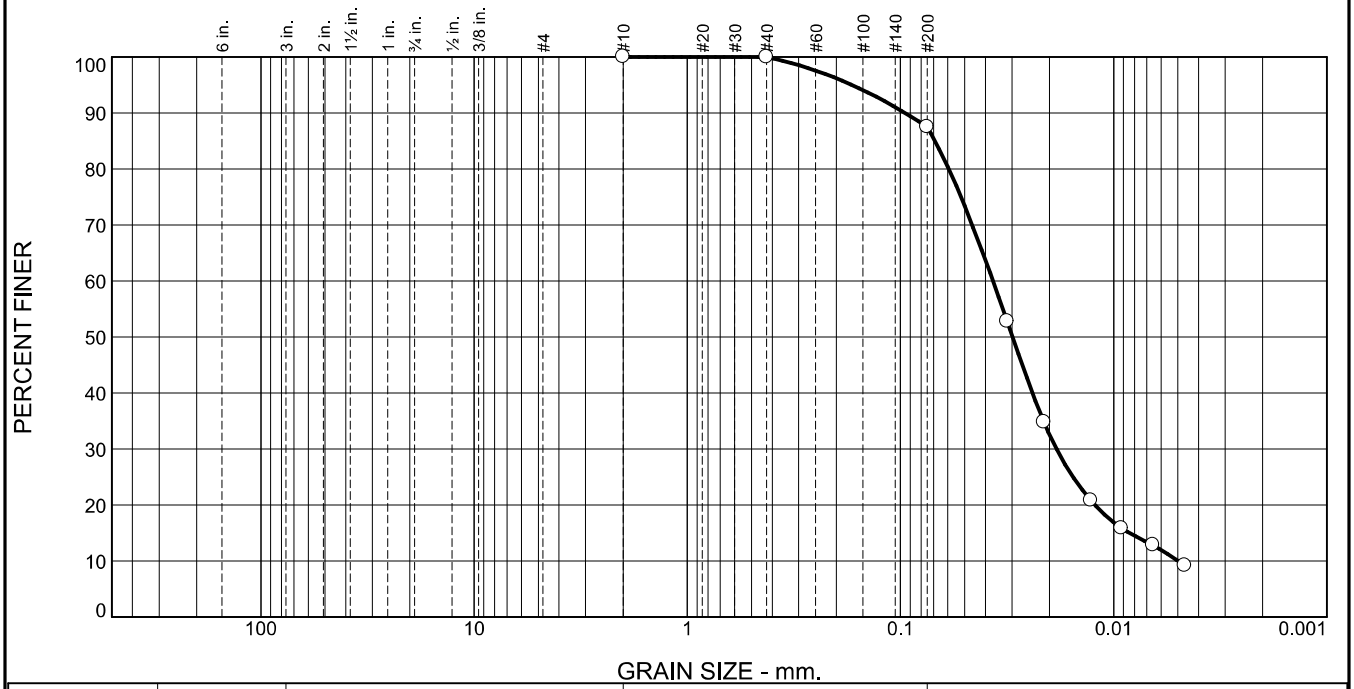
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 65

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	12.5	77.5	10.0

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#40	100.0		
#200	87.5		
0.0316 mm.	52.8		
0.0212 mm.	34.8		
0.0128 mm.	20.8		
0.0092 mm.	15.8		
0.0066 mm.	12.9		
0.0046 mm.	9.2		

* (no specification provided)

Material Description

SOFT, BROWN SILT, LITTLE FINE SAND, TRACE CLAY, DAMP

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0955 D_{85}= 0.0690 D_{60}= 0.0368
D_{50}= 0.0298 D_{30}= 0.0185 D_{15}= 0.0084
D_{10}= 0.0050 C_u= 7.39 C_c= 1.87

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-067-0-20 **Depth:** 28.5-30.0 FT **Date Sampled:**

Sample Number: SS-11

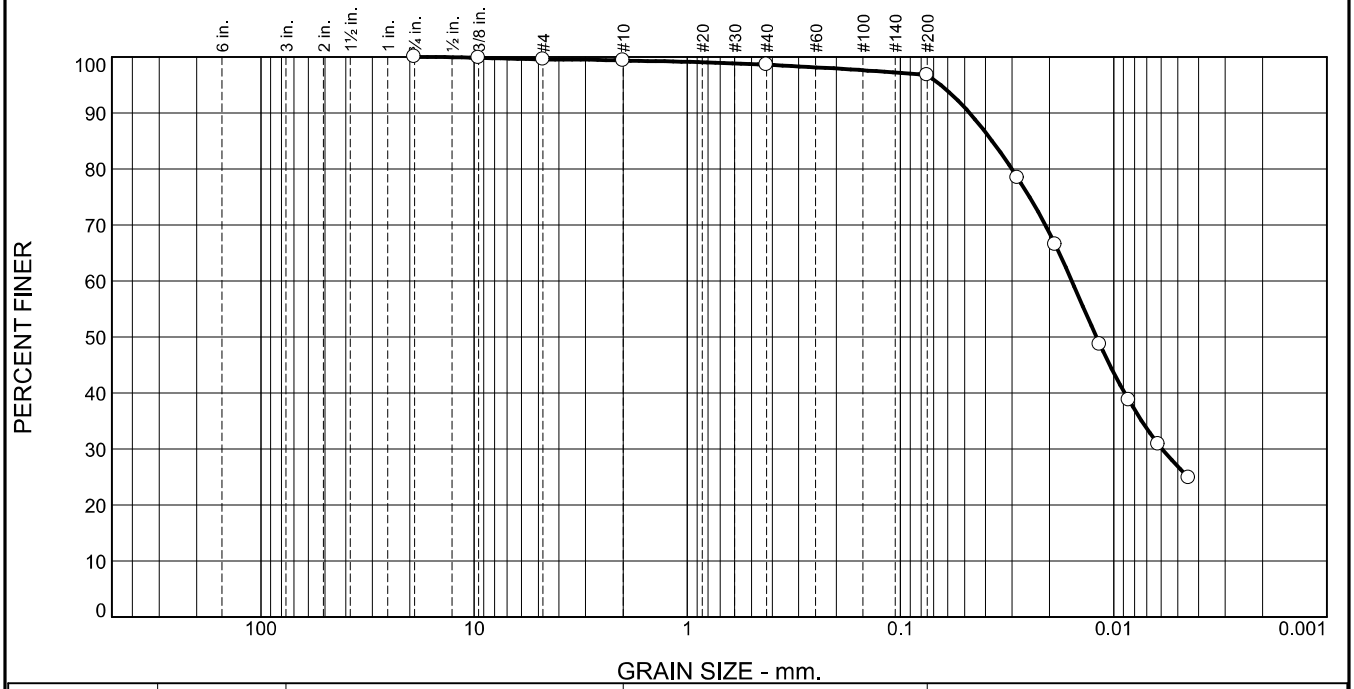
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 66

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.7	0.7	1.8	70.0	26.8

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.8		
#4	99.5		
#10	99.3		
#40	98.6		
#200	96.8		
0.0283 mm.	78.4		
0.0188 mm.	66.5		
0.0116 mm.	48.7		
0.0085 mm.	38.8		
0.0062 mm.	30.8		
0.0045 mm.	24.8		

* (no specification provided)

Material Description

GRAY-BROWN TO GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 26 **PI=** 7

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0476 D_{85}= 0.0372 D_{60}= 0.0157
D_{50}= 0.0121 D_{30}= 0.0059 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

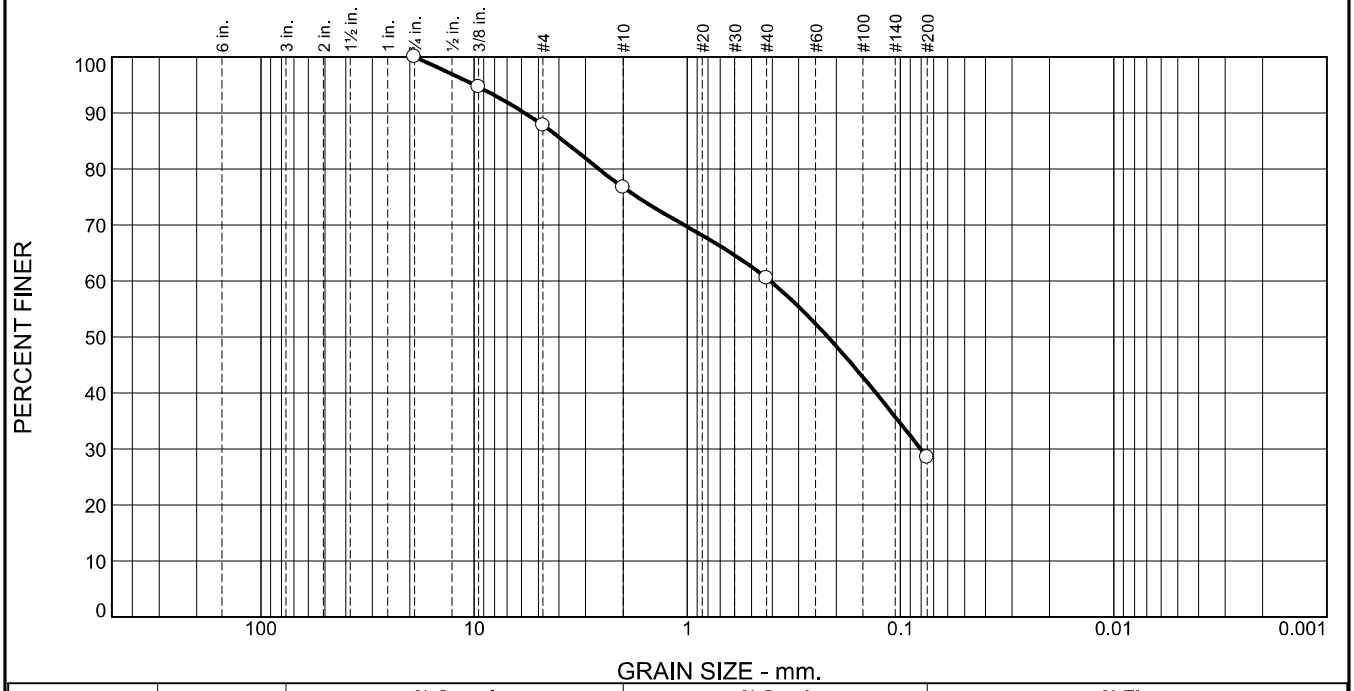
Source of Sample: B-067-0-20 **Depth:** 17.5-19.5 FT **Date Sampled:**
Sample Number: ST-8

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 67

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	23.3	16.2	32.0	28.5	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	94.6		
#4	87.8		
#10	76.7		
#40	60.5		
#200	28.5		

* (no specification provided)

Material Description

SOFT, BROWN COARSE AND FINE SAND, SOME SILT AND CLAY, SOME FINE GRAVEL, DAMP

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 5.8005 D_{85}= 3.7988 D_{60}= 0.4094
D_{50}= 0.2191 D_{30}= 0.0805 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-068-0-20 **Depth:** 1.0-2.5 FT **Date Sampled:**

Sample Number: SS-1

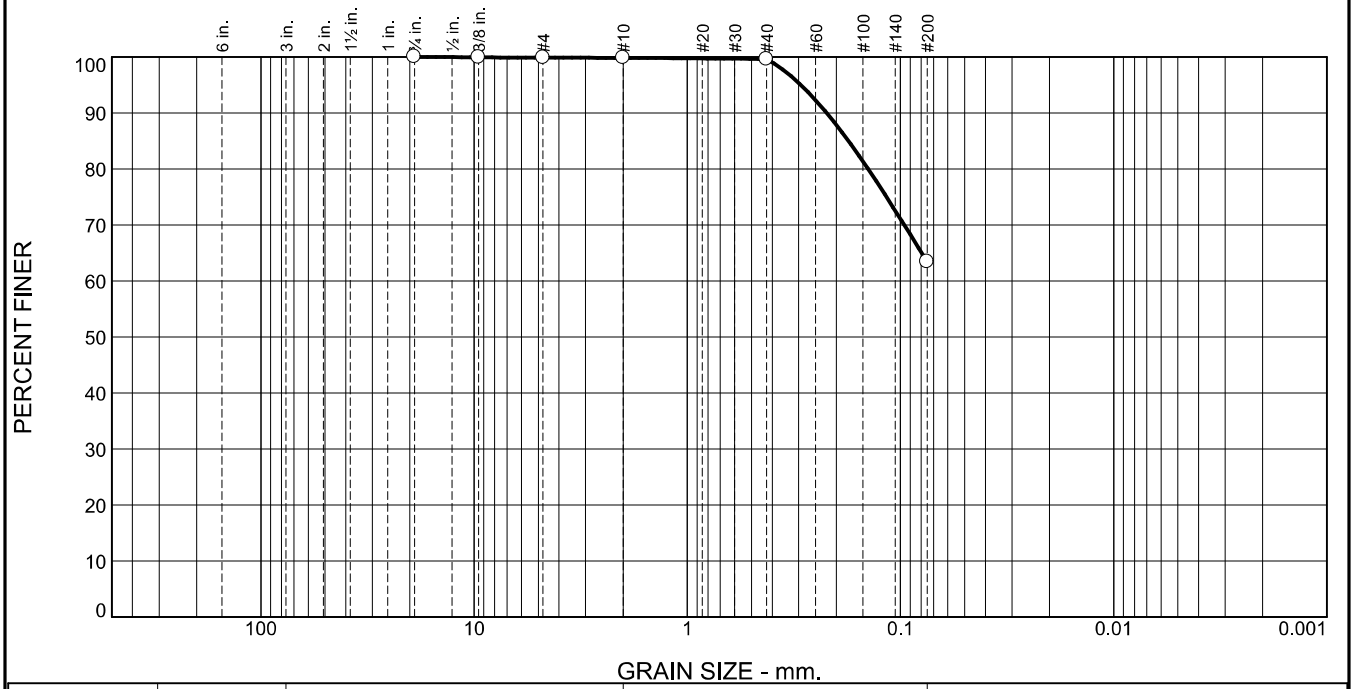
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 68

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.2	36.2	63.4	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.9		
#4	99.8		
#10	99.8		
#40	99.6		
#200	63.4		

* (no specification provided)

Material Description

VERY LOOSE, BROWN SILT AND SAND, AND COARSE AND FINE SAND, TRACE FINE GRAVEL, DRY

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 0.2223 D_{85}= 0.1757 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-068-0-20 **Depth:** 8.5-10.0 FT **Date Sampled:**

Sample Number: SS-4

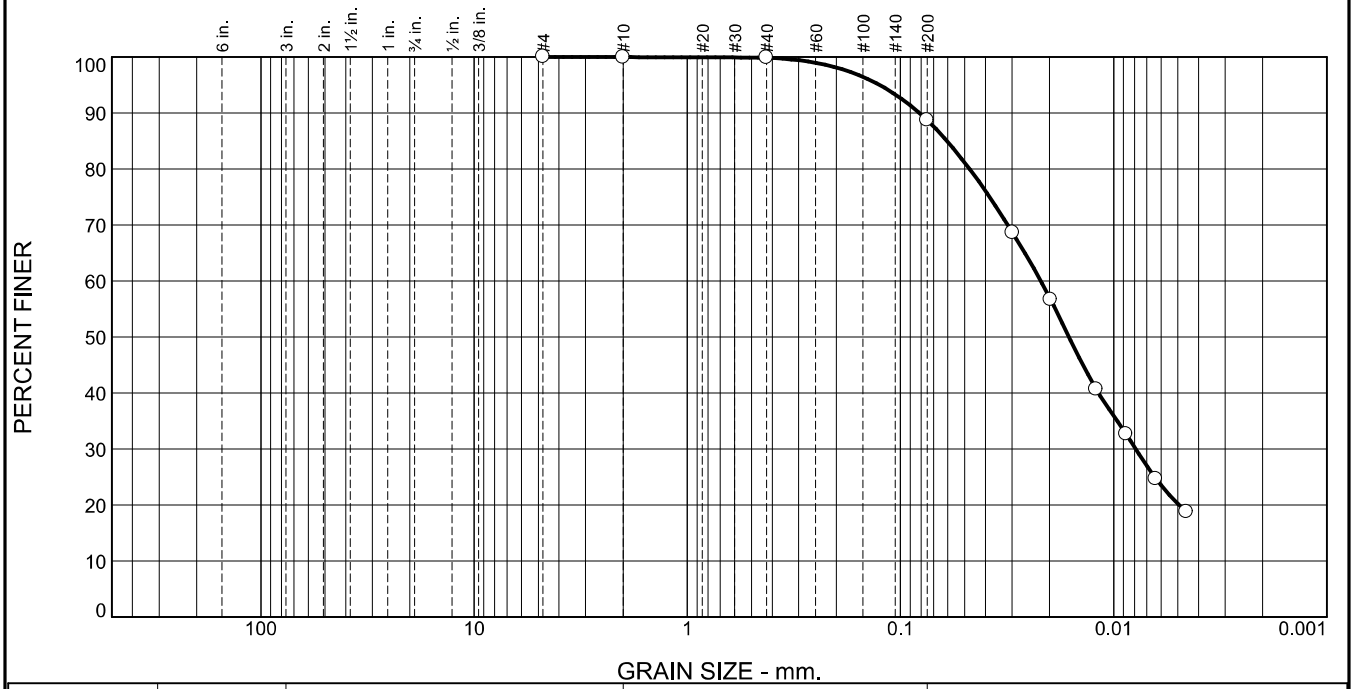
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 69

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.0	11.2	68.4	20.3

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.9		
#200	88.7		
0.0298 mm.	68.6		
0.0198 mm.	56.6		
0.0121 mm.	40.7		
0.0088 mm.	32.7		
0.0064 mm.	24.7		
0.0046 mm.	18.8		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN-GRAY SILT, SOME CLAY, LITTLE FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 18 **LL=** 20 **PI=** 2

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0818 D_{85}= 0.0606 D_{60}= 0.0220
D_{50}= 0.0162 D_{30}= 0.0079 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-068-0-20 **Depth:** 23.5-25.0 FT **Date Sampled:**

Sample Number: SS-9

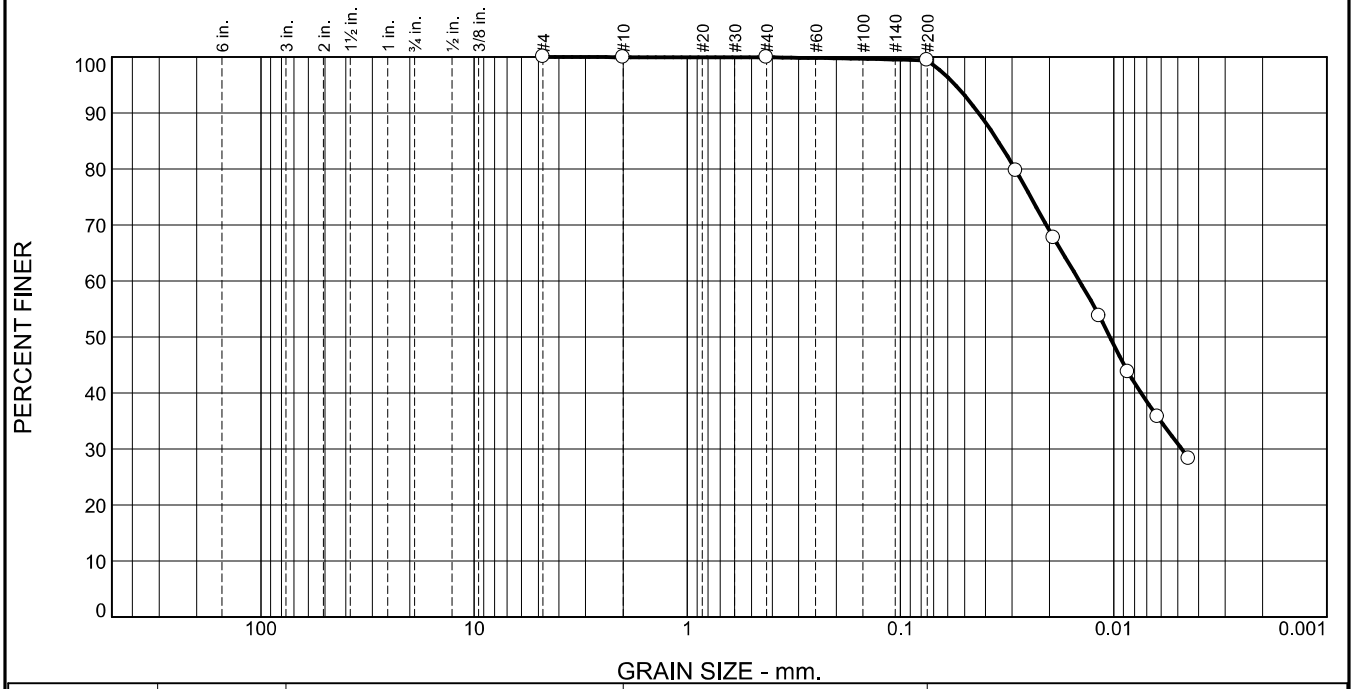
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 70

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.0	0.5	68.5	30.9

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.9		
#200	99.4		
0.0287 mm.	79.7		
0.0192 mm.	67.7		
0.0117 mm.	53.7		
0.0086 mm.	43.8		
0.0062 mm.	35.8		
0.0045 mm.	28.3		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN-GRAY SILT, SOME CLAY, TRACE FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 22 **PI=** 2

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0431 D_{85}= 0.0350 D_{60}= 0.0145
D_{50}= 0.0104 D_{30}= 0.0048 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-068-0-20 **Depth:** 35.5-40.0 FT **Date Sampled:**

Sample Number: SS-12

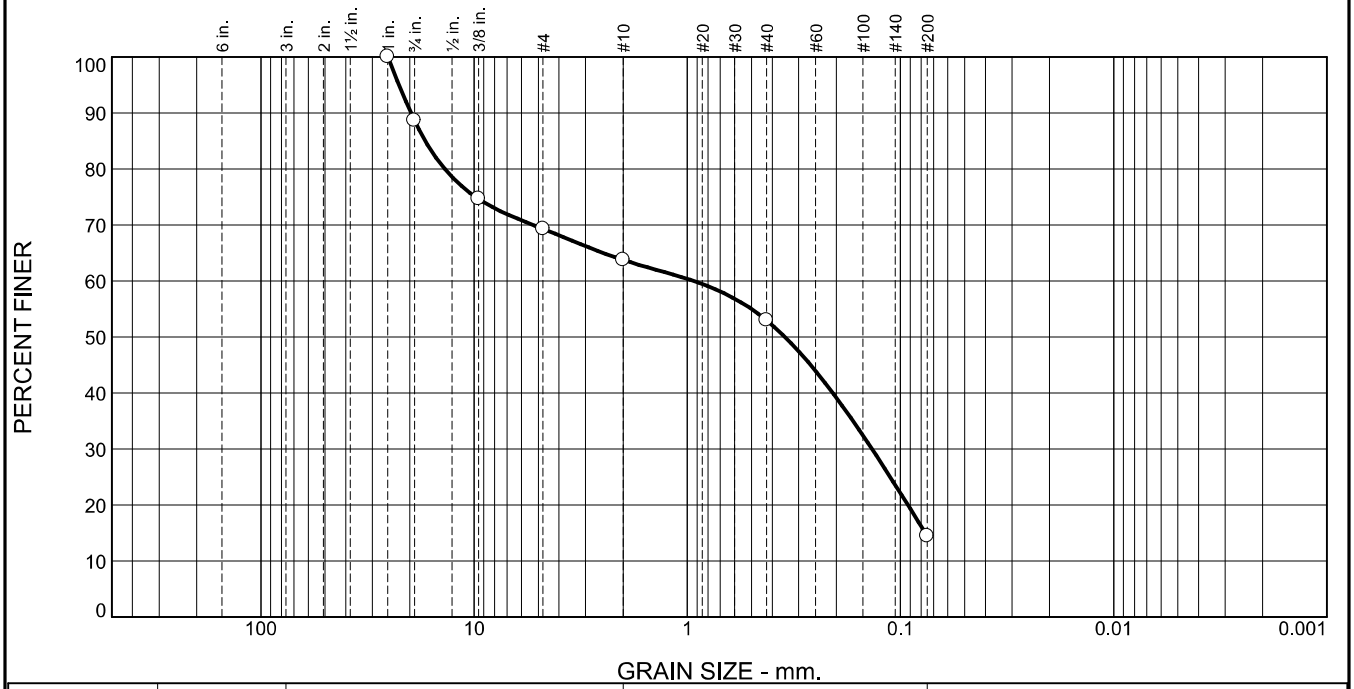
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 71

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	11.3	25.0	10.7	38.5	14.5	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.0"	100.0		
3/4"	88.7		
3/8"	74.7		
#4	69.3		
#10	63.7		
#40	53.0		
#200	14.5		

* (no specification provided)

Material Description

VERY LOOSE, BROWN COARSE AND FINE SAND AND COARSE AND FINE GRAVEL, LITTLE SILT AND CLAY

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 19.7901 D_{85}= 16.9449 D_{60}= 0.9326
D_{50}= 0.3484 D_{30}= 0.1362 D_{15}= 0.0764
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-070-0-20 **Depth:** 6.0-7.5 FT **Date Sampled:**

Sample Number: SS-3

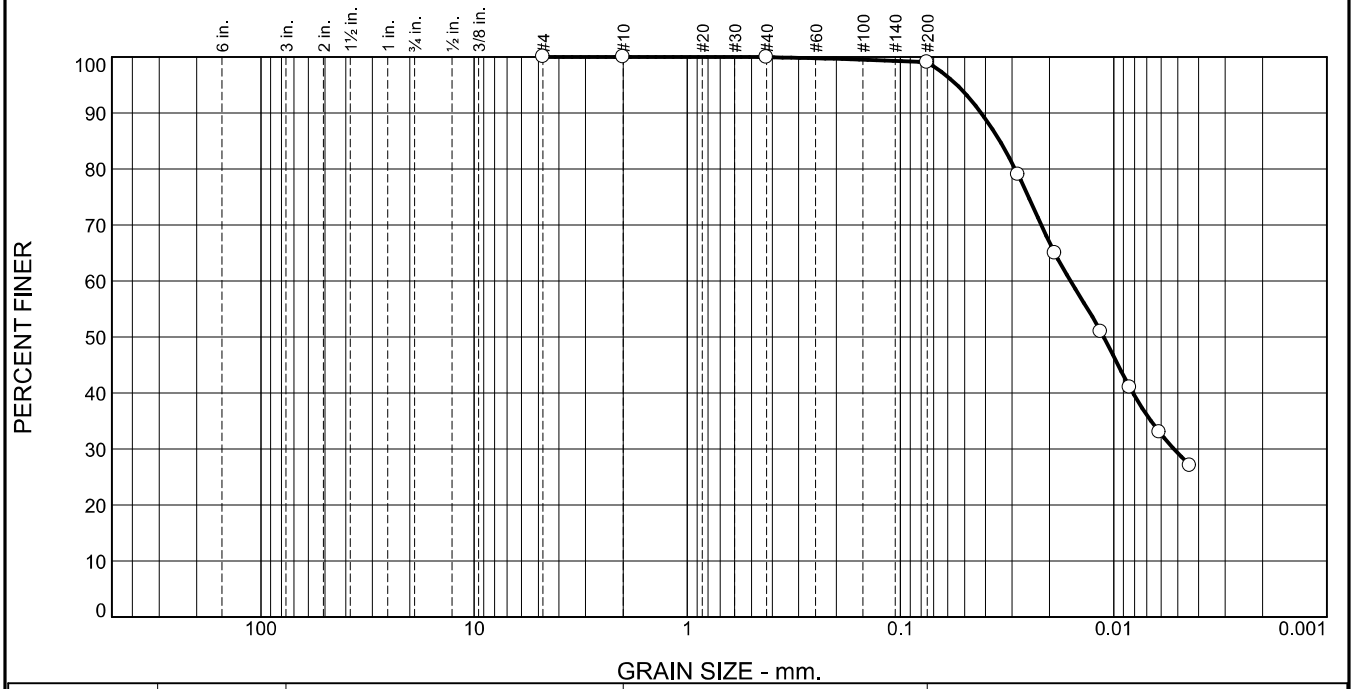
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 72

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.9	69.8	29.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.9		
#200	99.0		
0.0281 mm.	79.0		
0.0189 mm.	65.0		
0.0115 mm.	51.0		
0.0084 mm.	41.0		
0.0061 mm.	33.0		
0.0044 mm.	27.1		

* (no specification provided)

Material Description

SOFT, BROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 LL= 22 PI= 2

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4b

Coefficients

D_{90}= 0.0419 D_{85}= 0.0343 D_{60}= 0.0160
D_{50}= 0.0112 D_{30}= 0.0052 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-070-0-20 **Depth:** 16.0-17.5 FT **Date Sampled:**

Sample Number: SS-7

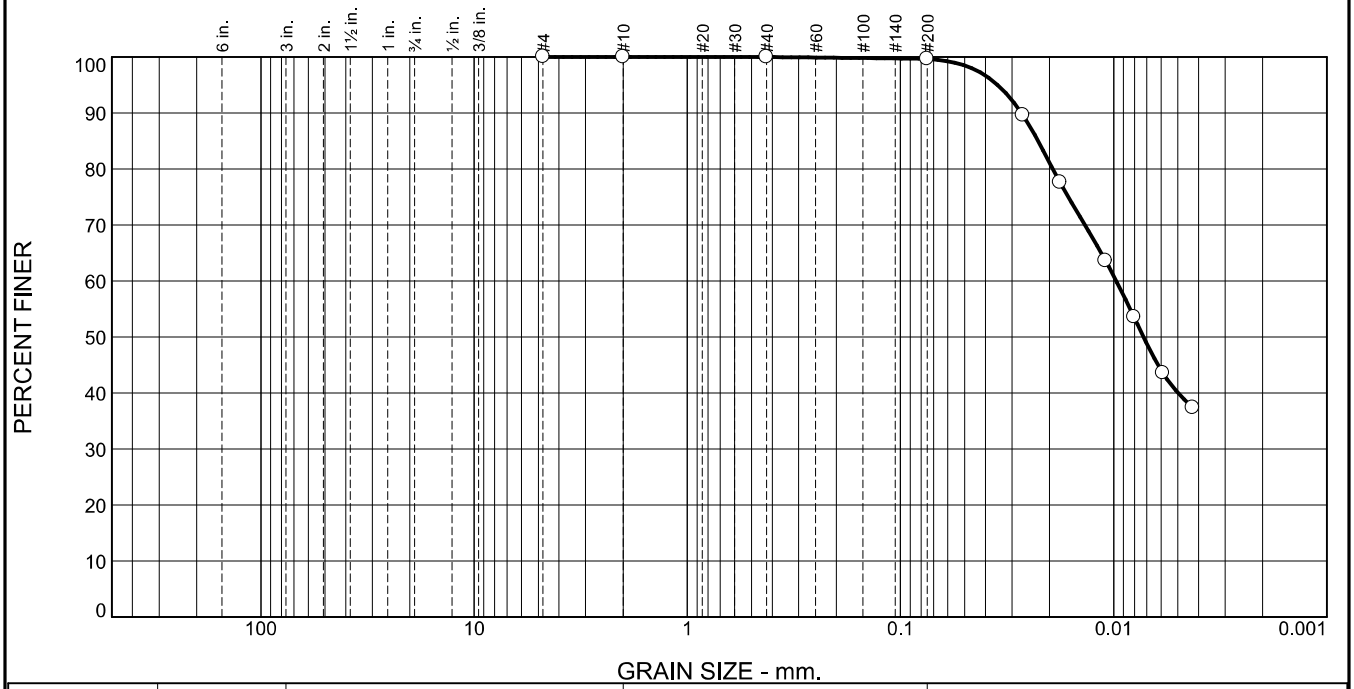
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 73

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.3	59.6	40.0

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.9		
#200	99.6		
0.0267 mm.	89.6		
0.0179 mm.	77.6		
0.0109 mm.	63.6		
0.0080 mm.	53.5		
0.0059 mm.	43.5		
0.0043 mm.	37.4		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN-GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND, DAMP

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 24 **PI=** 5

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0271 D_{85}= 0.0227 D_{60}= 0.0097
D_{50}= 0.0072 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-070-0-20 **Depth:** 58.5-60.0 FT **Date Sampled:**

Sample Number: SS-18

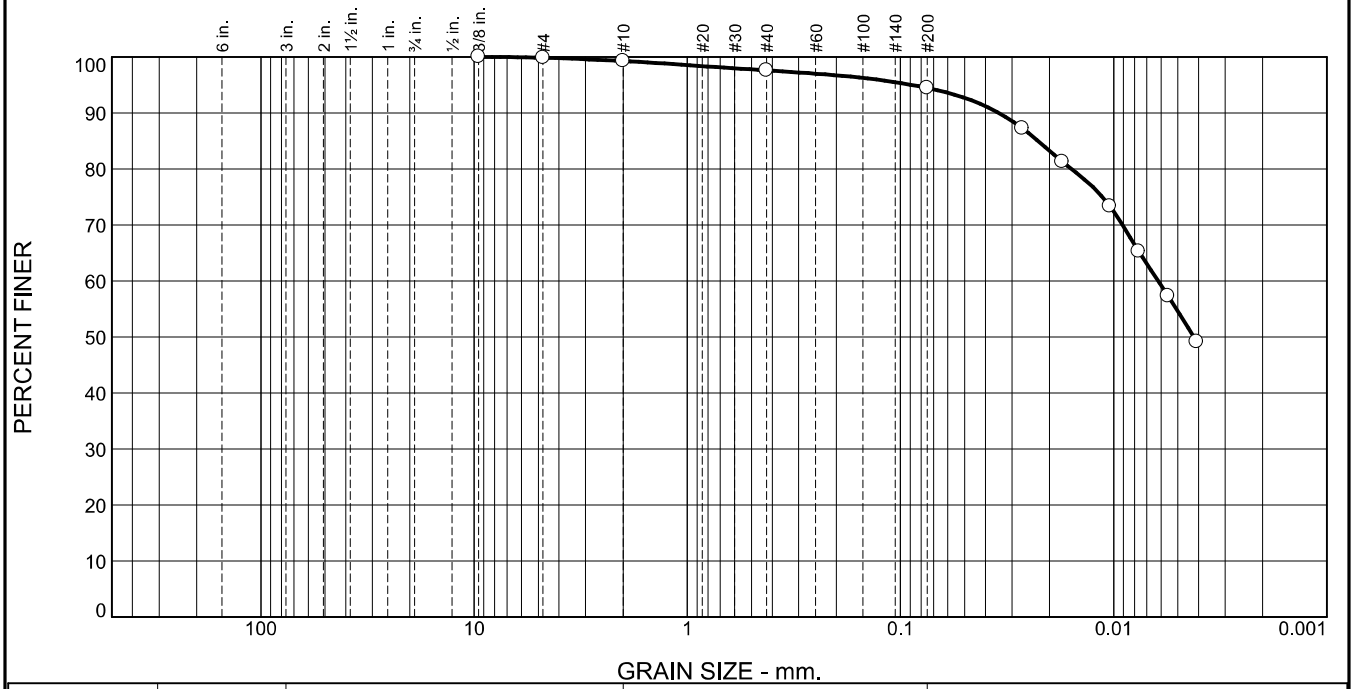
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 74

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.8	1.6	3.2	39.8	54.6

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.8		
#10	99.2		
#40	97.6		
#200	94.4		
0.0268 mm.	87.2		
0.0174 mm.	81.3		
0.0104 mm.	73.3		
0.0076 mm.	65.3		
0.0056 mm.	57.3		
0.0041 mm.	49.1		

* (no specification provided)

Material Description

SOFT, GRAY-BROWN CLAY AND SILT, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 29 **PI=** 10

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0347 D_{85}= 0.0227 D_{60}= 0.0062
D_{50}= 0.0042 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-070-0-20 **Depth:** 88.5-90.0 FT **Date Sampled:**

Sample Number: SS-24

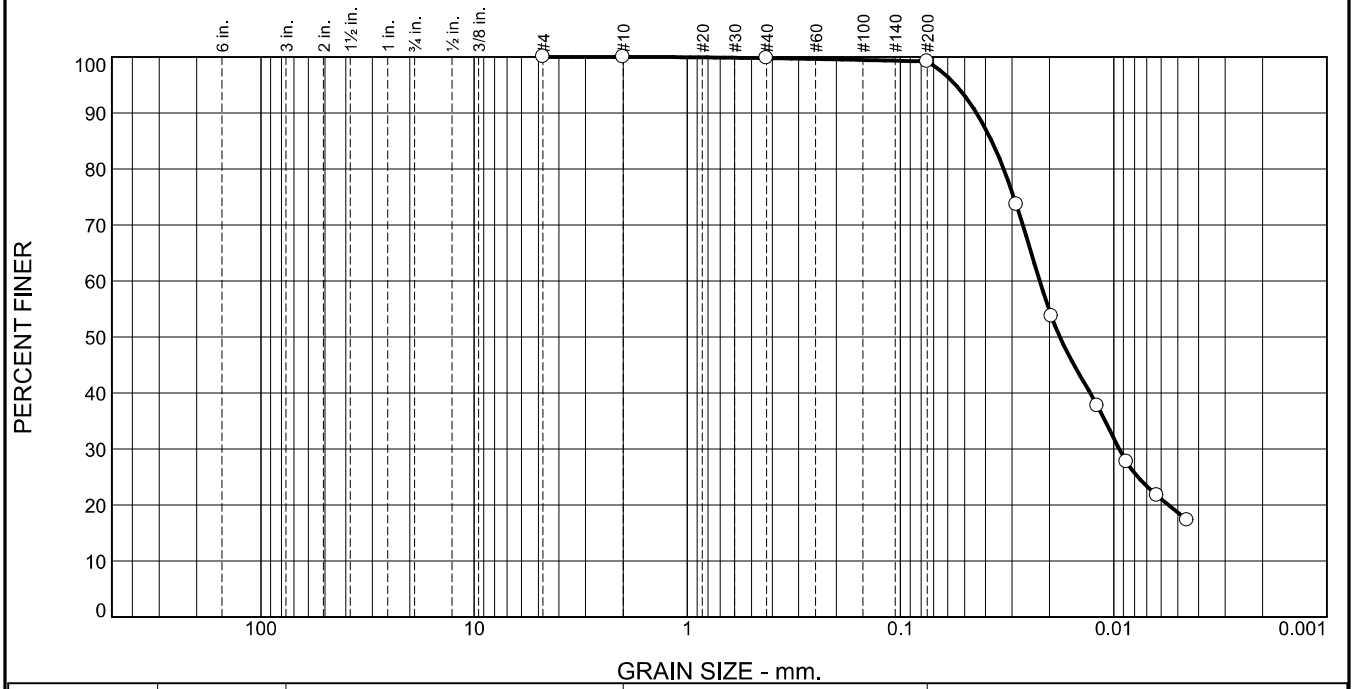
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 75

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	0.6	80.6	18.6

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.8		
#200	99.2		
0.0286 mm.	73.6		
0.0196 mm.	53.7		
0.0119 mm.	37.7		
0.0087 mm.	27.7		
0.0063 mm.	21.7		
0.0045 mm.	17.3		

* (no specification provided)

Material Description

GRAY-BROWN TO GRAY SILT, LITTLE CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 22 **PI=** 3

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0441 D_{85}= 0.0374 D_{60}= 0.0222
D_{50}= 0.0179 D_{30}= 0.0094 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-070-0-20 **Depth:** 21.0-23.0 FT **Date Sampled:**

Sample Number: ST-9

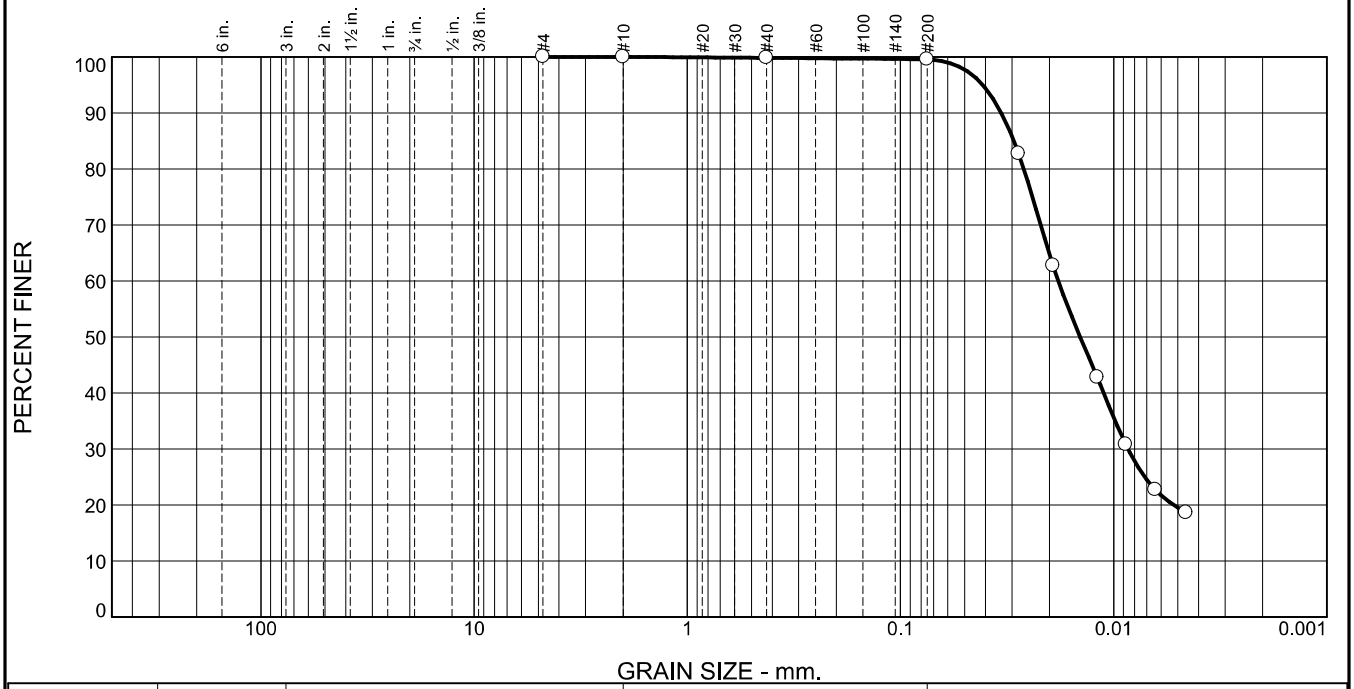
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 76

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	0.2	80.1	19.5

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.8		
#200	99.6		
0.0279 mm.	82.7		
0.0192 mm.	62.7		
0.0119 mm.	42.8		
0.0088 mm.	30.8		
0.0064 mm.	22.7		
0.0046 mm.	18.6		

* (no specification provided)

Material Description

GRAY-BROWN SILT, LITTLE CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 25 **PI=** 4

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0337 D_{85}= 0.0294 D_{60}= 0.0182
D_{50}= 0.0144 D_{30}= 0.0086 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/09/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-070-0-20 **Depth:** 31.0-33.0 FT **Date Sampled:**

Sample Number: ST-12

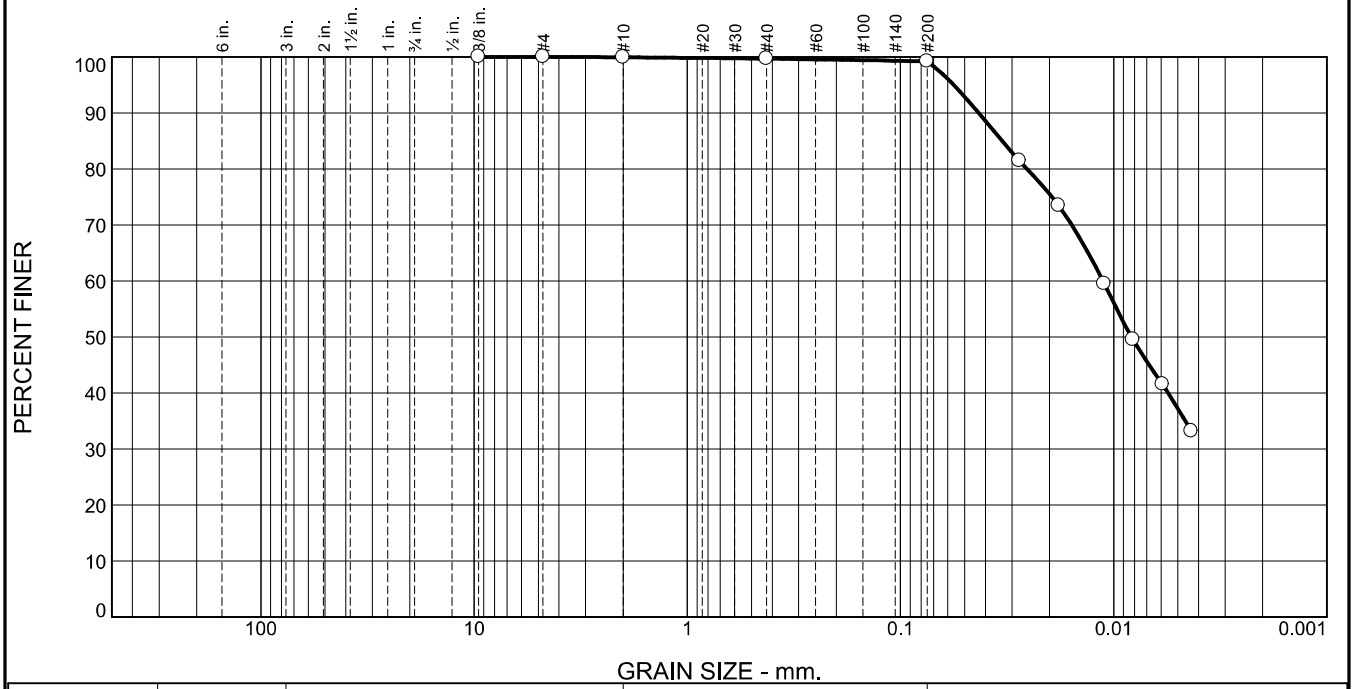
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 77

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.2	0.5	62.0	37.2

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	100.0		
#10	99.9		
#40	99.7		
#200	99.2		
0.0277 mm.	81.5		
0.0181 mm.	73.5		
0.0111 mm.	59.5		
0.0081 mm.	49.5		
0.0059 mm.	41.6		
0.0043 mm.	33.2		

* (no specification provided)

Material Description

GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 29 **PI=** 9

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0430 D_{85}= 0.0334 D_{60}= 0.0112
D_{50}= 0.0083 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-070-0-20 **Depth:** 38.0-40.0 FT **Date Sampled:**

Sample Number: ST-14

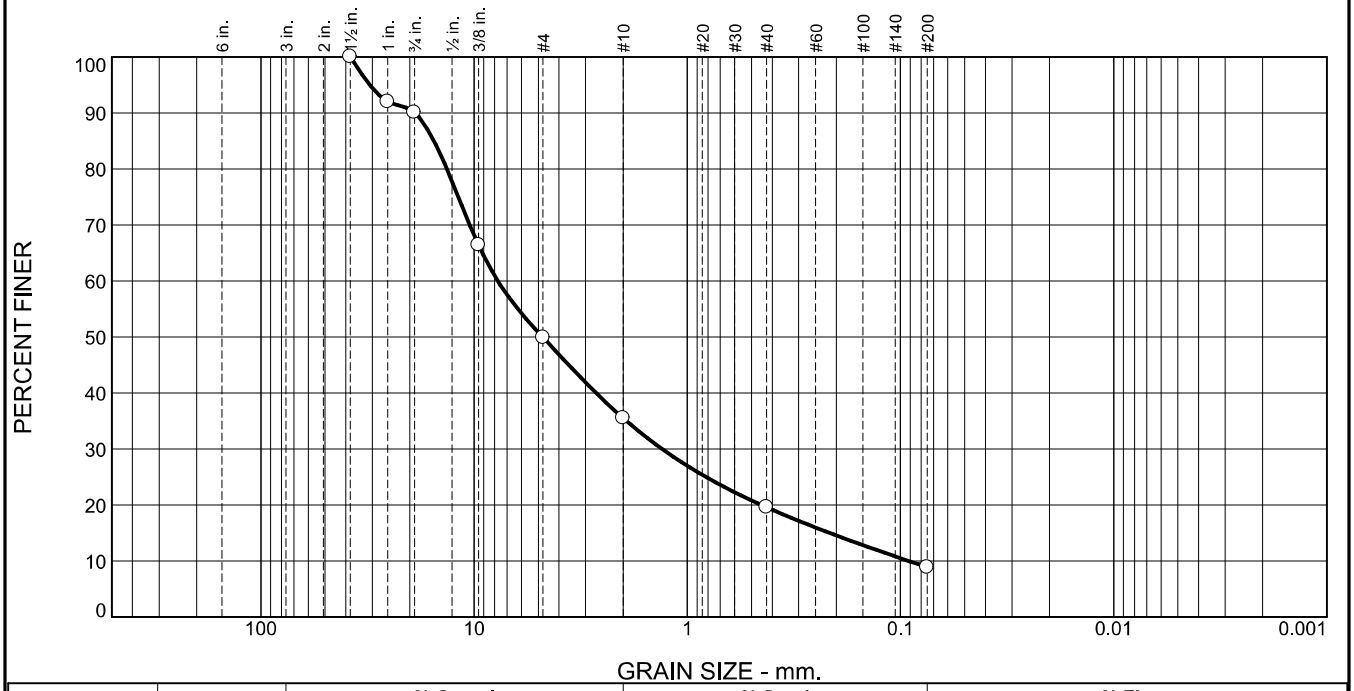
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 78

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	9.9	54.6	15.9	10.7	8.9	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1.0"	92.0		
3/4"	90.1		
3/8"	66.4		
#4	49.9		
#10	35.5		
#40	19.6		
#200	8.9		

* (no specification provided)

Material Description

LOOSE, BROWN TO BLACK COARSE AND FINE GRAVEL, SOME COARSE AND FINE SAND, TRACE SILT AND CLAY, DRY

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= GW-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 18.9657 D_{85}= 15.4215 D_{60}= 7.7280
D_{50}= 4.7743 D_{30}= 1.3140 D_{15}= 0.2146
D_{10}= 0.0914 C_u= 84.55 C_c= 2.44

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/01/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-071-0-20 **Depth:** 1.0-2.5 FT **Date Sampled:**

Sample Number: SS-1

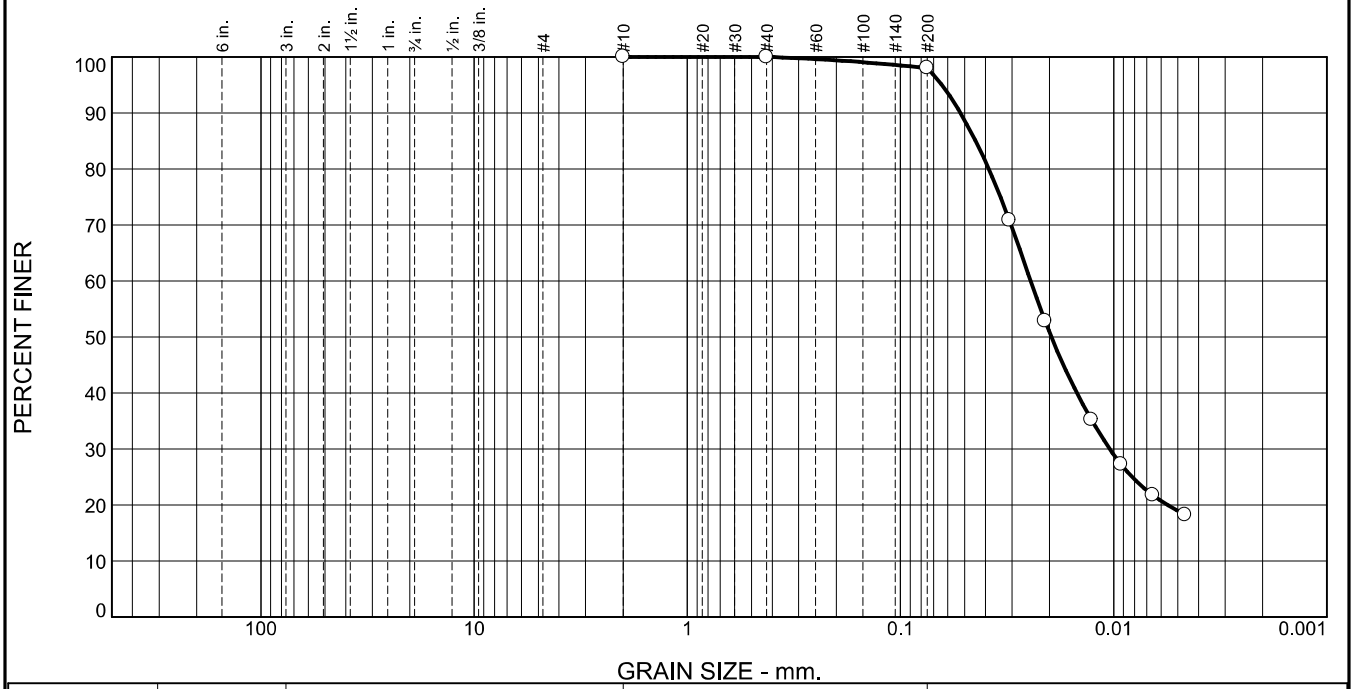
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 79

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	2.0	79.1	18.9

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#40	100.0		
#200	98.0		
0.0309 mm.	70.8		
0.0210 mm.	52.9		
0.0127 mm.	35.3		
0.0092 mm.	27.3		
0.0066 mm.	21.8		
0.0046 mm.	18.2		

* (no specification provided)

Material Description

MEDIUM STIFF, BROWN-GRAY SILT, LITTLE CLAY, TRACE FINE SAND, MOST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 19 **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0524 D_{85}= 0.0445 D_{60}= 0.0245
D_{50}= 0.0196 D_{30}= 0.0105 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-071-0-20 **Depth:** 18.5-20.0 FT **Date Sampled:**

Sample Number: SS-8

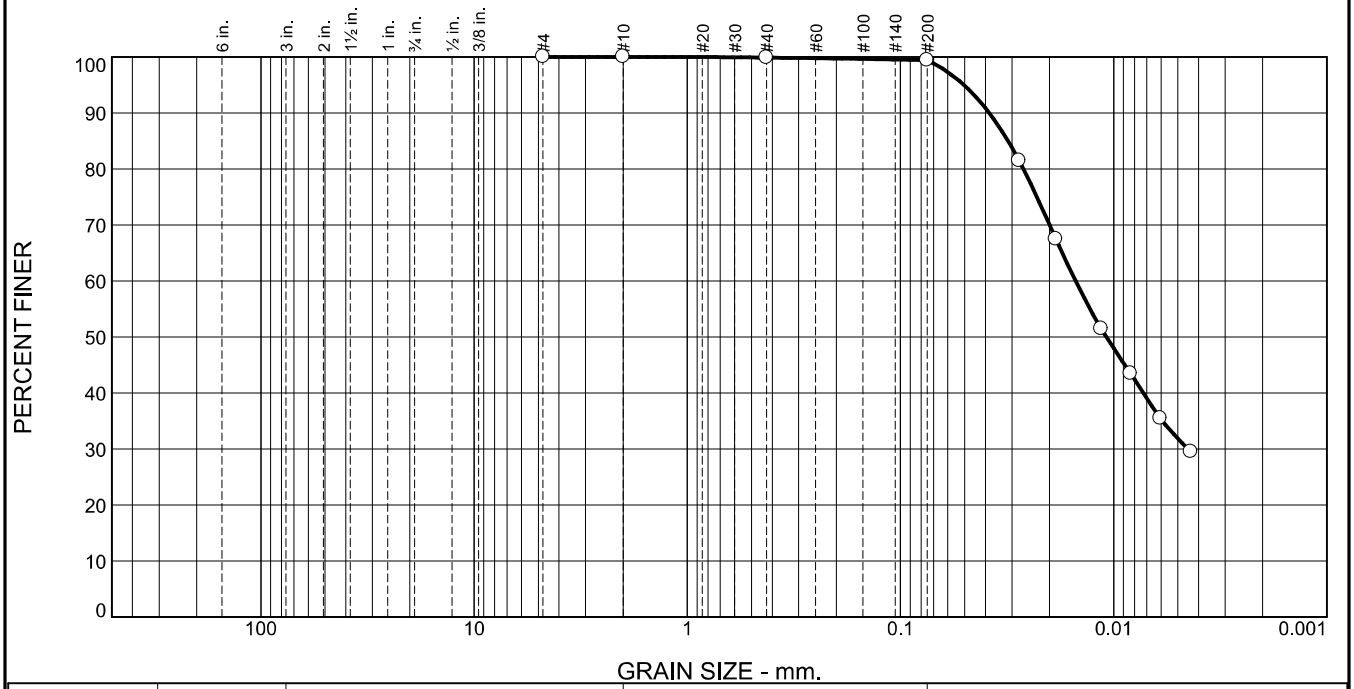
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 80

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.5	67.6	31.8

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.9		
#200	99.4		
0.0278 mm.	81.5		
0.0187 mm.	67.5		
0.0115 mm.	51.5		
0.0083 mm.	43.5		
0.0060 mm.	35.5		
0.0044 mm.	29.5		

* (no specification provided)

Material Description

SOFT, BROWN SILT, SOME CLAY, TRACE COARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 21 **PI=** 2

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0384 D_{85}= 0.0314 D_{60}= 0.0151
D_{50}= 0.0108 D_{30}= 0.0045 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/07/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-071-0-20 **Depth:** 28.5-30.0 FT **Date Sampled:**

Sample Number: SS-12

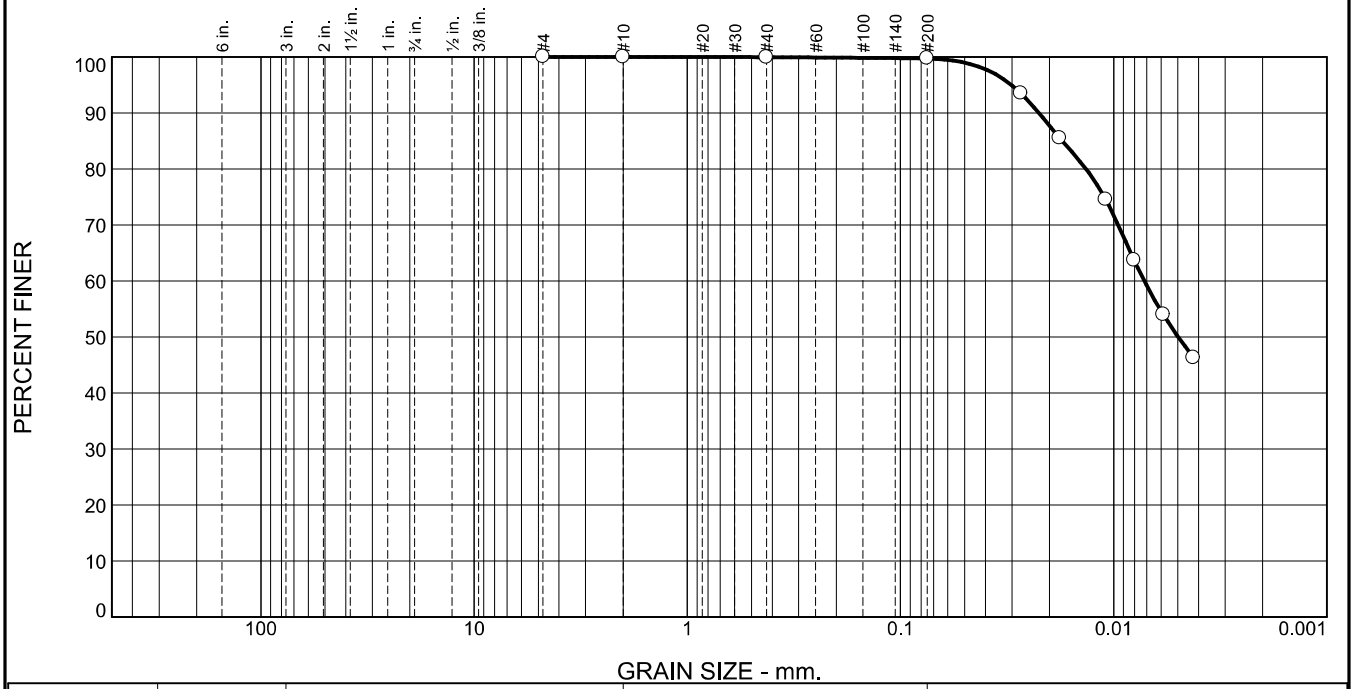
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 81

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	0.2	49.6	50.1

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.9		
#200	99.7		
0.0273 mm.	93.5		
0.0180 mm.	85.5		
0.0109 mm.	74.5		
0.0080 mm.	63.7		
0.0059 mm.	54.0		
0.0042 mm.	46.3		

* (no specification provided)

Material Description

SOFT, BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, DAMP

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 25 **PI=** 6

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0225 D_{85}= 0.0175 D_{60}= 0.0072
D_{50}= 0.0050 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

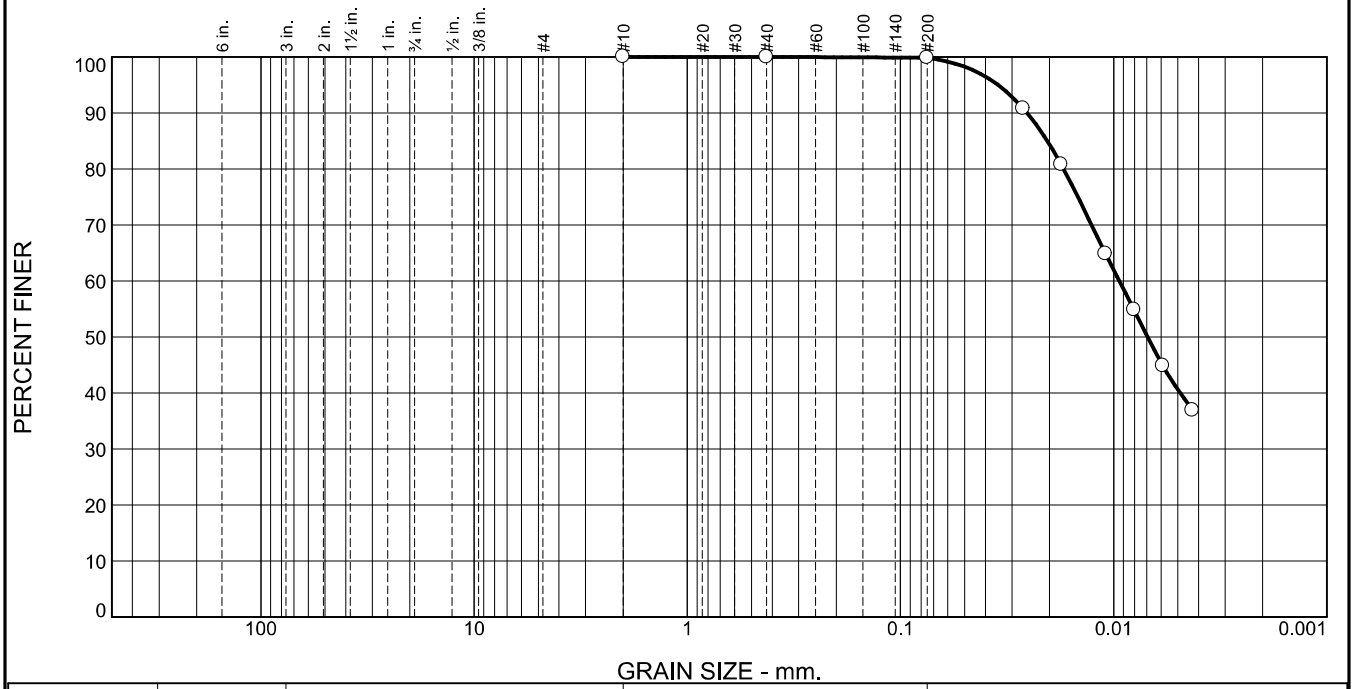
Source of Sample: B-071-0-20 **Depth:** 38.5-40.0 FT **Date Sampled:**
Sample Number: SS-15

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 82

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	0.2	59.2	40.6

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#40	100.0		
#200	99.8		
0.0266 mm.	90.8		
0.0177 mm.	80.8		
0.0109 mm.	64.8		
0.0080 mm.	54.8		
0.0059 mm.	44.9		
0.0043 mm.	36.9		

* (no specification provided)

Material Description

SOFT, BROWN SILT AND CLAY, TRACE FINE SAND, DAMP

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 27 **PI=** 7

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0255 D_{85}= 0.0205 D_{60}= 0.0094
D_{50}= 0.0069 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-071-0-20 **Depth:** 58.5-60.0 FT **Date Sampled:**

Sample Number: SS-20

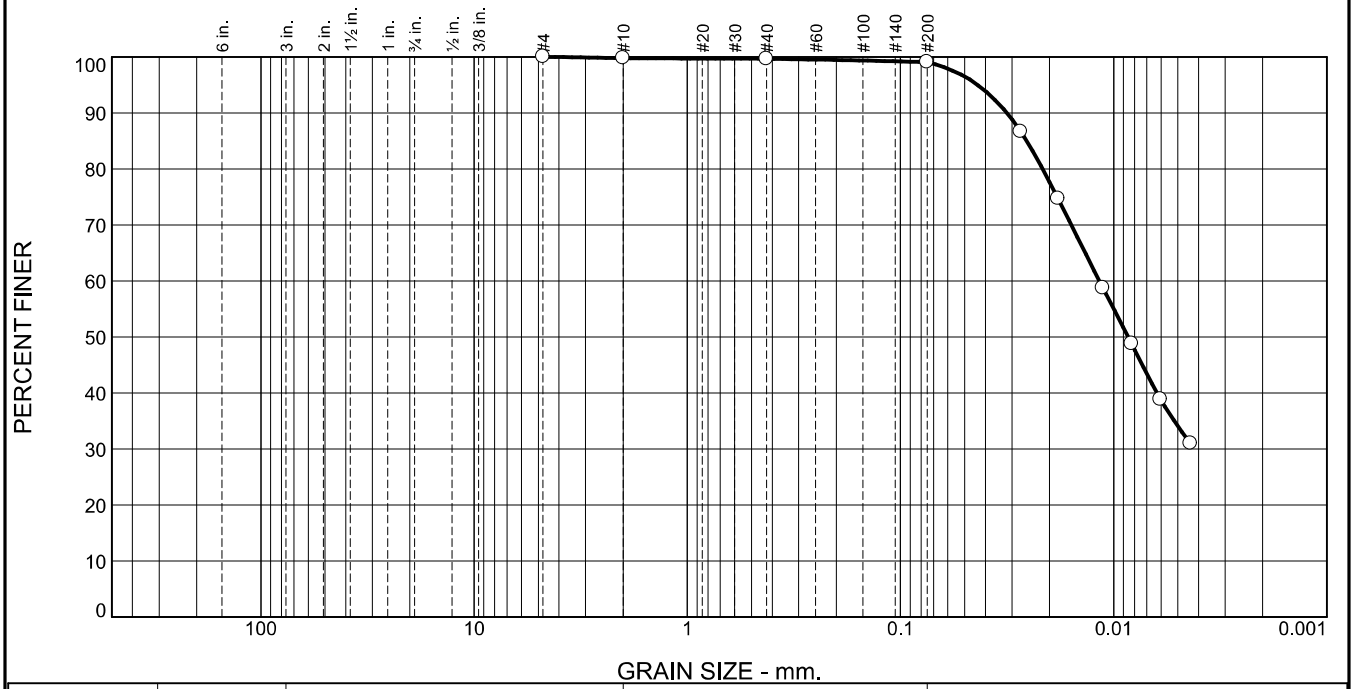
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 83

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.2	0.6	65.0	34.0

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.8		
#40	99.6		
#200	99.0		
0.0273 mm.	86.6		
0.0183 mm.	74.7		
0.0112 mm.	58.8		
0.0082 mm.	48.8		
0.0060 mm.	38.8		
0.0044 mm.	31.0		

* (no specification provided)

Material Description

SOFT, BROWN SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, DAMPL

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 23 **PI=** 2

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0318 D_{85}= 0.0256 D_{60}= 0.0117
D_{50}= 0.0086 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/04/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-071-0-20 **Depth:** 73.5-75.0 FT **Date Sampled:**

Sample Number: SS-23

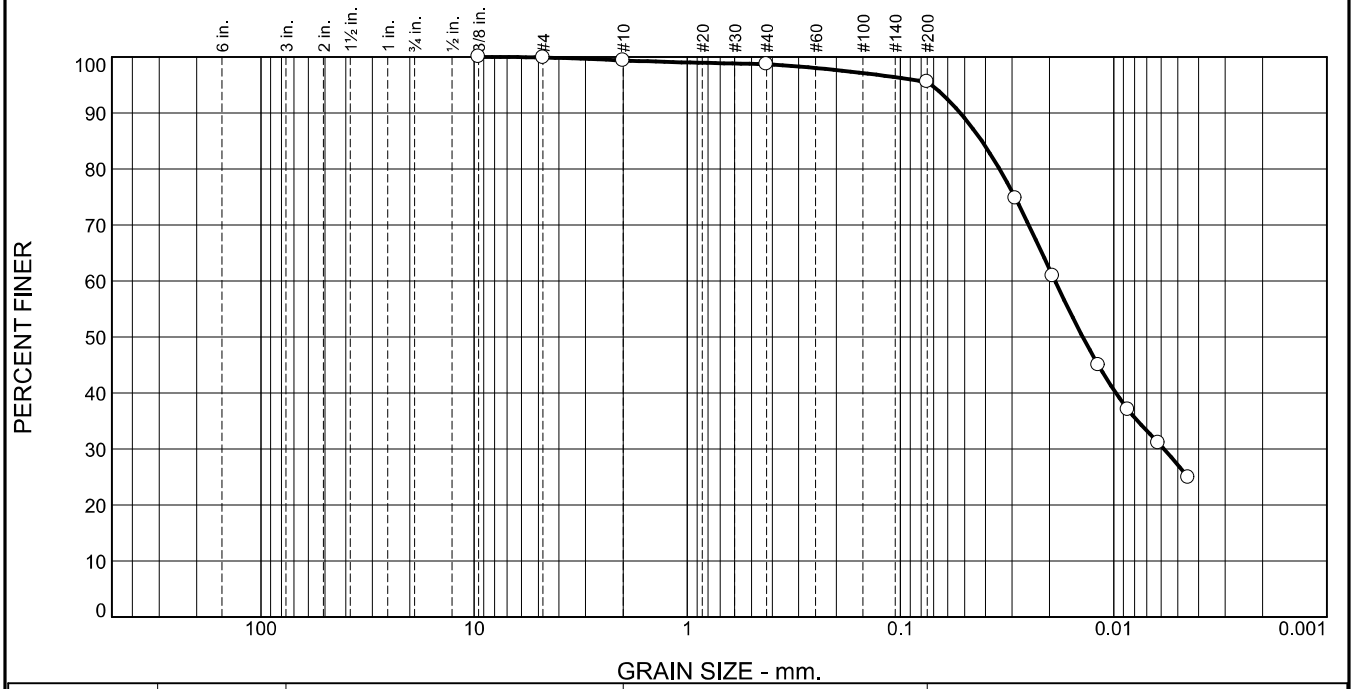
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 84

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.7	0.6	3.2	68.4	27.1

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	99.9		
#10	99.3		
#40	98.7		
#200	95.5		
0.0289 mm.	74.8		
0.0193 mm.	60.9		
0.0118 mm.	45.0		
0.0086 mm.	37.0		
0.0062 mm.	31.1		
0.0045 mm.	24.9		

* (no specification provided)

Material Description

BROWN TO GROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 23 **PI=** 4

Classification

USCS (D 2487)= CL-ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0525 D_{85}= 0.0417 D_{60}= 0.0189
D_{50}= 0.0140 D_{30}= 0.0058 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/06/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-071-0-20 **Depth:** 26.0-28.0 FT **Date Sampled:**

Sample Number: ST-11

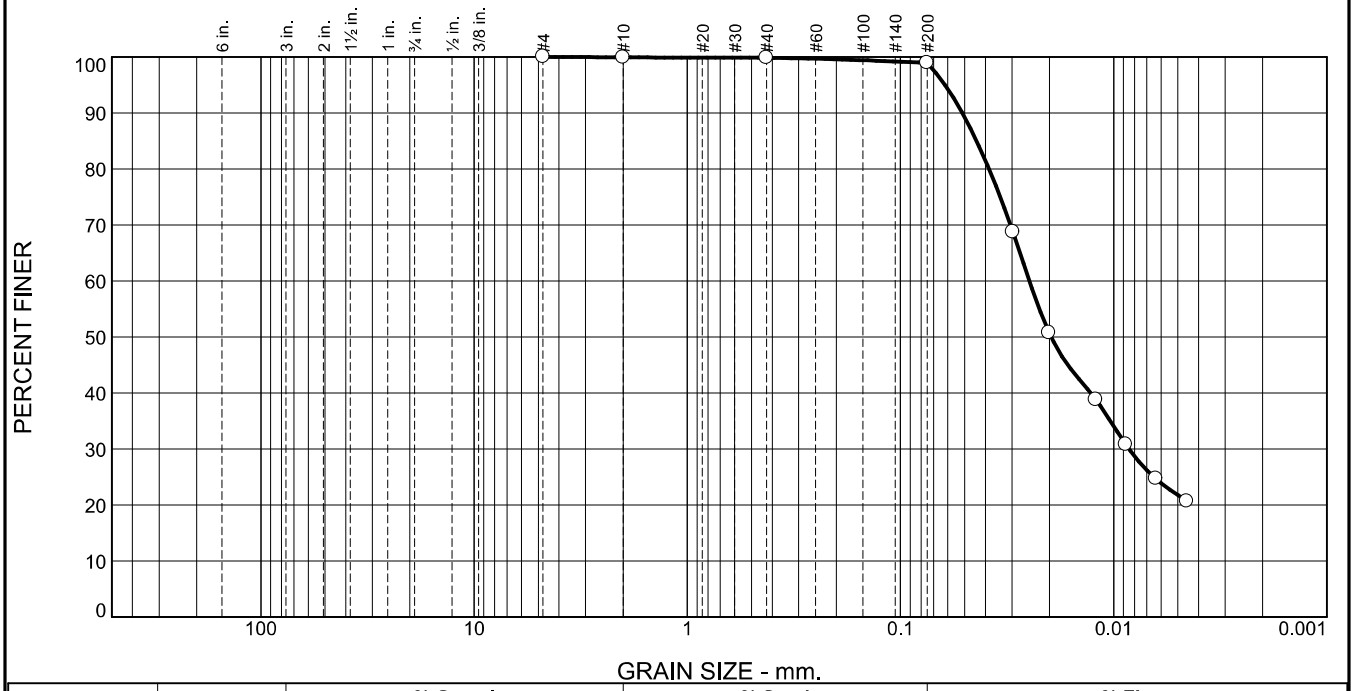
TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 85

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.1	0.9	77.2	21.7

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.8		
#200	98.9		
0.0297 mm.	68.7		
0.0201 mm.	50.8		
0.0121 mm.	38.8		
0.0088 mm.	30.8		
0.0063 mm.	24.7		
0.0045 mm.	20.7		

* (no specification provided)

Material Description

BROWN TO BROWN-GRAY SILT, SOME CLAY, TRACE FCOARSE AND FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 22 **PI=** 3

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4b

Coefficients

D_{90}= 0.0513 D_{85}= 0.0440 D_{60}= 0.0249
D_{50}= 0.0197 D_{30}= 0.0085 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/09/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

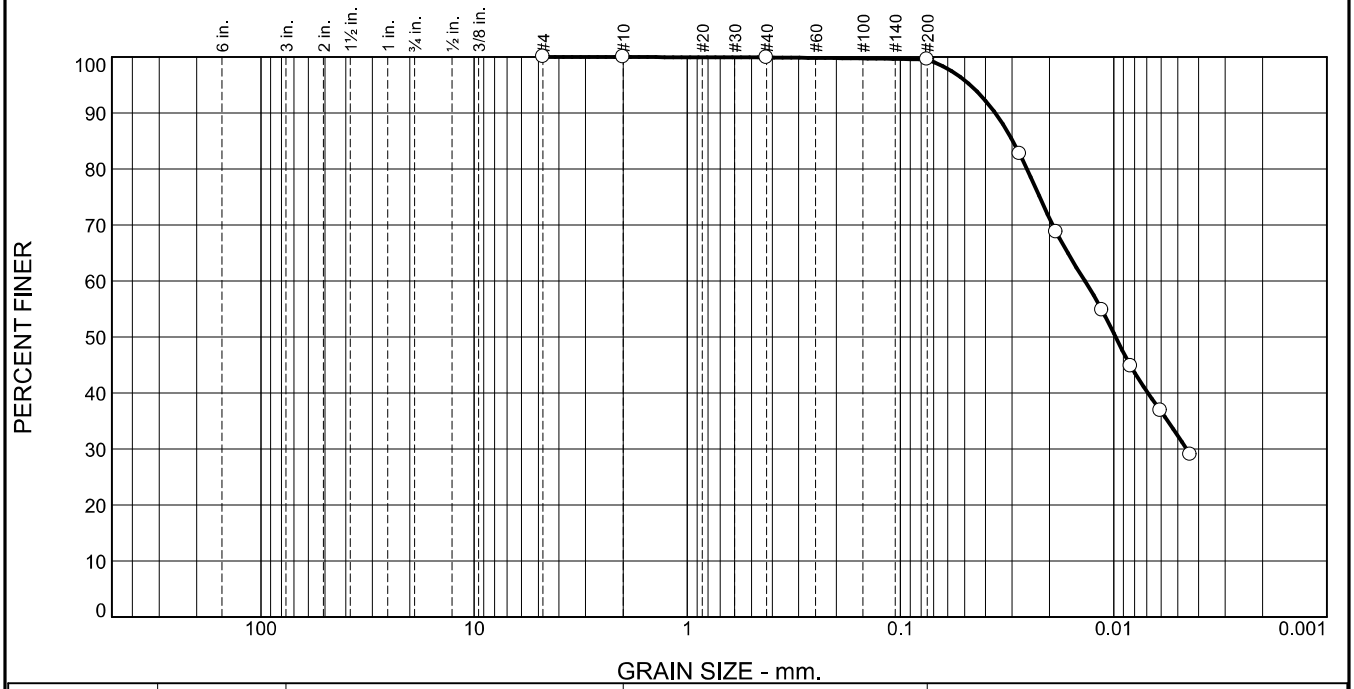
Source of Sample: B-071-0-20 **Depth:** 36.0-38.0 FT **Date Sampled:**
Sample Number: ST-14

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 86

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.0	0.4	67.2	32.3

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	99.9		
#200	99.5		
0.0277 mm.	82.7		
0.0186 mm.	68.7		
0.0114 mm.	54.8		
0.0083 mm.	44.8		
0.0060 mm.	36.9		
0.0044 mm.	29.0		

* (no specification provided)

Material Description

BROWN-GRAY SILT, SOME CLAY, TRACE FINE SAND, MOIST

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 33 **PI=** 12

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-6a

Coefficients

D_{90}= 0.0361 D_{85}= 0.0298 D_{60}= 0.0137
D_{50}= 0.0098 D_{30}= 0.0046 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 04/03/22

Tested By: T. THURSTON

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

Source of Sample: B-071-0-20 **Depth:** 41.0-43.0 FT **Date Sampled:**

Sample Number: ST-16

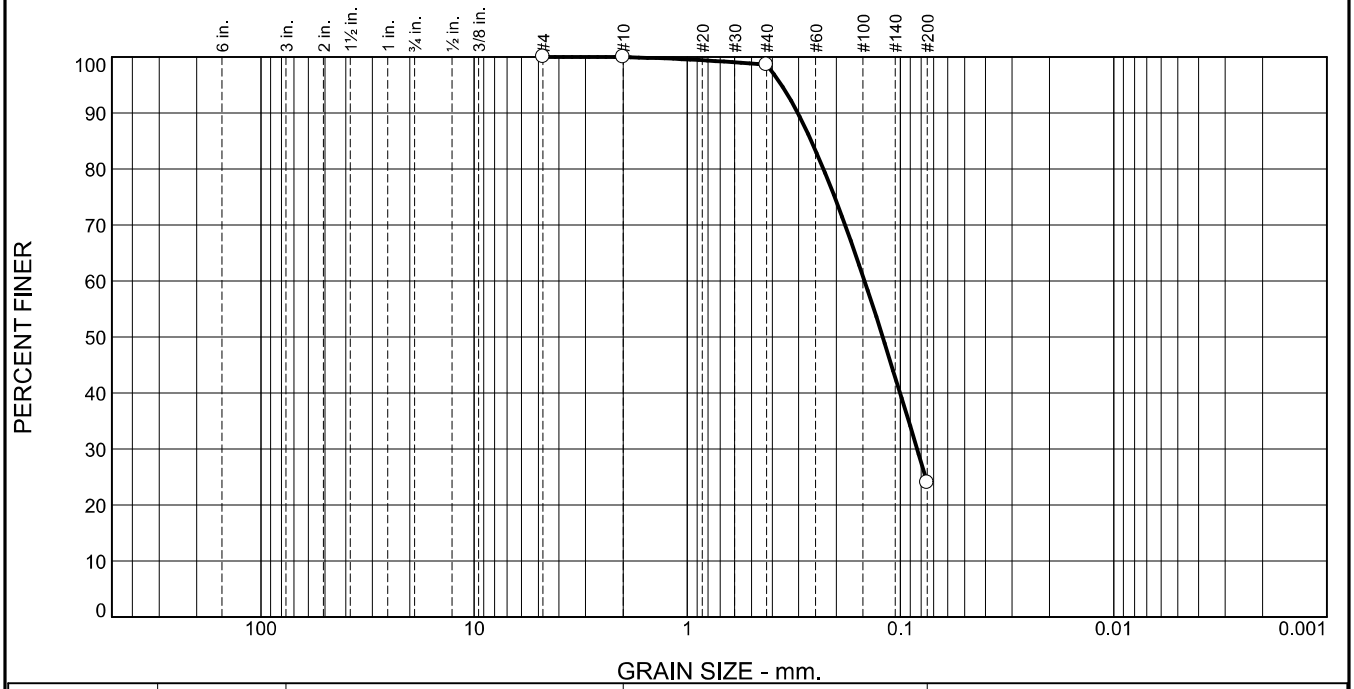
TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 87

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.3	74.6	24.0	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#40	98.6		
#200	24.0		

* (no specification provided)

Material Description

BROWN COARSE AND FINE SAND, SOME SILT AND CLAY, DAMP

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.3038 D_{85}= 0.2622 D_{60}= 0.1476
D_{50}= 0.1213 D_{30}= 0.0836 D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

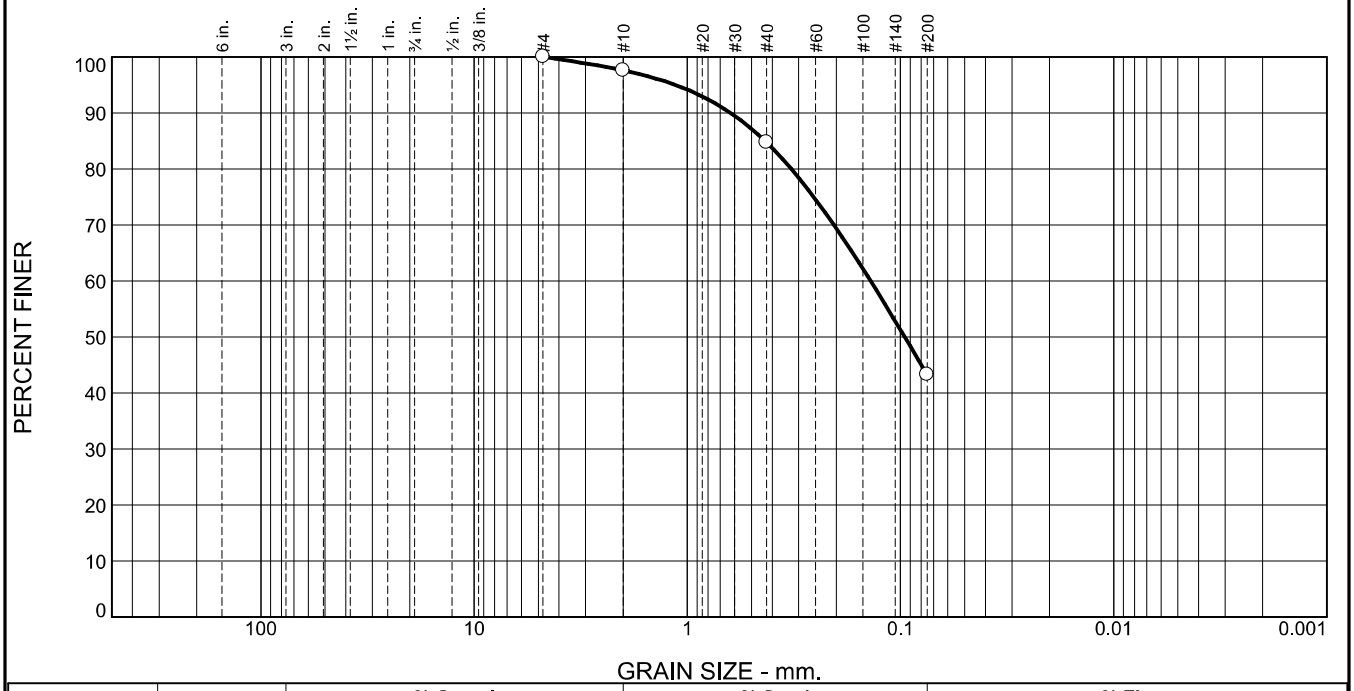
Source of Sample: B-072-0-20 **Depth:** 18.5-20.0 FT **Date Sampled:**
Sample Number: S-5

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 88

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	2.4	12.9	41.4	43.3	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.6		
#40	84.7		
#200	43.3		

* (no specification provided)

Material Description

BROWN COARSE AND FINE SAND AND SILT AND CLAY, TRACE FINE GRAVEL, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4a

Coefficients

D_{90}= 0.6286 D_{85}= 0.4326 D_{60}= 0.1382
D_{50}= 0.0955 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

Title: Geotechnical Practice Lead

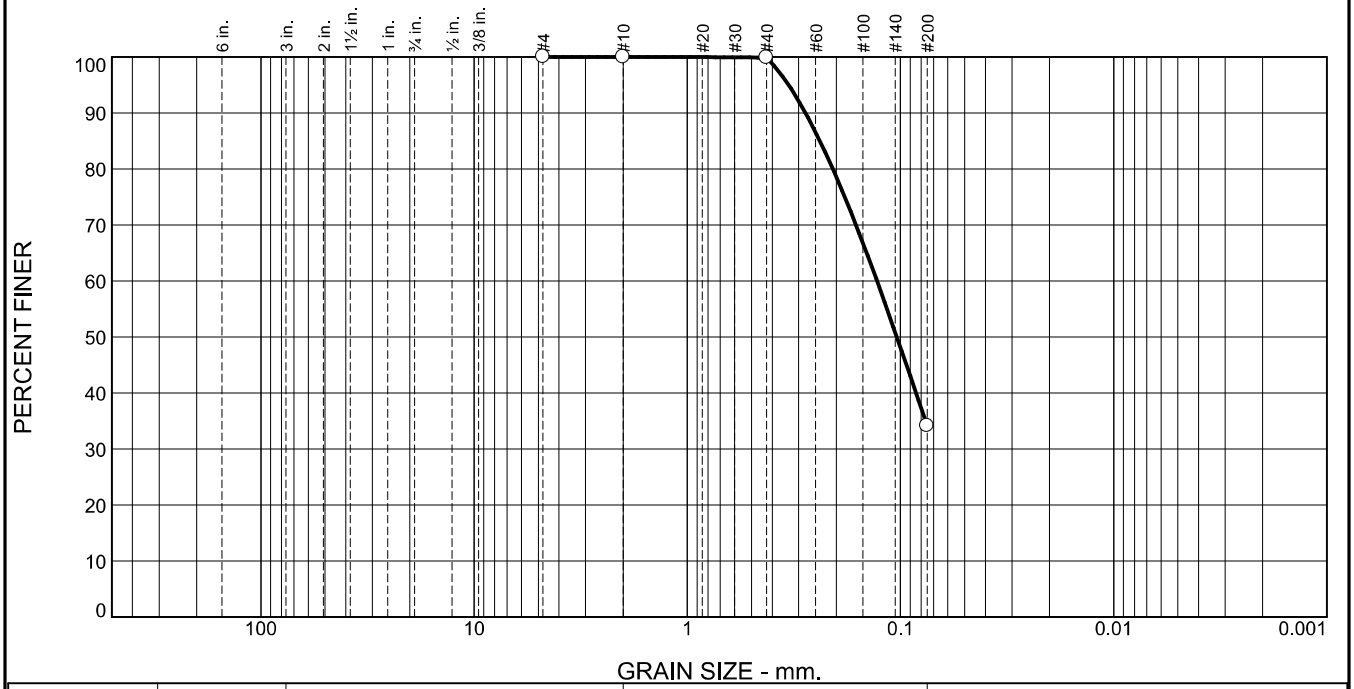
Source of Sample: B-073-0-20 **Depth:** 3.5-5.0 FT **Date Sampled:**
Sample Number: S-2

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 89

Particle Size Distribution Report



% Boulders	% +3"	% Gravel		% Sand		% Fines	
		Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	65.7	34.2	

Test Results (AASHTO T 27 & AASHTO T 11)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#40	99.9		
#200	34.2		

* (no specification provided)

Material Description

BROWN COARSE AND FINE SAND, SOME SILT AND CLAY, MOIST

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.2793 D_{85}= 0.2391 D_{60}= 0.1290
D_{50}= 0.1041 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Date Received: _____ **Date Tested:** 12/21/21

Tested By: C. ZIELKE

Checked By: Shawn McGee

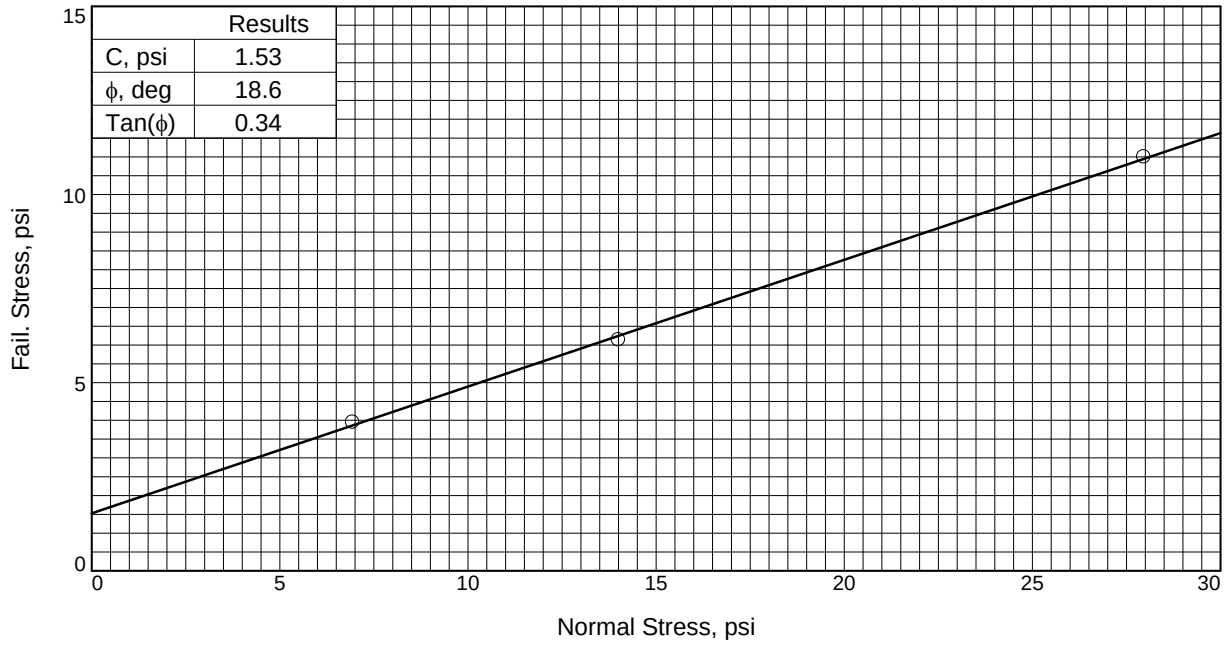
Title: Geotechnical Practice Lead

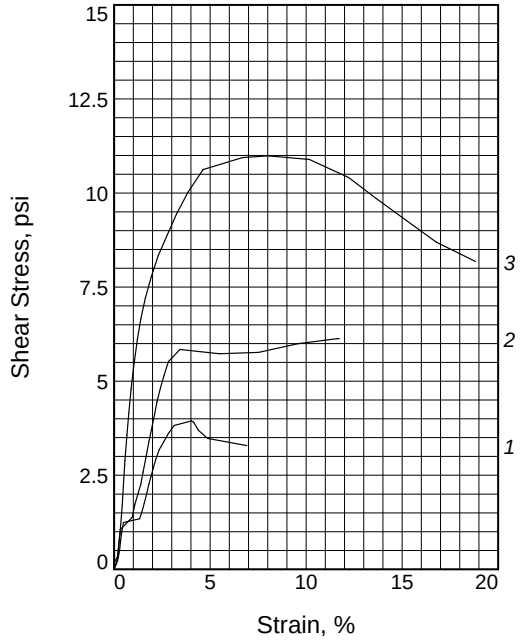
Source of Sample: B-073-0-20 **Depth:** 18.5-20.0 FT **Date Sampled:**
Sample Number: S-5

TRC Engineers, Inc. Mt. Laurel, NJ

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21

Project No: 301525.1000 **Figure** 90





Sample No.		1	2	3
Initial	Water Content, %	26.3	28.2	28.7
	Dry Density, pcf	99.1	94.9	95.7
	Saturation, %	96.8	94.0	97.5
	Void Ratio	0.7577	0.8360	0.8202
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.981	0.976	1.000
At Test	Water Content, %	27.9	31.3	30.3
	Dry Density, pcf	100.4	99.9	102.1
	Saturation, %	105.9	117.4	119.6
	Void Ratio	0.7341	0.7430	0.7067
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.967	0.926	0.938
Normal Stress, psi		6.94	14.01	27.97
Fail. Stress, psi		3.94	6.13	10.99
Strain, %		4.0	11.6	8.0
Ult. Stress, psi				
Strain, %				
Strain rate, in./min.		0.001	0.001	0.001

Sample Type: TRIMMED
Description: GRAY-BROWN SILT AND CLAY

LL= 29 **PL=** 21 **PI=** 8
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 91

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-041-0-20 **Depth:** 12.5-14.5 FT
Sample Number: ST-6
Proj. No.: 301525.1000 **Date Sampled:**

DIRECT SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22

DIRECT SHEAR TEST

1/22/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-041-0-20
Depth: 12.5-14.5 FT **Sample Number:** ST-6
Description: GRAY-BROWN SILT AND CLAY
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**29 **PL=**21 **PI=**8

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	355.740		321.580
Moisture content: Dry soil+tare, gms.	322.850		286.730
Moisture content: Tare, gms.	197.760		161.640
Moisture, %	26.3	27.9	27.9
Moist specimen weight, gms.	157.98		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.981	0.967	
Net decrease in height, in.		0.013	
Wet density, pcf	125.1	128.4	
Dry density, pcf	99.1	100.4	
Void ratio	0.7577	0.7341	
Saturation, %	96.8	105.9	

Test Readings for Specimen No. 1

Normal stress = 6.94 psi
Strain rate, in./min. = 0.001
Fail. Stress = 3.94 psi **at reading no.** 18

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.1	60.1	39.8

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.417	0.0	0.0	0.00
1	0.0045	1.517	1.1	0.2	0.22
2	0.0070	2.867	2.5	0.3	0.50
3	0.0085	4.261	3.8	0.3	0.78
4	0.0100	5.383	5.0	0.4	1.01
5	0.0121	6.520	6.1	0.5	1.24
6	0.0331	7.000	6.6	1.3	1.34
7	0.0361	7.870	7.5	1.4	1.52
8	0.0391	9.033	8.6	1.6	1.76
9	0.0421	10.192	9.8	1.7	1.99
10	0.0451	11.488	11.1	1.8	2.26
11	0.0481	12.551	12.1	1.9	2.47
12	0.0511	13.709	13.3	2.0	2.71
13	0.0541	14.737	14.3	2.2	2.92
14	0.0586	16.013	15.6	2.3	3.18

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
15	0.0646	17.072	16.7	2.6	3.40
16	0.0707	18.125	17.7	2.8	3.61
17	0.0782	19.160	18.7	3.1	3.82
18	0.1007	19.754	19.3	4.0	3.94
19	0.1037	19.582	19.2	4.1	3.91
20	0.1097	18.549	18.1	4.4	3.70
21	0.1217	17.489	17.1	4.9	3.48
22	0.1727	16.540	16.1	6.9	3.29

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	357.290		312.040
Moisture content: Dry soil+tare, gms.	323.820		274.890
Moisture content: Tare, gms.	204.960		156.030
Moisture, %	28.2	31.3	31.3
Moist specimen weight, gms.	152.33		
Diameter, in.	2.496	2.496	
Area, in.²	4.893	4.893	
Height, in.	0.976	0.926	
Net decrease in height, in.		0.049	
Wet density, pcf	121.6	131.2	
Dry density, pcf	94.9	99.9	
Void ratio	0.8360	0.7430	
Saturation, %	94.0	117.4	

Test Readings for Specimen No. 2

Normal stress = 14.01 psi

Strain rate, in./min. = 0.001

Fail. Stress = 6.13 psi **at reading no.** 21

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.118	0.0	0.0	0.00
1	0.0005	1.071	1.0	0.0	0.19
2	0.0045	1.804	1.7	0.2	0.34
3	0.0060	3.369	3.3	0.2	0.66
4	0.0080	5.277	5.2	0.3	1.05
5	0.0236	6.881	6.8	0.9	1.38
6	0.0271	8.588	8.5	1.1	1.73
7	0.0346	11.173	11.1	1.4	2.26
8	0.0376	12.758	12.6	1.5	2.58
9	0.0421	15.061	14.9	1.7	3.05
10	0.0451	16.664	16.5	1.8	3.38
11	0.0496	18.797	18.7	2.0	3.82
12	0.0526	20.313	20.2	2.1	4.13
13	0.0556	21.883	21.8	2.2	4.45
14	0.0601	23.688	23.6	2.4	4.82
15	0.0646	25.257	25.1	2.6	5.14
16	0.0706	27.125	27.0	2.8	5.52

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
17	0.0856	28.704	28.6	3.4	5.84
18	0.1367	28.157	28.0	5.5	5.73
19	0.1877	28.325	28.2	7.5	5.76
20	0.2387	29.448	29.3	9.6	5.99
21	0.2898	30.104	30.0	11.6	6.13
22	0.2928	30.117	30.0	11.7	6.13

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	268.470		336.280
Moisture content: Dry soil+tare, gms.	233.220		299.010
Moisture content: Tare, gms.	110.220		176.010
Moisture, %	28.7	30.3	30.3
Moist specimen weight, gms.	158.25		
Diameter, in.	2.497	2.497	
Area, in.²	4.897	4.897	
Height, in.	1.000	0.938	
Net decrease in height, in.		0.062	
Wet density, pcf	123.1	133.0	
Dry density, pcf	95.7	102.1	
Void ratio	0.8202	0.7067	
Saturation, %	97.5	119.6	

Test Readings for Specimen No. 3

Normal stress = 27.97 psi

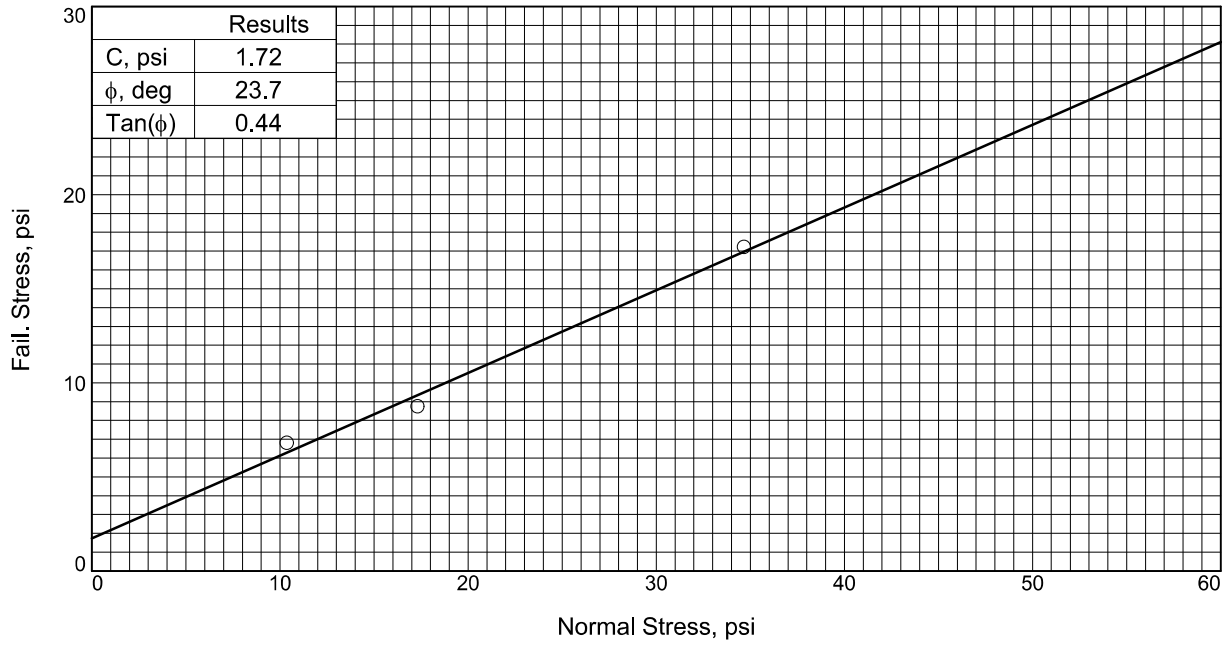
Strain rate, in./min. = 0.001

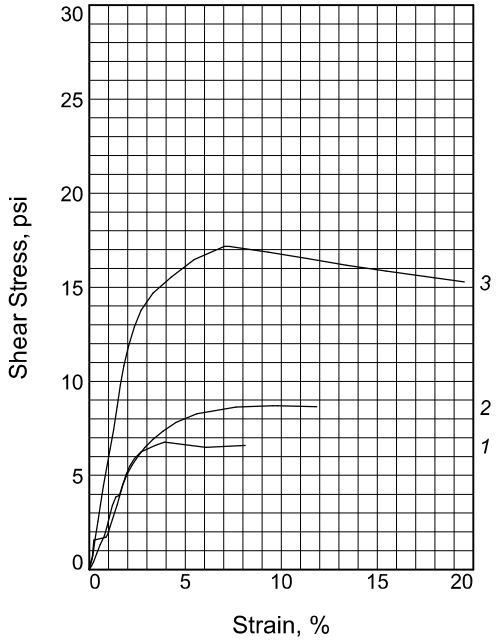
Fail. Stress = 10.99 psi **at reading no.** 22

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.247	0.0	0.0	0.00
1	0.0005	0.734	0.5	0.0	0.10
2	0.0025	0.986	0.7	0.1	0.15
3	0.0045	1.825	1.6	0.2	0.32
4	0.0075	4.921	4.7	0.3	0.95
5	0.0105	8.585	8.3	0.4	1.70
6	0.0120	11.343	11.1	0.5	2.27
7	0.0140	14.406	14.2	0.6	2.89
8	0.0165	17.712	17.5	0.7	3.57
9	0.0191	20.562	20.3	0.8	4.15
10	0.0221	23.684	23.4	0.9	4.79
11	0.0251	26.419	26.2	1.0	5.34
12	0.0301	30.121	29.9	1.2	6.10
13	0.0346	32.826	32.6	1.4	6.65
14	0.0406	35.532	35.3	1.6	7.21
15	0.0481	38.273	38.0	1.9	7.77
16	0.0571	41.033	40.8	2.3	8.33
17	0.0691	43.784	43.5	2.8	8.89
18	0.0811	46.496	46.2	3.2	9.44

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
19	0.0962	49.351	49.1	3.9	10.03
20	0.1157	52.267	52.0	4.6	10.62
21	0.1667	53.837	53.6	6.7	10.94
22	0.1997	54.060	53.8	8.0	10.99
23	0.2027	54.034	53.8	8.1	10.98
24	0.2538	53.590	53.3	10.2	10.89
25	0.3048	51.244	51.0	12.2	10.41
26	0.3409	48.494	48.2	13.7	9.85
27	0.3799	45.648	45.4	15.2	9.27
28	0.4189	42.834	42.6	16.8	8.70
29	0.4700	40.304	40.1	18.8	8.18





Sample No.		1	2	3
Initial	Water Content, %	22.5	22.1	23.1
	Dry Density, pcf	104.9	101.2	106.1
	Saturation, %	94.9	85.6	100.4
	Void Ratio	0.6608	0.7215	0.6412
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.981	0.976	1.000
At Test	Water Content, %	24.6	25.6	25.0
	Dry Density, pcf	106.1	107.5	112.9
	Saturation, %	107.0	115.0	128.9
	Void Ratio	0.6417	0.6198	0.5420
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.969	0.918	0.940
Normal Stress, psi		10.41	17.35	34.71
Fail. Stress, psi		6.76	8.71	17.18
Strain, %		3.9	9.6	7.0
Ult. Stress, psi				
Strain, %				
Strain rate, in./min.		0.001	0.001	0.001

Sample Type: TRIMMED
Description: BROWN-GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE
LL= 29 **PL=** 20 **PI=** 9
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT DESCRIPTION

Figure 92

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-043-0-20 **Depth:** 16.0-18.0 FT

Sample Number: ST-7

Proj. No.: 301525.1000 **Date Sampled:**

DIRECT SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/03/22 **Checked By:** SM 04/08/22

DIRECT SHEAR TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-043-0-20
Depth: 16.0-18.0 FT **Sample Number:** ST-7
Description: BROWN-GRAY SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT DESCRIPTION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**29 **PL=**20 **PI=**9

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	359.920		318.820
Moisture content: Dry soil+tare, gms.	330.150		286.250
Moisture content: Tare, gms.	197.760		153.860
Moisture, %	22.5	24.6	24.6
Moist specimen weight, gms.	162.16		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.981	0.969	
Net decrease in height, in.		0.011	
Wet density, pcf	128.5	132.2	
Dry density, pcf	104.9	106.1	
Void ratio	0.6608	0.6417	
Saturation, %	94.9	107.0	

Test Readings for Specimen No. 1

Normal stress = 10.41 psi
Strain rate, in./min. = 0.001
Fail. Stress = 6.76 psi **at reading no.** 18

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.8	1.4	1.0	60.6	36.2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	1.381	0.0	0.0	0.00
1	0.0040	4.160	2.8	0.2	0.57
2	0.0050	6.898	5.5	0.2	1.12
3	0.0060	9.046	7.7	0.2	1.56
4	0.0216	9.805	8.4	0.9	1.72
5	0.0241	10.636	9.3	1.0	1.89
6	0.0271	12.599	11.2	1.1	2.29
7	0.0301	14.365	13.0	1.2	2.65
8	0.0331	16.174	14.8	1.3	3.02
9	0.0361	18.198	16.8	1.4	3.43
10	0.0391	20.322	18.9	1.6	3.86
11	0.0421	22.421	21.0	1.7	4.29
12	0.0451	24.296	22.9	1.8	4.67
13	0.0481	26.110	24.7	1.9	5.04

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
14	0.0526	28.303	26.9	2.1	5.49
15	0.0586	30.277	28.9	2.3	5.89
16	0.0676	32.030	30.6	2.7	6.25
17	0.0856	33.757	32.4	3.4	6.60
18	0.0977	34.555	33.2	3.9	6.76
19	0.0992	34.524	33.1	4.0	6.76
20	0.1517	33.221	31.8	6.1	6.49
21	0.2028	33.755	32.4	8.1	6.60

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	359.800		314.730
Moisture content: Dry soil+tare, gms.	331.730		282.330
Moisture content: Tare, gms.	204.960		155.560
Moisture, %	22.1	25.6	25.6
Moist specimen weight, gms.	154.84		
Diameter, in.	2.496	2.496	
Area, in.²	4.893	4.893	
Height, in.	0.976	0.918	
Net decrease in height, in.		0.058	
Wet density, pcf	123.6	135.0	
Dry density, pcf	101.2	107.5	
Void ratio	0.7215	0.6198	
Saturation, %	85.6	115.0	

Test Readings for Specimen No. 2

Normal stress = 17.35 psi

Strain rate, in./min. = 0.001

Fail. Stress = 8.71 psi **at reading no.** 21

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.303	0.0	0.0	0.00
1	0.0030	1.276	1.0	0.1	0.20
2	0.0055	2.158	1.9	0.2	0.38
3	0.0095	4.477	4.2	0.4	0.85
4	0.0140	6.784	6.5	0.6	1.32
5	0.0196	9.005	8.7	0.8	1.78
6	0.0231	11.312	11.0	0.9	2.25
7	0.0256	13.771	13.5	1.0	2.75
8	0.0301	16.963	16.7	1.2	3.40
9	0.0346	19.201	18.9	1.4	3.86
10	0.0391	19.542	19.2	1.6	3.93
11	0.0436	22.501	22.2	1.7	4.54
12	0.0496	25.270	25.0	2.0	5.10
13	0.0556	27.493	27.2	2.2	5.56
14	0.0631	29.752	29.4	2.5	6.02
15	0.0721	31.981	31.7	2.9	6.47
16	0.0827	34.141	33.8	3.3	6.92

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
17	0.0962	36.337	36.0	3.9	7.36
18	0.1127	38.585	38.3	4.5	7.82
19	0.1397	40.848	40.5	5.6	8.29
20	0.1907	42.557	42.3	7.6	8.64
21	0.2388	42.916	42.6	9.6	8.71
22	0.2448	42.905	42.6	9.8	8.71
23	0.2958	42.597	42.3	11.9	8.64

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	278.110		328.250
Moisture content: Dry soil+tare, gms.	246.640		294.080
Moisture content: Tare, gms.	110.220		157.660
Moisture, %	23.1	25.0	25.0
Moist specimen weight, gms.	167.89		
Diameter, in.	2.497	2.497	
Area, in.²	4.897	4.897	
Height, in.	1.000	0.940	
Net decrease in height, in.		0.060	
Wet density, pcf	130.6	141.2	
Dry density, pcf	106.1	112.9	
Void ratio	0.6412	0.5420	
Saturation, %	100.4	128.9	

Test Readings for Specimen No. 3

Normal stress = 34.71 psi

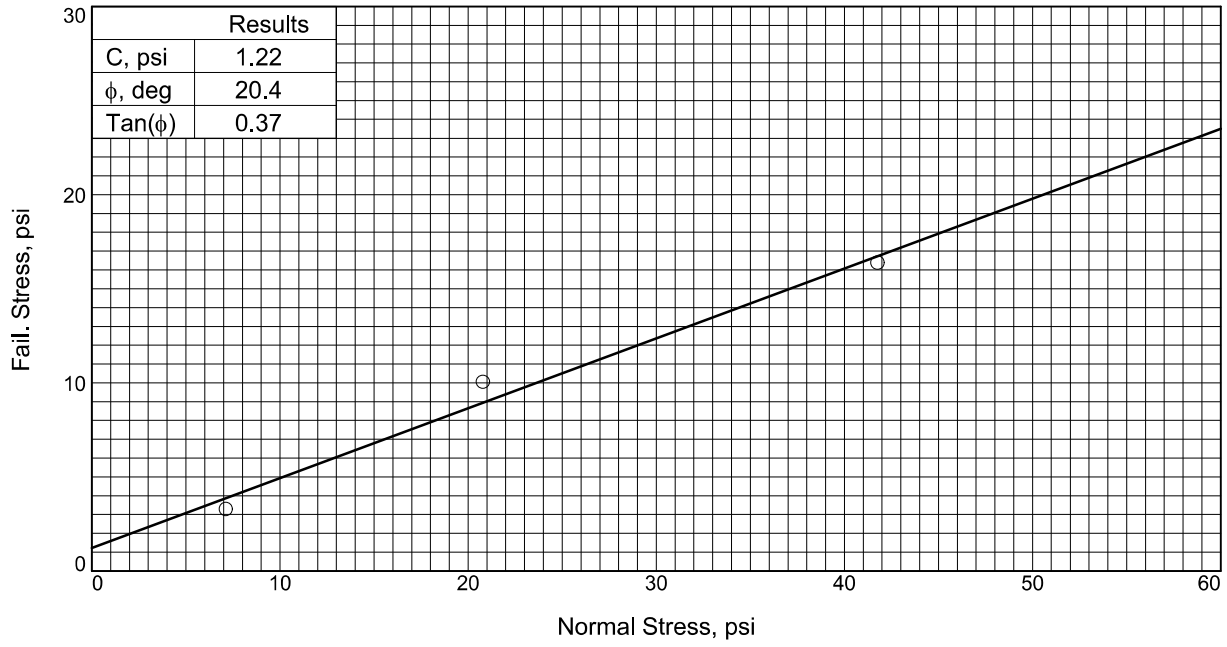
Strain rate, in./min. = 0.001

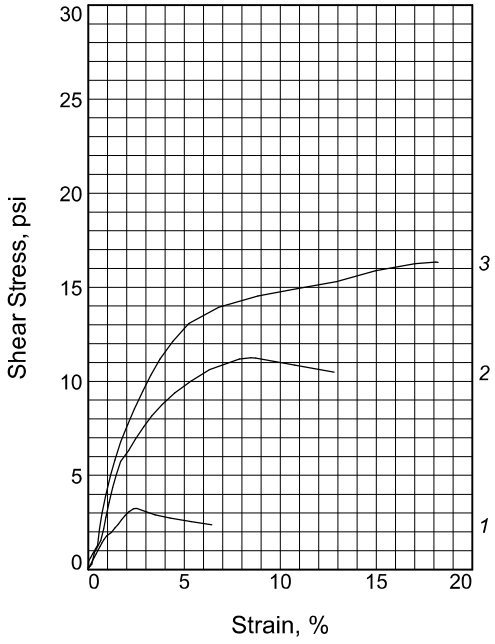
Fail. Stress = 17.18 psi **at reading no.** 19

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0005	1.095	1.1	0.0	0.22
2	0.0045	3.558	3.6	0.2	0.73
3	0.0075	7.883	7.9	0.3	1.61
4	0.0110	12.576	12.6	0.4	2.57
5	0.0145	16.962	17.0	0.6	3.46
6	0.0185	21.722	21.7	0.7	4.44
7	0.0226	26.327	26.3	0.9	5.38
8	0.0271	31.389	31.4	1.1	6.41
9	0.0316	36.419	36.4	1.3	7.44
10	0.0361	42.334	42.3	1.4	8.64
11	0.0406	48.031	48.0	1.6	9.81
12	0.0451	53.037	53.0	1.8	10.83
13	0.0511	58.258	58.3	2.0	11.90
14	0.0586	63.209	63.2	2.3	12.91
15	0.0676	67.509	67.5	2.7	13.79
16	0.0826	71.901	71.9	3.3	14.68
17	0.1066	76.120	76.1	4.3	15.54

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
18	0.1366	80.669	80.7	5.5	16.47
19	0.1757	84.106	84.1	7.0	17.18
20	0.1817	84.081	84.1	7.3	17.17
21	0.2327	82.575	82.6	9.3	16.86
22	0.2837	80.937	80.9	11.4	16.53
23	0.3348	79.195	79.2	13.4	16.17
24	0.3858	77.696	77.7	15.4	15.87
25	0.4368	76.265	76.3	17.5	15.57
26	0.4878	74.809	74.8	19.5	15.28





Sample No.		1	2	3
Initial	Water Content, %	25.6	26.8	27.9
	Dry Density, pcf	98.7	96.4	94.4
	Saturation, %	93.3	92.7	92.2
	Void Ratio	0.7642	0.8070	0.8444
	Diameter, in.	2.499	2.499	2.497
	Height, in.	0.981	0.976	1.000
At Test	Water Content, %	27.7	29.1	30.5
	Dry Density, pcf	101.8	103.1	103.9
	Saturation, %	108.8	117.8	126.0
	Void Ratio	0.7113	0.6895	0.6764
	Diameter, in.	2.499	2.499	2.497
	Height, in.	0.951	0.912	0.909
Normal Stress, psi		7.17	20.83	41.81
Fail. Stress, psi		3.25	10.01	16.34
Strain, %		2.5	5.3	18.1
Ult. Stress, psi				
Strain, %				
Strain rate, in./min.		0.001	0.001	0.001

Sample Type: TRIMMED
Description: GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST
LL= 27 **PL=** 21 **PI=** 6
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 93

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-044-0-20 **Depth:** 18.0-20.0 FT

Sample Number: ST-8

Proj. No.: 301525.1000 **Date Sampled:**

DIRECT SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/3/22 **Checked By:** SM 04/08/22

DIRECT SHEAR TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-044-0-20
Depth: 18.0-20.0 FT **Sample Number:** ST-8
Description: GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**27 **PL=**21 **PI=**6

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	354.250		317.520
Moisture content: Dry soil+tare, gms.	322.390		282.960
Moisture content: Tare, gms.	197.760		158.330
Moisture, %	25.6	27.7	27.7
Moist specimen weight, gms.	156.49		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.981	0.951	
Net decrease in height, in.		0.029	
Wet density, pcf	124.0	130.0	
Dry density, pcf	98.7	101.8	
Void ratio	0.7642	0.7113	
Saturation, %	93.3	108.8	

Test Readings for Specimen No. 1

Normal stress = 7.17 psi
Strain rate, in./min. = 0.001
Fail. Stress = 3.25 psi **at reading no.** 20

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.2	0.2	63.0	36.6

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0000	0.643	0.6	0.0	0.13
2	0.0010	0.565	0.6	0.0	0.12
3	0.0035	1.383	1.4	0.1	0.28
4	0.0055	2.293	2.3	0.2	0.47
5	0.0080	3.231	3.2	0.3	0.66
6	0.0105	4.179	4.2	0.4	0.85
7	0.0130	5.135	5.1	0.5	1.05
8	0.0155	6.060	6.1	0.6	1.24
9	0.0181	6.970	7.0	0.7	1.42
10	0.0206	7.785	7.8	0.8	1.59
11	0.0236	8.726	8.7	0.9	1.78
12	0.0301	9.649	9.6	1.2	1.97
13	0.0346	10.799	10.8	1.4	2.20
14	0.0391	11.798	11.8	1.6	2.41

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
15	0.0436	12.956	13.0	1.7	2.64
16	0.0481	14.067	14.1	1.9	2.87
17	0.0526	14.953	15.0	2.1	3.05
18	0.0586	15.763	15.8	2.3	3.21
19	0.0616	15.934	15.9	2.5	3.25
20	0.0631	15.928	15.9	2.5	3.25
21	0.0751	15.035	15.0	3.0	3.07
22	0.0872	14.208	14.2	3.5	2.90
23	0.1067	13.369	13.4	4.3	2.73
24	0.1337	12.514	12.5	5.3	2.55
25	0.1607	11.695	11.7	6.4	2.38

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	358.490		283.090
Moisture content: Dry soil+tare, gms.	326.020		247.830
Moisture content: Tare, gms.	204.960		126.770
Moisture, %	26.8	29.1	29.1
Moist specimen weight, gms.	153.53		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.976	0.912	
Net decrease in height, in.		0.063	
Wet density, pcf	122.2	133.1	
Dry density, pcf	96.4	103.1	
Void ratio	0.8070	0.6895	
Saturation, %	92.7	117.8	

Test Readings for Specimen No. 2

Normal stress = 20.83 psi

Strain rate, in./min. = 0.001

Fail. Stress = 10.01 psi **at reading no.** 18

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0005	0.658	0.7	0.0	0.13
2	0.0020	0.799	0.8	0.1	0.16
3	0.0045	1.419	1.4	0.2	0.29
4	0.0080	4.395	4.4	0.3	0.90
5	0.0160	7.561	7.6	0.6	1.54
6	0.0200	10.533	10.5	0.8	2.15
7	0.0231	13.647	13.6	0.9	2.78
8	0.0271	17.503	17.5	1.1	3.57
9	0.0316	21.353	21.4	1.3	4.35
10	0.0361	24.595	24.6	1.4	5.01
11	0.0421	28.137	28.1	1.7	5.74
12	0.0526	31.046	31.0	2.1	6.33
13	0.0616	34.080	34.1	2.5	6.95

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
14	0.0721	37.164	37.2	2.9	7.58
15	0.0826	40.010	40.0	3.3	8.16
16	0.0961	43.013	43.0	3.8	8.77
17	0.1126	46.044	46.0	4.5	9.39
18	0.1337	49.106	49.1	5.3	10.01
19	0.1577	52.073	52.1	6.3	10.62
20	0.1967	54.868	54.9	7.9	11.19
21	0.2117	55.154	55.2	8.5	11.24
22	0.2177	55.093	55.1	8.7	11.23
23	0.2688	53.283	53.3	10.8	10.86
24	0.3198	51.479	51.5	12.8	10.50

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	265.470		725.450
Moisture content: Dry soil+tare, gms.	231.610		688.380
Moisture content: Tare, gms.	110.220		566.990
Moisture, %	27.9	30.5	30.5
Moist specimen weight, gms.	155.25		
Diameter, in.	2.497	2.497	
Area, in.²	4.897	4.897	
Height, in.	1.000	0.909	
Net decrease in height, in.		0.091	
Wet density, pcf	120.8	135.6	
Dry density, pcf	94.4	103.9	
Void ratio	0.8444	0.6764	
Saturation, %	92.2	126.0	

Test Readings for Specimen No. 3

Normal stress = 41.81 psi

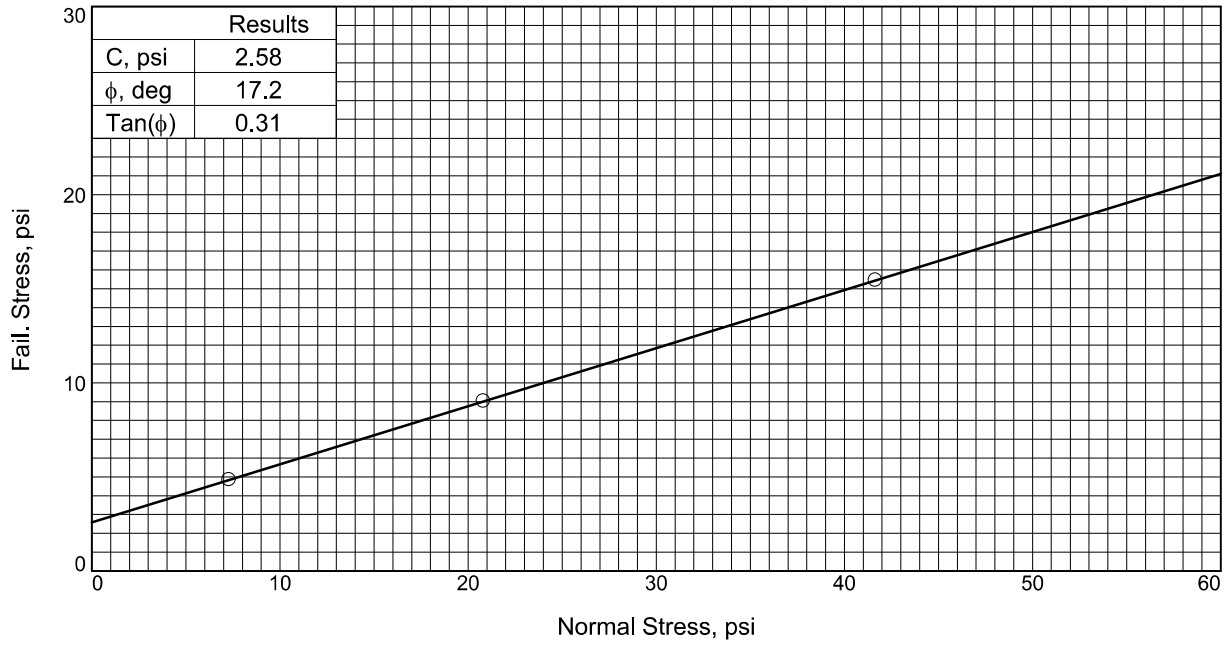
Strain rate, in./min. = 0.001

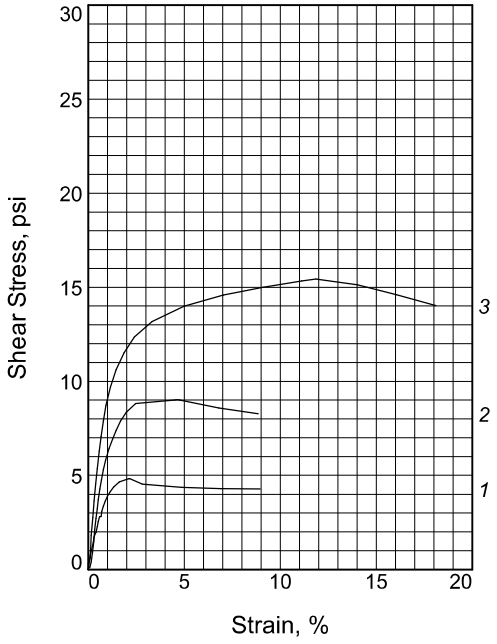
Fail. Stress = 16.34 psi **at reading no.** 24

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0005	2.247	2.2	0.0	0.46
2	0.0030	3.062	3.1	0.1	0.63
3	0.0060	4.132	4.1	0.2	0.84
4	0.0120	6.316	6.3	0.5	1.29
5	0.0145	10.646	10.6	0.6	2.17
6	0.0181	14.666	14.7	0.7	2.99
7	0.0226	19.143	19.1	0.9	3.91
8	0.0286	24.404	24.4	1.1	4.98
9	0.0346	28.502	28.5	1.4	5.82
10	0.0421	33.158	33.2	1.7	6.77
11	0.0511	37.718	37.7	2.0	7.70
12	0.0601	41.780	41.8	2.4	8.53
13	0.0706	46.318	46.3	2.8	9.46

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
14	0.0812	50.484	50.5	3.2	10.31
15	0.0932	54.810	54.8	3.7	11.19
16	0.1097	59.373	59.4	4.4	12.12
17	0.1307	64.035	64.0	5.2	13.08
18	0.1697	68.274	68.3	6.8	13.94
19	0.2207	71.223	71.2	8.8	14.54
20	0.2718	73.072	73.1	10.9	14.92
21	0.3228	74.958	75.0	12.9	15.31
22	0.3739	77.725	77.7	15.0	15.87
23	0.4249	79.614	79.6	17.0	16.26
24	0.4519	80.006	80.0	18.1	16.34
25	0.4549	79.966	80.0	18.2	16.33





Sample No.		1	2	3
Initial	Water Content, %	21.9	23.1	23.9
	Dry Density, pcf	105.9	103.1	102.1
	Saturation, %	94.9	93.5	94.3
	Void Ratio	0.6443	0.6893	0.7061
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.981	0.976	1.000
At Test	Water Content, %	25.3	26.1	27.5
	Dry Density, pcf	107.7	108.1	113.3
	Saturation, %	114.4	119.4	142.8
	Void Ratio	0.6170	0.6107	0.5367
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.964	0.930	0.901
Normal Stress, psi		7.31	20.83	41.66
Fail. Stress, psi		4.83	9.02	15.43
Strain, %		2.1	4.5	11.8
Ult. Stress, psi				
Strain, %				
Strain rate, in./min.		0.060	0.060	0.060

Sample Type: TRIMMED
Description: MOIST, BROWN-GRAY SILT AND CLAY, TRACE FINE SAND, MOIST
LL= 33 **PL=** 21 **PI=** 12
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 94

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-046-0-20 **Depth:** 18.0-20.0 FT
Sample Number: ST-8
Proj. No.: 301525.1000 **Date Sampled:**

DIRECT SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/08/22 **Checked By:** SM 04/11/22

DIRECT SHEAR TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-046-0-20
Depth: 18.0-20.0 FT **Sample Number:** ST-8
Description: MOIST, BROWN-GRAY SILT AND CLAY, TRACE FINE SAND, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**33 **PL=**21 **PI=**12

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	360.780		325.490
Moisture content: Dry soil+tare, gms.	331.480		291.650
Moisture content: Tare, gms.	197.760		157.930
Moisture, %	21.9	25.3	25.3
Moist specimen weight, gms.	163.02		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.981	0.964	
Net decrease in height, in.		0.016	
Wet density, pcf	129.1	135.0	
Dry density, pcf	105.9	107.7	
Void ratio	0.6443	0.6170	
Saturation, %	94.9	114.4	

Test Readings for Specimen No. 1

Normal stress = 7.31 psi
Strain rate, in./min. = 0.060
Fail. Stress = 4.83 psi **at reading no.** 21

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.2	59.3	40.5

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0000	1.633	1.6	0.0	0.33
2	0.0015	2.412	2.4	0.1	0.49
3	0.0025	3.089	3.1	0.1	0.63
4	0.0035	4.523	4.5	0.1	0.92
5	0.0055	6.076	6.1	0.2	1.24
6	0.0065	7.305	7.3	0.3	1.49
7	0.0075	8.524	8.5	0.3	1.74
8	0.0090	9.368	9.4	0.4	1.91
9	0.0100	9.641	9.6	0.4	1.97
10	0.0115	11.169	11.2	0.5	2.28
11	0.0130	12.504	12.5	0.5	2.55
12	0.0145	13.720	13.7	0.6	2.80
13	0.0166	13.792	13.8	0.7	2.81
14	0.0176	15.123	15.1	0.7	3.08

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
15	0.0196	16.499	16.5	0.8	3.36
16	0.0221	17.798	17.8	0.9	3.63
17	0.0251	19.101	19.1	1.0	3.89
18	0.0286	20.315	20.3	1.1	4.14
19	0.0331	21.502	21.5	1.3	4.38
20	0.0406	22.821	22.8	1.6	4.65
21	0.0526	23.677	23.7	2.1	4.83
22	0.0541	23.637	23.6	2.2	4.82
23	0.0706	22.255	22.3	2.8	4.54
24	0.1217	21.430	21.4	4.9	4.37
25	0.1727	21.074	21.1	6.9	4.30
26	0.2238	21.035	21.0	9.0	4.29

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	363.990		319.120
Moisture content: Dry soil+tare, gms.	334.140		285.360
Moisture content: Tare, gms.	204.960		156.180
Moisture, %	23.1	26.1	26.1
Moist specimen weight, gms.	159.03		
Diameter, in.	2.496	2.496	
Area, in.²	4.893	4.893	
Height, in.	0.976	0.930	
Net decrease in height, in.		0.045	
Wet density, pcf	126.9	136.4	
Dry density, pcf	103.1	108.1	
Void ratio	0.6893	0.6107	
Saturation, %	93.5	119.4	

Test Readings for Specimen No. 2

Normal stress = 20.83 psi

Strain rate, in./min. = 0.060

Fail. Stress = 9.02 psi **at reading no.** 20

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.195	0.0	0.0	0.00
1	0.0005	0.529	0.3	0.0	0.07
2	0.0020	0.828	0.6	0.1	0.13
3	0.0040	2.160	2.0	0.2	0.40
4	0.0055	4.559	4.4	0.2	0.89
5	0.0070	7.445	7.2	0.3	1.48
6	0.0085	10.628	10.4	0.3	2.13
7	0.0100	13.430	13.2	0.4	2.70
8	0.0115	15.988	15.8	0.5	3.23
9	0.0131	18.307	18.1	0.5	3.70
10	0.0151	21.141	20.9	0.6	4.28
11	0.0171	23.507	23.3	0.7	4.76
12	0.0196	26.080	25.9	0.8	5.29

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
13	0.0226	28.607	28.4	0.9	5.81
14	0.0271	31.665	31.5	1.1	6.43
15	0.0316	34.155	34.0	1.3	6.94
16	0.0361	36.385	36.2	1.4	7.40
17	0.0421	38.839	38.6	1.7	7.90
18	0.0496	41.076	40.9	2.0	8.35
19	0.0617	43.318	43.1	2.5	8.81
20	0.1127	44.311	44.1	4.5	9.02
21	0.1157	44.333	44.1	4.6	9.02
22	0.1187	44.298	44.1	4.8	9.01
23	0.1697	42.180	42.0	6.8	8.58
24	0.2208	40.692	40.5	8.8	8.28

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	272.770		322.200
Moisture content: Dry soil+tare, gms.	241.450		286.150
Moisture content: Tare, gms.	110.220		154.920
Moisture, %	23.9	27.5	27.5
Moist specimen weight, gms.	162.55		
Diameter, in.	2.497	2.497	
Area, in.²	4.897	4.897	
Height, in.	1.000	0.901	
Net decrease in height, in.		0.099	
Wet density, pcf	126.5	144.5	
Dry density, pcf	102.1	113.3	
Void ratio	0.7061	0.5367	
Saturation, %	94.3	142.8	

Test Readings for Specimen No. 3

Normal stress = 41.66 psi

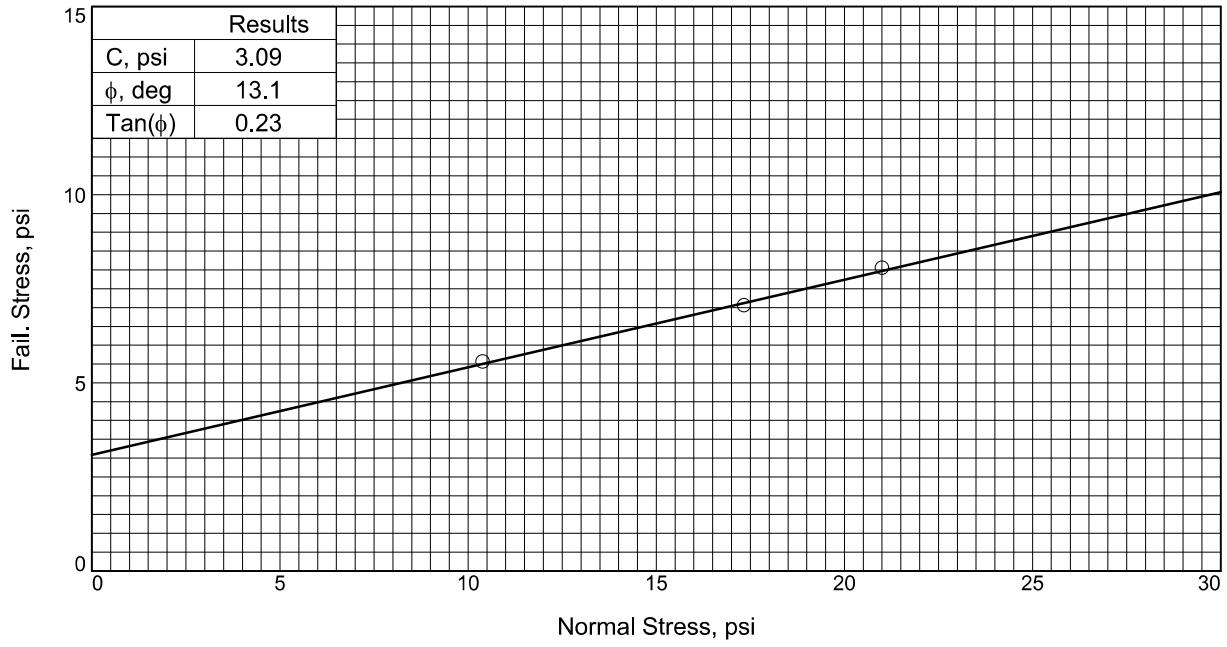
Strain rate, in./min. = 0.060

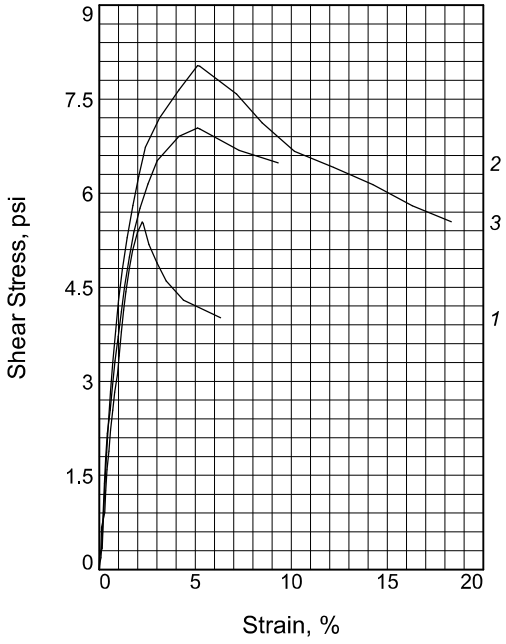
Fail. Stress = 15.43 psi **at reading no.** 21

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	1.232	0.0	0.0	0.00
1	0.0005	1.882	0.6	0.0	0.13
2	0.0030	5.896	4.7	0.1	0.95
3	0.0040	10.067	8.8	0.2	1.80
4	0.0060	14.674	13.4	0.2	2.74
5	0.0075	19.003	17.8	0.3	3.63
6	0.0095	23.507	22.3	0.4	4.55
7	0.0115	27.467	26.2	0.5	5.36
8	0.0140	31.955	30.7	0.6	6.27
9	0.0166	35.870	34.6	0.7	7.07
10	0.0196	39.838	38.6	0.8	7.88
11	0.0231	43.907	42.7	0.9	8.71
12	0.0286	48.699	47.5	1.1	9.69

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
13	0.0361	53.219	52.0	1.4	10.62
14	0.0466	57.672	56.4	1.9	11.53
15	0.0601	61.740	60.5	2.4	12.36
16	0.0827	65.791	64.6	3.3	13.18
17	0.1247	69.742	68.5	5.0	13.99
18	0.1757	72.653	71.4	7.0	14.58
19	0.2268	74.666	73.4	9.1	15.00
20	0.2778	76.337	75.1	11.1	15.34
21	0.2958	76.798	75.6	11.8	15.43
22	0.2988	76.794	75.6	12.0	15.43
23	0.3498	75.369	74.1	14.0	15.14
24	0.4009	72.770	71.5	16.1	14.61
25	0.4519	69.945	68.7	18.1	14.03





Sample No.		1	2	3
Initial	Water Content, %	29.0	27.6	29.0
	Dry Density, pcf	95.9	94.0	96.4
	Saturation, %	99.1	90.4	100.3
	Void Ratio	0.8153	0.8533	0.8072
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.981	0.976	1.000
At Test	Water Content, %	32.1	29.9	30.7
	Dry Density, pcf	98.3	98.5	99.7
	Saturation, %	116.2	108.8	114.6
	Void Ratio	0.7722	0.7678	0.7473
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.957	0.930	0.967
Normal Stress, psi		10.41	17.35	21.02
Fail. Stress, psi		5.54	7.04	8.04
Strain, %		2.2	5.1	5.1
Ult. Stress, psi				
Strain, %				
Strain rate, in./min.		0.001	0.001	0.001

Sample Type: TRIMMED
Description: GRAY-BROWN SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE
LL= 31 **PL=** 21 **PI=** 10
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 95

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-049-0-20 **Depth:** 17.5-19.5 FT

Sample Number: ST-8

Proj. No.: 301525.1000 **Date Sampled:**

DIRECT SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/4/22 **Checked By:** SM 04/08/22

DIRECT SHEAR TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-049-0-20
Depth: 17.5-19.5 FT **Sample Number:** ST-8
Description: GRAY-BROWN SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**31 **PL=**21 **PI=**10

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	353.970		314.960
Moisture content: Dry soil+tare, gms.	318.880		276.020
Moisture content: Tare, gms.	197.760		154.900
Moisture, %	29.0	32.1	32.1
Moist specimen weight, gms.	156.21		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.981	0.957	
Net decrease in height, in.		0.023	
Wet density, pcf	123.7	129.9	
Dry density, pcf	95.9	98.3	
Void ratio	0.8153	0.7722	
Saturation, %	99.1	116.2	

Test Readings for Specimen No. 1

Normal stress = 10.41 psi
Strain rate, in./min. = 0.001
Fail. Stress = 5.54 psi **at reading no.** 19

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.1	0.3	0.4	66.5	32.7

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0005	0.954	1.0	0.0	0.19
2	0.0020	1.500	1.5	0.1	0.31
3	0.0030	3.307	3.3	0.1	0.67
4	0.0070	4.478	4.5	0.3	0.91
5	0.0085	6.145	6.1	0.3	1.25
6	0.0100	7.793	7.8	0.4	1.59
7	0.0125	9.246	9.2	0.5	1.89
8	0.0146	10.865	10.9	0.6	2.22
9	0.0176	12.461	12.5	0.7	2.54
10	0.0201	13.859	13.9	0.8	2.83
11	0.0236	15.323	15.3	0.9	3.12
12	0.0256	16.711	16.7	1.0	3.41
13	0.0286	18.583	18.6	1.1	3.79

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
14	0.0316	20.287	20.3	1.3	4.14
15	0.0346	21.719	21.7	1.4	4.43
16	0.0391	23.575	23.6	1.6	4.81
17	0.0436	24.935	24.9	1.7	5.08
18	0.0496	26.337	26.3	2.0	5.37
19	0.0556	27.172	27.2	2.2	5.54
20	0.0571	27.076	27.1	2.3	5.52
21	0.0646	25.419	25.4	2.6	5.18
22	0.0751	23.986	24.0	3.0	4.89
23	0.0872	22.565	22.6	3.5	4.60
24	0.1097	21.058	21.1	4.4	4.29
25	0.1577	19.697	19.7	6.3	4.02

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	355.250		313.030
Moisture content: Dry soil+tare, gms.	322.710		277.780
Moisture content: Tare, gms.	204.960		160.030
Moisture, %	27.6	29.9	29.9
Moist specimen weight, gms.	150.29		
Diameter, in.	2.496	2.496	
Area, in.²	4.893	4.893	
Height, in.	0.976	0.930	
Net decrease in height, in.		0.045	
Wet density, pcf	120.0	128.0	
Dry density, pcf	94.0	98.5	
Void ratio	0.8533	0.7678	
Saturation, %	90.4	108.8	

Test Readings for Specimen No. 2

Normal stress = 17.35 psi

Strain rate, in./min. = 0.001

Fail. Stress = 7.04 psi **at reading no.** 20

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.523	0.0	0.0	0.00
1	0.0005	0.936	0.4	0.0	0.08
2	0.0020	1.426	0.9	0.1	0.18
3	0.0040	2.877	2.4	0.2	0.48
4	0.0050	4.942	4.4	0.2	0.90
5	0.0065	7.239	6.7	0.3	1.37
6	0.0085	9.286	8.8	0.3	1.79
7	0.0105	11.153	10.6	0.4	2.17
8	0.0140	12.942	12.4	0.6	2.54
9	0.0171	14.803	14.3	0.7	2.92
10	0.0206	16.780	16.3	0.8	3.32
11	0.0246	18.689	18.2	1.0	3.71
12	0.0286	20.640	20.1	1.1	4.11

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
13	0.0331	22.615	22.1	1.3	4.52
14	0.0391	24.902	24.4	1.6	4.98
15	0.0451	26.864	26.3	1.8	5.38
16	0.0526	28.698	28.2	2.1	5.76
17	0.0631	30.598	30.1	2.5	6.15
18	0.0751	32.423	31.9	3.0	6.52
19	0.1037	34.316	33.8	4.2	6.91
20	0.1277	34.953	34.4	5.1	7.04
21	0.1307	34.893	34.4	5.2	7.02
22	0.1817	33.214	32.7	7.3	6.68
23	0.2327	32.246	31.7	9.3	6.48

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	270.060		318.000
Moisture content: Dry soil+tare, gms.	234.110		279.960
Moisture content: Tare, gms.	110.220		156.070
Moisture, %	29.0	30.7	30.7
Moist specimen weight, gms.	159.84		
Diameter, in.	2.497	2.497	
Area, in.²	4.897	4.897	
Height, in.	1.000	0.967	
Net decrease in height, in.		0.033	
Wet density, pcf	124.3	130.3	
Dry density, pcf	96.4	99.7	
Void ratio	0.8072	0.7473	
Saturation, %	100.3	114.6	

Test Readings for Specimen No. 3

Normal stress = 21.02 psi

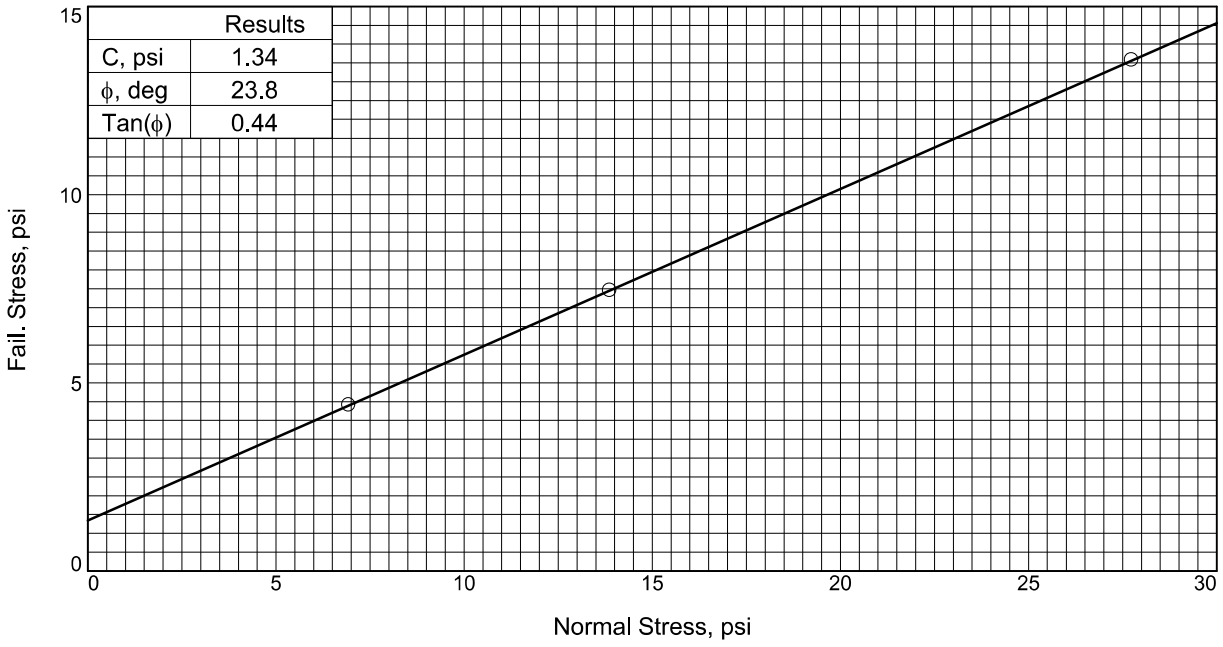
Strain rate, in./min. = 0.001

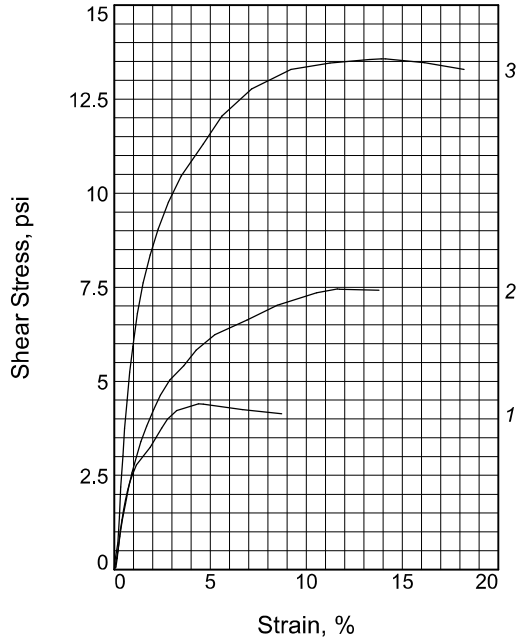
Fail. Stress = 8.04 psi **at reading no.** 18

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	3.384	0.0	0.0	0.00
1	0.0005	4.501	1.1	0.0	0.23
2	0.0040	5.038	1.7	0.2	0.34
3	0.0055	7.559	4.2	0.2	0.85
4	0.0075	10.217	6.8	0.3	1.40
5	0.0095	12.521	9.1	0.4	1.87
6	0.0120	15.039	11.7	0.5	2.38
7	0.0145	17.280	13.9	0.6	2.84
8	0.0175	19.547	16.2	0.7	3.30
9	0.0211	21.976	18.6	0.8	3.80
10	0.0251	24.387	21.0	1.0	4.29
11	0.0301	26.807	23.4	1.2	4.78
12	0.0361	29.299	25.9	1.4	5.29
13	0.0436	31.810	28.4	1.7	5.80

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
14	0.0511	34.068	30.7	2.0	6.27
15	0.0601	36.363	33.0	2.4	6.73
16	0.0781	38.620	35.2	3.1	7.20
17	0.1037	40.824	37.4	4.2	7.65
18	0.1277	42.732	39.3	5.1	8.04
19	0.1307	42.677	39.3	5.2	8.02
20	0.1787	40.506	37.1	7.2	7.58
21	0.2117	38.244	34.9	8.5	7.12
22	0.2538	36.043	32.7	10.2	6.67
23	0.3048	34.779	31.4	12.2	6.41
24	0.3558	33.436	30.1	14.2	6.14
25	0.4069	31.790	28.4	16.3	5.80
26	0.4579	30.535	27.2	18.3	5.54





Sample No.		1	2	3
Initial	Water Content, %	20.4	21.3	23.2
	Dry Density, pcf	105.5	101.2	100.2
	Saturation, %	87.5	82.4	87.6
	Void Ratio	0.6516	0.7216	0.7389
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.981	0.976	1.000
At Test	Water Content, %	22.9	25.3	23.9
	Dry Density, pcf	107.3	105.5	109.4
	Saturation, %	102.6	108.7	112.4
	Void Ratio	0.6238	0.6508	0.5927
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.964	0.935	0.916
Normal Stress, psi		6.94	13.88	27.75
Fail. Stress, psi		4.40	7.45	13.57
Strain, %		4.4	11.6	13.9
Ult. Stress, psi				
Strain, %				
Strain rate, in./min.		0.001	0.001	0.001

Sample Type: TRIMMED
Description: BROWN GRAY TO GRAY SILT AND CLAY, TRACE FINE SAND, TRACE
LL= 26 **PL=** 20 **PI=** 6
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT

Figure 96

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-054-0-20 **Depth:** 12.5-14.5 FT
Sample Number: ST-6
Proj. No.: 301525.1000 **Date Sampled:**

DIRECT SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/01/22 **Checked By:** SM 04/08/22

DIRECT SHEAR TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-054-0-20
Depth: 12.5-14.5 FT **Sample Number:** ST-6
Description: BROWN GRAY TO GRAY SILT AND CLAY, TRACE FINE SAND, TRACE COARSE AND FINE GRAVEL, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**26 **PL=**20 **PI=**6

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	358.100		319.980
Moisture content: Dry soil+tare, gms.	330.890		289.440
Moisture content: Tare, gms.	197.760		156.310
Moisture, %	20.4	22.9	22.9
Moist specimen weight, gms.	160.34		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.981	0.964	
Net decrease in height, in.		0.017	
Wet density, pcf	127.0	131.9	
Dry density, pcf	105.5	107.3	
Void ratio	0.6516	0.6238	
Saturation, %	87.5	102.6	

Test Readings for Specimen No. 1

Normal stress = 6.94 psi
Strain rate, in./min. = 0.001
Fail. Stress = 4.40 psi **at reading no.** 20

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
1.8	0.2	0.0	2.0	61.4	34.6

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0005	0.197	0.2	0.0	0.04
2	0.0020	0.307	0.3	0.1	0.06
3	0.0040	1.444	1.4	0.2	0.29
4	0.0050	2.572	2.6	0.2	0.52
5	0.0065	3.946	3.9	0.3	0.80
6	0.0080	5.157	5.2	0.3	1.05
7	0.0100	6.437	6.4	0.4	1.31
8	0.0120	7.781	7.8	0.5	1.59
9	0.0145	9.090	9.1	0.6	1.85
10	0.0170	10.211	10.2	0.7	2.08
11	0.0201	11.316	11.3	0.8	2.31
12	0.0241	12.488	12.5	1.0	2.55
13	0.0286	13.629	13.6	1.1	2.78

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
14	0.0376	14.733	14.7	1.5	3.00
15	0.0466	15.941	15.9	1.9	3.25
16	0.0541	17.182	17.2	2.2	3.50
17	0.0616	18.426	18.4	2.5	3.76
18	0.0691	19.570	19.6	2.8	3.99
19	0.0811	20.709	20.7	3.2	4.22
20	0.1097	21.586	21.6	4.4	4.40
21	0.1157	21.572	21.6	4.6	4.40
22	0.1667	20.828	20.8	6.7	4.25
23	0.2177	20.306	20.3	8.7	4.14

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	358.740		313.810
Moisture content: Dry soil+tare, gms.	331.720		281.680
Moisture content: Tare, gms.	204.960		154.920
Moisture, %	21.3	25.3	25.3
Moist specimen weight, gms.	153.78		
Diameter, in.	2.496	2.496	
Area, in.²	4.893	4.893	
Height, in.	0.976	0.935	
Net decrease in height, in.		0.040	
Wet density, pcf	122.7	132.3	
Dry density, pcf	101.2	105.5	
Void ratio	0.7216	0.6508	
Saturation, %	82.4	108.7	

Test Readings for Specimen No. 2

Normal stress = 13.88 psi

Strain rate, in./min. = 0.001

Fail. Stress = 7.45 psi **at reading no.** 20

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.906	0.0	0.0	0.00
1	0.0005	1.002	0.1	0.0	0.02
2	0.0045	3.276	2.4	0.2	0.48
3	0.0070	5.205	4.3	0.3	0.88
4	0.0105	7.343	6.4	0.4	1.32
5	0.0145	9.446	8.5	0.6	1.75
6	0.0186	11.427	10.5	0.7	2.15
7	0.0231	13.440	12.5	0.9	2.56
8	0.0286	15.531	14.6	1.1	2.99
9	0.0346	17.517	16.6	1.4	3.39
10	0.0421	19.533	18.6	1.7	3.81
11	0.0511	21.696	20.8	2.0	4.25
12	0.0601	23.590	22.7	2.4	4.64
13	0.0721	25.543	24.6	2.9	5.03
14	0.0901	27.413	26.5	3.6	5.42

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
15	0.1067	29.431	28.5	4.3	5.83
16	0.1307	31.412	30.5	5.2	6.23
17	0.1727	33.336	32.4	6.9	6.63
18	0.2117	35.244	34.3	8.5	7.02
19	0.2628	36.883	36.0	10.5	7.35
20	0.2898	37.362	36.5	11.6	7.45
21	0.2928	37.343	36.4	11.7	7.45
22	0.3438	37.210	36.3	13.8	7.42

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	268.840		315.280
Moisture content: Dry soil+tare, gms.	238.970		284.540
Moisture content: Tare, gms.	110.220		155.790
Moisture, %	23.2	23.9	23.9
Moist specimen weight, gms.	158.62		
Diameter, in.	2.497	2.497	
Area, in.²	4.897	4.897	
Height, in.	1.000	0.916	
Net decrease in height, in.		0.084	
Wet density, pcf	123.4	135.5	
Dry density, pcf	100.2	109.4	
Void ratio	0.7389	0.5927	
Saturation, %	87.6	112.4	

Test Readings for Specimen No. 3

Normal stress = 27.75 psi

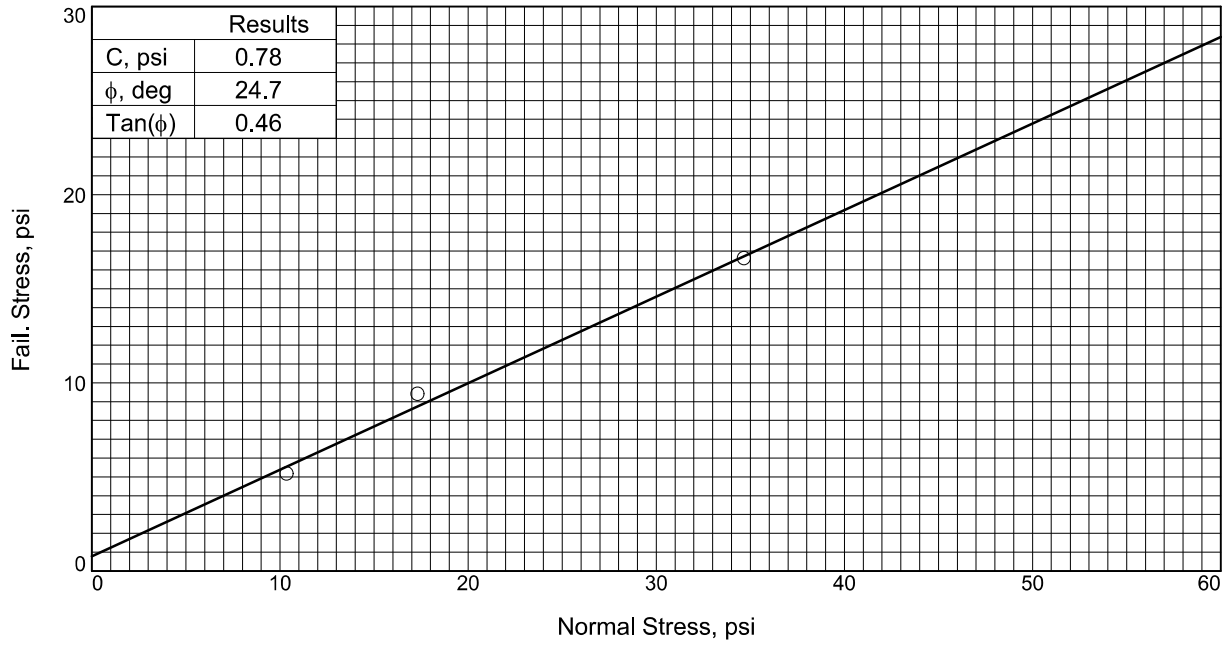
Strain rate, in./min. = 0.001

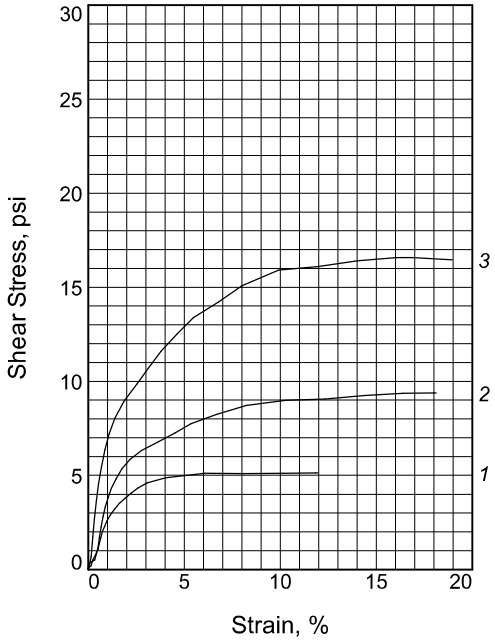
Fail. Stress = 13.57 psi **at reading no.** 22

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.520	0.0	0.0	0.00
1	0.0005	1.367	0.8	0.0	0.17
2	0.0045	3.979	3.5	0.2	0.71
3	0.0065	7.387	6.9	0.3	1.40
4	0.0085	11.252	10.7	0.3	2.19
5	0.0110	15.261	14.7	0.4	3.01
6	0.0135	18.862	18.3	0.5	3.75
7	0.0165	22.482	22.0	0.7	4.48
8	0.0201	26.186	25.7	0.8	5.24
9	0.0241	29.552	29.0	1.0	5.93
10	0.0301	33.796	33.3	1.2	6.80
11	0.0376	37.819	37.3	1.5	7.62
12	0.0466	41.451	40.9	1.9	8.36
13	0.0571	44.800	44.3	2.3	9.04
14	0.0706	48.317	47.8	2.8	9.76
15	0.0871	51.721	51.2	3.5	10.46
16	0.1157	55.908	55.4	4.6	11.31

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
17	0.1397	59.516	59.0	5.6	12.05
18	0.1787	63.048	62.5	7.2	12.77
19	0.2298	65.586	65.1	9.2	13.29
20	0.2808	66.440	65.9	11.2	13.46
21	0.3318	66.877	66.4	13.3	13.55
22	0.3469	66.978	66.5	13.9	13.57
23	0.3529	66.974	66.5	14.1	13.57
24	0.4039	66.480	66.0	16.2	13.47
25	0.4550	65.591	65.1	18.2	13.29





Sample No.		1	2	3
Initial	Water Content, %	24.8	23.2	24.5
	Dry Density, pcf	98.7	102.5	102.0
	Saturation, %	90.4	92.6	96.8
	Void Ratio	0.7652	0.7000	0.7070
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.981	0.976	1.000
At Test	Water Content, %	25.1	24.8	24.0
	Dry Density, pcf	103.0	107.4	111.1
	Saturation, %	101.2	111.6	118.0
	Void Ratio	0.6907	0.6211	0.5682
	Diameter, in.	2.499	2.496	2.497
	Height, in.	0.939	0.930	0.919
Normal Stress, psi		10.40	17.35	34.71
Fail. Stress, psi		5.13	9.37	16.58
Strain, %		11.8	18.0	16.5
Ult. Stress, psi				
Strain, %				
Strain rate, in./min.		0.001	0.001	0.001

Sample Type: TRIMMED
Description: GRAY-BROWN TO GRAY SILT, SOME CLAY, TRACE COARSE AND FINE
LL= 26 **PL=** 19 **PI=** 7
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 97

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-067-0-20 **Depth:** 17.5-19.5 FT
Sample Number: ST-8
Proj. No.: 301525.1000 **Date Sampled:**

DIRECT SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22

DIRECT SHEAR TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-067-0-20
Depth: 17.5-19.5 FT **Sample Number:** ST-8
Description: GRAY-BROWN TO GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**26 **PL=**19 **PI=**7

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	353.200		314.370
Moisture content: Dry soil+tare, gms.	322.320		283.160
Moisture content: Tare, gms.	197.760		158.600
Moisture, %	24.8	25.1	25.1
Moist specimen weight, gms.	155.44		
Diameter, in.	2.499	2.499	
Area, in.²	4.905	4.905	
Height, in.	0.981	0.939	
Net decrease in height, in.		0.041	
Wet density, pcf	123.1	128.8	
Dry density, pcf	98.7	103.0	
Void ratio	0.7652	0.6907	
Saturation, %	90.4	101.2	

Test Readings for Specimen No. 1

Normal stress = 10.4 psi
Strain rate, in./min. = 0.001
Fail. Stress = 5.13 psi **at reading no.** 22

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.7	0.7	1.8	70.0	26.8

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0010	0.603	0.6	0.0	0.12
2	0.0035	0.917	0.9	0.1	0.19
3	0.0060	2.471	2.5	0.2	0.50
4	0.0090	3.734	3.7	0.4	0.76
5	0.0125	5.248	5.2	0.5	1.07
6	0.0140	6.659	6.7	0.6	1.36
7	0.0160	8.282	8.3	0.6	1.69
8	0.0185	9.858	9.9	0.7	2.01
9	0.0211	11.248	11.2	0.8	2.29
10	0.0241	12.638	12.6	1.0	2.58
11	0.0286	14.252	14.3	1.1	2.91
12	0.0346	15.796	15.8	1.4	3.22
13	0.0406	17.230	17.2	1.6	3.51

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
14	0.0481	18.592	18.6	1.9	3.79
15	0.0556	19.871	19.9	2.2	4.05
16	0.0646	21.278	21.3	2.6	4.34
17	0.0766	22.555	22.6	3.1	4.60
18	0.1006	23.940	23.9	4.0	4.88
19	0.1517	25.072	25.1	6.1	5.11
20	0.2027	25.006	25.0	8.1	5.10
21	0.2538	25.102	25.1	10.2	5.12
22	0.2958	25.166	25.2	11.8	5.13
23	0.2989	25.183	25.2	12.0	5.13

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	363.170		317.210
Moisture content: Dry soil+tare, gms.	333.330		285.320
Moisture content: Tare, gms.	204.960		156.950
Moisture, %	23.2	24.8	24.8
Moist specimen weight, gms.	158.21		
Diameter, in.	2.496	2.496	
Area, in.²	4.893	4.893	
Height, in.	0.976	0.930	
Net decrease in height, in.		0.045	
Wet density, pcf	126.3	134.1	
Dry density, pcf	102.5	107.4	
Void ratio	0.7000	0.6211	
Saturation, %	92.6	111.6	

Test Readings for Specimen No. 2

Normal stress = 17.35 psi

Strain rate, in./min. = 0.001

Fail. Stress = 9.37 psi **at reading no.** 25

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0000	0.430	0.4	0.0	0.09
2	0.0005	1.455	1.5	0.0	0.30
3	0.0045	2.092	2.1	0.2	0.43
4	0.0085	2.489	2.5	0.3	0.51
5	0.0125	5.556	5.6	0.5	1.14
6	0.0145	8.567	8.6	0.6	1.75
7	0.0166	11.056	11.1	0.7	2.26
8	0.0191	13.653	13.7	0.8	2.79
9	0.0221	16.261	16.3	0.9	3.32
10	0.0256	18.684	18.7	1.0	3.82
11	0.0301	21.112	21.1	1.2	4.31
12	0.0361	23.597	23.6	1.4	4.82
13	0.0436	26.152	26.2	1.7	5.34
14	0.0541	28.602	28.6	2.2	5.85

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
15	0.0692	30.927	30.9	2.8	6.32
16	0.0917	33.247	33.2	3.7	6.79
17	0.1127	35.551	35.6	4.5	7.27
18	0.1337	37.899	37.9	5.4	7.75
19	0.1667	40.337	40.3	6.7	8.24
20	0.2058	42.638	42.6	8.2	8.71
21	0.2568	44.010	44.0	10.3	8.99
22	0.3078	44.298	44.3	12.3	9.05
23	0.3589	45.264	45.3	14.4	9.25
24	0.4099	45.805	45.8	16.4	9.36
25	0.4489	45.860	45.9	18.0	9.37
26	0.4520	45.859	45.9	18.1	9.37

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	273.540		320.180
Moisture content: Dry soil+tare, gms.	241.380		288.650
Moisture content: Tare, gms.	110.220		157.490
Moisture, %	24.5	24.0	24.0
Moist specimen weight, gms.	163.32		
Diameter, in.	2.497	2.497	
Area, in.²	4.897	4.897	
Height, in.	1.000	0.919	
Net decrease in height, in.		0.081	
Wet density, pcf	127.1	137.8	
Dry density, pcf	102.0	111.1	
Void ratio	0.7070	0.5682	
Saturation, %	96.8	118.0	

Test Readings for Specimen No. 3

Normal stress = 34.71 psi

Strain rate, in./min. = 0.001

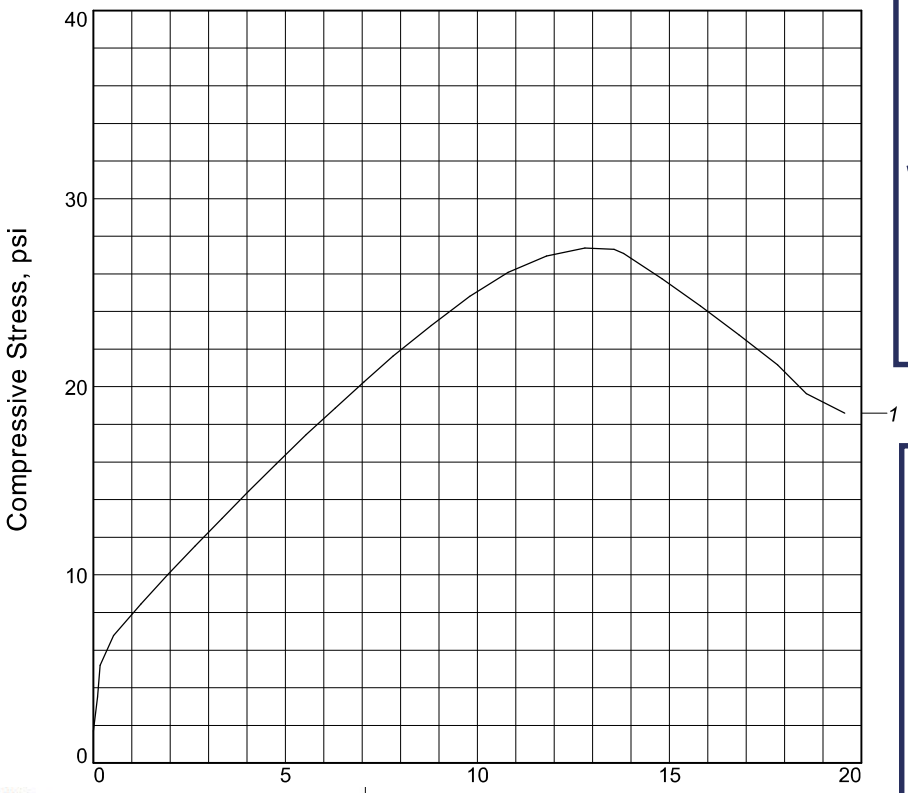
Fail. Stress = 16.58 psi **at reading no.** 24

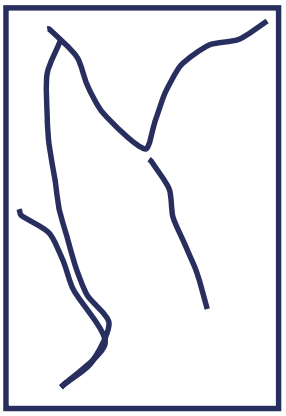
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0000	0.265	0.3	0.0	0.05
2	0.0015	1.358	1.4	0.1	0.28
3	0.0040	3.400	3.4	0.2	0.69
4	0.0060	8.524	8.5	0.2	1.74
5	0.0080	13.160	13.2	0.3	2.69
6	0.0105	17.748	17.7	0.4	3.62
7	0.0135	22.334	22.3	0.5	4.56
8	0.0171	26.667	26.7	0.7	5.45
9	0.0216	31.179	31.2	0.9	6.37
10	0.0271	35.247	35.2	1.1	7.20
11	0.0346	39.400	39.4	1.4	8.05
12	0.0466	43.838	43.8	1.9	8.95

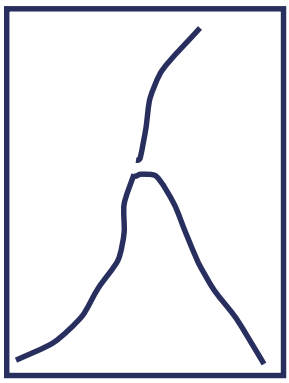
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psi
13	0.0631	48.235	48.2	2.5	9.85
14	0.0781	52.483	52.5	3.1	10.72
15	0.0947	56.759	56.8	3.8	11.59
16	0.1157	61.405	61.4	4.6	12.54
17	0.1367	65.537	65.5	5.5	13.38
18	0.1697	69.649	69.6	6.8	14.22
19	0.1998	73.830	73.8	8.0	15.08
20	0.2478	77.929	77.9	9.9	15.91
21	0.2989	78.838	78.8	12.0	16.10
22	0.3499	80.362	80.4	14.0	16.41
23	0.4009	81.166	81.2	16.1	16.57
24	0.4129	81.183	81.2	16.5	16.58
25	0.4219	81.175	81.2	16.9	16.58
26	0.4730	80.600	80.6	18.9	16.46

UNCONFINED COMPRESSION TEST







GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.0	0.2	59.3	40.5

Sample No.	1			
Unconfined strength, psi	27.38			
Undrained shear strength, psi	13.69			
Failure strain, %	12.8			
Strain rate, in./min.	1.000			
Water content, %	20.9			
Wet density, pcf	132.3			
Dry density, pcf	109.4			
Saturation, %	98.6			
Void ratio	0.5919			
Specimen diameter, in.	2.833			
Specimen height, in.	5.611			
Height/diameter ratio	1.98			

Description: MOIST, BROWN-GRAY LEAN CLAY

LL = N/A	**PL =** N/A	**PI =** N/A	**Assumed GS=** 2.79	**Type:** TRIMMED

Project No.: 301525.1000
Date Sampled:

Remarks:
SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 98

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-046-0-20 **Depth:** 20.0-22.0 FT
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/09/22 **Checked By:** SM 04/11/22

UNCONFINED COMPRESSION TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-046-0-20
Depth: 18.0-20.0 FT **Sample Number:** ST-8
Description: MOIST, BROWN-GRAY LEAN CLAY
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**N/A **PL=**N/A **PI=**N/A

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	1379.980
Moisture content: Dry soil+tare, gms.	1168.150
Moisture content: Tare, gms.	155.030
Moisture, %	20.9
Moist specimen weight, gms.	1227.81
Diameter, in.	2.833
Area, in.²	6.301
Height, in.	5.611
Wet density, pcf	132.3
Dry density, pcf	109.4
Void ratio	0.5919
Saturation, %	98.6

Test Readings for Specimen No. 1

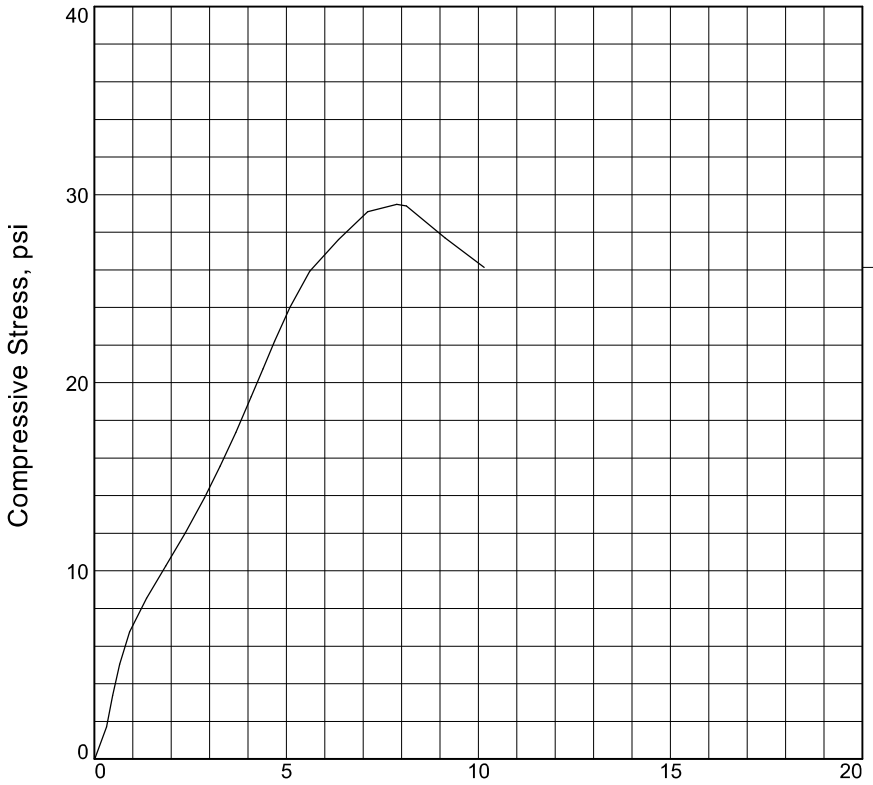
Strain rate, in./min. = 1.000
Unconfined compressive strength = 27.38 psi **at reading no.** 19

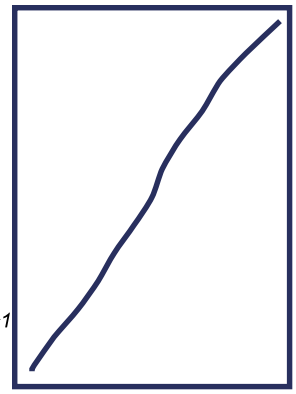
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi
0	0.0000	0.000	0.0	0.0	0.00
1	0.0000	10.736	10.7	0.0	1.70
2	0.0056	22.176	22.2	0.1	3.52
3	0.0097	32.751	32.8	0.2	5.19
4	0.0290	42.902	42.9	0.5	6.77
5	0.0694	54.000	54.0	1.2	8.46
6	0.1083	64.242	64.2	1.9	10.00
7	0.1478	74.558	74.6	2.6	11.52
8	0.1876	84.755	84.8	3.3	13.00
9	0.2269	94.886	94.9	4.0	14.45
10	0.2663	105.049	105.0	4.7	15.88
11	0.3108	116.414	116.4	5.5	17.45
12	0.3532	126.877	126.9	6.3	18.87
13	0.3953	137.363	137.4	7.0	20.26
14	0.4373	147.790	147.8	7.8	21.63
15	0.4935	160.724	160.7	8.8	23.26
16	0.5496	173.224	173.2	9.8	24.80

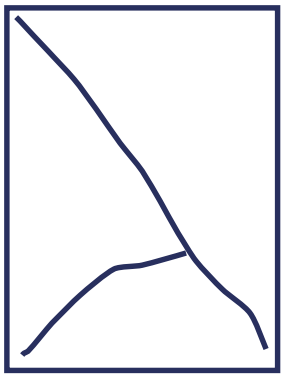
Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi
17	0.6057	184.300	184.3	10.8	26.09
18	0.6619	192.495	192.5	11.8	26.95
19	0.7181	197.828	197.8	12.8	27.38
20	0.7606	199.023	199.0	13.6	27.30
21	0.7748	197.997	198.0	13.8	27.08
22	0.8305	190.456	190.5	14.8	25.75
23	0.8867	181.896	181.9	15.8	24.30
24	0.9429	172.460	172.5	16.8	22.77
25	0.9995	162.339	162.3	17.8	21.17
26	1.0415	151.949	151.9	18.6	19.64
27	1.0977	145.660	145.7	19.6	18.59

UNCONFINED COMPRESSION TEST







GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.3	2.3	1.2	54.7	41.5

Sample No.	1			
Unconfined strength, psi	29.49			
Undrained shear strength, psi	14.75			
Failure strain, %	7.9			
Strain rate, in./min.	1.000			
Water content, %	21.9			
Wet density, pcf	129.1			
Dry density, pcf	105.9			
Saturation, %	94.7			
Void ratio	0.6449			
Specimen diameter, in.	2.806			
Specimen height, in.	5.562			
Height/diameter ratio	1.98			

Description: GRAY-BROWN TO ORANGE-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE

LL = 30	**PL =** 20	**PI =** 10	**Assumed GS=** 2.79	**Type:** TRIMMED

Project No.: 301525.1000
Date Sampled:

Remarks:
SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 99

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-049-0-20 **Depth:** 10.0-12.0 FT
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/09/22 **Checked By:** SM 04/11/22

UNCONFINED COMPRESSION TEST

5/1/2026

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-049-0-20
Depth: 10.0-12.0 FT **Sample Number:** ST-5
Description: GRAY-BROWN TO ORANGE-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**30 **PL=**20 **PI=**10

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	1322.080
Moisture content: Dry soil+tare, gms.	1113.180
Moisture content: Tare, gms.	158.860
Moisture, %	21.9
Moist specimen weight, gms.	1164.87
Diameter, in.	2.806
Area, in.²	6.182
Height, in.	5.562
Wet density, pcf	129.1
Dry density, pcf	105.9
Void ratio	0.6449
Saturation, %	94.7

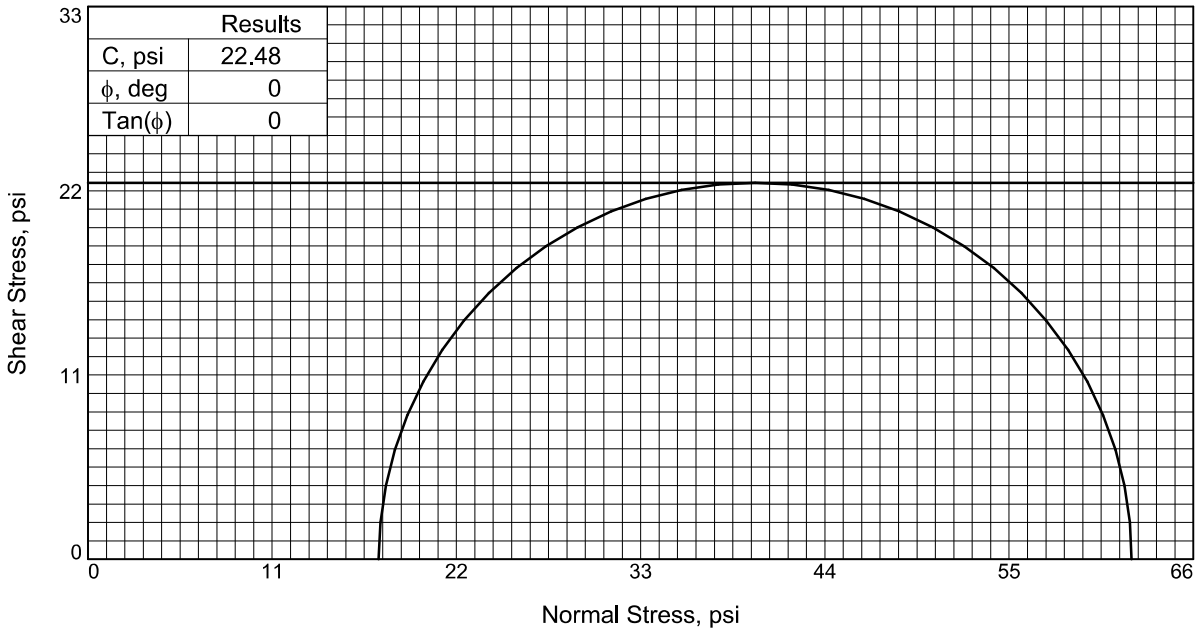
Test Readings for Specimen No. 1

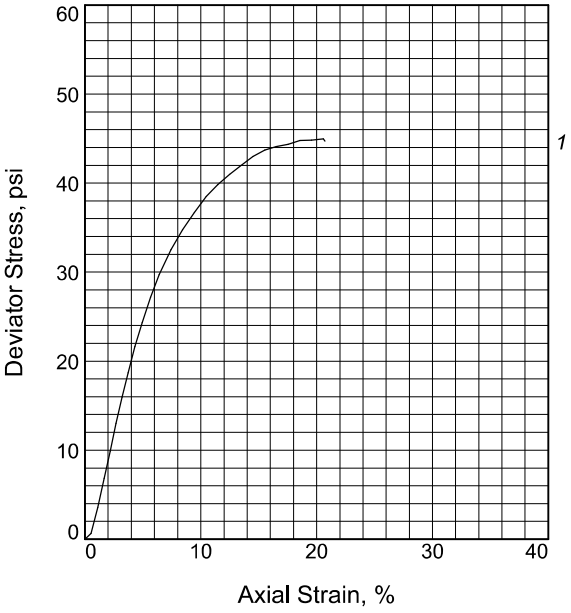
Strain rate, in./min. = 1.000
Unconfined compressive strength = 29.49 psi **at reading no.** 19

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi
0	0.0000	-0.104	0.0	0.0	0.00
1	0.0011	0.411	0.5	0.0	0.08
2	0.0174	10.505	10.6	0.3	1.71
3	0.0260	20.862	21.0	0.5	3.38
4	0.0363	31.300	31.4	0.7	5.05
5	0.0510	42.092	42.2	0.9	6.76
6	0.0754	53.451	53.6	1.4	8.55
7	0.1034	64.518	64.6	1.9	10.26
8	0.1314	75.911	76.0	2.4	12.01
9	0.1594	88.318	88.4	2.9	13.89
10	0.1819	99.403	99.5	3.3	15.57
11	0.2046	111.250	111.4	3.7	17.35
12	0.2271	124.060	124.2	4.1	19.26
13	0.2439	134.051	134.2	4.4	20.75
14	0.2606	143.946	144.0	4.7	22.21
15	0.2832	156.266	156.4	5.1	24.01

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi
16	0.3115	169.714	169.8	5.6	25.93
17	0.3534	182.245	182.3	6.4	27.62
18	0.3954	193.464	193.6	7.1	29.08
19	0.4379	197.804	197.9	7.9	29.49
20	0.4516	197.672	197.8	8.1	29.39
21	0.5078	188.310	188.4	9.1	27.69
22	0.5640	179.670	179.8	10.1	26.13





Sample No.		1
Initial	Water Content, %	20.8
	Dry Density, pcf	110.1
	Saturation, %	99.8
	Void Ratio	0.5821
	Diameter, in.	2.828
	Height, in.	5.553
At Test	Water Content, %	20.7
	Dry Density, pcf	110.1
	Saturation, %	99.3
	Void Ratio	0.5821
	Diameter, in.	2.828
	Height, in.	5.553
Strain rate, in./min.		0.057
Back Pressure, psi		0.0
Cell Pressure, psi		17.4
Fail. Stress, psi		45.0
Strain, %		20.6
Ult. Stress, psi		
Strain, %		
σ_1 Failure, psi		62.3
σ_3 Failure, psi		17.4

Type of Test: Unconsolidated Undrained

Sample Type: TRIMMED

Description: GRAY-BROWN TO GRAY SILT, LITTLE CLAY, TRACE COARSE AND FINE

LL= 22 **PL=** 19 **PI=** 3

Assumed Specific Gravity= 2.79

Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 100

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

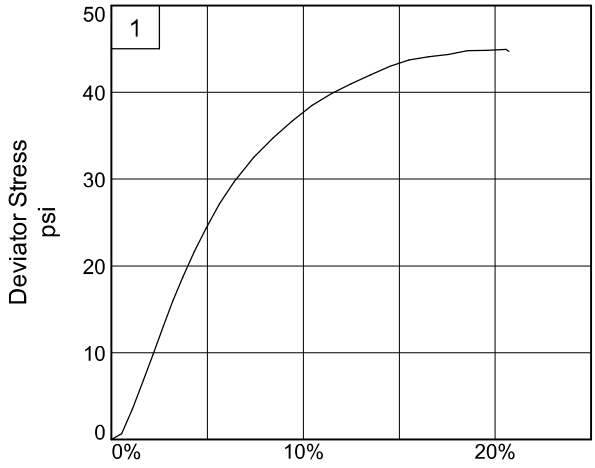
Source of Sample: B-070-0-20 **Depth:** 21.0-23.0 FT

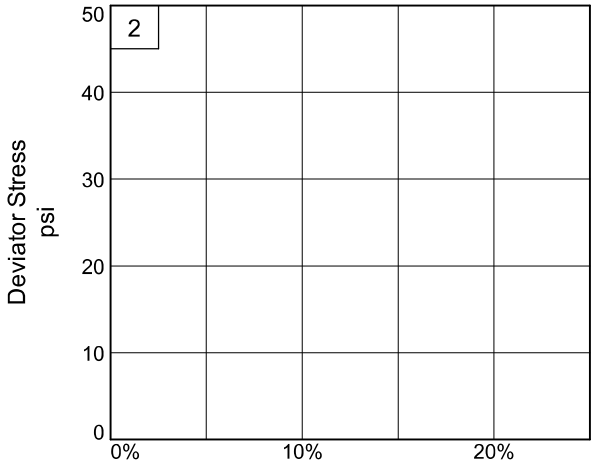
Sample Number: ST-9

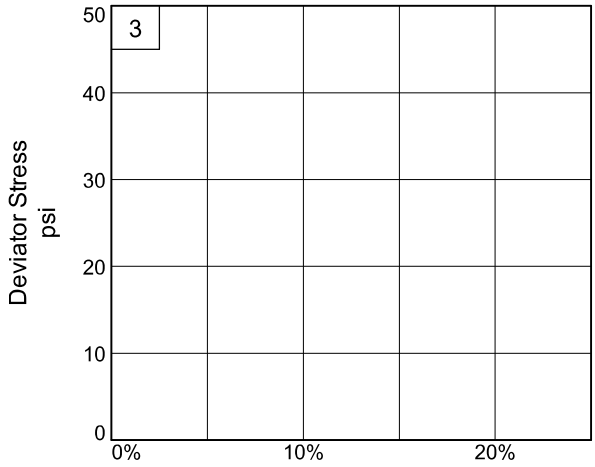
Proj. No.: 301525.1000 **Date Sampled:**

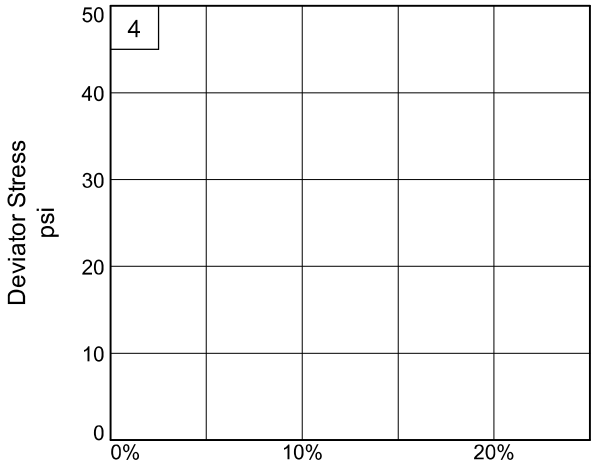
TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

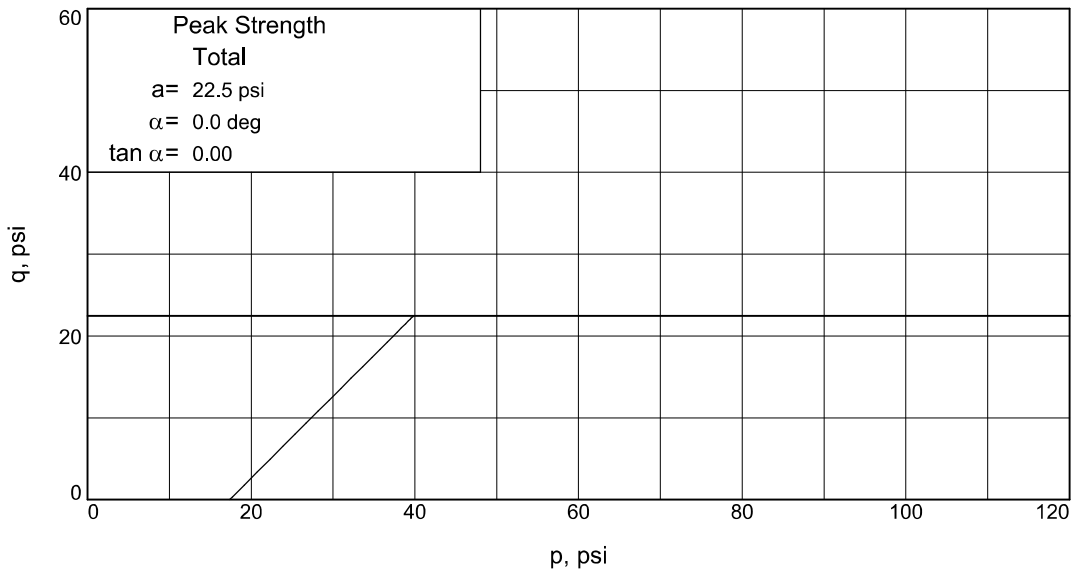
Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22











Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Source of Sample: B-070-0-20 **Depth:** 21.0-23.0 FT **Sample Number:** ST-9
Project No.: 301525.1000 **Figure** 101

TRC Engineers, Inc.

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

5/1/2026
7:23 AM

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-070-0-20
Depth: 21.0-23.0 FT **Sample Number:** ST-9
Description: GRAY-BROWN TO GRAY SILT, LITTLE CLAY, TRACE COARSE AND FINE SAND, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**22 **PL=**19 **PI=**3
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1217.560	1372.640
Moisture content: Dry soil+tare, gms.	1007.820	1163.850
Moisture content: Tare, gms.	0.000	156.030
Moisture, %	20.8	20.7
Moist specimen weight, gms.	1217.56	
Diameter, in.	2.828	
Area, in.²	6.280	
Height, in.	5.553	
Wet density, pcf	133.0	
Dry density, pcf	110.1	
Void ratio	0.5821	
Saturation, %	99.8	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 17.36 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.057
Fail. Stress = 44.95 psi **at reading no.** 25

GRAIN SIZE - mm.

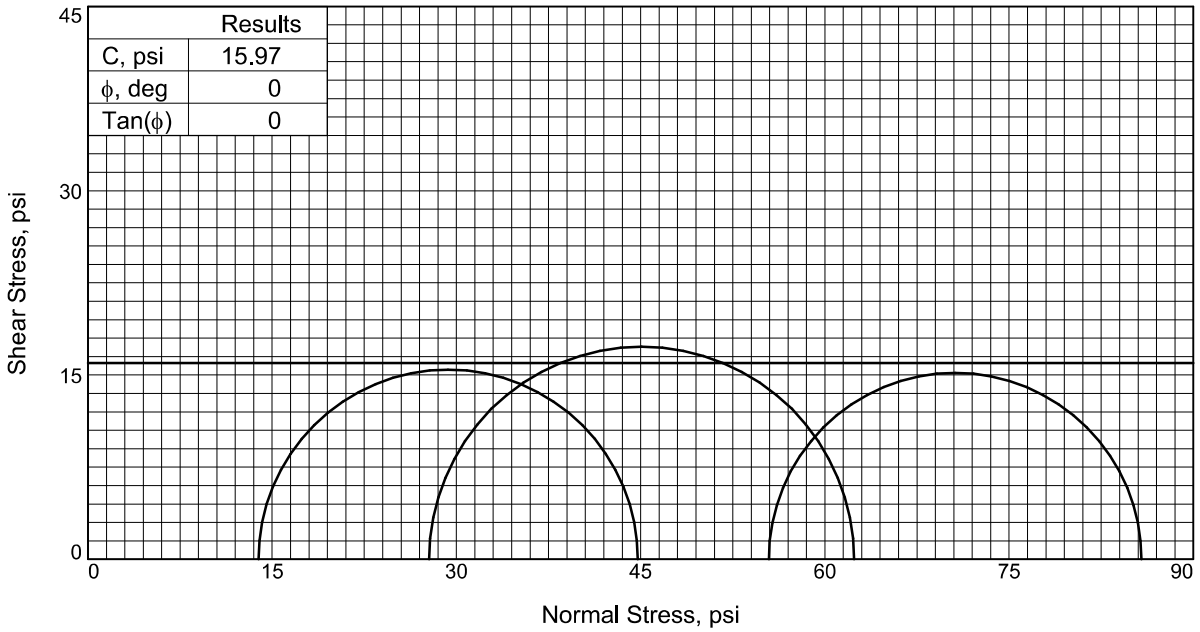
% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.2	0.6	80.6	18.6

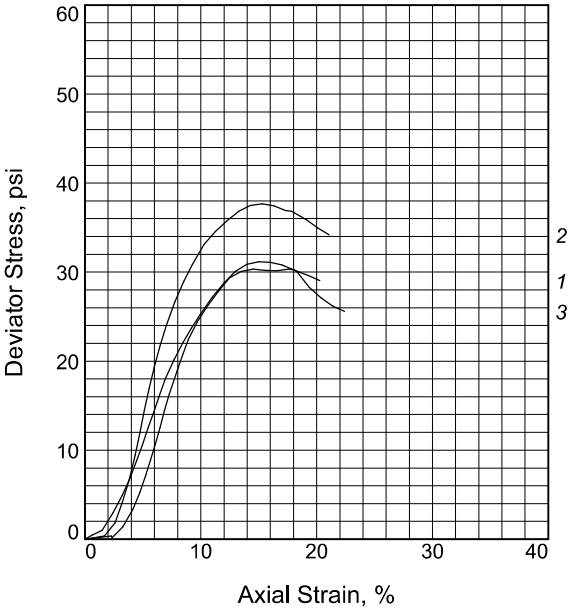
Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	17.36	17.36	1.00	17.36	0.00
1	0.0290	4.167	4.2	0.5	0.66	17.36	18.02	1.04	17.69	0.33
2	0.0608	22.610	22.6	1.1	3.56	17.36	20.92	1.21	19.14	1.78
3	0.0925	43.513	43.5	1.7	6.81	17.36	24.17	1.39	20.77	3.41
4	0.1212	63.504	63.5	2.2	9.89	17.36	27.25	1.57	22.31	4.95
5	0.1493	83.909	83.9	2.7	13.00	17.36	30.36	1.75	23.86	6.50
6	0.1774	103.600	103.6	3.2	15.97	17.36	33.33	1.92	25.34	7.98
7	0.2061	121.912	121.9	3.7	18.69	17.36	36.05	2.08	26.71	9.35
8	0.2396	142.146	142.1	4.3	21.66	17.36	39.02	2.25	28.19	10.83
9	0.2737	160.633	160.6	4.9	24.32	17.36	41.68	2.40	29.52	12.16
10	0.3132	180.874	180.9	5.6	27.18	17.36	44.54	2.57	30.95	13.59
11	0.3556	199.436	199.4	6.4	29.72	17.36	47.08	2.71	32.22	14.86
12	0.4119	220.540	220.5	7.4	32.51	17.36	49.87	2.87	33.62	16.26
13	0.4681	238.489	238.5	8.4	34.77	17.36	52.13	3.00	34.75	17.39
14	0.5243	254.555	254.6	9.4	36.70	17.36	54.06	3.11	35.71	18.35
15	0.5805	270.018	270.0	10.5	38.50	17.36	55.86	3.22	36.61	19.25
16	0.6367	282.565	282.6	11.5	39.83	17.36	57.19	3.29	37.28	19.92
17	0.6926	293.880	293.9	12.5	40.96	17.36	58.32	3.36	37.84	20.48
18	0.7489	304.879	304.9	13.5	42.00	17.36	59.36	3.42	38.36	21.00
19	0.8051	315.746	315.7	14.5	42.99	17.36	60.35	3.48	38.85	21.49
20	0.8614	324.988	325.0	15.5	43.72	17.36	61.08	3.52	39.22	21.86
21	0.9179	331.843	331.8	16.5	44.10	17.36	61.46	3.54	39.41	22.05
22	0.9741	337.800	337.8	17.5	44.35	17.36	61.71	3.55	39.54	22.18
23	1.0300	345.339	345.3	18.5	44.79	17.36	62.15	3.58	39.75	22.39
24	1.0859	350.103	350.1	19.6	44.84	17.36	62.20	3.58	39.78	22.42
25	1.1421	355.438	355.4	20.6	44.95	17.36	62.31	3.59	39.84	22.48
26	1.1499	354.114	354.1	20.7	44.71	17.36	62.07	3.58	39.71	22.35

Before

After





Sample No.		1	2	3
Initial	Water Content, %	26.3	26.5	28.1
	Dry Density, pcf	99.6	98.7	99.7
	Saturation, %	98.0	96.8	105.1
	Void Ratio	0.7488	0.7642	0.7467
	Diameter, in.	2.842	2.853	2.816
	Height, in.	5.577	5.593	5.522
At Test	Water Content, %	26.3	26.5	27.5
	Dry Density, pcf	99.6	98.7	99.7
	Saturation, %	97.8	96.6	102.6
	Void Ratio	0.7488	0.7642	0.7467
	Diameter, in.	2.842	2.853	2.816
	Height, in.	5.577	5.593	5.522
Strain rate, in./min.		1.029	1.083	1.113
Back Pressure, psi		0.0	0.0	0.0
Cell Pressure, psi		13.9	27.8	55.4
Fail. Stress, psi		30.9	34.6	30.3
Strain, %		14.0	11.3	17.6
Ult. Stress, psi				
Strain, %				
σ_1 Failure, psi		44.8	62.4	85.8
σ_3 Failure, psi		13.9	27.8	55.4

Type of Test:
Unconsolidated Undrained
Sample Type: TRIMMED
Description: GRAY-BROWN SILT, LITTLE CLAY, TRACE COARSE AND FINE SAND,
LL= 25 **PL=** 21 **PI=** 4
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 102

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

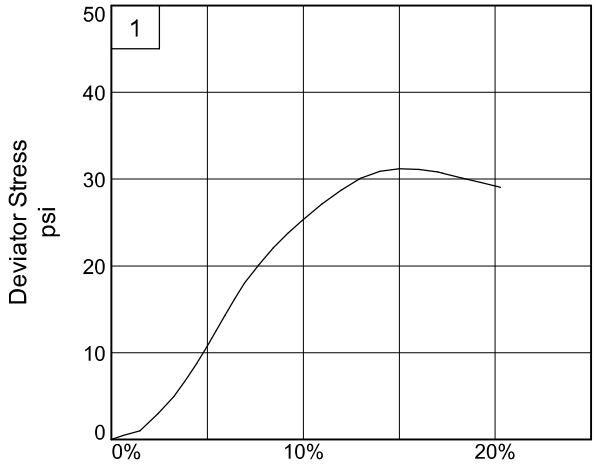
Source of Sample: B-070-0-20 **Depth:** 31.0-33.0 FT

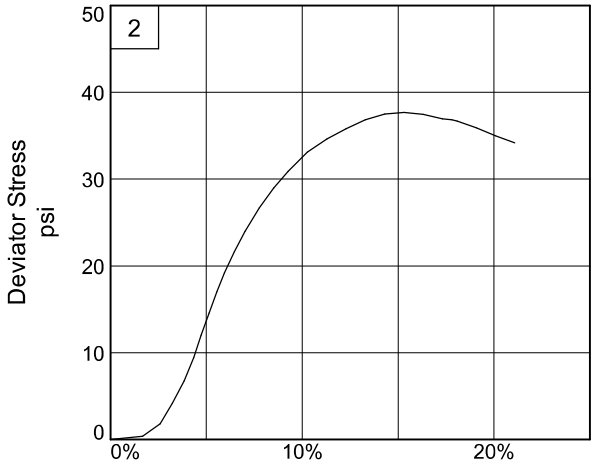
Sample Number: ST-12

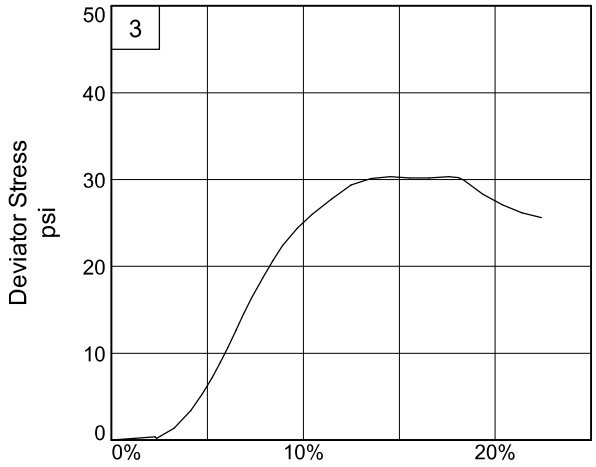
Proj. No.: 301525.1000 **Date Sampled:**

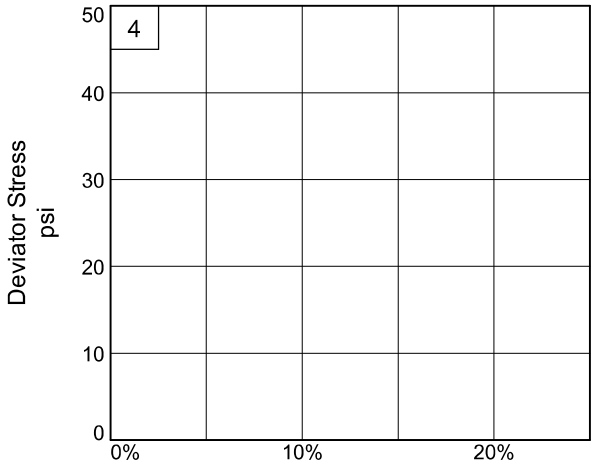
TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

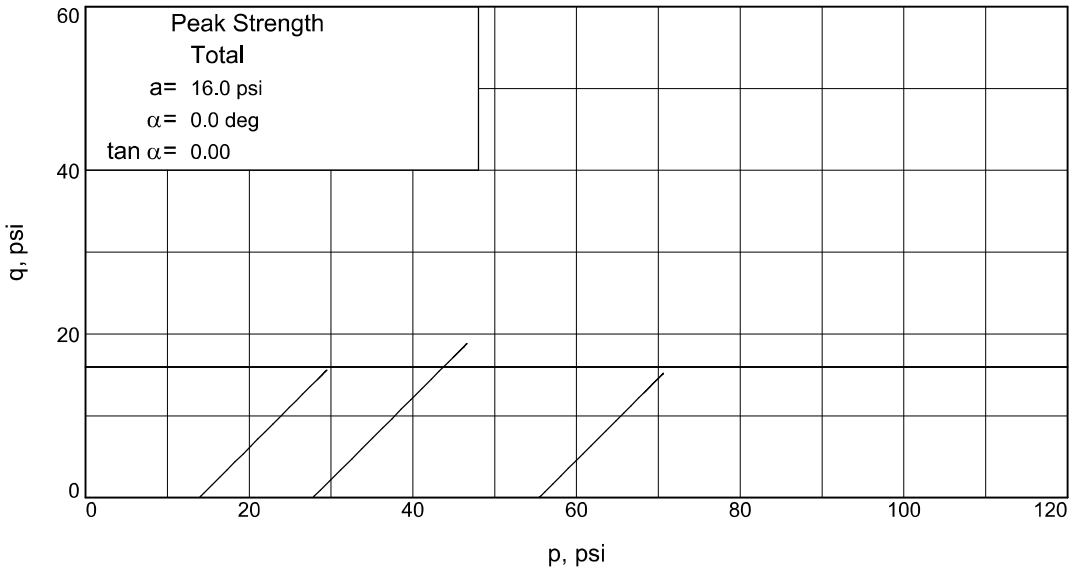
Tested By: TBT 04/09/22 **Checked By:** SM 04/11/22











Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Source of Sample: B-070-0-20 **Depth:** 31.0-33.0 FT **Sample Number:** ST-12
Project No.: 301525.1000 **Figure** 103

TRC Engineers, Inc.

Tested By: TBT 04/09/22 **Checked By:** SM 04/11/22

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

5/1/2026
7:30 AM

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-070-0-20
Depth: 31.0-33.0 FT **Sample Number:** ST-12
Description: GRAY-BROWN SILT, LITTLE CLAY, TRACE COARSE AND FINE SAND, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**25 **PL=**21 **PI=**4
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1167.900	1323.280
Moisture content: Dry soil+tare, gms.	924.760	1080.500
Moisture content: Tare, gms.	0.000	155.740
Moisture, %	26.3	26.3
Moist specimen weight, gms.	1167.90	
Diameter, in.	2.842	
Area, in.²	6.343	
Height, in.	5.577	
Wet density, pcf	125.8	
Dry density, pcf	99.6	
Void ratio	0.7488	
Saturation, %	98.0	

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.2	0.2	80.1	19.5

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 13.89 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 1.029
Fail. Stress = 30.88 psi **at reading no.** 19

After Test

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	13.89	13.89	1.00	13.89	0.00
1	0.0318	2.767	2.8	0.6	0.43	13.89	14.32	1.03	14.11	0.22
2	0.0824	6.502	6.5	1.5	1.01	13.89	14.90	1.07	14.39	0.50
3	0.1352	19.400	19.4	2.4	2.98	13.89	16.87	1.21	15.38	1.49
4	0.1806	32.479	32.5	3.2	4.95	13.89	18.84	1.36	16.37	2.48
5	0.2147	44.736	44.7	3.8	6.78	13.89	20.67	1.49	17.28	3.39
6	0.2482	58.166	58.2	4.5	8.76	13.89	22.65	1.63	18.27	4.38
7	0.2763	70.949	70.9	5.0	10.63	13.89	24.52	1.77	19.21	5.32
8	0.3050	84.322	84.3	5.5	12.57	13.89	26.46	1.90	20.17	6.28
9	0.3301	96.350	96.4	5.9	14.29	13.89	28.18	2.03	21.04	7.15
10	0.3582	109.650	109.6	6.4	16.18	13.89	30.07	2.16	21.98	8.09
11	0.3863	122.701	122.7	6.9	18.01	13.89	31.90	2.30	22.89	9.00
12	0.4282	138.274	138.3	7.7	20.13	13.89	34.02	2.45	23.95	10.06
13	0.4706	152.835	152.8	8.4	22.06	13.89	35.95	2.59	24.92	11.03
14	0.5126	165.839	165.8	9.2	23.74	13.89	37.63	2.71	25.76	11.87
15	0.5550	177.803	177.8	10.0	25.24	13.89	39.13	2.82	26.51	12.62
16	0.6112	193.376	193.4	11.0	27.15	13.89	41.04	2.95	27.46	13.57
17	0.6674	206.912	206.9	12.0	28.72	13.89	42.61	3.07	28.25	14.36
18	0.7236	219.178	219.2	13.0	30.07	13.89	43.96	3.17	28.93	15.04
19	0.7799	227.700	227.7	14.0	30.88	13.89	44.77	3.22	29.33	15.44
20	0.8362	232.554	232.6	15.0	31.17	13.89	45.06	3.24	29.47	15.58
21	0.8924	234.785	234.8	16.0	31.09	13.89	44.98	3.24	29.44	15.55
22	0.9486	235.425	235.4	17.0	30.80	13.89	44.69	3.22	29.29	15.40
23	0.9622	235.074	235.1	17.3	30.67	13.89	44.56	3.21	29.22	15.33
24	1.0185	233.816	233.8	18.3	30.13	13.89	44.02	3.17	28.96	15.07
25	1.0747	232.576	232.6	19.3	29.60	13.89	43.49	3.13	28.69	14.80
26	1.1310	231.121	231.1	20.3	29.05	13.89	42.94	3.09	28.41	14.52

Parameters for Specimen No. 2

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1172.230	1333.880
Moisture content: Dry soil+tare, gms.	926.610	1088.690
Moisture content: Tare, gms.	0.000	162.080
Moisture, %	26.5	26.5
Moist specimen weight, gms.	1172.23	
Diameter, in.	2.853	
Area, in.²	6.393	
Height, in.	5.593	
Wet density, pcf	124.9	
Dry density, pcf	98.7	
Void ratio	0.7642	
Saturation, %	96.8	

After Test

Test Readings for Specimen No. 2

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 27.78 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 1.083
Fail. Stress = 34.60 psi **at reading no.** 16

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	27.78	27.78	1.00	27.78	0.00
1	0.0936	2.630	2.6	1.7	0.37	27.78	28.15	1.01	27.97	0.19
2	0.1446	12.013	12.0	2.6	1.83	27.78	29.61	1.07	28.70	0.92
3	0.1805	27.599	27.6	3.2	4.18	27.78	31.96	1.15	29.87	2.09
4	0.2146	44.853	44.9	3.8	6.75	27.78	34.53	1.24	31.15	3.37
5	0.2428	63.113	63.1	4.3	9.44	27.78	37.22	1.34	32.50	4.72
6	0.2648	80.532	80.5	4.7	12.00	27.78	39.78	1.43	33.78	6.00
7	0.2875	98.080	98.1	5.1	14.55	27.78	42.33	1.52	35.06	7.28
8	0.3103	115.054	115.1	5.5	17.00	27.78	44.78	1.61	36.28	8.50
9	0.3330	130.684	130.7	6.0	19.22	27.78	47.00	1.69	37.39	9.61
10	0.3611	148.015	148.0	6.5	21.66	27.78	49.44	1.78	38.61	10.83
11	0.3922	164.757	164.8	7.0	23.96	27.78	51.74	1.86	39.76	11.98
12	0.4341	184.916	184.9	7.8	26.68	27.78	54.46	1.96	41.12	13.34
13	0.4766	202.400	202.4	8.5	28.96	27.78	56.74	2.04	42.26	14.48
14	0.5184	217.588	217.6	9.3	30.88	27.78	58.66	2.11	43.22	15.44
15	0.5746	235.791	235.8	10.3	33.09	27.78	60.87	2.19	44.33	16.55
16	0.6308	249.303	249.3	11.3	34.60	27.78	62.38	2.25	45.08	17.30
17	0.6870	260.910	260.9	12.3	35.80	27.78	63.58	2.29	45.68	17.90
18	0.7433	271.678	271.7	13.3	36.85	27.78	64.63	2.33	46.20	18.42
19	0.7995	279.750	279.8	14.3	37.50	27.78	65.28	2.35	46.53	18.75
20	0.8557	284.353	284.4	15.3	37.67	27.78	65.45	2.36	46.62	18.84
21	0.9120	286.177	286.2	16.3	37.46	27.78	65.24	2.35	46.51	18.73
22	0.9682	285.566	285.6	17.3	36.93	27.78	64.71	2.33	46.25	18.47
23	0.9963	286.538	286.5	17.8	36.83	27.78	64.61	2.33	46.20	18.42
24	1.0106	286.181	286.2	18.1	36.67	27.78	64.45	2.32	46.12	18.34
25	1.0668	283.569	283.6	19.1	35.89	27.78	63.67	2.29	45.73	17.95
26	1.1230	279.721	279.7	20.1	34.97	27.78	62.75	2.26	45.26	17.48

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
27	1.1793	276.940	276.9	21.1	34.18	27.78	61.96	2.23	44.87	17.09

Parameters for Specimen No. 3

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1153.220	1303.730
Moisture content: Dry soil+tare, gms.	900.140	1056.500
Moisture content: Tare, gms.	0.000	156.360
Moisture, %	28.1	27.5
Moist specimen weight, gms.	1153.22	
Diameter, in.	2.816	
Area, in.²	6.228	
Height, in.	5.522	
Wet density, pcf	127.8	
Dry density, pcf	99.7	
Void ratio	0.7467	
Saturation, %	105.1	

Test Readings for Specimen No. 3

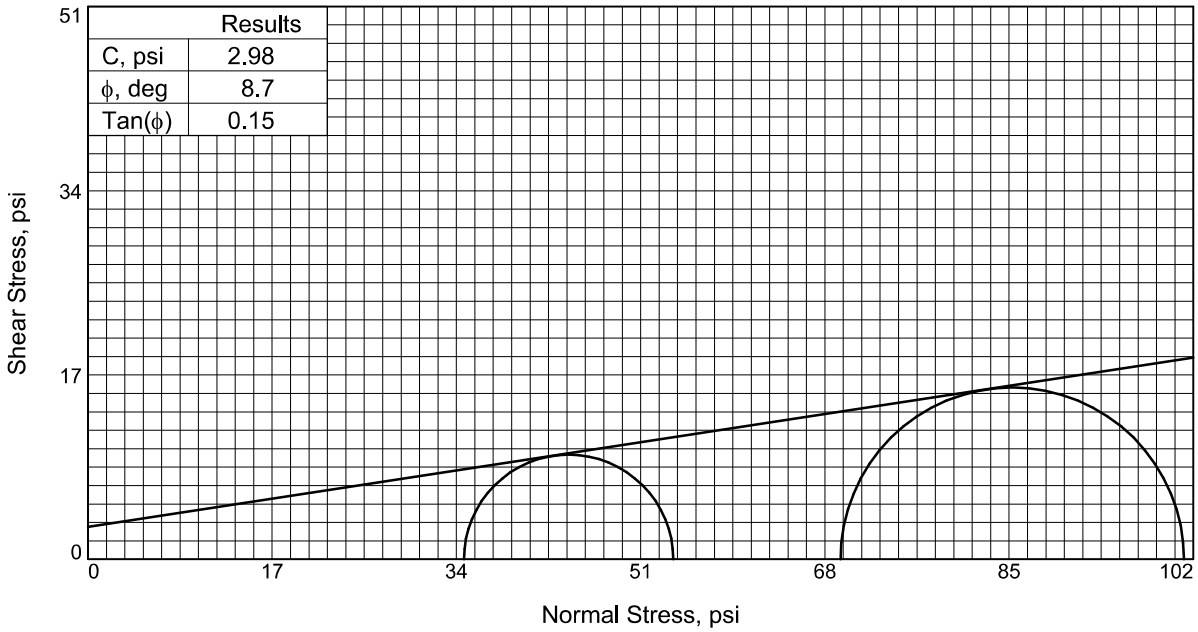
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 55.43 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 1.113
Fail. Stress = 30.34 psi **at reading no.** 23

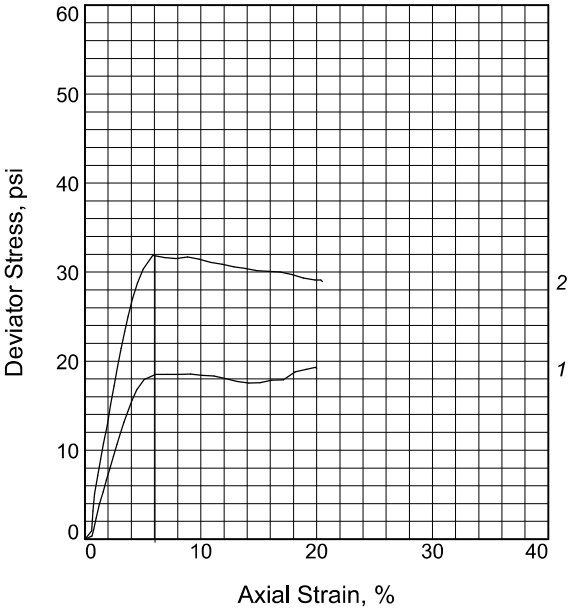
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	55.43	55.43	1.00	55.43	0.00
1	0.1255	2.573	2.6	2.3	0.36	55.43	55.79	1.01	55.61	0.18
2	0.1295	1.473	1.5	2.3	0.18	55.43	55.61	1.00	55.52	0.09
3	0.1801	8.869	8.9	3.3	1.38	55.43	56.81	1.02	56.12	0.69
4	0.2281	21.948	21.9	4.1	3.38	55.43	58.81	1.06	57.12	1.69
5	0.2616	34.552	34.6	4.7	5.29	55.43	60.72	1.10	58.07	2.64
6	0.2897	47.322	47.3	5.2	7.20	55.43	62.63	1.13	59.03	3.60
7	0.3124	58.860	58.9	5.7	8.92	55.43	64.35	1.16	59.89	4.46
8	0.3351	70.768	70.8	6.1	10.67	55.43	66.10	1.19	60.77	5.34
9	0.3578	83.876	83.9	6.5	12.60	55.43	68.03	1.23	61.73	6.30
10	0.3800	97.197	97.2	6.9	14.53	55.43	69.96	1.26	62.70	7.27
11	0.4027	109.940	109.9	7.3	16.37	55.43	71.80	1.30	63.61	8.18
12	0.4368	127.180	127.2	7.9	18.81	55.43	74.24	1.34	64.83	9.40
13	0.4649	140.584	140.6	8.4	20.67	55.43	76.10	1.37	65.77	10.34
14	0.4930	153.343	153.3	8.9	22.42	55.43	77.85	1.40	66.64	11.21
15	0.5348	168.215	168.2	9.7	24.39	55.43	79.82	1.44	67.63	12.20
16	0.5773	180.831	180.8	10.5	26.00	55.43	81.43	1.47	68.43	13.00
17	0.6335	195.318	195.3	11.5	27.76	55.43	83.19	1.50	69.31	13.88
18	0.6898	209.072	209.1	12.5	29.38	55.43	84.81	1.53	70.12	14.69
19	0.7460	216.785	216.8	13.5	30.11	55.43	85.54	1.54	70.48	15.05
20	0.8022	221.034	221.0	14.5	30.34	55.43	85.77	1.55	70.60	15.17
21	0.8584	222.780	222.8	15.5	30.21	55.43	85.64	1.55	70.54	15.11

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
22	0.9146	225.168	225.2	16.6	30.17	55.43	85.60	1.54	70.51	15.08
23	0.9708	229.246	229.2	17.6	30.34	55.43	85.77	1.55	70.60	15.17
24	0.9990	229.819	229.8	18.1	30.23	55.43	85.66	1.55	70.54	15.11
25	1.0127	228.631	228.6	18.3	29.98	55.43	85.41	1.54	70.42	14.99
26	1.0690	218.599	218.6	19.4	28.31	55.43	83.74	1.51	69.58	14.15
27	1.1252	212.024	212.0	20.4	27.11	55.43	82.54	1.49	68.98	13.55
28	1.1814	207.262	207.3	21.4	26.16	55.43	81.59	1.47	68.51	13.08
29	1.2376	205.576	205.6	22.4	25.61	55.43	81.04	1.46	68.24	12.81

After Test





Sample No.		1	2
Initial	Water Content, %	23.9	24.1
	Dry Density, pcf	103.0	98.2
	Saturation, %	96.3	86.9
	Void Ratio	0.6918	0.7728
	Diameter, in.	2.829	2.892
	Height, in.	5.605	5.625
At Test	Water Content, %	23.7	23.9
	Dry Density, pcf	103.0	98.2
	Saturation, %	95.6	86.3
	Void Ratio	0.6918	0.7728
	Diameter, in.	2.829	2.892
	Height, in.	5.605	5.625
Strain rate, in./min.		0.056	0.058
Back Pressure, psi		0	0
Cell Pressure, psi		35	69
Fail. Stress, psi		18	32
Strain, %		6.0	6.0
Ult. Stress, psi			
Strain, %			
σ_1 Failure, psi		53	101
σ_3 Failure, psi		35	69

Type of Test:
Unconsolidated Undrained
Sample Type: TRIMMED
Description: GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST
LL= 29 **PL=** 20 **PI=** 9
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 104

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

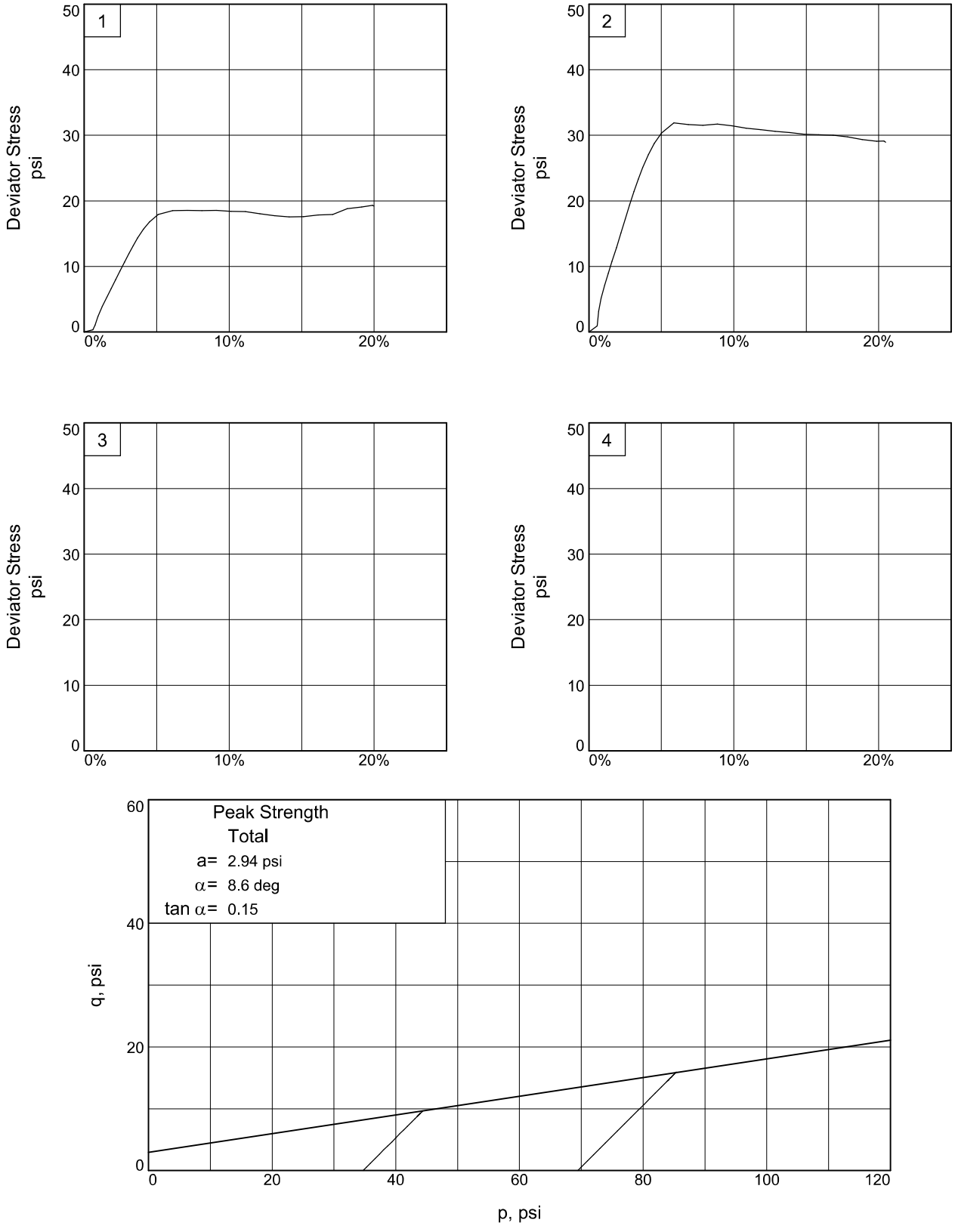
Source of Sample: B-070-0-20 **Depth:** 38.0-40.0 FT

Sample Number: ST-14

Proj. No.: 301525.1000 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22



Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

Source of Sample: B-070-0-20 **Depth:** 38.0-40.0 FT **Sample Number:** ST-14

Project No.: 301525.1000 **Figure** 105

TRC Engineers, Inc.

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

5/1/2026
7:30 AM

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-070-0-20
Depth: 38.0-40.0 FT **Sample Number:** ST-14
Description: GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**29 **PL=**20 **PI=**9
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1179.540	1339.420
Moisture content: Dry soil+tare, gms.	952.180	1113.760
Moisture content: Tare, gms.	0.000	161.580
Moisture, %	23.9	23.7
Moist specimen weight, gms.	1179.54	
Diameter, in.	2.829	
Area, in.²	6.286	
Height, in.	5.605	
Wet density, pcf	127.5	
Dry density, pcf	103.0	
Void ratio	0.6918	
Saturation, %	96.3	

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.1	0.2	0.5	62.0	37.2

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 34.70 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.056
Fail. Stress = 19.30 psi **at reading no.** 30

After Test

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	34.70	34.70	1.00	34.70	0.00
1	0.0333	2.187	2.2	0.6	0.35	34.70	35.05	1.01	34.87	0.17
2	0.0413	6.500	6.5	0.7	1.03	34.70	35.73	1.03	35.21	0.51
3	0.0530	15.046	15.0	0.9	2.37	34.70	37.07	1.07	35.89	1.19
4	0.0700	24.975	25.0	1.2	3.92	34.70	38.62	1.11	36.66	1.96
5	0.0874	33.994	34.0	1.6	5.32	34.70	40.02	1.15	37.36	2.66
6	0.1043	42.473	42.5	1.9	6.63	34.70	41.33	1.19	38.02	3.32
7	0.1210	51.095	51.1	2.2	7.95	34.70	42.65	1.23	38.68	3.98
8	0.1380	59.904	59.9	2.5	9.30	34.70	44.00	1.27	39.35	4.65
9	0.1553	68.833	68.8	2.8	10.65	34.70	45.35	1.31	40.02	5.32
10	0.1722	77.445	77.4	3.1	11.94	34.70	46.64	1.34	40.67	5.97
11	0.1890	85.656	85.7	3.4	13.17	34.70	47.87	1.38	41.28	6.58
12	0.2065	93.538	93.5	3.7	14.33	34.70	49.03	1.41	41.87	7.17
13	0.2287	102.715	102.7	4.1	15.67	34.70	50.37	1.45	42.54	7.84
14	0.2516	110.395	110.4	4.5	16.77	34.70	51.47	1.48	43.09	8.39
15	0.2857	118.784	118.8	5.1	17.93	34.70	52.63	1.52	43.67	8.97
16	0.3420	123.838	123.8	6.1	18.50	34.70	53.20	1.53	43.95	9.25
17	0.3984	125.374	125.4	7.1	18.53	34.70	53.23	1.53	43.96	9.26
18	0.4546	126.627	126.6	8.1	18.51	34.70	53.21	1.53	43.96	9.26
19	0.5109	128.315	128.3	9.1	18.55	34.70	53.25	1.53	43.98	9.28
20	0.5671	128.615	128.6	10.1	18.39	34.70	53.09	1.53	43.90	9.20
21	0.6234	129.768	129.8	11.1	18.35	34.70	53.05	1.53	43.87	9.17
22	0.6797	128.961	129.0	12.1	18.03	34.70	52.73	1.52	43.71	9.01
23	0.7354	128.155	128.2	13.1	17.71	34.70	52.41	1.51	43.56	8.86
24	0.7920	128.478	128.5	14.1	17.55	34.70	52.25	1.51	43.48	8.78
25	0.8477	130.224	130.2	15.1	17.58	34.70	52.28	1.51	43.49	8.79
26	0.9042	133.805	133.8	16.1	17.85	34.70	52.55	1.51	43.63	8.93
27	0.9605	135.837	135.8	17.1	17.91	34.70	52.61	1.52	43.65	8.95
28	1.0167	144.295	144.3	18.1	18.79	34.70	53.49	1.54	44.10	9.40
29	1.0730	148.304	148.3	19.1	19.08	34.70	53.78	1.55	44.24	9.54
30	1.1155	151.484	151.5	19.9	19.30	34.70	54.00	1.56	44.35	9.65
31	1.1203	150.801	150.8	20.0	19.20	34.70	53.90	1.55	44.30	9.60

Parameters for Specimen No. 2

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1181.920	1336.130
Moisture content: Dry soil+tare, gms.	952.660	1108.440
Moisture content: Tare, gms.	0.000	155.780
Moisture, %	24.1	23.9
Moist specimen weight, gms.	1181.92	
Diameter, in.	2.892	
Area, in.²	6.567	
Height, in.	5.625	
Wet density, pcf	121.9	
Dry density, pcf	98.2	
Void ratio	0.7728	
Saturation, %	86.9	

Test Readings for Specimen No. 2

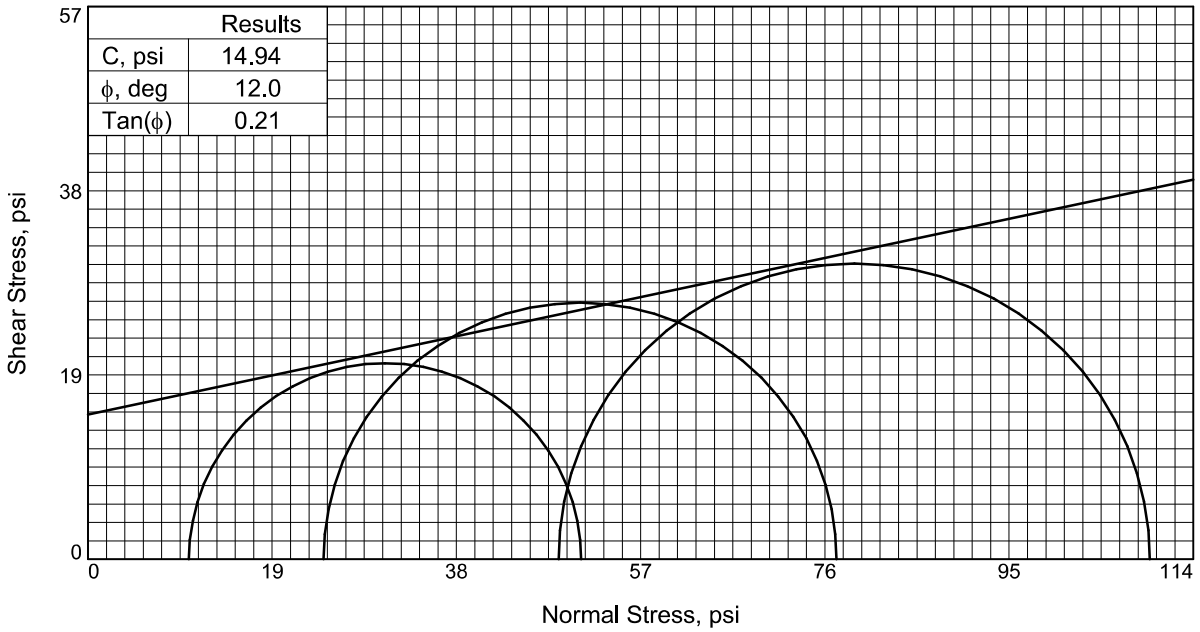
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 69.44 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.058
Fail. Stress = 31.69 psi **at reading no.** 20

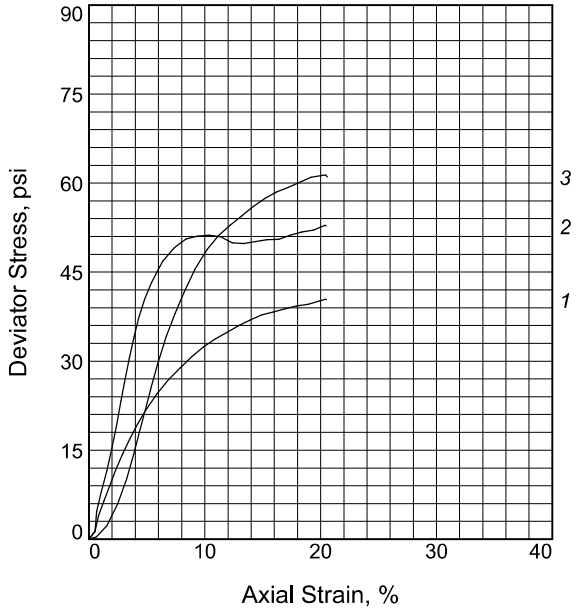
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	69.44	69.44	1.00	69.44	0.00
1	0.0321	6.126	6.1	0.6	0.93	69.44	70.37	1.01	69.90	0.46
2	0.0378	20.848	20.8	0.7	3.15	69.44	72.59	1.05	71.02	1.58
3	0.0469	33.851	33.9	0.8	5.11	69.44	74.55	1.07	72.00	2.56
4	0.0614	47.386	47.4	1.1	7.14	69.44	76.58	1.10	73.01	3.57
5	0.0758	59.688	59.7	1.3	8.97	69.44	78.41	1.13	73.92	4.48
6	0.0901	71.905	71.9	1.6	10.77	69.44	80.21	1.16	74.83	5.39
7	0.1075	86.013	86.0	1.9	12.85	69.44	82.29	1.19	75.86	6.42
8	0.1241	101.216	101.2	2.2	15.07	69.44	84.51	1.22	76.98	7.54
9	0.1410	116.041	116.0	2.5	17.23	69.44	86.67	1.25	78.05	8.61
10	0.1583	131.126	131.1	2.8	19.41	69.44	88.85	1.28	79.14	9.70
11	0.1750	145.197	145.2	3.1	21.42	69.44	90.86	1.31	80.15	10.71
12	0.1918	158.377	158.4	3.4	23.30	69.44	92.74	1.34	81.09	11.65
13	0.2085	170.920	170.9	3.7	25.06	69.44	94.50	1.36	81.97	12.53
14	0.2312	185.360	185.4	4.1	27.07	69.44	96.51	1.39	82.97	13.53
15	0.2540	197.687	197.7	4.5	28.75	69.44	98.19	1.41	83.81	14.37
16	0.2821	209.697	209.7	5.0	30.33	69.44	99.77	1.44	84.61	15.17
17	0.3301	222.346	222.3	5.9	31.87	69.44	101.31	1.46	85.38	15.94
18	0.3861	222.895	222.9	6.9	31.61	69.44	101.05	1.46	85.25	15.81
19	0.4423	224.715	224.7	7.9	31.53	69.44	100.97	1.45	85.21	15.77
20	0.4985	228.332	228.3	8.9	31.69	69.44	101.13	1.46	85.29	15.85
21	0.5548	229.100	229.1	9.9	31.45	69.44	100.89	1.45	85.16	15.72
22	0.6110	228.977	229.0	10.9	31.08	69.44	100.52	1.45	84.98	15.54
23	0.6673	229.908	229.9	11.9	30.86	69.44	100.30	1.44	84.87	15.43
24	0.7235	230.572	230.6	12.9	30.60	69.44	100.04	1.44	84.74	15.30
25	0.7797	231.876	231.9	13.9	30.42	69.44	99.86	1.44	84.65	15.21
26	0.8359	232.668	232.7	14.9	30.17	69.44	99.61	1.43	84.52	15.08

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
27	0.8921	234.689	234.7	15.9	30.07	69.44	99.51	1.43	84.48	15.04
28	0.9483	236.895	236.9	16.9	29.99	69.44	99.43	1.43	84.44	15.00
29	1.0045	237.724	237.7	17.9	29.74	69.44	99.18	1.43	84.31	14.87
30	1.0608	237.401	237.4	18.9	29.34	69.44	98.78	1.42	84.11	14.67
31	1.1170	238.385	238.4	19.9	29.09	69.44	98.53	1.42	83.99	14.55
32	1.1451	240.107	240.1	20.4	29.12	69.44	98.56	1.42	84.00	14.56
33	1.1523	238.885	238.9	20.5	28.93	69.44	98.37	1.42	83.90	14.46

After Test





Sample No.		1	2	3
Initial	Water Content, %	20.7	20.7	20.1
	Dry Density, pcf	109.4	108.7	110.6
	Saturation, %	97.4	95.7	97.3
	Void Ratio	0.5924	0.6030	0.5753
	Diameter, in.	2.834	2.833	2.821
	Height, in.	5.606	5.616	5.621
At Test	Water Content, %	20.6	20.6	20.0
	Dry Density, pcf	109.4	108.7	110.6
	Saturation, %	96.9	95.3	97.0
	Void Ratio	0.5924	0.6030	0.5753
	Diameter, in.	2.834	2.833	2.821
	Height, in.	5.606	5.616	5.621
Strain rate, in./min.		0.057	0.057	0.058
Back Pressure, psi		0	0	0
Cell Pressure, psi		10	24	49
Fail. Stress, psi		40	53	61
Strain, %		20.4	20.4	19.2
Ult. Stress, psi				
Strain, %				
σ_1 Failure, psi		51	77	110
σ_3 Failure, psi		10	24	49

Type of Test:
Unconsolidated Undrained

Sample Type: TRIMMED

Description: BROWN TO GROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE

LL= 23 **PL=** 19 **PI=** 4

Assumed Specific Gravity= 2.79

Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 106

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

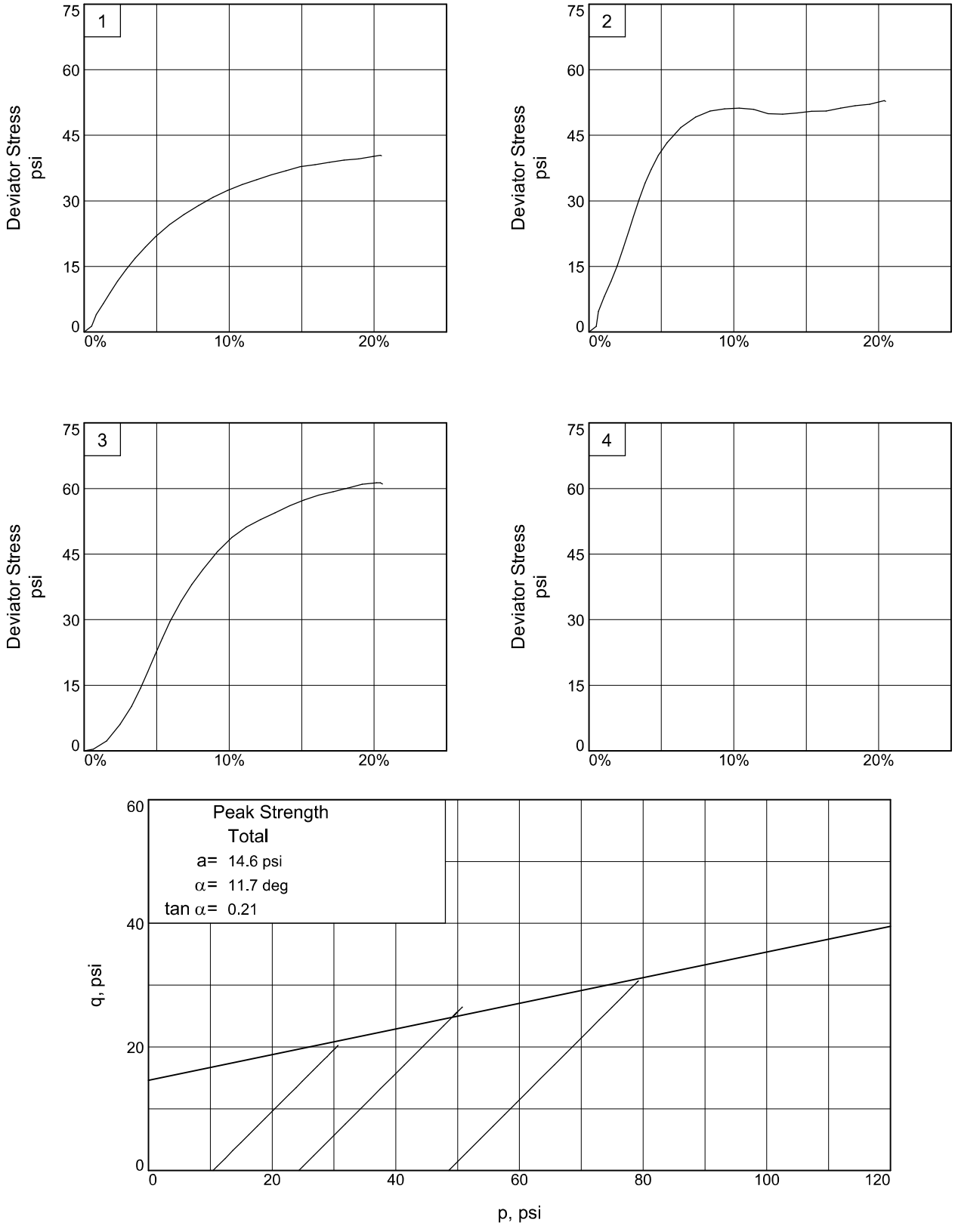
Source of Sample: B-071-0-20 **Depth:** 26.0-28.0 FT

Sample Number: ST-11

Proj. No.: 301525.1000 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22



Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Source of Sample: B-071-0-20 **Depth:** 26.0-28.0 FT **Sample Number:** ST-11
Project No.: 301525.1000 **Figure** 107

TRC Engineers, Inc.

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

5/1/2026
7:31 AM

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-071-0-20
Depth: 26.0-28.0 FT **Sample Number:** ST-11
Description: BROWN TO GROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**23 **PL=**19 **PI=**4
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1224.990	1381.950
Moisture content: Dry soil+tare, gms.	1015.130	1173.040
Moisture content: Tare, gms.	0.000	157.910
Moisture, %	20.7	20.6
Moist specimen weight, gms.	1224.99	
Diameter, in.	2.834	
Area, in.²	6.307	
Height, in.	5.606	
Wet density, pcf	132.0	
Dry density, pcf	109.4	
Void ratio	0.5924	
Saturation, %	97.4	

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.7	0.6	3.2	68.4	27.1

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 10.42 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.057
Fail. Stress = 40.44 psi **at reading no.** 25

After Test

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	10.42	10.42	1.00	10.42	0.00
1	0.0290	8.589	8.6	0.5	1.35	10.42	11.77	1.13	11.10	0.68
2	0.0468	25.285	25.3	0.8	3.98	10.42	14.40	1.38	12.41	1.99
3	0.0734	41.394	41.4	1.3	6.48	10.42	16.90	1.62	13.66	3.24
4	0.0998	57.657	57.7	1.8	8.98	10.42	19.40	1.86	14.91	4.49
5	0.1280	74.876	74.9	2.3	11.60	10.42	22.02	2.11	16.22	5.80
6	0.1622	93.018	93.0	2.9	14.32	10.42	24.74	2.37	17.58	7.16
7	0.1960	109.970	110.0	3.5	16.83	10.42	27.25	2.61	18.83	8.41
8	0.2359	127.753	127.8	4.2	19.40	10.42	29.82	2.86	20.12	9.70
9	0.2756	144.486	144.5	4.9	21.78	10.42	32.20	3.09	21.31	10.89
10	0.3295	164.595	164.6	5.9	24.56	10.42	34.98	3.36	22.70	12.28
11	0.3858	182.129	182.1	6.9	26.89	10.42	37.31	3.58	23.86	13.44
12	0.4421	197.919	197.9	7.9	28.91	10.42	39.33	3.77	24.87	14.45
13	0.4984	213.150	213.1	8.9	30.79	10.42	41.21	3.95	25.82	15.40
14	0.5547	226.881	226.9	9.9	32.41	10.42	42.83	4.11	26.63	16.21
15	0.6109	238.783	238.8	10.9	33.73	10.42	44.15	4.24	27.29	16.87
16	0.6672	249.453	249.5	11.9	34.84	10.42	45.26	4.34	27.84	17.42
17	0.7238	260.455	260.5	12.9	35.96	10.42	46.38	4.45	28.40	17.98
18	0.7800	270.344	270.3	13.9	36.90	10.42	47.32	4.54	28.87	18.45
19	0.8359	280.285	280.3	14.9	37.81	10.42	48.23	4.63	29.33	18.91
20	0.8922	287.122	287.1	15.9	38.28	10.42	48.70	4.67	29.56	19.14
21	0.9487	294.703	294.7	16.9	38.82	10.42	49.24	4.73	29.83	19.41
22	1.0047	301.876	301.9	17.9	39.29	10.42	49.71	4.77	30.06	19.64
23	1.0612	307.883	307.9	18.9	39.57	10.42	49.99	4.80	30.21	19.79
24	1.1174	316.362	316.4	19.9	40.16	10.42	50.58	4.85	30.50	20.08
25	1.1450	320.499	320.5	20.4	40.44	10.42	50.86	4.88	30.64	20.22
26	1.1494	320.044	320.0	20.5	40.34	10.42	50.76	4.87	30.59	20.17

Parameters for Specimen No. 2

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1218.780	1373.890
Moisture content: Dry soil+tare, gms.	1009.970	1165.950
Moisture content: Tare, gms.	0.000	155.980
Moisture, %	20.7	20.6
Moist specimen weight, gms.	1218.78	
Diameter, in.	2.833	
Area, in.²	6.305	
Height, in.	5.616	
Wet density, pcf	131.1	
Dry density, pcf	108.7	
Void ratio	0.6030	
Saturation, %	95.7	

After Test

Test Readings for Specimen No. 2

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 24.30 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.057
Fail. Stress = 52.90 psi **at reading no.** 28

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	24.30	24.30	1.00	24.30	0.00
1	0.0287	8.203	8.2	0.5	1.29	24.30	25.59	1.05	24.95	0.65
2	0.0373	29.832	29.8	0.7	4.70	24.30	29.00	1.19	26.65	2.35
3	0.0596	51.583	51.6	1.1	8.09	24.30	32.39	1.33	28.35	4.05
4	0.0861	73.804	73.8	1.5	11.53	24.30	35.83	1.47	30.06	5.76
5	0.1101	97.386	97.4	2.0	15.14	24.30	39.44	1.62	31.87	7.57
6	0.1329	123.310	123.3	2.4	19.10	24.30	43.40	1.79	33.85	9.55
7	0.1556	150.872	150.9	2.8	23.27	24.30	47.57	1.96	35.93	11.63
8	0.1724	171.961	172.0	3.1	26.44	24.30	50.74	2.09	37.52	13.22
9	0.1954	198.761	198.8	3.5	30.43	24.30	54.73	2.25	39.51	15.21
10	0.2181	223.482	223.5	3.9	34.07	24.30	58.37	2.40	41.33	17.03
11	0.2410	244.874	244.9	4.3	37.17	24.30	61.47	2.53	42.89	18.59
12	0.2696	267.587	267.6	4.8	40.40	24.30	64.70	2.66	44.50	20.20
13	0.3035	288.534	288.5	5.4	43.29	24.30	67.59	2.78	45.95	21.65
14	0.3569	315.045	315.0	6.4	46.79	24.30	71.09	2.93	47.70	23.40
15	0.4134	334.375	334.4	7.4	49.13	24.30	73.43	3.02	48.87	24.57
16	0.4698	347.855	347.9	8.4	50.56	24.30	74.86	3.08	49.58	25.28
17	0.5260	355.157	355.2	9.4	51.05	24.30	75.35	3.10	49.83	25.53
18	0.5819	360.188	360.2	10.4	51.21	24.30	75.51	3.11	49.90	25.60
19	0.6382	362.367	362.4	11.4	50.94	24.30	75.24	3.10	49.77	25.47
20	0.6945	359.288	359.3	12.4	49.94	24.30	74.24	3.06	49.27	24.97
21	0.7508	362.495	362.5	13.4	49.81	24.30	74.11	3.05	49.20	24.90
22	0.8072	368.991	369.0	14.4	50.11	24.30	74.41	3.06	49.36	25.06
23	0.8634	376.037	376.0	15.4	50.47	24.30	74.77	3.08	49.54	25.24
24	0.9200	380.855	380.9	16.4	50.51	24.30	74.81	3.08	49.56	25.26
25	0.9762	390.986	391.0	17.4	51.24	24.30	75.54	3.11	49.92	25.62
26	1.0321	399.806	399.8	18.4	51.76	24.30	76.06	3.13	50.18	25.88

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
27	1.0883	407.228	407.2	19.4	52.07	24.30	76.37	3.14	50.34	26.04
28	1.1446	418.914	418.9	20.4	52.90	24.30	77.20	3.18	50.75	26.45
29	1.1501	418.428	418.4	20.5	52.78	24.30	77.08	3.17	50.69	26.39

Parameters for Specimen No. 3

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1224.490	1378.860
Moisture content: Dry soil+tare, gms.	1019.860	1174.930
Moisture content: Tare, gms.	0.000	155.070
Moisture, %	20.1	20.0
Moist specimen weight, gms.	1224.49	
Diameter, in.	2.821	
Area, in.²	6.252	
Height, in.	5.621	
Wet density, pcf	132.8	
Dry density, pcf	110.6	
Void ratio	0.5753	
Saturation, %	97.3	

Test Readings for Specimen No. 3

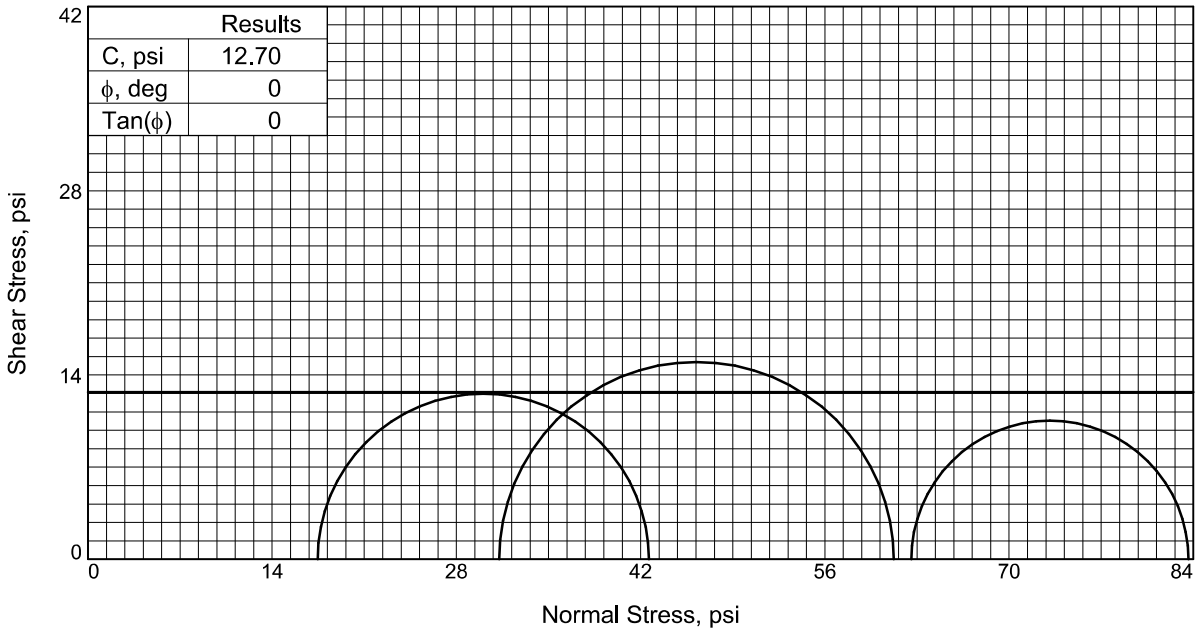
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 48.54 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.058
Fail. Stress = 60.97 psi **at reading no.** 23

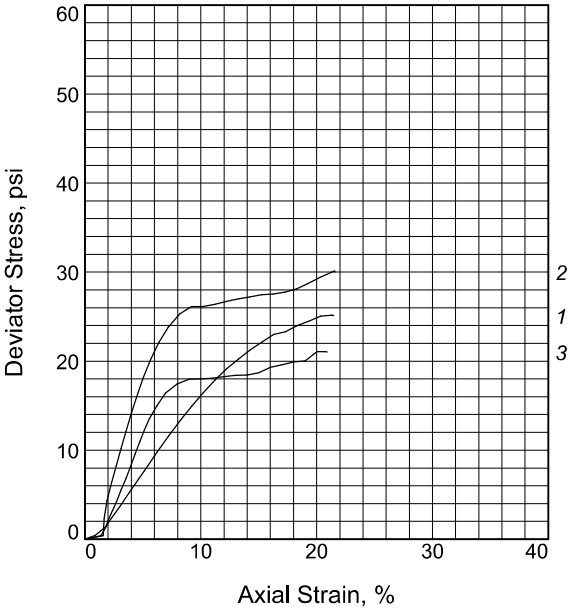
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	48.54	48.54	1.00	48.54	0.00
1	0.0357	2.598	2.6	0.6	0.41	48.54	48.95	1.01	48.75	0.21
2	0.0862	14.298	14.3	1.5	2.25	48.54	50.79	1.05	49.67	1.13
3	0.1384	38.440	38.4	2.5	6.00	48.54	54.54	1.12	51.54	3.00
4	0.1832	65.902	65.9	3.3	10.20	48.54	58.74	1.21	53.64	5.10
5	0.2176	93.313	93.3	3.9	14.35	48.54	62.89	1.30	55.71	7.17
6	0.2457	118.393	118.4	4.4	18.11	48.54	66.65	1.37	57.60	9.06
7	0.2738	144.080	144.1	4.9	21.92	48.54	70.46	1.45	59.50	10.96
8	0.3019	169.755	169.8	5.4	25.70	48.54	74.24	1.53	61.39	12.85
9	0.3330	196.567	196.6	5.9	29.58	48.54	78.12	1.61	63.33	14.79
10	0.3756	229.211	229.2	6.7	34.21	48.54	82.75	1.70	65.65	17.11
11	0.4173	256.818	256.8	7.4	38.03	48.54	86.57	1.78	67.56	19.02
12	0.4599	282.344	282.3	8.2	41.47	48.54	90.01	1.85	69.27	20.73
13	0.5161	313.455	313.5	9.2	45.54	48.54	94.08	1.94	71.31	22.77
14	0.5723	339.758	339.8	10.2	48.81	48.54	97.35	2.01	72.95	24.41
15	0.6285	360.234	360.2	11.2	51.18	48.54	99.72	2.05	74.13	25.59
16	0.6847	376.401	376.4	12.2	52.87	48.54	101.41	2.09	74.98	26.44
17	0.7409	392.147	392.1	13.2	54.46	48.54	103.00	2.12	75.77	27.23
18	0.7971	408.240	408.2	14.2	56.04	48.54	104.58	2.15	76.56	28.02
19	0.8533	423.051	423.1	15.2	57.40	48.54	105.94	2.18	77.24	28.70

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
20	0.9095	436.381	436.4	16.2	58.51	48.54	107.05	2.21	77.79	29.25
21	0.9658	447.378	447.4	17.2	59.27	48.54	107.81	2.22	78.17	29.63
22	1.0220	459.337	459.3	18.2	60.12	48.54	108.66	2.24	78.60	30.06
23	1.0777	471.585	471.6	19.2	60.97	48.54	109.51	2.26	79.03	30.49
24	1.1339	479.953	480.0	20.2	61.29	48.54	109.83	2.26	79.18	30.64
25	1.1482	481.971	482.0	20.4	61.35	48.54	109.89	2.26	79.21	30.67
26	1.1566	480.660	480.7	20.6	61.07	48.54	109.61	2.26	79.07	30.53

After Test





Sample No.		1	2	3
Initial	Water Content, %	21.4	23.1	24.1
	Dry Density, pcf	110.0	103.7	103.4
	Saturation, %	102.2	94.9	98.5
	Void Ratio	0.5830	0.6792	0.6837
	Diameter, in.	2.807	2.856	2.831
	Height, in.	5.570	5.588	5.592
At Test	Water Content, %	21.0	23.0	24.0
	Dry Density, pcf	110.0	103.7	103.4
	Saturation, %	100.7	94.4	98.1
	Void Ratio	0.5830	0.6792	0.6837
	Diameter, in.	2.807	2.856	2.831
	Height, in.	5.570	5.588	5.592
Strain rate, in./min.		1.067	1.077	1.043
Back Pressure, psi		0.0	0.0	0.0
Cell Pressure, psi		17.5	31.3	62.6
Fail. Stress, psi		25.2	30.0	21.1
Strain, %		21.3	21.3	20.0
Ult. Stress, psi				
Strain, %				
σ_1 Failure, psi		42.6	61.2	83.6
σ_3 Failure, psi		17.5	31.3	62.6

Type of Test:
Unconsolidated Undrained
Sample Type: TRIMMED
Description: BROWN TO BROWN-GRAY SILT, SOME CLAY, TRACE FCOARSE AND FINE
LL= 22 **PL=** 19 **PI=** 3
Assumed Specific Gravity= 2.79
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 109

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

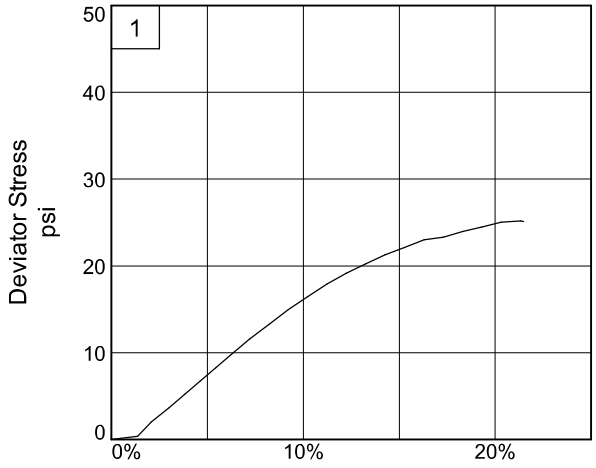
Source of Sample: B-071-0-20 **Depth:** 36.0-38.0 FT

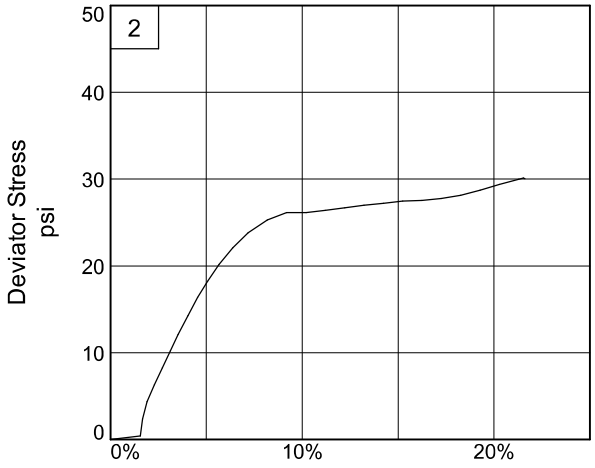
Sample Number: ST-14

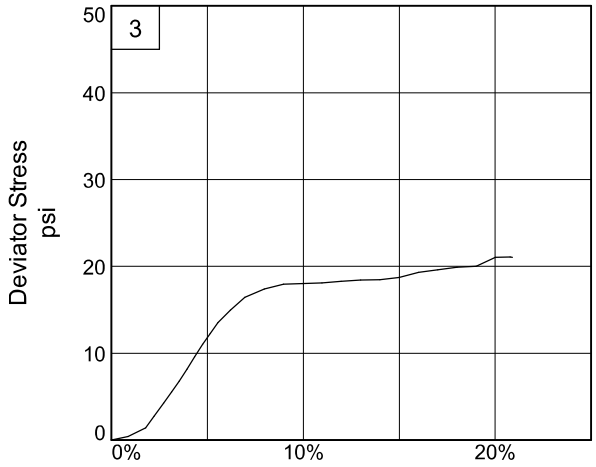
Proj. No.: 301525.1000 **Date Sampled:**

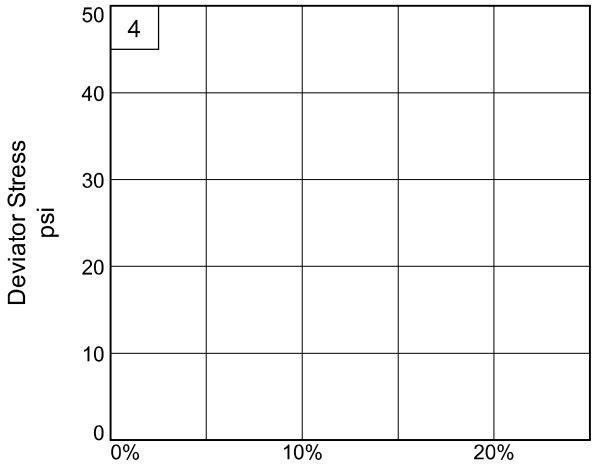
TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

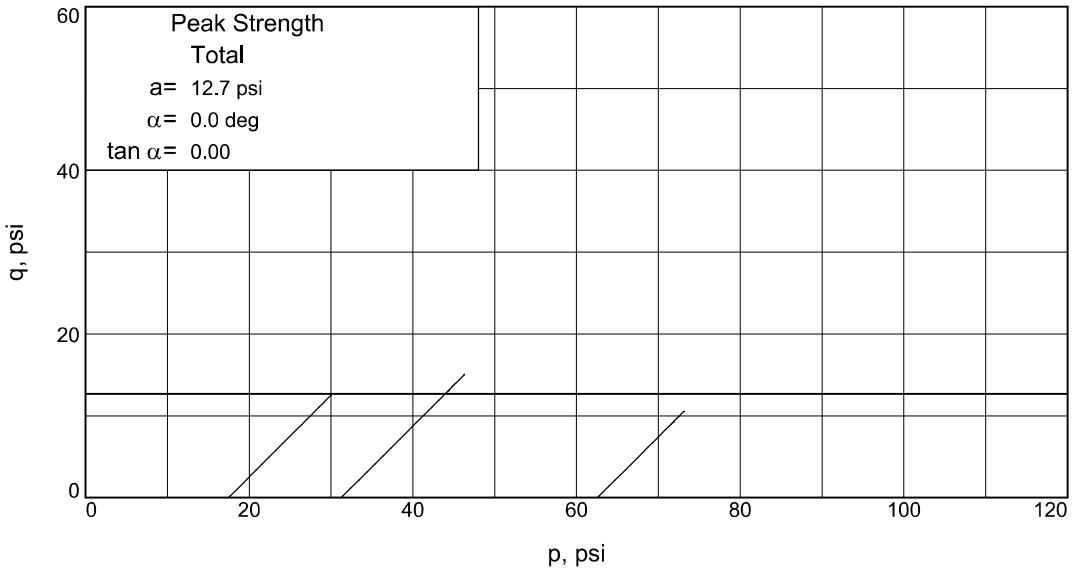
Tested By: TBT 04/09/22 **Checked By:** SM 04/11/22











Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Source of Sample: B-071-0-20 **Depth:** 36.0-38.0 FT **Sample Number:** ST-14
Project No.: 301525.1000 **Figure** 110

TRC Engineers, Inc.

Tested By: TBT 04/09/22 **Checked By:** SM 04/11/22

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

5/1/2026
7:32 AM

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-071-0-20
Depth: 36.0-38.0 FT **Sample Number:** ST-14
Description: BROWN TO BROWN-GRAY SILT, SOME CLAY, TRACE FCOARSE AND FINE SAND, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Assumed Specific Gravity=2.79 **LL=**22 **PL=**19 **PI=**3
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1208.290	1360.620
Moisture content: Dry soil+tare, gms.	995.680	1151.120
Moisture content: Tare, gms.	0.000	155.440
Moisture, %	21.4	21.0
Moist specimen weight, gms.	1208.29	
Diameter, in.	2.807	
Area, in.²	6.190	
Height, in.	5.570	
Wet density, pcf	133.5	
Dry density, pcf	110.0	
Void ratio	0.5830	
Saturation, %	102.2	

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.1	0.1	0.9	77.2	21.7

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 17.46 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 1.067
Fail. Stress = 25.17 psi **at reading no.** 22

After Test

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	17.46	17.46	1.00	17.46	0.00
1	0.0760	2.589	2.6	1.4	0.39	17.46	17.85	1.02	17.65	0.19
2	0.1160	12.780	12.8	2.1	2.02	17.46	19.48	1.12	18.47	1.01
3	0.1672	23.351	23.4	3.0	3.66	17.46	21.12	1.21	19.29	1.83
4	0.2126	33.442	33.4	3.8	5.20	17.46	22.66	1.30	20.06	2.60
5	0.2576	43.694	43.7	4.6	6.73	17.46	24.19	1.39	20.83	3.37
6	0.3029	54.113	54.1	5.4	8.27	17.46	25.73	1.47	21.59	4.13
7	0.3478	64.900	64.9	6.2	9.83	17.46	27.29	1.56	22.38	4.92
8	0.4011	77.277	77.3	7.2	11.59	17.46	29.05	1.66	23.25	5.79
9	0.4573	89.548	89.5	8.2	13.28	17.46	30.74	1.76	24.10	6.64
10	0.5135	101.952	102.0	9.2	14.95	17.46	32.41	1.86	24.94	7.48
11	0.5697	113.469	113.5	10.2	16.46	17.46	33.92	1.94	25.69	8.23
12	0.6259	124.798	124.8	11.2	17.90	17.46	35.36	2.03	26.41	8.95
13	0.6821	135.133	135.1	12.2	19.16	17.46	36.62	2.10	27.04	9.58
14	0.7383	144.498	144.5	13.3	20.25	17.46	37.71	2.16	27.59	10.13
15	0.7945	153.661	153.7	14.3	21.28	17.46	38.74	2.22	28.10	10.64
16	0.8507	161.655	161.7	15.3	22.13	17.46	39.59	2.27	28.52	11.06
17	0.9070	169.928	169.9	16.3	22.98	17.46	40.44	2.32	28.95	11.49
18	0.9632	174.381	174.4	17.3	23.30	17.46	40.76	2.33	29.11	11.65
19	1.0194	181.579	181.6	18.3	23.97	17.46	41.43	2.37	29.44	11.98
20	1.0756	187.850	187.9	19.3	24.49	17.46	41.95	2.40	29.70	12.24
21	1.1319	194.467	194.5	20.3	25.03	17.46	42.49	2.43	29.98	12.52
22	1.1881	198.024	198.0	21.3	25.17	17.46	42.63	2.44	30.04	12.58
23	1.1964	197.934	197.9	21.5	25.11	17.46	42.57	2.44	30.01	12.55

Parameters for Specimen No. 2

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1199.400	1358.830
Moisture content: Dry soil+tare, gms.	974.330	1134.870
Moisture content: Tare, gms.	0.000	160.540
Moisture, %	23.1	23.0
Moist specimen weight, gms.	1199.40	
Diameter, in.	2.856	
Area, in.²	6.404	
Height, in.	5.588	
Wet density, pcf	127.7	
Dry density, pcf	103.7	
Void ratio	0.6792	
Saturation, %	94.9	

After Test

Test Readings for Specimen No. 2

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 31.25 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 1.077
Fail. Stress = 29.98 psi **at reading no.** 27

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	31.25	31.25	1.00	31.25	0.00
1	0.0871	2.837	2.8	1.6	0.41	31.25	31.66	1.01	31.45	0.20
2	0.0932	15.233	15.2	1.7	2.34	31.25	33.59	1.07	32.42	1.17
3	0.1065	28.349	28.3	1.9	4.34	31.25	35.59	1.14	33.42	2.17
4	0.1280	41.423	41.4	2.3	6.32	31.25	37.57	1.20	34.41	3.16
5	0.1516	54.382	54.4	2.7	8.26	31.25	39.51	1.26	35.38	4.13
6	0.1745	67.538	67.5	3.1	10.22	31.25	41.47	1.33	36.36	5.11
7	0.1973	80.276	80.3	3.5	12.09	31.25	43.34	1.39	37.30	6.05
8	0.2257	95.268	95.3	4.0	14.28	31.25	45.53	1.46	38.39	7.14
9	0.2538	109.703	109.7	4.5	16.35	31.25	47.60	1.52	39.43	8.18
10	0.2826	122.815	122.8	5.1	18.21	31.25	49.46	1.58	40.35	9.10
11	0.3164	136.813	136.8	5.7	20.15	31.25	51.40	1.64	41.33	10.08
12	0.3563	151.140	151.1	6.4	22.10	31.25	53.35	1.71	42.30	11.05
13	0.4014	164.283	164.3	7.2	23.81	31.25	55.06	1.76	43.16	11.91
14	0.4571	176.452	176.5	8.2	25.30	31.25	56.55	1.81	43.90	12.65
15	0.5135	184.282	184.3	9.2	26.13	31.25	57.38	1.84	44.32	13.07
16	0.5698	186.492	186.5	10.2	26.15	31.25	57.40	1.84	44.33	13.08
17	0.6260	190.315	190.3	11.2	26.39	31.25	57.64	1.84	44.44	13.19
18	0.6824	194.776	194.8	12.2	26.70	31.25	57.95	1.85	44.60	13.35
19	0.7387	199.109	199.1	13.2	26.98	31.25	58.23	1.86	44.74	13.49
20	0.7953	203.196	203.2	14.2	27.21	31.25	58.46	1.87	44.86	13.61
21	0.8517	207.477	207.5	15.2	27.46	31.25	58.71	1.88	44.98	13.73
22	0.9074	210.595	210.6	16.2	27.54	31.25	58.79	1.88	45.02	13.77
23	0.9636	214.832	214.8	17.2	27.76	31.25	59.01	1.89	45.13	13.88
24	1.0204	220.254	220.3	18.3	28.11	31.25	59.36	1.90	45.31	14.06
25	1.0767	227.807	227.8	19.3	28.72	31.25	59.97	1.92	45.61	14.36
26	1.1330	236.125	236.1	20.3	29.40	31.25	60.65	1.94	45.95	14.70

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
27	1.1889	243.881	243.9	21.3	29.98	31.25	61.23	1.96	46.24	14.99
28	1.2032	245.945	245.9	21.5	30.13	31.25	61.38	1.96	46.32	15.07
29	1.2074	245.357	245.4	21.6	30.03	31.25	61.28	1.96	46.27	15.02

Parameters for Specimen No. 3

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1186.780	1345.430
Moisture content: Dry soil+tare, gms.	956.040	1115.700
Moisture content: Tare, gms.	0.000	159.660
Moisture, %	24.1	24.0
Moist specimen weight, gms.	1186.78	
Diameter, in.	2.831	
Area, in.²	6.296	
Height, in.	5.592	
Wet density, pcf	128.4	
Dry density, pcf	103.4	
Void ratio	0.6837	
Saturation, %	98.5	

After Test

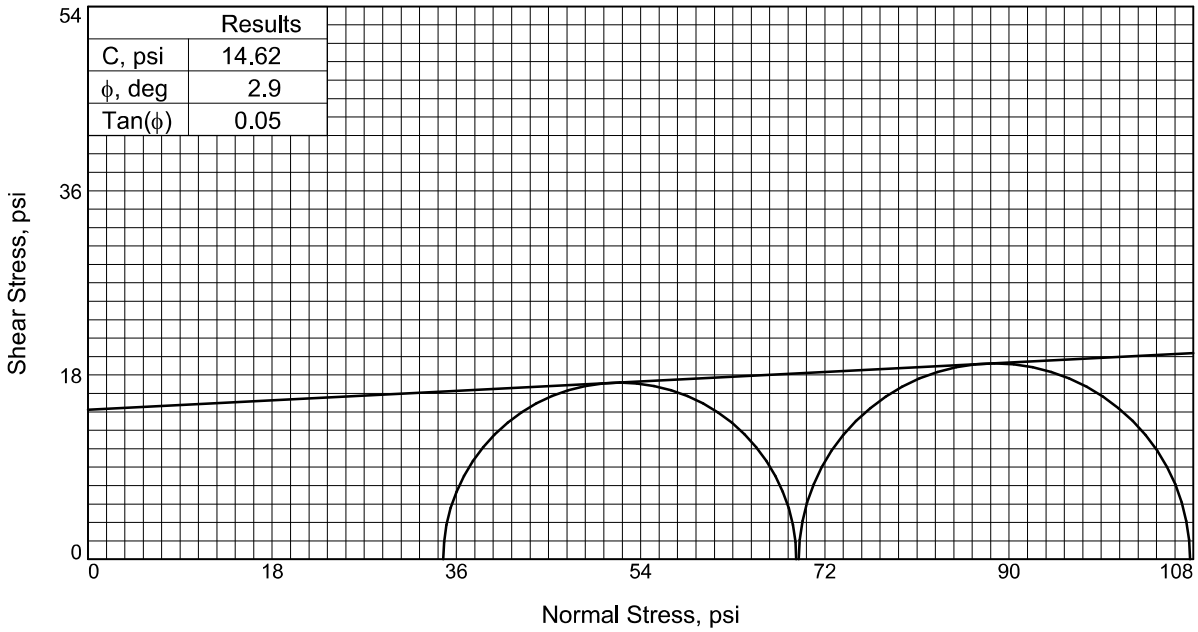
Test Readings for Specimen No. 3

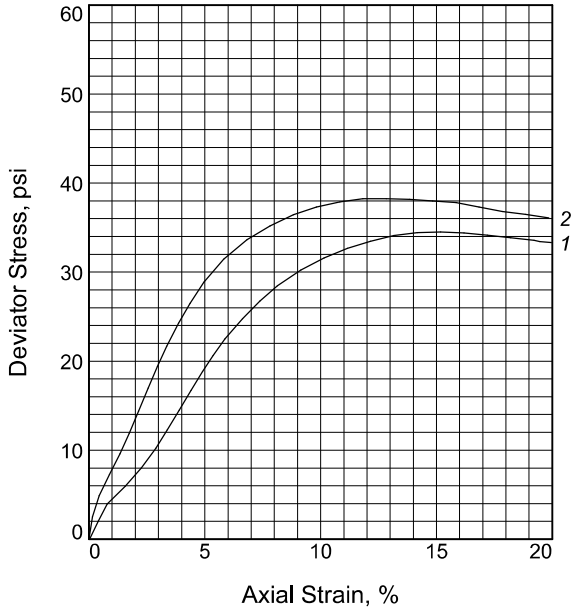
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 62.57 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 1.043
Fail. Stress = 21.05 psi **at reading no.** 26

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	0.000	0.0	0.0	0.00	62.57	62.57	1.00	62.57	0.00
1	0.0484	2.635	2.6	0.9	0.41	62.57	62.98	1.01	62.78	0.21
2	0.0993	8.974	9.0	1.8	1.40	62.57	63.97	1.02	63.27	0.70
3	0.1238	17.644	17.6	2.2	2.74	62.57	65.31	1.04	63.94	1.37
4	0.1519	27.477	27.5	2.7	4.25	62.57	66.82	1.07	64.69	2.12
5	0.1746	35.886	35.9	3.1	5.52	62.57	68.09	1.09	65.33	2.76
6	0.1973	44.293	44.3	3.5	6.79	62.57	69.36	1.11	65.96	3.39
7	0.2200	53.265	53.3	3.9	8.13	62.57	70.70	1.13	66.63	4.06
8	0.2422	63.130	63.1	4.3	9.59	62.57	72.16	1.15	67.37	4.80
9	0.2649	72.739	72.7	4.7	11.01	62.57	73.58	1.18	68.07	5.50
10	0.2876	81.509	81.5	5.1	12.28	62.57	74.85	1.20	68.71	6.14
11	0.3103	90.018	90.0	5.5	13.50	62.57	76.07	1.22	69.32	6.75
12	0.3468	100.488	100.5	6.2	14.97	62.57	77.54	1.24	70.06	7.49
13	0.3888	111.307	111.3	7.0	16.45	62.57	79.02	1.26	70.80	8.23
14	0.4450	119.093	119.1	8.0	17.41	62.57	79.98	1.28	71.28	8.71
15	0.5012	124.261	124.3	9.0	17.97	62.57	80.54	1.29	71.55	8.98
16	0.5574	126.035	126.0	10.0	18.02	62.57	80.59	1.29	71.58	9.01
17	0.6136	127.943	127.9	11.0	18.09	62.57	80.66	1.29	71.62	9.05
18	0.6698	130.637	130.6	12.0	18.26	62.57	80.83	1.29	71.70	9.13
19	0.7260	133.309	133.3	13.0	18.42	62.57	80.99	1.29	71.78	9.21

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
20	0.7823	135.102	135.1	14.0	18.46	62.57	81.03	1.29	71.80	9.23
21	0.8385	138.579	138.6	15.0	18.71	62.57	81.28	1.30	71.93	9.36
22	0.8946	144.737	144.7	16.0	19.31	62.57	81.88	1.31	72.23	9.66
23	0.9509	148.642	148.6	17.0	19.59	62.57	82.16	1.31	72.37	9.80
24	1.0071	152.895	152.9	18.0	19.91	62.57	82.48	1.32	72.53	9.96
25	1.0633	155.662	155.7	19.0	20.02	62.57	82.59	1.32	72.58	10.01
26	1.1196	165.732	165.7	20.0	21.05	62.57	83.62	1.34	73.10	10.53
27	1.1620	167.432	167.4	20.8	21.07	62.57	83.64	1.34	73.10	10.53
28	1.1686	167.399	167.4	20.9	21.03	62.57	83.60	1.34	73.09	10.52





Sample No.		1	2
Initial	Water Content, %	23.8	22.9
	Dry Density, pcf	104.7	105.0
	Saturation, %	100.0	97.1
	Void Ratio	0.6630	0.6581
	Diameter, in.	2.820	2.832
	Height, in.	5.585	5.609
At Test	Water Content, %	23.6	22.8
	Dry Density, pcf	104.7	105.0
	Saturation, %	99.5	96.6
	Void Ratio	0.6630	0.6581
	Diameter, in.	2.820	2.832
	Height, in.	5.585	5.609
Strain rate, in./min.		0.056	0.061
Back Pressure, psi		0	0
Cell Pressure, psi		35	69
Fail. Stress, psi		35	38
Strain, %		15.2	11.8
Ult. Stress, psi			
Strain, %			
σ_1 Failure, psi		69	108
σ_3 Failure, psi		35	69

Type of Test:
Unconsolidated Undrained

Sample Type: TRIMMED

Description: BROWN-GRAY SILT, SOME CLAY, TRACE FINE SAND, MOIST

LL= 33 **PL=** 21 **PI=** 12

Specific Gravity= 2.79

Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION

Figure 110

Client: OHIO DEPARTMENT OF TRANSPORTATION

Project: CUY-77-11.21

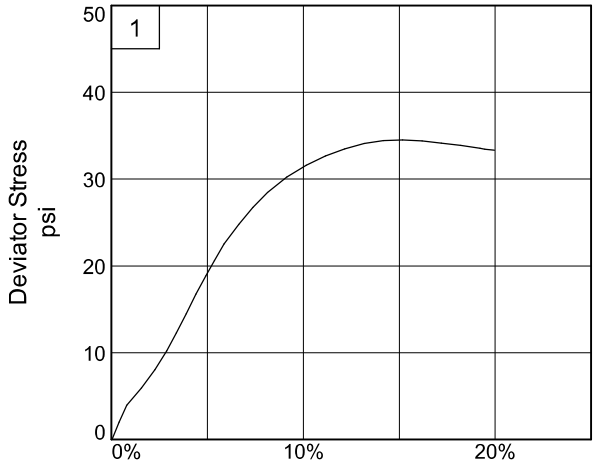
Source of Sample: B-071-0-20 **Depth:** 41.0-43.0 FT

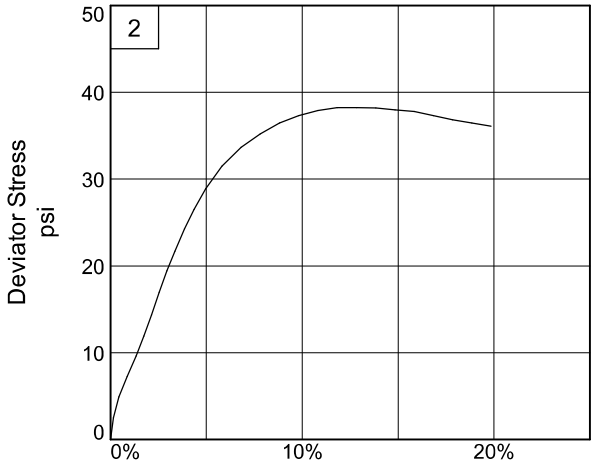
Sample Number: ST-16

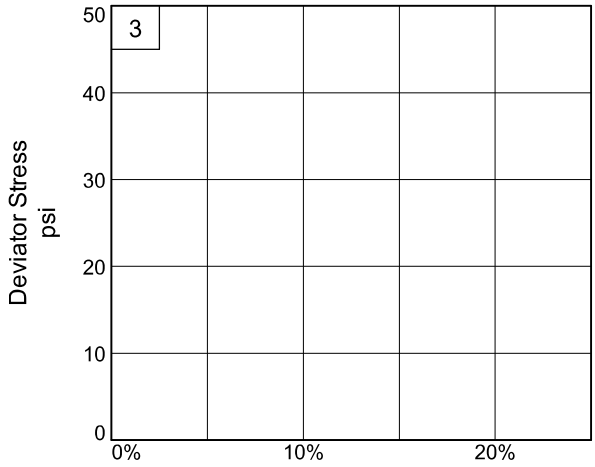
Proj. No.: 301525.1000 **Date Sampled:**

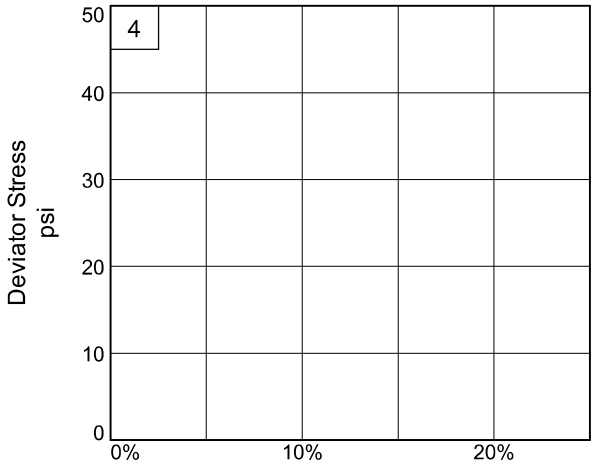
TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

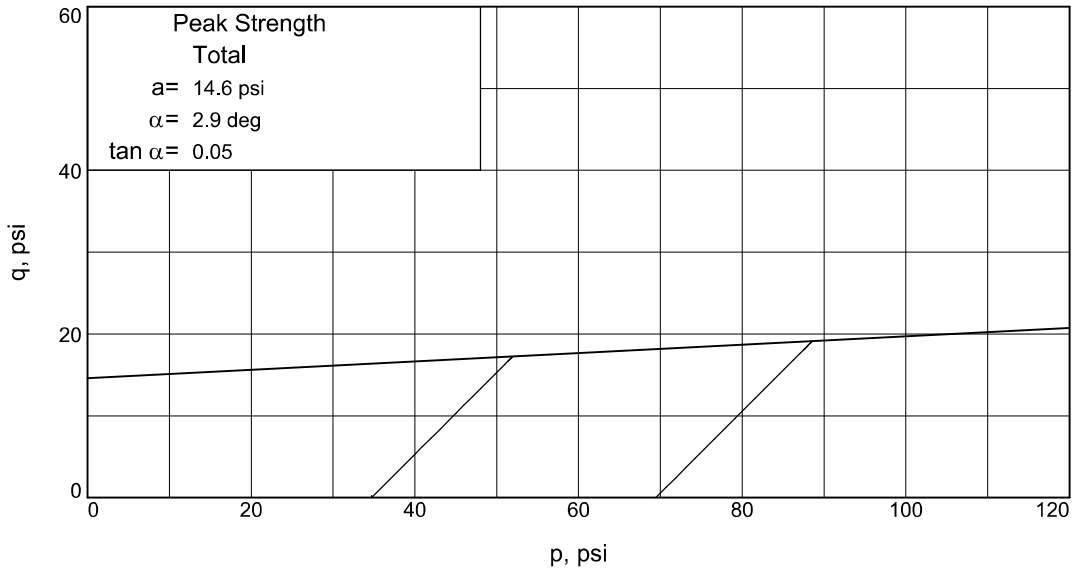
Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22











Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Source of Sample: B-071-0-20 **Depth:** 41.0-43.0 FT **Sample Number:** ST-16
Project No.: 301525.1000 **Figure** 111

TRC Engineers, Inc.

Tested By: TBT 04/02/22 **Checked By:** SM 04/08/22

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

5/1/2026
7:33 AM

Date:
Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project No.: 301525.1000
Location: B-071-0-20
Depth: 41.0-43.0 FT **Sample Number:** ST-16
Description: BROWN-GRAY SILT, SOME CLAY, TRACE FINE SAND, MOIST
Remarks: SAMPLE DESCRIPTION BASED ON ODOT CLASSIFICATION
Type of Sample: TRIMMED
Specific Gravity=2.79 **LL=**33 **PL=**21 **PI=**12
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1186.900	1341.170
Moisture content: Dry soil+tare, gms.	958.920	1114.430
Moisture content: Tare, gms.	0.000	155.510
Moisture, %	23.8	23.6
Moist specimen weight, gms.	1186.90	
Diameter, in.	2.820	
Area, in.²	6.245	
Height, in.	5.585	
Wet density, pcf	129.6	
Dry density, pcf	104.7	
Void ratio	0.6630	
Saturation, %	100.0	

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.1	0.0	0.4	67.2	32.3

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 34.70 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.056
Fail. Stress = 34.50 psi **at reading no.** 22

After Test

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.0000	-15.185	0.0	0.0	0.00	34.70	34.70	1.00	34.70	0.00
1	0.0015	-15.213	0.0	0.0	0.00	34.70	34.70	1.00	34.70	0.00
2	0.0220	-2.627	12.6	0.4	2.00	34.70	36.70	1.06	35.70	1.00
3	0.0437	9.655	24.8	0.8	3.95	34.70	38.65	1.11	36.67	1.97
4	0.0869	22.406	37.6	1.6	5.93	34.70	40.63	1.17	37.66	2.96
5	0.1265	36.108	51.3	2.3	8.03	34.70	42.73	1.23	38.71	4.01
6	0.1609	50.524	65.7	2.9	10.22	34.70	44.92	1.29	39.81	5.11
7	0.1892	64.220	79.4	3.4	12.28	34.70	46.98	1.35	40.84	6.14
8	0.2175	79.002	94.2	3.9	14.49	34.70	49.19	1.42	41.95	7.25
9	0.2459	94.072	109.3	4.4	16.73	34.70	51.43	1.48	43.06	8.36
10	0.2740	108.519	123.7	4.9	18.84	34.70	53.54	1.54	44.12	9.42
11	0.2993	120.939	136.1	5.4	20.63	34.70	55.33	1.59	45.01	10.31
12	0.3275	134.138	149.3	5.9	22.51	34.70	57.21	1.65	45.95	11.25
13	0.3698	150.484	165.7	6.6	24.77	34.70	59.47	1.71	47.09	12.39
14	0.4117	165.069	180.3	7.4	26.74	34.70	61.44	1.77	48.07	13.37
15	0.4542	178.211	193.4	8.1	28.45	34.70	63.15	1.82	48.93	14.23
16	0.5105	192.600	207.8	9.1	30.23	34.70	64.93	1.87	49.82	15.12
17	0.5668	204.433	219.6	10.1	31.60	34.70	66.30	1.91	50.50	15.80
18	0.6231	214.445	229.6	11.2	32.67	34.70	67.37	1.94	51.03	16.33
19	0.6788	222.747	237.9	12.2	33.47	34.70	68.17	1.96	51.43	16.73
20	0.7353	230.031	245.2	13.2	34.10	34.70	68.80	1.98	51.75	17.05
21	0.7915	235.405	250.6	14.2	34.44	34.70	69.14	1.99	51.92	17.22
22	0.8479	238.845	254.0	15.2	34.50	34.70	69.20	1.99	51.95	17.25
23	0.9044	241.018	256.2	16.2	34.38	34.70	69.08	1.99	51.89	17.19
24	0.9606	242.182	257.4	17.2	34.12	34.70	68.82	1.98	51.76	17.06
25	1.0169	243.510	258.7	18.2	33.88	34.70	68.58	1.98	51.64	16.94
26	1.0732	244.203	259.4	19.2	33.55	34.70	68.25	1.97	51.48	16.78
27	1.0870	244.159	259.3	19.5	33.45	34.70	68.15	1.96	51.42	16.72
28	1.1152	244.782	260.0	20.0	33.32	34.70	68.02	1.96	51.36	16.66

Parameters for Specimen No. 2

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	1197.180	1354.180
Moisture content: Dry soil+tare, gms.	974.110	1132.180
Moisture content: Tare, gms.	0.000	158.070
Moisture, %	22.9	22.8
Moist specimen weight, gms.	1197.18	
Diameter, in.	2.832	
Area, in.²	6.299	
Height, in.	5.609	
Wet density, pcf	129.1	
Dry density, pcf	105.0	
Void ratio	0.6581	
Saturation, %	97.1	

After Test

Test Readings for Specimen No. 2

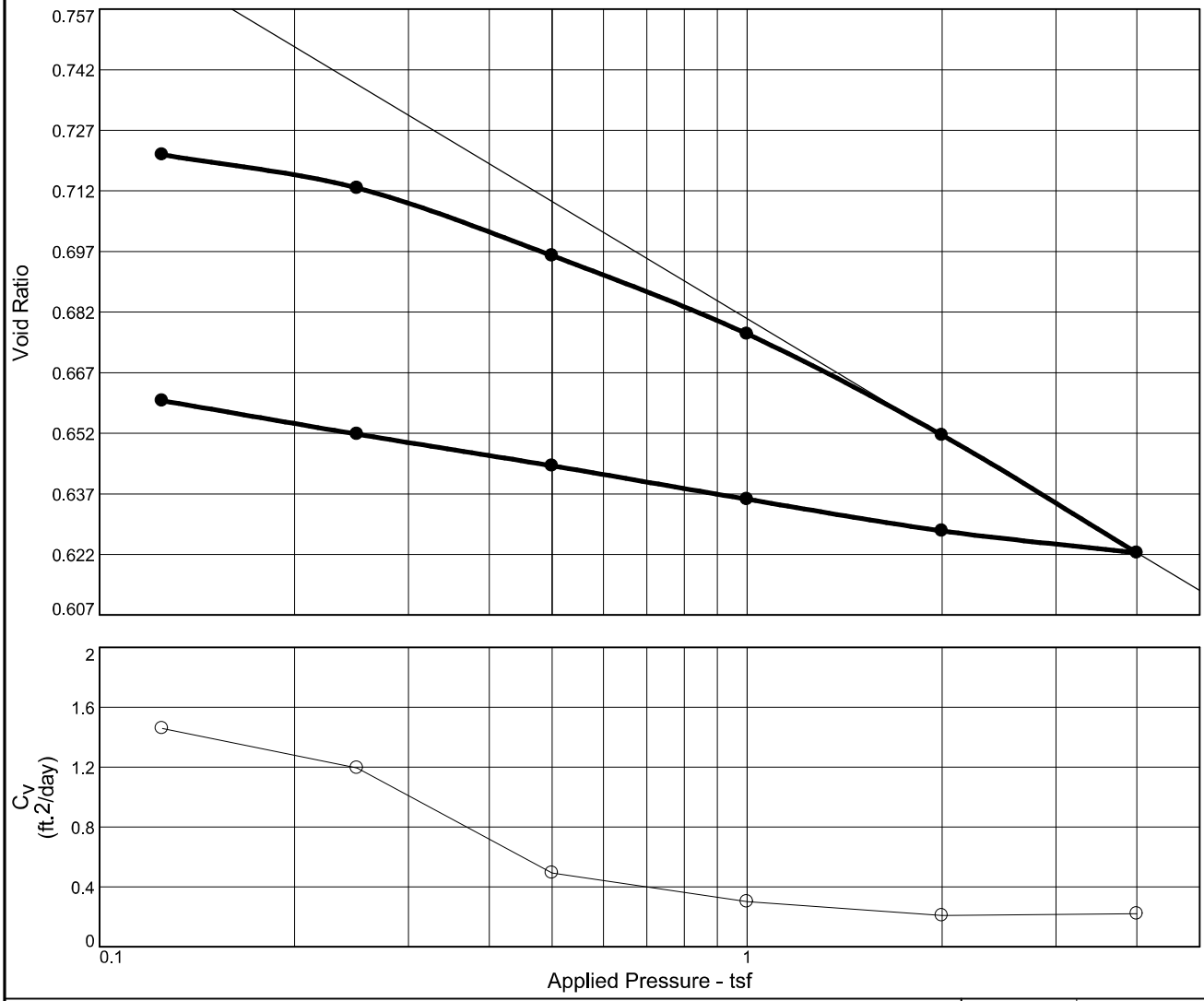
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Cell pressure = 69.44 psi
Back pressure = 0.00 psi
Strain rate, in./min. = 0.061
Fail. Stress = 38.24 psi **at reading no.** 19

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
0	0.1079	2.506	0.0	0.0	0.00	69.44	69.44	1.00	69.44	0.00
1	0.1163	18.264	15.8	0.2	2.50	69.44	71.94	1.04	70.69	1.25
2	0.1326	33.510	31.0	0.4	4.90	69.44	74.34	1.07	71.89	2.45
3	0.1573	48.663	46.2	0.9	7.26	69.44	76.70	1.10	73.07	3.63
4	0.1830	63.918	61.4	1.3	9.62	69.44	79.06	1.14	74.25	4.81
5	0.2052	78.774	76.3	1.7	11.90	69.44	81.34	1.17	75.39	5.95
6	0.2279	94.947	92.4	2.1	14.36	69.44	83.80	1.21	76.62	7.18
7	0.2506	112.064	109.6	2.5	16.95	69.44	86.39	1.24	77.92	8.48
8	0.2733	128.567	126.1	3.0	19.42	69.44	88.86	1.28	79.15	9.71
9	0.2961	143.801	141.3	3.4	21.68	69.44	91.12	1.31	80.28	10.84
10	0.3244	161.339	158.8	3.9	24.24	69.44	93.68	1.35	81.56	12.12
11	0.3526	177.116	174.6	4.4	26.51	69.44	95.95	1.38	82.70	13.26
12	0.3860	193.783	191.3	5.0	28.86	69.44	98.30	1.42	83.87	14.43
13	0.4340	212.984	210.5	5.8	31.47	69.44	100.91	1.45	85.18	15.74
14	0.4901	229.909	227.4	6.8	33.64	69.44	103.08	1.48	86.26	16.82
15	0.5464	243.042	240.5	7.8	35.20	69.44	104.64	1.51	87.04	17.60
16	0.6026	254.228	251.7	8.8	36.44	69.44	105.88	1.52	87.66	18.22
17	0.6588	263.072	260.6	9.8	37.30	69.44	106.74	1.54	88.09	18.65
18	0.7150	270.091	267.6	10.8	37.88	69.44	107.32	1.55	88.38	18.94
19	0.7712	275.674	273.2	11.8	38.24	69.44	107.68	1.55	88.56	19.12
20	0.8275	278.835	276.3	12.8	38.24	69.44	107.68	1.55	88.56	19.12
21	0.8837	281.571	279.1	13.8	38.17	69.44	107.61	1.55	88.53	19.09
22	0.9399	283.415	280.9	14.8	37.98	69.44	107.42	1.55	88.43	18.99
23	0.9961	285.417	282.9	15.8	37.80	69.44	107.24	1.54	88.34	18.90
24	1.0523	285.070	282.6	16.8	37.30	69.44	106.74	1.54	88.09	18.65
25	1.1086	284.715	282.2	17.8	36.81	69.44	106.25	1.53	87.84	18.40
26	1.1648	285.563	283.1	18.8	36.47	69.44	105.91	1.53	87.67	18.23

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress psi	Minor Princ. Stress psi	Major Princ. Stress psi	1:3 Ratio	P psi	Q psi
27	1.2211	286.199	283.7	19.8	36.10	69.44	105.54	1.52	87.49	18.05

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
GRAY-BROWN TO ORANGE-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST	CL	A-4b

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (tsf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
30	10	2.79		101.0	107.0	24.2 %	24.8 %	93.0 %	100.0 %	0.725	0.660	0.8	0.10

D2435 Method	C_r	Swell Press. (tsf)	Swell %
B	0.03		

Preparation Process: TRIMMING

Condition of Test: INUNDATED

Project No. 301525.1000 **Client:** OHIO DEPARTMENT OF

Project: CUY-77-11.21

Source: B-049-0-20 **Depth:** 10.0-12.0 FT **Sample No.:** ST-5

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:
SAMPLE DESCRIPTION BASED ON USCS

Checked By: SM

Title: LABORATORY SUPERVISOR

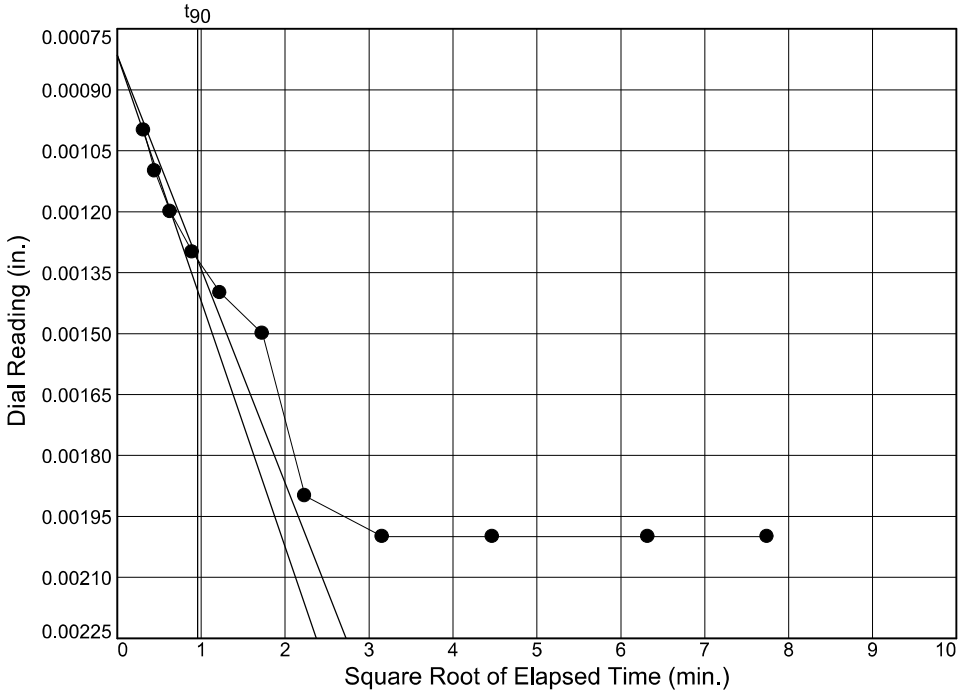
Figure 112

Tested By: TBT

Dial Reading vs. Time

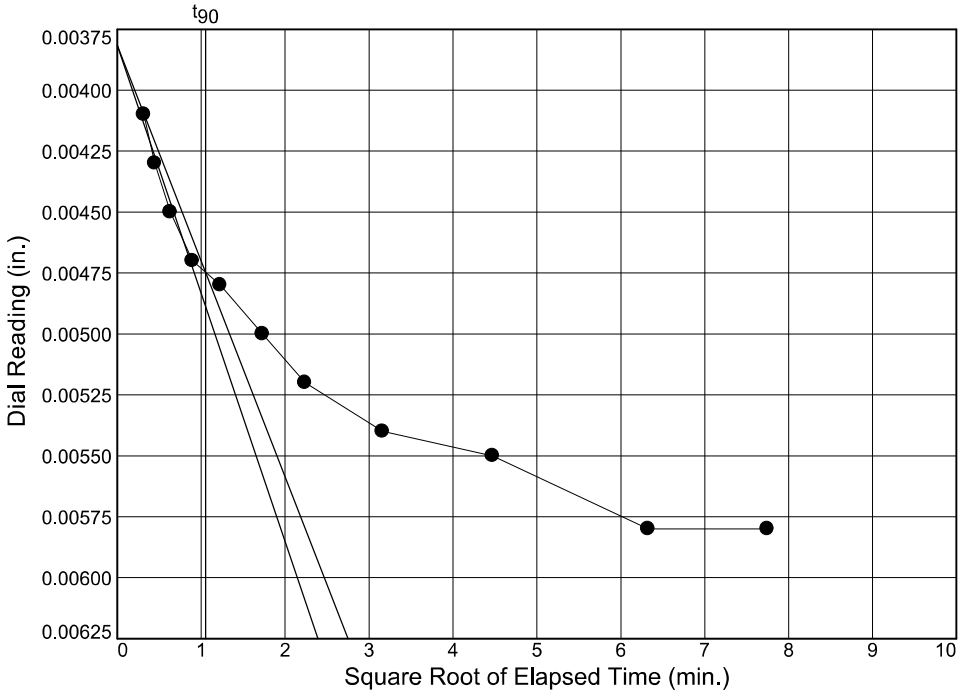
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-049-0-20 Depth: 10.0-12.0 FT Sample Number: ST-5



Load No.= 1
Load= 0.13 tsf
D_0 = 0.0008
D_{90} = 0.0013
D_{100} = 0.0014
T_{90} = 0.91 min.

C_v @ T_{90}
1.459 ft.^{2}/day



Load No.= 2
Load= 0.25 tsf
D_0 = 0.0038
D_{90} = 0.0047
D_{100} = 0.0049
T_{90} = 1.10 min.

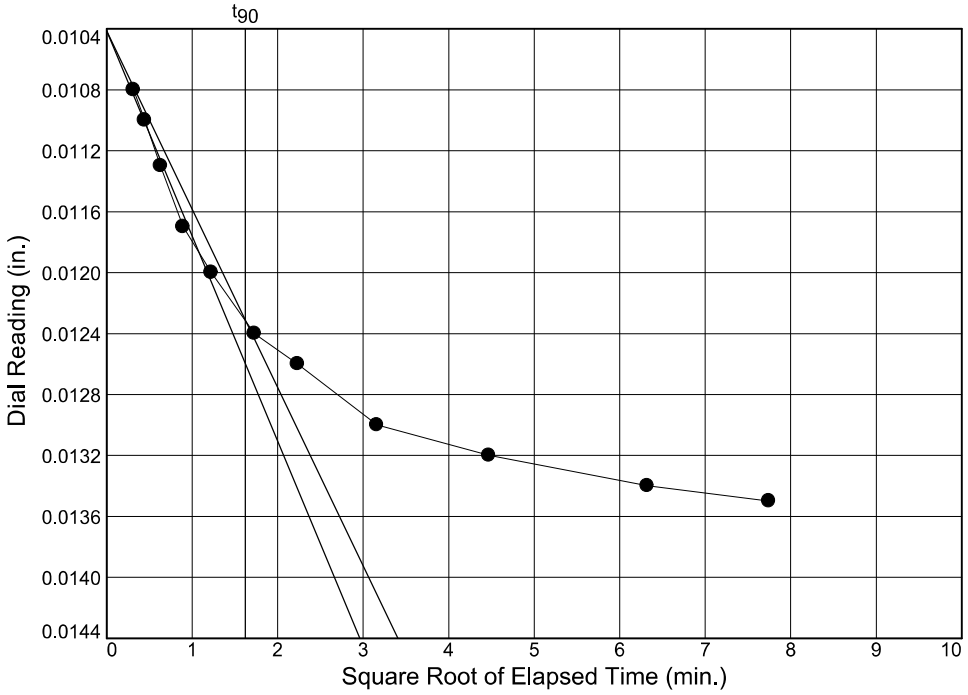
C_v @ T_{90}
1.195 ft.^{2}/day

Figure 113

Dial Reading vs. Time

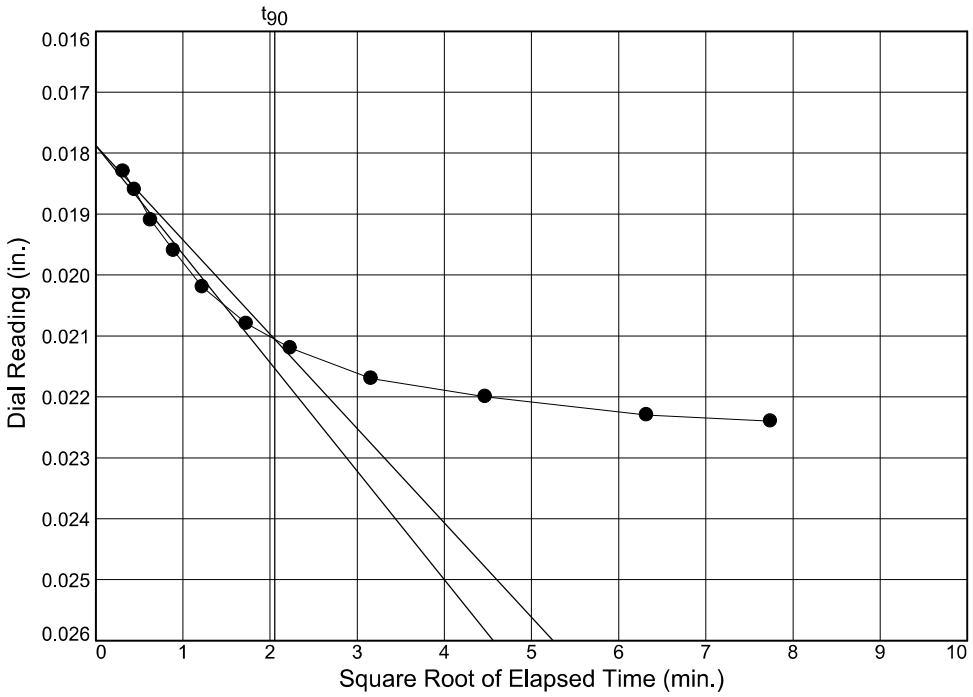
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-049-0-20 Depth: 10.0-12.0 FT Sample Number: ST-5



Load No.= 3
Load= 0.50 tsf
D_0 = 0.0104
D_{90} = 0.0123
D_{100} = 0.0125
T_{90} = 2.63 min.

C_v @ T_{90}
0.494 ft.^{2}/day



Load No.= 4
Load= 1.00 tsf
D_0 = 0.0179
D_{90} = 0.0211
D_{100} = 0.0214
T_{90} = 4.21 min.

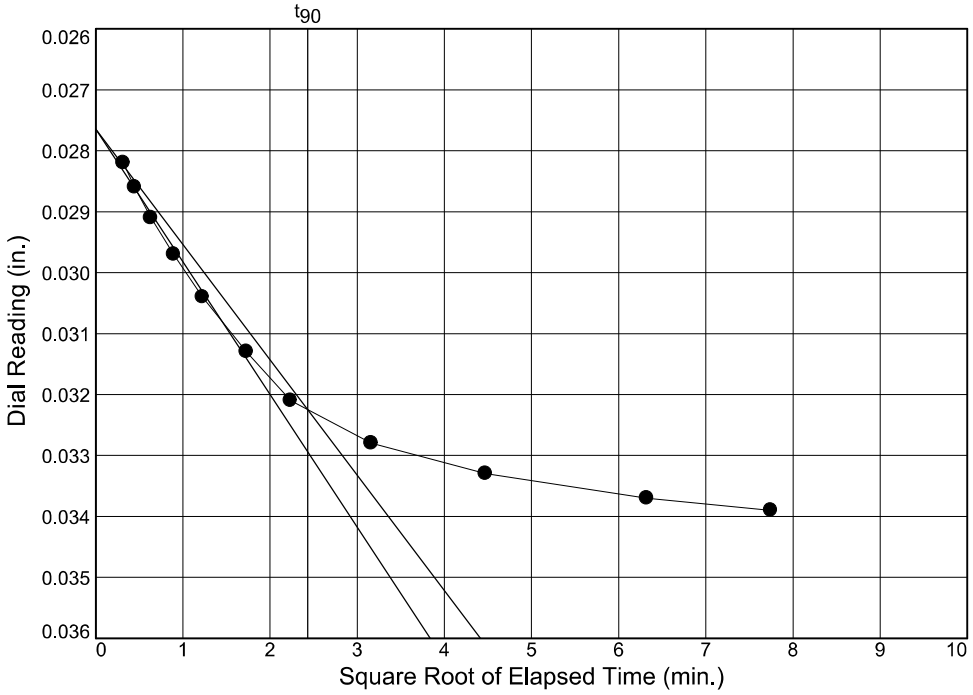
C_v @ T_{90}
0.302 ft.^{2}/day

Figure 114

Dial Reading vs. Time

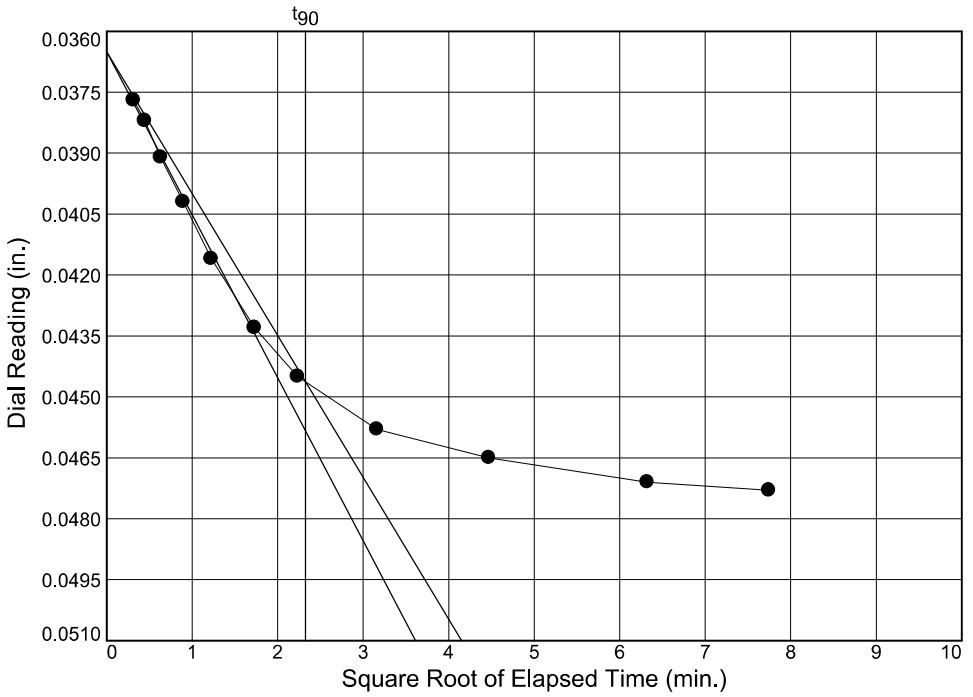
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-049-0-20 Depth: 10.0-12.0 FT Sample Number: ST-5



Load No.= 5
Load= 2.00 tsf
D_0 = 0.0276
D_{90} = 0.0322
D_{100} = 0.0328
T_{90} = 5.92 min.

C_v @ T_{90}
0.210 ft.^{2}/day



Load No.= 6
Load= 4.00 tsf
D_0 = 0.0365
D_{90} = 0.0446
D_{100} = 0.0455
T_{90} = 5.41 min.

C_v @ T_{90}
0.222 ft.^{2}/day

Figure 115

CONSOLIDATION TEST DATA

5/1/2026

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project Number: 301525.1000
Location: B-049-0-20
Depth: 10.0-12.0 FT

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.3	2.3	1.2	54.7	41.5

Sample Number: ST-5
Material Description: GRAY-BROWN TO ORANGE-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST
Liquid Limit: 30 **Plasticity Index:** 10 Plastic Limit: 20
USCS: CL **AASHTO:** A-4b
Preparation Process: TRIMMING
Condition of Test: INUNDATED
Test Method: B **Final Density:** 107.0 **Figure No.:** 112
Testing Remarks: SAMPLE DESCRIPTION BASED ON USCS
Tested By: TBT **Checked by:** SM **Title:** LABORATORY SUPERVISOR

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	192.58 g.	Spec. Gr. =	2.79	Wet w+t =	259.62 g.
Dry w+t =	167.67 g.	Est. Ht. Solids =	0.460 in.	Dry w+t =	234.05 g.
Tare Wt. =	64.60 g.	Init. V.R. =	0.725	Tare Wt. =	130.98 g.
Moisture =	24.2 %	Init. Sat. =	93.0 %	Moisture =	24.8 %

UNIT WEIGHT		TEST START			
Height =	0.793 in.	Height =	0.793 in.	Dry Wt. =	103.07* g.
Diameter =	2.499 in.	Diameter =	2.499 in.		
Weight =	127.98 g.				
Dry Dens. =	101.0 pcf				

* Final dry weight used as mineral solids weight

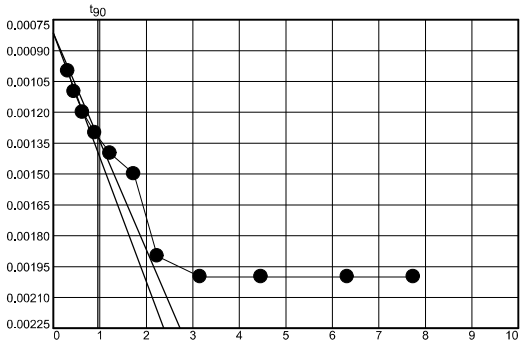
End-Of-Load Summary

Pressure (tsf)	Final Dial (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000	0.00000			0.725	
0.13	0.00200	0.00200	1.459		0.721	0.3 Comprs.
0.25	0.00580	0.00580	1.195		0.713	0.7 Comprs.
0.50	0.01350	0.01350	0.494		0.696	1.7 Comprs.
1.00	0.02240	0.02240	0.302		0.677	2.8 Comprs.
2.00	0.03390	0.03390	0.210		0.652	4.3 Comprs.
4.00	0.04730	0.04730	0.222		0.622	6.0 Comprs.
2.00	0.04480	0.04480			0.628	5.6 Comprs.
1.00	0.04120	0.04120			0.636	5.2 Comprs.
0.50	0.03740	0.03740			0.644	4.7 Comprs.
0.25	0.03380	0.03380			0.652	4.3 Comprs.
0.13	0.03000	0.03000			0.660	3.8 Comprs.

Compression index (C_c), tsf = 0.10 **Preconsolidation pressure (P_p), tsf =** 0.8 **Void ratio at P_p (e_m) =** 0.683
Recompression index (C_r) = 0.03

Pressure: 0.13 tsf	TEST READINGS	Load No. 1

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00000	11	40	0.00200
2	0.1	0.00100	12	60	0.00200
3	0.2	0.00110			
4	0.4	0.00120			
5	0.8	0.00130			
6	1.5	0.00140			
7	3	0.00150			
8	5	0.00190			
9	10	0.00200			
10	20	0.00200			

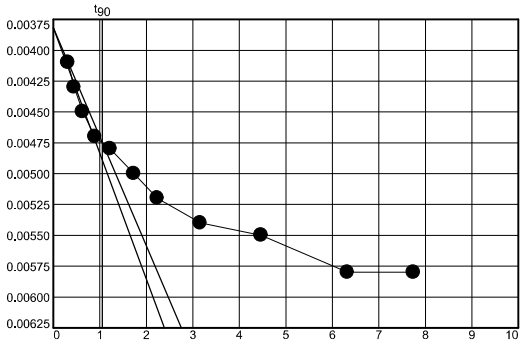


Void Ratio = 0.721 **Compression =** 0.3%

D_0 = 0.0008 **D_{90} =** 0.0013 **D_{100} =** 0.0014 **C_v at 0.91 min. =** 1.459 ft.^{2}/day

Pressure: 0.25 tsf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00200	11	40	0.00580
2	0.1	0.00410	12	60	0.00580
3	0.2	0.00430			
4	0.4	0.00450			
5	0.8	0.00470			
6	1.5	0.00480			
7	3	0.00500			
8	5	0.00520			
9	10	0.00540			
10	20	0.00550			

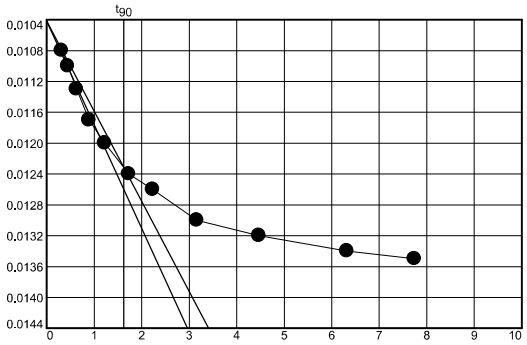


Void Ratio = 0.713 **Compression =** 0.7%

D_0 = 0.0038 **D_{90} =** 0.0047 **D_{100} =** 0.0049 **C_v at 1.10 min. =** 1.195 ft.^{2}/day

Pressure: 0.50 tsf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00580	11	40	0.01340
2	0.1	0.01080	12	60	0.01350
3	0.2	0.01100			
4	0.4	0.01130			
5	0.8	0.01170			
6	1.5	0.01200			
7	3	0.01240			
8	5	0.01260			
9	10	0.01300			
10	20	0.01320			

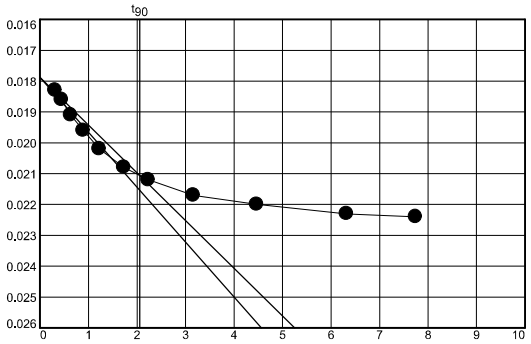


Void Ratio = 0.696 **Compression =** 1.7%

D_0 = 0.0104 **D_{90} =** 0.0123 **D_{100} =** 0.0125 **C_v at 2.63 min. =** 0.494 ft.^{2}/day

Pressure: 1.00 tsf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01350	11	40	0.02230
2	0.1	0.01830	12	60	0.02240
3	0.2	0.01860			
4	0.4	0.01910			
5	0.8	0.01960			
6	1.5	0.02020			
7	3	0.02080			
8	5	0.02120			
9	10	0.02170			
10	20	0.02200			

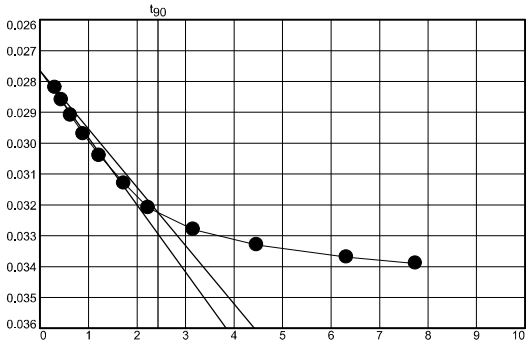


Void Ratio = 0.677 **Compression =** 2.8%

D_0 = 0.0179 **D_{90} =** 0.0211 **D_{100} =** 0.0214 **C_v at 4.21 min. =** 0.302 ft.^{2}/day

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 5**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.02240	11	40	0.03370
2	0.1	0.02820	12	60	0.03390
3	0.2	0.02860			
4	0.4	0.02910			
5	0.8	0.02970			
6	1.5	0.03040			
7	3	0.03130			
8	5	0.03210			
9	10	0.03280			
10	20	0.03330			

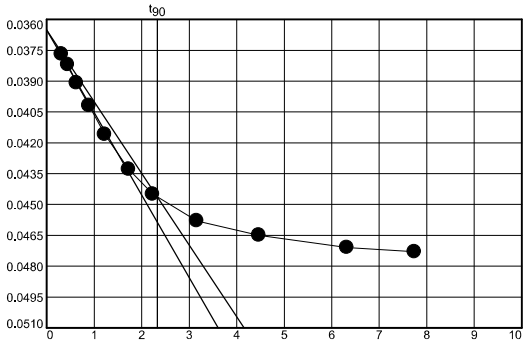


Void Ratio = 0.652 **Compression =** 4.3%

D_0 = 0.0276 **D_{90} =** 0.0322 **D_{100} =** 0.0328 **C_v at 5.92 min. =** 0.210 ft.^{2}/day

Pressure: 4.00 tsf | **TEST READINGS** | **Load No. 6**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.03390	11	40	0.04710
2	0.1	0.03770	12	60	0.04730
3	0.2	0.03820			
4	0.4	0.03910			
5	0.8	0.04020			
6	1.5	0.04160			
7	3	0.04330			
8	5	0.04450			
9	10	0.04580			
10	20	0.04650			



Void Ratio = 0.622 **Compression =** 6.0%

D_0 = 0.0365 **D_{90} =** 0.0446 **D_{100} =** 0.0455 **C_v at 5.41 min. =** 0.222 ft.^{2}/day

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 7**

No.	Elapsed Time	Dial Reading
1	0	0.04730
2	20	0.04480

Void Ratio = 0.628 **Compression =** 5.6%

Pressure: 1.00 tsf | **TEST READINGS** | **Load No. 8**

No.	Elapsed Time	Dial Reading
1	0	0.04480
2	20	0.04120

Void Ratio = 0.636 **Compression =** 5.2%

Pressure: 0.50 tsf	TEST READINGS	Load No. 9

No.	Elapsed Time	Dial Reading
1	0	0.04120
2	20	0.03740

Void Ratio = 0.644 **Compression =** 4.7%

Pressure: 0.25 tsf	TEST READINGS	Load No. 10

No.	Elapsed Time	Dial Reading
1	0	0.03740
2	20	0.03380

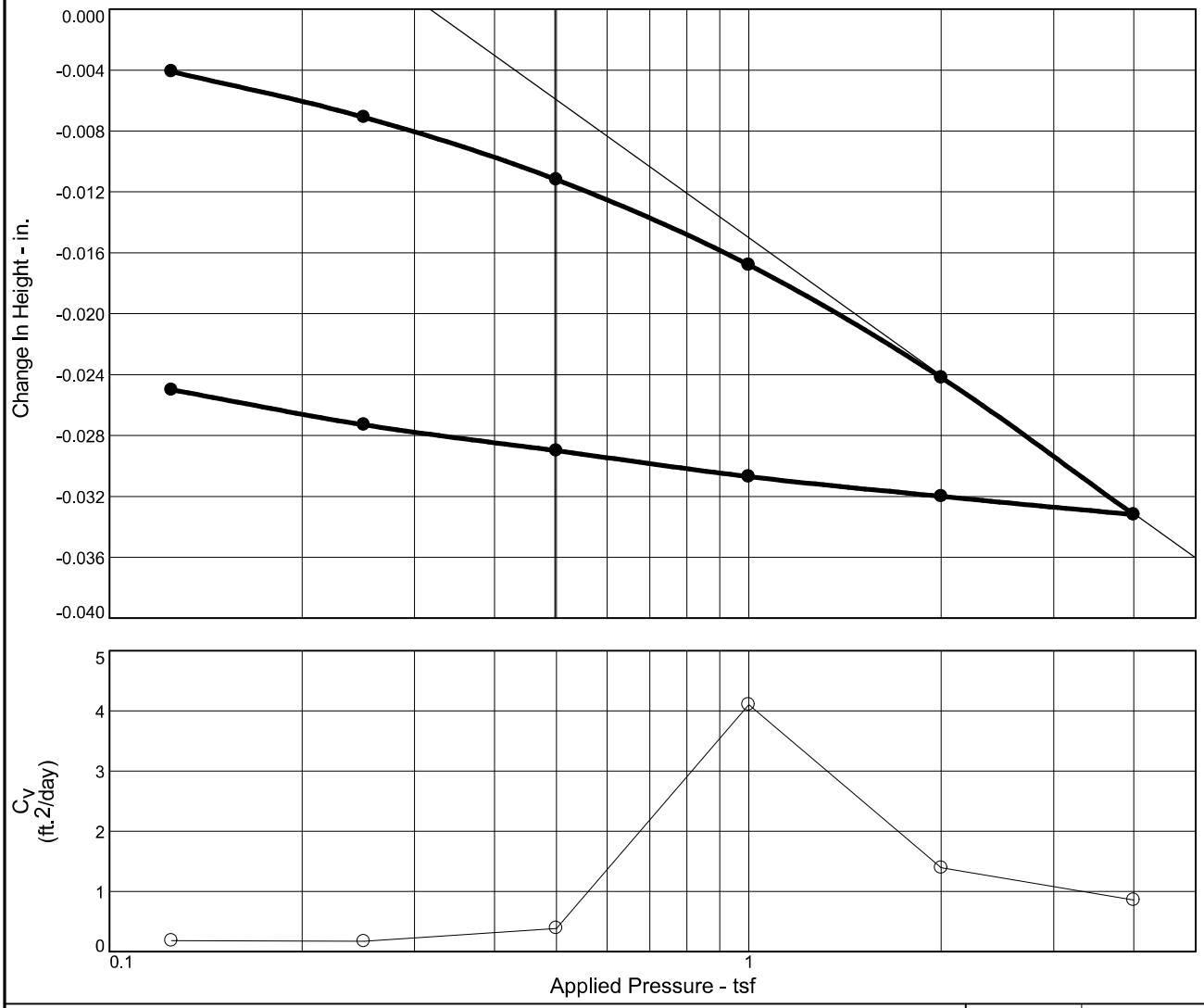
Void Ratio = 0.652 **Compression =** 4.3%

Pressure: 0.13 tsf	TEST READINGS	Load No. 11

No.	Elapsed Time	Dial Reading
1	0	0.03380
2	20	0.03000

Void Ratio = 0.660 **Compression =** 3.8%

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
GRAY-BROWN TO GRAY SILT, LITTLE CLAY, TRACE COARSE AND FINE SAND, MOIST	ML	A-4b

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (tsf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
22	3	2.79		106.6	110.3	21.7 %	20.1 %	95.3 %	96.6 %	0.634	0.579	0.9	0.07

Preparation Process: TRIMMING	D2435 Method	C_r	Swell Press. (tsf)	Swell %
Condition of Test: INUNDATED	B	0.01		

Project No. 301525.1000 **Client:** OHIO DEPARTMENT OF

Project: CUY-77-11.21

Source: B-070-0-20 **Depth:** 21.0-23.0 FT **Sample No.:** ST-9

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:
SAMPLE DESCRIPTION BASED ON USCS

Checked By: SM 04/06/22

Title: LABORATORY SUPERVISOR

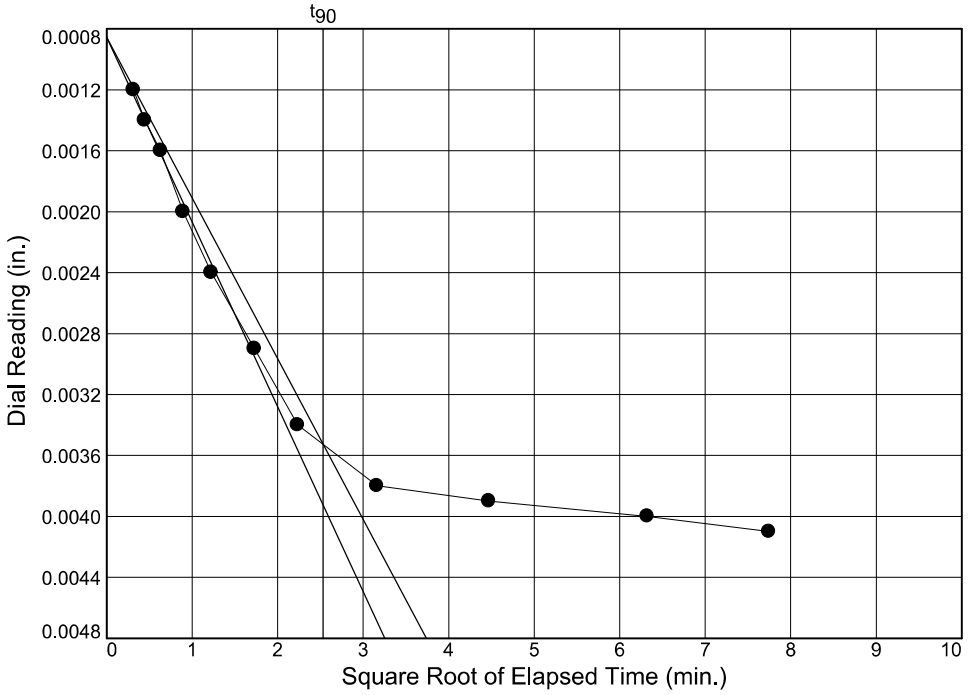
Figure 116

Tested By: TBT 03/24/22

Dial Reading vs. Time

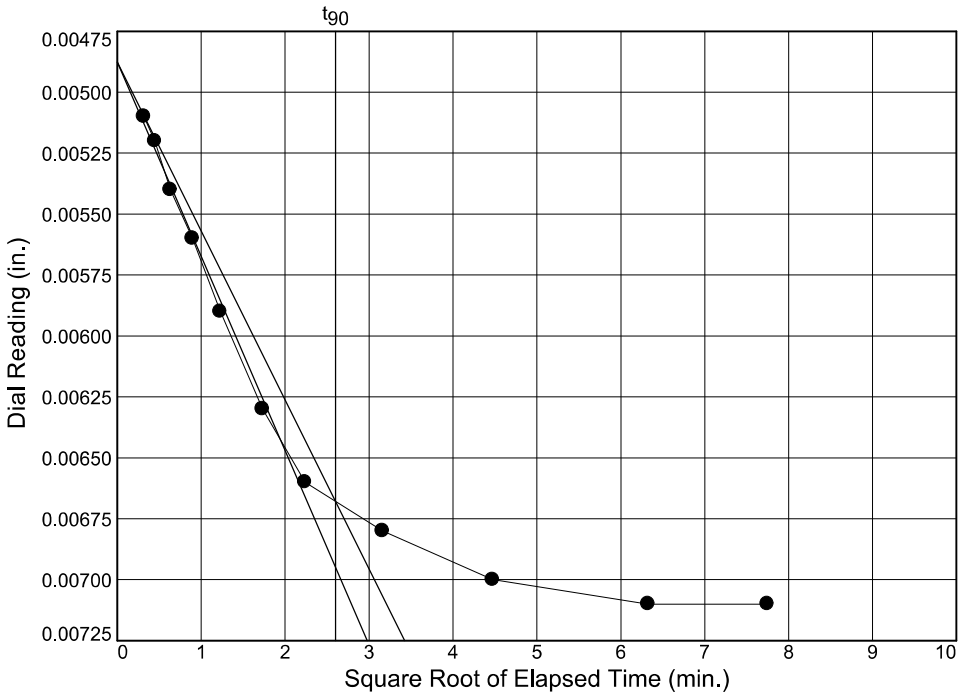
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-070-0-20 Depth: 21.0-23.0 FT Sample Number: ST-9



Load No.= 1
Load= 0.13 tsf
D_0 = 0.0009
D_{90} = 0.0035
D_{100} = 0.0038
T_{90} = 6.42 min.

C_v @ T_{90}
0.184 ft.^{2}/day



Load No.= 2
Load= 0.25 tsf
D_0 = 0.0049
D_{90} = 0.0067
D_{100} = 0.0069
T_{90} = 6.77 min.

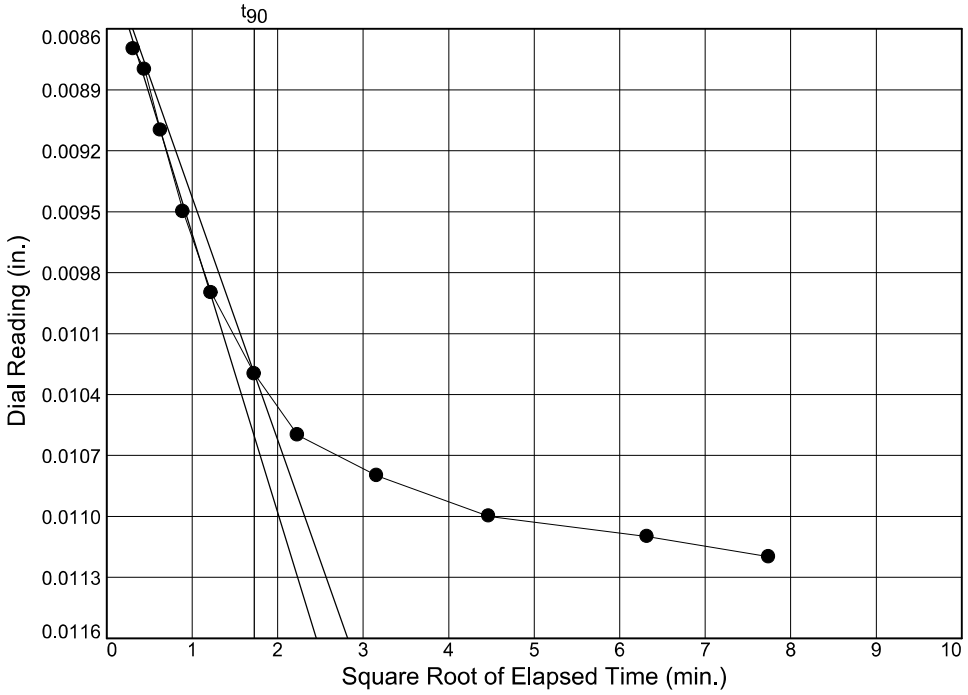
C_v @ T_{90}
0.173 ft.^{2}/day

Figure 117

Dial Reading vs. Time

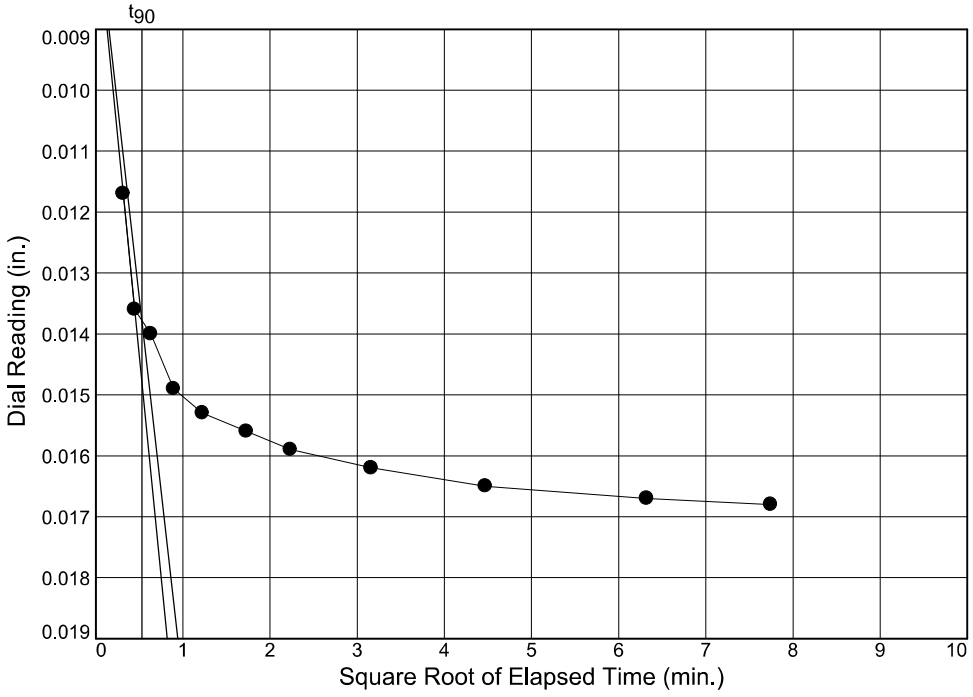
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-070-0-20 Depth: 21.0-23.0 FT Sample Number: ST-9



Load No.= 3
Load= 0.50 tsf
D_0 = 0.0082
D_{90} = 0.0103
D_{100} = 0.0105
T_{90} = 2.98 min.

C_v @ T_{90}
0.389 ft.^{2}/day



Load No.= 4
Load= 1.00 tsf
D_0 = 0.0071
D_{90} = 0.0138
D_{100} = 0.0145
T_{90} = 0.28 min.

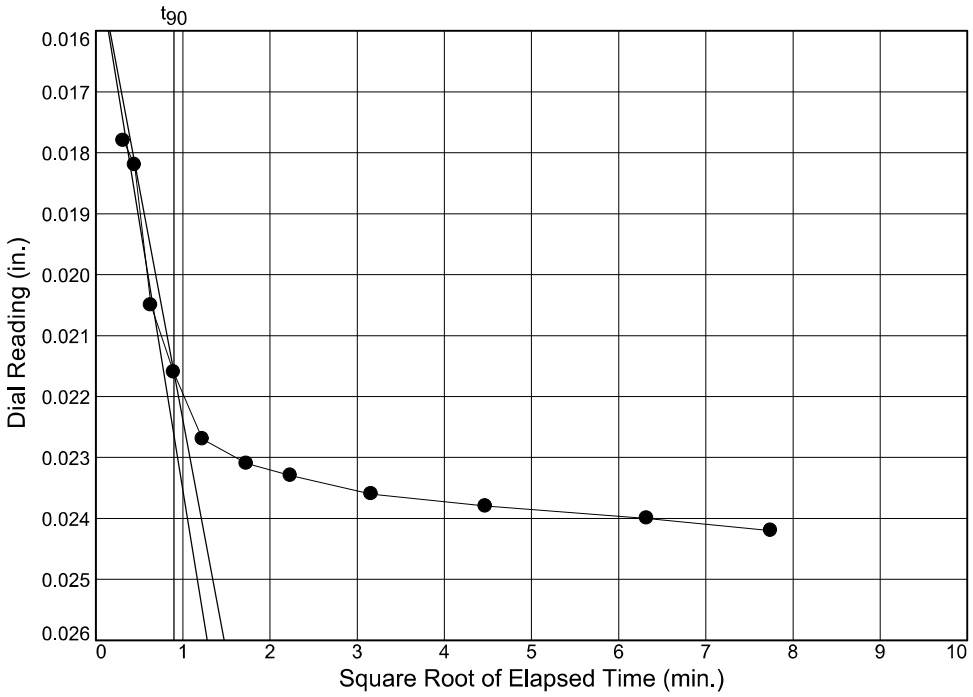
C_v @ T_{90}
4.105 ft.^{2}/day

Figure 118

Dial Reading vs. Time

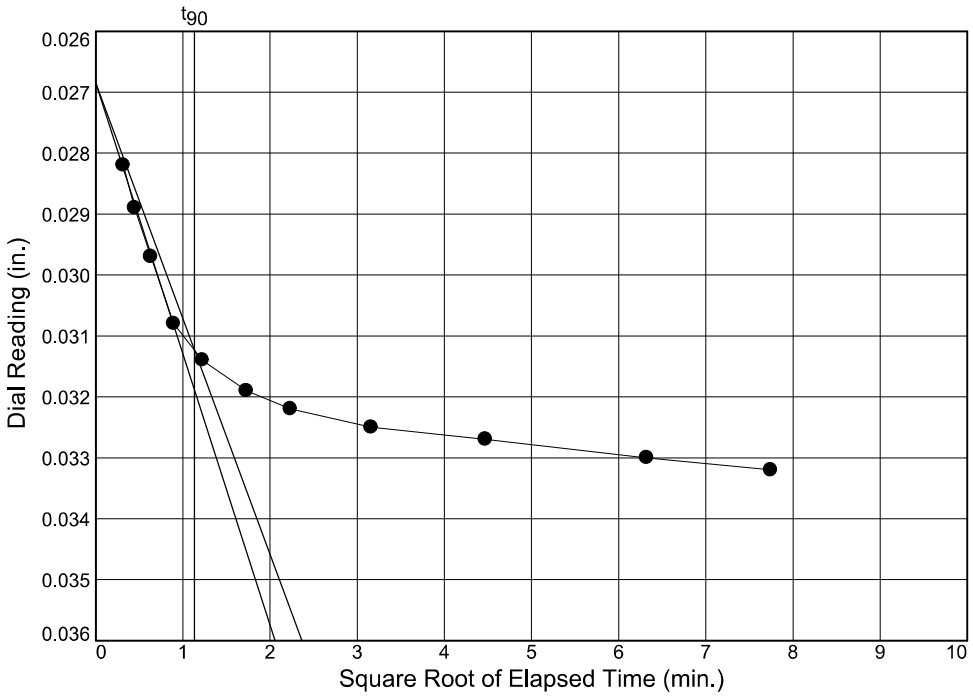
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-070-0-20 Depth: 21.0-23.0 FT Sample Number: ST-9



Load No.= 5
Load= 2.00 tsf
D_0 = 0.0147
D_{90} = 0.0216
D_{100} = 0.0224
T_{90} = 0.81 min.

C_v @ T_{90}
1.394 ft.^{2}/day



Load No.= 6
Load= 4.00 tsf
D_0 = 0.0269
D_{90} = 0.0312
D_{100} = 0.0317
T_{90} = 1.28 min.

C_v @ T_{90}
0.858 ft.^{2}/day

Figure 119

CONSOLIDATION TEST DATA

5/1/2026

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project Number: 301525.1000
Location: B-070-0-20
Depth: 21.0-23.0 FT

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.0	0.2	0.6	80.6	18.6

Sample Number: ST-9
Material Description: GRAY-BROWN TO GRAY SILT, LITTLE CLAY, TRACE COARSE AND FINE SAND, MOIST
Liquid Limit: 22 **Plasticity Index:** 3 Plastic Limit: 19
USCS: ML **AASHTO:** A-4b
Preparation Process: TRIMMING
Condition of Test: INUNDATED
Test Method: B **Final Density:** 110.3 **Figure No.:** 116
Testing Remarks: SAMPLE DESCRIPTION BASED ON USCS
Tested By: TBT 03/24/22 **Checked by:** SM 04/06/22 **Title:** LABORATORY SUPERVISOR

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	186.40 g.	Spec. Gr. =	2.79	Wet w+t =	258.80 g.
Dry w+t =	164.13 g.	Est. Ht. Solids =	0.458 in.	Dry w+t =	238.18 g.
Tare Wt. =	61.34 g.	Init. V.R. =	0.634	Tare Wt. =	135.39 g.
Moisture =	21.7 %	Init. Sat. =	95.3 %	Moisture =	20.1 %

UNIT WEIGHT		TEST START			
Height =	0.749 in.	Height =	0.749 in.	Dry Wt. =	102.79 g.
Diameter =	2.499 in.	Diameter =	2.499 in.		
Weight =	125.06 g.				
Dry Dens. =	106.6 pcf				

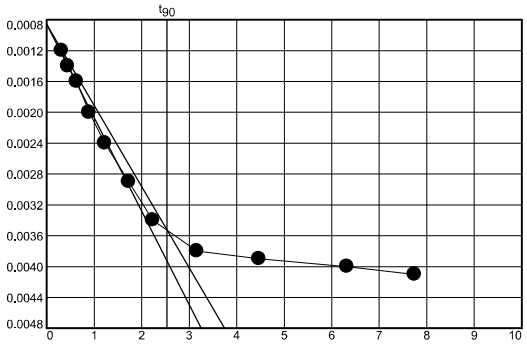
End-Of-Load Summary

Pressure (tsf)	Final Dial (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000	0.00000			0.634	
0.13	0.00410	0.00410	0.184		0.625	0.5 Comprs.
0.25	0.00710	0.00710	0.173		0.619	0.9 Comprs.
0.50	0.01120	0.01120	0.389		0.610	1.5 Comprs.
1.00	0.01680	0.01680	4.105		0.597	2.2 Comprs.
2.00	0.02420	0.02420	1.394		0.581	3.2 Comprs.
4.00	0.03320	0.03320	0.858		0.562	4.4 Comprs.
2.00	0.03200	0.03200			0.564	4.3 Comprs.
1.00	0.03070	0.03070			0.567	4.1 Comprs.
0.50	0.02900	0.02900			0.571	3.9 Comprs.
0.25	0.02730	0.02730			0.574	3.6 Comprs.
0.13	0.02500	0.02500			0.579	3.3 Comprs.

Compression index (C_c), tsf = 0.07 **Preconsolidation pressure (P_p), tsf =** 0.9 **Void ratio at P_p (e_m) =** 0.600
Recompression index (C_r) = 0.01

Pressure: 0.13 tsf | **TEST READINGS** | **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00000	11	40	0.00400
2	0.1	0.00120	12	60	0.00410
3	0.2	0.00140			
4	0.4	0.00160			
5	0.8	0.00200			
6	1.5	0.00240			
7	3	0.00290			
8	5	0.00340			
9	10	0.00380			
10	20	0.00390			

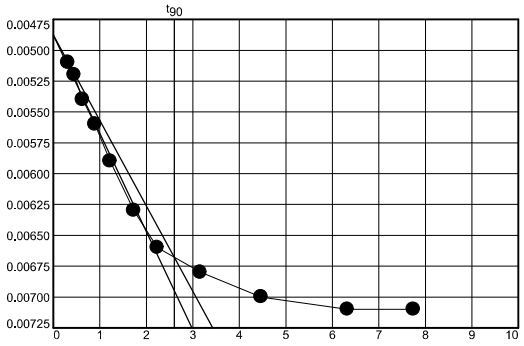


Void Ratio = 0.625 **Compression =** 0.5%

D_0 = 0.0009 **D_{90} =** 0.0035 **D_{100} =** 0.0038 **C_v at 6.42 min. =** 0.184 ft.^{2}/day

Pressure: 0.25 tsf | **TEST READINGS** | **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00410	11	40	0.00710
2	0.1	0.00510	12	60	0.00710
3	0.2	0.00520			
4	0.4	0.00540			
5	0.8	0.00560			
6	1.5	0.00590			
7	3	0.00630			
8	5	0.00660			
9	10	0.00680			
10	20	0.00700			

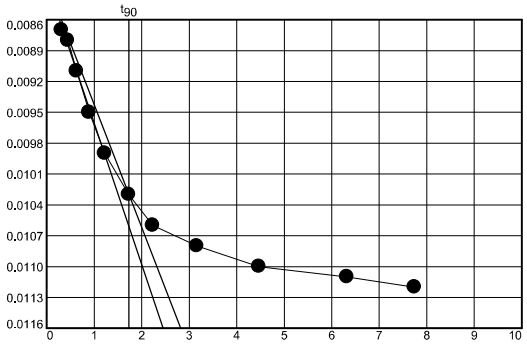


Void Ratio = 0.619 **Compression =** 0.9%

D_0 = 0.0049 **D_{90} =** 0.0067 **D_{100} =** 0.0069 **C_v at 6.77 min. =** 0.173 ft.^{2}/day

Pressure: 0.50 tsf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00710	11	40	0.01110
2	0.1	0.00870	12	60	0.01120
3	0.2	0.00880			
4	0.4	0.00910			
5	0.8	0.00950			
6	1.5	0.00990			
7	3	0.01030			
8	5	0.01060			
9	10	0.01080			
10	20	0.01100			

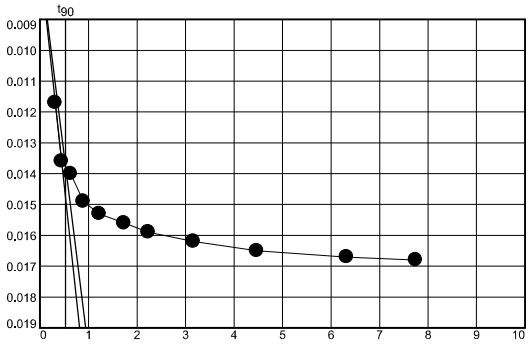


Void Ratio = 0.610 **Compression =** 1.5%

D_0 = 0.0082 **D_{90} =** 0.0103 **D_{100} =** 0.0105 **C_v at 2.98 min. =** 0.389 ft.^{2}/day

Pressure: 1.00 tsf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01120	11	40	0.01670
2	0.1	0.01170	12	60	0.01680
3	0.2	0.01360			
4	0.4	0.01400			
5	0.8	0.01490			
6	1.5	0.01530			
7	3	0.01560			
8	5	0.01590			
9	10	0.01620			
10	20	0.01650			

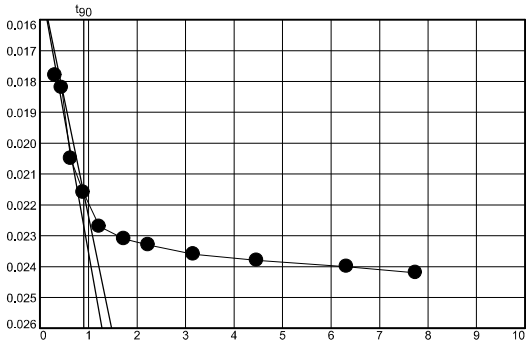


Void Ratio = 0.597 **Compression =** 2.2%

D_0 = 0.0071 **D_{90} =** 0.0138 **D_{100} =** 0.0145 **C_v at 0.28 min. =** 4.105 ft.^{2}/day

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 5**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01680	11	40	0.02400
2	0.1	0.01780	12	60	0.02420
3	0.2	0.01820			
4	0.4	0.02050			
5	0.8	0.02160			
6	1.5	0.02270			
7	3	0.02310			
8	5	0.02330			
9	10	0.02360			
10	20	0.02380			

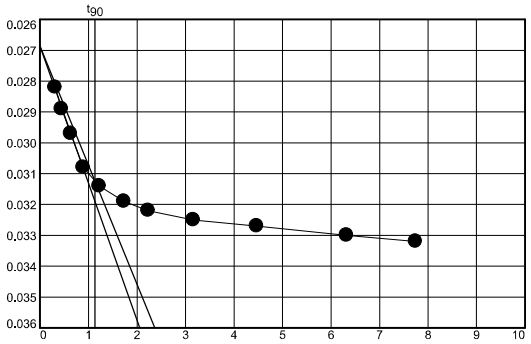


Void Ratio = 0.581 **Compression =** 3.2%

D_0 = 0.0147 **D_{90} =** 0.0216 **D_{100} =** 0.0224 **C_v at 0.81 min. =** 1.394 ft.^{2}/day

Pressure: 4.00 tsf | **TEST READINGS** | **Load No. 6**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.02420	11	40	0.03300
2	0.1	0.02820	12	60	0.03320
3	0.2	0.02890			
4	0.4	0.02970			
5	0.8	0.03080			
6	1.5	0.03140			
7	3	0.03190			
8	5	0.03220			
9	10	0.03250			
10	20	0.03270			



Void Ratio = 0.562 **Compression =** 4.4%

D_0 = 0.0269 **D_{90} =** 0.0312 **D_{100} =** 0.0317 **C_v at 1.28 min. =** 0.858 ft.^{2}/day

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 7**

No.	Elapsed Time	Dial Reading
1	0	0.03320
2	20	0.03200

Void Ratio = 0.564 **Compression =** 4.3%

Pressure: 1.00 tsf | **TEST READINGS** | **Load No. 8**

No.	Elapsed Time	Dial Reading
1	0	0.03200
2	20	0.03070

Void Ratio = 0.567 **Compression =** 4.1%

Pressure: 0.50 tsf	TEST READINGS	Load No. 9

No.	Elapsed Time	Dial Reading
1	0	0.03070
2	20	0.02900

Void Ratio = 0.571 **Compression =** 3.9%

Pressure: 0.25 tsf	TEST READINGS	Load No. 10

No.	Elapsed Time	Dial Reading
1	0	0.02900
2	20	0.02730

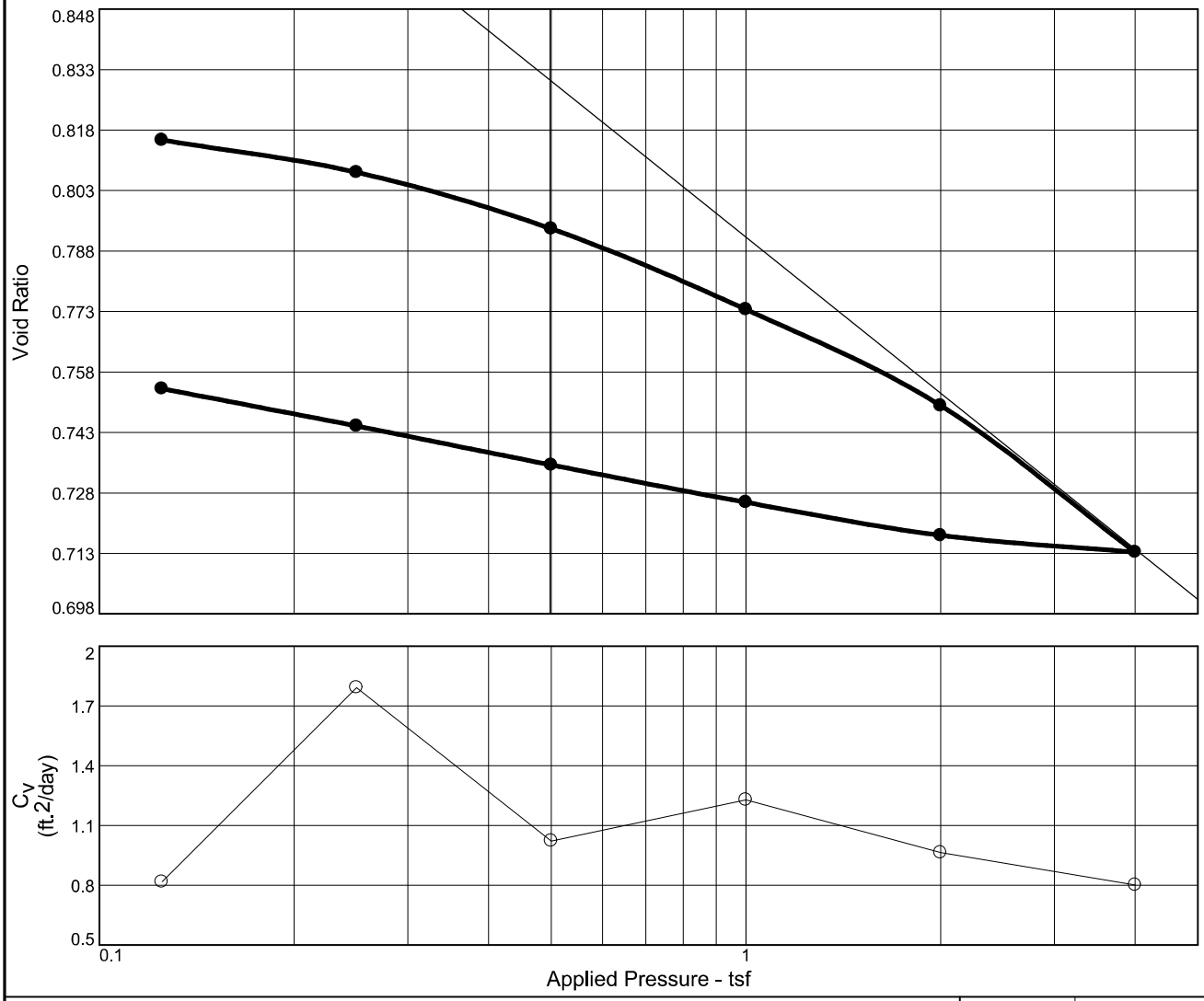
Void Ratio = 0.574 **Compression =** 3.6%

Pressure: 0.13 tsf	TEST READINGS	Load No. 11

No.	Elapsed Time	Dial Reading
1	0	0.02730
2	20	0.02500

Void Ratio = 0.579 **Compression =** 3.3%

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST	CL	A-4b

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (tsf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
29	9	2.79		95.7	99.2	26.0 %	26.7 %	88.6 %	98.9 %	0.820	0.754	1.2	0.13

Preparation Process: TRIMMING	D2435 Method	C_r	Swell Press. (tsf)	Swell %
Condition of Test: INUNDATED	B	0.03		

Project No. 301525.1000 **Client:** OHIO DEPARTMENT OF

Project: CUY-77-11.21

Source: B-070-0-20 **Depth:** 38.0-40.0 FT **Sample No.:** ST-14

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:
SAMPLE DESCRIPTION BASED ON USCS

Checked By: SM 04/06/22

Title: LABORATORY SUPERVISOR

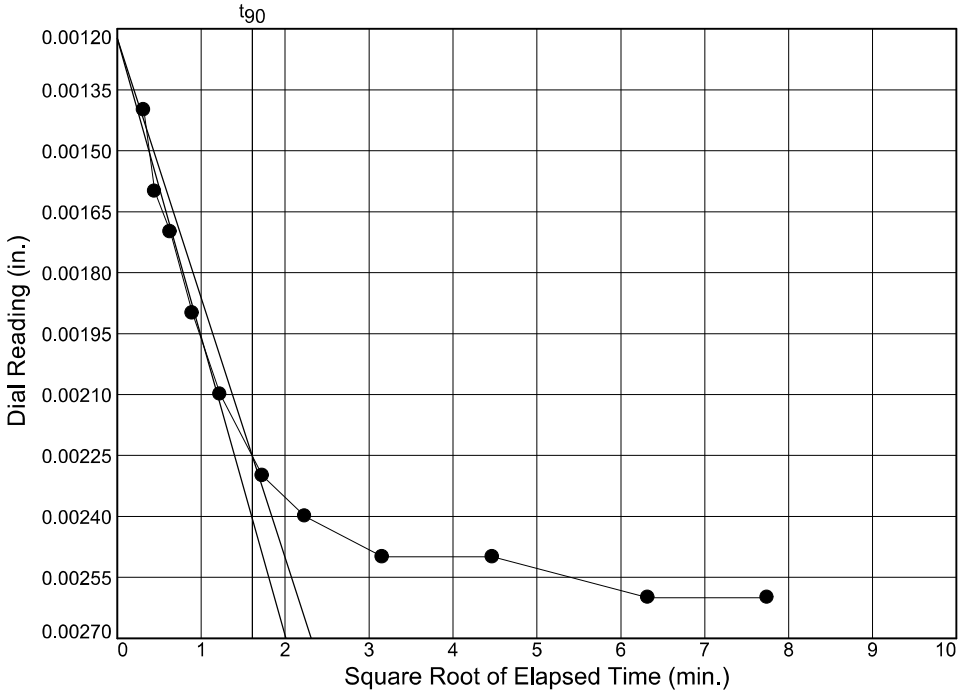
Figure 120

Tested By: TBT 03/24/22

Dial Reading vs. Time

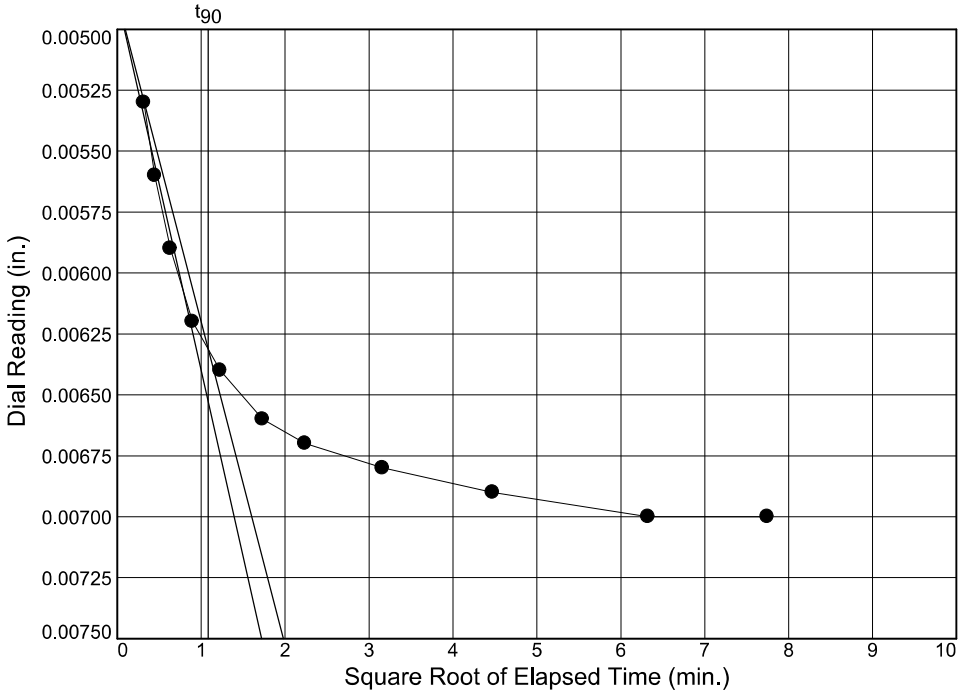
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-070-0-20 Depth: 38.0-40.0 FT Sample Number: ST-14



Load No.= 1
Load= 0.13 tsf
D_0 = 0.0012
D_{90} = 0.0023
D_{100} = 0.0024
T_{90} = 2.59 min.

C_v @ T_{90}
0.818 ft.^{2}/day



Load No.= 2
Load= 0.25 tsf
D_0 = 0.0049
D_{90} = 0.0063
D_{100} = 0.0065
T_{90} = 1.17 min.

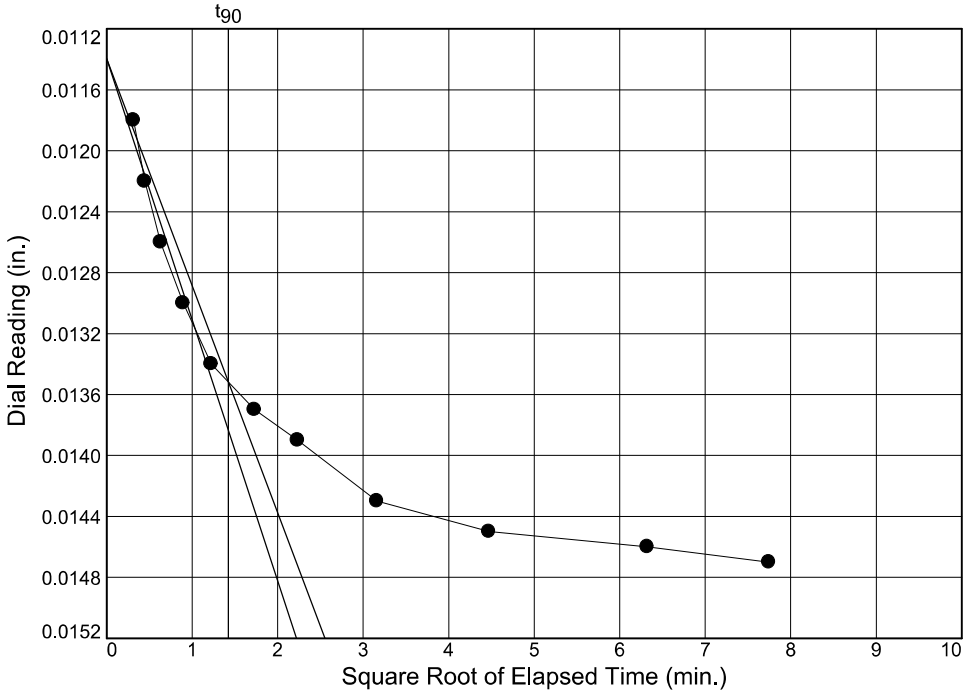
C_v @ T_{90}
1.792 ft.^{2}/day

Figure 121

Dial Reading vs. Time

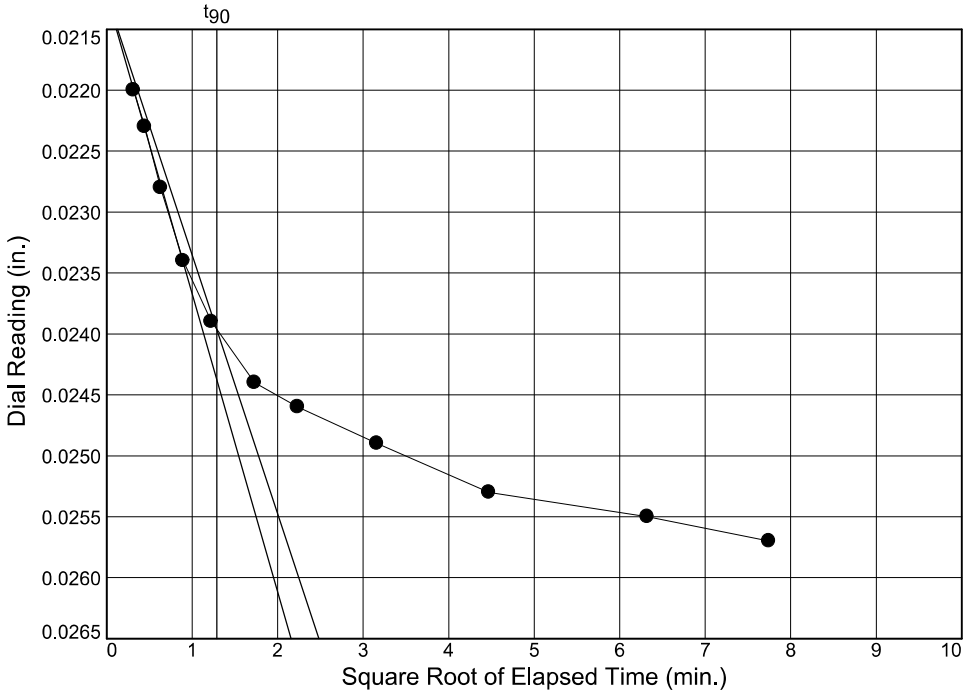
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-070-0-20 Depth: 38.0-40.0 FT Sample Number: ST-14



Load No.= 3
Load= 0.50 tsf
D_0 = 0.0114
D_{90} = 0.0135
D_{100} = 0.0138
T_{90} = 2.03 min.

C_v @ T_{90}
1.023 ft.^{2}/day



Load No.= 4
Load= 1.00 tsf
D_0 = 0.0212
D_{90} = 0.0240
D_{100} = 0.0243
T_{90} = 1.66 min.

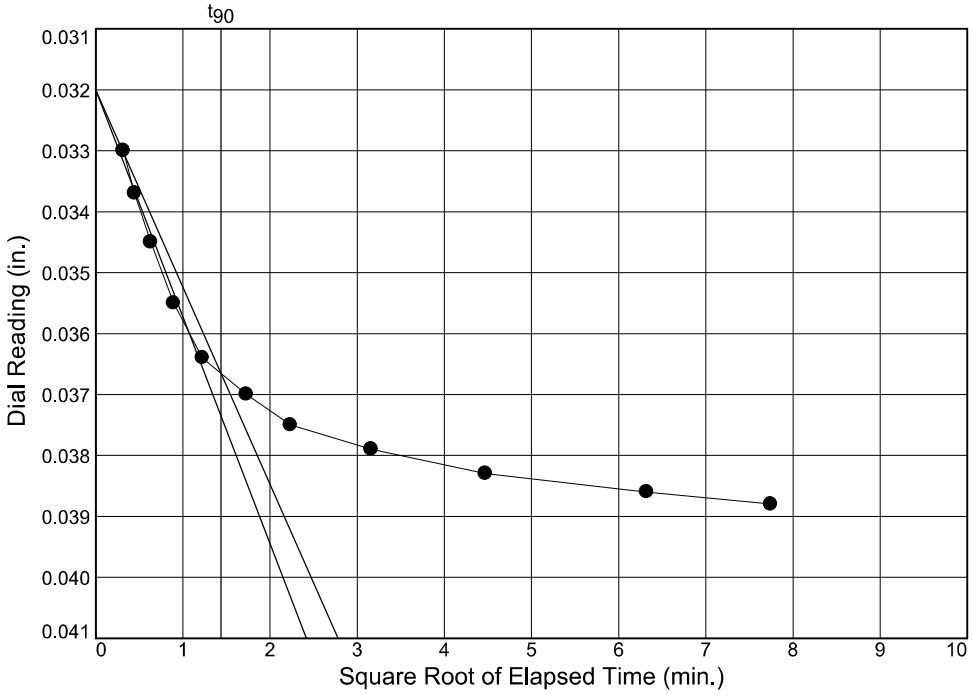
C_v @ T_{90}
1.228 ft.^{2}/day

Figure 122

Dial Reading vs. Time

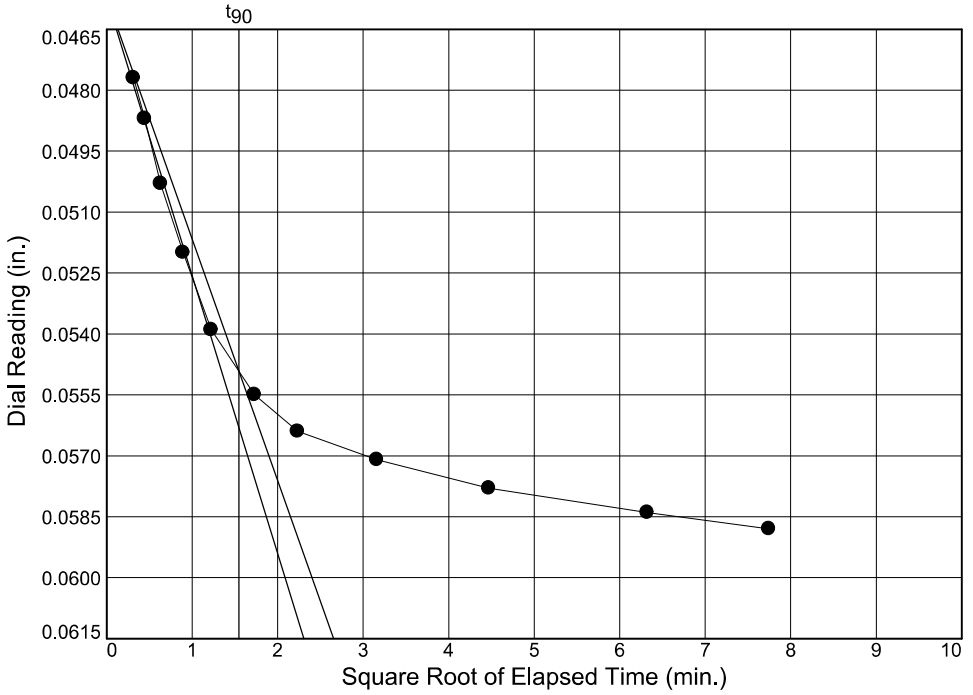
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-070-0-20 Depth: 38.0-40.0 FT Sample Number: ST-14



Load No.= 5
Load= 2.00 tsf
D_0 = 0.0320
D_{90} = 0.0367
D_{100} = 0.0372
T_{90} = 2.06 min.

C_v @ T_{90}
0.965 ft.^{2}/day



Load No.= 6
Load= 4.00 tsf
D_0 = 0.0457
D_{90} = 0.0549
D_{100} = 0.0559
T_{90} = 2.40 min.

C_v @ T_{90}
0.802 ft.^{2}/day

Figure 123

CONSOLIDATION TEST DATA

5/1/2026

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project Number: 301525.1000
Location: B-070-0-20
Depth: 38.0-40.0 FT

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.1	0.2	0.5	62.0	37.2

Sample Number: ST-14
Material Description: GRAY-BROWN SILT AND CLAY, TRACE COARSE AND FINE SAND, MOIST
Liquid Limit: 29 **Plasticity Index:** 9 Plastic Limit: 20
USCS: CL **AASHTO:** A-4b
Preparation Process: TRIMMING
Condition of Test: INUNDATED
Test Method: B **Final Density:** 99.2 **Figure No.:** 120
Testing Remarks: SAMPLE DESCRIPTION BASED ON USCS
Tested By: TBT 03/24/22 **Checked by:** SM 04/06/22 **Title:** LABORATORY SUPERVISOR

Test Specimen Data

NATURAL MOISTURE
Wet w+t = 350.17 g.
Dry w+t = 318.05 g.
Tare Wt. = 194.73 g.
Moisture = 26.0 %

VOID RATIO
Spec. Gr. = 2.79
Est. Ht. Solids = 0.550 in.
Init. V.R. = 0.820
Init. Sat. = 88.6 %

AFTER TEST
Wet w+t = 288.28 g.
Dry w+t = 255.32 g.
Tare Wt. = 132.00 g.
Moisture = 26.7 %

UNIT WEIGHT
Height = 1.001 in.
Diameter = 2.499 in.
Weight = 155.44 g.
Dry Dens. = 95.7 pcf

TEST START
Height = 1.001 in.
Diameter = 2.499 in.

Dry Wt. = 123.32 g.

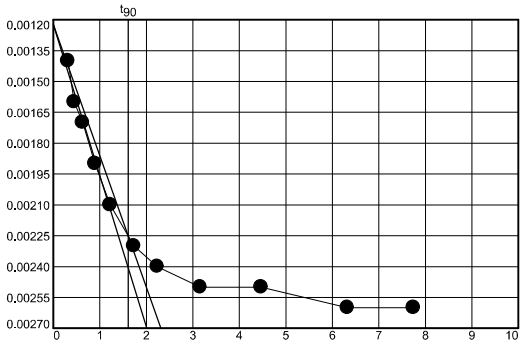
End-Of-Load Summary

Pressure (tsf)	Final Dial (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000	0.00000			0.820	
0.13	0.00260	0.00260	0.818		0.816	0.3 Comprs.
0.25	0.00700	0.00700	1.792		0.808	0.7 Comprs.
0.50	0.01470	0.01470	1.023		0.794	1.5 Comprs.
1.00	0.02570	0.02570	1.228		0.774	2.6 Comprs.
2.00	0.03880	0.03880	0.965		0.750	3.9 Comprs.
4.00	0.05880	0.05880	0.802		0.713	5.9 Comprs.
2.00	0.05650	0.05650			0.717	5.6 Comprs.
1.00	0.05200	0.05200			0.726	5.2 Comprs.
0.50	0.04690	0.04690			0.735	4.7 Comprs.
0.25	0.04160	0.04160			0.745	4.2 Comprs.
0.13	0.03650	0.03650			0.754	3.6 Comprs.

Compression index (C_c), tsf = 0.13 **Preconsolidation pressure (P_p), tsf =** 1.2 **Void ratio at P_p (e_m) =** 0.769
Recompression index (C_r) = 0.03

Pressure: 0.13 tsf	TEST READINGS	Load No. 1

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00000	11	40	0.00260
2	0.1	0.00140	12	60	0.00260
3	0.2	0.00160			
4	0.4	0.00170			
5	0.8	0.00190			
6	1.5	0.00210			
7	3	0.00230			
8	5	0.00240			
9	10	0.00250			
10	20	0.00250			

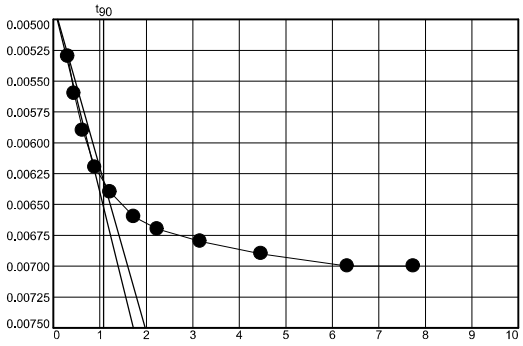


Void Ratio = 0.816 **Compression =** 0.3%

D_0 = 0.0012 **D_{90} =** 0.0023 **D_{100} =** 0.0024 **C_v at 2.59 min. =** 0.818 ft.^{2}/day

Pressure: 0.25 tsf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00260	11	40	0.00700
2	0.1	0.00530	12	60	0.00700
3	0.2	0.00560			
4	0.4	0.00590			
5	0.8	0.00620			
6	1.5	0.00640			
7	3	0.00660			
8	5	0.00670			
9	10	0.00680			
10	20	0.00690			

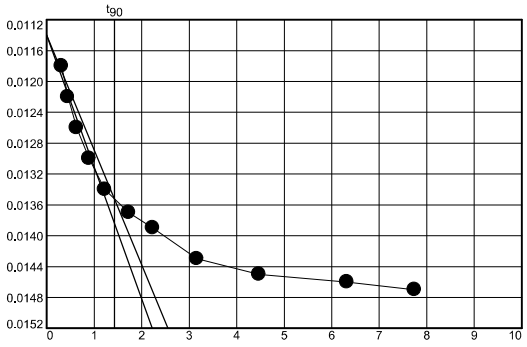


Void Ratio = 0.808 **Compression =** 0.7%

D_0 = 0.0049 **D_{90} =** 0.0063 **D_{100} =** 0.0065 **C_v at 1.17 min. =** 1.792 ft.^{2}/day

Pressure: 0.50 tsf | **TEST READINGS** | **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00700	11	40	0.01460
2	0.1	0.01180	12	60	0.01470
3	0.2	0.01220			
4	0.4	0.01260			
5	0.8	0.01300			
6	1.5	0.01340			
7	3	0.01370			
8	5	0.01390			
9	10	0.01430			
10	20	0.01450			

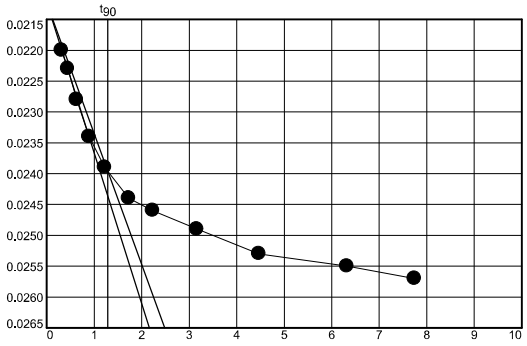


Void Ratio = 0.794 **Compression =** 1.5%

D_0 = 0.0114 **D_{90} =** 0.0135 **D_{100} =** 0.0138 **C_v at 2.03 min. =** 1.023 ft.^{2}/day

Pressure: 1.00 tsf | **TEST READINGS** | **Load No. 4**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01470	11	40	0.02550
2	0.1	0.02200	12	60	0.02570
3	0.2	0.02230			
4	0.4	0.02280			
5	0.8	0.02340			
6	1.5	0.02390			
7	3	0.02440			
8	5	0.02460			
9	10	0.02490			
10	20	0.02530			

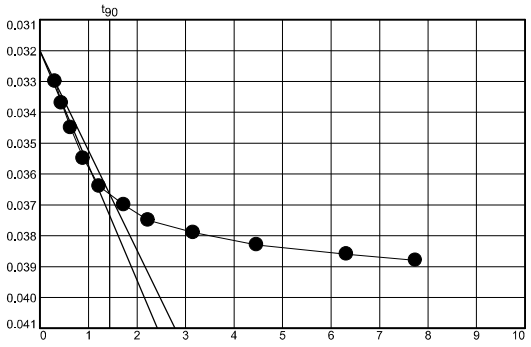


Void Ratio = 0.774 **Compression =** 2.6%

D_0 = 0.0212 **D_{90} =** 0.0240 **D_{100} =** 0.0243 **C_v at 1.66 min. =** 1.228 ft.^{2}/day

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 5**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.02570	11	40	0.03860
2	0.1	0.03300	12	60	0.03880
3	0.2	0.03370			
4	0.4	0.03450			
5	0.8	0.03550			
6	1.5	0.03640			
7	3	0.03700			
8	5	0.03750			
9	10	0.03790			
10	20	0.03830			

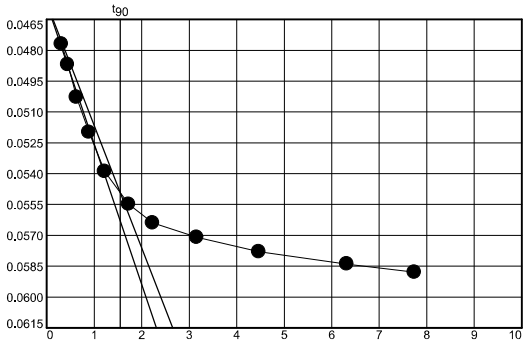


Void Ratio = 0.750 **Compression =** 3.9%

D_0 = 0.0320 **D_{90} =** 0.0367 **D_{100} =** 0.0372 **C_v at 2.06 min. =** 0.965 ft.^{2}/day

Pressure: 4.00 tsf | **TEST READINGS** | **Load No. 6**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.03880	11	40	0.05840
2	0.1	0.04770	12	60	0.05880
3	0.2	0.04870			
4	0.4	0.05030			
5	0.8	0.05200			
6	1.5	0.05390			
7	3	0.05550			
8	5	0.05640			
9	10	0.05710			
10	20	0.05780			



Void Ratio = 0.713 **Compression =** 5.9%

D_0 = 0.0457 **D_{90} =** 0.0549 **D_{100} =** 0.0559 **C_v at 2.40 min. =** 0.802 ft.^{2}/day

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 7**

No.	Elapsed Time	Dial Reading
1	0	0.05880
2	20	0.05650

Void Ratio = 0.717 **Compression =** 5.6%

Pressure: 1.00 tsf | **TEST READINGS** | **Load No. 8**

No.	Elapsed Time	Dial Reading
1	0	0.05650
2	20	0.05200

Void Ratio = 0.726 **Compression =** 5.2%

Pressure: 0.50 tsf	TEST READINGS	Load No. 9

No.	Elapsed Time	Dial Reading
1	0	0.05200
2	20	0.04690

Void Ratio = 0.735 **Compression =** 4.7%

Pressure: 0.25 tsf	TEST READINGS	Load No. 10

No.	Elapsed Time	Dial Reading
1	0	0.04690
2	20	0.04160

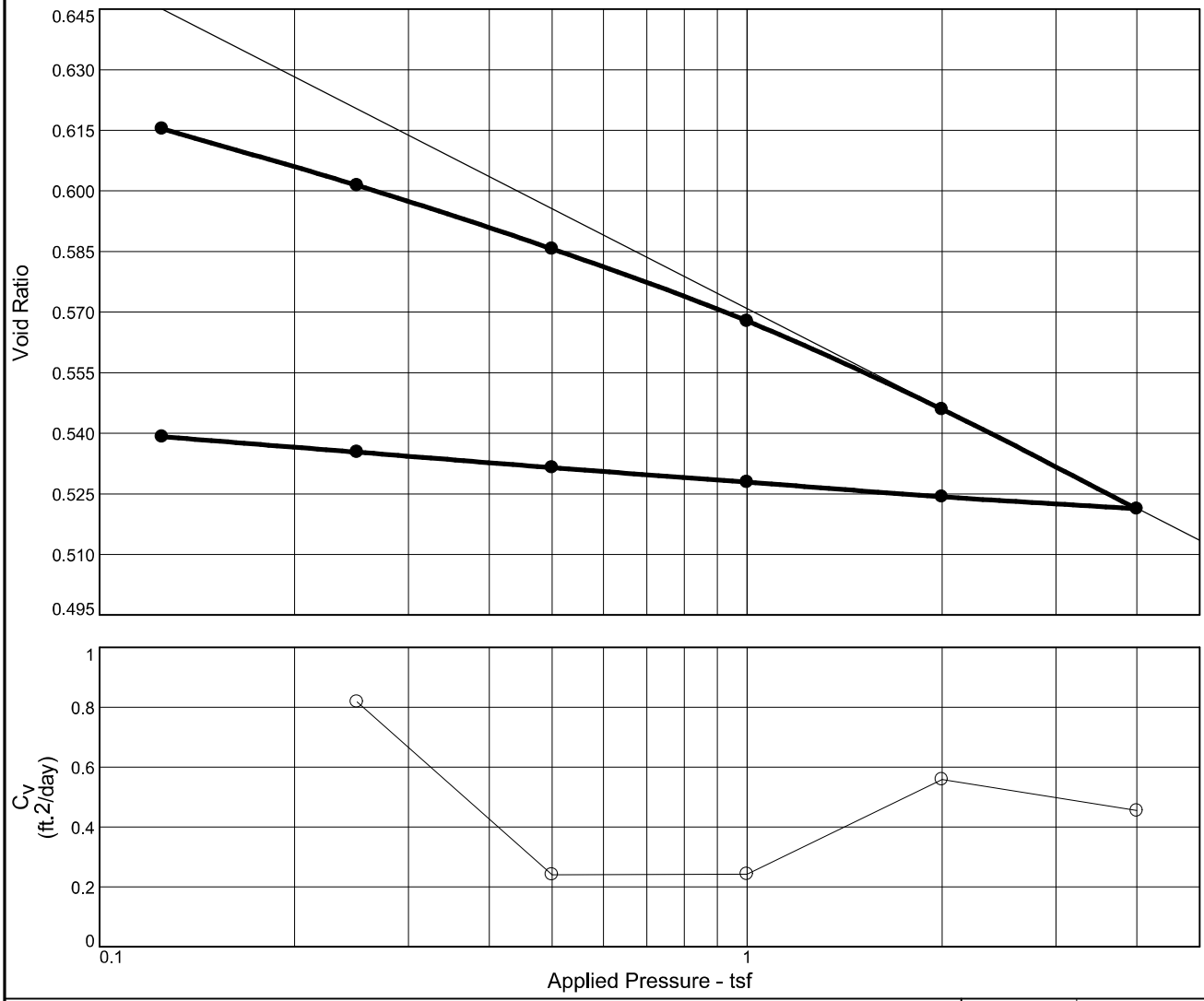
Void Ratio = 0.745 **Compression =** 4.2%

Pressure: 0.13 tsf	TEST READINGS	Load No. 11

No.	Elapsed Time	Dial Reading
1	0	0.04160
2	20	0.03650

Void Ratio = 0.754 **Compression =** 3.6%

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
BROWN TO GROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST	CL-ML	A-4b

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (tsf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
23	4	2.79		106.3	113.2	19.8 %	18.2 %	86.4 %	94.2 %	0.639	0.539	1.2	0.08

D2435 Method	C_r	Swell Press. (tsf)	Swell %
B	0.01		

Preparation Process: TRIMMING

Condition of Test: INUNDATED

Project No. 301525.1000 **Client:** OHIO DEPARTMENT OF

Project: CUY-77-11.21

Source: B-071-0-20 **Depth:** 26.0-28.0 FT **Sample No.:** ST-11

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:
SAMPLE DESCRIPTION BASED ON USCS

Checked By: SM 04/06/22

Title: LABORATORY SUPERVISOR

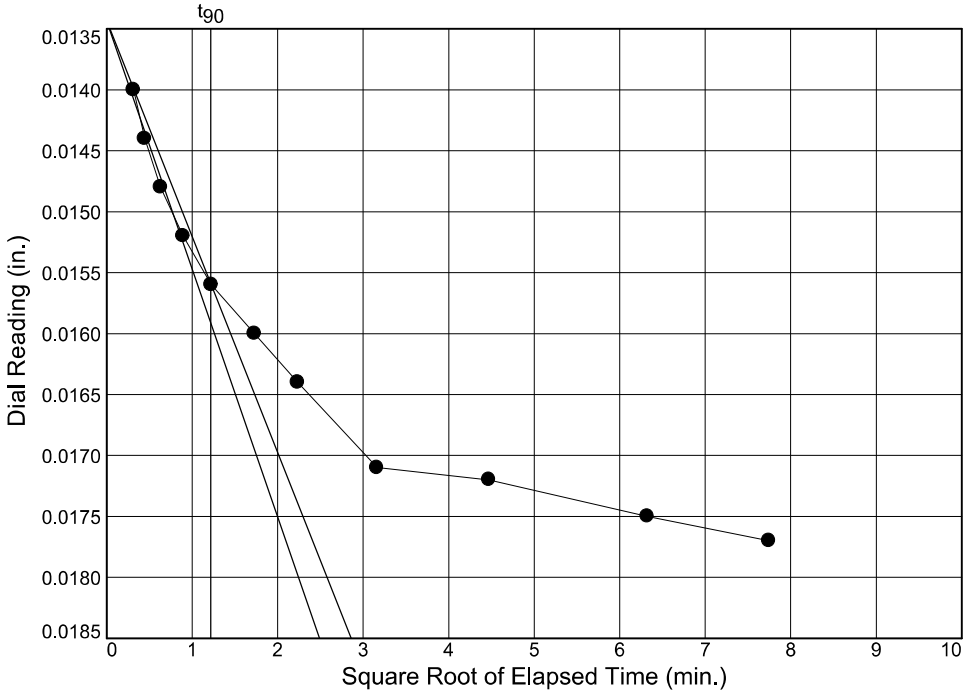
Figure 124

Tested By: TBT 03/29/22

Dial Reading vs. Time

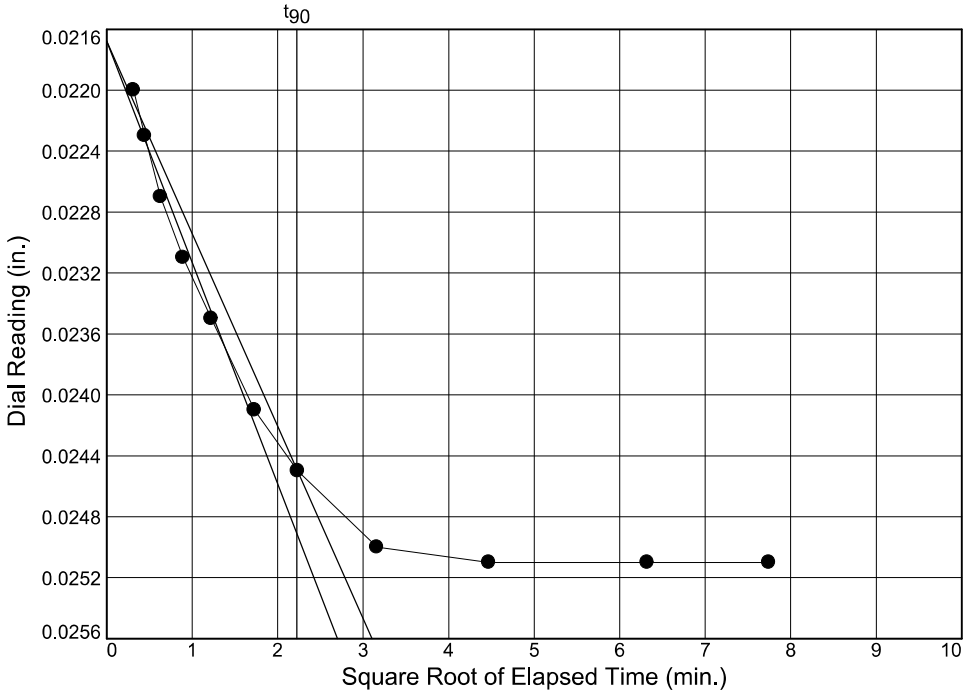
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-071-0-20 Depth: 26.0-28.0 FT Sample Number: ST-11



Load No.= 2
Load= 0.25 tsf
D_0 = 0.0134
D_{90} = 0.0156
D_{100} = 0.0158
T_{90} = 1.49 min.

C_v @ T_{90}
0.818 ft.^{2}/day



Load No.= 3
Load= 0.50 tsf
D_0 = 0.0217
D_{90} = 0.0245
D_{100} = 0.0248
T_{90} = 4.95 min.

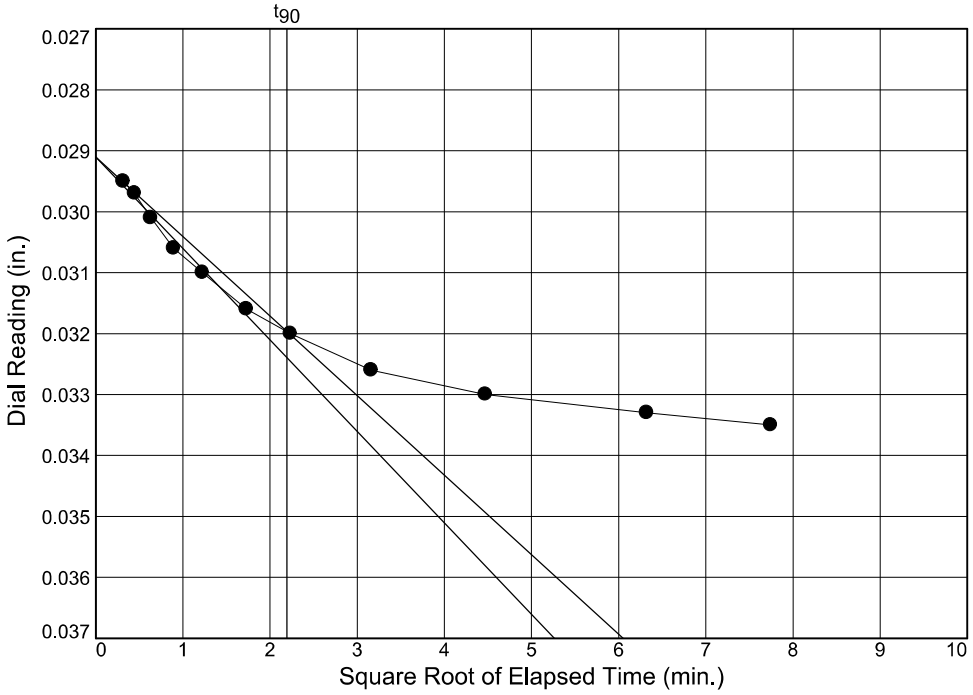
C_v @ T_{90}
0.241 ft.^{2}/day

Figure 125

Dial Reading vs. Time

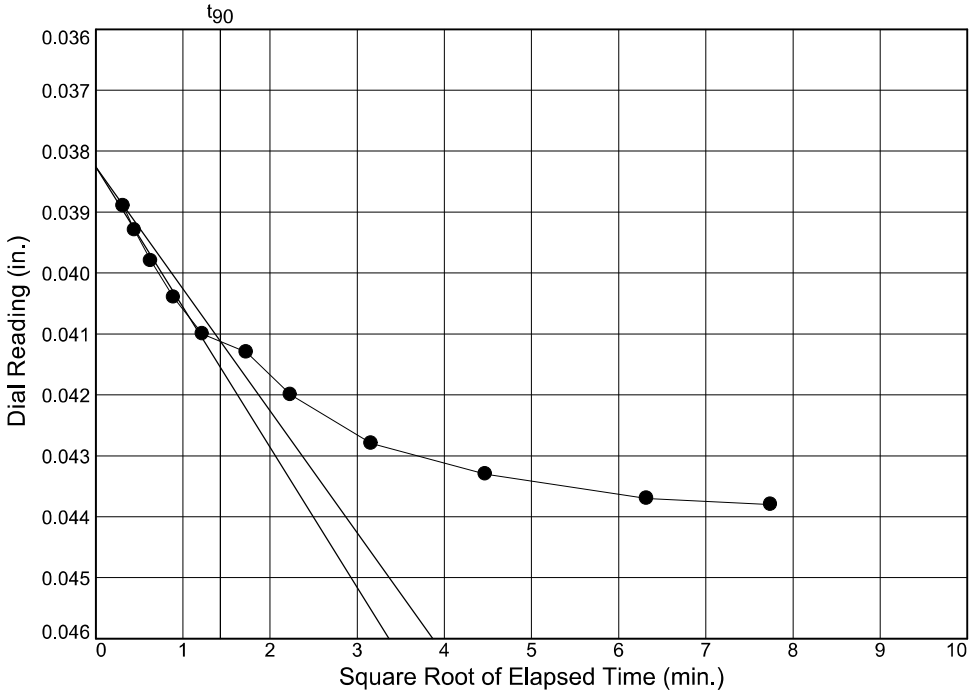
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-071-0-20 Depth: 26.0-28.0 FT Sample Number: ST-11



Load No.= 4
Load= 1.00 tsf
D_0 = 0.0291
D_{90} = 0.0320
D_{100} = 0.0323
T_{90} = 4.81 min.

C_v @ T_{90}
0.243 ft.^{2}/day



Load No.= 5
Load= 2.00 tsf
D_0 = 0.0383
D_{90} = 0.0411
D_{100} = 0.0414
T_{90} = 2.04 min.

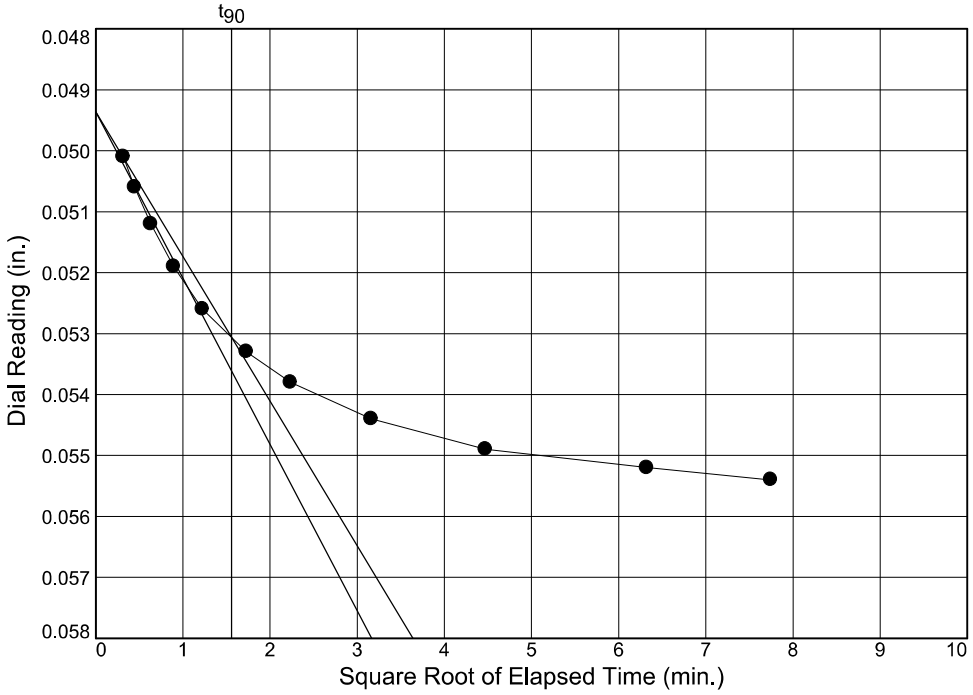
C_v @ T_{90}
0.559 ft.^{2}/day

Figure 126

Dial Reading vs. Time

Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-071-0-20 Depth: 26.0-28.0 FT Sample Number: ST-11



Load No.= 6
Load= 4.00 tsf
D_0 = 0.0494
D_{90} = 0.0531
D_{100} = 0.0535
T_{90} = 2.43 min.

C_v @ T_{90}
0.455 ft.^{2}/day

Figure 127

CONSOLIDATION TEST DATA

5/1/2026

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project Number: 301525.1000
Location: B-071-0-20
Depth: 26.0-28.0 FT

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.7	0.6	3.2	68.4	27.1

Sample Number: ST-11
Material Description: BROWN TO GROWN-GRAY SILT, SOME CLAY, TRACE COARSE AND FINE SAND, TRACE FINE GRAVEL, MOIST
Liquid Limit: 23 **Plasticity Index:** 4 Plastic Limit: 19
USCS: CL-ML **AASHTO:** A-4b
Preparation Process: TRIMMING
Condition of Test: INUNDATED
Test Method: B **Final Density:** 113.2 **Figure No.:** 124
Testing Remarks: SAMPLE DESCRIPTION BASED ON USCS
Tested By: TBT 03/29/22 **Checked by:** SM 04/06/22 **Title:** LABORATORY SUPERVISOR

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	191.12 g.	Spec. Gr. =	2.79	Wet w+t =	249.57 g.
Dry w+t =	170.23 g.	Est. Ht. Solids =	0.471 in.	Dry w+t =	230.34 g.
Tare Wt. =	64.60 g.	Init. V.R. =	0.639	Tare Wt. =	124.71 g.
Moisture =	19.8 %	Init. Sat. =	86.4 %	Moisture =	18.2 %

UNIT WEIGHT		TEST START			
Height =	0.772 in.	Height =	0.772 in.	Dry Wt. =	105.63 g.
Diameter =	2.499 in.	Diameter =	2.499 in.		
Weight =	126.52 g.				
Dry Dens. =	106.3 pcf				

End-Of-Load Summary

Pressure (tsf)	Final Dial (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000	0.00000			0.639	
0.13	0.01110	0.01110			0.615	1.4 Comprs.
0.25	0.01770	0.01770	0.818		0.601	2.3 Comprs.
0.50	0.02510	0.02510	0.241		0.586	3.3 Comprs.
1.00	0.03350	0.03350	0.243		0.568	4.3 Comprs.
2.00	0.04380	0.04380	0.559		0.546	5.7 Comprs.
4.00	0.05540	0.05540	0.455		0.521	7.2 Comprs.
2.00	0.05400	0.05400			0.524	7.0 Comprs.
1.00	0.05230	0.05230			0.528	6.8 Comprs.
0.50	0.05060	0.05060			0.531	6.6 Comprs.
0.25	0.04880	0.04880			0.535	6.3 Comprs.
0.13	0.04700	0.04700			0.539	6.1 Comprs.

Compression index (C_c), tsf = 0.08 **Preconsolidation pressure (P_p), tsf =** 1.2 **Void ratio at P_p (e_m) =** 0.564
Recompression index (C_r) = 0.01

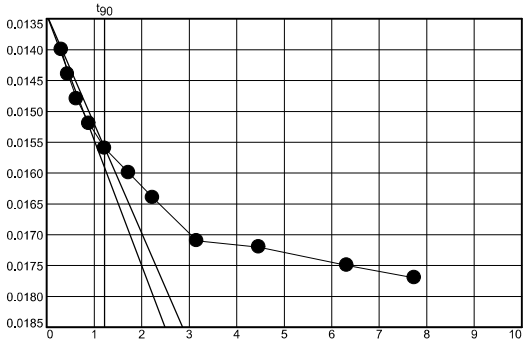
Pressure: 0.13 tsf | **TEST READINGS** | **Load No. 1**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00000	11	40	0.01100
2	0.1	0.00580	12	60	0.01110
3	0.2	0.00620			
4	0.4	0.00670			
5	0.8	0.00720			
6	1.5	0.00780			
7	3	0.00870			
8	5	0.00930			
9	10	0.01010			
10	20	0.01070			

Void Ratio = 0.615 **Compression =** 1.4%

Pressure: 0.25 tsf | **TEST READINGS** | **Load No. 2**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01110	11	40	0.01750
2	0.1	0.01400	12	60	0.01770
3	0.2	0.01440			
4	0.4	0.01480			
5	0.8	0.01520			
6	1.5	0.01560			
7	3	0.01600			
8	5	0.01640			
9	10	0.01710			
10	20	0.01720			

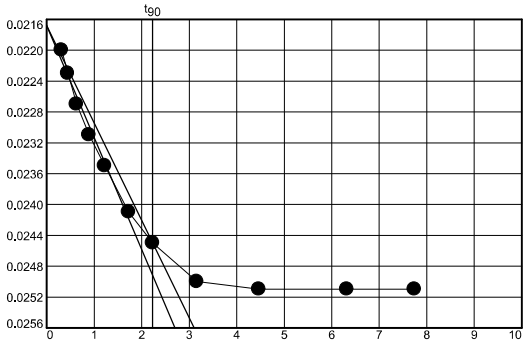


Void Ratio = 0.601 **Compression =** 2.3%

D_0 = 0.0134 **D_{90} =** 0.0156 **D_{100} =** 0.0158 **C_v at 1.49 min. =** 0.818 ft.^{2}/day

Pressure: 0.50 tsf | **TEST READINGS** | **Load No. 3**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01770	11	40	0.02510
2	0.1	0.02200	12	60	0.02510
3	0.2	0.02230			
4	0.4	0.02270			
5	0.8	0.02310			
6	1.5	0.02350			
7	3	0.02410			
8	5	0.02450			
9	10	0.02500			
10	20	0.02510			

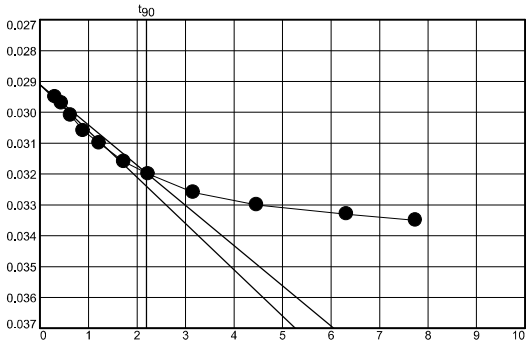


Void Ratio = 0.586 **Compression =** 3.3%

D_0 = 0.0217 **D_{90} =** 0.0245 **D_{100} =** 0.0248 **C_v at 4.95 min. =** 0.241 ft.^{2}/day

Pressure: 1.00 tsf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.02510	11	40	0.03330
2	0.1	0.02950	12	60	0.03350
3	0.2	0.02970			
4	0.4	0.03010			
5	0.8	0.03060			
6	1.5	0.03100			
7	3	0.03160			
8	5	0.03200			
9	10	0.03260			
10	20	0.03300			

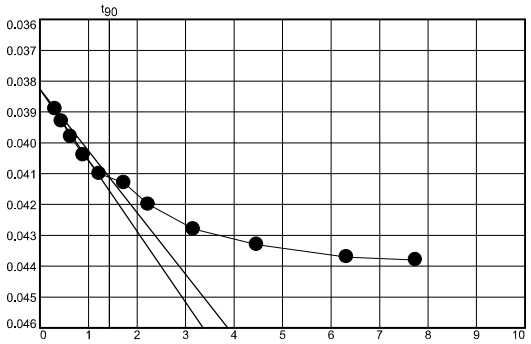


Void Ratio = 0.568 **Compression =** 4.3%

D_0 = 0.0291 **D_{90} =** 0.0320 **D_{100} =** 0.0323 **C_v at 4.81 min. =** 0.243 ft.^{2}/day

Pressure: 2.00 tsf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.03350	11	40	0.04370
2	0.1	0.03890	12	60	0.04380
3	0.2	0.03930			
4	0.4	0.03980			
5	0.8	0.04040			
6	1.5	0.04100			
7	3	0.04130			
8	5	0.04200			
9	10	0.04280			
10	20	0.04330			

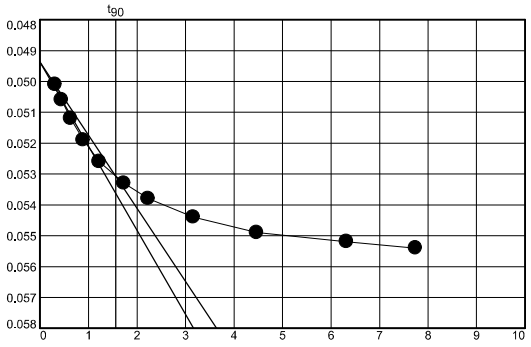


Void Ratio = 0.546 **Compression =** 5.7%

D_0 = 0.0383 **D_{90} =** 0.0411 **D_{100} =** 0.0414 **C_v at 2.04 min. =** 0.559 ft.^{2}/day

Pressure: 4.00 tsf | **TEST READINGS** | **Load No. 6**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.04380	11	40	0.05520
2	0.1	0.05010	12	60	0.05540
3	0.2	0.05060			
4	0.4	0.05120			
5	0.8	0.05190			
6	1.5	0.05260			
7	3	0.05330			
8	5	0.05380			
9	10	0.05440			
10	20	0.05490			



Void Ratio = 0.521 **Compression =** 7.2%

D_0 = 0.0494 **D_{90} =** 0.0531 **D_{100} =** 0.0535 **C_v at 2.43 min. =** 0.455 ft.^{2}/day

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 7**

No.	Elapsed Time	Dial Reading
1	0	0.05540
2	20	0.05400

Void Ratio = 0.524 **Compression =** 7.0%

Pressure: 1.00 tsf | **TEST READINGS** | **Load No. 8**

No.	Elapsed Time	Dial Reading
1	0	0.05400
2	20	0.05230

Void Ratio = 0.528 **Compression =** 6.8%

Pressure: 0.50 tsf | **TEST READINGS** | **Load No. 9**

No.	Elapsed Time	Dial Reading
1	0	0.05230
2	20	0.05060

Void Ratio = 0.531 **Compression =** 6.6%

Pressure: 0.25 tsf | **TEST READINGS** | **Load No. 10**

No.	Elapsed Time	Dial Reading
1	0	0.05060
2	20	0.04880

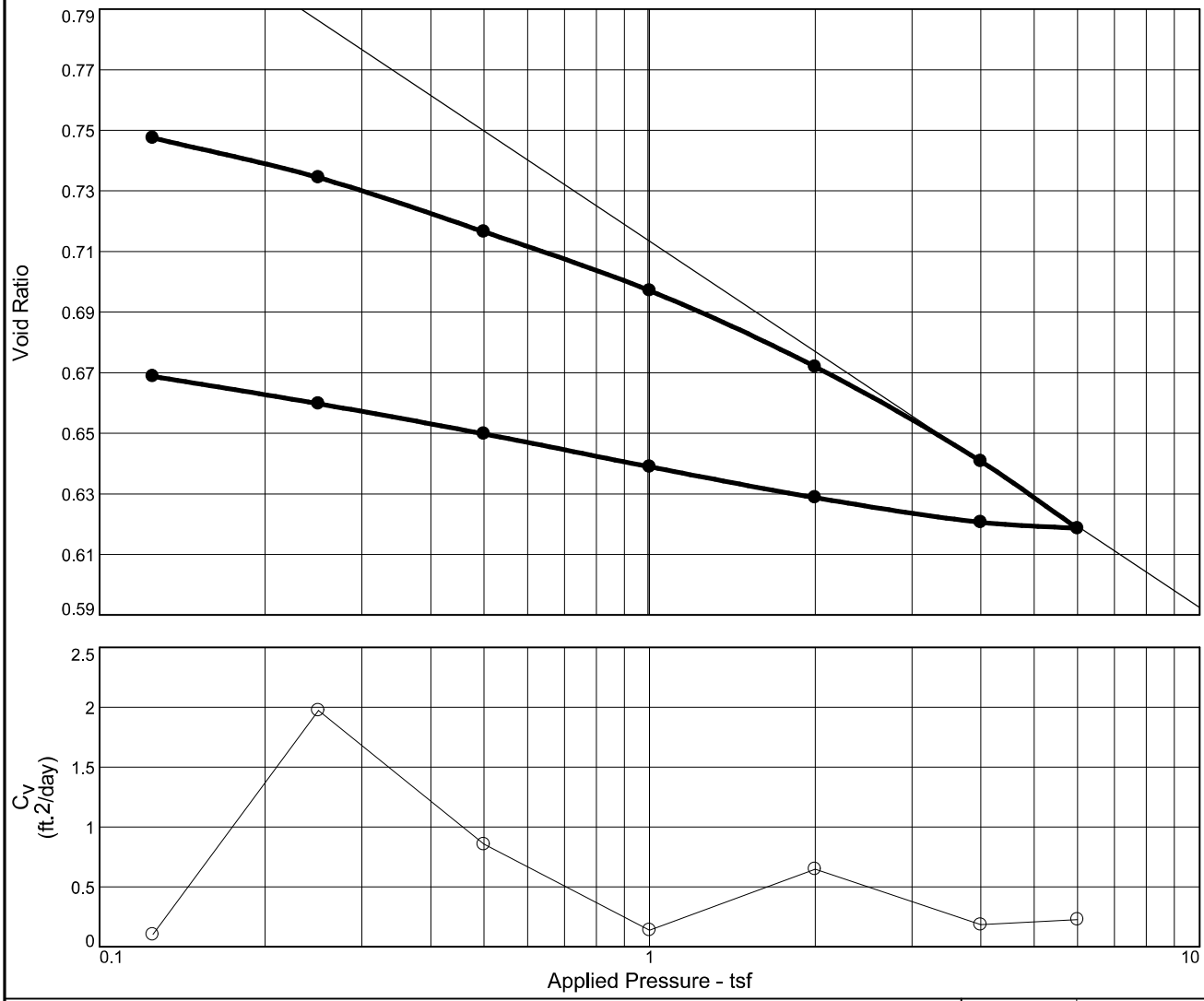
Void Ratio = 0.535 **Compression =** 6.3%

Pressure: 0.13 tsf	TEST READINGS	Load No. 11

No.	Elapsed Time	Dial Reading
1	0	0.04880
2	20	0.04700

Void Ratio = 0.539 **Compression =** 6.1%

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
BROWN-GRAY SILT, SOME CLAY, TRACE FINE SAND, MOIST	CL	A-6a

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (tsf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
33	12	2.79		98.5	104.4	24.9 %	24.0 %	90.4 %	100.0 %	0.768	0.669	1.6	0.12

Preparation Process: TRIMMING

Condition of Test: INUNDATED

D2435 Method	C_r	Swell Press. (tsf)	Swell %
B	0.03		

Project No. 301525.1000 **Client:** OHIO DEPARTMENT OF

Project: CUY-77-11.21

Source: B-071-0-20 **Depth:** 41.0-43.0 FT **Sample No.:** ST-16

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:
SAMPLE DESCRIPTION BASED ON USCS

Checked By: SM 04/06/22

Title: LABORATORY SUPERVISOR

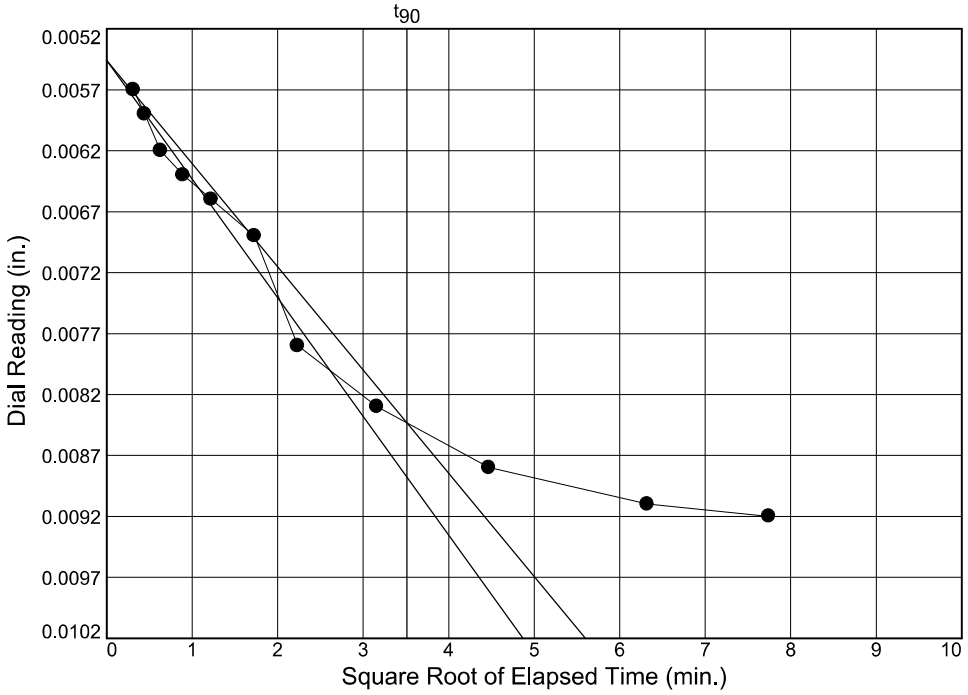
Figure 128

Tested By: TBT 03/29/22

Dial Reading vs. Time

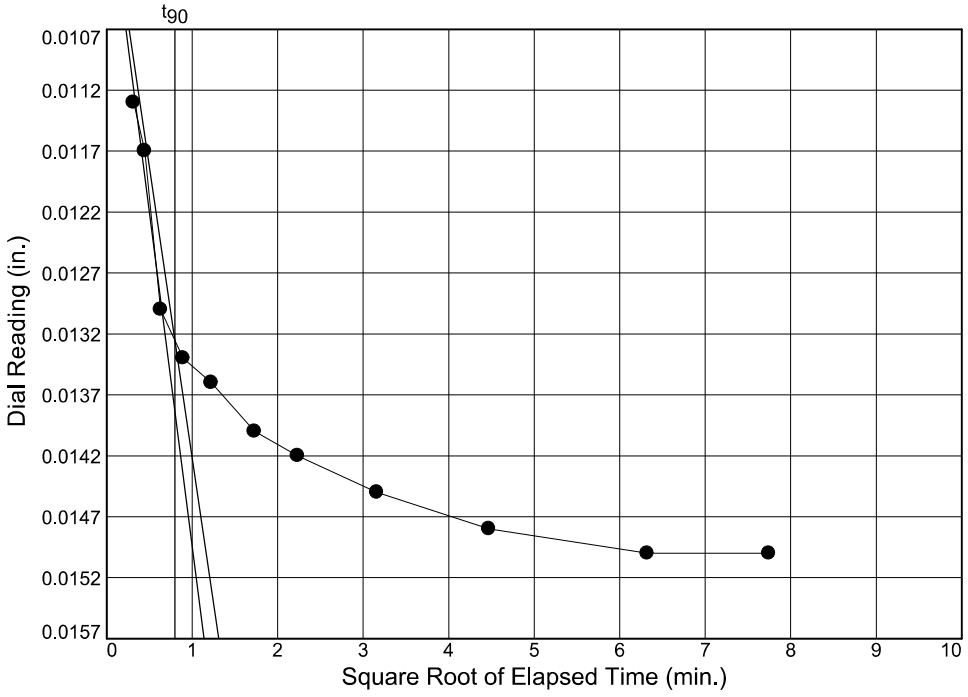
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-071-0-20 Depth: 41.0-43.0 FT Sample Number: ST-16



Load No.= 1
Load= 0.13 tsf
D_0 = 0.0055
D_{90} = 0.0084
D_{100} = 0.0088
T_{90} = 12.33 min.

C_v @ T_{90}
0.104 ft.^{2}/day



Load No.= 2
Load= 0.25 tsf
D_0 = 0.0094
D_{90} = 0.0133
D_{100} = 0.0137
T_{90} = 0.64 min.

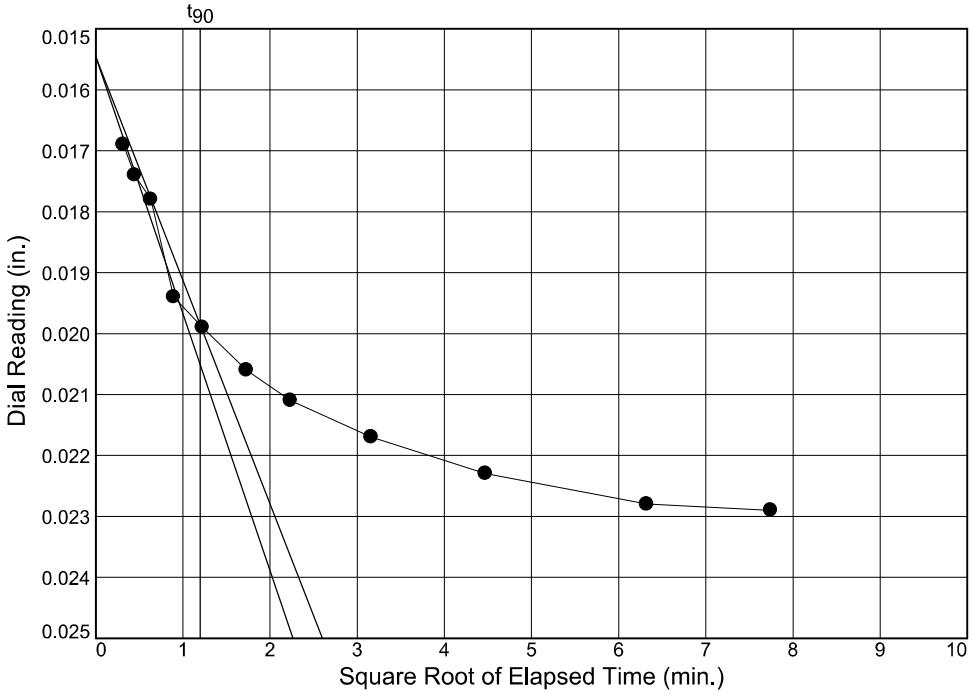
C_v @ T_{90}
1.974 ft.^{2}/day

Figure 129

Dial Reading vs. Time

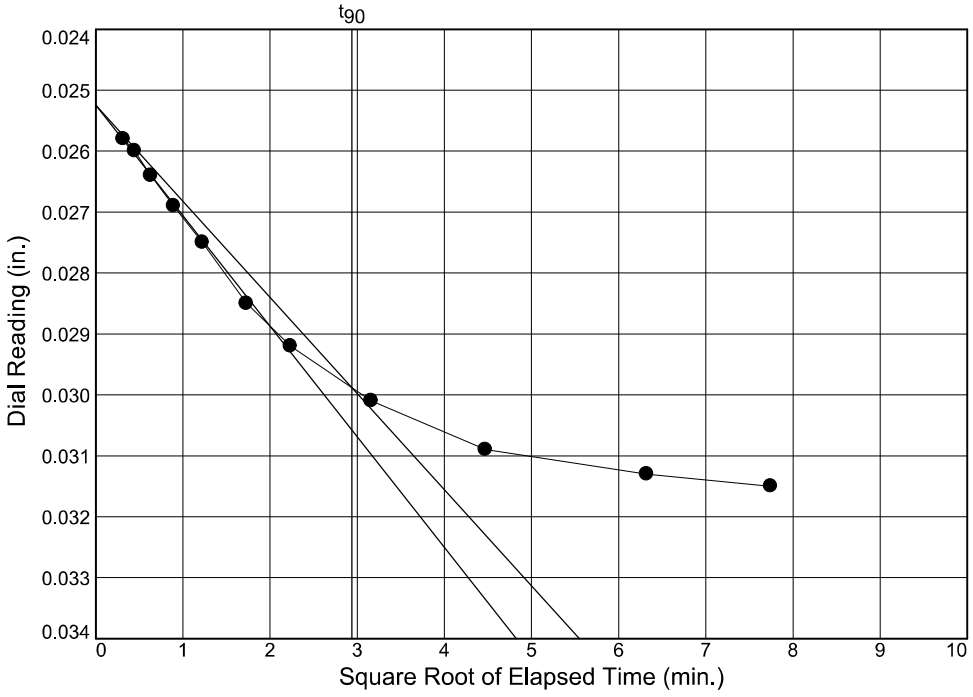
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-071-0-20 Depth: 41.0-43.0 FT Sample Number: ST-16



Load No.= 3
Load= 0.50 tsf
D_0 = 0.0155
D_{90} = 0.0199
D_{100} = 0.0204
T_{90} = 1.44 min.

C_v @ T_{90}
0.856 ft.^{2}/day



Load No.= 4
Load= 1.00 tsf
D_0 = 0.0252
D_{90} = 0.0299
D_{100} = 0.0304
T_{90} = 8.64 min.

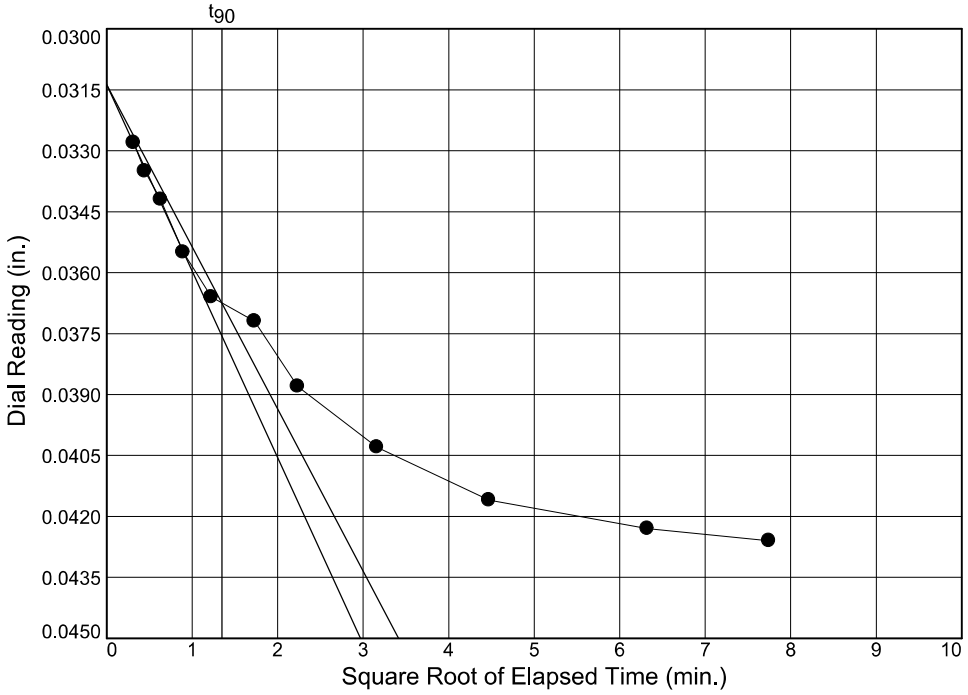
C_v @ T_{90}
0.140 ft.^{2}/day

Figure 130

Dial Reading vs. Time

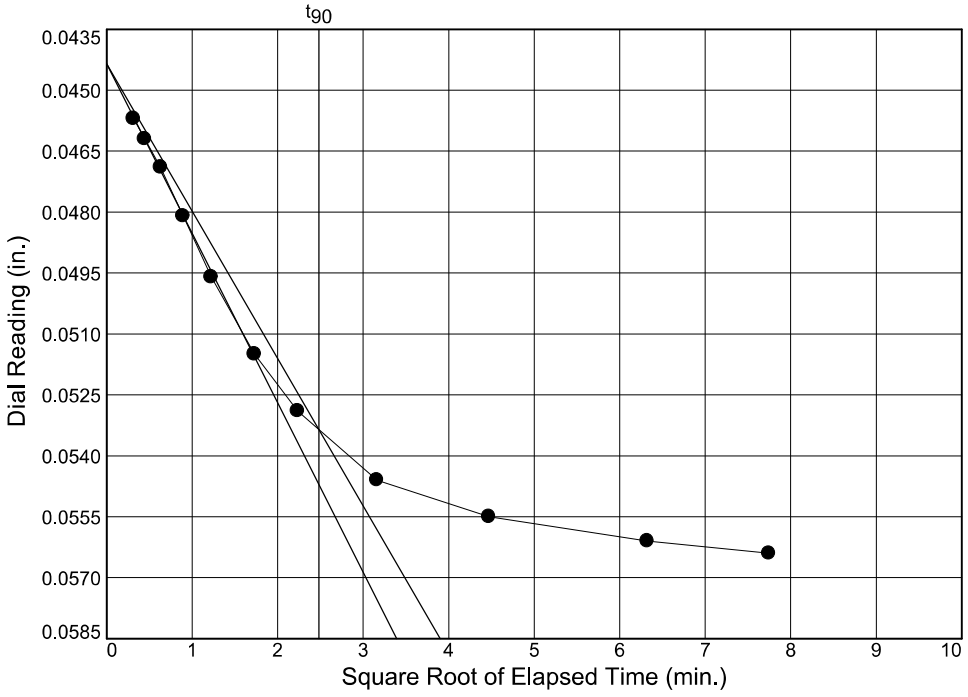
Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-071-0-20 Depth: 41.0-43.0 FT Sample Number: ST-16



Load No.= 5
Load= 2.00 tsf
D_0 = 0.0314
D_{90} = 0.0367
D_{100} = 0.0373
T_{90} = 1.81 min.

C_v @ T_{90}
0.649 ft.^{2}/day



Load No.= 6
Load= 4.00 tsf
D_0 = 0.0444
D_{90} = 0.0534
D_{100} = 0.0544
T_{90} = 6.16 min.

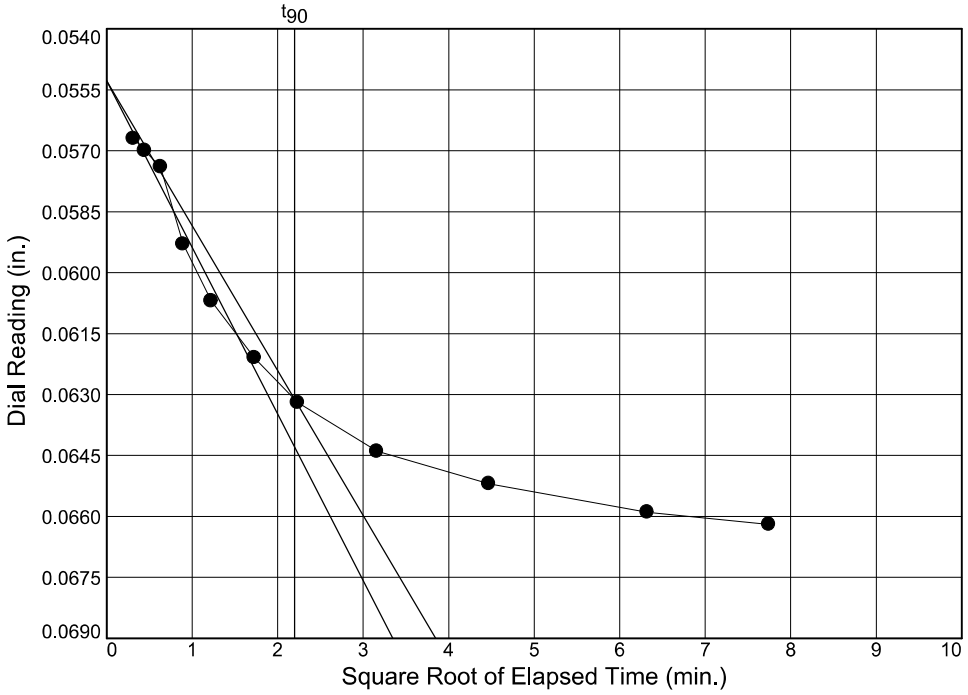
C_v @ T_{90}
0.185 ft.^{2}/day

Figure 131

Dial Reading vs. Time

Project No.: 301525.1000
Project: CUY-77-11.21

Source of Sample: B-071-0-20 Depth: 41.0-43.0 FT Sample Number: ST-16



Load No.= 7
Load= 6.00 tsf
D_0 = 0.0553
D_{90} = 0.0631
D_{100} = 0.0640
T_{90} = 4.83 min.

C_v @ T_{90}
0.228 ft.^{2}/day

Figure 132

CONSOLIDATION TEST DATA

5/1/2026

Client: OHIO DEPARTMENT OF TRANSPORTATION
Project: CUY-77-11.21
Project Number: 301525.1000
Location: B-071-0-20
Depth: 41.0-43.0 FT

GRAIN SIZE - mm.

% Gravel		% Sand		% Fines	
Coarse	Fine	Coarse	Fine	Silt	Clay
0.0	0.1	0.0	0.4	67.2	32.3

Sample Number: ST-16
Material Description: BROWN-GRAY SILT, SOME CLAY, TRACE FINE SAND, MOIST
Liquid Limit: 33 **Plasticity Index:** 12 Plastic Limit: 21
USCS: CL **AASHTO:** A-6a
Preparation Process: TRIMMING
Condition of Test: INUNDATED
Test Method: B **Final Density:** 104.4 **Figure No.:** 128
Testing Remarks: SAMPLE DESCRIPTION BASED ON USCS
Tested By: TBT 03/29/22 **Checked by:** SM 04/06/22 **Title:** LABORATORY SUPERVISOR

Test Specimen Data

NATURAL MOISTURE

Wet w+t	=	185.15 g.
Dry w+t	=	160.46 g.
Tare Wt.	=	61.29 g.
Moisture	=	24.9 %

VOID RATIO

Spec. Gr.	=	2.79
Est. Ht. Solids	=	0.442 in.
Init. V.R.	=	0.768
Init. Sat.	=	90.4 %

AFTER TEST

Wet w+t	=	255.52 g.
Dry w+t	=	231.75 g.
Tare Wt.	=	132.58 g.
Moisture	=	24.0 %
Dry Wt.	=	99.17 g.

UNIT WEIGHT

Height	=	0.782 in.
Diameter	=	2.499 in.
Weight	=	123.86 g.
Dry Dens.	=	98.5 pcf

TEST START

Height	=	0.782 in.
Diameter	=	2.499 in.

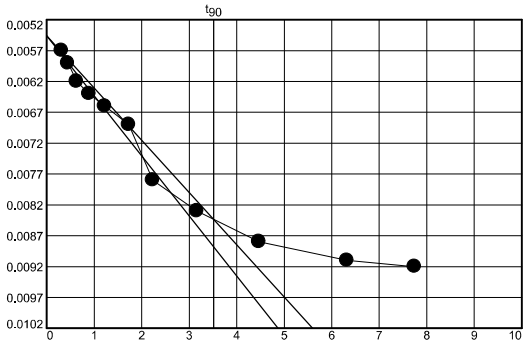
End-Of-Load Summary

Pressure (tsf)	Final Dial (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.00000	0.00000			0.768	
0.13	0.00920	0.00920	0.104		0.747	1.2 Comprs.
0.25	0.01500	0.01500	1.974		0.734	1.9 Comprs.
0.50	0.02290	0.02290	0.856		0.717	2.9 Comprs.
1.00	0.03150	0.03150	0.140		0.697	4.0 Comprs.
2.00	0.04260	0.04260	0.649		0.672	5.4 Comprs.
4.00	0.05640	0.05640	0.185		0.641	7.2 Comprs.
6.00	0.06620	0.06620	0.228		0.619	8.5 Comprs.
4.00	0.06530	0.06530			0.621	8.4 Comprs.
2.00	0.06170	0.06170			0.629	7.9 Comprs.
1.00	0.05720	0.05720			0.639	7.3 Comprs.
0.50	0.05240	0.05240			0.650	6.7 Comprs.
0.25	0.04800	0.04800			0.660	6.1 Comprs.
0.13	0.04400	0.04400			0.669	5.6 Comprs.

Compression index (C_c), tsf = 0.12 **Preconsolidation pressure (P_p), tsf =** 1.6 **Void ratio at P_p (e_m) =** 0.682
Recompression index (C_r) = 0.03

Pressure: 0.13 tsf	TEST READINGS	Load No. 1

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00000	11	40	0.00910
2	0.1	0.00570	12	60	0.00920
3	0.2	0.00590			
4	0.4	0.00620			
5	0.8	0.00640			
6	1.5	0.00660			
7	3	0.00690			
8	5	0.00780			
9	10	0.00830			
10	20	0.00880			

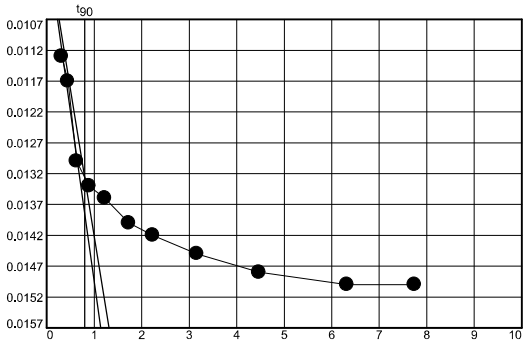


Void Ratio = 0.747 **Compression =** 1.2%

D_0 = 0.0055 **D_{90} =** 0.0084 **D_{100} =** 0.0088 **C_v at 12.33 min. =** 0.104 ft.^{2}/day

Pressure: 0.25 tsf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.00920	11	40	0.01500
2	0.1	0.01130	12	60	0.01500
3	0.2	0.01170			
4	0.4	0.01300			
5	0.8	0.01340			
6	1.5	0.01360			
7	3	0.01400			
8	5	0.01420			
9	10	0.01450			
10	20	0.01480			

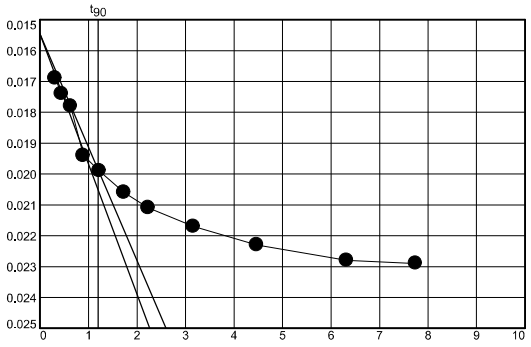


Void Ratio = 0.734 **Compression =** 1.9%

D_0 = 0.0094 **D_{90} =** 0.0133 **D_{100} =** 0.0137 **C_v at 0.64 min. =** 1.974 ft.^{2}/day

Pressure: 0.50 tsf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.01500	11	40	0.02280
2	0.1	0.01690	12	60	0.02290
3	0.2	0.01740			
4	0.4	0.01780			
5	0.8	0.01940			
6	1.5	0.01990			
7	3	0.02060			
8	5	0.02110			
9	10	0.02170			
10	20	0.02230			

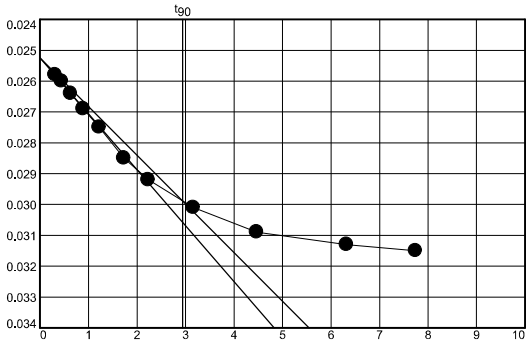


Void Ratio = 0.717 **Compression =** 2.9%

D_0 = 0.0155 **D_{90} =** 0.0199 **D_{100} =** 0.0204 **C_v at 1.44 min. =** 0.856 ft.^{2}/day

Pressure: 1.00 tsf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.02290	11	40	0.03130
2	0.1	0.02580	12	60	0.03150
3	0.2	0.02600			
4	0.4	0.02640			
5	0.8	0.02690			
6	1.5	0.02750			
7	3	0.02850			
8	5	0.02920			
9	10	0.03010			
10	20	0.03090			

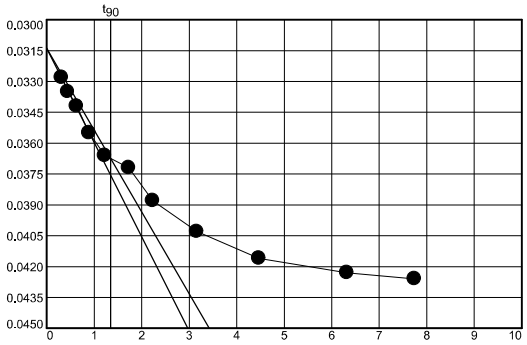


Void Ratio = 0.697 **Compression =** 4.0%

D_0 = 0.0252 **D_{90} =** 0.0299 **D_{100} =** 0.0304 **C_v at 8.64 min. =** 0.140 ft.^{2}/day

Pressure: 2.00 tsf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.03150	11	40	0.04230
2	0.1	0.03280	12	60	0.04260
3	0.2	0.03350			
4	0.4	0.03420			
5	0.8	0.03550			
6	1.5	0.03660			
7	3	0.03720			
8	5	0.03880			
9	10	0.04030			
10	20	0.04160			

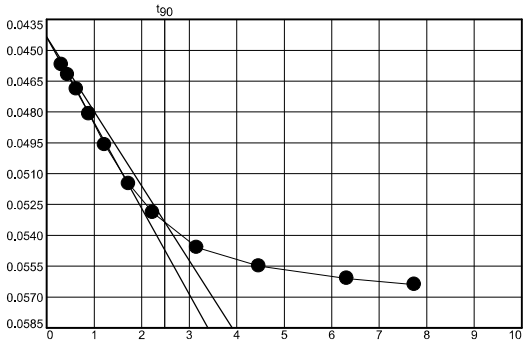


Void Ratio = 0.672 **Compression =** 5.4%

D_0 = 0.0314 **D_{90} =** 0.0367 **D_{100} =** 0.0373 **C_v at 1.81 min. =** 0.649 ft.^{2}/day

Pressure: 4.00 tsf	TEST READINGS	Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.04260	11	40	0.05610
2	0.1	0.04570	12	60	0.05640
3	0.2	0.04620			
4	0.4	0.04690			
5	0.8	0.04810			
6	1.5	0.04960			
7	3	0.05150			
8	5	0.05290			
9	10	0.05460			
10	20	0.05550			

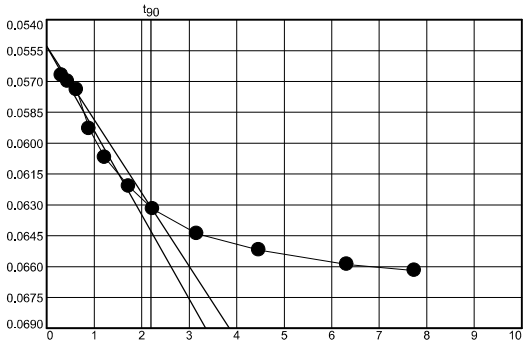


Void Ratio = 0.641 **Compression =** 7.2%

D_0 = 0.0444 **D_{90} =** 0.0534 **D_{100} =** 0.0544 **C_v at 6.16 min. =** 0.185 ft.^{2}/day

Pressure: 6.00 tsf | **TEST READINGS** | **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.05640	11	40	0.06590
2	0.1	0.05670	12	60	0.06620
3	0.2	0.05700			
4	0.4	0.05740			
5	0.8	0.05930			
6	1.5	0.06070			
7	3	0.06210			
8	5	0.06320			
9	10	0.06440			
10	20	0.06520			



Void Ratio = 0.619 **Compression =** 8.5%

D_0 = 0.0553 **D_{90} =** 0.0631 **D_{100} =** 0.0640 **C_v at 4.83 min. =** 0.228 ft.^{2}/day

Pressure: 4.00 tsf | **TEST READINGS** | **Load No. 8**

No.	Elapsed Time	Dial Reading
1	0	0.06620
2	20	0.06530

Void Ratio = 0.621 **Compression =** 8.4%

Pressure: 2.00 tsf | **TEST READINGS** | **Load No. 9**

No.	Elapsed Time	Dial Reading
1	0	0.06530
2	20	0.06170

Void Ratio = 0.629 **Compression =** 7.9%

Pressure: 1.00 tsf | **TEST READINGS** | **Load No. 10**

No.	Elapsed Time	Dial Reading
1	0	0.06170
2	20	0.05720

Void Ratio = 0.639 **Compression =** 7.3%

Pressure: 0.50 tsf | **TEST READINGS** | **Load No. 11**

No.	Elapsed Time	Dial Reading
1	0	0.05720
2	20	0.05240

Void Ratio = 0.650 **Compression =** 6.7%

Pressure: 0.25 tsf	TEST READINGS	Load No. 12

No.	Elapsed Time	Dial Reading
1	0	0.05240
2	20	0.04800

Void Ratio = 0.660 **Compression =** 6.1%

Pressure: 0.13 tsf	TEST READINGS	Load No. 13

No.	Elapsed Time	Dial Reading
1	0	0.04800
2	20	0.04400

Void Ratio = 0.669 **Compression =** 5.6%

KE CORROSION

3028 ALDON AVE. LAS VEGAS, NV 89121

702-340-1186 KDE@KECORROSION.COM

CLIENT
TRC Solutions, Inc.
1600 Commerce Parkway, Suite B
Mount Laurel, NJ 08054

PROJECT NO: 301525.1000, Phase 003000
Task 001LAB

PROJECT
CUY-77-11.21(PID 105743)

DATE: April 6, 2022

LAB ID: 22-0043

Sample By: Client

Analyzed By: Kurt D. Ergun

RESULTS FOR CORROSIVITY ANALYSIS OF SOILS

Sample No:	B-042-0-20	B-043-0-20	B-044-0-20	B-50-0-20
Sample Location:	B-1(1)	B-1(2)	B-1(3)	B-1(4)
Sample Depth:	0.0-10.0	0.0-10.0	0.0-10.0	0.0-10.0
Laboratory Testing Methods				
pH Analysis, AASHTO T289	8.55	8.02	8.01	11.48
Water Soluble Sulfates, AASTHTO T290(mg/kg	50	4390	2410	1238
Chlorides, AASHTO T291(mg/kg)	505	390	1605	1665
Resistivity, AASHTO T288(ohm-cm)	715	360	145	275

(1) Sample B-1 represents Samples SS-1 though SS-4 from Borehole.
(2) Sample B-1 represents Samples SS-1 though SS-4 from Borehole.
(3) Sample B-1 represents Samples SS-1 though SS-4 from Borehole.
(4) Sample B-1 represents Samples SS-1 though SS-4 from Borehole.

Kurt D. Ergun
Chemist

Note: The tests were performed in accordance with applicable ASTM, AASHTO, or AWWA methods. Test results submitted are only applicable to samples tested at referenced locations and are not indicative of the results of similar materials.

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CLIENT
TRC Solutions, Inc.
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Mount Laurel, NJ 08054

PROJECT NO: 301525.1000, Phase 003000
Task 001LAB

PROJECT
CUY-77-11.21(PID 105743)

DATE: April 6, 2022

LAB ID: 22-0043

Sample By: Client

Analyzed By: Kurt D. Ergun

RESULTS FOR CORROSIVITY ANALYSIS OF SOILS

Sample No:	B-054-0-20	B-060-0-20	B-063-0-20	B-067-0-20
Sample Location:	B-1 (1)	B-1 (2)	B-1 (3)	B-1 (4)
Sample Depth:	0.0-10.0	0.0-10.0	0.0-10.0	0.0-10.0
Laboratory Testing Methods				
pH Analysis, AASHTO T289	11.15	9.13	7.86	7.95
Water Soluble Sulfates, AASTHTO T290(mg/kg	776	347	190	80
Chlorides, AASHTO T291(mg/kg)	360	765	45	135
Resistivity, AASHTO T288(ohm-cm)	755	330	1960	1665

(1) Sample B-1 represent Samples SS-1 through SS-4 from borehole.
(2) Sample B-1 represent Samples SS-1, SS-2 and SS-4 from borehole.
(3) Sample B-1 represent Samples SS-1 through SS-4 from borehole.
(4) Sample B-1 represent Samples SS-1 through SS-4 from borehole.

Kurt D. Ergun
Chemist

Note: The tests were performed in accordance with applicable ASTM, AASHTO, or AWWA methods. Test results submitted are only applicable to samples tested at referenced locations and are not indicative of the results of similar materials.

KE CORROSION

3028 ALDON AVE. LAS VEGAS, NV 89121

702-340-1186 KDE@KECORROSION.COM

CLIENT
TRC Solutions, Inc.
16000 Commerce Parkway, Suite B
Mount Laurel, NJ 08054

PROJECT NO: 301525.0000

PROJECT
CUY-77-11.21 (PID 105743)

DATE: December 29, 2021

LAB ID: 21-0156

Sample By: Client

Analyzed By: Kurt D. Ergun

RESULTS FOR CORROSIVITY ANALYSIS OF SOILS

Sample Number:	B-066-0-20
Sample Location:	B-1
Sample Depth:	0.0-10.0
Laboratory Testing Methods	
pH Analysis, AASHTO T289	7.87
Water Soluble Sulfates, AASHTO T290 (mg/kg)	523
Chlorides, AASHTO T291 (mg/kg)	200
Resistivity, AASHTO T288 (ohm-cm)	1470

(1) Sample B-1 represent Samples SS-1 through SS-4 from borehole.

Kurt D. Ergun
Chemist

Note: The tests were performed in accordance with applicable ASTM, AASHTO, or AWWA methods. Test results submitted are only applicable to samples tested at referenced locations and are not indicative of the results of similar materials.

APPENDIX D
SOIL STRATIGRAPHY AND MATERIAL PROPERTIES AT EACH SOLDIER PILE WALL LOCATION

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date 3/17/26

Checked by: RLT Date 3/22/26

Generalized Soil Stratigraphy and Material Properties

Wall 1A B-041-0-20 %ER= 85.6
85+65, 67 LT
water= 678.9 687.9
Use 689.84 Bottom of wall
GS El= 694.3
Pavement layers not included in profile below

Wall 1A Boring: B-041-0-20 App. Sta: 85+65, 67 LT
Design Height, H= 10.49 Wall Height, H= 11.49 At approx. Boring Location Wall Sta: 1+62.4
Top of Wall= 701.33
Top of Retained fill= 700.3 Copping or Parapet= 1.0 ft (not supporting fill)
Lower grade = 693.34 Bottom of frost El= 689.84 = 693.34-3.5
Bottom of wall El= 689.84 Top of shaft El= 691.69

from	to		N60	Profile zone/ Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	Lpile E50	
701.33		Top of Wall												
694.3	693.3	Block Asphalt/gravel		New fill/ sand	0	8.03	120	120	0	0	30	110	NA	
693.3	690.8	Fine sand medium dense	15	Retained/ sand	8.03	10.53	120	120	0	0	32	140	NA	
690.8	689.84	Gravel with stone fragments	22	Retained/ sand	10.53	11.49	120	120	0	0	36	440	NA	Bottom of Wall
689.84	683.3	Gravel with stone fragments	22	Foundation/ sand	11.49	18.03	125	62.6	0	0	34	125	NA	
683.3	678.3	Very stiff silt and clay	12	Foundation/ clay	18.03	23.03	120	57.6	2500	200	30	1000	0.005	
678.3	675.8	Hard sandy silt	36	Foundation/clay	23.03	25.53	125	62.6	4000	320	30	2000	0.004	
675.8	664.3	M dense to dense silt-	25	Foundation/ sand	25.53	37.03	125	62.6	0	0	34	125	NA	

* C' = 0.08 Cu (Estimated)

%ER= 85.6
Wall 1A B-042-0-20
88+24, 63 LT
water= 688.6 684.6
Use = 689.84 Bottom of wall
GS El= 696.6
Pavement layers not included in profile below

Wall 1A Boring B-042-0-20 App. Sta: 88+24, 63 LT
Design Height, H= 19.6 Wall Height, H= 20.6 At approx. Boring Location Wall Sta: 4+07
Top of Wall= 710.4
Top of Retained fill= 709.4 Copping or Parapet= 1.0 ft (not supporting fill)
Lower grade = 693.34 Bottom of frost El= 689.84 = 693.34-3.5
Bottom of wall El= 689.84 Top of shaft El= 692.72

from	to	Description	N60	Profile zone/ Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	Lpile E50	
710.4		Top of Wall												
696.6	695.8	Block Asphalt												
695.8	690.6	Gravel with stone fragments	20	New fill/ Sand	0	14.6	120	120	0	0	30	60	NA	
690.6	689.84	Gravel with stone fragments	20	Retained/ sand	14.6	20.6	120	120	0	0	32	60	NA	Bottom of Wall
689.84	688.1	M. dense coarse to fine sand	15	Foundation/ sand	20.6	22.3	120	57.6	0	0	32	60	NA	
688.1	685.6	Gravel with stone fragments	13	Foundation/ sand	22.34	24.8	120	57.6	0	0	32	60	NA	
685.6	680.6	V. stiff sandy silt	22	Foundation/ clay	24.84	29.8	125	62.6	3500	280	30	1500	0.005	
680.6	661.6	Hard Sandy silt	46	Foundation/ clay	29.84	48.8	125	62.6	4000	320	30	2000	0.004	

* C' = 0.08 Cu (Estimated)

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date 3/17/26

Checked by: RLT Date 3/22/26

Generalized Soil Stratigraphy and Material Properties

Wall 1B		**B-001-0-02**		Wall 1B			Boring	B-001-0-02					App. Sta:	89+49.82, 64.13' LT	
		89+49.82, 64.13' LT		Design Height, H=	21.56		Wall Height, H=	22.56	At approx. Boring Location				Wall Sta:	After End of Wall 1B	
				Top of Wall=	715.04	(Max. in Range)									
Water =	692.90			Top of Retained Fill=	714.04		Copping or Parapet=	1 ft	(not supporting fill)						
Use=	692.48			Lower Grade=	695.98		Bottom of frost El=	692.48	= 695.98-3.5						
				Bottom of wall El=	692.48		Top of shaft El=	693.28							
GS El=	718.89				Profile								Lpile		
from	to		N60	zone/ Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg		K, pci	E50	
715.04		Top of Wall													
718.89	716.90	Crushed aggregate													
716.90	710.90	Dense-V. dense sandy silt	53												
710.90	702.40	V. stiff-hard sandy silt	43												
702.40	698.90	M. dense sand	14												
716.90	692.48	V.stiff silt and clay	16	Retained/ sand	0.0	22.6	120	120	0	0	30		60	NA	Bottom of Wall
692.48	690.9	V.stiff silt and clay	16	Foundation/ clay	22.56	24.14	120	57.6	2500	200	30		NA	0.005	
690.9	685.9	Loose-M. dense sand	11	Foundation/ sand	24.14	29.14	125	62.6	0	0	32		60	NA	
685.9	680.4	V. stiff sandy silt	18	Foundation/ clay	29.14	34.64	120	57.6	2500	200	30		NA	0.005	
680.4	678.9	M. dense gravel with sand	16	Foundation/ sand	34.64	36.14	125	62.6	0	0	32		60	NA	
678.9	675.9	V. stiff silt and clay	25	Foundation/ clay	36.14	39.14	125	62.6	3000	240	30		NA	0.005	
675.9	671.9	Dense silt	36	Foundation/ sand	39.14	43.14	125	62.6	0	0	34		125	NA	
680.4	643.9	Dense-V. dense sand	40	Foundation/ sand	34.64	71.14	130	67.6	0	0	34		125	NA	

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date 3/17/26

Checked by: RLT Date 3/22/26

Generalized Soil Stratigraphy and Material Properties

Profiles Customized to Maximum Height in range:

Wall 1A — Design Height(ft) = 8.27 (max. height in this range) — From: Wall Sta: 0+24.76 — To: 0+91

Total Height (ft)= 9.27

Based on Boring: B-041-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50
Foundation/ sand	9.27	15.81	125	62.6	0	0	34	125	NA
Foundation/ clay	15.81	20.81	120	57.6	2500	200	30		0.005
Foundation/clay	20.81	23.31	125	62.6	4000	320	30		0.004
Foundation/ sand	23.31	34.81	125	62.6	0	0	34	125	NA

Wall 1A — Design Height(ft) = 9.87 (max. height in this range) — From: Wall Sta: 0+91 — To: 1+51

Total Height (ft)= 10.87

Based on Boring: B-041-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50
Foundation/ sand	10.87	17.41	125	62.6	0	0	34	125	NA
Foundation/ clay	17.41	22.41	120	57.6	2500	200	30		0.005
Foundation/clay	22.41	24.91	125	62.6	4000	320	30		0.004
Foundation/ sand	24.91	36.41	125	62.6	0	0	34	125	NA

Wall 1A — Design Height(ft) = 11.92 (max. height in this range) — From: Wall Sta: 1+51 — To: 2+26

Total Height (ft)= 12.92

Based on Boring: B-041-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50
Foundation/ sand	12.92	19.46	125	62.6	0	0	34	125	NA
Foundation/ clay	19.46	24.46	120	57.6	2500	200	30		0.005
Foundation/clay	24.46	26.96	125	62.6	4000	320	30		0.004
Foundation/ sand	26.96	38.46	125	62.6	0	0	34	125	NA

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date 3/17/26

Checked by: RLT Date 3/22/26

Generalized Soil Stratigraphy and Material Properties

Profiles Customized to Maximum Height in range:

Wall 1A — Design Height(ft) = 14.11 (max. height in this range) — From: Wall Sta: 2+26 — To: 3+01

Total Height (ft)= 15.11

Based on Boring: B-042-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50	
Foundation/ sand	15.11	16.85	120	57.6	0	0	32	60	NA	
Foundation/ sand	16.85	19.35	120	57.6	0	0	32	60	NA	
Foundation/ clay	19.35	24.35	125	62.6	3500	280	30		0.005	
Foundation/ clay	24.35	43.35	125	62.6	4000	320	30		0.004	

Wall 1A — Design Height(ft) = 17.51 (max. height in this range) — From: Wall Sta: 3+01 — To: 3+61

Total Height (ft)= 18.51

Based on Boring: B-042-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50	
Foundation/ sand	18.51	20.25	120	57.6	0	0	32	60	NA	
Foundation/ sand	20.25	22.75	120	57.6	0	0	32	60	NA	
Foundation/ clay	22.75	27.75	125	62.6	3500	280	30		0.005	
Foundation/ clay	27.75	46.75	125	62.6	4000	320	30		0.004	Assumed to continue below 46.75 ft

Wall 1A — Design Height(ft) = 18.04 (max. height in this range) — From: Wall Sta: 3+61 — To: 4+21

Total Height (ft)= 19.04

Based on Boring: B-042-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50	
Foundation/ sand	19.04	20.78	120	57.6	0	0	32	60	NA	
Foundation/ sand	20.78	23.28	120	57.6	0	0	32	60	NA	
Foundation/ clay	23.28	28.28	125	62.6	3500	280	30		0.005	
Foundation/ clay	28.28	47.28	125	62.6	4000	320	30		0.004	Assumed to continue below 47.28 ft

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date 3/17/26

Checked by: RLT Date 3/22/26

Generalized Soil Stratigraphy and Material Properties

Profiles Customized to Maximum Height in range:

Wall 1A — Design Height(ft) = 19.47 (max. height in this range) — Total Height (ft)= 20.47 — Based on Boring: B-042-0-20

	From	To
Wall Sta:	4+21	4+61.42

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50	
Foundation/ sand	20.47	22.21	120	57.6	0	0	32	60	NA	
Foundation/ sand	22.21	24.71	120	57.6	0	0	32	60	NA	
Foundation/ clay	24.71	29.71	125	62.6	3500	280	30		0.005	
Foundation/ clay	29.71	48.71	125	62.6	4000	320	30		0.004	Assumed to continue below 48.71 ft

Wall 1A — Design Height(ft) = 21.56 (max. height in this range) — Total Height (ft)= 22.56 — Based on Boring: B-001-0-02

	From	To
Wall Sta:	4+61.42	5+21

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50
Foundation/ clay	22.56	24.14	120	57.6	2500	200	30	NA	0.005
Foundation/ sand	24.14	29.14	125	62.6	0	0	32	60	NA
Foundation/ clay	29.14	34.64	120	57.6	2500	200	30	NA	0.005
Foundation/ sand	34.64	36.14	125	62.6	0	0	32	60	NA
Foundation/ clay	36.14	39.14	125	62.6	3000	240	30	NA	0.005
Foundation/ sand	39.14	43.14	125	62.6	0	0	34	125	NA
Foundation/ sand	34.64	71.14	130	67.6	0	0	34	125	NA

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date: 3/17/26

Checked by: RLT Date: 3/22/26

Generalized Soil Stratigraphy and Material Properties

Wall 1B **B-043-0-20** 90+25, 53 LT

ER= 85.6 %

Water = 686.50

Use= 692.53

GS El= 697.8

Wall 1B Boring B-043-0-20 App. Sta: 90+25, 53 LT

Design Height, H= 21.65 Wall Height, H= 22.65 At approx. Boring Location Wall Sta: 10+29.8

Top of Wall= 715.18 (Max. in Range)

Top of Retained Fill= 714.18 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 696.03 Bottom of frost El= 692.53 = 696.03-3.5

Bottom of wall El= 692.53 Top of shaft El= 693.47

from	to		N60	Profile zone/ Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	Lpile E50	
715.18		Top of Wall												
697.8	694.3	Asphalt/gravel												
694.3	692.53	Med. Dense silt	11	Retained/ sand	0.0	22.7	120	120	0	0	30	60	NA	Bottom of Wall
692.53	691.8	Med. Dense silt	11	Foundation/ sand	22.65	23.38	120	57.6	0	0	32	60	NA	
691.8	681.8	Gravel and stone fragments	18	Foundation/ sand	23.38	33.38	125	62.6	0	0	33	90	NA	
681.8	671.8	Hard silt and clay	16	Foundation/ clay	33.38	43.38	125	62.6	4000	320	30		0.004	
671.8	667.8	Sand/silty sand- dense	44	Foundation/ sand	43.38	47.38	130	67.6	0	0	34	125	NA	

* C' = 0.08 Cu (Estimated) Bottom layer is assumed to continue below 47.38 ft

Wall 1B **B-001-0-02** 89+49.82, 64.13' LT

Water = 692.90

Use= 692.53

GS El= 718.89

Wall 1B Boring B-001-0-02 App. Sta: 89+49.82, 64.13' LT

Design Height, H= 21.65 Wall Height, H= 22.65 At approx. Boring Location Wall Sta: Before Wall 1B starts

Top of Wall= 715.18 (Max. in Range)

Top of Retained Fill= 714.18 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 696.03 Bottom of frost El= 692.53 = 696.03-3.5

Bottom of wall El= 692.53 Top of shaft El= 693.47

from	to		N60	Profile zone/ Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	Lpile E50	
715.18		Top of Wall												
718.89	716.90	Crushed aggregate												
716.90	710.90	Dense-V. dense sandy silt	53											
710.90	702.40	V. stiff-hard sandy silt	43											
702.40	698.90	M. dense sand	14											
716.90	692.53	V.stiff silt and clay	16	Retained/ sand	0.0	22.7	120	120	0	0	30	60	NA	Bottom of Wall
692.53	690.9	V.stiff silt and clay	16	Foundation/ clay	22.65	24.28	120	57.6	2500	200	30	NA	0.005	
690.9	685.9	Loose-M. dense sand	11	Foundation/ sand	24.28	29.28	125	62.6	0	0	32	60	NA	
685.9	680.4	V. stiff sandy silt	18	Foundation/ clay	29.28	34.78	120	57.6	2500	200	30	NA	0.005	
680.4	678.9	M. dense gravel with sand	16	Foundation/ sand	34.78	36.28	125	62.6	0	0	32	60	NA	
678.9	675.9	V. stiff silt and clay	25	Foundation/ clay	36.28	39.28	125	62.6	3000	240	30	NA	0.005	
675.9	671.9	Dense silt	36	Foundation/ sand	39.28	43.28	125	62.6	0	0	34	125	NA	
680.4	643.9	Dense-V. dense sand	40	Foundation/ sand	34.78	71.28	130	67.6	0	0	34	125	NA	

* C' = 0.08 Cu (Estimated)

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date: 3/17/26

Checked by: RLT Date: 3/22/26

Generalized Soil Stratigraphy and Material Properties

%ER= 85.6

Wall 1C **B-044-0-20**

93+00, 50 LT

Water = 685.5

Use 692.5 (Bottom of wall)

GS El= 697.5

Wall 1C Boring B-044-0-20 App. Sta: 93+00, 50 LT

Design Height, H= 20.48 Wall Height, H= 21.48 At approx. Boring Location Wall Sta: 101+66.7

Top of Wall= 713.94

Top of Retained Fill= 712.94 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 695.96 Bottom of frost El= 692.46 = 695.96-3.5

Bottom of wall El= 692.46 Top of shaft El= 692.76

from	to		N60	Profile zone	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	Lpile K, pci	Lpile E50	
713.94	Top of Wall													
697.5	696.0	Asphalt		zone/ Soil Model	0.00	17.94	120	120	0	0	30	60		
696	692.5	Gravel with sand	16	Retained/ Sand	17.94	21.48	120	120	0	0	30	60		Bottom of Wall
692.46	685.5	Coarse and Fine Sand	16	Foundation/ sand	21.48	28.44	120	57.6	0	0	32	90	NA	
685.5	680.5	Gravel with Sand	13	Foundation/ sand	28.44	33.44	120	57.6	0	0	30	60	NA	
680.5	668.5	V. stiff to hard silt & clay	19	Foundation/ clay	33.44	45.44	120	57.6	3000	240	30		0.005	
668.5	667.5	Dense fine sand	36	Foundation/ sand	45.44	46.44	125	62.6	0	0	34	125	NA	

* C' = 0.08 Cu (Estimated)

Bottom layer is assumed to continue below 46.44 ft

Wall 1C **N-001-S-01**

167+00, 48 LT

Water = 685.5

Use 692.5 (Bottom of wall)

GS El= 716.19

Wall 1C Boring N-001-S-01 App. Sta: 91+20.92, 91.96' LT

Design Height, H= 20.48 Wall Height, H= 21.48 At approx. Boring Location Wall Sta: Just before wall starts

Top of Wall= 713.94

Top of Retained Fill= 712.94 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 695.96 Bottom of frost El= 692.46 = 695.96-3.5

Bottom of wall El= 692.46 Top of shaft El= 692.76

from	to		N60	Profile zone	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	Lpile K, pci	Lpile E50	
713.94	Top of Wall													
716.19	711.20	M. dense- loose silt	15											
711.20	702.70	Stiff cohesive sandy silt	9											
702.70	701.20	M dense sand	12											
702.70	692.46	M. stiff silt and clay	8	Retained/ Sand	0.00	21.48	120	120	0	0	30	60		Bottom of Wall
692.46	690.20	M. stiff silt and clay	8	Foundation/ clay	21.48	23.74	120	57.6	1200	100	30	NA	0	
690.20	682.70	Loose-M. de. Gravel with Sand	16	Foundation/ sand	23.74	31.24	125	62.6	0	0	33	90	NA	
682.70	672.70	V. stiff silt/sandy silt	23	Foundation/ clay	31.24	41.24	125	62.6	3000	240	30	NA	0.005	
672.70	642.70	Dense-V. dense sand	38	Foundation/ sand	41.24	71.24	125	62.6	0	0	34	125	NA	

* C' = 0.08 Cu (Estimated)

Bottom layer is assumed to continue below 71.24 ft

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date: Date 3/17/26

Checked by: RLT Date: Date 3/19/26

Generalized Soil Stratigraphy and Material Properties

%ER= 85.6

Wall 1D B-048-0-20 97+20, 54 LT

water= 684.5

Use = 688.95

GS= 693

from	to	Description	N60
706.8		Top of Wall	
693	691.1	Block Asphalt/gravel	
691.1	688.95	Gravel with stone fragments	5
689.0	684.5	Gravel with stone fragments	5
684.5	669.5	Silt, medium stiff to stiff	14
669.5	658	Hard Sandy silt	26

Wall 1D Boring B-048-0-20 App. Sta: 97+20, 54 LT

Design Height, H= 16.85 Wall Height, H= 17.85 Wall Sta: 1000+20

Top of Wall= 706.8

Top of Retained Fill= 705.8 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 692.45 Bottom of frost El= 688.95 = 692.45-3.5

Bottom of wall El= 688.95 Top of shaft El= 689.71

Profile zone/ Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	Lpile E50	
New fill / sand	0	15.7	120	120	0	0	30	60	NA	
Retained/ sand	15.7	17.85	120	120	0	0	30	60	NA	Bottom of Wall
Foundation/ sand	17.85	22.3	120	57.6	0	0	30	60	NA	
Foundation/ clay	22.3	37.3	125	62.6	2500	200	29		0.005	
Foundation/ clay	37.3	48.8	130	67.6	4000	320	30		0.004	

* C' = 0.08 Cu

Wall 1D B-049-0-20 98+75, 57 LT

water= 686.2

Use = 687.82

GS= 691.7

from	to	Description	N60
697.83		Top of Wall	
691.7	690.2	Block Asphalt	
690.2	687.82	Gravel and stone fragment	20
687.82	685.2	Gravel and stone fragment	20
685.2	682.7	Coarse & fine sand, loose	10
685.2	668.2	Very stiff silt	11
668.2	656.7	Med. dense to dense silt	30

Wall 1D Boring B-049-0-20 App. Sta: 98+75, 57 LT

Design Height, H= 9.01 Wall Height, H= 10.01 Wall Sta: 1002+00

Top of Wall= 697.83

Top of Retained Fill= 696.83 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 691.32 Bottom of frost El= 687.82 = 691.32-3.5

Bottom of wall El= 687.82 Top of shaft El= 688.47

Profile zone/ Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	Lpile E50	
New Fill / Sand	0	7.63	120	120		0	30	60	NA	
Retained/sand	7.63	10.01	120	120	0	0	33	60	NA	Bottom of Wall
Foundation/ sand	10.01	12.63	125	62.6	0	0	34	120	NA	
Foundation/ sand	12.63	15.13	120	57.6	0	0	30	60	NA	
Foundation / clay	15.13	29.63	120	57.6	2000	160	30		0.007	
Foundation/ sand	29.63	41.13	125	62.6	0	0	34	120	NA	

* C' = 0.08 Cu

| | | |

Wall 1D | Design Height (ft)= 16.17 | Boring: B-048-0-20 | From | To
Total Height (ft)= 17.17 | Wall Sta | 1000+37.04 | 1000+57.58

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg		K, pci	E50	
Foundation/ sand	17.17	22.21	120	57.6	0	0	30	0	60	NA	
Foundation/ clay	22.21	37.21	125	62.6	2000	150	29	0	1000	0.007	
Foundation/ clay	37.21	48.71	130	67.6	4000	300	30	0	2000	0.004	Assumed to continue below 48.71 ft

Wall 1D | Design Height (ft)= 15.03 | Boring: B-049-0-20 | From | To
Total Height (ft)= 16.03 | Wall Sta: | 1000+57.6 | 1002+07.58

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50	
Foundation/ sand	16.03	18.65	125	62.6	0	0	34	120	NA	
Foundation/ sand	18.65	21.15	120	57.6	0	0	30	60	NA	
Foundation / clay	21.15	35.65	120	57.6	2000	160	30	0	0.007	
Foundation/ sand	35.65	47.15	125	62.6	0	0	34	120	NA	Assumed to continue below 47.15 ft

Wall 1D | Design Height (ft)= 9.39 | Boring: B-050-0-20 | From | To
Total Height (ft)= 10.39 | Wall Sta: | 1002+07.58 | 1002+97.6

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50	
Foundation/ Sand	10.39	12.62	125	62.6	0	0	34	120	NA	
Foundation/ clay	12.62	25.12	125	62.6	3000	240	30	0	0.005	
Foundation/ clay	25.12	41.62	125	62.6	4000	320	30	0	0.004	Assumed to continue below 41.62 ft

Wall 1D | Design Height (ft)= 8.90 | Boring: B-050-0-20 | From | To
Total Height (ft)= 9.90 | Wall Sta: | 1002+97.6 | 1003+87.6

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	K, pci	E50
Foundation/ Sand	9.90	14.35	125	62.6	0	0	34	120	NA
Foundation/ clay	13.35	29.35	125	62.6	3000	240	30	0	0.005
Foundation/ clay	28.35	40.85	125	62.6	4000	320	30	0	0.004

Wall 1D — Design Height (ft)= 8.32 — Total Height (ft)= 9.32 — Boring: B-050-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	From / K, pci	To / E50
								Wall Sta: 1003+87.6	1005+07.6
Foundation/ Sand	9.32	11.55	125	62.6	0	0	34	120	NA
Foundation/ clay	11.55	24.05	125	62.6	3000	240	30	0	0.005
Foundation/ clay	24.05	40.55	125	62.6	4000	320	30	0	0.004

Wall 1D — Design Height (ft)= 7.14 — Total Height (ft)= 8.14 — Boring: B-051-0-20

Soil Model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	From / K, pci	To / E50	
								Wall Sta: 1005+07.6	1009+23.83	
Foundation/ sand	8.14	10.12	120	57.6	0	0	30	60	NA	
Foundation/ clay	10.12	15.12	125	62.6	3500	280	30	0	0.004	
Foundation/ clay	15.12	27.62	120	57.6	3000	240	30	0	0.005	
Foundation/ sand	27.62	32.62	125	62.6	0	0	34	120	NA	
Foundation/ clay	32.62	34.12	130	67.6	4000	320	30	0	0.004	Assumed to continue below 34.12 ft

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Completed by: DA Date: 3/17/26

Checked by: RLT Date: 3/22/26

Generalized Soil Stratigraphy and Material Properties

Boring B-002-0-02 Closest boring to Wall from North side

Historic: B-2, 2002)

			%ER=	89.3	Wall 2	Boring:	B-002-0-02	(Historic: B-2, CUY-77-11.69, 2002)					App. Sta:	89+62.37, 72.11 Rt			
Wall 2		**B-002-0-02**			Design Height, H=	8.27	Wall Height, H=	9.27						After end of wall			
		89+62.37, 72.11 Rt			Top of Wall=	705.74							Wall Sta:	89+02.52 - 89+31.99			
	Water =	695.10			Top of Retained Fill=	704.74	Copping or Parapet=	1	ft	(not supporting fill)							
	Use	696.47			Lower Grade=	699.97	Bottom of frost El=	696.47	= 699.97-3.5								
GS=	720.14				Bottom of wall El=	696.47	Top of shaft El=	697.39									
from	to			N60		Profile								Lpile			
705.74		Top of Wall			zone/ soil model	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg		K, pci	E50		
720.14	715.4	Gravel/ sandy silt		25													
715.4	706.00	V. stiff sandysilt/silty clay		19													
706.00	696.47	Med. dense sand		10	New Fill / Sand	0	9.27	120	120	0	0	30		60	NA	Bottom of Wall	
696.47	692.30	M. stiff silt & clay		6	Foundation/ Clay	9.27	13.44	120	57.6	1000	100	30			0.007	Top of shaft	
692.30	685.10	M. dense gravel with sand		21	Foundation/ Sand	13.44	20.64	125	62.6	0	0	34		120	NA		
685.10	677.10	V. stiff silt & clay/silt		22	Foundation/ Clay	20.64	28.64	125	62.6	2500	200	30			0.005		
677.10	660.10	M.dense-dense sand		38	Foundation/ Sand	28.64	45.64	125	62.6	0	0	34		120	NA		
660.10	654.10	V. dense sand		55	Foundation/ Sand	45.64	51.64	130	67.6	0	0	34		120	NA		
654.10	661.60	V. dense sand		76	Foundation/ Clay	51.64	44.14	130	67.6	0	0	34		120	0.004		

* C' = 0.08 Cu

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

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Generalized Soil Stratigraphy and Material Properties

%ER= 85.6

Wall 2 **B-046-0-20**

92+50, 64 RT

Water = 695.1

Use 695.58

GS= 699.6

from	to		N60
714.32		Top of Wall	
699.6	699.3	Aggregate base	
699.3	695.58	Loose-M. dense silt, some clay	10
695.58	693.6	Loose-M. dense silt, some clay	10
693.6	683.6	Med. Dense f-c sand	18
683.6	676.1	Hard silt and clay	21
676.1	659.6	Very stiff sandy silt	21

Wall 2 Boring: B-046-0-20 **(Most Critical Case)** App. Sta: 92+50, 64 RT

Design Height, H= 17.74 Wall Height, H= 18.74 Wall Sta: 21+75

Top of Wall= 714.32

Top of Retained Fill= 713.32 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 699.08 Bottom of frost El= 695.58 = 699.08-3.5

Bottom of wall El= 695.58 Top of shaft El= 696.14

zone/ soil model	Profile from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	E50	
New Fill / Sand	0	15.02	120	120	0	0	30	60	NA	
Retained/ sand	15.02	18.74	120	120	0	0	30	60	NA	Bottom of Wall
Foundation/ sand	18.74	20.72	120	57.6	0	0	30	60	NA	
Foundation/ sand	20.72	30.72	125	62.6	0	0	33	90	NA	
Foundation/ clay	30.72	38.22	125	62.6	4000	320	30	2000	0.004	
Foundation/ clay	38.22	54.72	125	62.6	3000	240	30	1000	0.005	

* C' = 0.08 Cu

Wall 2 **N-003-N-01**

93+82.88, 77.15' RT

Water = 695.1

Use 694.85

GS= 718

from	to		N60
713.97		Top of Wall	
718.00	716.00	Aggregate base	
716.00	694.85	Stiff-v. stiif Sandy silt /Stiff silt	13
694.85	694.50	Stiff-v. stiif Sandy silt /Stiff silt	13
694.50	689.50	Med. Dense f-c sand	20
689.50	682.00	Med. Dense gravel with sand	21
682.00	674.50	Hard-V. stiff silt and clay	22
674.50	669.50	Dense C-f Sand	33
669.50	660.00	M. Dense Silt	29
660.00	638.00	Dense to V. dense silt	48

Wall 2 Boring: N-003-N-01 App. Sta: 93+82.88, 77.15' RT

Design Height, H= 18.12 Wall Height, H= 19.12 Wall Sta: 23+07.9

Top of Wall= 713.97

Top of Retained Fill= 712.97 Copping or Parapet= 1 ft (not supporting fill)

Lower Grade= 698.44 Bottom of frost El= 694.94 = 698.44-3.5

Bottom of wall El= 694.85 Top of shaft El= 694.85

zone/ soil model	Profile from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Lpile K, pci	E50	
New Fill / Sand	0	19.12	120	120	0	0	30	60	NA	Bottom of Wall
Foundation/ clay	19.12	19.47	120	57.6	1300	104	30	NA	0.007	
Foundation/ sand	19.47	24.47	125	62.6	0	0	33	90	NA	
Foundation/ sand	24.47	31.97	125	62.6	0	0	33	90	NA	
Foundation/ clay	31.97	39.47	125	62.6	3500	280	30	NA	0.004	
Foundation/ sand	39.47	44.47	125	62.6	0	0	34	120	NA	
Foundation/ sand	44.47	53.97	125	62.6	0	0	34	120	NA	
Foundation/ sand	53.97	75.97	130	67.6	0	0	34	125	NA	

Project: **CUY-77-11.41: Reconstruction of I-77**

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Completed by: DA Date: 3/17/2026

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Generalized Soil Stratigraphy and Material Properties — Wall 5B

Wall 5B | B-070-0-20 | Boring: B-070-0-20 | Second most Critical & representative | App. Sta: 170+75, 64 LT

170+75, 64 LT | Design Height, H= 27.46 | Wall Height, H= 27.46 | Wall Sta: 50+30.82

Top of Wall= 680.11 | (Before start of wall)

water= 540 540 | Top of retained fill= 680.11

Use = 652.65 | Lower grade= 657.33 | Bottom of frost El= 653.83 = 657.33-3.5

Bottom of wall El= 652.65 | Top of shaft El= 652.65

GS= 656.8

from	to	Description	N60	Profile zone	Profile from	Profile to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	Equiv. * ϕs'	Lpile K, pci	Lpile E50	
680.11	Top of retained fill														
656.80	652.65	Dense Gravel & stone frag- fill	41	Retained (new fill)	0	27.46	120		0	0	30	30	60	---	Bottom of Wall/top of shaft
652.65	648.30	Dense Gravel & stone frag- fill	18	Foundation/ sand	27.46	31.81	125	62.6	0	0	32	32	90	NA	
648.30	643.30	Soft- v. stiff sandy silt	11	Foundation/ clay	31.81	36.81	120	57.6	2000	150	28	30		0.005	
643.30	627.30	Stiff to v. stiff silt, some clay	16	Foundation/ clay	36.81	52.81	125	62.6	3000	200	28	30		0.005	
627.30	546.80	Stiff sandy silt, some clay	16	Foundation/ clay	52.81	133.31	120	57.6	2000	150	28	29		0.005	

Most Critical & representative

Wall 5B | B-026-0-18 | Boring: B-026-0-18 | Worst Case (based on soil conditions) | App. Sta: 171+20, 74 LT

171+20, 74 LT | Design Height, H= 27.46 | Wall Height, H= 27.54 | Wall Sta: 50+30.82

Top of Wall= 680.11

water= 540 540 | Top of retained fill= 680.11

Use = 652.56 | Lower grade= 657.33 | Bottom of frost El= 653.83 = 657.33-3.5

Bottom of wall El= 652.65 | Top of shaft El= 652.65

GS= 653.6

from	to	Description	N60	Profile zone	Profile from	Profile to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	Lpile K, pci	Lpile E50	
680.11	Top of retained fill													
653.60	652.65	M. Dense Gravel & stone frag- fill		Retained (new fill)	0	27.46	120	120	0	0	30	60	---	Bottom of Wall/top of shaft
652.65	651.90	Dense Gravel & stone frag- fill	25	Foundation/ sand	27.46	28.21	125	62.6	0	0	34	120	NA	
651.90	649.80	V. stiff sandy silt- fill	25	Foundation/ clay	28.21	30.31	120	57.6	2500	200	30		0.005	
649.80	647.00	Loose sand/silt- fill	10	Foundation/ sand	30.31	33.11	118	55.6	0	0	28	25	NA	
647.00	644.10	Hard silt (Modeled as V. stiff)	6	Foundation/ clay	33.11	36.01	120	57.6	2500	200	30		0.005	
644.10	641.80	Loose sandy silt (possible fill)	6	Foundation/ sand	36.01	38.31	115	52.6	0	0	28	25	NA	
641.80	636.80	Med. stiff silt & clay (possible fill)	10	Foundation/ clay	38.31	43.31	115	52.6	1100	100	28		0.007	
636.80	630.60	V. stiff silt	13	Foundation/ clay	43.31	49.51	120	57.6	2500	200	30		0.005	
630.60	618.10	M. stiff silt	11	Foundation/ clay	49.51	62.01	115	52.6	1100	100	28		0.007	
618.10	606.80	Stiff sandy silt, some clay	15	Foundation/ clay	62.01	73.31	120	57.6	2500	200	30		0.005	
606.80	604.3	M. dense silt	23.00	Foundation/ sand	73.31	75.81	120	57.6	0	0	33	90	NA	
604.30	603.6	V. stiff silt and clay	23.00	Foundation/ clay	75.81	76.51	120	57.6	2500	200	30		0.005	

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

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Generalized Soil Stratigraphy and Material Properties — Wall 5B

Wall 5B		B-068-0-20		B-068-0-20									Sta:	172+00, 48' Lt		
		172+00, 48' Lt		Design Height, H=	24.61	Wall Height, H=	24.61						Wall Sta:	51+84		
				Top of Wall=	681.06											
				Top of retained fill=	681.06											
water=	NA	NA		Lower grade=	661.09			Bottom of frost El=	657.59	= 661.09-3.5						
				Bottom of wall El=	656.45			Top of shaft El=	637.63							
GS=	662.0				Profile								Equiv. *	Lpile		
from	to	Description	N60	zone	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	ϕ_s'	K, pci	E50		
681.06																
662.00	656.45	V. loose gravel & stone frag- Fill		New Fill/ sand	0	24.61	120	120	0	0	30	30	60	NA	Bottom of Wall	
656.45	646.00	Lo - M. dense silt & sand	11	Foundation/ sand	24.61	35.06	120	57.6	0	0	32	32	60	NA	Top of shaft	
646.00	646.00	Lo - M. dense silt & sand	11	Foundation/ sand	35.06	35.06	120	57.6	0	0	32	32	60	NA		
646.00	618.50	V. stiff to hard silt, little clay	27	Foundation/ clay	35.06	35.10	120	57.6	3500	200	30	32		0		
618.50	602.00	Silt little clay	22	Foundation/ clay	35.1	51.60	125	62.6	2500	200	30	32		0.005		

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

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Generalized Soil Stratigraphy and Material Properties

Wall 5C		B-006-0-12		B-006-0-12								App. Sta:	175+71, 65.0' Lt					
		175+71, 65.0' Lt		Design Height, H=	18.31	Wall Height, H=	18.31					Wall Sta:	Boring is before Wall 5C (closest boring)					
				Top of Wall=	682.14													
water=	649.1			Top of retained fill=	682.14													
Use=	663.83			Lower grade=	668.52			Bottom of frost El=	665.02			= 668.52-3.5						
				Bottom of wall El=	663.83			Top of shaft El=	663.83									
GS=	665.1					Profile								Equiv. *		Lpile		
from	to	Description	N	zone		from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg		ϕ_s'	K, pci	E50		
682.14																		
665.10	664.1	Conc/Granular base																
664.1	663.83	M. dense fine sand	22	Soil/ Fill (retained)		0	18.31	120	120	0	0	30		30	---	---	Bottom of Wall	
663.83	657.1	M. dense fine sand	22	Foundation/ Sand		18.31	25.04	125	62.6	0	0	34		34	120	NA		
657.1	654.6	Loose sandy silt	10	Foundation/ Sand		27.54	27.54	120	57.6	0	0	32		32	90	NA		
654.6	639.6	M. dense- dense C-F sand	21	Foundation/ Sand		27.54	42.54	125	62.6	0	0	33		33	120	NA		
639.6	618.1	M. dense- V. dense silt, some clay	55	Foundation/ Sand		42.54	64.04	130	67.6	0	0	34		34	120	NA		
618.1	568.1	Stiff-V. stiff silt and clay	26	Foundation/ clay		64.04	114.04	125	62.6	3000	240	30		30.918	1000	0.005	Cu is estimated based on SPT	
568.1	563.6	M. stiff-stiff silt and clay	27	Foundation/ clay		114.04	118.54	120	57.6	3500	280	30		30.855	1000	0.005		
563.6	555.1	Soft- medium stiff silt and clay	34	Foundation/ clay		118.54	127.04	115	52.6	3500	280	30		30.845	1500	0.005		

Project: **CUY-77-11.41: Reconstruction of I-77**
PID: **PID 105743**

Completed by: DA Date: 3/17/2026
Checked by: RLT Date: 3/22/2026

Generalized Soil Stratigraphy and Material Properties

Wall 7 B-071-0-20
170+00

water= NA
Use = 652.7
GS= 654.4

from	to	Description	N
678.93	Top of wall		
678.93	652.70	M. dense gravel and stone	
652.70	648.4	M. dense fine sand, little silt	27
648.4	645.9	M. dense gravel and stone	16
645.9	633.4	Lo to dense silt	23
633.4	613.4	V. stiff silt, some clay	20
613.4	544.4	Stiff to very stiff silt and clay	15

B-071-0-20 App. Sta: 170+00, 64' Rt
Design Height, H= 26.23 Wall Height, H= 26.23 Closest Boring to Wall 7
Top of Wall= 678.93
Top of retained fill= 678.93
Lower grade= 656.28 Bottom of frost El= 652.78 = 656.28-3.5
Bottom of wall El= 652.70 Top of shaft El= 652.70

Profile zone	from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	Lpile K, pci	Lpile E50	
New Fill	0	26.23	120	120	0	0	30	---	---	bottom of wall
Foundation/ sand	26.23	30.53	125	62.6	0	0	34	120	NA	Top of shaft El
Foundation/ sand	30.53	33.03	125	62.6	0	0	32	90	NA	
Foundation/ sand	33.03	45.53	125	62.6	0	0	33	90	NA	
Foundation/ clay	45.53	65.53	125	62.6	2500	200	30	NA	0.006	
Foundation/ clay	65.53	134.53	120	57.6	2000	160	30	NA	0.007	

APPENDIX E
LATERAL PRESSURES ON SOLDIER PILE WALLS

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1A: Sta 0+24.76 - 0+91**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Lateral Earth Pressure Calculations

H =	9.27	ft	design height of wall
β =	23.52	degrees	Equiv. slope of ground above wall
ℓ =	7.5	ft	spacing between soldier piles

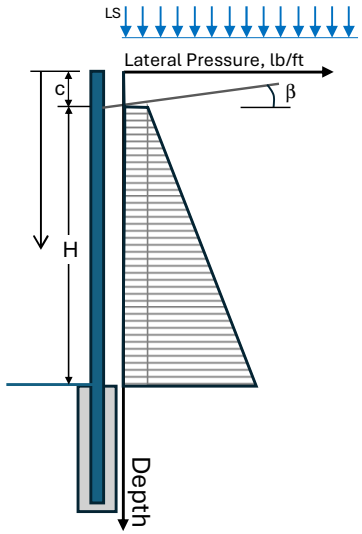
Traffic Surcharge, LS = 0 psf

Top of Wall El.=	698.27	c=	1
Top of Shaft Elev =	689.69		
Lower Grade El =	692.5		
Bottom of Frost El =	689.0		
Total Wall Height, ft=	9.27		
Design Height, ft=	8.27		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.27	3584.1	5376.1	298.7	448.0

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	23.52	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.482

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1A: Sta 0+24.76 - 0+91**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.49	120	0	58.4	87.6	210.83	316.24	0.00	0.00	210.83	316.24
1.97	120	0	116.8	175.1	421.65	632.48	0.00	0.00	421.65	632.48
2.46	120	0	175.1	262.7	632.48	948.72	0.00	0.00	632.48	948.72
2.95	120	0	233.5	350.3	843.31	1264.96	0.00	0.00	843.31	1264.96
3.43	120	0	291.9	437.8	1054.13	1581.20	0.00	0.00	1054.13	1581.20
3.92	120	0	350.3	525.4	1264.96	1897.44	0.00	0.00	1264.96	1897.44
4.41	120	0	408.6	613.0	1475.79	2213.68	0.00	0.00	1475.79	2213.68
4.89	120	0	467.0	700.5	1686.61	2529.92	0.00	0.00	1686.61	2529.92
5.38	120	0	525.4	788.1	1897.44	2846.16	0.00	0.00	1897.44	2846.16
5.86	120	0	583.8	875.6	2108.27	3162.40	0.00	0.00	2108.27	3162.40
6.35	120	0	642.1	963.2	2319.09	3478.64	0.00	0.00	2319.09	3478.64
6.84	120	0	700.5	1,050.8	2529.92	3794.88	0.00	0.00	2529.92	3794.88
7.32	120	0	758.9	1,138.3	2740.74	4111.12	0.00	0.00	2740.74	4111.12
7.81	120	0	817.3	1,225.9	2951.57	4427.36	0.00	0.00	2951.57	4427.36
8.30	120	0	875.6	1,313.5	3162.40	4743.60	0.00	0.00	3162.40	4743.60
8.78	120	0	934.0	1,401.0	3373.22	5059.84	0.00	0.00	3373.22	5059.84
9.27	120	0	992.4	1,488.6	3584.05	5376.08	0.00	0.00	3584.05	5376.08

Lateral Earth Pressure Calculations

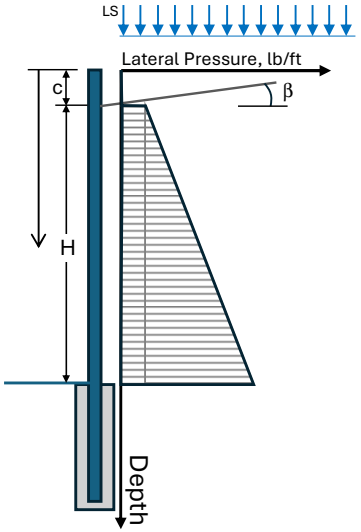
H =	10.87	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	21.98	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	700.57	c=	1
Top of Shaft Elev =	690.37		
Lower Grade El =	693.2		
Bottom of Frost El =	689.7		
Total Wall Height, ft=	10.87		
Design Height, ft=	9.87		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
10.87	4103.1	6154.6	341.9	512.9

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	21.98	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.462

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1A: Sta 0+91 - 1+51**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.58	120	0	69.7	104.5	241.36	362.04	0.00	0.00	241.36	362.04
2.16	120	0	139.3	209.0	482.72	724.07	0.00	0.00	482.72	724.07
2.74	120	0	209.0	313.5	724.07	1086.11	0.00	0.00	724.07	1086.11
3.32	120	0	278.7	418.0	965.43	1448.15	0.00	0.00	965.43	1448.15
3.90	120	0	348.4	522.5	1206.79	1810.18	0.00	0.00	1206.79	1810.18
4.48	120	0	418.0	627.0	1448.15	2172.22	0.00	0.00	1448.15	2172.22
5.06	120	0	487.7	731.5	1689.51	2534.26	0.00	0.00	1689.51	2534.26
5.64	120	0	557.4	836.0	1930.86	2896.29	0.00	0.00	1930.86	2896.29
6.23	120	0	627.0	940.6	2172.22	3258.33	0.00	0.00	2172.22	3258.33
6.81	120	0	696.7	1,045.1	2413.58	3620.37	0.00	0.00	2413.58	3620.37
7.39	120	0	766.4	1,149.6	2654.94	3982.40	0.00	0.00	2654.94	3982.40
7.97	120	0	836.0	1,254.1	2896.29	4344.44	0.00	0.00	2896.29	4344.44
8.55	120	0	905.7	1,358.6	3137.65	4706.48	0.00	0.00	3137.65	4706.48
9.13	120	0	975.4	1,463.1	3379.01	5068.52	0.00	0.00	3379.01	5068.52
9.71	120	0	1,045.1	1,567.6	3620.37	5430.55	0.00	0.00	3620.37	5430.55
10.29	120	0	1,114.7	1,672.1	3861.73	5792.59	0.00	0.00	3861.73	5792.59
10.87	120	0	1,184.4	1,776.6	4103.08	6154.63	0.00	0.00	4103.08	6154.63

Lateral Earth Pressure Calculations

H =	12.92	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	21.25	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	703.44	c=	1
Top of Shaft Elev =	691.40		
Lower Grade El =	694.02		
Bottom of Frost El =	690.5		
Total Wall Height, ft=	12.92		
Design Height, ft=	11.92		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
12.92	4868.1	7302.2	405.7	608.5

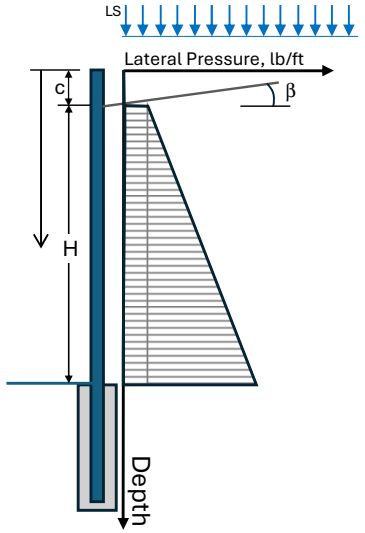
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	21.25	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.454

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.70	120	0	84.1	126.2	286.36	429.54	0.00	0.00	286.36	429.54
2.40	120	0	168.3	252.4	572.72	859.08	0.00	0.00	572.72	859.08
3.10	120	0	252.4	378.6	859.08	1288.62	0.00	0.00	859.08	1288.62
3.80	120	0	336.6	504.8	1145.44	1718.16	0.00	0.00	1145.44	1718.16
4.51	120	0	420.7	631.1	1431.80	2147.70	0.00	0.00	1431.80	2147.70
5.21	120	0	504.8	757.3	1718.16	2577.24	0.00	0.00	1718.16	2577.24
5.91	120	0	589.0	883.5	2004.52	3006.78	0.00	0.00	2004.52	3006.78
6.61	120	0	673.1	1,009.7	2290.88	3436.32	0.00	0.00	2290.88	3436.32
7.31	120	0	757.3	1,135.9	2577.24	3865.86	0.00	0.00	2577.24	3865.86
8.01	120	0	841.4	1,262.1	2863.60	4295.40	0.00	0.00	2863.60	4295.40
8.71	120	0	925.6	1,388.3	3149.96	4724.94	0.00	0.00	3149.96	4724.94
9.41	120	0	1,009.7	1,514.5	3436.32	5154.48	0.00	0.00	3436.32	5154.48
10.12	120	0	1,093.8	1,640.8	3722.68	5584.02	0.00	0.00	3722.68	5584.02
10.82	120	0	1,178.0	1,767.0	4009.04	6013.57	0.00	0.00	4009.04	6013.57
11.52	120	0	1,262.1	1,893.2	4295.40	6443.11	0.00	0.00	4295.40	6443.11
12.22	120	0	1,346.3	2,019.4	4581.76	6872.65	0.00	0.00	4581.76	6872.65
12.92	120	0	1,430.4	2,145.6	4868.12	7302.19	0.00	0.00	4868.12	7302.19

Lateral Earth Pressure Calculations

For Ret	15.11	ft	design height of wall	Traffic Surcharge, LS =	0 psf
β =	20.79	degrees	Equiv. slope of ground above wall		
ℓ =	7.5	ft	spacing between soldier piles		

Top of Wall El.=	706.31	c=	1
Top of Shaft Elev =	691.96		
Lower Grade El =	694.7		
Bottom of Frost El =	691.2		
Total Wall Height, ft=	15.11		
Design Height, ft=	14.11		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
15.11	5700.4	8550.6	475.0	712.5

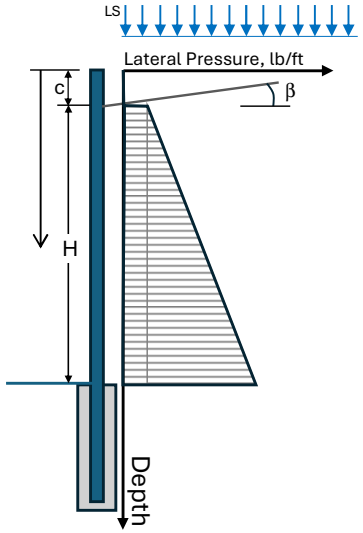
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	20.79	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.449

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1A: Sta 2+26 - 3+01**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.83	120	0	99.6	149.4	335.32	502.97	0.00	0.00	335.32	502.97
2.66	120	0	199.2	298.8	670.63	1005.95	0.00	0.00	670.63	1005.95
3.49	120	0	298.8	448.2	1005.95	1508.92	0.00	0.00	1005.95	1508.92
4.32	120	0	398.4	597.6	1341.26	2011.90	0.00	0.00	1341.26	2011.90
5.15	120	0	498.0	747.0	1676.58	2514.87	0.00	0.00	1676.58	2514.87
5.98	120	0	597.6	896.4	2011.90	3017.84	0.00	0.00	2011.90	3017.84
6.81	120	0	697.2	1,045.8	2347.21	3520.82	0.00	0.00	2347.21	3520.82
7.64	120	0	796.8	1,195.2	2682.53	4023.79	0.00	0.00	2682.53	4023.79
8.47	120	0	896.4	1,344.6	3017.84	4526.77	0.00	0.00	3017.84	4526.77
9.30	120	0	996.0	1,494.0	3353.16	5029.74	0.00	0.00	3353.16	5029.74
10.13	120	0	1,095.6	1,643.4	3688.48	5532.71	0.00	0.00	3688.48	5532.71
10.96	120	0	1,195.2	1,792.8	4023.79	6035.69	0.00	0.00	4023.79	6035.69
11.79	120	0	1,294.8	1,942.2	4359.11	6538.66	0.00	0.00	4359.11	6538.66
12.62	120	0	1,394.4	2,091.6	4694.42	7041.64	0.00	0.00	4694.42	7041.64
13.45	120	0	1,494.0	2,241.0	5029.74	7544.61	0.00	0.00	5029.74	7544.61
14.28	120	0	1,593.6	2,390.4	5365.06	8047.59	0.00	0.00	5365.06	8047.59
15.11	120	0	1,693.2	2,539.8	5700.37	8550.56	0.00	0.00	5700.37	8550.56

Lateral Earth Pressure Calculations

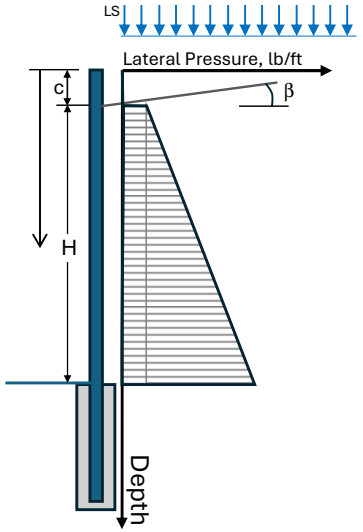
H =	18.51	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	19.18	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	708.61	c=	1
Top of Shaft Elev =	692.40		
Lower Grade El =	693.6		
Bottom of Frost El =	690.1		
Total Wall Height, ft=	18.51		
Design Height, ft=	17.51		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
18.51	6832.1	10248.2	569.3	854.0

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	19.18	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.434

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1A: Sta 3+01 - 3+61**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.03	120	0	123.6	185.4	401.89	602.84	0.00	0.00	401.89	602.84
3.06	120	0	247.2	370.8	803.78	1205.67	0.00	0.00	803.78	1205.67
4.09	120	0	370.8	556.2	1205.67	1808.51	0.00	0.00	1205.67	1808.51
5.12	120	0	494.4	741.6	1607.56	2411.34	0.00	0.00	1607.56	2411.34
6.15	120	0	618.0	927.0	2009.45	3014.18	0.00	0.00	2009.45	3014.18
7.18	120	0	741.6	1,112.4	2411.34	3617.02	0.00	0.00	2411.34	3617.02
8.21	120	0	865.2	1,297.8	2813.24	4219.85	0.00	0.00	2813.24	4219.85
9.24	120	0	988.8	1,483.2	3215.13	4822.69	0.00	0.00	3215.13	4822.69
10.27	120	0	1,112.4	1,668.6	3617.02	5425.53	0.00	0.00	3617.02	5425.53
11.30	120	0	1,236.0	1,854.0	4018.91	6028.36	0.00	0.00	4018.91	6028.36
12.33	120	0	1,359.6	2,039.4	4420.80	6631.20	0.00	0.00	4420.80	6631.20
13.36	120	0	1,483.2	2,224.8	4822.69	7234.03	0.00	0.00	4822.69	7234.03
14.39	120	0	1,606.8	2,410.2	5224.58	7836.87	0.00	0.00	5224.58	7836.87
15.42	120	0	1,730.4	2,595.6	5626.47	8439.71	0.00	0.00	5626.47	8439.71
16.45	120	0	1,854.0	2,781.0	6028.36	9042.54	0.00	0.00	6028.36	9042.54
17.48	120	0	1,977.6	2,966.4	6430.25	9645.38	0.00	0.00	6430.25	9645.38
18.51	120	0	2,101.2	3,151.8	6832.14	10248.21	0.00	0.00	6832.14	10248.21

Lateral Earth Pressure Calculations

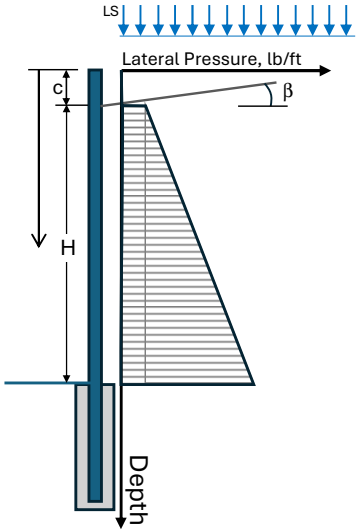
H =	19.04	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	16.97	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	710.91	c=	1
Top of Shaft Elev =	692.72		
Lower Grade El =	695.37		
Bottom of Frost El =	691.9		
Total Wall Height, ft=	19.04		
Design Height, ft=	18.04		

For Retain Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
19.04	6748.0	10122.0	562.3	843.5

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	16.97	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.416

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.06	120	0	127.3	191.0	396.94	595.41	0.00	0.00	396.94	595.41
3.12	120	0	254.7	382.0	793.88	1190.82	0.00	0.00	793.88	1190.82
4.18	120	0	382.0	573.0	1190.82	1786.23	0.00	0.00	1190.82	1786.23
5.24	120	0	509.4	764.0	1587.76	2381.65	0.00	0.00	1587.76	2381.65
6.31	120	0	636.7	955.1	1984.70	2977.06	0.00	0.00	1984.70	2977.06
7.37	120	0	764.0	1,146.1	2381.65	3572.47	0.00	0.00	2381.65	3572.47
8.43	120	0	891.4	1,337.1	2778.59	4167.88	0.00	0.00	2778.59	4167.88
9.49	120	0	1,018.7	1,528.1	3175.53	4763.29	0.00	0.00	3175.53	4763.29
10.55	120	0	1,146.1	1,719.1	3572.47	5358.70	0.00	0.00	3572.47	5358.70
11.61	120	0	1,273.4	1,910.1	3969.41	5954.11	0.00	0.00	3969.41	5954.11
12.67	120	0	1,400.8	2,101.1	4366.35	6549.52	0.00	0.00	4366.35	6549.52
13.73	120	0	1,528.1	2,292.1	4763.29	7144.94	0.00	0.00	4763.29	7144.94
14.80	120	0	1,655.4	2,483.2	5160.23	7740.35	0.00	0.00	5160.23	7740.35
15.86	120	0	1,782.8	2,674.2	5557.17	8335.76	0.00	0.00	5557.17	8335.76
16.92	120	0	1,910.1	2,865.2	5954.11	8931.17	0.00	0.00	5954.11	8931.17
17.98	120	0	2,037.5	3,056.2	6351.05	9526.58	0.00	0.00	6351.05	9526.58
19.04	120	0	2,164.8	3,247.2	6748.00	10121.99	0.00	0.00	6748.00	10121.99

Lateral Earth Pressure Calculations

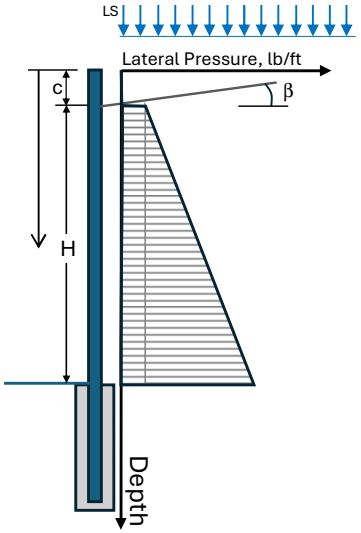
H =	20.47	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	15.95	degrees	Equiv. slope of ground above wall			
ℓ =	6.7	ft	spacing between soldier piles			

Top of Wall El.=	712.57	c=	1
Top of Shaft Elev =	692.97		
Lower Grade El =	695.6		
Bottom of Frost El =	692.1		
Total Wall Height, ft=	20.47		
Design Height, ft=	19.47		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
20.47	6362.6	9544.0	530.2	795.3

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	15.95	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.408

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1A: Sta 4+21 - 4+61.42**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

	Unfactored Forces		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
Depth	Active side									
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.15	120	0	137.4	206.2	374.27	561.41	0.00	0.00	374.27	561.41
3.29	120	0	274.9	412.3	748.55	1122.82	0.00	0.00	748.55	1122.82
4.44	120	0	412.3	618.5	1122.82	1684.23	0.00	0.00	1122.82	1684.23
5.58	120	0	549.7	824.6	1497.09	2245.64	0.00	0.00	1497.09	2245.64
6.73	120	0	687.2	1,030.8	1871.37	2807.05	0.00	0.00	1871.37	2807.05
7.87	120	0	824.6	1,236.9	2245.64	3368.46	0.00	0.00	2245.64	3368.46
9.02	120	0	962.0	1,443.1	2619.91	3929.87	0.00	0.00	2619.91	3929.87
10.16	120	0	1,099.5	1,649.2	2994.19	4491.28	0.00	0.00	2994.19	4491.28
11.31	120	0	1,236.9	1,855.4	3368.46	5052.69	0.00	0.00	3368.46	5052.69
12.45	120	0	1,374.4	2,061.5	3742.73	5614.10	0.00	0.00	3742.73	5614.10
13.60	120	0	1,511.8	2,267.7	4117.01	6175.51	0.00	0.00	4117.01	6175.51
14.74	120	0	1,649.2	2,473.8	4491.28	6736.92	0.00	0.00	4491.28	6736.92
15.89	120	0	1,786.7	2,680.0	4865.55	7298.33	0.00	0.00	4865.55	7298.33
17.03	120	0	1,924.1	2,886.1	5239.83	7859.74	0.00	0.00	5239.83	7859.74
18.18	120	0	2,061.5	3,092.3	5614.10	8421.15	0.00	0.00	5614.10	8421.15
19.32	120	0	2,199.0	3,298.4	5988.37	8982.56	0.00	0.00	5988.37	8982.56
20.47	120	0	2,336.4	3,504.6	6362.64	9543.97	0.00	0.00	6362.64	9543.97

Lateral Earth Pressure Calculations

H =	22.56	ft	design height of wall
β =	6.74	degrees	Equiv. slope of ground above wall
ℓ =	7.5	ft	spacing between soldier piles

Traffic Surcharge, LS = 0 psf

Top of Wall El.=	715.04	c=	1
Top of Shaft Elev =	693.28		
Lower Grade El =	695.98		
Bottom of Frost El =	692.5		
Total Wall Height, ft=	22.56		
Design Height, ft=	21.56		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
22.56	6960.7	10441.0	580.1	870.1

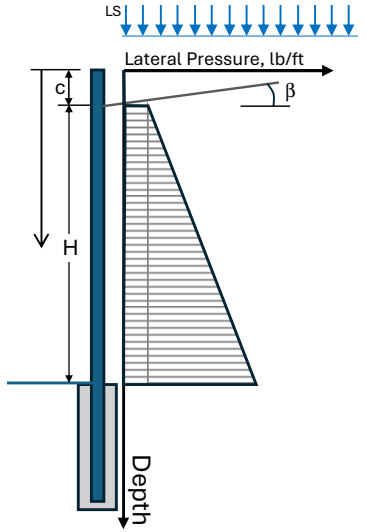
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	6.74	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.359

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 1A: Sta 4+61.42 - 5+21**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.27	120	0	152.2	228.3	409.45	614.18	0.00	0.00	409.45	614.18
3.54	120	0	304.4	456.6	818.90	1228.35	0.00	0.00	818.90	1228.35
4.80	120	0	456.6	684.8	1228.35	1842.53	0.00	0.00	1228.35	1842.53
6.07	120	0	608.8	913.1	1637.81	2456.71	0.00	0.00	1637.81	2456.71
7.34	120	0	760.9	1,141.4	2047.26	3070.89	0.00	0.00	2047.26	3070.89
8.61	120	0	913.1	1,369.7	2456.71	3685.06	0.00	0.00	2456.71	3685.06
9.88	120	0	1,065.3	1,598.0	2866.16	4299.24	0.00	0.00	2866.16	4299.24
11.15	120	0	1,217.5	1,826.3	3275.61	4913.42	0.00	0.00	3275.61	4913.42
12.41	120	0	1,369.7	2,054.5	3685.06	5527.60	0.00	0.00	3685.06	5527.60
13.68	120	0	1,521.9	2,282.8	4094.52	6141.77	0.00	0.00	4094.52	6141.77
14.95	120	0	1,674.1	2,511.1	4503.97	6755.95	0.00	0.00	4503.97	6755.95
16.22	120	0	1,826.3	2,739.4	4913.42	7370.13	0.00	0.00	4913.42	7370.13
17.49	120	0	1,978.4	2,967.7	5322.87	7984.31	0.00	0.00	5322.87	7984.31
18.76	120	0	2,130.6	3,196.0	5732.32	8598.48	0.00	0.00	5732.32	8598.48
20.02	120	0	2,282.8	3,424.2	6141.77	9212.66	0.00	0.00	6141.77	9212.66
21.29	120	0	2,435.0	3,652.5	6551.23	9826.84	0.00	0.00	6551.23	9826.84
22.56	120	0	2,587.2	3,880.8	6960.68	10441.02	0.00	0.00	6960.68	10441.02

Lateral Earth Pressure Calculations

H =	22.65	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	8.60	degrees	Equiv. slope of ground above wall			
ℓ =	6.6	ft	spacing between soldier piles			

Top of Wall El.=	715.18	c=	1
Top of Shaft Elev =	693.47		
Lower Grade El =	696.03		
Bottom of Frost El =	692.5		
Total Wall Height, ft=	22.65		
Design Height, ft=	21.65		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
22.65	6276.6	9415.0	523.1	784.6

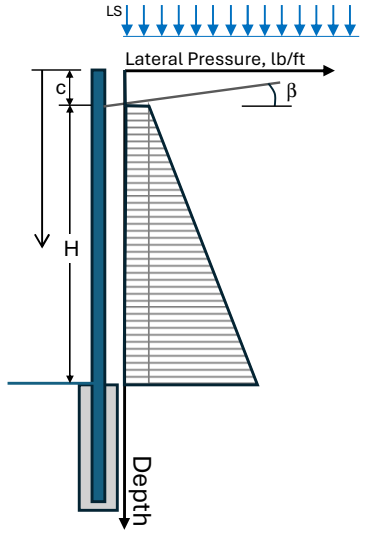
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	8.60	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.367

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1B: Sta 10+00 - 11+06.94**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.27	120	0	152.8	229.2	369.21	553.82	0.00	0.00	369.21	553.82
3.55	120	0	305.6	458.5	738.43	1107.64	0.00	0.00	738.43	1107.64
4.82	120	0	458.5	687.7	1107.64	1661.46	0.00	0.00	1107.64	1661.46
6.09	120	0	611.3	916.9	1476.86	2215.28	0.00	0.00	1476.86	2215.28
7.37	120	0	764.1	1,146.2	1846.07	2769.11	0.00	0.00	1846.07	2769.11
8.64	120	0	916.9	1,375.4	2215.28	3322.93	0.00	0.00	2215.28	3322.93
9.91	120	0	1,069.8	1,604.6	2584.50	3876.75	0.00	0.00	2584.50	3876.75
11.19	120	0	1,222.6	1,833.9	2953.71	4430.57	0.00	0.00	2953.71	4430.57
12.46	120	0	1,375.4	2,063.1	3322.93	4984.39	0.00	0.00	3322.93	4984.39
13.74	120	0	1,528.2	2,292.4	3692.14	5538.21	0.00	0.00	3692.14	5538.21
15.01	120	0	1,681.1	2,521.6	4061.36	6092.03	0.00	0.00	4061.36	6092.03
16.28	120	0	1,833.9	2,750.8	4430.57	6645.85	0.00	0.00	4430.57	6645.85
17.56	120	0	1,986.7	2,980.1	4799.78	7199.68	0.00	0.00	4799.78	7199.68
18.83	120	0	2,139.5	3,209.3	5169.00	7753.50	0.00	0.00	5169.00	7753.50
20.10	120	0	2,292.4	3,438.5	5538.21	8307.32	0.00	0.00	5538.21	8307.32
21.38	120	0	2,445.2	3,667.8	5907.43	8861.14	0.00	0.00	5907.43	8861.14
22.65	120	0	2,598.0	3,897.0	6276.64	9414.96	0.00	0.00	6276.64	9414.96

Lateral Earth Pressure Calculations

H =	21.42	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	12.44	degrees	Equiv. slope of ground above wall			
ℓ =	6.5	ft	spacing between soldier piles			

Top of Wall El.=	713.88	c=	1
Top of Shaft Elev =	693.27		
Lower Grade El =	695.96		
Bottom of Frost El =	692.5		
Total Wall Height, ft=	21.42		
Design Height, ft=	20.42		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
21.42	6156.0	9233.9	513.0	769.5

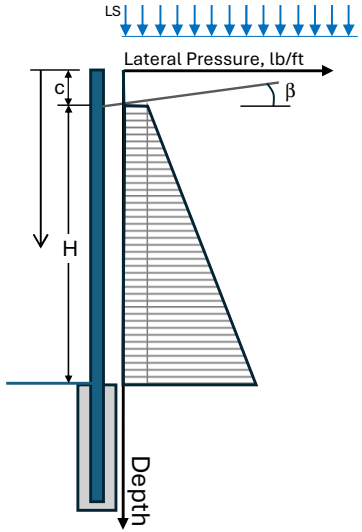
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	12.44	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.386

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1C: Sta 100+00 - 100+23.66**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.20	120	0	144.1	216.2	362.11	543.17	0.00	0.00	362.11	543.17
3.40	120	0	288.3	432.4	724.23	1086.34	0.00	0.00	724.23	1086.34
4.60	120	0	432.4	648.6	1086.34	1629.52	0.00	0.00	1086.34	1629.52
5.80	120	0	576.6	864.8	1448.46	2172.69	0.00	0.00	1448.46	2172.69
7.01	120	0	720.7	1,081.1	1810.57	2715.86	0.00	0.00	1810.57	2715.86
8.21	120	0	864.8	1,297.3	2172.69	3259.03	0.00	0.00	2172.69	3259.03
9.41	120	0	1,009.0	1,513.5	2534.80	3802.21	0.00	0.00	2534.80	3802.21
10.61	120	0	1,153.1	1,729.7	2896.92	4345.38	0.00	0.00	2896.92	4345.38
11.81	120	0	1,297.3	1,945.9	3259.03	4888.55	0.00	0.00	3259.03	4888.55
13.01	120	0	1,441.4	2,162.1	3621.15	5431.72	0.00	0.00	3621.15	5431.72
14.21	120	0	1,585.6	2,378.3	3983.26	5974.90	0.00	0.00	3983.26	5974.90
15.41	120	0	1,729.7	2,594.5	4345.38	6518.07	0.00	0.00	4345.38	6518.07
16.62	120	0	1,873.8	2,810.8	4707.49	7061.24	0.00	0.00	4707.49	7061.24
17.82	120	0	2,018.0	3,027.0	5069.61	7604.41	0.00	0.00	5069.61	7604.41
19.02	120	0	2,162.1	3,243.2	5431.72	8147.59	0.00	0.00	5431.72	8147.59
20.22	120	0	2,306.3	3,459.4	5793.84	8690.76	0.00	0.00	5793.84	8690.76
21.42	120	0	2,450.4	3,675.6	6155.95	9233.93	0.00	0.00	6155.95	9233.93

Lateral Earth Pressure Calculations

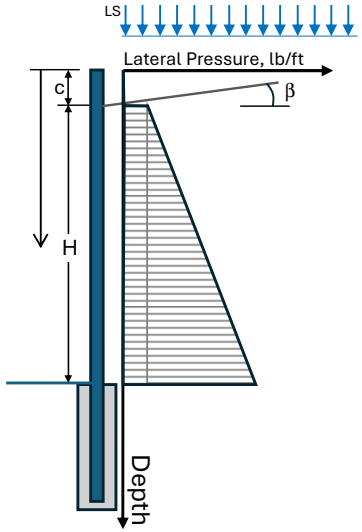
H =	20.90	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	12.44	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	713.70	c=	1
Top of Shaft Elev =	693.27		
Lower Grade El =	696.3		
Bottom of Frost El =	692.8		
Total Wall Height, ft=	20.90		
Design Height, ft=	19.9		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
20.90	6922.1	10383.2	576.8	865.3

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	12.44	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.386

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1C: Sta 100+00 - 100+23.66**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.17	120	0	140.5	210.7	407.18	610.78	0.00	0.00	407.18	610.78
3.34	120	0	280.9	421.4	814.37	1221.55	0.00	0.00	814.37	1221.55
4.51	120	0	421.4	632.1	1221.55	1832.33	0.00	0.00	1221.55	1832.33
5.68	120	0	561.9	842.8	1628.74	2443.11	0.00	0.00	1628.74	2443.11
6.85	120	0	702.4	1,053.5	2035.92	3053.89	0.00	0.00	2035.92	3053.89
8.02	120	0	842.8	1,264.2	2443.11	3664.66	0.00	0.00	2443.11	3664.66
9.19	120	0	983.3	1,474.9	2850.29	4275.44	0.00	0.00	2850.29	4275.44
10.36	120	0	1,123.8	1,685.6	3257.48	4886.22	0.00	0.00	3257.48	4886.22
11.54	120	0	1,264.2	1,896.4	3664.66	5497.00	0.00	0.00	3664.66	5497.00
12.71	120	0	1,404.7	2,107.1	4071.85	6107.77	0.00	0.00	4071.85	6107.77
13.88	120	0	1,545.2	2,317.8	4479.03	6718.55	0.00	0.00	4479.03	6718.55
15.05	120	0	1,685.6	2,528.5	4886.22	7329.33	0.00	0.00	4886.22	7329.33
16.22	120	0	1,826.1	2,739.2	5293.40	7940.11	0.00	0.00	5293.40	7940.11
17.39	120	0	1,966.6	2,949.9	5700.59	8550.88	0.00	0.00	5700.59	8550.88
18.56	120	0	2,107.1	3,160.6	6107.77	9161.66	0.00	0.00	6107.77	9161.66
19.73	120	0	2,247.5	3,371.3	6514.96	9772.44	0.00	0.00	6514.96	9772.44
20.90	120	0	2,388.0	3,582.0	6922.14	10383.22	0.00	0.00	6922.14	10383.22

Lateral Earth Pressure Calculations

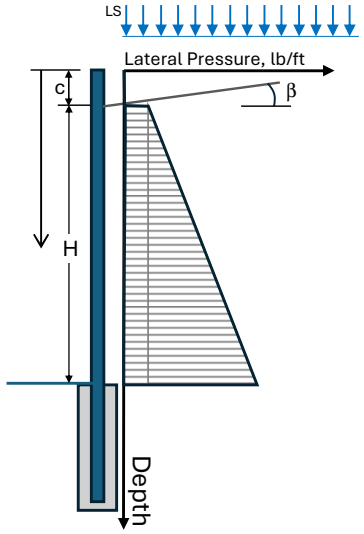
H =	18.46	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	14.54	degrees	Equiv. slope of ground above wall			
ℓ =	6.5	ft	spacing between soldier piles			

Top of Wall El.=	707.57	c=	1
Top of Shaft Elev =	689.71		
Lower Grade El =	692.61		
Bottom of Frost El =	689.11		
Total Wall Height, ft=	18.46		
Design Height, ft=	17.46		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
18.46	5433.6	8150.4	452.8	679.2

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	14.54	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.399

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.03	120	0	123.2	184.9	319.62	479.44	0.00	0.00	319.62	479.44
3.05	120	0	246.5	369.7	639.25	958.87	0.00	0.00	639.25	958.87
4.08	120	0	369.7	554.6	958.87	1438.31	0.00	0.00	958.87	1438.31
5.11	120	0	493.0	739.5	1278.50	1917.75	0.00	0.00	1278.50	1917.75
6.14	120	0	616.2	924.4	1598.12	2397.18	0.00	0.00	1598.12	2397.18
7.16	120	0	739.5	1,109.2	1917.75	2876.62	0.00	0.00	1917.75	2876.62
8.19	120	0	862.7	1,294.1	2237.37	3356.06	0.00	0.00	2237.37	3356.06
9.22	120	0	986.0	1,479.0	2557.00	3835.50	0.00	0.00	2557.00	3835.50
10.24	120	0	1,109.2	1,663.8	2876.62	4314.93	0.00	0.00	2876.62	4314.93
11.27	120	0	1,232.5	1,848.7	3196.25	4794.37	0.00	0.00	3196.25	4794.37
12.30	120	0	1,355.7	2,033.6	3515.87	5273.81	0.00	0.00	3515.87	5273.81
13.32	120	0	1,479.0	2,218.4	3835.50	5753.24	0.00	0.00	3835.50	5753.24
14.35	120	0	1,602.2	2,403.3	4155.12	6232.68	0.00	0.00	4155.12	6232.68
15.38	120	0	1,725.5	2,588.2	4474.75	6712.12	0.00	0.00	4474.75	6712.12
16.41	120	0	1,848.7	2,773.1	4794.37	7191.55	0.00	0.00	4794.37	7191.55
17.43	120	0	1,972.0	2,957.9	5113.99	7670.99	0.00	0.00	5113.99	7670.99
18.46	120	0	2,095.2	3,142.8	5433.62	8150.43	0.00	0.00	5433.62	8150.43

Lateral Earth Pressure Calculations

H =	17.76	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	17.04	degrees	Equiv. slope of ground above wall			
ℓ =	6.50	ft	spacing between soldier piles			

Top of Wall El.=	706.66	c=	1
Top of Shaft Elev =	689.71		
Lower Grade El =	692.4		
Bottom of Frost El =	688.9		
Total Wall Height, ft=	17.76		
Design Height, ft=	16.76		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
17.76	5440.1	8160.2	453.3	680.0

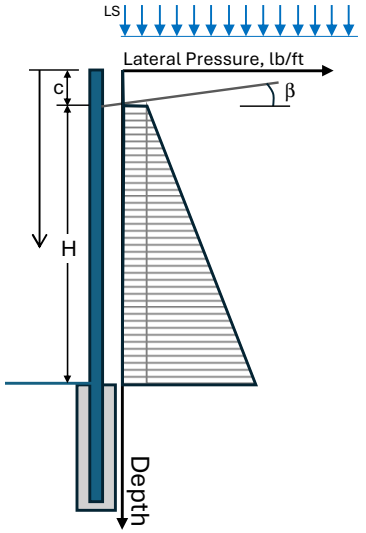
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	17.04	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.416

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 1D: Sta 1000+37.04 - 1000+57.58**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.99	120	0	118.3	177.5	320.01	480.01	0.00	0.00	320.01	480.01
2.97	120	0	236.6	354.9	640.01	960.02	0.00	0.00	640.01	960.02
3.96	120	0	354.9	532.4	960.02	1440.03	0.00	0.00	960.02	1440.03
4.94	120	0	473.2	709.8	1280.03	1920.04	0.00	0.00	1280.03	1920.04
5.93	120	0	591.5	887.3	1600.04	2400.05	0.00	0.00	1600.04	2400.05
6.92	120	0	709.8	1,064.8	1920.04	2880.07	0.00	0.00	1920.04	2880.07
7.90	120	0	828.1	1,242.2	2240.05	3360.08	0.00	0.00	2240.05	3360.08
8.89	120	0	946.4	1,419.7	2560.06	3840.09	0.00	0.00	2560.06	3840.09
9.87	120	0	1,064.8	1,597.1	2880.07	4320.10	0.00	0.00	2880.07	4320.10
10.86	120	0	1,183.1	1,774.6	3200.07	4800.11	0.00	0.00	3200.07	4800.11
11.84	120	0	1,301.4	1,952.0	3520.08	5280.12	0.00	0.00	3520.08	5280.12
12.83	120	0	1,419.7	2,129.5	3840.09	5760.13	0.00	0.00	3840.09	5760.13
13.82	120	0	1,538.0	2,307.0	4160.10	6240.14	0.00	0.00	4160.10	6240.14
14.80	120	0	1,656.3	2,484.4	4480.10	6720.15	0.00	0.00	4480.10	6720.15
15.79	120	0	1,774.6	2,661.9	4800.11	7200.16	0.00	0.00	4800.11	7200.16
16.77	120	0	1,892.9	2,839.3	5120.12	7680.18	0.00	0.00	5120.12	7680.18
17.76	120	0	2,011.2	3,016.8	5440.12	8160.19	0.00	0.00	5440.12	8160.19

Lateral Earth Pressure Calculations

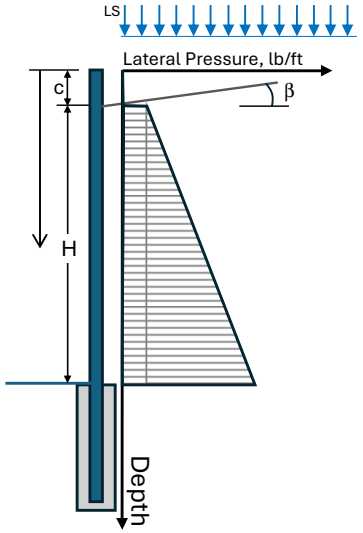
H =	17.17	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	17.04	degrees	Equiv. slope of ground above wall			
ℓ =	6.75	ft	spacing between soldier piles			

Top of Wall El.=	706.04	c=	1
Top of Shaft Elev =	689.71		
Lower Grade El =	692.37		
Bottom of Frost El =	688.87		
Total Wall Height, ft=	17.17		
Design Height, ft=	16.17		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
17.17	5450.5	8175.7	454.2	681.3

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	17.04	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.416

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 1D: Sta 1000+37.04 - 1000+57.58**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.95	120	0	114.1	171.2	320.62	480.93	0.00	0.00	320.62	480.93
2.90	120	0	228.3	342.4	641.23	961.85	0.00	0.00	641.23	961.85
3.85	120	0	342.4	513.6	961.85	1442.78	0.00	0.00	961.85	1442.78
4.80	120	0	456.6	684.8	1282.47	1923.70	0.00	0.00	1282.47	1923.70
5.76	120	0	570.7	856.1	1603.08	2404.63	0.00	0.00	1603.08	2404.63
6.71	120	0	684.8	1,027.3	1923.70	2885.55	0.00	0.00	1923.70	2885.55
7.66	120	0	799.0	1,198.5	2244.32	3366.48	0.00	0.00	2244.32	3366.48
8.61	120	0	913.1	1,369.7	2564.93	3847.40	0.00	0.00	2564.93	3847.40
9.56	120	0	1,027.3	1,540.9	2885.55	4328.33	0.00	0.00	2885.55	4328.33
10.51	120	0	1,141.4	1,712.1	3206.17	4809.25	0.00	0.00	3206.17	4809.25
11.46	120	0	1,255.6	1,883.3	3526.79	5290.18	0.00	0.00	3526.79	5290.18
12.41	120	0	1,369.7	2,054.5	3847.40	5771.10	0.00	0.00	3847.40	5771.10
13.37	120	0	1,483.8	2,225.8	4168.02	6252.03	0.00	0.00	4168.02	6252.03
14.32	120	0	1,598.0	2,397.0	4488.64	6732.95	0.00	0.00	4488.64	6732.95
15.27	120	0	1,712.1	2,568.2	4809.25	7213.88	0.00	0.00	4809.25	7213.88
16.22	120	0	1,826.3	2,739.4	5129.87	7694.80	0.00	0.00	5129.87	7694.80
17.17	120	0	1,940.4	2,910.6	5450.49	8175.73	0.00	0.00	5450.49	8175.73

Lateral Earth Pressure Calculations

H =	16.03	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	16.14	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	704.74	c=	1
Top of Shaft Elev =	690.35		
Lower Grade El =	692.21		
Bottom of Frost El =	688.71		
Total Wall Height, ft=	16.03		
Design Height, ft=	15.03		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
16.03	5541.0	8311.5	461.7	692.6

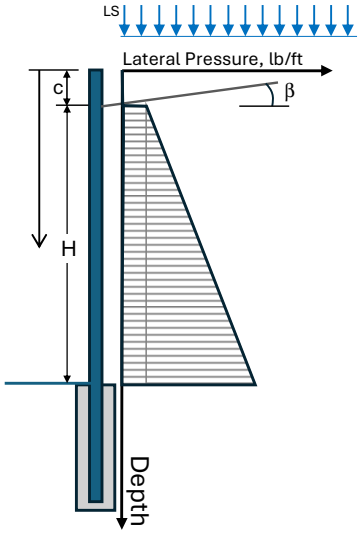
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	16.14	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.410

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 1D: Sta 1000+65.08 - 1002+07.58**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.88	120	0	106.1	159.1	325.94	488.91	0.00	0.00	325.94	488.91
2.77	120	0	212.2	318.3	651.88	977.82	0.00	0.00	651.88	977.82
3.65	120	0	318.3	477.4	977.82	1466.73	0.00	0.00	977.82	1466.73
4.54	120	0	424.4	636.6	1303.76	1955.64	0.00	0.00	1303.76	1955.64
5.42	120	0	530.5	795.7	1629.70	2444.55	0.00	0.00	1629.70	2444.55
6.30	120	0	636.6	954.8	1955.64	2933.46	0.00	0.00	1955.64	2933.46
7.19	120	0	742.7	1,114.0	2281.58	3422.37	0.00	0.00	2281.58	3422.37
8.07	120	0	848.8	1,273.1	2607.52	3911.29	0.00	0.00	2607.52	3911.29
8.96	120	0	954.8	1,432.3	2933.46	4400.20	0.00	0.00	2933.46	4400.20
9.84	120	0	1,060.9	1,591.4	3259.40	4889.11	0.00	0.00	3259.40	4889.11
10.73	120	0	1,167.0	1,750.6	3585.35	5378.02	0.00	0.00	3585.35	5378.02
11.61	120	0	1,273.1	1,909.7	3911.29	5866.93	0.00	0.00	3911.29	5866.93
12.49	120	0	1,379.2	2,068.8	4237.23	6355.84	0.00	0.00	4237.23	6355.84
13.38	120	0	1,485.3	2,228.0	4563.17	6844.75	0.00	0.00	4563.17	6844.75
14.26	120	0	1,591.4	2,387.1	4889.11	7333.66	0.00	0.00	4889.11	7333.66
15.15	120	0	1,697.5	2,546.3	5215.05	7822.57	0.00	0.00	5215.05	7822.57
16.03	120	0	1,803.6	2,705.4	5540.99	8311.48	0.00	0.00	5540.99	8311.48

Lateral Earth Pressure Calculations

H =	10.39	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	20.74	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	698.21	c=	1
Top of Shaft Elev =	688.47		
Lower Grade El =	691.32		
Bottom of Frost El =	687.82		
Total Wall Height, ft=	10.39		
Design Height, ft=	9.39		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
10.39	3789.0	5683.5	315.8	473.6

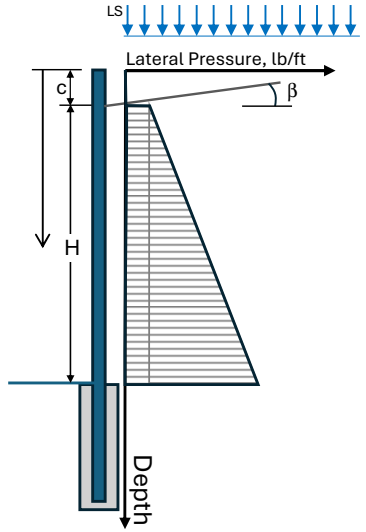
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	20.74	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.448

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of **Wall 1D: Sta 1002+15.08 - 1002+97.58**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft^3	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.55	120	0	66.3	99.4	222.88	334.33	0.00	0.00	222.88	334.33
2.10	120	0	132.6	198.8	445.77	668.65	0.00	0.00	445.77	668.65
2.66	120	0	198.8	298.3	668.65	1002.98	0.00	0.00	668.65	1002.98
3.21	120	0	265.1	397.7	891.53	1337.30	0.00	0.00	891.53	1337.30
3.76	120	0	331.4	497.1	1114.42	1671.63	0.00	0.00	1114.42	1671.63
4.31	120	0	397.7	596.5	1337.30	2005.95	0.00	0.00	1337.30	2005.95
4.87	120	0	464.0	696.0	1560.19	2340.28	0.00	0.00	1560.19	2340.28
5.42	120	0	530.3	795.4	1783.07	2674.60	0.00	0.00	1783.07	2674.60
5.97	120	0	596.5	894.8	2005.95	3008.93	0.00	0.00	2005.95	3008.93
6.52	120	0	662.8	994.2	2228.84	3343.26	0.00	0.00	2228.84	3343.26
7.08	120	0	729.1	1,093.7	2451.72	3677.58	0.00	0.00	2451.72	3677.58
7.63	120	0	795.4	1,193.1	2674.60	4011.91	0.00	0.00	2674.60	4011.91
8.18	120	0	861.7	1,292.5	2897.49	4346.23	0.00	0.00	2897.49	4346.23
8.73	120	0	928.0	1,391.9	3120.37	4680.56	0.00	0.00	3120.37	4680.56
9.29	120	0	994.2	1,491.4	3343.26	5014.88	0.00	0.00	3343.26	5014.88
9.84	120	0	1,060.5	1,590.8	3566.14	5349.21	0.00	0.00	3566.14	5349.21
10.39	120	0	1,126.8	1,690.2	3789.02	5683.54	0.00	0.00	3789.02	5683.54

Lateral Earth Pressure Calculations

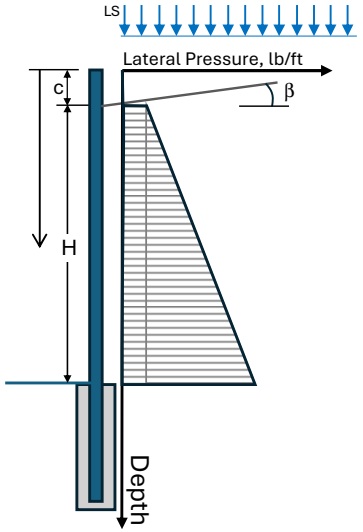
H =	9.90	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	21.26	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	696.69	c=	1
Top of Shaft Elev =	687.8		
Lower Grade El =	690.29		
Bottom of Frost El =	686.79		
Total Wall Height, ft=	9.9		
Design Height, ft=	8.9		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.90	3635.1	5452.7	302.9	454.4

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	21.26	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.454

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 1D: Sta 1003+05.08 - 1003+87.58**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft^3	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.52	120	0	62.8	94.2	213.83	320.75	0.00	0.00	213.83	320.75
2.05	120	0	125.6	188.5	427.66	641.50	0.00	0.00	427.66	641.50
2.57	120	0	188.5	282.7	641.50	962.24	0.00	0.00	641.50	962.24
3.09	120	0	251.3	376.9	855.33	1282.99	0.00	0.00	855.33	1282.99
3.62	120	0	314.1	471.2	1069.16	1603.74	0.00	0.00	1069.16	1603.74
4.14	120	0	376.9	565.4	1282.99	1924.49	0.00	0.00	1282.99	1924.49
4.66	120	0	439.8	659.6	1496.83	2245.24	0.00	0.00	1496.83	2245.24
5.19	120	0	502.6	753.9	1710.66	2565.99	0.00	0.00	1710.66	2565.99
5.71	120	0	565.4	848.1	1924.49	2886.73	0.00	0.00	1924.49	2886.73
6.24	120	0	628.2	942.4	2138.32	3207.48	0.00	0.00	2138.32	3207.48
6.76	120	0	691.1	1,036.6	2352.15	3528.23	0.00	0.00	2352.15	3528.23
7.28	120	0	753.9	1,130.8	2565.99	3848.98	0.00	0.00	2565.99	3848.98
7.81	120	0	816.7	1,225.1	2779.82	4169.73	0.00	0.00	2779.82	4169.73
8.33	120	0	879.5	1,319.3	2993.65	4490.48	0.00	0.00	2993.65	4490.48
8.85	120	0	942.4	1,413.5	3207.48	4811.22	0.00	0.00	3207.48	4811.22
9.38	120	0	1,005.2	1,507.8	3421.32	5131.97	0.00	0.00	3421.32	5131.97
9.90	120	0	1,068.0	1,602.0	3635.15	5452.72	0.00	0.00	3635.15	5452.72

Lateral Earth Pressure Calculations

H =	9.32	ft	design height of wall	Traffic Surcharge, LS =	0 psf
β =	22.11	degrees	Equiv. slope of ground above wall		
ℓ =	7.5	ft	spacing between soldier piles		

Top of Wall El.=	695.17	c=	1
Top of Shaft Elev =	686.40		
Lower Grade El =	689.35		
Bottom of Frost El =	685.85		
Total Wall Height, ft=	9.32		
Design Height, ft=	8.32		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.32	3469.7	5204.6	289.1	433.7

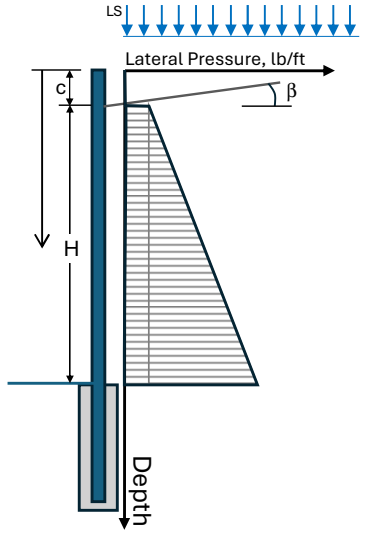
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	22.11	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.463

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 1D: Sta 1003+95.08 - 1005+07.58**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.49	120	0	58.7	88.1	204.10	306.15	0.00	0.00	204.10	306.15
1.98	120	0	117.5	176.2	408.20	612.30	0.00	0.00	408.20	612.30
2.47	120	0	176.2	264.3	612.30	918.45	0.00	0.00	612.30	918.45
2.96	120	0	234.9	352.4	816.40	1224.60	0.00	0.00	816.40	1224.60
3.45	120	0	293.6	440.5	1020.50	1530.76	0.00	0.00	1020.50	1530.76
3.94	120	0	352.4	528.6	1224.60	1836.91	0.00	0.00	1224.60	1836.91
4.43	120	0	411.1	616.7	1428.71	2143.06	0.00	0.00	1428.71	2143.06
4.92	120	0	469.8	704.8	1632.81	2449.21	0.00	0.00	1632.81	2449.21
5.40	120	0	528.6	792.8	1836.91	2755.36	0.00	0.00	1836.91	2755.36
5.89	120	0	587.3	880.9	2041.01	3061.51	0.00	0.00	2041.01	3061.51
6.38	120	0	646.0	969.0	2245.11	3367.66	0.00	0.00	2245.11	3367.66
6.87	120	0	704.8	1,057.1	2449.21	3673.81	0.00	0.00	2449.21	3673.81
7.36	120	0	763.5	1,145.2	2653.31	3979.97	0.00	0.00	2653.31	3979.97
7.85	120	0	822.2	1,233.3	2857.41	4286.12	0.00	0.00	2857.41	4286.12
8.34	120	0	880.9	1,321.4	3061.51	4592.27	0.00	0.00	3061.51	4592.27
8.83	120	0	939.7	1,409.5	3265.61	4898.42	0.00	0.00	3265.61	4898.42
9.32	120	0	998.4	1,497.6	3469.71	5204.57	0.00	0.00	3469.71	5204.57

Lateral Earth Pressure Calculations

H =	8.14	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	24.44	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	693.14	c=	1
Top of Shaft Elev =	685.63		
Lower Grade El =	688.5		
Bottom of Frost El =	685.0		
Total Wall Height, ft=	8.14		
Design Height, ft=	7.14		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
8.14	3181.7	4772.5	265.1	397.7

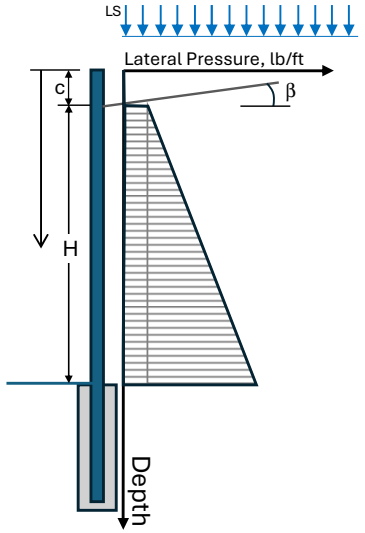
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	24.44	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.495

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 1D: Sta 1005+15.08 - 1009+23.83**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.42	120	0	50.4	75.6	187.16	280.74	0.00	0.00	187.16	280.74
1.84	120	0	100.8	151.2	374.32	561.47	0.00	0.00	374.32	561.47
2.26	120	0	151.2	226.8	561.47	842.21	0.00	0.00	561.47	842.21
2.68	120	0	201.6	302.4	748.63	1122.95	0.00	0.00	748.63	1122.95
3.10	120	0	252.0	378.0	935.79	1403.69	0.00	0.00	935.79	1403.69
3.52	120	0	302.4	453.6	1122.95	1684.42	0.00	0.00	1122.95	1684.42
3.94	120	0	352.8	529.2	1310.11	1965.16	0.00	0.00	1310.11	1965.16
4.36	120	0	403.2	604.8	1497.27	2245.90	0.00	0.00	1497.27	2245.90
4.78	120	0	453.6	680.4	1684.42	2526.63	0.00	0.00	1684.42	2526.63
5.20	120	0	504.0	756.0	1871.58	2807.37	0.00	0.00	1871.58	2807.37
5.62	120	0	554.4	831.6	2058.74	3088.11	0.00	0.00	2058.74	3088.11
6.04	120	0	604.8	907.2	2245.90	3368.85	0.00	0.00	2245.90	3368.85
6.46	120	0	655.2	982.8	2433.06	3649.58	0.00	0.00	2433.06	3649.58
6.88	120	0	705.6	1,058.4	2620.21	3930.32	0.00	0.00	2620.21	3930.32
7.30	120	0	756.0	1,134.0	2807.37	4211.06	0.00	0.00	2807.37	4211.06
7.72	120	0	806.4	1,209.6	2994.53	4491.80	0.00	0.00	2994.53	4491.80
8.14	120	0	856.8	1,285.2	3181.69	4772.53	0.00	0.00	3181.69	4772.53

Lateral Earth Pressure Calculations

H =	9.27	ft	design height of wall	Traffic Surcharge, LS =	0	psf
β =	26.57	degrees	Equiv. slope of ground above wall			
ℓ =	7.5	ft	spacing between soldier piles			

Top of Wall El.=	705.74	c=	1
Top of Shaft Elev =	698.39		
Lower Grade El =	699.97		
Bottom of Frost El =	696.47		
Total Wall Height, ft=	9.27		
Design Height, ft=	8.27		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.27	3988.7	5983.0	332.4	498.6

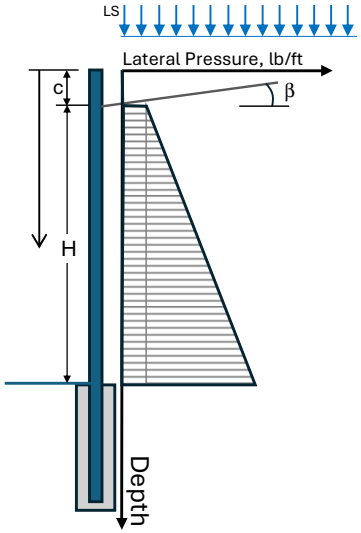
	Service I	**Strength I**	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	26.57	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.536

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$



CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 2A: Sta 200+00.00 - 200+30.00**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.49	120	0	58.4	87.6	234.63	351.94	0.00	0.00	234.63	351.94
1.97	120	0	116.8	175.1	469.26	703.89	0.00	0.00	469.26	703.89
2.46	120	0	175.1	262.7	703.89	1055.83	0.00	0.00	703.89	1055.83
2.95	120	0	233.5	350.3	938.52	1407.77	0.00	0.00	938.52	1407.77
3.43	120	0	291.9	437.8	1173.14	1759.72	0.00	0.00	1173.14	1759.72
3.92	120	0	350.3	525.4	1407.77	2111.66	0.00	0.00	1407.77	2111.66
4.41	120	0	408.6	613.0	1642.40	2463.60	0.00	0.00	1642.40	2463.60
4.89	120	0	467.0	700.5	1877.03	2815.55	0.00	0.00	1877.03	2815.55
5.38	120	0	525.4	788.1	2111.66	3167.49	0.00	0.00	2111.66	3167.49
5.86	120	0	583.8	875.6	2346.29	3519.43	0.00	0.00	2346.29	3519.43
6.35	120	0	642.1	963.2	2580.92	3871.38	0.00	0.00	2580.92	3871.38
6.84	120	0	700.5	1,050.8	2815.55	4223.32	0.00	0.00	2815.55	4223.32
7.32	120	0	758.9	1,138.3	3050.18	4575.26	0.00	0.00	3050.18	4575.26
7.81	120	0	817.3	1,225.9	3284.80	4927.21	0.00	0.00	3284.80	4927.21
8.30	120	0	875.6	1,313.5	3519.43	5279.15	0.00	0.00	3519.43	5279.15
8.78	120	0	934.0	1,401.0	3754.06	5631.09	0.00	0.00	3754.06	5631.09
9.27	120	0	992.4	1,488.6	3988.69	5983.04	0.00	0.00	3988.69	5983.04

Lateral Earth Pressure Calculations

H =	18.74	ft	design height of wall
β =	10.81	degrees	Equiv. slope of ground above wall
β' =	0	degrees	slope of ground below wall
ℓ =	7.5	ft	spacing between soldier piles

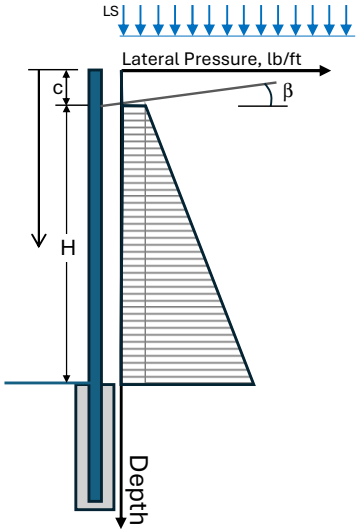
Traffic Surcharge, LS = 0 psf

Top of Wall El.=	714.32	c=	1
Top of Shaft Elev =	696.14		
Lower Grade El =	699.08		
Bottom of Frost El =	695.58		
Total Wall Height, ft=	18.74		
Design Height, ft=	17.74		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
18.74	6030.9	9046.3	502.6	753.9

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	10.81	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.378

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 2: Sta 20+00 - 22+94.21**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.04	120	0	125.2	187.8	354.76	532.13	0.00	0.00	354.76	532.13
3.09	120	0	250.4	375.7	709.51	1064.27	0.00	0.00	709.51	1064.27
4.13	120	0	375.7	563.5	1064.27	1596.40	0.00	0.00	1064.27	1596.40
5.17	120	0	500.9	751.3	1419.02	2128.54	0.00	0.00	1419.02	2128.54
6.22	120	0	626.1	939.2	1773.78	2660.67	0.00	0.00	1773.78	2660.67
7.26	120	0	751.3	1,127.0	2128.54	3192.80	0.00	0.00	2128.54	3192.80
8.30	120	0	876.6	1,314.8	2483.29	3724.94	0.00	0.00	2483.29	3724.94
9.35	120	0	1,001.8	1,502.7	2838.05	4257.07	0.00	0.00	2838.05	4257.07
10.39	120	0	1,127.0	1,690.5	3192.80	4789.20	0.00	0.00	3192.80	4789.20
11.44	120	0	1,252.2	1,878.4	3547.56	5321.34	0.00	0.00	3547.56	5321.34
12.48	120	0	1,377.5	2,066.2	3902.32	5853.47	0.00	0.00	3902.32	5853.47
13.52	120	0	1,502.7	2,254.0	4257.07	6385.61	0.00	0.00	4257.07	6385.61
14.57	120	0	1,627.9	2,441.9	4611.83	6917.74	0.00	0.00	4611.83	6917.74
15.61	120	0	1,753.1	2,629.7	4966.58	7449.87	0.00	0.00	4966.58	7449.87
16.65	120	0	1,878.4	2,817.5	5321.34	7982.01	0.00	0.00	5321.34	7982.01
17.70	120	0	2,003.6	3,005.4	5676.09	8514.14	0.00	0.00	5676.09	8514.14
18.74	120	0	2,128.8	3,193.2	6030.85	9046.28	0.00	0.00	6030.85	9046.28

Lateral Earth Pressure Calculations

H =	19.12	ft	design height of wall
β =	10.81	degrees	Equiv. slope of ground above wall
β' =	0	degrees	slope of ground below wall
ℓ =	7.5	ft	spacing between soldier piles

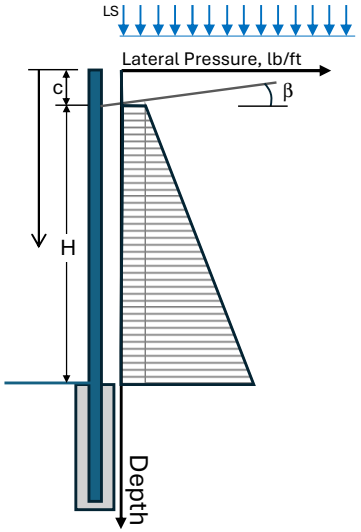
Traffic Surcharge, LS = 0 psf

Top of Wall El.=	713.97	c=	1
Top of Shaft Elev =	694.85		
Lower Grade El =	698.44		
Bottom of Frost El =	694.94		
Total Wall Height, ft=	19.12		
Design Height, ft=	18.12		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
19.12	6160.0	9240.1	513.3	770.0

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH



For Retained Soil (Behind Wall)

ϕ (deg)=	30	
β (deg)=	10.81	
θ =	90	Wall Angle
δ =	0	interface angle

Ka= 0.378

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

CUY-77-11.41: Reconstruction of I-77

Design of **Wall 2: Sta 20+00 - 22+94.21**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Depth	Unfactored Forces Active side		σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	0	0	0.0	0	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
2.07	120	0	127.9	191.9	362.35	543.53	0.00	0.00	362.35	543.53
3.13	120	0	255.8	383.7	724.71	1087.06	0.00	0.00	724.71	1087.06
4.20	120	0	383.7	575.6	1087.06	1630.60	0.00	0.00	1087.06	1630.60
5.26	120	0	511.6	767.4	1449.42	2174.13	0.00	0.00	1449.42	2174.13
6.33	120	0	639.5	959.3	1811.77	2717.66	0.00	0.00	1811.77	2717.66
7.40	120	0	767.4	1,151.2	2174.13	3261.19	0.00	0.00	2174.13	3261.19
8.46	120	0	895.3	1,343.0	2536.48	3804.73	0.00	0.00	2536.48	3804.73
9.53	120	0	1,023.2	1,534.9	2898.84	4348.26	0.00	0.00	2898.84	4348.26
10.59	120	0	1,151.2	1,726.7	3261.19	4891.79	0.00	0.00	3261.19	4891.79
11.66	120	0	1,279.1	1,918.6	3623.55	5435.32	0.00	0.00	3623.55	5435.32
12.72	120	0	1,407.0	2,110.4	3985.90	5978.86	0.00	0.00	3985.90	5978.86
13.79	120	0	1,534.9	2,302.3	4348.26	6522.39	0.00	0.00	4348.26	6522.39
14.86	120	0	1,662.8	2,494.2	4710.61	7065.92	0.00	0.00	4710.61	7065.92
15.92	120	0	1,790.7	2,686.0	5072.97	7609.45	0.00	0.00	5072.97	7609.45
16.99	120	0	1,918.6	2,877.9	5435.32	8152.99	0.00	0.00	5435.32	8152.99
18.05	120	0	2,046.5	3,069.7	5797.68	8696.52	0.00	0.00	5797.68	8696.52
19.12	120	0	2,174.4	3,261.6	6160.03	9240.05	0.00	0.00	6160.03	9240.05

CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 5B: Sta 50+30.82 - 54+66.32**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Lateral Earth Pressure Calculations- with Geofoam

H =	27.46	ft	design height of wall
β =	30.00	degrees	Equiv. slope of ground above wall
β' =	0	degrees	slope of ground below wall
ℓ =	6.5	ft	spacing between soldier piles

Traffic Surcharge, LS = 250 psf

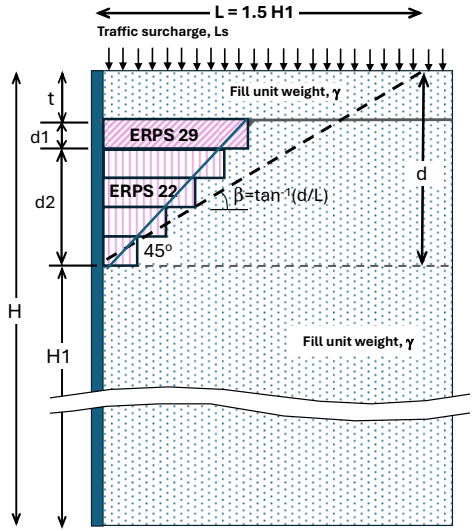
Top of Wall El.=	680.11
Top of Shaft Elev =	652.65
Lower Grade El =	657.33
Bottom of Frost El =	653.83
Height, ft =	27.46
Top of EPS 29 El.=	676.96
Top of EPS 22 El.=	674.96
Bottom of EPS 22 El. =	666.96
t, ft=	**3.15**

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	**Service**	**Strength**	**Service**	**Strength**
0.00	**541.7**	**947.9**	**45.1**	**79.0**
3.15	**1360.7**	**2176.4**	**113.4**	**181.4**
3.15	**0.0**	**0.0**	**0.0**	**0.0**
13.15	**0.0**	**0.0**	**0.0**	**0.0**
13.15	**3131.7**	**4984.7**	**261.0**	**415.4**
27.46	**11503.1**	**17541.7**	**958.6**	**1461.8**

	Thick (ft)	γ_{sps} (pcf)	@ 5% strain qu(psi)	qu(psf)	Equiv. Cohesion, Su (psf) Per layer
EPS 29	2.0	1.80	25	3600	1800
EPS 22	8.0	1.35	16.7	2405	1202
d (ft)=	**13.15**				
H1 (ft)=	**14.31**				

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH
γ_p =	1.0	1.25	active Geofoam



For Soil Under Geofoam

ϕ (deg)=	30	
d (ft)=	13.15	
L =1.5 H1 (ft)=	21.47	
β (deg)=	30.00	$=\tan^{-1}(d/L) < 30$ deg
θ =	90	Wall Angle
δ =	0	interface angle
Ka=	0.750	

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta))}$$

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

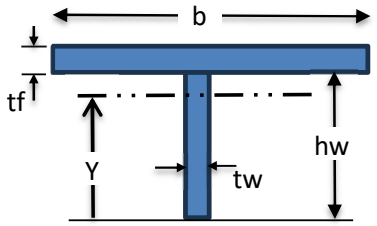
Unfactored Forces

Ref.	Depth ft	Active side γ'_s, lb/ft³	Su psf	ϕ ' (deg)	Ka	σ_v, psf Service	σ_v, psf Factored	EH, lb/ft Service	EH, lb/ft Factored	LS, lb/ft Service	LS, lb/ft Factored	Net Force (lb/ft) Service	Net Force (lb/ft) Factored
Soil (t)	0.0	120	0	30	0.333	0.0	0	0.00	0.00	541.67	947.92	541.67	947.92
Soil (t)	3.15	120	0	30	0.333	378.0	567.0	819.00	1228.50	541.67	947.92	1360.67	2176.42
EPS 29	3.15	1.8	1800	0	1.000	378.0	567.0	0.00	0.00	0.00	0.00	0.00	0.00
EPS 29	5.15	1.8	1800	0	1.000	381.6	571.5	0.00	0.00	0.00	0.00	0.00	0.00
EPS 22	5.15	1.35	1202	0	1.000	381.6	571.5	0.00	0.00	0.00	0.00	0.00	0.00
EPS 22	13.15	1.35	1202	0	1.000	392.4	585.0	0.00	0.00	0.00	0.00	0.00	0.00
Soil	13.15	120	0	30	0.750	392.4	585.0	1912.95	2851.88	1218.75	2132.81	3131.70	4984.69
	14.17	120	0	30	0.750	515.1	769.0	2510.90	3748.81	1218.75	2132.81	3729.65	5881.62
	15.19	120	0	30	0.750	637.7	953.0	3108.86	4645.74	1218.75	2132.81	4327.61	6778.55
	16.22	120	0	30	0.750	760.4	1,137.0	3706.81	5542.67	1218.75	2132.81	4925.56	7675.48
	17.24	120	0	30	0.750	883.0	1,320.9	4304.76	6439.60	1218.75	2132.81	5523.51	8572.41
	18.26	120	0	30	0.750	1,005.7	1,504.9	4902.72	7336.53	1218.75	2132.81	6121.47	9469.34
	19.28	120	0	30	0.750	1,128.3	1,688.9	5500.67	8233.46	1218.75	2132.81	6719.42	10366.27
	20.31	120	0	30	0.750	1,251.0	1,872.9	6098.63	9130.39	1218.75	2132.81	7317.38	11263.20
	21.33	120	0	30	0.750	1,373.7	2,056.9	6696.58	10027.32	1218.75	2132.81	7915.33	12160.13
	22.35	120	0	30	0.750	1,496.3	2,240.9	7294.53	10924.25	1218.75	2132.81	8513.28	13057.06
	23.37	120	0	30	0.750	1,619.0	2,424.9	7892.49	11821.18	1218.75	2132.81	9111.24	13953.99
	24.39	120	0	30	0.750	1,741.6	2,608.8	8490.44	12718.11	1218.75	2132.81	9709.19	14850.92
	25.42	120	0	30	0.750	1,864.3	2,792.8	9088.39	13615.04	1218.75	2132.81	10307.14	15747.85
	26.44	120	0	30	0.750	1,986.9	2,976.8	9686.35	14511.97	1218.75	2132.81	10905.10	16644.78
	27.46	120	0	30	0.750	2,109.6	3,160.8	10284.30	15408.90	1218.75	2132.81	11503.05	17541.71

Pile/ Shaft Sections

Section	Depth (ft) From	To	Type
1	0	3.0	T-Section (see below)
2	3	27.46	W36x194 (or other sections for case without geofoam)
3	27.46	End*	48 inch drilled shaft with Steel section (core)

	T-section	from HP36x256
b, in=	12.20	
hw, in=	5.00	
Web thickness, tw, in=	0.961	
Flang thickness, tf, in=	1.370	
A, in2=	**21.519**	=Aw+Af
Ix, in4=	**50.48375**	For T-section
Sx, in3=	**10.150**	
De, in=	**5.663**	
Factored Mom. Resist., Mr=	**507.495**	k.in = **42.3** k.ft



$$Yc = \frac{A_f y_f + A_w y_w}{A_f y_f + A_w y_w}$$

$$I_X = \sum I_{ci} + A_i d_i^2$$

$$I_X = (I_{c_f} + Af\ df^2) + (I_{w_f} + Aw\ dw^2)$$

$$S_x = \frac{I_x}{Y} \qquad Z_x \simeq 1.12\ S_x$$

Equiv. Diameter, De (Based on Ix):

$$D_e = \left(\frac{64\ I_x}{\pi}\right)^{1/4}$$

Web Area, Aw, in2=	4.805	
Single Flange Area, Af, in2=	16.714	
yw=	2.50	center of web from bottom of T
yf=	5.69	center of flange from bottom of T
Y, in=	4.97	Y = (yw.Aw+yf.Af)/(Aw+Af)
Ix_w, in4=	10.01	Ix_w= tw.hw^3/11
Ix_f, in4=	2.61	Ix_f= b.tf^3/12
dw, in=	2.47	dw = ABS(Y-yw)
df, in =	0.71	df = ABS(Y-yf)

Lateral Earth Pressure Calculations

H =	18.31	ft	design height of wall
β =	0.00	degrees	Equiv. slope of ground above wall
β' =	0	degrees	slope of ground below wall
ℓ =	6.5	ft	spacing between soldier piles

Traffic Surcharge, LS = 250 psf

Top of Wall El.=	682.14	c=	0
Top of Shaft Elev =	663.83		
Lower Grade El =	668.52		
Bottom of Frost El =	665.02		
Height, ft =	18.31		

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	541.7	947.9	45.1	79.0
18.31	5302.3	5848.5	441.9	487.4

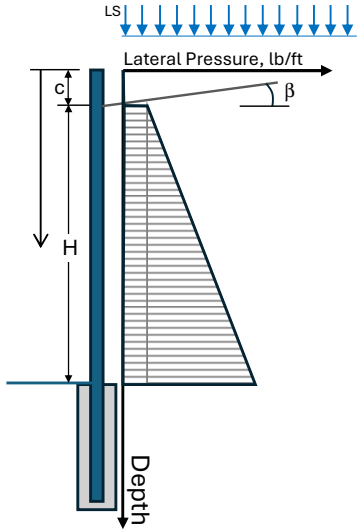
	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH

For Soil Under Geofoam

ϕ (deg)=	30	
β (deg)=	0.00	
θ =	90	Wall Angle
δ =	0	interface angle

$$K_a = tan^2\left(45 - \frac{\varphi}{2}\right)$$

Ka= 0.333



Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

Unfactored Forces

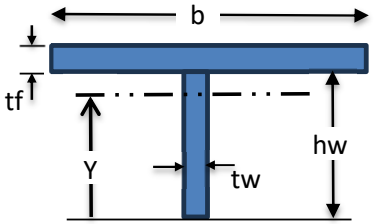
Depth	Active side				σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
ft	γ'_s, lb/ft³	Su psf	ϕ' (deg)	Ka	Service	Factored	Service	Factored	Service	Factored	Service	Factored
0.0	120	0	30	0.333	0.0	0	0.00	0.00	541.67	947.92	541.67	947.92
0.00	120	0	30	0.333	0.0	0.0	0.00	0.00	541.67	947.92	541.67	947.92
1.08	120	0	30	0.333	129.2	193.9	280.04	420.05	541.67	947.92	821.70	1367.97
2.15	120	0	30	0.333	258.5	323.1	560.07	700.09	541.67	947.92	1101.74	1648.00
3.23	120	0	30	0.333	387.7	452.4	840.11	980.12	541.67	947.92	1381.77	1928.04
4.31	120	0	30	0.333	517.0	581.6	1120.14	1260.16	541.67	947.92	1661.81	2208.08
5.39	120	0	30	0.333	646.2	710.9	1400.18	1540.19	541.67	947.92	1941.84	2488.11
6.46	120	0	30	0.333	775.5	840.1	1680.21	1820.23	541.67	947.92	2221.88	2768.15
7.54	120	0	30	0.333	904.7	969.4	1960.25	2100.26	541.67	947.92	2501.91	3048.18
8.62	120	0	30	0.333	1,034.0	1,098.6	2240.28	2380.30	541.67	947.92	2781.95	3328.22
9.69	120	0	30	0.333	1,163.2	1,227.8	2520.32	2660.34	541.67	947.92	3061.98	3608.25
10.77	120	0	30	0.333	1,292.5	1,357.1	2800.35	2940.37	541.67	947.92	3342.02	3888.29
11.85	120	0	30	0.333	1,421.7	1,486.3	3080.39	3220.41	541.67	947.92	3622.05	4168.32
12.92	120	0	30	0.333	1,551.0	1,615.6	3360.42	3500.44	541.67	947.92	3902.09	4448.36
14.00	120	0	30	0.333	1,680.2	1,744.8	3640.46	3780.48	541.67	947.92	4182.13	4728.39
15.08	120	0	30	0.333	1,809.5	1,874.1	3920.49	4060.51	541.67	947.92	4462.16	5008.43
16.16	120	0	30	0.333	1,938.7	2,003.3	4200.53	4340.55	541.67	947.92	4742.20	5288.46
17.23	120	0	30	0.333	2,068.0	2,132.6	4480.56	4620.58	541.67	947.92	5022.23	5568.50
18.31	120	0	30	0.333	2,197.2	2,261.8	4760.60	4900.62	541.67	947.92	5302.27	5848.53

Pile/ Shaft Sections

Section	Depth (ft) From	To	Type
1	0	3.0	T-Section (see below)
2	3	27.46	W36x194 (or other sections for case without geofoam)
3	27.46	End*	48 inch drilled shaft with Steel section (core)

T-section from HP36x256

b, in=	12.20
hw, in=	5.00
Web thickness, tw, in=	0.961
Flang thickness, tf, in=	1.370
A, in2=	**21.519** =Aw+Af
Ix, in4=	**50.48375** For T-section
Sx, in3=	**10.150**
De, in=	**5.663**
Factored Mom. Resist., Mr=	**507.495** k.in = **42.3** k.ft



$$Yc = \frac{A_f y_f + A_w y_w}{A_f y_f + A_w y_w}$$

$$I_X = \sum I_{ci} + A_i d_i^2$$

$$I_X = (I_{c_f} + Af\ df^2) + (I_{w_f} + Aw\ dw^2)$$

$$S_x = \frac{I_x}{Y} \qquad Z_x \simeq 1.12\ S_x$$

Equiv. Diameter, De (Based on Ix):

$$D_e = \left(\frac{64\ I_x}{\pi}\right)^{1/4}$$

Web Area, Aw, in2=	4.805	
Single Flange Area, Af, in2=	16.714	
yw=	2.50	center of web from bottom of T
yf=	5.69	center of flange from bottom of T
Y, in=	4.97	Y = (yw.Aw+yf.Af)/(Aw+Af)
Ix_w, in4=	10.01	Ix_w= tw.hw^3/11
Ix_f, in4=	2.61	Ix_f= b.tf^3/12
dw, in=	2.47	dw = ABS(Y-yw)
df, in =	0.71	df = ABS(Y-yf)

CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 7: Sta 70+00.00 - 70+59.29**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Lateral Earth Pressure Calculations- with Geofoam

H =	26.23	ft	design height of wall
β =	30.00	degrees	Equiv. slope of ground above wall
β' =	0	degrees	slope of ground below wall
ℓ =	6.75	ft	spacing between soldier piles

Traffic Surcharge, LS = 250 psf

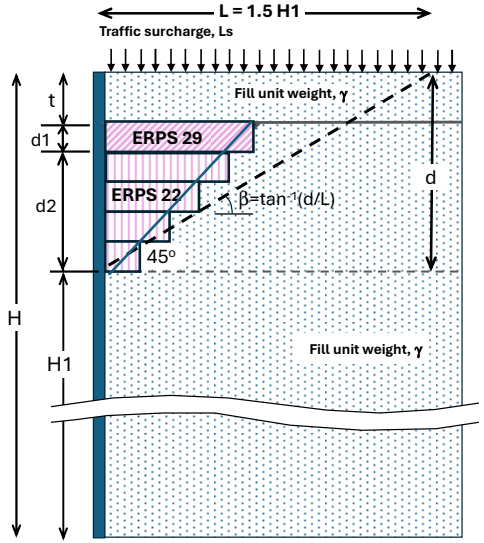
Top of Wall El.=	678.93
Top of Shaft Elev =	652.7
Lower Grade El =	656.28
Bottom of Frost El =	652.78
Height, ft =	26.23
Top of EPS 29 El.=	675.78
Top of EPS 22 El.=	673.78
Bottom of EPS 22 El. =	665.78
t, ft=	**3.15**

Lateral Pressures used for LPile:

	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	562.5	984.4	46.9	82.0
3.15	1413.0	2260.1	117.7	188.3
3.15	0.0	0.0	0.0	0.0
13.15	0.0	0.0	0.0	0.0
13.15	3252.1	5176.4	271.0	431.4
26.23	11198.2	17095.6	933.2	1424.6

	Thick (ft)	γ_{sps} (pcf)	@ 5% strain qu(psi)	qu(psf)	Equiv. Cohesion, Su (psf) Per layer
EPS 29	2.0	1.80	25	3600	1800
EPS 22	8.0	1.35	16.7	2405	1202
d (ft)=	**13.15**				
H1 (ft)=	**13.08**				

	Service I	Strength I	Load factors for:
γ =	1.0	1.75	LS and LL
γ_p =	1.0	1.50	active EH
γ_p =	1.0	1.25	active Geofoam



For Soil Under Geofoam

ϕ (deg)=	30	
d (ft)=	13.15	
L =1.5 H1 (ft)	19.62	
β (deg)=	30.00	$=\tan^{-1}(d/L) < 30$ deg
θ =	90	Wall Angle
δ =	0	interface angle
Ka=	0.750	

$$K_a = \frac{sin^2(\theta+\varphi)}{\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 (sin^2\theta\, sin(\theta-\delta$$

CUY-77-11.41: Reconstruction of I-77

Design of: **Wall 7: Sta 70+00.00 - 70+59.29**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Loads, Shear, Moment

Lateral Pressures Distriibutions within Wall Height

		Unfactored Forces Active side				σ_v, psf		EH, lb/ft		LS, lb/ft		Net Force (lb/ft)	
Ref.	Depth ft	γ'_s, lb/ft^3	Su psf	ϕ ' (deg)	Ka	Service	Factored	Service	Factored	Service	Factored	Service	Factored
Soil (t)	0.0	120	0	30	0.333	0.0	0	0.00	0.00	562.50	984.38	562.50	984.38
Soil (t)	3.15	120	0	30	0.333	378.0	567.0	850.50	1275.75	562.50	984.38	1413.00	2260.12
EPS 29	3.15	1.8	1800	0	1.000	378.0	567.0	0.00	0.00	0.00	0.00	0.00	0.00
EPS 29	5.15	1.8	1800	0	1.000	381.6	571.5	0.00	0.00	0.00	0.00	0.00	0.00
EPS 22	5.15	1.35	1202	0	1.000	381.6	571.5	0.00	0.00	0.00	0.00	0.00	0.00
EPS 22	13.15	1.35	1202	0	1.000	392.4	585.0	0.00	0.00	0.00	0.00	0.00	0.00
Soil	13.15	120	0	30	0.750	392.4	585.0	1986.52	2961.56	1265.63	2214.84	3252.15	5176.41
	14.08	120	0	30	0.750	504.5	753.2	2554.10	3812.93	1265.63	2214.84	3819.73	6027.77
	15.02	120	0	30	0.750	616.6	921.3	3121.68	4664.30	1265.63	2214.84	4387.31	6879.14
	15.95	120	0	30	0.750	728.7	1,089.5	3689.26	5515.67	1265.63	2214.84	4954.89	7730.51
	16.89	120	0	30	0.750	840.9	1,257.7	4256.84	6367.03	1265.63	2214.84	5522.46	8581.88
	17.82	120	0	30	0.750	953.0	1,425.9	4824.42	7218.40	1265.63	2214.84	6090.04	9433.25
	18.76	120	0	30	0.750	1,065.1	1,594.0	5392.00	8069.77	1265.63	2214.84	6657.62	10284.61
	19.69	120	0	30	0.750	1,177.2	1,762.2	5959.57	8921.14	1265.63	2214.84	7225.20	11135.98
	20.62	120	0	30	0.750	1,289.3	1,930.4	6527.15	9772.51	1265.63	2214.84	7792.78	11987.35
	21.56	120	0	30	0.750	1,401.4	2,098.5	7094.73	10623.87	1265.63	2214.84	8360.36	12838.72
	22.49	120	0	30	0.750	1,513.5	2,266.7	7662.31	11475.24	1265.63	2214.84	8927.94	13690.08
	23.43	120	0	30	0.750	1,625.7	2,434.9	8229.89	12326.61	1265.63	2214.84	9495.51	14541.45
	24.36	120	0	30	0.750	1,737.8	2,603.1	8797.47	13177.98	1265.63	2214.84	10063.09	15392.82
	25.30	120	0	30	0.750	1,849.9	2,771.2	9365.05	14029.34	1265.63	2214.84	10630.67	16244.19
	26.23	120	0	30	0.750	1,962.0	2,939.4	9932.62	14880.71	1265.63	2214.84	11198.25	17095.56

Concrete Segment within upper 3.25 ft of the wall

Height of section, ho(ft)= 3.25 Upper 3.25 ft of wall

Depth, t(ft)= 1.4

Depth, t(in)= 16.8

Width, b (ft)= 3.25 = Min of section height (ho) and Spacing

Width, b (in)= 39

Area (ft2)= 4.55

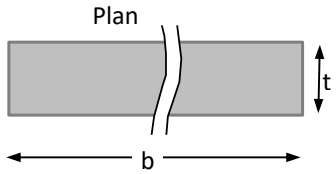
Area (in2)= 655.2

Mom. Of Inertia, I (ft4)= 0.530833

Mom. Of Inertia, I (in4)= 11007.4

Young's Modulus, E (ksi)= 3987

Young's Modulus, E (ksf)= 574128.0



APPENDIX F
L-PILE ANALYSES FOR SOLDIER PILES DRILLED SHAFTS

CUY-77-11.41: Reconstruction of I-77

Subject: **Summary of Lpile Results**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Wall	Wall Station		Height (ft)		Beam Section	Spacing, S (ft)	Shaft Dia, B (in)	S/B	Pm	Shaft Embed. (ft)	Deflection (in)		Max. Shear (K)	Max. Moment		Moment, k.ft at 3.0ft	Boring
	From	To	Retained	Total							Tolerance	LPile		(K.in)	(K.ft)		
1A	0+24.76	0+91	8.27	9.27	W16X36	7.50	24.00	3.75	1.000	20	1.11	1.00	28.97	1875.72	156.31	-	B-041-0-20
	0+98.5	1+51	9.87	10.87	W21x48	7.50	30.00	3.00	0.930	20	1.30	0.97	37.55	2946.15	245.51	-	B-041-0-20
	1+58.5	2+11	11.92	12.92	W21x73	7.50	30.00	3.00	0.930	21	1.55	1.47	54.13	4849.13	404.09	-	B-041-0-20
	2+18.5	3+01	14.11	15.11	W24X94	7.50	36.00	2.50	0.874	21	1.81	1.35	84.18	7367.52	613.96	-	B-042-0-20
	3+08.5	3+61	17.51	18.51	W24X162	7.50	42.00	2.14	0.829	22	2.22	1.66	137.42	12545.07	1045.42	-	B-042-0-20
	3+61	4+21	18.04	19.04	W24X162	7.50	42.00	2.14	0.829	23	2.28	1.88	140.11	13148.75	1095.73	-	B-042-0-20
	4+28.08	4+61.42	19.47	20.47	W24X162	6.67	42.00	1.91	0.797	24	2.46	2.18	138.41	14026.48	1168.87	-	B-042-0-20
	4+68.5	5+21	21.56	22.56	W33x169	7.50	42.00	2.14	0.829	26	2.71	2.38	167.53	18508.21	1542.35	-	B-042-0-20
												2.3	110.15	15654.76	1304.56	-	B-001-0-02
1B	10+00	10+75.65	21.65	22.65	W30X211	6.58	42.00	1.88	0.793	35	2.72	2.43	122.72	18537.59	1544.80	-	B-043-0-20
												1.80	99.80	14693.79	1224.48		B-001-0-02
1C	100+00	103+23.66	20.48	21.48	W30X211	6.50	42.00	1.86	0.790	35	2.58	1.72	93.98	14599.62	1216.64		N-001-S-01
	103+23.66	103+56.91	19.90	20.90		7.50	42.00	2.14	0.829		2.51	2.43	120.4	17991.14	1499.26	-	B-044-0-20
1D	1000+00	1000+23.29	17.46	18.46	W27x129	6.50	36.00	2.17	0.832	27	2.22	2.02	90.96	10495.17	874.60	-	B-048-0-20
	1000+23.29	1000+37.04	16.76	17.76	W27x114	6.50	36.00	2.17	0.832	27	2.13	1.96	87.4	9741.26	811.77		B-048-0-20
	1000+37.04	1000+57.58	16.17	17.17	W27x114	6.75	36.00	2.25	0.843	26	2.06	1.81	83.58	9324.66	777.06	-	B-048-0-20
	1000+65.08	1002+07.58	15.03	16.03	W27x114	7.50	36.00	2.50	0.874	27	1.92	1.7	70.37	8426.44	702.20	-	B-049-0-20
	1002+15.08	1002+97.58	9.39	10.39	W21x93	7.50	30.00	3.00	0.930	16	1.25	0.28	30.03	2147.86	178.99	-	B-050-0-20
	1003+05.08	1003+87.58	8.90	9.90	W16x45	7.50	24.00	3.75	1.000	15	1.19	0.81	34.3	2089.46	174.12	-	B-050-0-20
	1003+95.08	1005+07.58	8.32	9.32	W16x45	7.50	24.00	3.75	1.000	14	1.12	0.51	25.91	1565.51	130.46	-	B-050-0-20
	1005+15.08	1009+23.83	7.14	8.14	W16x36	7.50	24.00	3.75	1.000	12	0.98	0.31	20.75	1077.22	89.77	-	B-051-0-20
2	20+00.00	22+40	17.74	18.74	W33X169	7.50	48.00	1.88	0.793	27	2.25	1.30	120.35	12590.83	1049.2	-	B-046-0-20
	22+40	22+94.21	18.12	19.12	W33X169	7.5	48	1.875	0.793	27	2.29	1.22	102.29	11557.61	963.13		N-003-N-01
2A	200+00.00	200+30.00	8.27	9.27	W21X48	7.50	30.00	3.00	0.930	20	1.11	0.49	24.12	1820.21	151.7	-	B-002-0-02
5B	50+30.82	54+66.32	26.46	27.46	W36x256	6.50	48.00	1.63	0.755	40	3.30	3.00	164.77	25894.76	2157.9	73.43	B-026-0-18
												3.24	178.32	30651.22	2554.3	73.43	B-070-0-20
5C	60+00.00	60+26.00	17.31	18.31	W36x194	6.50	48.00	1.63	0.755	35	2.20	1.29	62.11	10086.70	840.6	66.22	B-006-0-12
7	70+00.00	70+59.29	25.23	26.23	W36x256	6.75	48.00	1.69	0.765	35	3.15	2.89	161.65	26359.373	2196.6	75.2	B-071-0-20

CUY-77-11.41: Reconstruction of I-77

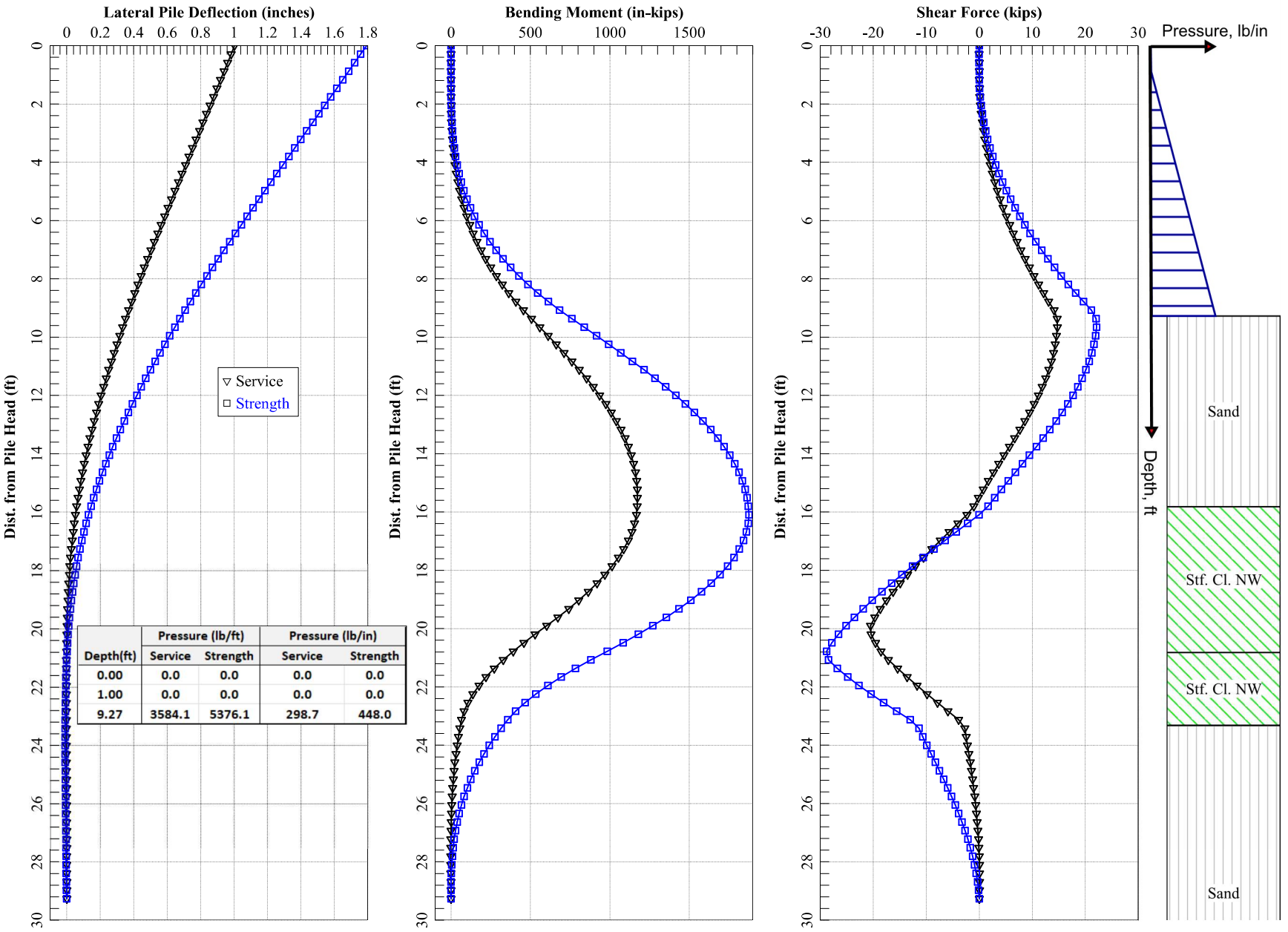
Subject: **Summary of Lpile Results**

Designer: DA Date 6/9/26

Checker: RLT Date 6/9/26

Wall	Wall Station		Height (ft)		Beam Section	Spacing, S (ft)	Shaft Dia, B (in)	S/B	Pm	Shaft Embed. (ft)	Deflection (in)		Max. Shear (K)	Max. Moment		Moment, k.ft at 3.0ft	Boring
	From	To	Retained	Total							Tolerance	LPile		(K.in)	(K.ft)		
1A	0+24.76	0+91	8.27	9.27	W16X36	7.50	24.00	3.75	1.000	20	1.11	1.00	28.97	1875.72	156.31	-	B-041-0-20
	0+98.5	1+51	9.87	10.87	W21x48	7.50	30.00	3.00	0.930	20	1.30	0.97	37.55	2946.15	245.51	-	B-041-0-20
	1+58.5	2+11	11.92	12.92	W21x73	7.50	30.00	3.00	0.930	21	1.55	1.47	54.13	4849.13	404.09	-	B-041-0-20
	2+18.5	3+01	14.11	15.11	W24X94	7.50	36.00	2.50	0.874	21	1.81	1.35	84.18	7367.52	613.96	-	B-042-0-20
	3+08.5	3+61	17.51	18.51	W24X162	7.50	42.00	2.14	0.829	22	2.22	1.66	137.42	12545.07	1045.42	-	B-042-0-20
	3+61	4+21	18.04	19.04	W24X162	7.50	42.00	2.14	0.829	23	2.28	1.88	140.11	13148.75	1095.73	-	B-042-0-20
	4+28.08	4+61.42	19.47	20.47	W24X162	6.67	42.00	1.91	0.797	24	2.46	2.18	138.41	14026.48	1168.87	-	B-042-0-20
	4+68.5	5+21	21.56	22.56	W33x169	7.50	42.00	2.14	0.829	26	2.71	2.38	167.53	18508.21	1542.35	-	B-042-0-20
												2.3	110.15	15654.76	1304.56	-	B-001-0-02
1B	10+00	10+75.65	21.65	22.65	W30X211	6.58	42.00	1.88	0.793	35	2.72	2.43	122.72	18537.59	1544.80	-	B-043-0-20
												1.80	99.80	14693.79	1224.48		B-001-0-02
1C	100+00	103+23.66	20.48	21.48	W30X211	6.50	42.00	1.86	0.790	35	2.58	1.72	93.98	14599.62	1216.64		N-001-S-01
	103+23.66	103+56.91	19.90	20.90		7.50	42.00	2.14	0.829		2.51	2.43	120.4	17991.14	1499.26	-	B-044-0-20
1D	1000+00	1000+23.29	17.46	18.46	W27x129	6.50	36.00	2.17	0.832	27	2.22	2.02	90.96	10495.17	874.60	-	B-048-0-20
	1000+23.29	1000+37.04	16.76	17.76	W27x114	6.50	36.00	2.17	0.832	27	2.13	1.96	87.4	9741.26	811.77		B-048-0-20
	1000+37.04	1000+57.58	16.17	17.17	W27x114	6.75	36.00	2.25	0.843	26	2.06	1.81	83.58	9324.66	777.06	-	B-048-0-20
	1000+65.08	1002+07.58	15.03	16.03	W27x114	7.50	36.00	2.50	0.874	27	1.92	1.7	70.37	8426.44	702.20	-	B-049-0-20
	1002+15.08	1002+97.58	9.39	10.39	W21x93	7.50	30.00	3.00	0.930	16	1.25	0.28	30.03	2147.86	178.99	-	B-050-0-20
	1003+05.08	1003+87.58	8.90	9.90	W16x45	7.50	24.00	3.75	1.000	15	1.19	0.81	34.3	2089.46	174.12	-	B-050-0-20
	1003+95.08	1005+07.58	8.32	9.32	W16x45	7.50	24.00	3.75	1.000	14	1.12	0.51	25.91	1565.51	130.46	-	B-050-0-20
	1005+15.08	1009+23.83	7.14	8.14	W16x36	7.50	24.00	3.75	1.000	12	0.98	0.31	20.75	1077.22	89.77	-	B-051-0-20
2	20+00.00	22+40	17.74	18.74	W33X169	7.50	48.00	1.88	0.793	27	2.25	1.30	120.35	12590.83	1049.2	-	B-046-0-20
	22+40	22+94.21	18.12	19.12	W33X169	7.5	48	1.875	0.793	27	2.29	1.22	102.29	11557.61	963.13		N-003-N-01
2A	200+00.00	200+30.00	8.27	9.27	W21X48	7.50	30.00	3.00	0.930	20	1.11	0.49	24.12	1820.21	151.7	-	B-002-0-02
5B	50+30.82	54+66.32	26.46	27.46	W36x256	6.50	48.00	1.63	0.755	40	3.30	3.00	164.77	25894.76	2157.9	73.43	B-026-0-18
												3.24	178.32	30651.22	2554.3	73.43	B-070-0-20
5C	60+00.00	60+26.00	17.31	18.31	W36x194	6.50	48.00	1.63	0.755	35	2.20	1.29	62.11	10086.70	840.6	66.22	B-006-0-12
7	70+00.00	70+59.29	25.23	26.23	W36x256	6.75	48.00	1.69	0.765	35	3.15	2.89	161.65	26359.373	2196.6	75.2	B-071-0-20

Wall 1A (9.27ft)



	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.27	3584.1	5376.1	298.7	448.0

```
================================================================================

                    LPile for Windows, Version 2022-12.005

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\0000 TRC projects\CUY-77-1141\App E LPile 04-05- 2026\Wall 1A\

Name of input data file:
01 Wall_1A-9.27ft_B-041.lp12d

Name of output report file:
01 Wall_1A-9.27ft_B-041.lp12o

Name of plot output file:
01 Wall_1A-9.27ft_B-041.lp12p

Name of runtime message file:
01 Wall_1A-9.27ft_B-041.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  April 6, 2026              Time:  14:48:10
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=9.27FT) Boring B-041-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 29.270 ft
Depth of ground surface below top of pile = 9.2700 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	6.9900
2	9.270	6.9900
3	9.270	24.0000
4	29.270	24.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 9.270000 ft
AISC Section Type = W

AISC Section Name = W16X36

Pile width = 6.990000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 20.000000 ft
Section Diameter = 24.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W16X36

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     9.270000 ft
   Distance from top of pile to bottom of layer        =    15.810000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    34.000000 deg.
   Friction angle at bottom of layer                   =    34.000000 deg.
   Subgrade k at top of layer                          =   125.000000 pci
   Subgrade k at bottom of layer                       =   125.000000 pci


Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer           =    15.810000 ft
   Distance from top of pile to bottom of layer        =    20.810000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2500. psf
   Undrained cohesion at bottom of layer               =        2500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    20.810000 ft
   Distance from top of pile to bottom of layer        =    23.310000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        4000. psf
   Undrained cohesion at bottom of layer               =        4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


Layer 4 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    23.310000 ft
   Distance from top of pile to bottom of layer        =    34.810000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

```
   Friction angle at top of layer                    =    34.000000 deg.
   Friction angle at bottom of layer                 =    34.000000 deg.
   Subgrade k at top of layer                        =   125.000000 pci
   Subgrade k at bottom of layer                     =   125.000000 pci


 (Depth of the lowest soil layer extends 5.540 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	9.2700	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	15.8100	62.6000	--	34.0000	--	125.0000
2	Stiff Clay	15.8100	57.6000	2500.	--	0.00500	--
	w/o Free Water	20.8100	57.6000	2500.	--	0.00500	--
3	Stiff Clay	20.8100	62.6000	4000.	--	0.00400	--
	w/o Free Water	23.3100	62.6000	4000.	--	0.00400	--
4	Sand	23.3100	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	34.8100	62.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	9.270	1.0000	1.0000
2	30.000	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.270	298.700

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.270	448.000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	9.270000 ft
Flange Width	=	6.990000 in
Section Depth	=	15.900000 in
Flange Thickness	=	0.430000 in
Web Thickness	=	0.295000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	10.600000 sq. in.
Moment of Inertia	=	448.000000 in^4
Elastic Bending Stiffness	=	12992000. kip-in^2
Plastic Modulus, Z	=	64.000000in^3
Plastic Moment Capacity = Fy Z	=	3200.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	530.000 kips
Nominal Axial Tensile Capacity	=	-530.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00001048	134.6248988	12842265.	7.9500000	2.3926771	
0.00002097	269.2497976	12842265.	7.9500000	4.7853541	
0.00003145	403.8746964	12842265.	7.9500000	7.1780312	
0.00004193	538.4995952	12842265.	7.9500000	9.5707083	

0.00005241	673.1244941	12842265.	7.9500000	11.9633853	
0.00006290	807.7493929	12842265.	7.9500000	14.3560624	
0.00007338	942.3742917	12842265.	7.9500000	16.7487395	
0.00008386	1077.	12842265.	7.9500000	19.1414166	
0.00009435	1212.	12842265.	7.9500000	21.5340936	
0.0001048	1346.	12842265.	7.9500000	23.9267707	
0.0001153	1481.	12842265.	7.9500000	26.3194478	
0.0001258	1615.	12842265.	7.9500000	28.7121248	
0.0001363	1750.	12842265.	7.9500000	31.1048019	
0.0001468	1885.	12842265.	7.9500000	33.4974790	
0.0001572	2019.	12842265.	7.9500000	35.8901560	
0.0001677	2154.	12842265.	7.9500000	38.2828331	
0.0001782	2289.	12842265.	7.9500000	40.6755102	
0.0001887	2423.	12842265.	7.9500000	43.0681872	
0.0001992	2558.	12842265.	7.9500000	45.4608643	
0.0002097	2692.	12842265.	7.9500000	47.8535414	
0.0002201	2823.	12822698.	7.9500000	50.0000000	Y
0.0002306	2882.	12498264.	7.9500000	50.0000000	Y
0.0002411	2906.	12051812.	7.9500000	50.0000000	Y
0.0002516	2926.	11631208.	7.9500000	50.0000000	Y
0.0002621	2944.	11235221.	7.9500000	50.0000000	Y
0.0002726	2960.	10861868.	7.9500000	50.0000000	Y
0.0002830	2975.	10510181.	7.9500000	50.0000000	Y
0.0002935	2988.	10178301.	7.9500000	50.0000000	Y
0.0003040	2999.	9865275.	7.9500000	50.0000000	Y
0.0003145	3010.	9569543.	7.9500000	50.0000000	Y
0.0003250	3019.	9289604.	7.9500000	50.0000000	Y
0.0003355	3027.	9024653.	7.9500000	50.0000000	Y
0.0003459	3035.	8773603.	7.9500000	50.0000000	Y
0.0003564	3042.	8535478.	7.9500000	50.0000000	Y
0.0003669	3049.	8309288.	7.9500000	50.0000000	Y
0.0003774	3055.	8094109.	7.9500000	50.0000000	Y
0.0003879	3060.	7889392.	7.9500000	50.0000000	Y
0.0003984	3065.	7694489.	7.9500000	50.0000000	Y
0.0004088	3070.	7508760.	7.9500000	50.0000000	Y
0.0004298	3078.	7161693.	7.9500000	50.0000000	Y
0.0004508	3085.	6844498.	7.9500000	50.0000000	Y
0.0004717	3092.	6553548.	7.9500000	50.0000000	Y
0.0004927	3097.	6285777.	7.9500000	50.0000000	Y
0.0005137	3102.	6038597.	7.9500000	50.0000000	Y
0.0005346	3106.	5809804.	7.9500000	50.0000000	Y
0.0005556	3110.	5597482.	7.9500000	50.0000000	Y
0.0005766	3113.	5399674.	7.9500000	50.0000000	Y
0.0005975	3116.	5215277.	7.9500000	50.0000000	Y
0.0006185	3119.	5043016.	7.9500000	50.0000000	Y
0.0006395	3121.	4881399.	7.9500000	50.0000000	Y
0.0006604	3124.	4729915.	7.9500000	50.0000000	Y
0.0006814	3126.	4587265.	7.9500000	50.0000000	Y
0.0007024	3128.	4453067.	7.9500000	50.0000000	Y
0.0007233	3129.	4326233.	7.9500000	50.0000000	Y
0.0007443	3131.	4206544.	7.9500000	50.0000000	Y
0.0007653	3132.	4093085.	7.9500000	50.0000000	Y
0.0007862	3134.	3985611.	7.9500000	50.0000000	Y

```
    0.0008072         3135.      3883660.     7.9500000    50.0000000  Y
    0.0008282         3136.      3786612.     7.9500000    50.0000000  Y
    0.0008491         3137.      3694358.     7.9500000    50.0000000  Y
    0.0008701         3138.      3606517.     7.9500000    50.0000000  Y
    0.0008911         3139.      3522588.     7.9500000    50.0000000  Y
    0.0009120         3140.      3442518.     7.9500000    50.0000000  Y
    0.0009330         3140.      3366047.     7.9500000    50.0000000  Y
    0.0009539         3141.      3292832.     7.9500000    50.0000000  Y
    0.0009749         3142.      3222673.     7.9500000    50.0000000  Y
    0.0009959         3142.      3155468.     7.9500000    50.0000000  Y
    0.0010168         3143.      3091035.     7.9500000    50.0000000  Y
    0.0010378         3144.      3029168.     7.9500000    50.0000000  Y
    0.0010588         3144.      2969637.     7.9500000    50.0000000  Y
    0.0010797         3145.      2912418.     7.9500000    50.0000000  Y
    0.0011007         3145.      2857379.     7.9500000    50.0000000  Y


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
--------------------------------------------------------------------------------

                                          Nominal
Load              Axial                   Moment
 No.             Thrust                  Capacity
                  kips                    in-kips
----         ----------------          ----------------
  1               0.00000000                   3145.

Note that the values in the above table are not factored by a strength
reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the
LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to the LRFD structural
design standard being followed.



Pile Section No. 2:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:
--------------------------------------------------------------------------------

Length of Section                                =    20.000000 ft
Outside Diameter of Casing                       =    24.000000 in
Casing Wall Thickness                            =       0.0000 in
Moment of Inertia of Steel Casing                =       0.0000 in^4
Width Flange of Core/Insert                      =     6.990000 in
Depth of Core/Insert                             =    15.900000 in
```

```
Flange Thickness of Core/Insert                        =     0.430000 in
Web Thickness of Core/Insert                           =     0.295000 in
Moment of Inertia of Steel Core/Insert                 =   448.000000 in^4
Yield Stress of Casing                                 =       50000. psi
Elastic Modulus of Casing                              =    29000000. psi
Yield Stress of Core/Insert                            =       50000. psi
Elastic Modulus of Core/Insert                         =    29000000. psi
Number of Reinforcing Bars                             =            0 bars
Gross Area of Pile                                     =   452.389342 sq. in.
Area of Concrete                                       =   441.941142 sq. in.
Cross-sectional Area of Steel Casing                   =      0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert              =    10.600000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)      =    10.448200 sq. in.
Area Ratio of All Steel to Gross Area                  =         2.31 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As    =     2407.605 kips
Tensile Load for Cracking of Concrete                  =     -240.075 kips
Nominal Axial Tensile Capacity                         =     -530.000 kips



Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1               0.000

Definition of Run Messages:

   Y = part of pipe section has yielded.


Axial Thrust Force =      0.000 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing     Max Core   Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in          in/in         in/in          ksi           ksi          ksi           ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00001048   275.9710714     26325692.     7.0897524    0.00007432     -0.000177     0.3404498       0.00000       0.00000     -3.936949 C
   0.00002097   550.3541401     26249950.     7.1089178     0.0001490     -0.000354     0.6706698       0.00000       0.00000     -7.862246 C
   0.00003145   823.1104857     26172977.     7.1284444     0.0002242     -0.000531     0.9905093       0.00000       0.00000    -11.775560 C
   0.00004193         1094.     26094728.     7.1483464     0.0002997     -0.000707     1.2998110       0.00000       0.00000    -15.676546 C
   0.00005241         1364.     26015156.     7.1686389     0.0003757     -0.000882     1.5984112       0.00000       0.00000    -19.564837 C
   0.00006290         1631.     25934212.     7.1893379     0.0004522     -0.001057     1.8861389       0.00000       0.00000    -23.440049 C
   0.00007338         1897.     25851842.     7.2104604     0.0005291     -0.001232     2.1628155       0.00000       0.00000    -27.301774 C
   0.00008386         2161.     25767990.     7.2320244     0.0006065     -0.001406     2.4282540       0.00000       0.00000    -31.149583 C
```

0.00009435	2423.	25682597.	7.2540491	0.0006844	-0.001580	2.6822587	0.00000	0.00000	-34.983020 C
0.0001048	2683.	25595599.	7.2765551	0.0007628	-0.001753	2.9246242	0.00000	0.00000	-38.801603 C
0.0001153	2941.	25506928.	7.2995644	0.0008417	-0.001926	3.1551350	0.00000	0.00000	-42.604818 C
0.0001258	3197.	25416532.	7.3229984	0.0009212	-0.002098	3.3735295	0.00000	0.00000	-46.392495 C
0.0001363	3451.	25321293.	7.3459372	0.0010011	-0.002270	3.5792418	0.00000	0.00000	-50.000000 CY
0.0001468	3594.	24489418.	7.2855313	0.0010692	-0.002453	3.7432714	0.00000	0.00000	-50.000000 CY
0.0001572	3680.	23403499.	7.1919279	0.0011309	-0.002643	3.8827507	0.00000	0.00000	-50.000000 CY
0.0001677	3754.	22382211.	7.1028079	0.0011913	-0.002834	4.0114774	0.00000	0.00000	-50.000000 CY
0.0001782	3818.	21425101.	7.0158552	0.0012503	-0.003027	4.1293973	0.00000	0.00000	-50.000000 CY
0.0001887	3874.	20531508.	6.9328528	0.0013082	-0.003220	4.2378365	0.00000	0.00000	-50.000000 CY
0.0001992	3924.	19700525.	6.8549654	0.0013653	-0.003415	4.3378214	0.00000	0.00000	-50.000000 CY
0.0002097	3968.	18924909.	6.7791250	0.0014213	-0.003611	4.4288514	0.00000	0.00000	-50.000000 CY
0.0002201	4007.	18201663.	6.7071922	0.0014765	-0.003807	4.5120731	0.00000	0.00000	-50.000000 CY
0.0002306	4042.	17527309.	6.6396542	0.0015313	-0.004004	4.5880721	0.00000	0.00000	-50.000000 CY
0.0002411	4074.	16897412.	6.5751625	0.0015853	-0.004201	4.6567949	0.00000	0.00000	-50.000000 CY
0.0002516	4103.	16307415.	6.5127364	0.0016385	-0.004400	4.7183143	0.00000	0.00000	-50.000000 CY
0.0002621	4129.	15754986.	6.4540489	0.0016914	-0.004598	4.7734303	0.00000	0.00000	-50.000000 CY
0.0002726	4153.	15236886.	6.3988466	0.0017440	-0.004797	4.8223014	0.00000	0.00000	-50.000000 CY
0.0002830	4175.	14750160.	6.3462941	0.0017963	-0.004997	4.8649254	0.00000	0.00000	-50.000000 CY
0.0002935	4195.	14291162.	6.2948093	0.0018477	-0.005197	4.9011886	0.00000	0.00000	-50.000000 CY
0.0003040	4213.	13858721.	6.2462901	0.0018989	-0.005397	4.9316965	0.00000	0.00000	-50.000000 CY
0.0003145	4230.	13450667.	6.2005400	0.0019500	-0.005598	4.9565232	0.00000	0.00000	-50.000000 CY
0.0003250	4246.	13065070.	6.1573921	0.0020010	-0.005798	4.9757286	0.00000	0.00000	-50.000000 CY
0.0003355	4260.	12700119.	6.1165021	0.0020518	-0.005999	4.9893434	0.00000	0.00000	-50.000000 CY
0.0003459	4273.	12353269.	6.0757526	0.0021018	-0.006201	4.9973450	0.00000	0.00000	-50.000000 CY
0.0003564	4286.	12024310.	6.0373108	0.0021518	-0.006402	4.9999397	0.00000	0.00000	-50.000000 CY
0.0003669	4297.	11711572.	6.0010845	0.0022018	-0.006604	4.9982741	0.00000	0.00000	-50.000000 CY
0.0003774	4307.	11413747.	5.9666928	0.0022517	-0.006806	4.9969067	0.00000	0.00000	-50.000000 CY
0.0003879	4317.	11130217.	5.9344421	0.0023018	-0.007007	4.9982149	0.00000	0.00000	-50.000000 CY
0.0003984	4326.	10859971.	5.9039311	0.0023518	-0.007209	4.9982623	0.00000	0.00000	-50.000000 CY
0.0004088	4334.	10601437.	5.8747321	0.0024018	-0.007410	4.9971285	0.00000	0.00000	-50.000000 CY
0.0004298	4348.	10117424.	5.8178811	0.0025005	-0.007815	4.9940797	0.00000	0.00000	-50.000000 CY
0.0004508	4361.	9674030.	5.7667015	0.0025994	-0.008219	4.9983608	0.00000	0.00000	-50.000000 CY
0.0004717	4371.	9266282.	5.7206881	0.0026986	-0.008623	4.9987783	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	4371.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	9.2700	0.00	N.A.	No	0.00	32973.
2	15.8100	2.0125	No	No	32973.	106080.
3	20.8100	4.7830	Yes	No	139053.	91942.
4	23.3100	15.4236	No	No	230995.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0039	3.00E-06	0.00	-0.00598	2.34E-08	1.28E+10	0.00	0.00	0.00
0.2927	0.9829	-9.25E-07	-5.26E-07	-0.00598	7.21E-09	1.28E+10	0.00	0.00	0.00
0.5854	0.9619	-6.93E-07	6.58E-08	-0.00598	5.41E-09	1.28E+10	0.00	0.00	0.00
0.8781	0.9409	-4.62E-07	0.06478	-0.00598	3.61E-09	1.28E+10	0.00	0.00	0.03688
1.1708	0.9199	0.4550	10.9636	-0.00598	0.00355	1.28E+10	0.00	0.00	6.1690
1.4635	0.8989	77.0172	51.1981	-0.00598	0.6008	1.28E+10	0.00	0.00	16.7409

1.7562	0.8779	360.1114	128.5653	-0.00598	2.8094	1.28E+10	0.00	0.00	27.3128
2.0489	0.8569	980.1625	243.0651	-0.00598	7.6466	1.28E+10	0.00	0.00	37.8847
2.3416	0.8359	2068.	394.6977	-0.00598	16.1300	1.28E+10	0.00	0.00	48.4566
2.6343	0.8150	3753.	583.4629	-0.00597	29.2771	1.28E+10	0.00	0.00	59.0285
2.9270	0.7940	6166.	809.3608	-0.00597	48.1054	1.28E+10	0.00	0.00	69.6004
3.2197	0.7730	9438.	1072.	-0.00597	73.6324	1.28E+10	0.00	0.00	80.1722
3.5124	0.7520	13700.	1373.	-0.00597	106.8755	1.28E+10	0.00	0.00	90.7441
3.8051	0.7311	19080.	1710.	-0.00596	148.8523	1.28E+10	0.00	0.00	101.3160
4.0978	0.7101	25711.	2084.	-0.00596	200.5802	1.28E+10	0.00	0.00	111.8879
4.3905	0.6892	33722.	2496.	-0.00595	263.0768	1.28E+10	0.00	0.00	122.4598
4.6832	0.6683	43244.	2945.	-0.00594	337.3594	1.28E+10	0.00	0.00	133.0317
4.9759	0.6475	54407.	3430.	-0.00593	424.4457	1.28E+10	0.00	0.00	143.6035
5.2686	0.6267	67341.	3953.	-0.00591	525.3530	1.28E+10	0.00	0.00	154.1754
5.5613	0.6060	82178.	4513.	-0.00589	641.0989	1.28E+10	0.00	0.00	164.7473
5.8540	0.5854	99047.	5111.	-0.00586	772.7009	1.28E+10	0.00	0.00	175.3192
6.1467	0.5648	118079.	5745.	-0.00583	921.1764	1.28E+10	0.00	0.00	185.8911
6.4394	0.5444	139405.	6416.	-0.00580	1088.	1.28E+10	0.00	0.00	196.4630
6.7321	0.5241	163154.	7125.	-0.00576	1273.	1.28E+10	0.00	0.00	207.0349
7.0248	0.5039	189457.	7871.	-0.00571	1478.	1.28E+10	0.00	0.00	217.6067
7.3175	0.4840	218445.	8654.	-0.00565	1704.	1.28E+10	0.00	0.00	228.1786
7.6102	0.4642	250248.	9474.	-0.00559	1952.	1.28E+10	0.00	0.00	238.7505
7.9029	0.4447	284996.	10331.	-0.00552	2223.	1.28E+10	0.00	0.00	249.3224
8.1956	0.4255	322821.	11225.	-0.00543	2518.	1.28E+10	0.00	0.00	259.8943
8.4883	0.4065	363851.	12157.	-0.00534	2839.	1.28E+10	0.00	0.00	270.4662
8.7810	0.3880	408219.	13125.	-0.00523	3185.	1.28E+10	0.00	0.00	281.0381
9.0737	0.3698	456053.	14131.	-0.00512	3558.	1.28E+10	0.00	0.00	291.6099
9.3664	0.3520	507485.	14720.	-0.00502	0.00	2.63E+10	-6.950	69.3471	50.8200
9.6591	0.3345	559458.	14745.	-0.00495	0.00	2.62E+10	-29.572	310.4944	0.00
9.9518	0.3173	611067.	14599.	-0.00487	0.00	2.62E+10	-53.832	595.9391	0.00
10.2445	0.3003	662011.	14366.	-0.00478	0.00	2.62E+10	-78.907	922.8613	0.00
10.5372	0.2837	711982.	14043.	-0.00469	0.00	2.62E+10	-104.512	1294.	0.00
10.8299	0.2674	760664.	13632.	-0.00459	0.00	2.62E+10	-129.808	1705.	0.00
11.1226	0.2514	807744.	13133.	-0.00449	0.00	2.62E+10	-154.104	2153.	0.00
11.4153	0.2358	852922.	12552.	-0.00438	0.00	2.62E+10	-177.171	2639.	0.00
11.7080	0.2207	895916.	11891.	-0.00426	0.00	2.61E+10	-198.667	3162.	0.00
12.0007	0.2059	936458.	11160.	-0.00414	0.00	2.61E+10	-217.745	3714.	0.00
12.2934	0.1916	974314.	10367.	-0.00401	0.00	2.61E+10	-234.136	4292.	0.00
12.5861	0.1778	1009281.	9516.	-0.00387	0.00	2.61E+10	-250.026	4940.	0.00
12.8788	0.1644	1041164.	8616.	-0.00374	0.00	2.61E+10	-262.868	5616.	0.00
13.1715	0.1515	1069804.	7676.	-0.00359	0.00	2.61E+10	-272.316	6312.	0.00
13.4642	0.1392	1095084.	6705.	-0.00345	0.00	2.61E+10	-280.234	7073.	0.00
13.7569	0.1273	1116907.	5711.	-0.00330	0.00	2.61E+10	-285.868	7887.	0.00
14.0496	0.1160	1135203.	4703.	-0.00315	0.00	2.61E+10	-288.034	8723.	0.00
14.3423	0.1052	1149946.	3693.	-0.00299	0.00	2.61E+10	-286.966	9582.	0.00
14.6350	0.09495	1161148.	2692.	-0.00284	0.00	2.61E+10	-283.270	10479.	0.00
14.9277	0.08525	1168856.	1710.	-0.00268	0.00	2.61E+10	-275.634	11356.	0.00
15.2204	0.07611	1173164.	762.6367	-0.00252	0.00	2.61E+10	-264.030	12184.	0.00
15.5131	0.06753	1174214.	-147.135	-0.00237	0.00	2.61E+10	-254.005	13212.	0.00
15.8058	0.05950	1172130.	-1018.	-0.00221	0.00	2.61E+10	-241.718	14270.	0.00
16.0985	0.05202	1167064.	-2300.	-0.00205	0.00	2.61E+10	-488.387	32975.	0.00
16.3912	0.04510	1155973.	-4004.	-0.00189	0.00	2.61E+10	-481.674	37514.	0.00
16.6839	0.03872	1138940.	-5681.	-0.00174	0.00	2.61E+10	-473.686	42967.	0.00
16.9766	0.03288	1116063.	-7329.	-0.00159	0.00	2.61E+10	-464.346	49596.	0.00

17.2693	0.02758	1087457.	-8941.	-0.00144	0.00	2.61E+10	-453.551	57770.	0.00
17.5620	0.02278	1053256.	-10512.	-0.00129	0.00	2.61E+10	-441.171	68023.	0.00
17.8547	0.01848	1013612.	-12037.	-0.00116	0.00	2.61E+10	-427.030	81152.	0.00
18.1474	0.01466	968700.	-13508.	-0.00102	0.00	2.61E+10	-410.879	98416.	0.00
18.4401	0.01130	918719.	-14919.	-8.95E-04	0.00	2.61E+10	-392.350	121924.	0.00
18.7328	0.00838	863897.	-16259.	-7.76E-04	0.00	2.62E+10	-370.852	155528.	0.00
19.0255	0.00586	804501.	-17517.	-6.64E-04	0.00	2.62E+10	-345.356	207177.	0.00
19.3182	0.00371	740843.	-18675.	-5.60E-04	0.00	2.62E+10	-313.797	296763.	0.00
19.6109	0.00192	673315.	-19702.	-4.65E-04	0.00	2.62E+10	-270.915	495099.	0.00
19.9036	4.47E-04	602444.	-20496.	-3.80E-04	0.00	2.62E+10	-181.340	1425305.	0.00
20.1963	-7.45E-04	529336.	-20426.	-3.04E-04	0.00	2.63E+10	220.9371	1041841.	0.00
20.4890	-0.00169	458953.	-19554.	-2.38E-04	0.00	2.63E+10	275.7715	573882.	0.00
20.7817	-0.00242	391973.	-18531.	-1.81E-04	0.00	2.63E+10	306.6489	445948.	0.00
21.0744	-0.00296	328776.	-17146.	-1.33E-04	0.00	2.63E+10	481.7679	571937.	0.00
21.3671	-0.00335	271523.	-15412.	-9.27E-05	0.00	2.63E+10	505.7964	530658.	0.00
21.6598	-0.00361	220509.	-13603.	-5.99E-05	0.00	2.63E+10	524.4891	510339.	0.00
21.9525	-0.00377	175966.	-11734.	-3.34E-05	0.00	2.63E+10	539.3303	502693.	0.00
22.2452	-0.00384	138077.	-9819.	-1.25E-05	0.00	2.63E+10	551.2515	503627.	0.00
22.5379	-0.00386	106988.	-7866.	3.88E-06	0.00	2.63E+10	560.8846	510908.	0.00
22.8306	-0.00382	82819.	-5882.	1.65E-05	0.00	2.63E+10	568.6720	523253.	0.00
23.1233	-0.00374	65666.	-3874.	2.64E-05	0.00	2.63E+10	574.9160	539962.	0.00
23.4160	-0.00363	55606.	-2729.	3.45E-05	0.00	2.63E+10	77.0565	74530.	0.00
23.7087	-0.00350	46496.	-2461.	4.13E-05	0.00	2.63E+10	75.7414	76072.	0.00
24.0014	-0.00334	38320.	-2198.	4.70E-05	0.00	2.63E+10	73.8268	77614.	0.00
24.2941	-0.00317	31056.	-1943.	5.16E-05	0.00	2.63E+10	71.3704	79156.	0.00
24.5868	-0.00298	24671.	-1697.	5.54E-05	0.00	2.63E+10	68.4267	80698.	0.00
24.8795	-0.00278	19131.	-1463.	5.83E-05	0.00	2.63E+10	65.0467	82240.	0.00
25.1722	-0.00257	14394.	-1241.	6.05E-05	0.00	2.63E+10	61.2771	83782.	0.00
25.4649	-0.00235	10412.	-1033.	6.22E-05	0.00	2.63E+10	57.1599	85324.	0.00
25.7576	-0.00213	7136.	-840.187	6.33E-05	0.00	2.63E+10	52.7325	86867.	0.00
26.0503	-0.00191	4510.	-663.234	6.41E-05	0.00	2.63E+10	48.0269	88409.	0.00
26.3430	-0.00168	2477.	-503.248	6.46E-05	0.00	2.63E+10	43.0705	89951.	0.00
26.6357	-0.00145	975.0372	-361.074	6.48E-05	0.00	2.63E+10	37.8851	91493.	0.00
26.9284	-0.00123	-59.506	-237.485	6.49E-05	0.00	2.63E+10	32.4880	93035.	0.00
27.2211	-9.99E-04	-693.246	-133.203	6.48E-05	0.00	2.63E+10	26.8915	94577.	0.00
27.5138	-7.71E-04	-995.227	-48.913	6.47E-05	0.00	2.63E+10	21.1038	96119.	0.00
27.8065	-5.44E-04	-1037.	14.7193	6.46E-05	0.00	2.63E+10	15.1293	97661.	0.00
28.0992	-3.18E-04	-891.827	57.0411	6.44E-05	0.00	2.63E+10	8.9692	99204.	0.00
28.3919	-9.14E-05	-636.149	77.3977	6.43E-05	0.00	2.63E+10	2.6221	100746.	0.00
28.6846	1.34E-04	-348.123	75.1272	6.43E-05	0.00	2.63E+10	-3.915	102288.	0.00
28.9773	3.60E-04	-108.396	49.5564	6.42E-05	0.00	2.63E+10	-10.645	103830.	0.00
29.2700	5.86E-04	0.00	0.00	6.42E-05	0.00	2.63E+10	-17.573	52686.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     1.00385588 inches
Computed slope at pile head      =     -0.0059760 radians
Maximum bending moment           =       1174214. inch-lbs
Maximum shear force              =        -20496. lbs
Depth of maximum bending moment  =    15.51310000 feet below pile head
Depth of maximum shear force     =    19.90360000 feet below pile head
Number of iterations             =             20
Number of zero deflection points =              2
Pile deflection at ground        =     0.35787752 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
29.27000	1.00385588	1174214.	-20496.
27.80650	0.99709893	1176701.	-20606.
26.34300	1.00724742	1173996.	-20830.
24.87950	1.00640651	1173986.	-21177.
23.41600	1.02210733	1168959.	-22001.
21.95250	1.32636847	1118321.	-23843.
20.48900	2.75459910	1023722.	-24477.
19.02550	23.61341238	1008979.	-30205.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                          =          0.0 lbs
Applied moment at pile head                       =          0.0 in-lbs
Axial thrust load on pile head                    =          0.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.7939	-3.00E-06	0.00	-0.01020	2.34E-08	1.28E+10	0.00	0.00	0.00

0.2927	1.7581	-3.70E-06	-9.87E-08	-0.01020	2.89E-08	1.28E+10	0.00	0.00	0.00
0.5854	1.7222	-3.70E-06	-6.58E-08	-0.01020	2.89E-08	1.28E+10	0.00	0.00	0.00
0.8781	1.6864	-4.16E-06	0.09715	-0.01020	3.25E-08	1.28E+10	0.00	0.00	0.05532
1.1708	1.6506	0.6825	16.4436	-0.01020	0.00532	1.28E+10	0.00	0.00	9.2525
1.4635	1.6148	115.5129	76.7886	-0.01020	0.9012	1.28E+10	0.00	0.00	25.1086
1.7562	1.5789	540.1069	192.8264	-0.01020	4.2136	1.28E+10	0.00	0.00	40.9646
2.0489	1.5431	1470.	364.5570	-0.01020	11.4686	1.28E+10	0.00	0.00	56.8207
2.3416	1.5073	3101.	591.9804	-0.01020	24.1923	1.28E+10	0.00	0.00	72.6768
2.6343	1.4715	5629.	875.0967	-0.01020	43.9108	1.28E+10	0.00	0.00	88.5328
2.9270	1.4356	9248.	1214.	-0.01020	72.1501	1.28E+10	0.00	0.00	104.3889
3.2197	1.3998	14156.	1608.	-0.01019	110.4363	1.28E+10	0.00	0.00	120.2449
3.5124	1.3640	20547.	2059.	-0.01019	160.2954	1.28E+10	0.00	0.00	136.1010
3.8051	1.3283	28617.	2564.	-0.01018	223.2536	1.28E+10	0.00	0.00	151.9570
4.0978	1.2925	38562.	3126.	-0.01017	300.8368	1.28E+10	0.00	0.00	167.8131
4.3905	1.2568	50577.	3743.	-0.01016	394.5711	1.28E+10	0.00	0.00	183.6692
4.6832	1.2211	64858.	4416.	-0.01014	505.9827	1.28E+10	0.00	0.00	199.5252
4.9759	1.1855	81601.	5145.	-0.01012	636.5975	1.28E+10	0.00	0.00	215.3813
5.2686	1.1500	101001.	5929.	-0.01010	787.9416	1.28E+10	0.00	0.00	231.2373
5.5613	1.1146	123253.	6769.	-0.01007	961.5411	1.28E+10	0.00	0.00	247.0934
5.8540	1.0793	148554.	7665.	-0.01003	1159.	1.28E+10	0.00	0.00	262.9495
6.1467	1.0441	177099.	8617.	-0.00999	1382.	1.28E+10	0.00	0.00	278.8055
6.4394	1.0091	209084.	9624.	-0.00993	1631.	1.28E+10	0.00	0.00	294.6616
6.7321	0.9743	244703.	10686.	-0.00987	1909.	1.28E+10	0.00	0.00	310.5176
7.0248	0.9398	284154.	11805.	-0.00980	2217.	1.28E+10	0.00	0.00	326.3737
7.3175	0.9055	327631.	12979.	-0.00972	2556.	1.28E+10	0.00	0.00	342.2297
7.6102	0.8715	375330.	14209.	-0.00962	2928.	1.28E+10	0.00	0.00	358.0858
7.9029	0.8379	427447.	15495.	-0.00951	3335.	1.28E+10	0.00	0.00	373.9419
8.1956	0.8047	484177.	16836.	-0.00939	3777.	1.28E+10	0.00	0.00	389.7979
8.4883	0.7720	545716.	18233.	-0.00924	4257.	1.28E+10	0.00	0.00	405.6540
8.7810	0.7398	612260.	19686.	-0.00909	4776.	1.28E+10	0.00	0.00	421.5100
9.0737	0.7082	684003.	21194.	-0.00891	5336.	1.28E+10	0.00	0.00	437.3661
9.3664	0.6772	761143.	22081.	-0.00876	0.00	2.62E+10	-8.480	43.9849	76.2215
9.6591	0.6466	839118.	22137.	-0.00866	0.00	2.62E+10	-36.128	196.2484	0.00
9.9518	0.6164	916647.	21957.	-0.00854	0.00	2.61E+10	-65.904	375.5393	0.00
10.2445	0.5866	993364.	21671.	-0.00841	0.00	2.61E+10	-96.898	580.1809	0.00
10.5372	0.5573	1068885.	21276.	-0.00827	0.00	2.61E+10	-128.360	808.9774	0.00
10.8299	0.5285	1142822.	20770.	-0.00812	0.00	2.61E+10	-159.523	1060.	0.00
11.1226	0.5002	1214792.	20157.	-0.00796	0.00	2.61E+10	-189.670	1332.	0.00
11.4153	0.4726	1284421.	19440.	-0.00780	0.00	2.60E+10	-218.535	1624.	0.00
11.7080	0.4455	1351355.	18625.	-0.00762	0.00	2.60E+10	-245.752	1938.	0.00
12.0007	0.4190	1415256.	17718.	-0.00743	0.00	2.60E+10	-270.452	2267.	0.00
12.2934	0.3933	1475821.	16730.	-0.00724	0.00	2.60E+10	-292.393	2611.	0.00
12.5861	0.3682	1532779.	15664.	-0.00703	0.00	2.60E+10	-314.232	2997.	0.00
12.8788	0.3439	1585860.	14528.	-0.00682	0.00	2.59E+10	-332.720	3398.	0.00
13.1715	0.3203	1634836.	13334.	-0.00660	0.00	2.59E+10	-347.415	3810.	0.00
13.4642	0.2975	1679527.	12091.	-0.00638	0.00	2.59E+10	-360.185	4253.	0.00
13.7569	0.2755	1719773.	10808.	-0.00615	0.00	2.59E+10	-370.195	4720.	0.00
14.0496	0.2543	1755453.	9498.	-0.00591	0.00	2.59E+10	-376.140	5195.	0.00
14.3423	0.2340	1786492.	8172.	-0.00567	0.00	2.59E+10	-378.761	5686.	0.00
14.6350	0.2145	1812859.	6839.	-0.00543	0.00	2.59E+10	-379.930	6223.	0.00
14.9277	0.1958	1834538.	5511.	-0.00518	0.00	2.59E+10	-376.485	6753.	0.00
15.2204	0.1781	1851573.	4203.	-0.00493	0.00	2.59E+10	-368.228	7264.	0.00
15.5131	0.1612	1864065.	2919.	-0.00468	0.00	2.59E+10	-362.793	7906.	0.00

15.8058	0.1452	1872081.	1659.	-0.00442	0.00	2.59E+10	-354.618	8578.	0.00
16.0985	0.1301	1875722.	-41.955	-0.00417	0.00	2.59E+10	-614.173	16580.	0.00
16.3912	0.1159	1871786.	-2192.	-0.00392	0.00	2.59E+10	-609.871	18481.	0.00
16.6839	0.1026	1860326.	-4324.	-0.00366	0.00	2.59E+10	-604.349	20688.	0.00
16.9766	0.09019	1841410.	-6435.	-0.00341	0.00	2.59E+10	-597.547	23271.	0.00
17.2693	0.07865	1815123.	-8519.	-0.00316	0.00	2.59E+10	-589.399	26322.	0.00
17.5620	0.06798	1781564.	-10573.	-0.00292	0.00	2.59E+10	-579.822	29960.	0.00
17.8547	0.05815	1740852.	-12590.	-0.00268	0.00	2.59E+10	-568.714	34351.	0.00
18.1474	0.04916	1693123.	-14565.	-0.00245	0.00	2.59E+10	-555.942	39725.	0.00
18.4401	0.04097	1638536.	-16492.	-0.00222	0.00	2.59E+10	-541.333	46413.	0.00
18.7328	0.03356	1577271.	-18364.	-0.00200	0.00	2.59E+10	-524.652	54916.	0.00
19.0255	0.02690	1509533.	-20173.	-0.00179	0.00	2.60E+10	-505.561	66020.	0.00
19.3182	0.02095	1435558.	-21910.	-0.00159	0.00	2.60E+10	-483.556	81056.	0.00
19.6109	0.01569	1355617.	-23564.	-0.00141	0.00	2.60E+10	-457.827	102472.	0.00
19.9036	0.01107	1270028.	-25117.	-0.00123	0.00	2.60E+10	-426.949	135414.	0.00
20.1963	0.00706	1179172.	-26549.	-0.00106	0.00	2.61E+10	-388.032	193114.	0.00
20.4890	0.00360	1083529.	-27816.	-9.12E-04	0.00	2.61E+10	-333.489	325466.	0.00
20.7817	6.53E-04	983771.	-28791.	-7.73E-04	0.00	2.61E+10	-221.600	1192700.	0.00
21.0744	-0.00183	881280.	-28430.	-6.47E-04	0.00	2.62E+10	426.9606	819857.	0.00
21.3671	-0.00390	784056.	-26758.	-5.36E-04	0.00	2.62E+10	525.2127	473598.	0.00
21.6598	-0.00559	693311.	-24808.	-4.37E-04	0.00	2.62E+10	585.0728	367507.	0.00
21.9525	-0.00696	609785.	-22676.	-3.49E-04	0.00	2.62E+10	628.7383	317210.	0.00
22.2452	-0.00805	534015.	-20408.	-2.73E-04	0.00	2.63E+10	662.9843	289449.	0.00
22.5379	-0.00888	466425.	-18030.	-2.06E-04	0.00	2.63E+10	690.8727	273345.	0.00
22.8306	-0.00949	407357.	-15563.	-1.47E-04	0.00	2.63E+10	714.0634	264265.	0.00
23.1233	-0.00991	357099.	-13020.	-9.63E-05	0.00	2.63E+10	733.5531	259922.	0.00
23.4160	-0.01017	315891.	-11371.	-5.13E-05	0.00	2.63E+10	205.7845	71091.	0.00
23.7087	-0.01027	277222.	-10633.	-1.18E-05	0.00	2.63E+10	214.5658	73358.	0.00
24.0014	-0.01025	241200.	-9866.	2.28E-05	0.00	2.63E+10	221.8620	76028.	0.00
24.2941	-0.01011	207914.	-9077.	5.28E-05	0.00	2.63E+10	227.7232	79091.	0.00
24.5868	-0.00988	177439.	-8278.	7.85E-05	0.00	2.63E+10	226.9717	80698.	0.00
24.8795	-0.00956	149763.	-7486.	1.00E-04	0.00	2.63E+10	223.8806	82240.	0.00
25.1722	-0.00917	124850.	-6709.	1.19E-04	0.00	2.63E+10	218.8368	83782.	0.00
25.4649	-0.00873	102636.	-5952.	1.34E-04	0.00	2.63E+10	212.0314	85324.	0.00
25.7576	-0.00823	83038.	-5222.	1.46E-04	0.00	2.63E+10	203.6450	86867.	0.00
26.0503	-0.00770	65952.	-4524.	1.56E-04	0.00	2.63E+10	193.8452	88409.	0.00
26.3430	-0.00714	51258.	-3863.	1.64E-04	0.00	2.63E+10	182.7859	89951.	0.00
26.6357	-0.00655	38819.	-3242.	1.70E-04	0.00	2.63E+10	170.6058	91493.	0.00
26.9284	-0.00594	28484.	-2666.	1.74E-04	0.00	2.63E+10	157.4276	93035.	0.00
27.2211	-0.00532	20092.	-2138.	1.78E-04	0.00	2.63E+10	143.3578	94577.	0.00
27.5138	-0.00470	13468.	-1660.	1.80E-04	0.00	2.63E+10	128.4863	96119.	0.00
27.8065	-0.00406	8430.	-1236.	1.81E-04	0.00	2.63E+10	112.8872	97661.	0.00
28.0992	-0.00342	4784.	-868.303	1.82E-04	0.00	2.63E+10	96.6188	99204.	0.00
28.3919	-0.00278	2330.	-558.608	1.83E-04	0.00	2.63E+10	79.7248	100746.	0.00
28.6846	-0.00214	860.0113	-309.297	1.83E-04	0.00	2.63E+10	62.2359	102288.	0.00
28.9773	-0.00149	157.5383	-122.425	1.83E-04	0.00	2.63E+10	44.1709	103830.	0.00
29.2700	-8.51E-04	0.00	0.00	1.83E-04	0.00	2.63E+10	25.5393	52686.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the

magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     1.79390240 inches
Computed slope at pile head      =     -0.0102003 radians
Maximum bending moment           =       1875722. inch-lbs
Maximum shear force              =        -28791. lbs
Depth of maximum bending moment  =    16.09850000 feet below pile head
Depth of maximum shear force     =    20.78170000 feet below pile head
Number of iterations             =             25
Number of zero deflection points =              1
Pile deflection at ground        =     0.68740418 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
29.27000	1.79390240	1875722.	-28791.
27.80650	1.78523000	1875924.	-28907.
26.34300	1.81970220	1869572.	-30177.
24.87950	1.90807537	1846790.	-32473.
23.41600	2.16875223	1796097.	-34573.
21.95250	3.55340031	1690585.	-35307.
20.48900	54.17448404	1683602.	-46810.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

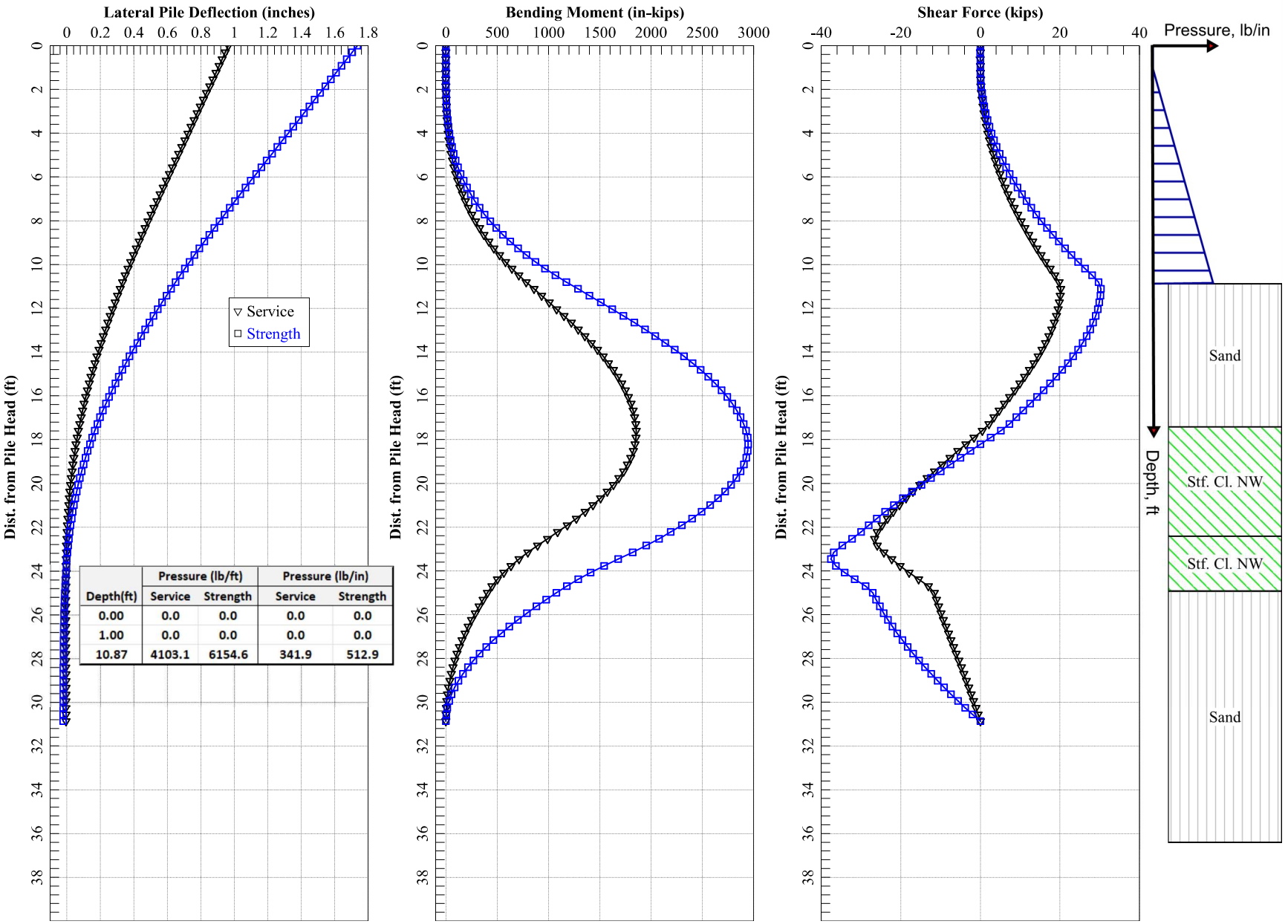
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.0039	-0.00598	-20496.	1174214.
2	V, lb	0.00	M, in-lb	0.00	0.00	1.7939	-0.01020	-28791.	1875722.

Maximum pile-head deflection = 1.7939024038 inches
Maximum pile-head rotation = -0.0102003194 radians = -0.584435 deg.

The analysis ended normally.

Wall 1A (10.87ft)



	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
10.87	4103.1	6154.6	341.9	512.9

```
================================================================================

                    LPile for Windows, Version 2022-12.005

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\0000 TRC projects\CUY-77-1141\App E LPile 04-05- 2026\Wall 1A\

Name of input data file:
02 Wall_1A-10.87ft_B-041.lp12d

Name of output report file:
02 Wall_1A-10.87ft_B-041.lp12o

Name of plot output file:
02 Wall_1A-10.87ft_B-041.lp12p

Name of runtime message file:
02 Wall_1A-10.87ft_B-041.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  April 6, 2026              Time:  14:58:17
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=10.87FT) Boring B-041-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 30.870 ft
Depth of ground surface below top of pile = 10.8700 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	8.1400
2	10.870	8.1400
3	10.870	30.0000
4	30.870	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 10.870000 ft
AISC Section Type = W

AISC Section Name = W21X48

Pile width = 8.140000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 20.000000 ft
Section Diameter = 30.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W21X48

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    10.870000 ft
   Distance from top of pile to bottom of layer        =    17.410000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    34.000000 deg.
   Friction angle at bottom of layer                   =    34.000000 deg.
   Subgrade k at top of layer                          =   125.000000 pci
   Subgrade k at bottom of layer                       =   125.000000 pci


Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer           =    17.410000 ft
   Distance from top of pile to bottom of layer        =    22.410000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2500. psf
   Undrained cohesion at bottom of layer               =        2500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    22.410000 ft
   Distance from top of pile to bottom of layer        =    24.910000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        4000. psf
   Undrained cohesion at bottom of layer               =        4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


Layer 4 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    24.910000 ft
   Distance from top of pile to bottom of layer        =    36.410000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

```
   Friction angle at top of layer                    =    34.000000 deg.
   Friction angle at bottom of layer                 =    34.000000 deg.
   Subgrade k at top of layer                        =   125.000000 pci
   Subgrade k at bottom of layer                     =   125.000000 pci


 (Depth of the lowest soil layer extends 5.540 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	10.8700	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	17.4100	62.6000	--	34.0000	--	125.0000
2	Stiff Clay	17.4100	57.6000	2500.	--	0.00500	--
	w/o Free Water	22.4100	57.6000	2500.	--	0.00500	--
3	Stiff Clay	22.4100	62.6000	4000.	--	0.00400	--
	w/o Free Water	24.9100	62.6000	4000.	--	0.00400	--
4	Sand	24.9100	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	36.4100	62.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	10.870	0.9300	1.0000
2	30.870	0.9300	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	10.870	341.900

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	10.870	512.900

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	10.870000 ft
Flange Width	=	8.140000 in
Section Depth	=	20.600000 in
Flange Thickness	=	0.430000 in
Web Thickness	=	0.350000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	14.100000 sq. in.
Moment of Inertia	=	959.000000 in^4
Elastic Bending Stiffness	=	27811000. kip-in^2
Plastic Modulus, Z	=	107.000000in^3
Plastic Moment Capacity = Fy Z	=	5350.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	705.000 kips
Nominal Axial Tensile Capacity	=	-705.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000900	244.3185254	27140626.	10.3000000	2.6619933	
0.00001800	488.6370509	27140626.	10.3000000	5.3239865	
0.00002701	732.9555763	27140626.	10.3000000	7.9859798	
0.00003601	977.2741017	27140626.	10.3000000	10.6479731	

0.00004501	1222.	27140626.	10.3000000	13.3099663	
0.00005401	1466.	27140626.	10.3000000	15.9719596	
0.00006301	1710.	27140626.	10.3000000	18.6339529	
0.00007202	1955.	27140626.	10.3000000	21.2959462	
0.00008102	2199.	27140626.	10.3000000	23.9579394	
0.00009002	2443.	27140626.	10.3000000	26.6199327	
0.00009902	2688.	27140626.	10.3000000	29.2819260	
0.0001080	2932.	27140626.	10.3000000	31.9439192	
0.0001170	3176.	27140626.	10.3000000	34.6059125	
0.0001260	3420.	27140626.	10.3000000	37.2679058	
0.0001350	3665.	27140626.	10.3000000	39.9298990	
0.0001440	3909.	27140626.	10.3000000	42.5918923	
0.0001530	4153.	27140626.	10.3000000	45.2538856	
0.0001620	4398.	27140626.	10.3000000	47.9158788	
0.0001710	4622.	27025086.	10.3000000	50.0000000	Y
0.0001800	4699.	26097207.	10.3000000	50.0000000	Y
0.0001890	4748.	25116944.	10.3000000	50.0000000	Y
0.0001980	4791.	24192917.	10.3000000	50.0000000	Y
0.0002070	4829.	23323100.	10.3000000	50.0000000	Y
0.0002160	4862.	22503691.	10.3000000	50.0000000	Y
0.0002250	4891.	21732866.	10.3000000	50.0000000	Y
0.0002341	4917.	21007412.	10.3000000	50.0000000	Y
0.0002431	4940.	20324453.	10.3000000	50.0000000	Y
0.0002521	4960.	19679845.	10.3000000	50.0000000	Y
0.0002611	4979.	19071981.	10.3000000	50.0000000	Y
0.0002701	4996.	18498003.	10.3000000	50.0000000	Y
0.0002791	5011.	17955375.	10.3000000	50.0000000	Y
0.0002881	5024.	17441835.	10.3000000	50.0000000	Y
0.0002971	5037.	16955353.	10.3000000	50.0000000	Y
0.0003061	5048.	16494093.	10.3000000	50.0000000	Y
0.0003151	5059.	16056087.	10.3000000	50.0000000	Y
0.0003241	5068.	15639249.	10.3000000	50.0000000	Y
0.0003331	5077.	15242974.	10.3000000	50.0000000	Y
0.0003421	5085.	14866014.	10.3000000	50.0000000	Y
0.0003511	5093.	14505792.	10.3000000	50.0000000	Y
0.0003691	5106.	13834632.	10.3000000	50.0000000	Y
0.0003871	5118.	13221115.	10.3000000	50.0000000	Y
0.0004051	5128.	12658289.	10.3000000	50.0000000	Y
0.0004231	5136.	12140325.	10.3000000	50.0000000	Y
0.0004411	5144.	11662286.	10.3000000	50.0000000	Y
0.0004591	5151.	11219957.	10.3000000	50.0000000	Y
0.0004771	5157.	10809570.	10.3000000	50.0000000	Y
0.0004951	5163.	10427181.	10.3000000	50.0000000	Y
0.0005131	5168.	10070951.	10.3000000	50.0000000	Y
0.0005311	5172.	9737768.	10.3000000	50.0000000	Y
0.0005491	5176.	9425723.	10.3000000	50.0000000	Y
0.0005671	5179.	9132825.	10.3000000	50.0000000	Y
0.0005851	5183.	8857446.	10.3000000	50.0000000	Y
0.0006031	5186.	8597884.	10.3000000	50.0000000	Y
0.0006211	5189.	8353308.	10.3000000	50.0000000	Y
0.0006391	5191.	8121659.	10.3000000	50.0000000	Y
0.0006571	5193.	7902703.	10.3000000	50.0000000	Y
0.0006751	5195.	7695196.	10.3000000	50.0000000	Y

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    0.0006932         5197.      7497971.    10.3000000    50.0000000  Y
    0.0007112         5199.      7310732.    10.3000000    50.0000000  Y
    0.0007292         5201.      7132696.    10.3000000    50.0000000  Y
    0.0007472         5202.      6962717.    10.3000000    50.0000000  Y
    0.0007652         5204.      6800737.    10.3000000    50.0000000  Y
    0.0007832         5205.      6646204.    10.3000000    50.0000000  Y
    0.0008012         5206.      6498518.    10.3000000    50.0000000  Y
    0.0008192         5208.      6356990.    10.3000000    50.0000000  Y
    0.0008372         5209.      6221549.    10.3000000    50.0000000  Y


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
--------------------------------------------------------------------------------

                                          Nominal
Load              Axial                   Moment
 No.             Thrust                  Capacity
                  kips                    in-kips
----         ----------------          ----------------
  1               0.00000000                   5209.

Note that the values in the above table are not factored by a strength
reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the
LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to the LRFD structural
design standard being followed.



Pile Section No. 2:
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Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:
--------------------------------------------------------------------------------

Length of Section                                 =    20.000000 ft
Outside Diameter of Casing                        =    30.000000 in
Casing Wall Thickness                             =       0.0000 in
Moment of Inertia of Steel Casing                 =       0.0000 in^4
Width Flange of Core/Insert                       =     8.140000 in
Depth of Core/Insert                              =    20.600000 in
Flange Thickness of Core/Insert                   =     0.430000 in
Web Thickness of Core/Insert                      =     0.350000 in
Moment of Inertia of Steel Core/Insert            =   959.000000 in^4
Yield Stress of Casing                            =       50000. psi
Elastic Modulus of Casing                         =    29000000. psi
Yield Stress of Core/Insert                       =       50000. psi
```

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Elastic Modulus of Core/Insert                          =    29000000. psi
Number of Reinforcing Bars                              =            0 bars
Gross Area of Pile                                      =   706.858347 sq. in.
Area of Concrete                                        =   692.948947 sq. in.
Cross-sectional Area of Steel Casing                    =       0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert               =    14.100000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)       =    13.909400 sq. in.
Area Ratio of All Steel to Gross Area                   =         1.97 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:
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Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As     =     3649.223 kips
Tensile Load for Cracking of Concrete                   =     -368.047 kips
Nominal Axial Tensile Capacity                          =     -705.000 kips



Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                        kips
   ------     ------------------
      1                0.000

Definition of Run Messages:

   Y = part of pipe section has yielded.


Axial Thrust Force =      0.000 kips
```

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000900	516.2026224	57343431.	8.4878467	0.00007641	-0.000194	0.3495694	0.00000	0.00000	-4.401975	C
0.00001800	1029.	57179428.	8.5128157	0.0001533	-0.000387	0.6884519	0.00000	0.00000	-8.790913	C
0.00002701	1540.	57012512.	8.5382994	0.0002306	-0.000580	1.0164771	0.00000	0.00000	-13.166412	C
0.00003601	2047.	56842633.	8.5638426	0.0003084	-0.000772	1.3333976	0.00000	0.00000	-17.528543	C
0.00004501	2551.	56669742.	8.5895232	0.0003866	-0.000964	1.6389956	0.00000	0.00000	-21.877158	C
0.00005401	3051.	56493689.	8.6157499	0.0004654	-0.001155	1.9331252	0.00000	0.00000	-26.211510	C
0.00006301	3549.	56314345.	8.6425470	0.0005446	-0.001346	2.2155870	0.00000	0.00000	-30.531126	C
0.00007202	4042.	56131571.	8.6699405	0.0006244	-0.001536	2.4861724	0.00000	0.00000	-34.835505	C
0.00008102	4533.	55945220.	8.6979583	0.0007047	-0.001726	2.7446617	0.00000	0.00000	-39.124115	C
0.00009002	5019.	55755133.	8.7266302	0.0007856	-0.001915	2.9908242	0.00000	0.00000	-43.396389	C
0.00009902	5502.	55561141.	8.7559882	0.0008670	-0.002104	3.2244164	0.00000	0.00000	-47.651723	C
0.0001080	5912.	54727095.	8.7478982	0.0009450	-0.002296	3.4342602	0.00000	0.00000	-50.000000	CY
0.0001170	6108.	52192509.	8.6352203	0.0010105	-0.002500	3.6000093	0.00000	0.00000	-50.000000	CY
0.0001260	6272.	49769910.	8.5241277	0.0010743	-0.002707	3.7521591	0.00000	0.00000	-50.000000	CY

0.0001350	6412.	47485645.	8.4138697	0.0011361	-0.002915	3.8913487	0.00000	0.00000	-50.000000 CY
0.0001440	6532.	45351873.	8.3089359	0.0011967	-0.003124	4.0197536	0.00000	0.00000	-50.000000 CY
0.0001530	6636.	43364563.	8.2077800	0.0012561	-0.003335	4.1376782	0.00000	0.00000	-50.000000 CY
0.0001620	6727.	41518697.	8.1100630	0.0013141	-0.003547	4.2457217	0.00000	0.00000	-50.000000 CY
0.0001710	6808.	39804155.	8.0180319	0.0013714	-0.003760	4.3451868	0.00000	0.00000	-50.000000 CY
0.0001800	6880.	38212590.	7.9308456	0.0014279	-0.003973	4.4363735	0.00000	0.00000	-50.000000 CY
0.0001890	6943.	36729926.	7.8457407	0.0014832	-0.004188	4.5189978	0.00000	0.00000	-50.000000 CY
0.0001980	7001.	35349266.	7.7657334	0.0015379	-0.004403	4.5943715	0.00000	0.00000	-50.000000 CY
0.0002070	7053.	34064396.	7.6909133	0.0015924	-0.004619	4.6628747	0.00000	0.00000	-50.000000 CY
0.0002160	7100.	32862056.	7.6188393	0.0016460	-0.004835	4.7242077	0.00000	0.00000	-50.000000 CY
0.0002250	7142.	31736526.	7.5490921	0.0016989	-0.005053	4.7786163	0.00000	0.00000	-50.000000 CY
0.0002341	7181.	30682704.	7.4836016	0.0017515	-0.005270	4.8268238	0.00000	0.00000	-50.000000 CY
0.0002431	7217.	29693043.	7.4218527	0.0018039	-0.005488	4.8689122	0.00000	0.00000	-50.000000 CY
0.0002521	7250.	28763356.	7.3638407	0.0018561	-0.005706	4.9050395	0.00000	0.00000	-50.000000 CY
0.0002611	7280.	27886001.	7.3066752	0.0019075	-0.005924	4.9349108	0.00000	0.00000	-50.000000 CY
0.0002701	7307.	27058234.	7.2520059	0.0019585	-0.006143	4.9590052	0.00000	0.00000	-50.000000 CY
0.0002791	7333.	26276216.	7.2003740	0.0020093	-0.006362	4.9775113	0.00000	0.00000	-50.000000 CY
0.0002881	7356.	25536445.	7.1516169	0.0020601	-0.006582	4.9904820	0.00000	0.00000	-50.000000 CY
0.0002971	7378.	24836132.	7.1056862	0.0021108	-0.006801	4.9979570	0.00000	0.00000	-50.000000 CY
0.0003061	7398.	24172404.	7.0625020	0.0021616	-0.007020	4.9969981	0.00000	0.00000	-50.000000 CY
0.0003151	7417.	23540024.	7.0197538	0.0022117	-0.007240	4.9982906	0.00000	0.00000	-50.000000 CY
0.0003241	7433.	22937618.	6.9783471	0.0022615	-0.007461	4.9970163	0.00000	0.00000	-50.000000 CY
0.0003331	7449.	22364579.	6.9396229	0.0023114	-0.007681	4.9974822	0.00000	0.00000	-50.000000 CY
0.0003421	7463.	21817845.	6.9026797	0.0023612	-0.007901	4.9999798	0.00000	0.00000	-50.000000 CY
0.0003511	7477.	21296193.	6.8680710	0.0024112	-0.008121	4.9950538	0.00000	0.00000	-50.000000 CY
0.0003691	7500.	20321766.	6.8041286	0.0025113	-0.008561	4.9934281	0.00000	0.00000	-50.000000 CY
0.0003871	7521.	19429367.	6.7466657	0.0026115	-0.009001	4.9995524	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	7521.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	10.8700	0.00	N.A.	No	0.00	41722.
2	17.4100	2.0652	No	No	41722.	125908.
3	22.4100	4.7714	Yes	No	167630.	107328.
4	24.9100	15.9544	No	No	274958.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.9654	1.38E-05	5.93E-08	-0.00503	5.87E-08	2.71E+10	0.00	0.00	0.00
0.3087	0.9468	1.67E-05	2.37E-07	-0.00503	7.08E-08	2.71E+10	0.00	0.00	0.00
0.6174	0.9281	1.56E-05	-2.37E-07	-0.00503	6.62E-08	2.71E+10	0.00	0.00	0.00
0.9261	0.9095	1.49E-05	0.6726	-0.00503	6.34E-08	2.71E+10	0.00	0.00	0.3631
1.2348	0.8909	4.9832	16.4102	-0.00503	0.02115	2.71E+10	0.00	0.00	8.1335
1.5435	0.8723	121.5796	66.3465	-0.00503	0.5160	2.71E+10	0.00	0.00	18.8270
1.8522	0.8537	496.5312	155.8958	-0.00503	2.1073	2.71E+10	0.00	0.00	29.5205
2.1609	0.8350	1277.	285.0579	-0.00503	5.4178	2.71E+10	0.00	0.00	40.2140
2.4696	0.8164	2608.	453.8329	-0.00503	11.0703	2.71E+10	0.00	0.00	50.9074
2.7783	0.7978	4639.	662.2208	-0.00503	19.6877	2.71E+10	0.00	0.00	61.6009
3.0870	0.7792	7515.	910.2215	-0.00502	31.8925	2.71E+10	0.00	0.00	72.2944
3.3957	0.7606	11383.	1198.	-0.00502	48.3077	2.71E+10	0.00	0.00	82.9878
3.7044	0.7420	16389.	1525.	-0.00502	69.5560	2.71E+10	0.00	0.00	93.6813

4.0131	0.7234	22681.	1892.	-0.00502	96.2602	2.71E+10	0.00	0.00	104.3748
4.3218	0.7048	30406.	2298.	-0.00501	129.0431	2.71E+10	0.00	0.00	115.0682
4.6305	0.6862	39710.	2744.	-0.00501	168.5273	2.71E+10	0.00	0.00	125.7617
4.9392	0.6677	50739.	3230.	-0.00500	215.3358	2.71E+10	0.00	0.00	136.4552
5.2479	0.6492	63641.	3755.	-0.00500	270.0912	2.71E+10	0.00	0.00	147.1486
5.5566	0.6307	78562.	4320.	-0.00499	333.4163	2.71E+10	0.00	0.00	157.8421
5.8653	0.6122	95649.	4925.	-0.00497	405.9340	2.71E+10	0.00	0.00	168.5356
6.1740	0.5938	115049.	5569.	-0.00496	488.2670	2.71E+10	0.00	0.00	179.2290
6.4827	0.5755	136908.	6253.	-0.00494	581.0380	2.71E+10	0.00	0.00	189.9225
6.7914	0.5572	161374.	6976.	-0.00492	684.8699	2.71E+10	0.00	0.00	200.6160
7.1001	0.5390	188592.	7739.	-0.00490	800.3853	2.71E+10	0.00	0.00	211.3094
7.4088	0.5209	218710.	8542.	-0.00487	928.2072	2.71E+10	0.00	0.00	222.0029
7.7175	0.5029	251875.	9384.	-0.00484	1069.	2.71E+10	0.00	0.00	232.6964
8.0262	0.4850	288233.	10266.	-0.00480	1223.	2.71E+10	0.00	0.00	243.3898
8.3349	0.4673	327931.	11187.	-0.00476	1392.	2.71E+10	0.00	0.00	254.0833
8.6436	0.4498	371115.	12148.	-0.00471	1575.	2.71E+10	0.00	0.00	264.7768
8.9523	0.4324	417933.	13149.	-0.00466	1774.	2.71E+10	0.00	0.00	275.4703
9.2610	0.4153	468531.	14189.	-0.00460	1988.	2.71E+10	0.00	0.00	286.1637
9.5697	0.3983	523056.	15269.	-0.00453	2220.	2.71E+10	0.00	0.00	296.8572
9.8784	0.3817	581655.	16388.	-0.00445	2469.	2.71E+10	0.00	0.00	307.5507
10.1871	0.3653	644474.	17547.	-0.00437	2735.	2.71E+10	0.00	0.00	318.2441
10.4958	0.3493	711660.	18746.	-0.00428	3020.	2.71E+10	0.00	0.00	328.9376
10.8045	0.3336	783360.	19801.	-0.00418	3325.	2.71E+10	0.00	0.00	240.7825
11.1132	0.3184	858364.	20212.	-0.00410	0.00	5.72E+10	-19.176	223.1236	0.00
11.4219	0.3033	933105.	20093.	-0.00404	0.00	5.72E+10	-45.198	552.0233	0.00
11.7306	0.2885	1007226.	19875.	-0.00397	0.00	5.72E+10	-72.443	930.3164	0.00
12.0393	0.2739	1080352.	19555.	-0.00391	0.00	5.72E+10	-100.215	1356.	0.00
12.3480	0.2595	1152104.	19131.	-0.00383	0.00	5.71E+10	-128.416	1833.	0.00
12.6567	0.2454	1222093.	18604.	-0.00376	0.00	5.71E+10	-156.448	2361.	0.00
12.9654	0.2317	1289936.	17974.	-0.00368	0.00	5.71E+10	-183.615	2936.	0.00
13.2741	0.2182	1355258.	17246.	-0.00359	0.00	5.71E+10	-209.391	3555.	0.00
13.5828	0.2051	1417708.	16425.	-0.00350	0.00	5.70E+10	-233.951	4226.	0.00
13.8915	0.1923	1476947.	15516.	-0.00341	0.00	5.70E+10	-256.730	4946.	0.00
14.2002	0.1798	1532663.	14527.	-0.00331	0.00	5.70E+10	-277.057	5707.	0.00
14.5089	0.1678	1584577.	13469.	-0.00321	0.00	5.70E+10	-294.546	6504.	0.00
14.8176	0.1561	1632449.	12347.	-0.00310	0.00	5.70E+10	-310.810	7377.	0.00
15.1263	0.1448	1676056.	11169.	-0.00299	0.00	5.70E+10	-325.167	8319.	0.00
15.4350	0.1339	1715200.	9944.	-0.00288	0.00	5.69E+10	-336.337	9305.	0.00
15.7437	0.1234	1749730.	8684.	-0.00277	0.00	5.69E+10	-344.068	10327.	0.00
16.0524	0.1134	1779538.	7398.	-0.00266	0.00	5.69E+10	-350.376	11450.	0.00
16.3611	0.1037	1804538.	6091.	-0.00254	0.00	5.69E+10	-354.911	12674.	0.00
16.6698	0.09454	1824667.	4774.	-0.00242	0.00	5.69E+10	-356.123	13954.	0.00
16.9785	0.08578	1839910.	3459.	-0.00230	0.00	5.69E+10	-353.911	15283.	0.00
17.2872	0.07748	1850296.	2158.	-0.00218	0.00	5.69E+10	-348.563	16666.	0.00
17.5959	0.06961	1855899.	480.0110	-0.00206	0.00	5.69E+10	-557.434	29664.	0.00
17.9046	0.06220	1853852.	-1576.	-0.00194	0.00	5.69E+10	-552.657	32916.	0.00
18.2133	0.05523	1844222.	-3613.	-0.00182	0.00	5.69E+10	-546.865	36680.	0.00
18.5220	0.04871	1827087.	-5626.	-0.00170	0.00	5.69E+10	-540.006	41072.	0.00
18.8307	0.04262	1802542.	-7611.	-0.00158	0.00	5.69E+10	-532.018	46239.	0.00
19.1394	0.03697	1770696.	-9565.	-0.00147	0.00	5.69E+10	-522.825	52381.	0.00
19.4481	0.03175	1731676.	-11482.	-0.00135	0.00	5.69E+10	-512.330	59771.	0.00
19.7568	0.02695	1685625.	-13358.	-0.00124	0.00	5.70E+10	-500.409	68787.	0.00
20.0655	0.02255	1632707.	-15187.	-0.00113	0.00	5.70E+10	-486.895	79983.	0.00

20.3742	0.01855	1573108.	-16962.	-0.00103	0.00	5.70E+10	-471.559	94190.	0.00
20.6829	0.01492	1507038.	-18677.	-9.30E-04	0.00	5.70E+10	-454.069	112738.	0.00
20.9916	0.01166	1434737.	-20321.	-8.34E-04	0.00	5.70E+10	-433.923	137897.	0.00
21.3003	0.00874	1356481.	-21885.	-7.44E-04	0.00	5.71E+10	-410.303	173931.	0.00
21.6090	0.00615	1272595.	-23352.	-6.58E-04	0.00	5.71E+10	-381.746	230060.	0.00
21.9177	0.00386	1183471.	-24698.	-5.79E-04	0.00	5.71E+10	-345.187	331193.	0.00
22.2264	0.00186	1089609.	-25879.	-5.05E-04	0.00	5.72E+10	-292.028	581802.	0.00
22.5351	1.19E-04	991740.	-26542.	-4.38E-04	0.00	5.72E+10	-66.127	2050719.	0.00
22.8438	-0.00138	892964.	-25894.	-3.77E-04	0.00	5.72E+10	415.8201	1114195.	0.00
23.1525	-0.00267	799894.	-24201.	-3.22E-04	0.00	5.72E+10	498.1924	691142.	0.00
23.4612	-0.00377	713660.	-22257.	-2.73E-04	0.00	5.73E+10	551.5685	542526.	0.00
23.7699	-0.00469	634995.	-20139.	-2.29E-04	0.00	5.73E+10	591.8208	467349.	0.00
24.0786	-0.00546	564452.	-17887.	-1.90E-04	0.00	5.73E+10	624.2922	423267.	0.00
24.3873	-0.00610	502475.	-15524.	-1.56E-04	0.00	5.73E+10	651.4959	395551.	0.00
24.6960	-0.00662	449439.	-13067.	-1.25E-04	0.00	5.73E+10	674.8242	377689.	0.00
25.0047	-0.00703	405663.	-11561.	-9.75E-05	0.00	5.73E+10	138.5879	73043.	0.00
25.3134	-0.00734	363789.	-11030.	-7.27E-05	0.00	5.73E+10	147.9157	74638.	0.00
25.6221	-0.00757	323944.	-10468.	-5.05E-05	0.00	5.73E+10	155.7213	76234.	0.00
25.9308	-0.00772	286237.	-9879.	-3.07E-05	0.00	5.73E+10	162.0925	77829.	0.00
26.2395	-0.00779	250754.	-9269.	-1.34E-05	0.00	5.73E+10	167.1227	79424.	0.00
26.5482	-0.00781	217564.	-8643.	1.72E-06	0.00	5.73E+10	170.9091	81019.	0.00
26.8569	-0.00778	186719.	-8005.	1.48E-05	0.00	5.73E+10	173.5513	82615.	0.00
27.1656	-0.00770	158256.	-7359.	2.59E-05	0.00	5.73E+10	175.1498	84210.	0.00
27.4743	-0.00759	132197.	-6709.	3.53E-05	0.00	5.73E+10	175.8047	85805.	0.00
27.7830	-0.00744	108550.	-6058.	4.31E-05	0.00	5.73E+10	175.6141	87400.	0.00
28.0917	-0.00727	87313.	-5409.	4.94E-05	0.00	5.73E+10	174.6733	88996.	0.00
28.4004	-0.00708	68473.	-4765.	5.44E-05	0.00	5.73E+10	173.0728	90591.	0.00
28.7091	-0.00687	52008.	-4128.	5.83E-05	0.00	5.73E+10	170.8979	92186.	0.00
29.0178	-0.00665	37888.	-3500.	6.12E-05	0.00	5.73E+10	168.2272	93781.	0.00
29.3265	-0.00641	26076.	-2883.	6.33E-05	0.00	5.73E+10	165.1316	95377.	0.00
29.6352	-0.00618	16531.	-2277.	6.47E-05	0.00	5.73E+10	161.6733	96972.	0.00
29.9439	-0.00593	9204.	-1685.	6.55E-05	0.00	5.73E+10	157.9051	98567.	0.00
30.2526	-0.00569	4044.	-1108.	6.59E-05	0.00	5.73E+10	153.8694	100162.	0.00
30.5613	-0.00545	995.6231	-545.851	6.61E-05	0.00	5.73E+10	149.5970	101758.	0.00
30.8700	-0.00520	0.00	0.00	6.61E-05	0.00	5.73E+10	145.1073	51676.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.96537091 inches
Computed slope at pile head = -0.0050261 radians
Maximum bending moment = 1855899. inch-lbs
Maximum shear force = -26542. lbs
Depth of maximum bending moment = 17.59590000 feet below pile head
Depth of maximum shear force = 22.53510000 feet below pile head
Number of iterations = 21

Number of zero deflection points = 1
Pile deflection at ground = 0.33040403 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
30.87000	0.96537091	1855899.	-26542.
29.32650	0.97542549	1852441.	-27274.
27.78300	1.01685180	1836175.	-29551.
26.23950	1.15090427	1796606.	-32152.
24.69600	1.43945735	1744918.	-33579.
23.15250	3.01296406	1613726.	-33891.
21.60900	28.37612792	1572396.	-41526.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.7361	-1.58E-05	0.00	-0.00861	6.71E-08	2.71E+10	0.00	0.00	0.00
0.3087	1.7042	-3.12E-05	-2.07E-06	-0.00861	1.32E-07	2.71E+10	0.00	0.00	0.00
0.6174	1.6723	-3.12E-05	1.19E-07	-0.00861	1.32E-07	2.71E+10	0.00	0.00	0.00
0.9261	1.6404	-3.03E-05	1.0090	-0.00861	1.29E-07	2.71E+10	0.00	0.00	0.5448
1.2348	1.6085	7.4754	24.6176	-0.00861	0.03173	2.71E+10	0.00	0.00	12.2015
1.5435	1.5765	182.3871	99.5295	-0.00861	0.7741	2.71E+10	0.00	0.00	28.2433
1.8522	1.5446	744.8693	233.8664	-0.00861	3.1612	2.71E+10	0.00	0.00	44.2850
2.1609	1.5127	1915.	427.6285	-0.00861	8.1275	2.71E+10	0.00	0.00	60.3268
2.4696	1.4808	3913.	680.8157	-0.00861	16.6071	2.71E+10	0.00	0.00	76.3686

2.7783	1.4489	6959.	993.4280	-0.00861	29.5344	2.71E+10	0.00	0.00	92.4103
3.0870	1.4170	11273.	1365.	-0.00861	47.8435	2.71E+10	0.00	0.00	108.4521
3.3957	1.3851	17076.	1797.	-0.00861	72.4687	2.71E+10	0.00	0.00	124.4939
3.7044	1.3532	24586.	2288.	-0.00861	104.3442	2.71E+10	0.00	0.00	140.5356
4.0131	1.3213	34026.	2838.	-0.00860	144.4044	2.71E+10	0.00	0.00	156.5774
4.3218	1.2895	45613.	3448.	-0.00860	193.5835	2.71E+10	0.00	0.00	172.6192
4.6305	1.2576	59570.	4117.	-0.00859	252.8156	2.71E+10	0.00	0.00	188.6609
4.9392	1.2258	76116.	4846.	-0.00858	323.0351	2.71E+10	0.00	0.00	204.7027
5.2479	1.1941	95470.	5634.	-0.00857	405.1762	2.71E+10	0.00	0.00	220.7445
5.5566	1.1623	117854.	6481.	-0.00855	500.1732	2.71E+10	0.00	0.00	236.7862
5.8653	1.1307	143487.	7388.	-0.00854	608.9604	2.71E+10	0.00	0.00	252.8280
6.1740	1.0991	172590.	8354.	-0.00852	732.4718	2.71E+10	0.00	0.00	268.8698
6.4827	1.0676	205382.	9380.	-0.00849	871.6420	2.71E+10	0.00	0.00	284.9115
6.7914	1.0362	242084.	10465.	-0.00846	1027.	2.71E+10	0.00	0.00	300.9533
7.1001	1.0049	282916.	11610.	-0.00842	1201.	2.71E+10	0.00	0.00	316.9951
7.4088	0.9738	328097.	12814.	-0.00838	1392.	2.71E+10	0.00	0.00	333.0368
7.7175	0.9428	377849.	14077.	-0.00833	1604.	2.71E+10	0.00	0.00	349.0786
8.0262	0.9120	432391.	15400.	-0.00828	1835.	2.71E+10	0.00	0.00	365.1204
8.3349	0.8815	491944.	16782.	-0.00822	2088.	2.71E+10	0.00	0.00	381.1621
8.6436	0.8512	556727.	18224.	-0.00814	2363.	2.71E+10	0.00	0.00	397.2039
8.9523	0.8212	626961.	19725.	-0.00806	2661.	2.71E+10	0.00	0.00	413.2457
9.2610	0.7914	702865.	21285.	-0.00797	2983.	2.71E+10	0.00	0.00	429.2874
9.5697	0.7621	784661.	22905.	-0.00787	3330.	2.71E+10	0.00	0.00	445.3292
9.8784	0.7331	872567.	24585.	-0.00776	3703.	2.71E+10	0.00	0.00	461.3710
10.1871	0.7046	966805.	26324.	-0.00763	4103.	2.71E+10	0.00	0.00	477.4127
10.4958	0.6766	1067594.	28122.	-0.00749	4531.	2.71E+10	0.00	0.00	493.4545
10.8045	0.6491	1175154.	29705.	-0.00734	4987.	2.71E+10	0.00	0.00	361.2090
11.1132	0.6222	1287671.	30331.	-0.00722	0.00	5.71E+10	-22.972	136.7683	0.00
11.4219	0.5956	1399873.	30188.	-0.00713	0.00	5.70E+10	-54.345	337.9869	0.00
11.7306	0.5694	1511330.	29925.	-0.00704	0.00	5.70E+10	-87.494	569.2368	0.00
12.0393	0.5435	1621585.	29538.	-0.00693	0.00	5.70E+10	-121.687	829.3959	0.00
12.3480	0.5180	1730171.	29023.	-0.00683	0.00	5.69E+10	-156.507	1119.	0.00
12.6567	0.4929	1836609.	28378.	-0.00671	0.00	5.69E+10	-191.346	1438.	0.00
12.9654	0.4683	1940421.	27606.	-0.00659	0.00	5.69E+10	-225.467	1784.	0.00
13.2741	0.4441	2041140.	26711.	-0.00646	0.00	5.68E+10	-258.233	2154.	0.00
13.5828	0.4205	2138314.	25696.	-0.00632	0.00	5.68E+10	-289.746	2553.	0.00
13.8915	0.3973	2231513.	24567.	-0.00618	0.00	5.68E+10	-319.354	2978.	0.00
14.2002	0.3747	2320329.	23334.	-0.00603	0.00	5.67E+10	-346.291	3424.	0.00
14.5089	0.3526	2404393.	22008.	-0.00588	0.00	5.67E+10	-370.083	3888.	0.00
14.8176	0.3312	2483379.	20595.	-0.00572	0.00	5.67E+10	-392.791	4394.	0.00
15.1263	0.3103	2556975.	19101.	-0.00555	0.00	5.67E+10	-413.566	4937.	0.00
15.4350	0.2900	2624895.	17537.	-0.00538	0.00	5.66E+10	-430.781	5502.	0.00
15.7437	0.2704	2686904.	15917.	-0.00521	0.00	5.66E+10	-444.100	6083.	0.00
16.0524	0.2515	2742819.	14250.	-0.00503	0.00	5.66E+10	-455.613	6712.	0.00
16.3611	0.2332	2792482.	12545.	-0.00485	0.00	5.66E+10	-464.916	7386.	0.00
16.6698	0.2155	2835764.	10813.	-0.00466	0.00	5.66E+10	-470.297	8083.	0.00
16.9785	0.1986	2872594.	9069.	-0.00448	0.00	5.65E+10	-471.584	8796.	0.00
17.2872	0.1824	2902951.	7324.	-0.00429	0.00	5.65E+10	-470.271	9553.	0.00
17.5959	0.1668	2926856.	5168.	-0.00410	0.00	5.65E+10	-693.566	15400.	0.00
17.9046	0.1520	2941243.	2604.	-0.00390	0.00	5.65E+10	-690.999	16839.	0.00
18.2133	0.1379	2946147.	50.7461	-0.00371	0.00	5.65E+10	-687.427	18466.	0.00
18.5220	0.1245	2941619.	-2487.	-0.00352	0.00	5.65E+10	-682.808	20315.	0.00
18.8307	0.1118	2927720.	-5006.	-0.00333	0.00	5.65E+10	-677.095	22429.	0.00

19.1394	0.09986	2904530.	-7502.	-0.00314	0.00	5.65E+10	-670.230	24863.	0.00
19.4481	0.08860	2872143.	-9969.	-0.00295	0.00	5.65E+10	-662.143	27685.	0.00
19.7568	0.07803	2830669.	-12405.	-0.00276	0.00	5.66E+10	-652.752	30989.	0.00
20.0655	0.06815	2780238.	-14803.	-0.00258	0.00	5.66E+10	-641.953	34894.	0.00
20.3742	0.05894	2720998.	-17158.	-0.00240	0.00	5.66E+10	-629.613	39568.	0.00
20.6829	0.05040	2653117.	-19464.	-0.00222	0.00	5.66E+10	-615.561	45245.	0.00
20.9916	0.04250	2576790.	-21715.	-0.00205	0.00	5.67E+10	-599.567	52265.	0.00
21.3003	0.03522	2492235.	-23902.	-0.00188	0.00	5.67E+10	-581.312	61147.	0.00
21.6090	0.02854	2399703.	-26017.	-0.00172	0.00	5.67E+10	-560.338	72726.	0.00
21.9177	0.02245	2299482.	-28047.	-0.00157	0.00	5.67E+10	-535.946	88448.	0.00
22.2264	0.01691	2191906.	-29979.	-0.00142	0.00	5.68E+10	-506.995	111080.	0.00
22.5351	0.01190	2077373.	-32216.	-0.00128	0.00	5.68E+10	-700.962	218231.	0.00
22.8438	0.00739	1953221.	-34686.	-0.00115	0.00	5.69E+10	-632.512	317016.	0.00
23.1525	0.00335	1820389.	-36835.	-0.00103	0.00	5.69E+10	-527.576	582550.	0.00
23.4612	-2.42E-04	1680317.	-37551.	-9.16E-04	0.00	5.70E+10	140.8092	2151626.	0.00
23.7699	-0.00343	1542178.	-36277.	-8.12E-04	0.00	5.70E+10	547.4504	590416.	0.00
24.0786	-0.00626	1411551.	-34066.	-7.16E-04	0.00	5.70E+10	645.7975	382398.	0.00
24.3873	-0.00874	1289786.	-31550.	-6.28E-04	0.00	5.71E+10	712.7093	302159.	0.00
24.6960	-0.01091	1177802.	-28814.	-5.48E-04	0.00	5.71E+10	764.6351	259645.	0.00
25.0047	-0.01280	1076310.	-27007.	-4.75E-04	0.00	5.72E+10	211.0105	61079.	0.00
25.3134	-0.01443	977713.	-26180.	-4.08E-04	0.00	5.72E+10	235.2297	60396.	0.00
25.6221	-0.01582	882345.	-25267.	-3.48E-04	0.00	5.72E+10	257.7061	60331.	0.00
25.9308	-0.01701	790513.	-24274.	-2.94E-04	0.00	5.72E+10	278.7163	60708.	0.00
26.2395	-0.01800	702506.	-23205.	-2.46E-04	0.00	5.73E+10	298.4655	61418.	0.00
26.5482	-0.01883	618594.	-22064.	-2.03E-04	0.00	5.73E+10	317.1168	62394.	0.00
26.8569	-0.01951	539035.	-20857.	-1.66E-04	0.00	5.73E+10	334.8090	63586.	0.00
27.1656	-0.02005	464069.	-19585.	-1.33E-04	0.00	5.73E+10	351.6658	64959.	0.00
27.4743	-0.02049	393930.	-18253.	-1.05E-04	0.00	5.73E+10	367.8014	66489.	0.00
27.7830	-0.02084	328837.	-16862.	-8.21E-05	0.00	5.73E+10	383.3243	68153.	0.00
28.0917	-0.02110	269005.	-15414.	-6.28E-05	0.00	5.73E+10	398.3400	69934.	0.00
28.4004	-0.02130	214639.	-13911.	-4.72E-05	0.00	5.73E+10	412.9512	71817.	0.00
28.7091	-0.02145	165940.	-12355.	-3.49E-05	0.00	5.73E+10	427.2584	73789.	0.00
29.0178	-0.02156	123104.	-10746.	-2.55E-05	0.00	5.73E+10	441.3587	75837.	0.00
29.3265	-0.02164	86324.	-9085.	-1.88E-05	0.00	5.73E+10	455.3448	77952.	0.00
29.6352	-0.02170	55793.	-7373.	-1.42E-05	0.00	5.73E+10	469.3028	80122.	0.00
29.9439	-0.02174	31702.	-5608.	-1.14E-05	0.00	5.73E+10	483.3102	82340.	0.00
30.2526	-0.02178	14243.	-3792.	-9.87E-06	0.00	5.73E+10	497.4333	84597.	0.00
30.5613	-0.02182	3611.	-1922.	-9.29E-06	0.00	5.73E+10	511.7237	86888.	0.00
30.8700	-0.02185	0.00	0.00	-9.17E-06	0.00	5.73E+10	526.2155	44605.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 1.73610344 inches
Computed slope at pile head = -0.0086145 radians
Maximum bending moment = 2946147. inch-lbs

```
Maximum shear force              =        -37551. lbs
Depth of maximum bending moment  =    18.21330000 feet below pile head
Depth of maximum shear force     =    23.46120000 feet below pile head
Number of iterations             =             24
Number of zero deflection points =              1
Pile deflection at ground        =     0.64339951 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
30.87000	1.73610344	2946147.	-37551.
29.32650	1.82964124	2917271.	-40541.
27.78300	2.08587089	2852300.	-44921.
26.23950	2.72155441	2736682.	-47838.
24.69600	4.28720483	2617841.	-49506.
23.15250	36.63232175	2608423.	-60270.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

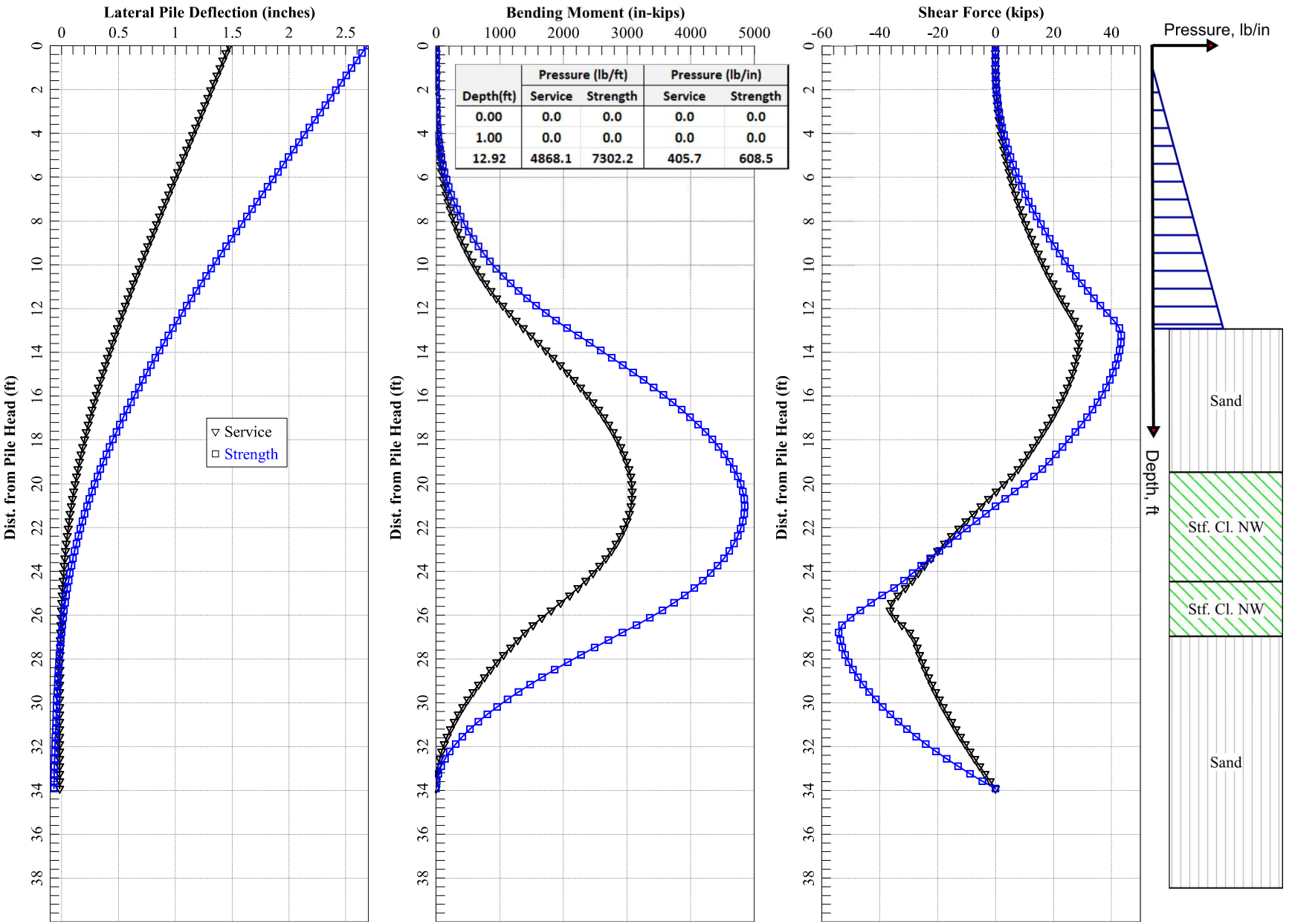
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	0.9654	-0.00503	-26542.	1855899.
2	V, lb	0.00	M, in-lb	0.00	0.00	1.7361	-0.00861	-37551.	2946147.

Maximum pile-head deflection = 1.7361034448 inches

Maximum pile-head rotation   = -0.0086144554 radians = -0.493572 deg.

The analysis ended normally.

Wall 1A (12.92ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
12.92	4868.1	7302.2	405.7	608.5

```
================================================================================

                    LPile for Windows, Version 2022-12.005

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\0000 TRC projects\CUY-77-1141\App E LPile 04-05- 2026\Wall 1A\

Name of input data file:
03 Wall_1A-12.92ft_B-041.lp12d

Name of output report file:
03 Wall_1A-12.92ft_B-041.lp12o

Name of plot output file:
03 Wall_1A-12.92ft_B-041.lp12p

Name of runtime message file:
03 Wall_1A-12.92ft_B-041.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  April 6, 2026              Time:  14:22:05
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=12.92FT) Boring B-041-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 33.920 ft
Depth of ground surface below top of pile = 12.9200 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	8.3000
2	12.920	8.3000
3	12.920	30.0000
4	33.920	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 12.920000 ft
AISC Section Type = W

AISC Section Name = W21X73

Pile width = 8.300000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 21.000000 ft
Section Diameter = 30.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W21X73

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    12.920000 ft
   Distance from top of pile to bottom of layer        =    19.460000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    34.000000 deg.
   Friction angle at bottom of layer                   =    34.000000 deg.
   Subgrade k at top of layer                          =   125.000000 pci
   Subgrade k at bottom of layer                       =   125.000000 pci


Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer           =    19.460000 ft
   Distance from top of pile to bottom of layer        =    24.460000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2500. psf
   Undrained cohesion at bottom of layer               =        2500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    24.460000 ft
   Distance from top of pile to bottom of layer        =    26.960000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        4000. psf
   Undrained cohesion at bottom of layer               =        4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


Layer 4 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    26.960000 ft
   Distance from top of pile to bottom of layer        =    38.460000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

```
   Friction angle at top of layer                    =    34.000000 deg.
   Friction angle at bottom of layer                 =    34.000000 deg.
   Subgrade k at top of layer                        =   125.000000 pci
   Subgrade k at bottom of layer                     =   125.000000 pci


 (Depth of the lowest soil layer extends 4.540 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	12.9200	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	19.4600	62.6000	--	34.0000	--	125.0000
2	Stiff Clay	19.4600	57.6000	2500.	--	0.00500	--
	w/o Free Water	24.4600	57.6000	2500.	--	0.00500	--
3	Stiff Clay	24.4600	62.6000	4000.	--	0.00400	--
	w/o Free Water	26.9600	62.6000	4000.	--	0.00400	--
4	Sand	26.9600	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	38.4600	62.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	12.920	0.9300	1.0000
2	34.000	0.9300	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	12.920	405.700

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	12.920	608.500

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	12.920000 ft
Flange Width	=	8.300000 in
Section Depth	=	21.200000 in
Flange Thickness	=	0.740000 in
Web Thickness	=	0.455000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	21.500000 sq. in.
Moment of Inertia	=	1600. in^4
Elastic Bending Stiffness	=	46400000. kip-in^2
Plastic Modulus, Z	=	172.000000in^3
Plastic Moment Capacity = Fy Z	=	8600.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1075.000 kips
Nominal Axial Tensile Capacity	=	-1075.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000883	403.2560368	45677048.	10.6000000	2.6867169	
0.00001766	806.5120736	45677048.	10.6000000	5.3734338	
0.00002649	1210.	45677048.	10.6000000	8.0601507	
0.00003531	1613.	45677048.	10.6000000	10.7468676	

0.00004414	2016.	45677048.	10.6000000	13.4335845	
0.00005297	2420.	45677048.	10.6000000	16.1203014	
0.00006180	2823.	45677048.	10.6000000	18.8070183	
0.00007063	3226.	45677048.	10.6000000	21.4937351	
0.00007946	3629.	45677048.	10.6000000	24.1804520	
0.00008828	4033.	45677048.	10.6000000	26.8671689	
0.00009711	4436.	45677048.	10.6000000	29.5538858	
0.0001059	4839.	45677048.	10.6000000	32.2406027	
0.0001148	5242.	45677048.	10.6000000	34.9273196	
0.0001236	5646.	45677048.	10.6000000	37.6140365	
0.0001324	6049.	45677048.	10.6000000	40.3007534	
0.0001413	6452.	45677048.	10.6000000	42.9874703	
0.0001501	6855.	45677048.	10.6000000	45.6741872	
0.0001589	7259.	45677048.	10.6000000	48.3609041	
0.0001677	7623.	45442871.	10.6000000	50.0000000	Y
0.0001766	7767.	43990744.	10.6000000	50.0000000	Y
0.0001854	7835.	42258616.	10.6000000	50.0000000	Y
0.0001942	7893.	40637759.	10.6000000	50.0000000	Y
0.0002031	7944.	39121180.	10.6000000	50.0000000	Y
0.0002119	7988.	37702384.	10.6000000	50.0000000	Y
0.0002207	8028.	36372074.	10.6000000	50.0000000	Y
0.0002295	8063.	35125975.	10.6000000	50.0000000	Y
0.0002384	8094.	33954772.	10.6000000	50.0000000	Y
0.0002472	8122.	32854675.	10.6000000	50.0000000	Y
0.0002560	8147.	31819594.	10.6000000	50.0000000	Y
0.0002649	8169.	30844184.	10.6000000	50.0000000	Y
0.0002737	8190.	29923724.	10.6000000	50.0000000	Y
0.0002825	8208.	29054022.	10.6000000	50.0000000	Y
0.0002913	8225.	28231332.	10.6000000	50.0000000	Y
0.0003002	8240.	27452290.	10.6000000	50.0000000	Y
0.0003090	8254.	26713859.	10.6000000	50.0000000	Y
0.0003178	8267.	26012713.	10.6000000	50.0000000	Y
0.0003267	8279.	25345602.	10.6000000	50.0000000	Y
0.0003355	8290.	24711473.	10.6000000	50.0000000	Y
0.0003443	8300.	24107542.	10.6000000	50.0000000	Y
0.0003620	8319.	22981785.	10.6000000	50.0000000	Y
0.0003796	8334.	21953938.	10.6000000	50.0000000	Y
0.0003973	8348.	21012537.	10.6000000	50.0000000	Y
0.0004149	8360.	20146902.	10.6000000	50.0000000	Y
0.0004326	8370.	19348499.	10.6000000	50.0000000	Y
0.0004502	8379.	18610229.	10.6000000	50.0000000	Y
0.0004679	8388.	17925865.	10.6000000	50.0000000	Y
0.0004856	8395.	17288976.	10.6000000	50.0000000	Y
0.0005032	8401.	16695377.	10.6000000	50.0000000	Y
0.0005209	8407.	16141058.	10.6000000	50.0000000	Y
0.0005385	8413.	15621535.	10.6000000	50.0000000	Y
0.0005562	8418.	15134584.	10.6000000	50.0000000	Y
0.0005738	8422.	14676404.	10.6000000	50.0000000	Y
0.0005915	8426.	14245159.	10.6000000	50.0000000	Y
0.0006092	8430.	13838407.	10.6000000	50.0000000	Y
0.0006268	8433.	13453772.	10.6000000	50.0000000	Y
0.0006445	8436.	13090213.	10.6000000	50.0000000	Y
0.0006621	8439.	12745361.	10.6000000	50.0000000	Y

```
    0.0006798         8442.     12418068.    10.6000000    50.0000000  Y
    0.0006974         8444.     12107347.    10.6000000    50.0000000  Y
    0.0007151         8446.     11811602.    10.6000000    50.0000000  Y
    0.0007328         8448.     11529668.    10.6000000    50.0000000  Y
    0.0007504         8450.     11261001.    10.6000000    50.0000000  Y
    0.0007681         8452.     11004686.    10.6000000    50.0000000  Y
    0.0007857         8454.     10759497.    10.6000000    50.0000000  Y
    0.0008034         8456.     10524862.    10.6000000    50.0000000  Y
    0.0008210         8457.     10300319.    10.6000000    50.0000000  Y


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
--------------------------------------------------------------------------------

                                          Nominal
Load              Axial                   Moment
 No.             Thrust                  Capacity
                  kips                    in-kips
----         ----------------         ----------------
  1               0.00000000                    8457.

Note that the values in the above table are not factored by a strength
reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the
LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to the LRFD structural
design standard being followed.



Pile Section No. 2:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:
--------------------------------------------------------------------------------

Length of Section                                =    21.000000 ft
Outside Diameter of Casing                       =    30.000000 in
Casing Wall Thickness                            =       0.0000 in
Moment of Inertia of Steel Casing                =       0.0000 in^4
Width Flange of Core/Insert                      =     8.300000 in
Depth of Core/Insert                             =    21.200000 in
Flange Thickness of Core/Insert                  =     0.740000 in
Web Thickness of Core/Insert                     =     0.455000 in
Moment of Inertia of Steel Core/Insert           =        1600. in^4
Yield Stress of Casing                           =       50000. psi
Elastic Modulus of Casing                        =    29000000. psi
Yield Stress of Core/Insert                      =       50000. psi
```

```
Elastic Modulus of Core/Insert                          =    29000000. psi
Number of Reinforcing Bars                              =            0 bars
Gross Area of Pile                                      =   706.858347 sq. in.
Area of Concrete                                        =   685.601747 sq. in.
Cross-sectional Area of Steel Casing                    =       0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert               =    21.500000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)       =    21.256600 sq. in.
Area Ratio of All Steel to Gross Area                   =         3.01 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As     =     3987.773 kips
Tensile Load for Cracking of Concrete                   =     -389.292 kips
Nominal Axial Tensile Capacity                          =    -1075.000 kips



Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                        kips
   ------     ------------------
      1                0.000

Definition of Run Messages:

   Y = part of pipe section has yielded.


Axial Thrust Force =      0.000 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing     Max Core   Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress       Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi          ksi           ksi
------------ ------------ ------------ ------------ ------------ ------------ ------------ ------------ ------------ ------------ ---
   0.00000883   734.7951309     83230677.     9.5065216    0.00008393     -0.000181     0.3840152       0.00000       0.00000     -4.133119 C
   0.00001766         1465.     82968506.     9.5336598     0.0001683     -0.000361     0.7547826       0.00000       0.00000     -8.252343 C
   0.00002649         2190.     82701843.     9.5613392     0.0002532     -0.000541     1.1120934       0.00000       0.00000    -12.357254 C
   0.00003531         2911.     82430515.     9.5895823     0.0003386     -0.000721     1.4557298       0.00000       0.00000    -16.447416 C
   0.00004414         3626.     82154340.     9.6184130     0.0004246     -0.000900     1.7854643       0.00000       0.00000    -20.522363 C
   0.00005297         4337.     81873124.     9.6478568     0.0005111     -0.001078     2.1010583       0.00000       0.00000    -24.581605 C
   0.00006180         5042.     81586661.     9.6779410     0.0005981     -0.001256     2.4022621       0.00000       0.00000    -28.624624 C
   0.00007063         5742.     81294729.     9.7086945     0.0006857     -0.001433     2.6888136       0.00000       0.00000    -32.650867 C
   0.00007946         6436.     80997095.     9.7401484     0.0007739     -0.001610     2.9604372       0.00000       0.00000    -36.659748 C
   0.00008828         7124.     80693801.     9.7717036     0.0008627     -0.001786     3.2166849       0.00000       0.00000    -40.652265 C
   0.00009711         7806.     80384579.     9.8037098     0.0009521     -0.001961     3.4573201       0.00000       0.00000    -44.627353 C
    0.0001059         8483.     80069052.     9.8364785     0.0010421     -0.002136     3.6820955       0.00000       0.00000    -48.583710 C
    0.0001148         9029.     78668164.     9.8165451     0.0011266     -0.002316     3.8769224       0.00000       0.00000    -50.000000 CY
    0.0001236         9271.     75010323.     9.6787400     0.0011963     -0.002512     4.0251850       0.00000       0.00000    -50.000000 CY
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0.0001324	9476.	71556972.	9.5446784	0.0012640	-0.002709	4.1591933	0.00000	0.00000	-50.000000 CY
0.0001413	9653.	68334855.	9.4168931	0.0013302	-0.002907	4.2806368	0.00000	0.00000	-50.000000 CY
0.0001501	9806.	65335585.	9.2934048	0.0013948	-0.003108	4.3899467	0.00000	0.00000	-50.000000 CY
0.0001589	9940.	62553175.	9.1775542	0.0014584	-0.003309	4.4887889	0.00000	0.00000	-50.000000 CY
0.0001677	10059.	59968053.	9.0658695	0.0015207	-0.003511	4.5770455	0.00000	0.00000	-50.000000 CY
0.0001766	10164.	57565533.	8.9600872	0.0015821	-0.003715	4.6557893	0.00000	0.00000	-50.000000 CY
0.0001854	10259.	55334613.	8.8611439	0.0016428	-0.003919	4.7257637	0.00000	0.00000	-50.000000 CY
0.0001942	10343.	53251487.	8.7647423	0.0017023	-0.004124	4.7865692	0.00000	0.00000	-50.000000 CY
0.0002031	10419.	51310890.	8.6740455	0.0017613	-0.004330	4.8393014	0.00000	0.00000	-50.000000 CY
0.0002119	10488.	49499798.	8.5890221	0.0018199	-0.004537	4.8842760	0.00000	0.00000	-50.000000 CY
0.0002207	10551.	47804019.	8.5073821	0.0018777	-0.004744	4.9214363	0.00000	0.00000	-50.000000 CY
0.0002295	10607.	46211595.	8.4287516	0.0019347	-0.004951	4.9510713	0.00000	0.00000	-50.000000 CY
0.0002384	10659.	44718294.	8.3549267	0.0019915	-0.005159	4.9736387	0.00000	0.00000	-50.000000 CY
0.0002472	10707.	43315147.	8.2855272	0.0020481	-0.005368	4.9892365	0.00000	0.00000	-50.000000 CY
0.0002560	10751.	41992152.	8.2186594	0.0021042	-0.005577	4.9979074	0.00000	0.00000	-50.000000 CY
0.0002649	10791.	40742105.	8.1539018	0.0021596	-0.005786	4.9951487	0.00000	0.00000	-50.000000 CY
0.0002737	10827.	39561267.	8.0929244	0.0022149	-0.005996	4.9996677	0.00000	0.00000	-50.000000 CY
0.0002825	10861.	38444235.	8.0355456	0.0022701	-0.006205	4.9971124	0.00000	0.00000	-50.000000 CY
0.0002913	10892.	37386765.	7.9814603	0.0023253	-0.006415	4.9999950	0.00000	0.00000	-50.000000 CY
0.0003002	10921.	36381920.	7.9294147	0.0023801	-0.006625	4.9978287	0.00000	0.00000	-50.000000 CY
0.0003090	10946.	35425238.	7.8781260	0.0024343	-0.006836	4.9995835	0.00000	0.00000	-50.000000 CY
0.0003178	10970.	34515961.	7.8298946	0.0024885	-0.007046	4.9972504	0.00000	0.00000	-50.000000 CY
0.0003267	10992.	33651731.	7.7841983	0.0025427	-0.007257	4.9999421	0.00000	0.00000	-50.000000 CY
0.0003355	11013.	32826431.	7.7406361	0.0025968	-0.007468	4.9951577	0.00000	0.00000	-50.000000 CY
0.0003443	11032.	32040928.	7.6994972	0.0026510	-0.007678	4.9992387	0.00000	0.00000	-50.000000 CY
0.0003620	11066.	30571713.	7.6212352	0.0027586	-0.008100	4.9964586	0.00000	0.00000	-50.000000 CY
0.0003796	11095.	29225731.	7.5471149	0.0028651	-0.008524	4.9929604	0.00000	0.00000	-50.000000 CY
0.0003973	11120.	27990447.	7.4796245	0.0029715	-0.008947	4.9988989	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	11120.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	12.9200	0.00	N.A.	No	0.00	41722.
2	19.4600	2.0652	No	No	41722.	125908.
3	24.4600	4.7714	Yes	No	167630.	107328.
4	26.9600	15.9544	No	No	274958.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.4734	5.51E-06	0.00	-0.00655	1.43E-08	4.57E+10	0.00	0.00	0.00
0.3392	1.4467	9.18E-06	6.02E-07	-0.00655	2.38E-08	4.57E+10	0.00	0.00	0.00
0.6784	1.4201	1.04E-05	3.76E-07	-0.00655	2.70E-08	4.57E+10	0.00	0.00	0.00
1.0176	1.3934	1.22E-05	3.5782	-0.00655	3.18E-08	4.57E+10	0.00	0.00	1.7581
1.3568	1.3668	29.1292	31.8714	-0.00655	0.07555	4.57E+10	0.00	0.00	12.1438
1.6960	1.3402	259.4583	104.7972	-0.00655	0.6730	4.57E+10	0.00	0.00	23.6885
2.0352	1.3135	882.2626	224.7149	-0.00655	2.2884	4.57E+10	0.00	0.00	35.2333
2.3744	1.2869	2089.	391.6243	-0.00655	5.4179	4.57E+10	0.00	0.00	46.7780
2.7136	1.2602	4070.	605.5254	-0.00655	10.5576	4.57E+10	0.00	0.00	58.3228
3.0528	1.2336	7018.	866.4184	-0.00654	18.2037	4.57E+10	0.00	0.00	69.8675
3.3920	1.2069	11124.	1174.	-0.00654	28.8522	4.57E+10	0.00	0.00	81.4123
3.7312	1.1803	16578.	1529.	-0.00654	42.9993	4.57E+10	0.00	0.00	92.9570

4.0704	1.1537	23572.	1931.	-0.00654	61.1411	4.57E+10	0.00	0.00	104.5018
4.4096	1.1271	32298.	2380.	-0.00654	83.7738	4.57E+10	0.00	0.00	116.0465
4.7488	1.1005	42947.	2876.	-0.00653	111.3933	4.57E+10	0.00	0.00	127.5913
5.0880	1.0739	55709.	3419.	-0.00653	144.4960	4.57E+10	0.00	0.00	139.1360
5.4272	1.0473	70777.	4008.	-0.00652	183.5778	4.57E+10	0.00	0.00	150.6808
5.7664	1.0207	88341.	4645.	-0.00652	229.1350	4.57E+10	0.00	0.00	162.2255
6.1056	0.9942	108593.	5329.	-0.00651	281.6635	4.57E+10	0.00	0.00	173.7703
6.4448	0.9678	131724.	6060.	-0.00650	341.6596	4.57E+10	0.00	0.00	185.3150
6.7840	0.9413	157926.	6838.	-0.00649	409.6194	4.57E+10	0.00	0.00	196.8598
7.1232	0.9150	187389.	7662.	-0.00647	486.0390	4.57E+10	0.00	0.00	208.4046
7.4624	0.8887	220304.	8534.	-0.00645	571.4144	4.57E+10	0.00	0.00	219.9493
7.8016	0.8624	256864.	9453.	-0.00643	666.2419	4.57E+10	0.00	0.00	231.4941
8.1408	0.8363	297260.	10419.	-0.00641	771.0175	4.57E+10	0.00	0.00	243.0388
8.4800	0.8103	341682.	11432.	-0.00638	886.2374	4.57E+10	0.00	0.00	254.5836
8.8192	0.7844	390322.	12491.	-0.00634	1012.	4.57E+10	0.00	0.00	266.1283
9.1584	0.7586	443371.	13598.	-0.00631	1150.	4.57E+10	0.00	0.00	277.6731
9.4976	0.7330	501021.	14752.	-0.00627	1300.	4.57E+10	0.00	0.00	289.2178
9.8368	0.7076	563463.	15953.	-0.00622	1461.	4.57E+10	0.00	0.00	300.7626
10.1760	0.6824	630888.	17200.	-0.00616	1636.	4.57E+10	0.00	0.00	312.3073
10.5152	0.6574	703487.	18495.	-0.00611	1825.	4.57E+10	0.00	0.00	323.8521
10.8544	0.6327	781452.	19837.	-0.00604	2027.	4.57E+10	0.00	0.00	335.3968
11.1936	0.6083	864973.	21225.	-0.00597	2244.	4.57E+10	0.00	0.00	346.9416
11.5328	0.5841	954243.	22661.	-0.00588	2475.	4.57E+10	0.00	0.00	358.4863
11.8720	0.5604	1049453.	24144.	-0.00580	2722.	4.57E+10	0.00	0.00	370.0311
12.2112	0.5370	1150793.	25673.	-0.00570	2985.	4.57E+10	0.00	0.00	381.5758
12.5504	0.5140	1258455.	27250.	-0.00559	3264.	4.57E+10	0.00	0.00	393.1206
12.8896	0.4915	1372630.	28533.	-0.00547	3560.	4.57E+10	0.00	0.00	237.2031
13.2288	0.4694	1490735.	28960.	-0.00538	0.00	8.30E+10	-27.290	236.6320	0.00
13.5680	0.4477	1608389.	28783.	-0.00530	0.00	8.29E+10	-59.782	543.5274	0.00
13.9072	0.4263	1725051.	28470.	-0.00522	0.00	8.28E+10	-93.966	897.2371	0.00
14.2464	0.4052	1840157.	28016.	-0.00513	0.00	8.28E+10	-129.007	1296.	0.00
14.5856	0.3845	1953126.	27419.	-0.00504	0.00	8.28E+10	-164.536	1742.	0.00
14.9248	0.3642	2063368.	26678.	-0.00494	0.00	8.27E+10	-199.483	2229.	0.00
15.2640	0.3443	2170305.	25798.	-0.00483	0.00	8.27E+10	-233.079	2755.	0.00
15.6032	0.3249	2273381.	24784.	-0.00472	0.00	8.27E+10	-265.169	3322.	0.00
15.9424	0.3059	2372063.	23643.	-0.00461	0.00	8.26E+10	-295.285	3930.	0.00
16.2816	0.2873	2465853.	22386.	-0.00449	0.00	8.26E+10	-322.394	4567.	0.00
16.6208	0.2693	2554302.	21026.	-0.00437	0.00	8.25E+10	-345.917	5228.	0.00
16.9600	0.2518	2637019.	19571.	-0.00424	0.00	8.25E+10	-368.803	5962.	0.00
17.2992	0.2348	2713626.	18030.	-0.00411	0.00	8.25E+10	-388.499	6735.	0.00
17.6384	0.2184	2783796.	16417.	-0.00397	0.00	8.25E+10	-404.044	7532.	0.00
17.9776	0.2025	2847272.	14748.	-0.00383	0.00	8.24E+10	-415.761	8358.	0.00
18.3168	0.1872	2903860.	13034.	-0.00369	0.00	8.24E+10	-426.596	9278.	0.00
18.6560	0.1724	2953380.	11284.	-0.00355	0.00	8.24E+10	-433.136	10224.	0.00
18.9952	0.1583	2995723.	9517.	-0.00340	0.00	8.24E+10	-435.159	11189.	0.00
19.3344	0.1448	3030856.	7749.	-0.00325	0.00	8.24E+10	-433.683	12194.	0.00
19.6736	0.1318	3058805.	5533.	-0.00310	0.00	8.24E+10	-655.088	20225.	0.00
20.0128	0.1195	3075899.	2871.	-0.00295	0.00	8.24E+10	-653.077	22238.	0.00
20.3520	0.1078	3082174.	218.6346	-0.00280	0.00	8.24E+10	-649.975	24532.	0.00
20.6912	0.09678	3077679.	-2418.	-0.00264	0.00	8.24E+10	-645.733	27159.	0.00
21.0304	0.08633	3062486.	-5036.	-0.00249	0.00	8.24E+10	-640.293	30190.	0.00
21.3696	0.07649	3036685.	-7628.	-0.00234	0.00	8.24E+10	-633.586	33714.	0.00
21.7088	0.06727	3000386.	-10191.	-0.00219	0.00	8.24E+10	-625.525	37849.	0.00

22.0480	0.05865	2953723.	-12718.	-0.00204	0.00	8.24E+10	-616.007	42751.	0.00
22.3872	0.05063	2896854.	-15202.	-0.00190	0.00	8.24E+10	-604.898	48635.	0.00
22.7264	0.04318	2829963.	-17638.	-0.00176	0.00	8.25E+10	-592.025	55805.	0.00
23.0656	0.03631	2753263.	-20018.	-0.00162	0.00	8.25E+10	-577.157	64705.	0.00
23.4048	0.02999	2667001.	-22332.	-0.00149	0.00	8.25E+10	-559.972	76013.	0.00
23.7440	0.02420	2571462.	-24571.	-0.00136	0.00	8.25E+10	-540.007	90830.	0.00
24.0832	0.01893	2466975.	-26721.	-0.00123	0.00	8.26E+10	-516.552	111074.	0.00
24.4224	0.01415	2353930.	-28767.	-0.00112	0.00	8.26E+10	-488.439	140462.	0.00
24.7616	0.00985	2232792.	-31134.	-0.00100	0.00	8.27E+10	-674.908	278862.	0.00
25.1008	0.00600	2100473.	-33743.	-8.96E-04	0.00	8.27E+10	-606.768	411932.	0.00
25.4400	0.00256	1958100.	-35993.	-7.96E-04	0.00	8.28E+10	-499.148	793438.	0.00
25.7792	-4.82E-04	1807458.	-36431.	-7.03E-04	0.00	8.28E+10	283.9460	2396300.	0.00
26.1184	-0.00316	1661520.	-34746.	-6.18E-04	0.00	8.29E+10	544.2996	700293.	0.00
26.4576	-0.00551	1524600.	-32344.	-5.40E-04	0.00	8.29E+10	635.8119	469445.	0.00
26.7968	-0.00756	1398214.	-29627.	-4.68E-04	0.00	8.30E+10	699.2739	376620.	0.00
27.1360	-0.00932	1283414.	-27846.	-4.02E-04	0.00	8.30E+10	175.7003	76710.	0.00
27.4752	-0.01083	1171525.	-27081.	-3.42E-04	0.00	8.30E+10	200.1524	75210.	0.00
27.8144	-0.01211	1062952.	-26221.	-2.87E-04	0.00	8.31E+10	222.5323	74810.	0.00
28.1536	-0.01317	958066.	-25273.	-2.38E-04	0.00	8.31E+10	243.1896	75154.	0.00
28.4928	-0.01404	857209.	-24244.	-1.93E-04	0.00	8.32E+10	262.3601	76041.	0.00
28.8320	-0.01475	760699.	-23140.	-1.54E-04	0.00	8.32E+10	280.2173	77351.	0.00
29.1712	-0.01530	668832.	-21965.	-1.19E-04	0.00	8.32E+10	296.8989	79008.	0.00
29.5104	-0.01571	581884.	-20725.	-8.83E-05	0.00	8.32E+10	312.5213	80957.	0.00
29.8496	-0.01601	500113.	-19423.	-6.18E-05	0.00	8.32E+10	327.1887	83162.	0.00
30.1888	-0.01622	423764.	-18063.	-3.92E-05	0.00	8.32E+10	340.9992	85594.	0.00
30.5280	-0.01633	353064.	-16649.	-2.02E-05	0.00	8.32E+10	354.0477	88230.	0.00
30.8672	-0.01638	288231.	-15182.	-4.53E-06	0.00	8.32E+10	366.4280	91053.	0.00
31.2064	-0.01637	229468.	-13667.	8.13E-06	0.00	8.32E+10	378.2336	94045.	0.00
31.5456	-0.01631	176972.	-12104.	1.81E-05	0.00	8.32E+10	389.5570	97193.	0.00
31.8848	-0.01622	130930.	-10496.	2.56E-05	0.00	8.32E+10	400.4894	100482.	0.00
32.2240	-0.01611	91524.	-8845.	3.10E-05	0.00	8.32E+10	411.1187	103900.	0.00
32.5632	-0.01597	58929.	-7150.	3.47E-05	0.00	8.32E+10	421.5281	107434.	0.00
32.9024	-0.01582	33318.	-5413.	3.70E-05	0.00	8.32E+10	431.7926	111073.	0.00
33.2416	-0.01567	14861.	-3635.	3.82E-05	0.00	8.32E+10	441.9766	114809.	0.00
33.5808	-0.01551	3726.	-1825.	3.86E-05	0.00	8.32E+10	447.1103	117316.	0.00
33.9200	-0.01536	0.00	0.00	3.87E-05	0.00	8.32E+10	449.8366	59621.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 1.47336693 inches
Computed slope at pile head = -0.0065456 radians
Maximum bending moment = 3082174. inch-lbs
Maximum shear force = -36431. lbs
Depth of maximum bending moment = 20.35200000 feet below pile head
Depth of maximum shear force = 25.77920000 feet below pile head

Number of iterations = 25
Number of zero deflection points = 1
Pile deflection at ground = 0.48948124 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.92000	1.47336693	3082174.	-36431.
32.22400	1.54036879	3057464.	-39681.
30.52800	1.76403962	2990347.	-44140.
28.83200	2.36624398	2879582.	-48317.
27.13600	3.71151675	2733799.	-49830.
25.44000	26.49133841	2700232.	-58834.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.6904	2.08E-05	0.00	-0.01136	5.40E-08	4.57E+10	0.00	0.00	0.00
0.3392	2.6442	2.08E-05	1.50E-07	-0.01136	5.40E-08	4.57E+10	0.00	0.00	0.00
0.6784	2.5980	2.20E-05	0.00	-0.01136	5.72E-08	4.57E+10	0.00	0.00	0.00
1.0176	2.5517	2.08E-05	5.3668	-0.01136	5.40E-08	4.57E+10	0.00	0.00	2.6370
1.3568	2.5055	43.6903	47.8031	-0.01136	0.1133	4.57E+10	0.00	0.00	18.2142
1.6960	2.4593	389.1556	157.1829	-0.01136	1.0094	4.57E+10	0.00	0.00	35.5299
2.0352	2.4131	1323.	337.0446	-0.01136	3.4323	4.57E+10	0.00	0.00	52.8456
2.3744	2.3669	3133.	587.3882	-0.01136	8.1261	4.57E+10	0.00	0.00	70.1613
2.7136	2.3206	6105.	908.2135	-0.01135	15.8351	4.57E+10	0.00	0.00	87.4770

3.0528	2.2744	10527.	1300.	-0.01135	27.3032	4.57E+10	0.00	0.00	104.7927
3.3920	2.2282	16684.	1761.	-0.01135	43.2747	4.57E+10	0.00	0.00	122.1084
3.7312	2.1820	24865.	2294.	-0.01135	64.4937	4.57E+10	0.00	0.00	139.4241
4.0704	2.1358	35356.	2896.	-0.01135	91.7041	4.57E+10	0.00	0.00	156.7398
4.4096	2.0896	48443.	3570.	-0.01134	125.6503	4.57E+10	0.00	0.00	174.0555
4.7488	2.0434	64415.	4313.	-0.01134	167.0763	4.57E+10	0.00	0.00	191.3712
5.0880	1.9973	83557.	5127.	-0.01133	216.7262	4.57E+10	0.00	0.00	208.6869
5.4272	1.9512	106157.	6012.	-0.01132	275.3441	4.57E+10	0.00	0.00	226.0026
5.7664	1.9051	132501.	6967.	-0.01131	343.6742	4.57E+10	0.00	0.00	243.3183
6.1056	1.8591	162876.	7993.	-0.01130	422.4606	4.57E+10	0.00	0.00	260.6340
6.4448	1.8131	197570.	9089.	-0.01128	512.4473	4.57E+10	0.00	0.00	277.9497
6.7840	1.7672	236869.	10256.	-0.01127	614.3786	4.57E+10	0.00	0.00	295.2654
7.1232	1.7214	281060.	11493.	-0.01124	728.9985	4.57E+10	0.00	0.00	312.5811
7.4624	1.6757	330429.	12800.	-0.01122	857.0512	4.57E+10	0.00	0.00	329.8968
7.8016	1.6301	385265.	14178.	-0.01118	999.2808	4.57E+10	0.00	0.00	347.2126
8.1408	1.5846	445853.	15627.	-0.01115	1156.	4.57E+10	0.00	0.00	364.5283
8.4800	1.5394	512481.	17146.	-0.01110	1329.	4.57E+10	0.00	0.00	381.8440
8.8192	1.4943	585435.	18735.	-0.01105	1518.	4.57E+10	0.00	0.00	399.1597
9.1584	1.4494	665002.	20395.	-0.01100	1725.	4.57E+10	0.00	0.00	416.4754
9.4976	1.4047	751470.	22126.	-0.01094	1949.	4.57E+10	0.00	0.00	433.7911
9.8368	1.3603	845125.	23927.	-0.01086	2192.	4.57E+10	0.00	0.00	451.1068
10.1760	1.3163	946254.	25798.	-0.01078	2454.	4.57E+10	0.00	0.00	468.4225
10.5152	1.2725	1055144.	27740.	-0.01070	2737.	4.57E+10	0.00	0.00	485.7382
10.8544	1.2292	1172081.	29753.	-0.01060	3040.	4.57E+10	0.00	0.00	503.0539
11.1936	1.1863	1297353.	31835.	-0.01049	3365.	4.57E+10	0.00	0.00	520.3696
11.5328	1.1438	1431247.	33989.	-0.01036	3712.	4.57E+10	0.00	0.00	537.6853
11.8720	1.1019	1574049.	36213.	-0.01023	4083.	4.57E+10	0.00	0.00	555.0010
12.2112	1.0605	1726047.	38507.	-0.01008	4477.	4.57E+10	0.00	0.00	572.3167
12.5504	1.0198	1887527.	40872.	-0.00992	4896.	4.57E+10	0.00	0.00	589.6324
12.8896	0.9798	2058776.	42796.	-0.00975	5340.	4.57E+10	0.00	0.00	355.7754
13.2288	0.9405	2235919.	43450.	-0.00960	0.00	8.27E+10	-34.193	147.9912	0.00
13.5680	0.9016	2412496.	43228.	-0.00949	0.00	8.26E+10	-74.979	338.4964	0.00
13.9072	0.8632	2587831.	42835.	-0.00936	0.00	8.25E+10	-118.058	556.6722	0.00
14.2464	0.8254	2761210.	42265.	-0.00923	0.00	8.25E+10	-162.347	800.6054	0.00
14.5856	0.7881	2931899.	41513.	-0.00909	0.00	8.24E+10	-206.861	1068.	0.00
14.9248	0.7514	3099160.	40582.	-0.00894	0.00	8.23E+10	-250.731	1358.	0.00
15.2640	0.7153	3262268.	39475.	-0.00878	0.00	8.23E+10	-293.104	1668.	0.00
15.6032	0.6799	3420519.	38199.	-0.00862	0.00	8.22E+10	-333.769	1998.	0.00
15.9424	0.6452	3573240.	36762.	-0.00845	0.00	8.22E+10	-372.213	2348.	0.00
16.2816	0.6111	3719795.	35176.	-0.00826	0.00	8.21E+10	-407.372	2713.	0.00
16.6208	0.5779	3859600.	33454.	-0.00808	0.00	8.21E+10	-438.638	3090.	0.00
16.9600	0.5454	3992137.	31605.	-0.00788	0.00	8.20E+10	-469.923	3507.	0.00
17.2992	0.5137	4116889.	29635.	-0.00768	0.00	8.19E+10	-498.093	3947.	0.00
17.6384	0.4829	4233388.	27559.	-0.00747	0.00	8.19E+10	-521.965	4400.	0.00
17.9776	0.4529	4341240.	25394.	-0.00726	0.00	8.19E+10	-541.502	4867.	0.00
18.3168	0.4238	4440119.	23153.	-0.00704	0.00	8.18E+10	-559.642	5376.	0.00
18.6560	0.3956	4529727.	20849.	-0.00682	0.00	8.18E+10	-572.771	5894.	0.00
18.9952	0.3683	4609845.	18501.	-0.00659	0.00	8.18E+10	-580.556	6417.	0.00
19.3344	0.3419	4680343.	16128.	-0.00636	0.00	8.17E+10	-585.750	6974.	0.00
19.6736	0.3165	4741138.	13276.	-0.00612	0.00	8.17E+10	-815.403	10487.	0.00
20.0128	0.2920	4788422.	9955.	-0.00589	0.00	8.17E+10	-816.484	11380.	0.00
20.3520	0.2686	4822179.	6632.	-0.00565	0.00	8.17E+10	-816.493	12375.	0.00
20.6912	0.2461	4842408.	3310.	-0.00541	0.00	8.17E+10	-815.392	13489.	0.00

21.0304	0.2245	4849127.	-4.088	-0.00517	0.00	8.17E+10	-813.135	14740.	0.00
21.3696	0.2040	4842374.	-3307.	-0.00492	0.00	8.17E+10	-809.667	16155.	0.00
21.7088	0.1845	4822207.	-6593.	-0.00468	0.00	8.17E+10	-804.928	17763.	0.00
22.0480	0.1659	4788704.	-9857.	-0.00444	0.00	8.17E+10	-798.844	19602.	0.00
22.3872	0.1483	4741965.	-13093.	-0.00421	0.00	8.17E+10	-791.327	21723.	0.00
22.7264	0.1316	4682115.	-16296.	-0.00397	0.00	8.17E+10	-782.269	24189.	0.00
23.0656	0.1159	4609304.	-19458.	-0.00374	0.00	8.18E+10	-771.537	27085.	0.00
23.4048	0.1012	4523711.	-22573.	-0.00351	0.00	8.18E+10	-758.960	30529.	0.00
23.7440	0.08735	4425543.	-25632.	-0.00329	0.00	8.18E+10	-744.319	34684.	0.00
24.0832	0.07441	4315043.	-28627.	-0.00307	0.00	8.19E+10	-727.320	39788.	0.00
24.4224	0.06234	4192492.	-31548.	-0.00286	0.00	8.19E+10	-707.559	46203.	0.00
24.7616	0.05111	4058219.	-35061.	-0.00266	0.00	8.20E+10	-1019.	81116.	0.00
25.1008	0.04071	3907070.	-39127.	-0.00246	0.00	8.20E+10	-979.418	97930.	0.00
25.4400	0.03109	3739694.	-43017.	-0.00227	0.00	8.21E+10	-931.690	121961.	0.00
25.7792	0.02224	3556881.	-46686.	-0.00209	0.00	8.22E+10	-871.539	159542.	0.00
26.1184	0.01409	3359629.	-50070.	-0.00192	0.00	8.22E+10	-790.826	228402.	0.00
26.4576	0.00663	3149274.	-53034.	-0.00176	0.00	8.23E+10	-665.826	408886.	0.00
26.7968	-2.03E-04	2927887.	-54133.	-0.00161	0.00	8.24E+10	125.7671	2518161.	0.00
27.1360	-0.00645	2708584.	-53617.	-0.00147	0.00	8.25E+10	127.8374	80721.	0.00
27.4752	-0.01215	2491400.	-52920.	-0.00134	0.00	8.26E+10	214.5696	71912.	0.00
27.8144	-0.01734	2277770.	-51920.	-0.00122	0.00	8.27E+10	276.8820	64980.	0.00
28.1536	-0.02209	2068728.	-50679.	-0.00111	0.00	8.27E+10	332.9975	61369.	0.00
28.4928	-0.02641	1865203.	-49217.	-0.00102	0.00	8.28E+10	385.2203	59361.	0.00
28.8320	-0.03037	1668060.	-47548.	-9.31E-04	0.00	8.29E+10	434.7826	58273.	0.00
29.1712	-0.03399	1478121.	-45682.	-8.53E-04	0.00	8.30E+10	482.4560	57773.	0.00
29.5104	-0.03732	1296175.	-43624.	-7.85E-04	0.00	8.30E+10	528.7808	57677.	0.00
29.8496	-0.04039	1122990.	-41379.	-7.26E-04	0.00	8.30E+10	574.1665	57870.	0.00
30.1888	-0.04323	959318.	-38951.	-6.75E-04	0.00	8.31E+10	618.9467	58280.	0.00
30.5280	-0.04588	805901.	-36341.	-6.32E-04	0.00	8.32E+10	663.4065	58855.	0.00
30.8672	-0.04837	663475.	-33550.	-5.96E-04	0.00	8.32E+10	707.7997	59559.	0.00
31.2064	-0.05073	532776.	-30578.	-5.67E-04	0.00	8.32E+10	752.3559	60364.	0.00
31.5456	-0.05299	414543.	-27425.	-5.44E-04	0.00	8.32E+10	797.2864	61248.	0.00
31.8848	-0.05516	309518.	-24087.	-5.26E-04	0.00	8.32E+10	842.7861	62195.	0.00
32.2240	-0.05727	218458.	-20562.	-5.13E-04	0.00	8.32E+10	889.0346	63191.	0.00
32.5632	-0.05933	142127.	-16847.	-5.04E-04	0.00	8.32E+10	936.1942	64226.	0.00
32.9024	-0.06137	81307.	-12939.	-4.99E-04	0.00	8.32E+10	984.4084	65292.	0.00
33.2416	-0.06339	36797.	-8831.	-4.96E-04	0.00	8.32E+10	1034.	66381.	0.00
33.5808	-0.06541	9415.	-4520.	-4.95E-04	0.00	8.32E+10	1084.	67490.	0.00
33.9200	-0.06742	0.00	0.00	-4.94E-04	0.00	8.32E+10	1136.	34307.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 2.69040813 inches
Computed slope at pile head = -0.0113556 radians
Maximum bending moment = 4849127. inch-lbs

```
Maximum shear force              =        -54133. lbs
Depth of maximum bending moment  =    21.03040000 feet below pile head
Depth of maximum shear force     =    26.79680000 feet below pile head
Number of iterations             =             26
Number of zero deflection points =              1
Pile deflection at ground        =     0.97624365 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
33.92000	2.69040813	4849127.	-54133.
32.22400	3.00259152	4750281.	-60577.
30.52800	3.86740473	4565054.	-66981.
28.83200	7.05893643	4480904.	-75493.
27.13600	43.00959280	4477734.	-89436.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

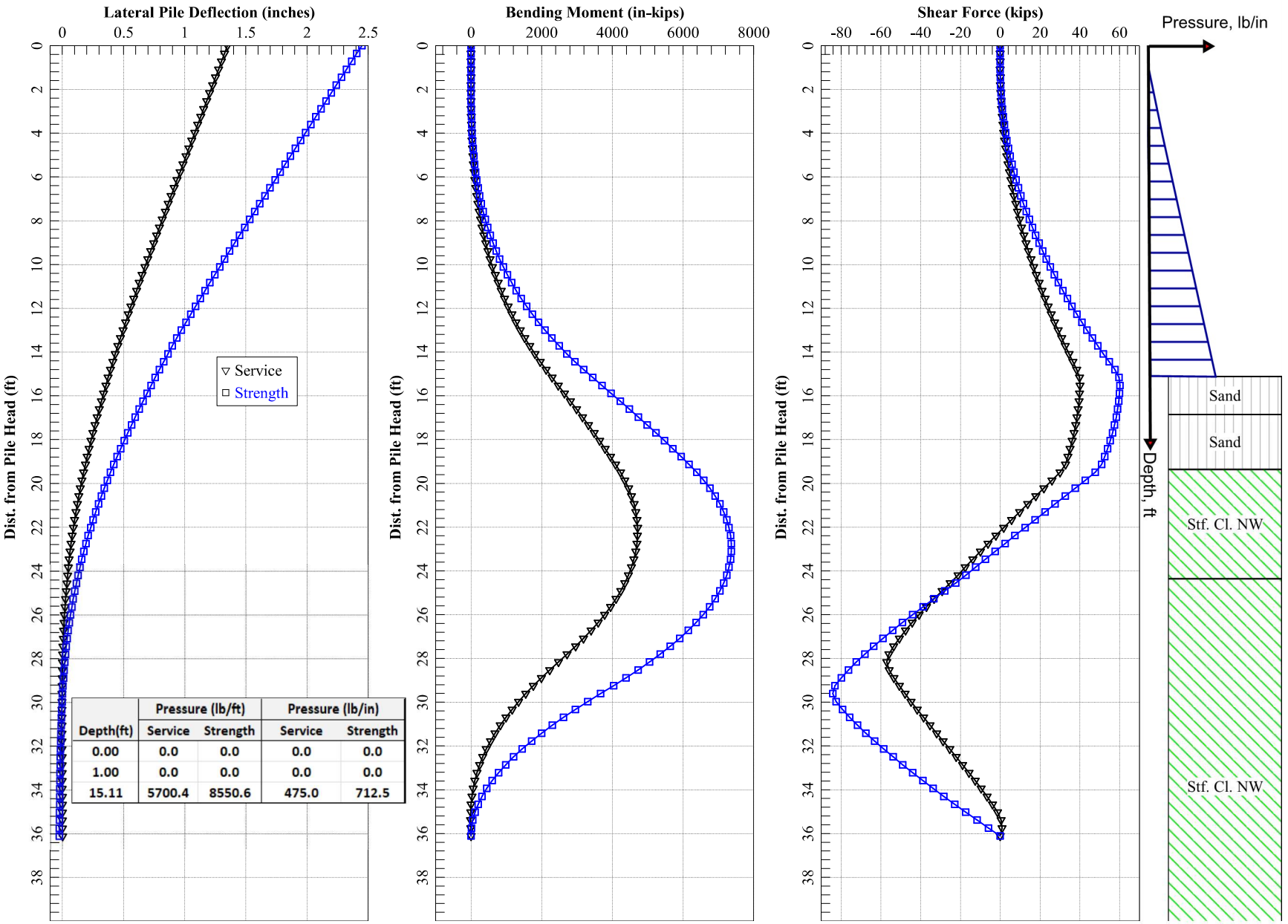
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.4734	-0.00655	-36431.	3082174.
2	V, lb	0.00	M, in-lb	0.00	0.00	2.6904	-0.01136	-54133.	4849127.

```
Maximum pile-head deflection = 2.6904081282 inches
Maximum pile-head rotation   = -0.0113556251 radians = -0.650629 deg.
```

The analysis ended normally.

Wall 1A (15.11ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
15.11	5700.4	8550.6	475.0	712.5

```
================================================================================

                    LPile for Windows, Version 2022-12.005

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\0000 TRC projects\CUY-77-1141\App E LPile 04-05- 2026\Wall 1A\

Name of input data file:
04 Wall_1A-15.11ft.lp12d

Name of output report file:
04 Wall_1A-15.11ft.lp12o

Name of plot output file:
04 Wall_1A-15.11ft.lp12p

Name of runtime message file:
04 Wall_1A-15.11ft.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  April 6, 2026              Time:  15:21:05
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=15.11FT) Boring B-042-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 36.110 ft
Depth of ground surface below top of pile = 15.1100 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	9.0700
2	15.110	9.0700
3	15.110	36.0000
4	36.110	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 15.110000 ft
AISC Section Type = W

AISC Section Name = W24X94

Pile width = 9.070000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 21.000000 ft
Section Diameter = 36.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W24X94

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    15.110000 ft
   Distance from top of pile to bottom of layer        =    16.850000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    16.850000 ft
   Distance from top of pile to bottom of layer        =    19.350000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    19.350000 ft
   Distance from top of pile to bottom of layer        =    24.350000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3500. psf
   Undrained cohesion at bottom of layer               =        3500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer           =    24.350000 ft
   Distance from top of pile to bottom of layer        =    43.350000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

```
   Undrained cohesion at top of layer                 =        4000. psf
   Undrained cohesion at bottom of layer              =        4000. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000


 (Depth of the lowest soil layer extends 7.240 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	15.1100	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	16.8500	57.6000	--	32.0000	--	60.0000
2	Sand	16.8500	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	19.3500	57.6000	--	32.0000	--	60.0000
3	Stiff Clay	19.3500	62.6000	3500.	--	0.00500	--
	w/o Free Water	24.3500	62.6000	3500.	--	0.00500	--
4	Stiff Clay	24.3500	62.6000	4000.	--	0.00400	--
	w/o Free Water	43.3500	62.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	15.110	0.8740	1.0000
2	36.110	0.8740	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	15.110	475.000

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	15.110	712.500

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	15.110000 ft
Flange Width	=	9.070000 in
Section Depth	=	24.300000 in
Flange Thickness	=	0.875000 in
Web Thickness	=	0.515000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	27.700000 sq. in.
Moment of Inertia	=	2700. in^4
Elastic Bending Stiffness	=	78300000. kip-in^2
Plastic Modulus, Z	=	254.000000in^3
Plastic Moment Capacity = Fy Z	=	12700.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1385.000 kips
Nominal Axial Tensile Capacity	=	-1385.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000808	625.0093634	77362924.	12.1500000	2.8181436	
0.00001616	1250.	77362924.	12.1500000	5.6362873	
0.00002424	1875.	77362924.	12.1500000	8.4544309	
0.00003232	2500.	77362924.	12.1500000	11.2725745	

0.00004039	3125.	77362924.	12.1500000	14.0907181	
0.00004847	3750.	77362924.	12.1500000	16.9088618	
0.00005655	4375.	77362924.	12.1500000	19.7270054	
0.00006463	5000.	77362924.	12.1500000	22.5451490	
0.00007271	5625.	77362924.	12.1500000	25.3632927	
0.00008079	6250.	77362924.	12.1500000	28.1814363	
0.00008887	6875.	77362924.	12.1500000	30.9995799	
0.00009695	7500.	77362924.	12.1500000	33.8177235	
0.0001050	8125.	77362924.	12.1500000	36.6358672	
0.0001131	8750.	77362924.	12.1500000	39.4540108	
0.0001212	9375.	77362924.	12.1500000	42.2721544	
0.0001293	10000.	77362924.	12.1500000	45.0902981	
0.0001373	10625.	77362924.	12.1500000	47.9084417	
0.0001454	11212.	77098003.	12.1500000	50.0000000	Y
0.0001535	11480.	74786450.	12.1500000	50.0000000	Y
0.0001616	11585.	71700164.	12.1500000	50.0000000	Y
0.0001697	11676.	68821642.	12.1500000	50.0000000	Y
0.0001777	11755.	66136268.	12.1500000	50.0000000	Y
0.0001858	11824.	63630774.	12.1500000	50.0000000	Y
0.0001939	11884.	61291503.	12.1500000	50.0000000	Y
0.0002020	11937.	59102180.	12.1500000	50.0000000	Y
0.0002101	11984.	57053894.	12.1500000	50.0000000	Y
0.0002181	12027.	55134748.	12.1500000	50.0000000	Y
0.0002262	12064.	53331358.	12.1500000	50.0000000	Y
0.0002343	12098.	51636248.	12.1500000	50.0000000	Y
0.0002424	12128.	50040735.	12.1500000	50.0000000	Y
0.0002504	12156.	48536810.	12.1500000	50.0000000	Y
0.0002585	12181.	47117362.	12.1500000	50.0000000	Y
0.0002666	12204.	45774748.	12.1500000	50.0000000	Y
0.0002747	12224.	44503507.	12.1500000	50.0000000	Y
0.0002828	12243.	43299242.	12.1500000	50.0000000	Y
0.0002908	12261.	42157371.	12.1500000	50.0000000	Y
0.0002989	12277.	41071338.	12.1500000	50.0000000	Y
0.0003070	12292.	40038551.	12.1500000	50.0000000	Y
0.0003151	12306.	39056472.	12.1500000	50.0000000	Y
0.0003312	12330.	37224887.	12.1500000	50.0000000	Y
0.0003474	12351.	35554335.	12.1500000	50.0000000	Y
0.0003636	12370.	34024908.	12.1500000	50.0000000	Y
0.0003797	12386.	32618841.	12.1500000	50.0000000	Y
0.0003959	12400.	31322855.	12.1500000	50.0000000	Y
0.0004120	12412.	30125060.	12.1500000	50.0000000	Y
0.0004282	12424.	29014729.	12.1500000	50.0000000	Y
0.0004443	12433.	27981388.	12.1500000	50.0000000	Y
0.0004605	12442.	27019484.	12.1500000	50.0000000	Y
0.0004767	12450.	26119896.	12.1500000	50.0000000	Y
0.0004928	12458.	25278659.	12.1500000	50.0000000	Y
0.0005090	12464.	24488592.	12.1500000	50.0000000	Y
0.0005251	12470.	23747144.	12.1500000	50.0000000	Y
0.0005413	12475.	23047693.	12.1500000	50.0000000	Y
0.0005574	12481.	22388729.	12.1500000	50.0000000	Y
0.0005736	12485.	21766190.	12.1500000	50.0000000	Y
0.0005898	12489.	21176608.	12.1500000	50.0000000	Y
0.0006059	12493.	20618470.	12.1500000	50.0000000	Y

```
    0.0006221        12497.     20088862.    12.1500000    50.0000000  Y
    0.0006382        12500.     19585087.    12.1500000    50.0000000  Y
    0.0006544        12503.     19106190.    12.1500000    50.0000000  Y
    0.0006706        12506.     18650373.    12.1500000    50.0000000  Y
    0.0006867        12509.     18215250.    12.1500000    50.0000000  Y
    0.0007029        12511.     17799785.    12.1500000    50.0000000  Y
    0.0007190        12513.     17402992.    12.1500000    50.0000000  Y


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

                                        Nominal
Load              Axial                 Moment
 No.             Thrust               Capacity
                  kips                 in-kips
----         ----------------         ----------------
  1               0.00000000                 12513.

Note that the values in the above table are not factored by a strength
reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the
LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to the LRFD structural
design standard being followed.



Pile Section No. 2:
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Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:
-------------------------------------------------------------------------------

Length of Section                                =    21.000000 ft
Outside Diameter of Casing                       =    36.000000 in
Casing Wall Thickness                            =       0.0000 in
Moment of Inertia of Steel Casing                =       0.0000 in^4
Width Flange of Core/Insert                      =     9.070000 in
Depth of Core/Insert                             =    24.300000 in
Flange Thickness of Core/Insert                  =     0.875000 in
Web Thickness of Core/Insert                     =     0.515000 in
Moment of Inertia of Steel Core/Insert           =        2700. in^4
Yield Stress of Casing                           =       50000. psi
Elastic Modulus of Casing                        =    29000000. psi
Yield Stress of Core/Insert                      =       50000. psi
Elastic Modulus of Core/Insert                   =    29000000. psi
Number of Reinforcing Bars                       =           0 bars
```

Gross Area of Pile = 1018. sq. in.
Area of Concrete = 990.390270 sq. in.
Cross-sectional Area of Steel Casing = 0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert = 27.700000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars) = 27.485750 sq. in.
Area Ratio of All Steel to Gross Area = 2.70 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 5593.248 kips
Tensile Load for Cracking of Concrete = -551.221 kips
Nominal Axial Tensile Capacity = -1385.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000808	1223.	151325937.	11.0876515	0.00008958	-0.000201	0.4091251	0.00000	0.00000	-4.445010	C
0.00001616	2437.	150793694.	11.1227962	0.0001797	-0.000402	0.8032571	0.00000	0.00000	-8.873552	C
0.00002424	3642.	150251288.	11.1587201	0.0002705	-0.000602	1.1821347	0.00000	0.00000	-13.285078	C
0.00003232	4838.	149698285.	11.1954593	0.0003618	-0.000802	1.5454835	0.00000	0.00000	-17.679007	C
0.00004039	6024.	149134223.	11.2330521	0.0004538	-0.001000	1.8930153	0.00000	0.00000	-22.054721	C
0.00004847	7201.	148558605.	11.2715402	0.0005464	-0.001199	2.2244267	0.00000	0.00000	-26.411561	C
0.00005655	8368.	147970900.	11.3109679	0.0006397	-0.001396	2.5393982	0.00000	0.00000	-30.748826	C
0.00006463	9525.	147370746.	11.3510461	0.0007336	-0.001593	2.8375243	0.00000	0.00000	-35.066396	C
0.00007271	10671.	146758136.	11.3912541	0.0008283	-0.001789	3.1183169	0.00000	0.00000	-39.364913	C
0.00008079	11806.	146132048.	11.4324927	0.0009236	-0.001985	3.3815680	0.00000	0.00000	-43.642175	C
0.00008887	12930.	145491809.	11.4748178	0.0010197	-0.002180	3.6268877	0.00000	0.00000	-47.897313	C
0.00009695	13855.	142914958.	11.4584062	0.0011109	-0.002379	3.8406439	0.00000	0.00000	-50.000000	CY
0.0001050	14256.	135741087.	11.2922958	0.0011860	-0.002595	4.0027569	0.00000	0.00000	-50.000000	CY
0.0001131	14593.	129020799.	11.1305617	0.0012589	-0.002813	4.1483881	0.00000	0.00000	-50.000000	CY
0.0001212	14880.	122787507.	10.9784233	0.0013304	-0.003032	4.2799226	0.00000	0.00000	-50.000000	CY
0.0001293	15126.	117014605.	10.8304732	0.0014000	-0.003253	4.3972782	0.00000	0.00000	-50.000000	CY

0.0001373	15340.	111693047.	10.6926122	0.0014685	-0.003476	4.5027000	0.00000	0.00000	-50.000000 CY
0.0001454	15527.	106775095.	10.5616408	0.0015359	-0.003699	4.5963457	0.00000	0.00000	-50.000000 CY
0.0001535	15692.	102227721.	10.4367851	0.0016020	-0.003924	4.6788178	0.00000	0.00000	-50.000000 CY
0.0001616	15839.	98025505.	10.3206769	0.0016676	-0.004149	4.7512373	0.00000	0.00000	-50.000000 CY
0.0001697	15970.	94128624.	10.2103763	0.0017323	-0.004375	4.8136028	0.00000	0.00000	-50.000000 CY
0.0001777	16086.	90503090.	10.1046781	0.0017960	-0.004603	4.8662370	0.00000	0.00000	-50.000000 CY
0.0001858	16191.	87136445.	10.0064421	0.0018594	-0.004830	4.9099548	0.00000	0.00000	-50.000000 CY
0.0001939	16287.	83996985.	9.9145778	0.0019224	-0.005058	4.9448748	0.00000	0.00000	-50.000000 CY
0.0002020	16372.	81058643.	9.8251378	0.0019844	-0.005287	4.9709112	0.00000	0.00000	-50.000000 CY
0.0002101	16449.	78309448.	9.7408871	0.0020461	-0.005516	4.9886155	0.00000	0.00000	-50.000000 CY
0.0002181	16520.	75733123.	9.6621126	0.0021076	-0.005745	4.9981494	0.00000	0.00000	-50.000000 CY
0.0002262	16584.	73313581.	9.5884758	0.0021690	-0.005975	4.9956702	0.00000	0.00000	-50.000000 CY
0.0002343	16643.	71034764.	9.5184633	0.0022301	-0.006204	4.9999677	0.00000	0.00000	-50.000000 CY
0.0002424	16695.	68881312.	9.4504318	0.0022905	-0.006435	4.9984969	0.00000	0.00000	-50.000000 CY
0.0002504	16742.	66849344.	9.3867201	0.0023509	-0.006665	4.9939094	0.00000	0.00000	-50.000000 CY
0.0002585	16786.	64929134.	9.3271739	0.0024113	-0.006896	4.9993874	0.00000	0.00000	-50.000000 CY
0.0002666	16825.	63109302.	9.2710548	0.0024717	-0.007126	4.9946307	0.00000	0.00000	-50.000000 CY
0.0002747	16861.	61384869.	9.2183413	0.0025321	-0.007356	4.9994669	0.00000	0.00000	-50.000000 CY
0.0002828	16895.	59748964.	9.1683698	0.0025925	-0.007587	4.9934527	0.00000	0.00000	-50.000000 CY
0.0002908	16924.	58189155.	9.1185041	0.0026520	-0.007818	4.9987947	0.00000	0.00000	-50.000000 CY
0.0002989	16951.	56706792.	9.0715128	0.0027117	-0.008049	4.9951739	0.00000	0.00000	-50.000000 CY
0.0003070	16976.	55294951.	9.0273238	0.0027714	-0.008281	4.9964855	0.00000	0.00000	-50.000000 CY
0.0003151	16998.	53949026.	8.9851637	0.0028310	-0.008512	4.9997413	0.00000	0.00000	-50.000000 CY
0.0003312	17038.	51438314.	8.9078668	0.0029506	-0.008974	4.9968841	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	17038.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	15.1100	0.00	N.A.	No	0.00	2536.
2	16.8500	1.7400	Yes	No	2536.	13993.
3	19.3500	0.5166	No	No	16529.	186643.
4	24.3500	4.9126	Yes	No	203172.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.3498	8.23E-06	1.06E-07	-0.00559	1.38E-08	7.74E+10	0.00	0.00	0.00
0.3611	1.3256	7.32E-06	-4.22E-07	-0.00559	1.23E-08	7.74E+10	0.00	0.00	0.00
0.7222	1.3013	4.57E-06	-2.11E-07	-0.00559	7.68E-09	7.74E+10	0.00	0.00	0.00
1.0833	1.2771	5.49E-06	7.0308	-0.00559	9.22E-09	7.74E+10	0.00	0.00	3.2451
1.4444	1.2528	60.9313	46.4745	-0.00559	0.1023	7.74E+10	0.00	0.00	14.9603
1.8055	1.2286	402.7668	137.6379	-0.00559	0.6765	7.74E+10	0.00	0.00	27.1164
2.1666	1.2044	1254.	281.4762	-0.00559	2.1058	7.74E+10	0.00	0.00	39.2725
2.5277	1.1801	2842.	477.9892	-0.00559	4.7738	7.74E+10	0.00	0.00	51.4286
2.8888	1.1559	5396.	727.1769	-0.00559	9.0636	7.74E+10	0.00	0.00	63.5847
3.2499	1.1317	9144.	1029.	-0.00559	15.3588	7.74E+10	0.00	0.00	75.7408
3.6110	1.1074	14314.	1384.	-0.00559	24.0427	7.74E+10	0.00	0.00	87.8969
3.9721	1.0832	21135.	1791.	-0.00559	35.4986	7.74E+10	0.00	0.00	100.0530
4.3332	1.0590	29834.	2251.	-0.00559	50.1100	7.74E+10	0.00	0.00	112.2091
4.6943	1.0348	40640.	2763.	-0.00559	68.2602	7.74E+10	0.00	0.00	124.3652
5.0554	1.0106	53781.	3328.	-0.00558	90.3326	7.74E+10	0.00	0.00	136.5213
5.4165	0.9864	69486.	3946.	-0.00558	116.7106	7.74E+10	0.00	0.00	148.6774

5.7776	0.9622	87982.	4617.	-0.00558	147.7776	7.74E+10	0.00	0.00	160.8335
6.1387	0.9380	109498.	5340.	-0.00557	183.9169	7.74E+10	0.00	0.00	172.9895
6.4998	0.9139	134263.	6116.	-0.00556	225.5118	7.74E+10	0.00	0.00	185.1456
6.8609	0.8898	162504.	6945.	-0.00556	272.9459	7.74E+10	0.00	0.00	197.3017
7.2220	0.8657	194449.	7826.	-0.00555	326.6024	7.74E+10	0.00	0.00	209.4578
7.5831	0.8417	230327.	8760.	-0.00553	386.8648	7.74E+10	0.00	0.00	221.6139
7.9442	0.8178	270367.	9747.	-0.00552	454.1163	7.74E+10	0.00	0.00	233.7700
8.3053	0.7939	314796.	10786.	-0.00550	528.7405	7.74E+10	0.00	0.00	245.9261
8.6664	0.7701	363842.	11878.	-0.00549	611.1206	7.74E+10	0.00	0.00	258.0822
9.0275	0.7463	417735.	13023.	-0.00546	701.6400	7.74E+10	0.00	0.00	270.2383
9.3886	0.7227	476702.	14220.	-0.00544	800.6822	7.74E+10	0.00	0.00	282.3944
9.7497	0.6992	540971.	15470.	-0.00541	908.6304	7.74E+10	0.00	0.00	294.5505
10.1108	0.6758	610770.	16773.	-0.00538	1026.	7.74E+10	0.00	0.00	306.7066
10.4719	0.6526	686329.	18128.	-0.00534	1153.	7.74E+10	0.00	0.00	318.8627
10.8330	0.6296	767875.	19536.	-0.00530	1290.	7.74E+10	0.00	0.00	331.0188
11.1941	0.6067	855636.	20997.	-0.00525	1437.	7.74E+10	0.00	0.00	343.1749
11.5552	0.5840	949841.	22510.	-0.00520	1595.	7.74E+10	0.00	0.00	355.3310
11.9163	0.5616	1050718.	24076.	-0.00515	1765.	7.74E+10	0.00	0.00	367.4871
12.2774	0.5394	1158495.	25695.	-0.00509	1946.	7.74E+10	0.00	0.00	379.6432
12.6385	0.5175	1273400.	27366.	-0.00502	2139.	7.74E+10	0.00	0.00	391.7993
12.9996	0.4959	1395662.	29090.	-0.00494	2344.	7.74E+10	0.00	0.00	403.9554
13.3607	0.4747	1525509.	30867.	-0.00486	2562.	7.74E+10	0.00	0.00	416.1114
13.7218	0.4538	1663169.	32697.	-0.00477	2794.	7.74E+10	0.00	0.00	428.2675
14.0829	0.4333	1808871.	34579.	-0.00468	3038.	7.74E+10	0.00	0.00	440.4236
14.4440	0.4133	1962842.	36513.	-0.00457	3297.	7.74E+10	0.00	0.00	452.5797
14.8051	0.3937	2125311.	38501.	-0.00446	3570.	7.74E+10	0.00	0.00	464.7358
15.1662	0.3746	2296507.	39852.	-0.00436	0.00	1.51E+11	-3.985	46.0897	162.8523
15.5273	0.3559	2470685.	40130.	-0.00429	0.00	1.51E+11	-30.671	373.4466	0.00
15.8884	0.3374	2644287.	39936.	-0.00422	0.00	1.51E+11	-58.728	754.1748	0.00
16.2495	0.3193	2816787.	39619.	-0.00414	0.00	1.51E+11	-87.465	1187.	0.00
16.6106	0.3015	2987645.	39178.	-0.00406	0.00	1.50E+11	-116.202	1670.	0.00
16.9717	0.2841	3156320.	38612.	-0.00397	0.00	1.50E+11	-145.224	2215.	0.00
17.3328	0.2671	3322269.	37921.	-0.00388	0.00	1.50E+11	-173.508	2815.	0.00
17.6939	0.2505	3484960.	37111.	-0.00378	0.00	1.50E+11	-200.529	3468.	0.00
18.0550	0.2344	3643885.	36187.	-0.00368	0.00	1.50E+11	-225.790	4174.	0.00
18.4161	0.2187	3798571.	35157.	-0.00357	0.00	1.50E+11	-249.713	4948.	0.00
18.7772	0.2035	3948568.	34028.	-0.00346	0.00	1.50E+11	-271.431	5781.	0.00
19.1383	0.1887	4093469.	32810.	-0.00334	0.00	1.50E+11	-290.425	6668.	0.00
19.4994	0.1745	4232916.	30140.	-0.00322	0.00	1.50E+11	-942.053	23393.	0.00
19.8605	0.1608	4354675.	26057.	-0.00310	0.00	1.50E+11	-942.596	25398.	0.00
20.2216	0.1477	4458735.	21974.	-0.00297	0.00	1.50E+11	-941.907	27639.	0.00
20.5827	0.1351	4545110.	17897.	-0.00284	0.00	1.50E+11	-939.945	30151.	0.00
20.9438	0.1231	4613835.	13831.	-0.00271	0.00	1.50E+11	-936.668	32979.	0.00
21.3049	0.1116	4664973.	9782.	-0.00257	0.00	1.50E+11	-932.031	36177.	0.00
21.6660	0.1008	4698610.	5756.	-0.00244	0.00	1.50E+11	-925.984	39812.	0.00
22.0271	0.09052	4714861.	1760.	-0.00230	0.00	1.50E+11	-918.475	43966.	0.00
22.3882	0.08085	4713865.	-2200.	-0.00216	0.00	1.50E+11	-909.446	48742.	0.00
22.7493	0.07177	4695794.	-6118.	-0.00203	0.00	1.50E+11	-898.830	54267.	0.00
23.1104	0.06328	4660845.	-9986.	-0.00189	0.00	1.50E+11	-886.552	60708.	0.00
23.4715	0.05537	4609250.	-13797.	-0.00176	0.00	1.50E+11	-872.523	68280.	0.00
23.8326	0.04804	4541272.	-17544.	-0.00163	0.00	1.50E+11	-856.641	77263.	0.00
24.1937	0.04128	4457209.	-21217.	-0.00150	0.00	1.50E+11	-838.778	88040.	0.00
24.5548	0.03508	4357396.	-25113.	-0.00137	0.00	1.50E+11	-959.620	118529.	0.00

24.9159	0.02943	4239566.	-29216.	-0.00124	0.00	1.50E+11	-933.726	137497.	0.00
25.2770	0.02430	4104203.	-33199.	-0.00112	0.00	1.50E+11	-904.764	161328.	0.00
25.6381	0.01969	3951851.	-37049.	-0.00101	0.00	1.50E+11	-872.309	191963.	0.00
25.9992	0.01557	3783121.	-40750.	-8.95E-04	0.00	1.50E+11	-835.751	232530.	0.00
26.3603	0.01193	3598698.	-44281.	-7.89E-04	0.00	1.50E+11	-794.160	288434.	0.00
26.7214	0.00874	3399363.	-47618.	-6.88E-04	0.00	1.50E+11	-746.016	369991.	0.00
27.0825	0.00597	3186021.	-50726.	-5.93E-04	0.00	1.50E+11	-688.550	499946.	0.00
27.4436	0.00360	2959750.	-53552.	-5.05E-04	0.00	1.51E+11	-615.806	741952.	0.00
27.8047	0.00159	2721916.	-55991.	-4.23E-04	0.00	1.51E+11	-510.027	1386220.	0.00
28.1658	-6.86E-05	2474506.	-57009.	-3.48E-04	0.00	1.51E+11	40.3694	2551639.	0.00
28.5269	-0.00142	2227853.	-55817.	-2.81E-04	0.00	1.51E+11	509.6873	1551799.	0.00
28.8880	-0.00250	1990771.	-53423.	-2.20E-04	0.00	1.51E+11	595.2373	1031465.	0.00
29.2491	-0.00333	1764866.	-50729.	-1.66E-04	0.00	1.51E+11	648.4027	843672.	0.00
29.6102	-0.00394	1551135.	-47839.	-1.19E-04	0.00	1.51E+11	685.5821	753908.	0.00
29.9713	-0.00436	1350277.	-44809.	-7.70E-05	0.00	1.51E+11	712.6119	708566.	0.00
30.3324	-0.00461	1162800.	-41679.	-4.10E-05	0.00	1.51E+11	732.2921	688660.	0.00
30.6935	-0.00471	989072.	-38475.	-1.02E-05	0.00	1.51E+11	746.1820	686013.	0.00
31.0546	-0.00470	829356.	-35223.	1.58E-05	0.00	1.51E+11	755.2224	696868.	0.00
31.4157	-0.00458	683820.	-31940.	3.75E-05	0.00	1.51E+11	760.0047	719689.	0.00
31.7768	-0.00437	552554.	-28644.	5.52E-05	0.00	1.51E+11	760.8951	754319.	0.00
32.1379	-0.00410	435575.	-25353.	6.94E-05	0.00	1.51E+11	758.0956	801712.	0.00
32.4990	-0.00377	332831.	-22082.	8.04E-05	0.00	1.51E+11	751.6677	863985.	0.00
32.8601	-0.00340	244200.	-18847.	8.86E-05	0.00	1.51E+11	741.5309	944776.	0.00
33.2212	-0.00300	169493.	-15665.	9.45E-05	0.00	1.51E+11	727.4345	1050058.	0.00
33.5823	-0.00258	108445.	-12553.	9.85E-05	0.00	1.51E+11	708.8895	1189842.	0.00
33.9434	-0.00215	60707.	-9533.	1.01E-04	0.00	1.51E+11	685.0299	1381923.	0.00
34.3045	-0.00171	25832.	-6631.	1.02E-04	0.00	1.51E+11	654.3125	1661147.	0.00
34.6656	-0.00126	3243.	-3883.	1.03E-04	0.00	1.51E+11	613.7898	2106804.	0.00
35.0267	-8.18E-04	-7822.	-1347.	1.03E-04	0.00	1.51E+11	556.9045	2951444.	0.00
35.3878	-3.74E-04	-8430.	473.4619	1.02E-04	0.00	1.51E+11	283.2595	3283608.	0.00
35.7489	6.90E-05	-3719.	972.6649	1.02E-04	0.00	1.51E+11	-52.851	3320212.	0.00
36.1100	5.11E-04	0.00	0.00	1.02E-04	0.00	1.51E+11	-396.085	1678409.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 1.34979825 inches
Computed slope at pile head = -0.0055935 radians
Maximum bending moment = 4714861. inch-lbs
Maximum shear force = -57009. lbs
Depth of maximum bending moment = 22.02710000 feet below pile head
Depth of maximum shear force = 28.16580000 feet below pile head
Number of iterations = 24
Number of zero deflection points = 2
Pile deflection at ground = 0.37760873 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
36.11000	1.34979825	4714861.	-57009.
34.30450	1.38180674	4722111.	-59088.
32.49900	1.59326374	4636736.	-65940.
30.69350	2.69547301	4498203.	-73106.
28.88800	6.01709429	4260426.	-77640.
27.08250	33.62252035	4222214.	-92196.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.4490	1.83E-06	0.00	-0.00964	3.07E-09	7.74E+10	0.00	0.00	0.00
0.3611	2.4072	-3.11E-05	-3.59E-06	-0.00964	5.22E-08	7.74E+10	0.00	0.00	0.00
0.7222	2.3655	-2.93E-05	2.11E-07	-0.00964	4.92E-08	7.74E+10	0.00	0.00	0.00
1.0833	2.3237	-2.93E-05	10.5461	-0.00964	4.92E-08	7.74E+10	0.00	0.00	4.8676
1.4444	2.2819	91.3970	69.7118	-0.00964	0.1535	7.74E+10	0.00	0.00	22.4405
1.8055	2.2402	604.1502	206.4569	-0.00964	1.0147	7.74E+10	0.00	0.00	40.6746
2.1666	2.1984	1881.	422.2142	-0.00964	3.1588	7.74E+10	0.00	0.00	58.9088
2.5277	2.1566	4263.	716.9837	-0.00964	7.1606	7.74E+10	0.00	0.00	77.1429
2.8888	2.1149	8094.	1091.	-0.00964	13.5954	7.74E+10	0.00	0.00	95.3770
3.2499	2.0731	13716.	1544.	-0.00964	23.0382	7.74E+10	0.00	0.00	113.6112
3.6110	2.0314	21471.	2075.	-0.00964	36.0640	7.74E+10	0.00	0.00	131.8453
3.9721	1.9896	31702.	2686.	-0.00963	53.2479	7.74E+10	0.00	0.00	150.0795
4.3332	1.9479	44751.	3376.	-0.00963	75.1650	7.74E+10	0.00	0.00	168.3136

4.6943	1.9061	60960.	4145.	-0.00963	102.3903	7.74E+10	0.00	0.00	186.5477
5.0554	1.8644	80672.	4993.	-0.00962	135.4990	7.74E+10	0.00	0.00	204.7819
5.4165	1.8227	104229.	5920.	-0.00962	175.0660	7.74E+10	0.00	0.00	223.0160
5.7776	1.7811	131973.	6925.	-0.00961	221.6664	7.74E+10	0.00	0.00	241.2502
6.1387	1.7394	164248.	8010.	-0.00960	275.8753	7.74E+10	0.00	0.00	259.4843
6.4998	1.6978	201394.	9174.	-0.00959	338.2678	7.74E+10	0.00	0.00	277.7185
6.8609	1.6563	243755.	10417.	-0.00958	409.4188	7.74E+10	0.00	0.00	295.9526
7.2220	1.6148	291674.	11739.	-0.00957	489.9036	7.74E+10	0.00	0.00	314.1867
7.5831	1.5734	345491.	13140.	-0.00955	580.2971	7.74E+10	0.00	0.00	332.4209
7.9442	1.5320	405550.	14620.	-0.00953	681.1745	7.74E+10	0.00	0.00	350.6550
8.3053	1.4908	472194.	16179.	-0.00950	793.1107	7.74E+10	0.00	0.00	368.8892
8.6664	1.4497	545764.	17817.	-0.00948	916.6809	7.74E+10	0.00	0.00	387.1233
9.0275	1.4087	626602.	19534.	-0.00944	1052.	7.74E+10	0.00	0.00	405.3575
9.3886	1.3678	715052.	21330.	-0.00940	1201.	7.74E+10	0.00	0.00	423.5916
9.7497	1.3272	811456.	23205.	-0.00936	1363.	7.74E+10	0.00	0.00	441.8257
10.1108	1.2867	916156.	25159.	-0.00931	1539.	7.74E+10	0.00	0.00	460.0599
10.4719	1.2465	1029494.	27192.	-0.00926	1729.	7.74E+10	0.00	0.00	478.2940
10.8330	1.2065	1151812.	29304.	-0.00920	1935.	7.74E+10	0.00	0.00	496.5282
11.1941	1.1667	1283454.	31495.	-0.00913	2156.	7.74E+10	0.00	0.00	514.7623
11.5552	1.1273	1424762.	33765.	-0.00905	2393.	7.74E+10	0.00	0.00	532.9965
11.9163	1.0883	1576077.	36114.	-0.00897	2647.	7.74E+10	0.00	0.00	551.2306
12.2774	1.0496	1737742.	38542.	-0.00888	2919.	7.74E+10	0.00	0.00	569.4647
12.6385	1.0113	1910100.	41049.	-0.00877	3208.	7.74E+10	0.00	0.00	587.6989
12.9996	0.9735	2093493.	43636.	-0.00866	3516.	7.74E+10	0.00	0.00	605.9330
13.3607	0.9363	2288264.	46301.	-0.00854	3843.	7.74E+10	0.00	0.00	624.1672
13.7218	0.8995	2494754.	49045.	-0.00841	4190.	7.74E+10	0.00	0.00	642.4013
14.0829	0.8634	2713307.	51868.	-0.00826	4557.	7.74E+10	0.00	0.00	660.6355
14.4440	0.8279	2944263.	54770.	-0.00810	4945.	7.74E+10	0.00	0.00	678.8696
14.8051	0.7932	3187967.	57751.	-0.00793	5355.	7.74E+10	0.00	0.00	697.1037
15.1662	0.7592	3444760.	59781.	-0.00779	0.00	1.50E+11	-4.810	27.4554	244.2785
15.5273	0.7257	3706049.	60219.	-0.00769	0.00	1.50E+11	-37.164	221.9167	0.00
15.8884	0.6926	3966641.	59983.	-0.00758	0.00	1.50E+11	-71.487	447.2574	0.00
16.2495	0.6600	4225890.	59597.	-0.00746	0.00	1.50E+11	-107.055	702.8562	0.00
16.6106	0.6280	4483129.	59055.	-0.00733	0.00	1.50E+11	-143.165	987.9095	0.00
16.9717	0.5965	4737680.	58355.	-0.00720	0.00	1.50E+11	-179.623	1305.	0.00
17.3328	0.5656	4988859.	57499.	-0.00706	0.00	1.50E+11	-215.572	1652.	0.00
17.6939	0.5353	5235989.	56489.	-0.00691	0.00	1.49E+11	-250.363	2027.	0.00
18.0550	0.5057	5478419.	55333.	-0.00676	0.00	1.49E+11	-283.407	2429.	0.00
18.4161	0.4767	5715527.	54036.	-0.00659	0.00	1.49E+11	-315.067	2864.	0.00
18.7772	0.4485	5946719.	52608.	-0.00642	0.00	1.49E+11	-344.375	3327.	0.00
19.1383	0.4211	6171445.	51058.	-0.00625	0.00	1.49E+11	-370.718	3815.	0.00
19.4994	0.3944	6389211.	47753.	-0.00606	0.00	1.49E+11	-1155.	12691.	0.00
19.8605	0.3685	6585288.	42737.	-0.00588	0.00	1.49E+11	-1160.	13637.	0.00
20.2216	0.3435	6759590.	37705.	-0.00568	0.00	1.49E+11	-1163.	14675.	0.00
20.5827	0.3193	6912051.	32659.	-0.00548	0.00	1.49E+11	-1165.	15818.	0.00
20.9438	0.2959	7042630.	27607.	-0.00528	0.00	1.49E+11	-1166.	17078.	0.00
21.3049	0.2735	7151307.	22554.	-0.00507	0.00	1.49E+11	-1166.	18474.	0.00
21.6660	0.2520	7238090.	17505.	-0.00486	0.00	1.49E+11	-1164.	20023.	0.00
22.0271	0.2314	7303011.	12466.	-0.00465	0.00	1.48E+11	-1161.	21749.	0.00
22.3882	0.2117	7346125.	7443.	-0.00444	0.00	1.48E+11	-1157.	23681.	0.00
22.7493	0.1929	7367518.	2444.	-0.00422	0.00	1.48E+11	-1151.	25850.	0.00
23.1104	0.1751	7367302.	-2527.	-0.00401	0.00	1.48E+11	-1143.	28297.	0.00
23.4715	0.1582	7345616.	-7462.	-0.00379	0.00	1.48E+11	-1134.	31071.	0.00

23.8326	0.1422	7302631.	-12354.	-0.00358	0.00	1.48E+11	-1124.	34233.	0.00
24.1937	0.1272	7238548.	-17196.	-0.00337	0.00	1.49E+11	-1111.	37859.	0.00
24.5548	0.1131	7153599.	-22390.	-0.00316	0.00	1.49E+11	-1286.	49278.	0.00
24.9159	0.09983	7044510.	-27921.	-0.00295	0.00	1.49E+11	-1267.	55002.	0.00
25.2770	0.08750	6911627.	-33366.	-0.00275	0.00	1.49E+11	-1246.	61720.	0.00
25.6381	0.07603	6755343.	-38716.	-0.00255	0.00	1.49E+11	-1223.	69684.	0.00
25.9992	0.06543	6576100.	-43957.	-0.00235	0.00	1.49E+11	-1196.	79241.	0.00
26.3603	0.05565	6374393.	-49078.	-0.00216	0.00	1.49E+11	-1167.	90876.	0.00
26.7214	0.04667	6150773.	-54063.	-0.00198	0.00	1.49E+11	-1134.	105294.	0.00
27.0825	0.03847	5905860.	-58897.	-0.00181	0.00	1.49E+11	-1097.	123570.	0.00
27.4436	0.03101	5640350.	-63559.	-0.00164	0.00	1.49E+11	-1055.	147426.	0.00
27.8047	0.02426	5355030.	-68026.	-0.00148	0.00	1.49E+11	-1007.	179839.	0.00
28.1658	0.01818	5050805.	-72267.	-0.00133	0.00	1.50E+11	-950.478	226493.	0.00
28.5269	0.01274	4728734.	-76238.	-0.00119	0.00	1.50E+11	-882.094	299966.	0.00
28.8880	0.00789	4390099.	-79868.	-0.00106	0.00	1.50E+11	-793.628	435668.	0.00
29.2491	0.00359	4036563.	-83020.	-9.34E-04	0.00	1.50E+11	-661.038	796858.	0.00
29.6102	-1.99E-04	3670615.	-84184.	-8.23E-04	0.00	1.50E+11	123.9500	2698005.	0.00
29.9713	-0.00353	3306994.	-82450.	-7.22E-04	0.00	1.50E+11	676.3361	829284.	0.00
30.3324	-0.00646	2956072.	-79258.	-6.32E-04	0.00	1.51E+11	796.8204	534819.	0.00
30.6935	-0.00901	2620112.	-75630.	-5.52E-04	0.00	1.51E+11	877.4847	422050.	0.00
31.0546	-0.01124	2300628.	-71694.	-4.81E-04	0.00	1.51E+11	939.3876	362283.	0.00
31.4157	-0.01318	1998783.	-67514.	-4.19E-04	0.00	1.51E+11	990.1328	325623.	0.00
31.7768	-0.01487	1715529.	-63129.	-3.66E-04	0.00	1.51E+11	1033.	301201.	0.00
32.1379	-0.01635	1451680.	-58569.	-3.20E-04	0.00	1.51E+11	1072.	284050.	0.00
32.4990	-0.01764	1207950.	-53851.	-2.82E-04	0.00	1.51E+11	1106.	271554.	0.00
32.8601	-0.01879	984982.	-48992.	-2.51E-04	0.00	1.51E+11	1137.	262184.	0.00
33.2212	-0.01982	783363.	-44002.	-2.26E-04	0.00	1.51E+11	1166.	254984.	0.00
33.5823	-0.02075	603641.	-38889.	-2.06E-04	0.00	1.51E+11	1194.	249319.	0.00
33.9434	-0.02160	446333.	-33660.	-1.91E-04	0.00	1.51E+11	1220.	244747.	0.00
34.3045	-0.02240	311932.	-28318.	-1.80E-04	0.00	1.51E+11	1246.	240954.	0.00
34.6656	-0.02316	200918.	-22867.	-1.72E-04	0.00	1.51E+11	1270.	237712.	0.00
35.0267	-0.02389	113758.	-17309.	-1.68E-04	0.00	1.51E+11	1295.	234857.	0.00
35.3878	-0.02461	50914.	-11644.	-1.66E-04	0.00	1.51E+11	1319.	232270.	0.00
35.7489	-0.02533	12842.	-5875.	-1.65E-04	0.00	1.51E+11	1344.	229875.	0.00
36.1100	-0.02604	0.00	0.00	-1.64E-04	0.00	1.51E+11	1368.	113811.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 2.44897699 inches
Computed slope at pile head = -0.0096376 radians
Maximum bending moment = 7367518. inch-lbs
Maximum shear force = -84184. lbs
Depth of maximum bending moment = 22.74930000 feet below pile head
Depth of maximum shear force = 29.61020000 feet below pile head
Number of iterations = 38

Number of zero deflection points = 1
Pile deflection at ground = 0.76451175 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
36.11000	2.44897699	7367518.	-84184.
34.30450	2.90806635	7255823.	-93406.
32.49900	4.37061630	6980497.	-100698.
30.69350	11.23861789	6837031.	-112231.
28.88800	36.37710371	6608760.	-122904.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

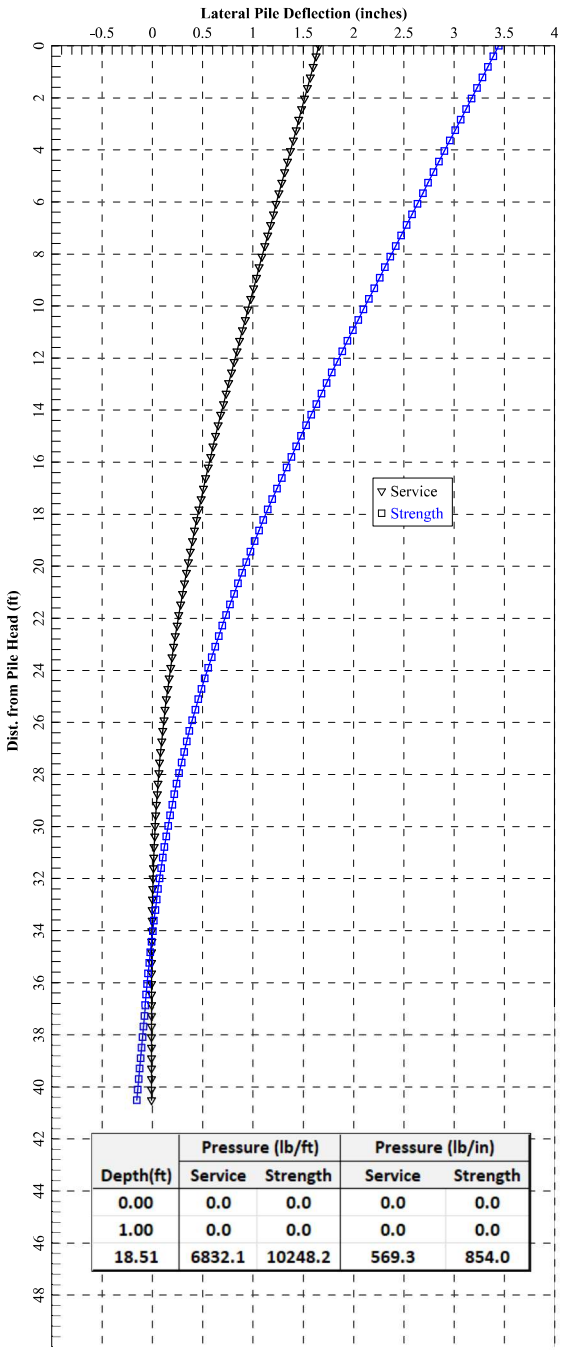
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.3498	-0.00559	-57009.	4714861.
2	V, lb	0.00	M, in-lb	0.00	0.00	2.4490	-0.00964	-84184.	7367518.

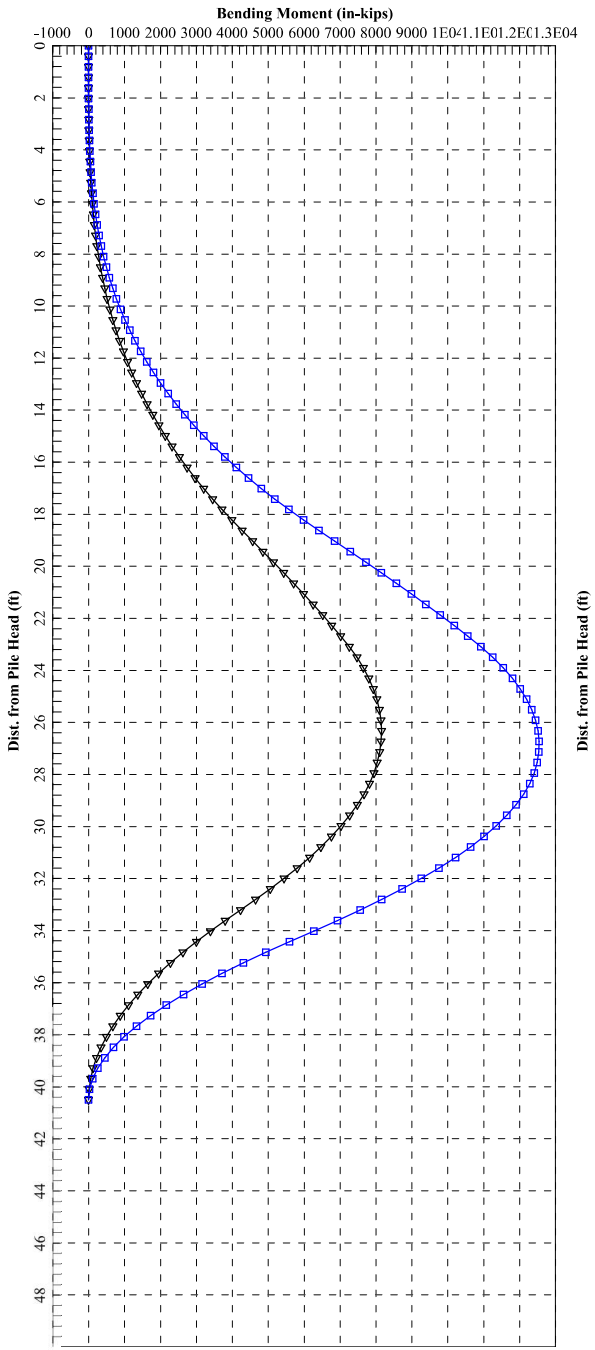
Maximum pile-head deflection = 2.4489769938 inches
Maximum pile-head rotation = -0.0096376437 radians = -0.552196 deg.

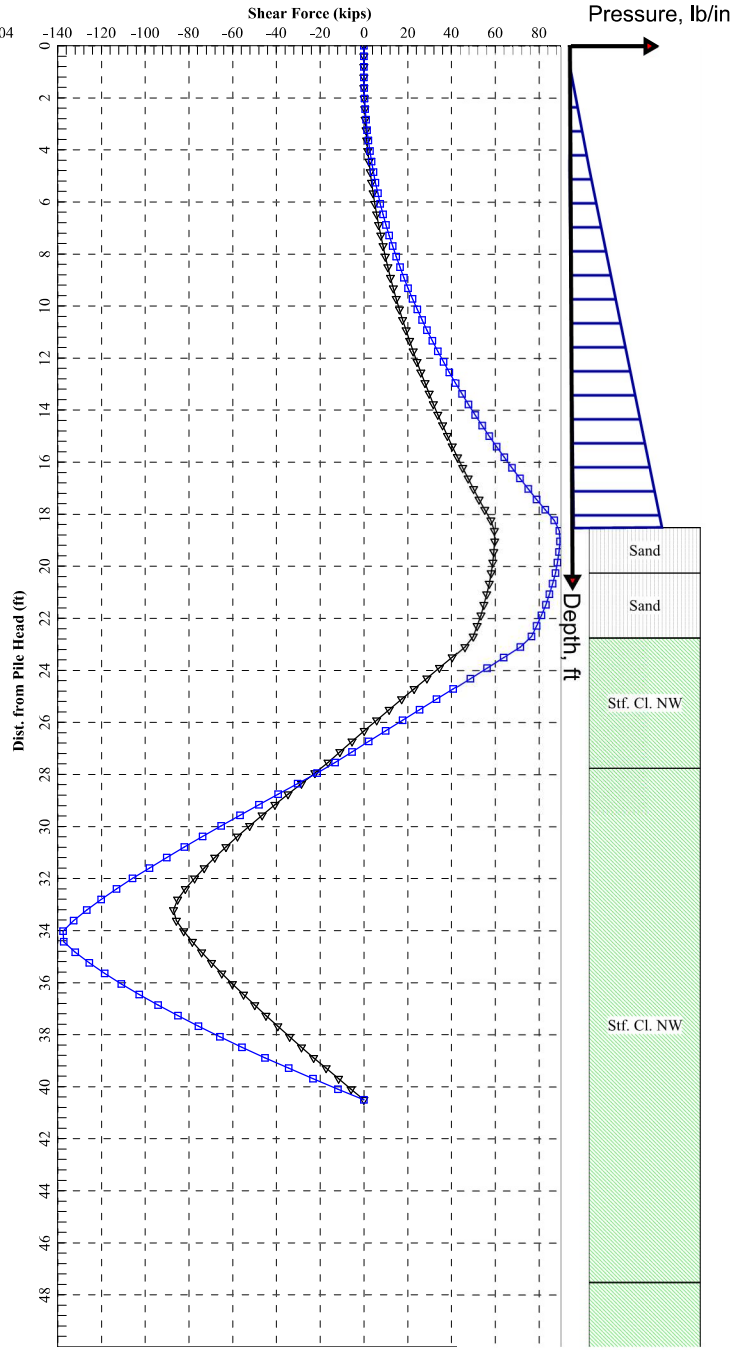
The analysis ended normally.

Wall 1A (18.51ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
18.51	6832.1	10248.2	569.3	854.0





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                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App E LPile March 2026\Wall 1A\

Name of input data file:
05 Wall_1A-18.51ft.lp12d

Name of output report file:
05 Wall_1A-18.51ft.lp12o

Name of plot output file:
05 Wall_1A-18.51ft.lp12p

Name of runtime message file:
05 Wall_1A-18.51ft.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 26, 2026             Time:  15:22:50
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=18.51FT) Boring B-042-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.510 ft
Depth of ground surface below top of pile = 18.5100 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	13.0000
2	18.510	13.0000
3	18.510	42.0000
4	40.510	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 18.510000 ft
AISC Section Type = W

AISC Section Name = W24X162

Pile width = 13.000000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 22.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W24X162

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    18.510000 ft
   Distance from top of pile to bottom of layer        =    20.250000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    20.250000 ft
   Distance from top of pile to bottom of layer        =    22.750000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    22.750000 ft
   Distance from top of pile to bottom of layer        =    27.750000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3500. psf
   Undrained cohesion at bottom of layer               =        3500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer           =    27.750000 ft
   Distance from top of pile to bottom of layer        =    56.750000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

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   Undrained cohesion at top of layer                 =        4000. psf
   Undrained cohesion at bottom of layer              =        4000. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000


 (Depth of the lowest soil layer extends 16.240 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	18.5100	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	20.2500	57.6000	--	32.0000	--	60.0000
2	Sand	20.2500	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	22.7500	57.6000	--	32.0000	--	60.0000
3	Stiff Clay	22.7500	62.6000	3500.	--	0.00500	--
	w/o Free Water	27.7500	62.6000	3500.	--	0.00500	--
4	Stiff Clay	27.7500	62.6000	4000.	--	0.00400	--
	w/o Free Water	56.7500	62.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	18.510	0.9300	1.0000
2	41.000	0.9300	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	18.510	569.300

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	18.510	854.000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	18.510000 ft
Flange Width	=	13.000000 in
Section Depth	=	25.000000 in
Flange Thickness	=	1.220000 in
Web Thickness	=	0.705000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	47.800000 sq. in.
Moment of Inertia	=	5170. in^4
Elastic Bending Stiffness	=	149930000. kip-in^2
Plastic Modulus, Z	=	468.000000in^3
Plastic Moment Capacity = Fy Z	=	23400.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	2390.000 kips
Nominal Axial Tensile Capacity	=	-2390.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000564	843.5817563	149661328.	12.5000000	2.0228366	
0.00001127	1687.	149661328.	12.5000000	4.0456731	
0.00001691	2531.	149661328.	12.5000000	6.0685097	
0.00002255	3374.	149661328.	12.5000000	8.0913462	

0.00002818	4218.	149661328.	12.5000000	10.1141828	
0.00003382	5061.	149661328.	12.5000000	12.1370193	
0.00003946	5905.	149661328.	12.5000000	14.1598559	
0.00004509	6749.	149661328.	12.5000000	16.1826924	
0.00005073	7592.	149661328.	12.5000000	18.2055290	
0.00005637	8436.	149661328.	12.5000000	20.2283655	
0.00006200	9279.	149661328.	12.5000000	22.2512021	
0.00006764	10123.	149661328.	12.5000000	24.2740387	
0.00007328	10967.	149661328.	12.5000000	26.2968752	
0.00007891	11810.	149661328.	12.5000000	28.3197118	
0.00008455	12654.	149661328.	12.5000000	30.3425483	
0.00009019	13497.	149661328.	12.5000000	32.3653849	
0.00009582	14341.	149661328.	12.5000000	34.3882214	
0.0001015	15184.	149661328.	12.5000000	36.4110580	
0.0001071	16028.	149661328.	12.5000000	38.4338945	
0.0001127	16872.	149661328.	12.5000000	40.4567311	
0.0001184	17715.	149661328.	12.5000000	42.4795677	
0.0001240	18559.	149661328.	12.5000000	44.5024042	
0.0001296	19402.	149661328.	12.5000000	46.5252408	
0.0001353	20246.	149661328.	12.5000000	48.5480773	
0.0001409	21044.	149335438.	12.5000000	50.0000000	Y
0.0001466	21568.	147167341.	12.5000000	50.0000000	Y
0.0001522	21830.	143443513.	12.5000000	50.0000000	Y
0.0001578	21936.	138990727.	12.5000000	50.0000000	Y
0.0001635	22031.	134778644.	12.5000000	50.0000000	Y
0.0001691	22117.	130792919.	12.5000000	50.0000000	Y
0.0001747	22195.	127019731.	12.5000000	50.0000000	Y
0.0001804	22265.	123438572.	12.5000000	50.0000000	Y
0.0001860	22329.	120041927.	12.5000000	50.0000000	Y
0.0001916	22387.	116816521.	12.5000000	50.0000000	Y
0.0001973	22441.	113750451.	12.5000000	50.0000000	Y
0.0002029	22490.	110832995.	12.5000000	50.0000000	Y
0.0002086	22535.	108054452.	12.5000000	50.0000000	Y
0.0002142	22577.	105406006.	12.5000000	50.0000000	Y
0.0002198	22616.	102879617.	12.5000000	50.0000000	Y
0.0002311	22684.	98157690.	12.5000000	50.0000000	Y
0.0002424	22744.	93839045.	12.5000000	50.0000000	Y
0.0002536	22795.	89870682.	12.5000000	50.0000000	Y
0.0002649	22841.	86216799.	12.5000000	50.0000000	Y
0.0002762	22880.	82841835.	12.5000000	50.0000000	Y
0.0002875	22916.	79715608.	12.5000000	50.0000000	Y
0.0002987	22947.	76812297.	12.5000000	50.0000000	Y
0.0003100	22975.	74109652.	12.5000000	50.0000000	Y
0.0003213	23000.	71588365.	12.5000000	50.0000000	Y
0.0003326	23023.	69228461.	12.5000000	50.0000000	Y
0.0003438	23043.	67017513.	12.5000000	50.0000000	Y
0.0003551	23062.	64943044.	12.5000000	50.0000000	Y
0.0003664	23078.	62989711.	12.5000000	50.0000000	Y
0.0003777	23094.	61150178.	12.5000000	50.0000000	Y
0.0003889	23108.	59413683.	12.5000000	50.0000000	Y
0.0004002	23120.	57772030.	12.5000000	50.0000000	Y
0.0004115	23132.	56217876.	12.5000000	50.0000000	Y
0.0004227	23143.	54744647.	12.5000000	50.0000000	Y

0.0004340	23153.	53345344.	12.5000000	50.0000000	Y
0.0004453	23163.	52016769.	12.5000000	50.0000000	Y
0.0004566	23171.	50750132.	12.5000000	50.0000000	Y
0.0004678	23179.	49544538.	12.5000000	50.0000000	Y
0.0004791	23186.	48394700.	12.5000000	50.0000000	Y
0.0004904	23193.	47295595.	12.5000000	50.0000000	Y
0.0005017	23200.	46245888.	12.5000000	50.0000000	Y
0.0005129	23206.	45241851.	12.5000000	50.0000000	Y
0.0005242	23211.	44278956.	12.5000000	50.0000000	Y
0.0005355	23216.	43356603.	12.5000000	50.0000000	Y
0.0005468	23222.	42472285.	12.5000000	50.0000000	Y
0.0005580	23226.	41622571.	12.5000000	50.0000000	Y
0.0005693	23231.	40805636.	12.5000000	50.0000000	Y
0.0005806	23235.	40020427.	12.5000000	50.0000000	Y
0.0005918	23239.	39265131.	12.5000000	50.0000000	Y
0.0006031	23243.	38537591.	12.5000000	50.0000000	Y
0.0006144	23246.	37835670.	12.5000000	50.0000000	Y
0.0006257	23249.	37159043.	12.5000000	50.0000000	Y
0.0006369	23252.	36506367.	12.5000000	50.0000000	Y
0.0006482	23255.	35876394.	12.5000000	50.0000000	Y
0.0006595	23258.	35267672.	12.5000000	50.0000000	Y
0.0006708	23261.	34678509.	12.5000000	50.0000000	Y
0.0007158	23270.	32507418.	12.5000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	23270.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

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Length of Section                                  =    22.000000 ft
Outside Diameter of Casing                         =    42.000000 in
Casing Wall Thickness                              =       0.0000 in
Moment of Inertia of Steel Casing                  =       0.0000 in^4
Width Flange of Core/Insert                        =    13.000000 in
Depth of Core/Insert                               =    25.000000 in
Flange Thickness of Core/Insert                    =     1.220000 in
Web Thickness of Core/Insert                       =     0.705000 in
Moment of Inertia of Steel Core/Insert             =        5170. in^4
Yield Stress of Casing                             =       50000. psi
Elastic Modulus of Casing                          =    29000000. psi
Yield Stress of Core/Insert                        =       50000. psi
Elastic Modulus of Core/Insert                     =    29000000. psi
Number of Reinforcing Bars                         =           0 bars
Gross Area of Pile                                 =        1385. sq. in.
Area of Concrete                                   =        1338. sq. in.
Cross-sectional Area of Steel Casing               =       0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert          =    47.800000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)  =    47.624800 sq. in.
Area Ratio of All Steel to Gross Area              =         3.44 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:
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Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     8074.980 kips
Tensile Load for Cracking of Concrete                =     -779.261 kips
Nominal Axial Tensile Capacity                       =    -2390.000 kips



Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1               0.000

Definition of Run Messages:

   Y = part of pipe section has yielded.


Axial Thrust Force =      0.000 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing     Max Core   Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress        Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in          in/in         in/in          ksi           ksi           ksi           ksi
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0.00000564	1718.	304847706.	13.7046008	0.00007725	-0.000159	0.3541727	0.00000	0.00000	-3.217806 C
0.00001127	3425.	303806256.	13.7398635	0.0001549	-0.000319	0.6970854	0.00000	0.00000	-6.424083 C
0.00001691	5119.	302748789.	13.7757534	0.0002329	-0.000477	1.0285779	0.00000	0.00000	-9.618525 C
0.00002255	6802.	301674713.	13.8122935	0.0003114	-0.000636	1.3484838	0.00000	0.00000	-12.800808 C
0.00002818	8471.	300583472.	13.8495084	0.0003903	-0.000793	1.6566296	0.00000	0.00000	-15.970594 C
0.00003382	10128.	299474458.	13.8874238	0.0004697	-0.000951	1.9528350	0.00000	0.00000	-19.127527 C
0.00003946	11772.	298347008.	13.9260672	0.0005495	-0.001108	2.2369117	0.00000	0.00000	-22.271232 C
0.00004509	13402.	297200485.	13.9654676	0.0006297	-0.001264	2.5086637	0.00000	0.00000	-25.401313 C
0.00005073	15018.	296034145.	14.0056558	0.0007105	-0.001420	2.7678857	0.00000	0.00000	-28.517353 C
0.00005637	16619.	294847222.	14.0466646	0.0007918	-0.001576	3.0143633	0.00000	0.00000	-31.618914 C
0.00006200	18206.	293639579.	14.0880402	0.0008735	-0.001731	3.2477866	0.00000	0.00000	-34.706409 C
0.00006764	19778.	292411001.	14.1296532	0.0009557	-0.001885	3.4678855	0.00000	0.00000	-37.779911 C
0.00007328	21335.	291159928.	14.1721496	0.0010385	-0.002039	3.6745215	0.00000	0.00000	-40.837932 C
0.00007891	22876.	289885431.	14.2155689	0.0011218	-0.002193	3.8674417	0.00000	0.00000	-43.879948 C
0.00008455	24400.	288586520.	14.2599532	0.0012057	-0.002345	4.0463800	0.00000	0.00000	-46.905403 C
0.00009019	25907.	287262136.	14.3053478	0.0012901	-0.002498	4.2110563	0.00000	0.00000	-49.913706 C
0.00009582	26870.	280412282.	14.2403551	0.0013645	-0.002660	4.3429470	0.00000	0.00000	-50.000000 CY
0.0001015	27342.	269490053.	14.0876093	0.0014293	-0.002832	4.4477011	0.00000	0.00000	-50.000000 CY
0.0001071	27754.	259152838.	13.9382428	0.0014927	-0.003005	4.5414135	0.00000	0.00000	-50.000000 CY
0.0001127	28119.	249428935.	13.7966137	0.0015553	-0.003179	4.6253669	0.00000	0.00000	-50.000000 CY
0.0001184	28445.	240311075.	13.6635282	0.0016173	-0.003354	4.7001606	0.00000	0.00000	-50.000000 CY
0.0001240	28737.	231736626.	13.5342117	0.0016783	-0.003530	4.7655752	0.00000	0.00000	-50.000000 CY
0.0001296	28999.	223686438.	13.4121601	0.0017388	-0.003706	4.8224896	0.00000	0.00000	-50.000000 CY
0.0001353	29236.	216120146.	13.2972863	0.0017988	-0.003883	4.8711946	0.00000	0.00000	-50.000000 CY
0.0001409	29453.	209009205.	13.1880338	0.0018584	-0.004060	4.9117894	0.00000	0.00000	-50.000000 CY
0.0001466	29646.	202292420.	13.0822558	0.0019172	-0.004238	4.9443621	0.00000	0.00000	-50.000000 CY
0.0001522	29824.	195967532.	12.9829466	0.0019759	-0.004416	4.9693851	0.00000	0.00000	-50.000000 CY
0.0001578	29987.	190002013.	12.8896457	0.0020343	-0.004594	4.9869475	0.00000	0.00000	-50.000000 CY
0.0001635	30136.	184364451.	12.8015378	0.0020926	-0.004773	4.9971122	0.00000	0.00000	-50.000000 CY
0.0001691	30271.	179015211.	12.7151469	0.0021501	-0.004952	4.9974799	0.00000	0.00000	-50.000000 CY
0.0001747	30394.	173944281.	12.6338840	0.0022076	-0.005131	4.9998534	0.00000	0.00000	-50.000000 CY
0.0001804	30506.	169130713.	12.5575082	0.0022650	-0.005311	4.9987541	0.00000	0.00000	-50.000000 CY
0.0001860	30609.	164558154.	12.4856574	0.0023224	-0.005490	4.9959643	0.00000	0.00000	-50.000000 CY
0.0001916	30703.	160210480.	12.4181036	0.0023799	-0.005669	4.9998696	0.00000	0.00000	-50.000000 CY
0.0001973	30789.	156066135.	12.3528877	0.0024370	-0.005849	4.9977452	0.00000	0.00000	-50.000000 CY
0.0002029	30867.	152117325.	12.2900370	0.0024939	-0.006029	4.9993625	0.00000	0.00000	-50.000000 CY
0.0002086	30937.	148341236.	12.2304223	0.0025507	-0.006209	4.9982042	0.00000	0.00000	-50.000000 CY
0.0002142	31003.	144742598.	12.1741019	0.0026076	-0.006388	4.9982762	0.00000	0.00000	-50.000000 CY
0.0002198	31063.	141305786.	12.1213188	0.0026646	-0.006568	4.9977794	0.00000	0.00000	-50.000000 CY
0.0002311	31168.	134869056.	12.0232560	0.0027786	-0.006928	4.9961791	0.00000	0.00000	-50.000000 CY
0.0002424	31257.	128960602.	11.9329742	0.0028922	-0.007287	4.9924504	0.00000	0.00000	-50.000000 CY
0.0002536	31330.	123518353.	11.8485351	0.0030053	-0.007648	4.9999072	0.00000	0.00000	-50.000000 CY
0.0002649	31392.	118495374.	11.7721246	0.0031187	-0.008008	4.9974879	0.00000	0.00000	-50.000000 CY
0.0002762	31443.	113845757.	11.7020284	0.0032320	-0.008368	4.9906429	0.00000	0.00000	-50.000000 CY
0.0002875	31487.	109532581.	11.6381699	0.0033456	-0.008728	4.9989157	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load	Axial	Nominal Moment

No.	Thrust kips	Capacity in-kips
1	0.00000000	31487.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	18.5100	0.00	N.A.	No	0.00	2914.
2	20.2500	1.7400	Yes	No	2914.	16097.
3	22.7500	0.5104	No	No	19011.	213289.
4	27.7500	4.8992	Yes	No	232300.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.6561	-7.59E-05	0.00	-0.00581	9.55E-08	1.50E+11	0.00	0.00	0.00
0.4051	1.6278	-5.63E-05	2.60E-06	-0.00581	7.07E-08	1.50E+11	0.00	0.00	0.00
0.8102	1.5995	-5.06E-05	0.01586	-0.00581	6.36E-08	1.50E+11	0.00	0.00	0.00652
1.2153	1.5713	0.1541	17.0460	-0.00581	1.94E-04	1.50E+11	0.00	0.00	7.0000
1.6204	1.5430	165.7275	83.0878	-0.00581	0.2084	1.50E+11	0.00	0.00	20.1710
2.0255	1.5148	807.9665	213.1562	-0.00581	1.0158	1.50E+11	0.00	0.00	33.3419
2.4306	1.4865	2238.	407.2513	-0.00581	2.8139	1.50E+11	0.00	0.00	46.5129
2.8357	1.4583	4767.	665.3731	-0.00581	5.9939	1.50E+11	0.00	0.00	59.6838
3.2408	1.4300	8707.	987.5215	-0.00581	10.9471	1.50E+11	0.00	0.00	72.8548
3.6459	1.4018	14369.	1374.	-0.00581	18.0649	1.50E+11	0.00	0.00	86.0257
4.0510	1.3735	22063.	1824.	-0.00581	27.7385	1.50E+11	0.00	0.00	99.1967
4.4561	1.3453	32101.	2338.	-0.00581	40.3593	1.50E+11	0.00	0.00	112.3677
4.8612	1.3170	44795.	2916.	-0.00581	56.3186	1.50E+11	0.00	0.00	125.5386
5.2663	1.2888	60455.	3559.	-0.00581	76.0078	1.50E+11	0.00	0.00	138.7096
5.6714	1.2606	79394.	4265.	-0.00581	99.8180	1.50E+11	0.00	0.00	151.8805
6.0765	1.2323	101921.	5035.	-0.00580	128.1407	1.50E+11	0.00	0.00	165.0515
6.4816	1.2041	128349.	5870.	-0.00580	161.3672	1.50E+11	0.00	0.00	178.2224
6.8867	1.1760	158988.	6768.	-0.00579	199.8887	1.50E+11	0.00	0.00	191.3934
7.2918	1.1478	194151.	7730.	-0.00579	244.0967	1.50E+11	0.00	0.00	204.5643
7.6969	1.1197	234147.	8757.	-0.00578	294.3823	1.50E+11	0.00	0.00	217.7353
8.1020	1.0916	279289.	9847.	-0.00577	351.1370	1.50E+11	0.00	0.00	230.9063
8.5071	1.0636	329887.	11002.	-0.00576	414.7520	1.50E+11	0.00	0.00	244.0772
8.9122	1.0356	386254.	12220.	-0.00575	485.6186	1.50E+11	0.00	0.00	257.2482
9.3173	1.0076	448699.	13503.	-0.00574	564.1282	1.50E+11	0.00	0.00	270.4191
9.7224	0.9798	517535.	14850.	-0.00572	650.6721	1.50E+11	0.00	0.00	283.5901
10.1275	0.9520	593072.	16260.	-0.00570	745.6416	1.50E+11	0.00	0.00	296.7610
10.5326	0.9243	675622.	17735.	-0.00568	849.4281	1.50E+11	0.00	0.00	309.9320
10.9377	0.8968	765496.	19273.	-0.00566	962.4227	1.50E+11	0.00	0.00	323.1029
11.3428	0.8693	863006.	20876.	-0.00563	1085.	1.50E+11	0.00	0.00	336.2739
11.7479	0.8420	968462.	22543.	-0.00560	1218.	1.50E+11	0.00	0.00	349.4449
12.1530	0.8148	1082176.	24274.	-0.00557	1361.	1.50E+11	0.00	0.00	362.6158
12.5581	0.7878	1204459.	26068.	-0.00553	1514.	1.50E+11	0.00	0.00	375.7868
12.9632	0.7610	1335622.	27927.	-0.00549	1679.	1.50E+11	0.00	0.00	388.9577
13.3683	0.7344	1475977.	29850.	-0.00545	1856.	1.50E+11	0.00	0.00	402.1287
13.7734	0.7081	1625835.	31837.	-0.00540	2044.	1.50E+11	0.00	0.00	415.2996
14.1785	0.6820	1785507.	33888.	-0.00534	2245.	1.50E+11	0.00	0.00	428.4706
14.5836	0.6562	1955304.	36002.	-0.00528	2458.	1.50E+11	0.00	0.00	441.6415
14.9887	0.6306	2135537.	38181.	-0.00521	2685.	1.50E+11	0.00	0.00	454.8125
15.3938	0.6055	2326519.	40424.	-0.00514	2925.	1.50E+11	0.00	0.00	467.9835
15.7989	0.5807	2528559.	42731.	-0.00506	3179.	1.50E+11	0.00	0.00	481.1544
16.2040	0.5563	2741970.	45102.	-0.00498	3447.	1.50E+11	0.00	0.00	494.3254
16.6091	0.5323	2967062.	47537.	-0.00488	3730.	1.50E+11	0.00	0.00	507.4963
17.0142	0.5088	3204147.	50036.	-0.00478	4028.	1.50E+11	0.00	0.00	520.6673
17.4193	0.4858	3453536.	52600.	-0.00468	4342.	1.50E+11	0.00	0.00	533.8382
17.8244	0.4633	3715540.	55227.	-0.00456	4671.	1.50E+11	0.00	0.00	547.0092
18.2295	0.4414	3990471.	57918.	-0.00443	5017.	1.50E+11	0.00	0.00	560.1801
18.6346	0.4202	4278640.	59518.	-0.00433	0.00	3.03E+11	-10.938	126.5359	109.3018
19.0397	0.3993	4569133.	59641.	-0.00426	0.00	3.03E+11	-48.049	584.9695	0.00

19.4448	0.3788	4858491.	59313.	-0.00419	0.00	3.03E+11	-86.841	1115.	0.00
19.8499	0.3586	5145796.	58794.	-0.00411	0.00	3.03E+11	-126.423	1714.	0.00
20.2550	0.3388	5430114.	58084.	-0.00402	0.00	3.02E+11	-165.917	2381.	0.00
20.6601	0.3195	5710511.	57180.	-0.00393	0.00	3.02E+11	-205.791	3131.	0.00
21.0652	0.3006	5986045.	56086.	-0.00384	0.00	3.02E+11	-244.678	3957.	0.00
21.4703	0.2821	6255797.	54806.	-0.00374	0.00	3.02E+11	-281.896	4857.	0.00
21.8754	0.2642	6518888.	53350.	-0.00364	0.00	3.02E+11	-316.806	5829.	0.00
22.2805	0.2468	6774492.	51730.	-0.00353	0.00	3.02E+11	-349.747	6890.	0.00
22.6856	0.2299	7021830.	49956.	-0.00342	0.00	3.02E+11	-380.043	8037.	0.00
23.0907	0.2135	7260188.	46144.	-0.00330	0.00	3.01E+11	-1189.	27062.	0.00
23.4958	0.1977	7470456.	40362.	-0.00319	0.00	3.01E+11	-1190.	29258.	0.00
23.9009	0.1826	7652599.	34576.	-0.00306	0.00	3.01E+11	-1190.	31694.	0.00
24.3060	0.1680	7806616.	28793.	-0.00294	0.00	3.01E+11	-1189.	34407.	0.00
24.7111	0.1540	7932539.	23021.	-0.00281	0.00	3.01E+11	-1186.	37440.	0.00
25.1162	0.1406	8030437.	17267.	-0.00268	0.00	3.01E+11	-1182.	40842.	0.00
25.5213	0.1279	8100415.	11538.	-0.00255	0.00	3.01E+11	-1175.	44677.	0.00
25.9264	0.1158	8142615.	5843.	-0.00242	0.00	3.01E+11	-1168.	49017.	0.00
26.3315	0.1044	8157219.	188.6156	-0.00229	0.00	3.01E+11	-1158.	53957.	0.00
26.7366	0.09355	8144449.	-5415.	-0.00216	0.00	3.01E+11	-1147.	59609.	0.00
27.1417	0.08339	8104569.	-10960.	-0.00203	0.00	3.01E+11	-1134.	66116.	0.00
27.5468	0.07385	8037889.	-16437.	-0.00190	0.00	3.01E+11	-1119.	73662.	0.00
27.9519	0.06495	7944763.	-22304.	-0.00177	0.00	3.01E+11	-1295.	96898.	0.00
28.3570	0.05668	7821040.	-28544.	-0.00164	0.00	3.01E+11	-1272.	109135.	0.00
28.7621	0.04902	7667248.	-34669.	-0.00151	0.00	3.01E+11	-1247.	123711.	0.00
29.1672	0.04196	7483979.	-40664.	-0.00139	0.00	3.01E+11	-1219.	141282.	0.00
29.5723	0.03548	7271893.	-46516.	-0.00127	0.00	3.01E+11	-1188.	162771.	0.00
29.9774	0.02958	7031731.	-52207.	-0.00116	0.00	3.01E+11	-1153.	189515.	0.00
30.3825	0.02423	6764316.	-57718.	-0.00105	0.00	3.02E+11	-1114.	223534.	0.00
30.7876	0.01941	6470573.	-63027.	-9.40E-04	0.00	3.02E+11	-1070.	268050.	0.00
31.1927	0.01509	6151540.	-68108.	-8.38E-04	0.00	3.02E+11	-1020.	328565.	0.00
31.5978	0.01126	5808400.	-72926.	-7.42E-04	0.00	3.02E+11	-962.144	415408.	0.00
32.0029	0.00788	5442524.	-77435.	-6.51E-04	0.00	3.02E+11	-892.899	550854.	0.00
32.4080	0.00493	5055547.	-81563.	-5.67E-04	0.00	3.03E+11	-805.390	794903.	0.00
32.8131	0.00237	4649538.	-85173.	-4.89E-04	0.00	3.03E+11	-680.009	1397419.	0.00
33.2182	1.68E-04	4227460.	-87085.	-4.18E-04	0.00	3.03E+11	-106.726	3080341.	0.00
33.6233	-0.00170	3802859.	-85780.	-3.54E-04	0.00	3.03E+11	643.5934	1841239.	0.00
34.0284	-0.00327	3393468.	-82348.	-2.96E-04	0.00	3.04E+11	768.4175	1142082.	0.00
34.4335	-0.00458	3002235.	-78422.	-2.45E-04	0.00	3.04E+11	847.0718	899416.	0.00
34.8386	-0.00565	2631019.	-74164.	-2.00E-04	0.00	3.04E+11	904.7641	778112.	0.00
35.2437	-0.00652	2281184.	-69656.	-1.61E-04	0.00	3.04E+11	950.0179	708082.	0.00
35.6488	-0.00721	1953799.	-64948.	-1.27E-04	0.00	3.05E+11	986.9028	664962.	0.00
36.0539	-0.00776	1649736.	-60075.	-9.81E-05	0.00	3.05E+11	1018.	637910.	0.00
36.4590	-0.00817	1369724.	-55064.	-7.41E-05	0.00	3.05E+11	1044.	621300.	0.00
36.8641	-0.00848	1114384.	-49933.	-5.43E-05	0.00	3.05E+11	1067.	611880.	0.00
37.2692	-0.00870	884255.	-44698.	-3.83E-05	0.00	3.05E+11	1087.	607592.	0.00
37.6743	-0.00885	679811.	-39370.	-2.58E-05	0.00	3.05E+11	1105.	607040.	0.00
38.0794	-0.00895	501479.	-33959.	-1.64E-05	0.00	3.05E+11	1121.	609213.	0.00
38.4845	-0.00901	349645.	-28471.	-9.64E-06	0.00	3.05E+11	1137.	613342.	0.00
38.8896	-0.00904	224670.	-22911.	-5.07E-06	0.00	3.05E+11	1151.	618823.	0.00
39.2947	-0.00906	126894.	-17282.	-2.26E-06	0.00	3.05E+11	1165.	625175.	0.00
39.6998	-0.00906	56643.	-11587.	-7.99E-07	0.00	3.05E+11	1178.	632026.	0.00
40.1049	-0.00907	14240.	-5826.	-2.34E-07	0.00	3.05E+11	1192.	639102.	0.00
40.5100	-0.00907	0.00	0.00	-1.21E-07	0.00	3.05E+11	1205.	323118.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     1.65605663 inches
Computed slope at pile head      =     -0.0058126 radians
Maximum bending moment           =       8157219. inch-lbs
Maximum shear force              =        -87085. lbs
Depth of maximum bending moment  =    26.33150000 feet below pile head
Depth of maximum shear force     =    33.21820000 feet below pile head
Number of iterations             =             34
Number of zero deflection points =              1
Pile deflection at ground        =     0.42673716 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
40.51000	1.65605663	8157219.	-87085.
38.48450	1.90528114	8037748.	-97184.
36.45900	2.83429797	7761993.	-106049.
34.43350	6.53164407	7454594.	-115749.
32.40800	27.78744209	7303067.	-132467.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                              =          0.0 lbs
```

Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.4449	-1.41E-04	0.00	-0.01109	1.77E-07	1.50E+11	0.00	0.00	0.00
0.4051	3.3910	-6.47E-05	7.81E-06	-0.01109	8.13E-08	1.50E+11	0.00	0.00	0.00
0.8102	3.3371	-6.47E-05	0.02379	-0.01109	8.13E-08	1.50E+11	0.00	0.00	0.00979
1.2153	3.2832	0.2312	25.5704	-0.01109	2.91E-04	1.50E+11	0.00	0.00	10.5006
1.6204	3.2293	248.6059	124.6389	-0.01109	0.3126	1.50E+11	0.00	0.00	30.2582
2.0255	3.1754	1212.	319.7530	-0.01109	1.5238	1.50E+11	0.00	0.00	50.0158
2.4306	3.1215	3357.	610.9127	-0.01109	4.2211	1.50E+11	0.00	0.00	69.7734
2.8357	3.0676	7152.	998.1180	-0.01109	8.9913	1.50E+11	0.00	0.00	89.5310
3.2408	3.0137	13061.	1481.	-0.01109	16.4216	1.50E+11	0.00	0.00	109.2886
3.6459	2.9598	21554.	2061.	-0.01109	27.0989	1.50E+11	0.00	0.00	129.0462
4.0510	2.9059	33096.	2736.	-0.01109	41.6102	1.50E+11	0.00	0.00	148.8038
4.4561	2.8520	48155.	3507.	-0.01108	60.5425	1.50E+11	0.00	0.00	168.5614
4.8612	2.7982	67196.	4375.	-0.01108	84.4829	1.50E+11	0.00	0.00	188.3189
5.2663	2.7443	90688.	5338.	-0.01108	114.0183	1.50E+11	0.00	0.00	208.0765
5.6714	2.6904	119098.	6398.	-0.01108	149.7358	1.50E+11	0.00	0.00	227.8341
6.0765	2.6366	152891.	7553.	-0.01107	192.2223	1.50E+11	0.00	0.00	247.5917
6.4816	2.5828	192535.	8805.	-0.01107	242.0650	1.50E+11	0.00	0.00	267.3493
6.8867	2.5290	238497.	10153.	-0.01106	299.8506	1.50E+11	0.00	0.00	287.1069
7.2918	2.4753	291243.	11596.	-0.01105	366.1664	1.50E+11	0.00	0.00	306.8645
7.6969	2.4216	351241.	13136.	-0.01104	441.5993	1.50E+11	0.00	0.00	326.6221
8.1020	2.3679	418958.	14772.	-0.01103	526.7363	1.50E+11	0.00	0.00	346.3797
8.5071	2.3144	494860.	16504.	-0.01101	622.1644	1.50E+11	0.00	0.00	366.1373
8.9122	2.2609	579414.	18332.	-0.01100	728.4706	1.50E+11	0.00	0.00	385.8948
9.3173	2.2075	673088.	20256.	-0.01098	846.2419	1.50E+11	0.00	0.00	405.6524
9.7224	2.1542	776347.	22276.	-0.01095	976.0654	1.50E+11	0.00	0.00	425.4100
10.1275	2.1010	889660.	24392.	-0.01092	1119.	1.50E+11	0.00	0.00	445.1676
10.5326	2.0479	1013492.	26604.	-0.01089	1274.	1.50E+11	0.00	0.00	464.9252
10.9377	1.9951	1148312.	28912.	-0.01086	1444.	1.50E+11	0.00	0.00	484.6828
11.3428	1.9424	1294584.	31316.	-0.01082	1628.	1.50E+11	0.00	0.00	504.4404
11.7479	1.8899	1452778.	33816.	-0.01077	1827.	1.50E+11	0.00	0.00	524.1980
12.1530	1.8376	1623359.	36412.	-0.01072	2041.	1.50E+11	0.00	0.00	543.9556
12.5581	1.7856	1806794.	39105.	-0.01067	2272.	1.50E+11	0.00	0.00	563.7132
12.9632	1.7339	2003551.	41893.	-0.01061	2519.	1.50E+11	0.00	0.00	583.4707
13.3683	1.6825	2214095.	44777.	-0.01054	2784.	1.50E+11	0.00	0.00	603.2283
13.7734	1.6314	2438895.	47758.	-0.01046	3066.	1.50E+11	0.00	0.00	622.9859
14.1785	1.5808	2678417.	50834.	-0.01038	3367.	1.50E+11	0.00	0.00	642.7435
14.5836	1.5305	2933127.	54007.	-0.01029	3688.	1.50E+11	0.00	0.00	662.5011
14.9887	1.4807	3203493.	57275.	-0.01019	4028.	1.50E+11	0.00	0.00	682.2587
15.3938	1.4314	3489982.	60640.	-0.01008	4388.	1.50E+11	0.00	0.00	702.0163
15.7989	1.3827	3793061.	64101.	-0.00996	4769.	1.50E+11	0.00	0.00	721.7739
16.2040	1.3346	4113195.	67657.	-0.00983	5171.	1.50E+11	0.00	0.00	741.5315
16.6091	1.2871	4450854.	71310.	-0.00969	5596.	1.50E+11	0.00	0.00	761.2891
17.0142	1.2403	4806502.	75059.	-0.00954	6043.	1.50E+11	0.00	0.00	781.0466
17.4193	1.1943	5180608.	78904.	-0.00938	6513.	1.50E+11	0.00	0.00	800.8042
17.8244	1.1491	5573637.	82845.	-0.00921	7007.	1.50E+11	0.00	0.00	820.5618
18.2295	1.1048	5986057.	86882.	-0.00902	7526.	1.50E+11	0.00	0.00	840.3194

18.6346	1.0614	6418336.	89288.	-0.00887	0.00	3.02E+11	-14.160	64.8525	163.9623
19.0397	1.0186	6854154.	89501.	-0.00876	0.00	3.02E+11	-62.483	298.2050	0.00
19.4448	0.9762	7288496.	89073.	-0.00865	0.00	3.01E+11	-113.528	565.3169	0.00
19.8499	0.9345	7720155.	88393.	-0.00853	0.00	3.01E+11	-166.315	865.1888	0.00
20.2550	0.8933	8147883.	87454.	-0.00840	0.00	3.01E+11	-219.891	1197.	0.00
20.6601	0.8528	8570416.	86254.	-0.00827	0.00	3.01E+11	-273.771	1561.	0.00
21.0652	0.8130	8986479.	84794.	-0.00812	0.00	3.00E+11	-327.008	1955.	0.00
21.4703	0.7738	9394814.	83078.	-0.00797	0.00	3.00E+11	-378.857	2380.	0.00
21.8754	0.7354	9794196.	81115.	-0.00782	0.00	3.00E+11	-428.619	2833.	0.00
22.2805	0.6978	1.02E+07	78915.	-0.00766	0.00	2.99E+11	-476.614	3320.	0.00
22.6856	0.6610	1.06E+07	76488.	-0.00749	0.00	2.99E+11	-521.941	3839.	0.00
23.0907	0.6250	1.09E+07	71440.	-0.00731	0.00	2.99E+11	-1555.	12093.	0.00
23.4958	0.5899	1.13E+07	63860.	-0.00713	0.00	2.99E+11	-1564.	12890.	0.00
23.9009	0.5557	1.15E+07	56237.	-0.00695	0.00	2.98E+11	-1572.	13754.	0.00
24.3060	0.5223	1.18E+07	48578.	-0.00676	0.00	2.98E+11	-1579.	14692.	0.00
24.7111	0.4900	1.20E+07	40891.	-0.00656	0.00	2.98E+11	-1584.	15715.	0.00
25.1162	0.4585	1.22E+07	33182.	-0.00637	0.00	2.98E+11	-1588.	16832.	0.00
25.5213	0.4281	1.23E+07	25459.	-0.00617	0.00	2.98E+11	-1590.	18055.	0.00
25.9264	0.3986	1.24E+07	17729.	-0.00596	0.00	2.98E+11	-1591.	19398.	0.00
26.3315	0.3701	1.25E+07	9999.	-0.00576	0.00	2.98E+11	-1590.	20879.	0.00
26.7366	0.3426	1.25E+07	2278.	-0.00555	0.00	2.98E+11	-1587.	22517.	0.00
27.1417	0.3161	1.25E+07	-5425.	-0.00535	0.00	2.98E+11	-1582.	24337.	0.00
27.5468	0.2906	1.25E+07	-13103.	-0.00515	0.00	2.98E+11	-1576.	26367.	0.00
27.9519	0.2661	1.24E+07	-21411.	-0.00494	0.00	2.98E+11	-1842.	33653.	0.00
28.3570	0.2425	1.23E+07	-30336.	-0.00474	0.00	2.98E+11	-1830.	36681.	0.00
28.7621	0.2200	1.21E+07	-39197.	-0.00454	0.00	2.98E+11	-1816.	40122.	0.00
29.1672	0.1984	1.19E+07	-47980.	-0.00435	0.00	2.98E+11	-1798.	44062.	0.00
29.5723	0.1777	1.16E+07	-56671.	-0.00415	0.00	2.98E+11	-1777.	48617.	0.00
29.9774	0.1580	1.14E+07	-65252.	-0.00397	0.00	2.99E+11	-1753.	53942.	0.00
30.3825	0.1392	1.10E+07	-73705.	-0.00378	0.00	2.99E+11	-1725.	60253.	0.00
30.7876	0.1212	1.06E+07	-82009.	-0.00361	0.00	2.99E+11	-1692.	67857.	0.00
31.1927	0.1041	1.02E+07	-90139.	-0.00344	0.00	2.99E+11	-1653.	77217.	0.00
31.5978	0.08775	9759127.	-98064.	-0.00328	0.00	3.00E+11	-1608.	89057.	0.00
32.0029	0.07220	9263424.	-105747.	-0.00312	0.00	3.00E+11	-1553.	104592.	0.00
32.4080	0.05738	8731011.	-113140.	-0.00298	0.00	3.00E+11	-1488.	126049.	0.00
32.8131	0.04325	8163436.	-120174.	-0.00284	0.00	3.01E+11	-1406.	158035.	0.00
33.2182	0.02976	7562633.	-126748.	-0.00271	0.00	3.01E+11	-1299.	212106.	0.00
33.6233	0.01687	6931141.	-132681.	-0.00260	0.00	3.02E+11	-1142.	329228.	0.00
34.0284	0.00451	6272655.	-137482.	-0.00249	0.00	3.02E+11	-832.835	896865.	0.00
34.4335	-0.00735	5594488.	-137189.	-0.00240	0.00	3.02E+11	953.3803	630742.	0.00
34.8386	-0.01877	4938850.	-131903.	-0.00231	0.00	3.03E+11	1221.	316269.	0.00
35.2437	-0.02981	4312074.	-125558.	-0.00224	0.00	3.03E+11	1389.	226497.	0.00
35.6488	-0.04052	3718123.	-118490.	-0.00217	0.00	3.04E+11	1519.	182274.	0.00
36.0539	-0.05093	3160070.	-110838.	-0.00212	0.00	3.04E+11	1629.	155499.	0.00
36.4590	-0.06110	2640515.	-102682.	-0.00207	0.00	3.04E+11	1726.	137366.	0.00
36.8641	-0.07106	2161759.	-94073.	-0.00203	0.00	3.04E+11	1815.	124180.	0.00
37.2692	-0.08085	1725898.	-85048.	-0.00200	0.00	3.05E+11	1898.	114104.	0.00
37.6743	-0.09052	1334886.	-75633.	-0.00198	0.00	3.05E+11	1976.	106116.	0.00
38.0794	-0.100	990567.	-65846.	-0.00196	0.00	3.05E+11	2050.	99602.	0.00
38.4845	-0.110	694702.	-55704.	-0.00194	0.00	3.05E+11	2122.	94169.	0.00
38.8896	-0.119	448989.	-45218.	-0.00194	0.00	3.05E+11	2192.	89554.	0.00
39.2947	-0.128	255073.	-34398.	-0.00193	0.00	3.05E+11	2260.	85574.	0.00
39.6998	-0.138	114559.	-23251.	-0.00193	0.00	3.05E+11	2326.	82099.	0.00

```
   40.1049     -0.147     29020.    -11783.   -0.00193       0.00   3.05E+11      2392.     79033.       0.00
   40.5100     -0.156       0.00       0.00   -0.00193       0.00   3.05E+11      2456.     38152.       0.00

* This analysis computed pile response using nonlinear moment-curvature rela-
  tionships. Values of total stress due to combined axial and bending stresses
  are computed only for elastic sections only and do not equal the actual
  stresses in concrete and steel. Stresses in concrete and steel may be inter-
  polated from the output for nonlinear bending properties relative to the
  magnitude of bending moment developed in the pile.


Output Summary for Load Case No. 2:

Pile-head deflection             =     3.44492142 inches
Computed slope at pile head      =     -0.0110878 radians
Maximum bending moment           =      12545065. inch-lbs
Maximum shear force              =       -137482. lbs
Depth of maximum bending moment  =    26.73660000 feet below pile head
Depth of maximum shear force     =    34.02840000 feet below pile head
Number of iterations             =             43
Number of zero deflection points =              1
Pile deflection at ground        =     1.07477645 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs


    Pile       Pile Head       Maximum       Maximum
   Length      Deflection      Moment         Shear
    feet         inches        ln-lbs          lbs
------------  ------------  ------------  ------------
   40.51000    3.44492142     12545065.      -137482.
   38.48450    5.11217473     12123776.      -148833.
   36.45900   10.79524159     11735171.      -161587.
   34.43350   37.17935034     11514222.      -182022.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
```

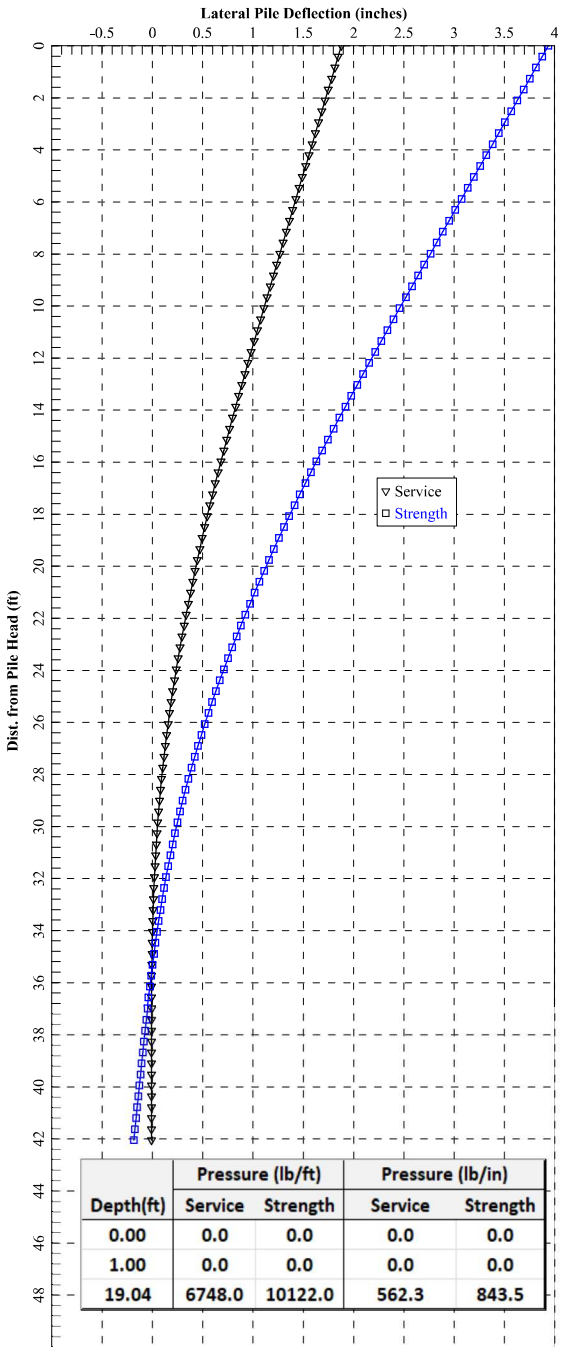
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.6561	-0.00581	-87085.	8157219.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.4449	-0.01109	-137482.	1.25E+07

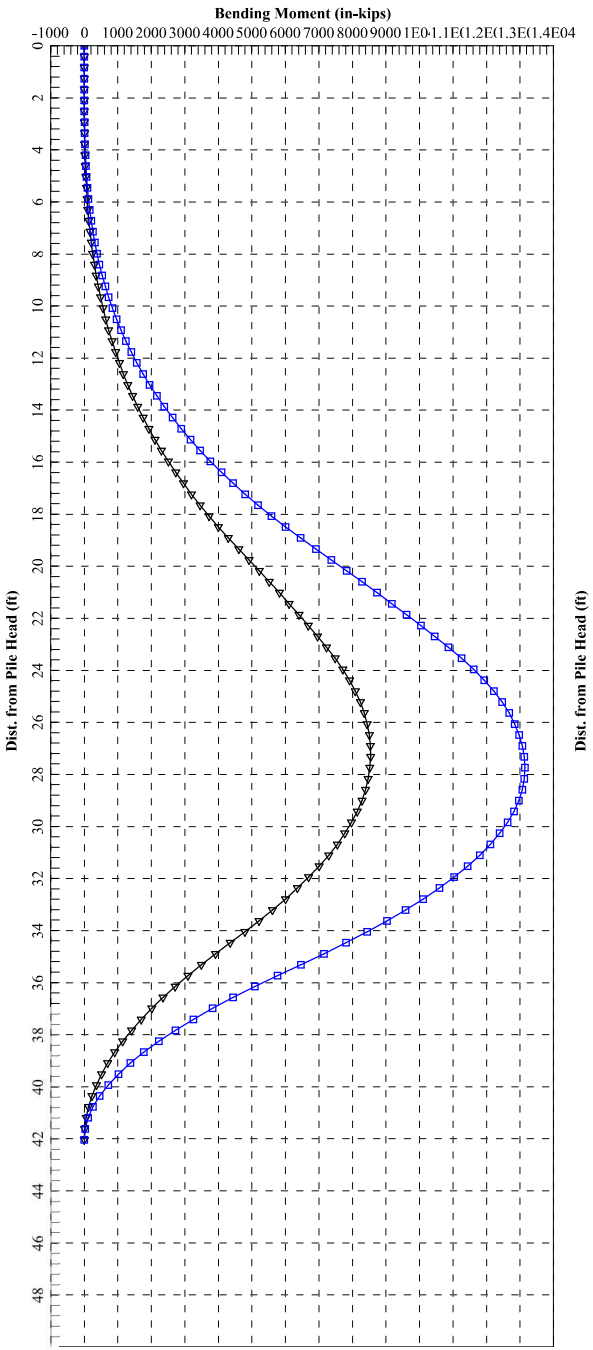
Maximum pile-head deflection = 3.4449214207 inches
Maximum pile-head rotation = -0.0110877736 radians = -0.635283 deg.

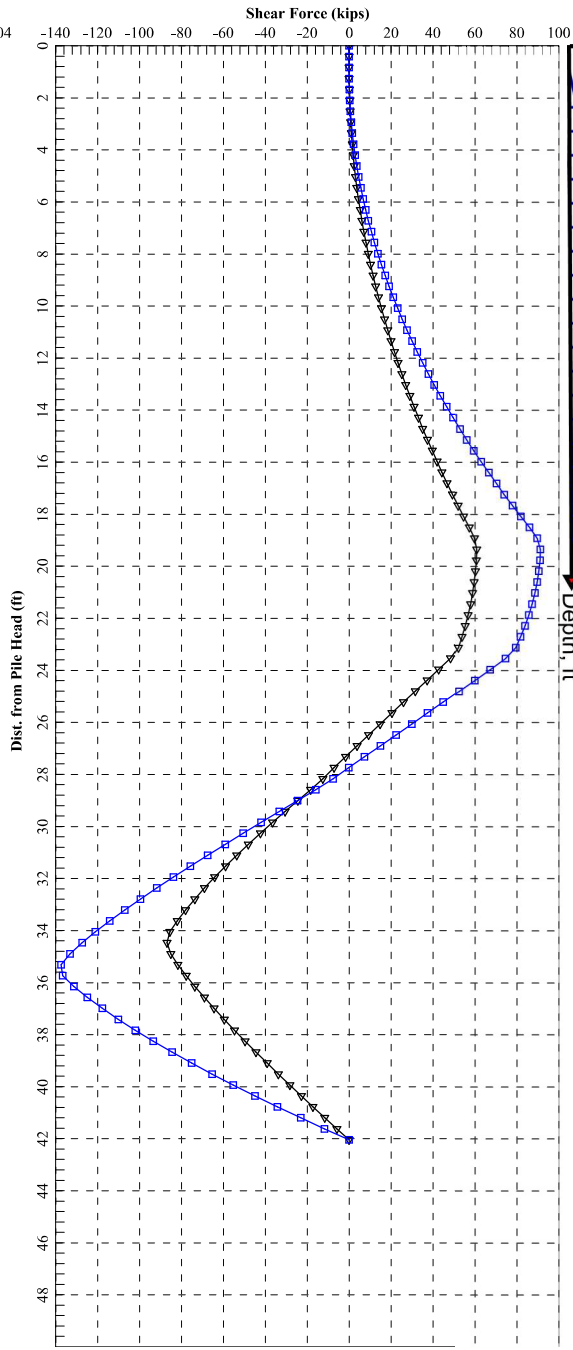
The analysis ended normally.

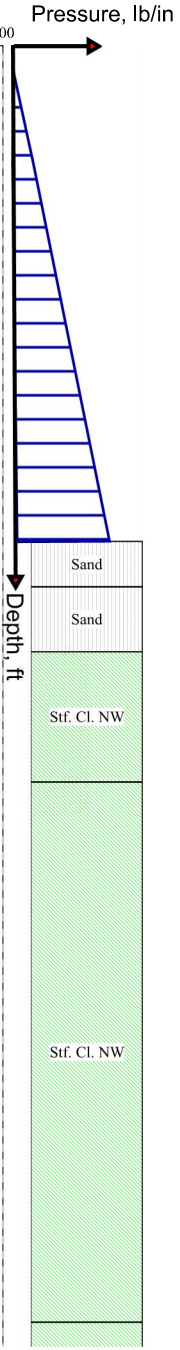
Wall 1A (19.04ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
19.04	6748.0	10122.0	562.3	843.5







```
================================================================================

                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App E LPile March 2026\Wall 1A\

Name of input data file:
06 Wall_1A-19.04ft.lp12d

Name of output report file:
06 Wall_1A-19.04ft.lp12o

Name of plot output file:
06 Wall_1A-19.04ft.lp12p

Name of runtime message file:
06 Wall_1A-19.04ft.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 26, 2026             Time:  15:28:01
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=19.04FT) Boring B-042-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 42.040 ft
Depth of ground surface below top of pile = 19.0400 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	13.0000
2	19.040	13.0000
3	19.040	42.0000
4	42.040	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 19.040000 ft
AISC Section Type = W

AISC Section Name = W24X162

Pile width = 13.000000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 23.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W24X162

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    19.040000 ft
   Distance from top of pile to bottom of layer        =    20.780000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    20.780000 ft
   Distance from top of pile to bottom of layer        =    23.280000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    23.280000 ft
   Distance from top of pile to bottom of layer        =    28.280000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3500. psf
   Undrained cohesion at bottom of layer               =        3500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer           =    28.280000 ft
   Distance from top of pile to bottom of layer        =    57.280000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

```
   Undrained cohesion at top of layer                 =        4000. psf
   Undrained cohesion at bottom of layer              =        4000. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000


 (Depth of the lowest soil layer extends 15.240 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	19.0400	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	20.7800	57.6000	--	32.0000	--	60.0000
2	Sand	20.7800	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	23.2800	57.6000	--	32.0000	--	60.0000
3	Stiff Clay	23.2800	62.6000	3500.	--	0.00500	--
	w/o Free Water	28.2800	62.6000	3500.	--	0.00500	--
4	Stiff Clay	28.2800	62.6000	4000.	--	0.00400	--
	w/o Free Water	57.2800	62.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	19.040	0.8290	1.0000
2	45.000	0.8290	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	19.040	562.300

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	19.040	843.500

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	19.040000 ft
Flange Width	=	13.000000 in
Section Depth	=	25.000000 in
Flange Thickness	=	1.220000 in
Web Thickness	=	0.705000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	47.800000 sq. in.
Moment of Inertia	=	5170. in^4
Elastic Bending Stiffness	=	149930000. kip-in^2
Plastic Modulus, Z	=	468.000000in^3
Plastic Moment Capacity = Fy Z	=	23400.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	2390.000 kips
Nominal Axial Tensile Capacity	=	-2390.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000564	843.5817563	149661328.	12.5000000	2.0228366	
0.00001127	1687.	149661328.	12.5000000	4.0456731	
0.00001691	2531.	149661328.	12.5000000	6.0685097	
0.00002255	3374.	149661328.	12.5000000	8.0913462	

0.00002818	4218.	149661328.	12.5000000	10.1141828	
0.00003382	5061.	149661328.	12.5000000	12.1370193	
0.00003946	5905.	149661328.	12.5000000	14.1598559	
0.00004509	6749.	149661328.	12.5000000	16.1826924	
0.00005073	7592.	149661328.	12.5000000	18.2055290	
0.00005637	8436.	149661328.	12.5000000	20.2283655	
0.00006200	9279.	149661328.	12.5000000	22.2512021	
0.00006764	10123.	149661328.	12.5000000	24.2740387	
0.00007328	10967.	149661328.	12.5000000	26.2968752	
0.00007891	11810.	149661328.	12.5000000	28.3197118	
0.00008455	12654.	149661328.	12.5000000	30.3425483	
0.00009019	13497.	149661328.	12.5000000	32.3653849	
0.00009582	14341.	149661328.	12.5000000	34.3882214	
0.0001015	15184.	149661328.	12.5000000	36.4110580	
0.0001071	16028.	149661328.	12.5000000	38.4338945	
0.0001127	16872.	149661328.	12.5000000	40.4567311	
0.0001184	17715.	149661328.	12.5000000	42.4795677	
0.0001240	18559.	149661328.	12.5000000	44.5024042	
0.0001296	19402.	149661328.	12.5000000	46.5252408	
0.0001353	20246.	149661328.	12.5000000	48.5480773	
0.0001409	21044.	149335438.	12.5000000	50.0000000	Y
0.0001466	21568.	147167341.	12.5000000	50.0000000	Y
0.0001522	21830.	143443513.	12.5000000	50.0000000	Y
0.0001578	21936.	138990727.	12.5000000	50.0000000	Y
0.0001635	22031.	134778644.	12.5000000	50.0000000	Y
0.0001691	22117.	130792919.	12.5000000	50.0000000	Y
0.0001747	22195.	127019731.	12.5000000	50.0000000	Y
0.0001804	22265.	123438572.	12.5000000	50.0000000	Y
0.0001860	22329.	120041927.	12.5000000	50.0000000	Y
0.0001916	22387.	116816521.	12.5000000	50.0000000	Y
0.0001973	22441.	113750451.	12.5000000	50.0000000	Y
0.0002029	22490.	110832995.	12.5000000	50.0000000	Y
0.0002086	22535.	108054452.	12.5000000	50.0000000	Y
0.0002142	22577.	105406006.	12.5000000	50.0000000	Y
0.0002198	22616.	102879617.	12.5000000	50.0000000	Y
0.0002311	22684.	98157690.	12.5000000	50.0000000	Y
0.0002424	22744.	93839045.	12.5000000	50.0000000	Y
0.0002536	22795.	89870682.	12.5000000	50.0000000	Y
0.0002649	22841.	86216799.	12.5000000	50.0000000	Y
0.0002762	22880.	82841835.	12.5000000	50.0000000	Y
0.0002875	22916.	79715608.	12.5000000	50.0000000	Y
0.0002987	22947.	76812297.	12.5000000	50.0000000	Y
0.0003100	22975.	74109652.	12.5000000	50.0000000	Y
0.0003213	23000.	71588365.	12.5000000	50.0000000	Y
0.0003326	23023.	69228461.	12.5000000	50.0000000	Y
0.0003438	23043.	67017513.	12.5000000	50.0000000	Y
0.0003551	23062.	64943044.	12.5000000	50.0000000	Y
0.0003664	23078.	62989711.	12.5000000	50.0000000	Y
0.0003777	23094.	61150178.	12.5000000	50.0000000	Y
0.0003889	23108.	59413683.	12.5000000	50.0000000	Y
0.0004002	23120.	57772030.	12.5000000	50.0000000	Y
0.0004115	23132.	56217876.	12.5000000	50.0000000	Y
0.0004227	23143.	54744647.	12.5000000	50.0000000	Y

0.0004340	23153.	53345344.	12.5000000	50.0000000	Y
0.0004453	23163.	52016769.	12.5000000	50.0000000	Y
0.0004566	23171.	50750132.	12.5000000	50.0000000	Y
0.0004678	23179.	49544538.	12.5000000	50.0000000	Y
0.0004791	23186.	48394700.	12.5000000	50.0000000	Y
0.0004904	23193.	47295595.	12.5000000	50.0000000	Y
0.0005017	23200.	46245888.	12.5000000	50.0000000	Y
0.0005129	23206.	45241851.	12.5000000	50.0000000	Y
0.0005242	23211.	44278956.	12.5000000	50.0000000	Y
0.0005355	23216.	43356603.	12.5000000	50.0000000	Y
0.0005468	23222.	42472285.	12.5000000	50.0000000	Y
0.0005580	23226.	41622571.	12.5000000	50.0000000	Y
0.0005693	23231.	40805636.	12.5000000	50.0000000	Y
0.0005806	23235.	40020427.	12.5000000	50.0000000	Y
0.0005918	23239.	39265131.	12.5000000	50.0000000	Y
0.0006031	23243.	38537591.	12.5000000	50.0000000	Y
0.0006144	23246.	37835670.	12.5000000	50.0000000	Y
0.0006257	23249.	37159043.	12.5000000	50.0000000	Y
0.0006369	23252.	36506367.	12.5000000	50.0000000	Y
0.0006482	23255.	35876394.	12.5000000	50.0000000	Y
0.0006595	23258.	35267672.	12.5000000	50.0000000	Y
0.0006708	23261.	34678509.	12.5000000	50.0000000	Y
0.0007158	23270.	32507418.	12.5000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	23270.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

```
--------------------------------------------------------------------------------

Length of Section                                  =    23.000000 ft
Outside Diameter of Casing                         =    42.000000 in
Casing Wall Thickness                              =       0.0000 in
Moment of Inertia of Steel Casing                  =       0.0000 in^4
Width Flange of Core/Insert                        =    13.000000 in
Depth of Core/Insert                               =    25.000000 in
Flange Thickness of Core/Insert                    =     1.220000 in
Web Thickness of Core/Insert                       =     0.705000 in
Moment of Inertia of Steel Core/Insert             =        5170. in^4
Yield Stress of Casing                             =       50000. psi
Elastic Modulus of Casing                          =    29000000. psi
Yield Stress of Core/Insert                        =       50000. psi
Elastic Modulus of Core/Insert                     =    29000000. psi
Number of Reinforcing Bars                         =           0 bars
Gross Area of Pile                                 =        1385. sq. in.
Area of Concrete                                   =        1338. sq. in.
Cross-sectional Area of Steel Casing               =       0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert          =    47.800000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)  =    47.624800 sq. in.
Area Ratio of All Steel to Gross Area              =         3.44 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     8074.980 kips
Tensile Load for Cracking of Concrete                =     -779.261 kips
Nominal Axial Tensile Capacity                       =    -2390.000 kips



Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1               0.000

Definition of Run Messages:

   Y = part of pipe section has yielded.


Axial Thrust Force =      0.000 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing     Max Core   Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress        Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in          in/in         in/in          ksi           ksi           ksi           ksi
------------ ------------ ------------ ------------ ------------ ------------ ------------ ------------ ------------ ------------ ---
```

0.00000564	1718.	304847706.	13.7046008	0.00007725	-0.000159	0.3541727	0.00000	0.00000	-3.217806 C
0.00001127	3425.	303806256.	13.7398635	0.0001549	-0.000319	0.6970854	0.00000	0.00000	-6.424083 C
0.00001691	5119.	302748789.	13.7757534	0.0002329	-0.000477	1.0285779	0.00000	0.00000	-9.618525 C
0.00002255	6802.	301674713.	13.8122935	0.0003114	-0.000636	1.3484838	0.00000	0.00000	-12.800808 C
0.00002818	8471.	300583472.	13.8495084	0.0003903	-0.000793	1.6566296	0.00000	0.00000	-15.970594 C
0.00003382	10128.	299474458.	13.8874238	0.0004697	-0.000951	1.9528350	0.00000	0.00000	-19.127527 C
0.00003946	11772.	298347008.	13.9260672	0.0005495	-0.001108	2.2369117	0.00000	0.00000	-22.271232 C
0.00004509	13402.	297200485.	13.9654676	0.0006297	-0.001264	2.5086637	0.00000	0.00000	-25.401313 C
0.00005073	15018.	296034145.	14.0056558	0.0007105	-0.001420	2.7678857	0.00000	0.00000	-28.517353 C
0.00005637	16619.	294847222.	14.0466646	0.0007918	-0.001576	3.0143633	0.00000	0.00000	-31.618914 C
0.00006200	18206.	293639579.	14.0880402	0.0008735	-0.001731	3.2477866	0.00000	0.00000	-34.706409 C
0.00006764	19778.	292411001.	14.1296532	0.0009557	-0.001885	3.4678855	0.00000	0.00000	-37.779911 C
0.00007328	21335.	291159928.	14.1721496	0.0010385	-0.002039	3.6745215	0.00000	0.00000	-40.837932 C
0.00007891	22876.	289885431.	14.2155689	0.0011218	-0.002193	3.8674417	0.00000	0.00000	-43.879948 C
0.00008455	24400.	288586520.	14.2599532	0.0012057	-0.002345	4.0463800	0.00000	0.00000	-46.905403 C
0.00009019	25907.	287262136.	14.3053478	0.0012901	-0.002498	4.2110563	0.00000	0.00000	-49.913706 C
0.00009582	26870.	280412282.	14.2403551	0.0013645	-0.002660	4.3429470	0.00000	0.00000	-50.000000 CY
0.0001015	27342.	269490053.	14.0876093	0.0014293	-0.002832	4.4477011	0.00000	0.00000	-50.000000 CY
0.0001071	27754.	259152838.	13.9382428	0.0014927	-0.003005	4.5414135	0.00000	0.00000	-50.000000 CY
0.0001127	28119.	249428935.	13.7966137	0.0015553	-0.003179	4.6253669	0.00000	0.00000	-50.000000 CY
0.0001184	28445.	240311075.	13.6635282	0.0016173	-0.003354	4.7001606	0.00000	0.00000	-50.000000 CY
0.0001240	28737.	231736626.	13.5342117	0.0016783	-0.003530	4.7655752	0.00000	0.00000	-50.000000 CY
0.0001296	28999.	223686438.	13.4121601	0.0017388	-0.003706	4.8224896	0.00000	0.00000	-50.000000 CY
0.0001353	29236.	216120146.	13.2972863	0.0017988	-0.003883	4.8711946	0.00000	0.00000	-50.000000 CY
0.0001409	29453.	209009205.	13.1880338	0.0018584	-0.004060	4.9117894	0.00000	0.00000	-50.000000 CY
0.0001466	29646.	202292420.	13.0822558	0.0019172	-0.004238	4.9443621	0.00000	0.00000	-50.000000 CY
0.0001522	29824.	195967532.	12.9829466	0.0019759	-0.004416	4.9693851	0.00000	0.00000	-50.000000 CY
0.0001578	29987.	190002013.	12.8896457	0.0020343	-0.004594	4.9869475	0.00000	0.00000	-50.000000 CY
0.0001635	30136.	184364451.	12.8015378	0.0020926	-0.004773	4.9971122	0.00000	0.00000	-50.000000 CY
0.0001691	30271.	179015211.	12.7151469	0.0021501	-0.004952	4.9974799	0.00000	0.00000	-50.000000 CY
0.0001747	30394.	173944281.	12.6338840	0.0022076	-0.005131	4.9998534	0.00000	0.00000	-50.000000 CY
0.0001804	30506.	169130713.	12.5575082	0.0022650	-0.005311	4.9987541	0.00000	0.00000	-50.000000 CY
0.0001860	30609.	164558154.	12.4856574	0.0023224	-0.005490	4.9959643	0.00000	0.00000	-50.000000 CY
0.0001916	30703.	160210480.	12.4181036	0.0023799	-0.005669	4.9998696	0.00000	0.00000	-50.000000 CY
0.0001973	30789.	156066135.	12.3528877	0.0024370	-0.005849	4.9977452	0.00000	0.00000	-50.000000 CY
0.0002029	30867.	152117325.	12.2900370	0.0024939	-0.006029	4.9993625	0.00000	0.00000	-50.000000 CY
0.0002086	30937.	148341236.	12.2304223	0.0025507	-0.006209	4.9982042	0.00000	0.00000	-50.000000 CY
0.0002142	31003.	144742598.	12.1741019	0.0026076	-0.006388	4.9982762	0.00000	0.00000	-50.000000 CY
0.0002198	31063.	141305786.	12.1213188	0.0026646	-0.006568	4.9977794	0.00000	0.00000	-50.000000 CY
0.0002311	31168.	134869056.	12.0232560	0.0027786	-0.006928	4.9961791	0.00000	0.00000	-50.000000 CY
0.0002424	31257.	128960602.	11.9329742	0.0028922	-0.007287	4.9924504	0.00000	0.00000	-50.000000 CY
0.0002536	31330.	123518353.	11.8485351	0.0030053	-0.007648	4.9999072	0.00000	0.00000	-50.000000 CY
0.0002649	31392.	118495374.	11.7721246	0.0031187	-0.008008	4.9974879	0.00000	0.00000	-50.000000 CY
0.0002762	31443.	113845757.	11.7020284	0.0032320	-0.008368	4.9906429	0.00000	0.00000	-50.000000 CY
0.0002875	31487.	109532581.	11.6381699	0.0033456	-0.008728	4.9989157	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load	Axial	Nominal Moment

No.	Thrust kips	Capacity in-kips
1	0.00000000	31487.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	19.0400	0.00	N.A.	No	0.00	2914.
2	20.7800	1.7400	Yes	No	2914.	16097.
3	23.2800	0.5104	No	No	19011.	213289.
4	28.2800	4.8992	Yes	No	232300.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.8800	7.70E-05	-1.29E-07	-0.00639	9.69E-08	1.50E+11	0.00	0.00	0.00
0.4204	1.8478	-1.83E-05	-9.58E-06	-0.00639	2.30E-08	1.50E+11	0.00	0.00	0.00
0.8408	1.8156	-1.96E-05	0.2432	-0.00639	2.46E-08	1.50E+11	0.00	0.00	0.09642
1.2612	1.7834	2.4539	21.0226	-0.00639	0.00309	1.50E+11	0.00	0.00	8.1415
1.6816	1.7512	212.1093	95.1476	-0.00639	0.2667	1.50E+11	0.00	0.00	21.2452
2.1020	1.7189	962.4555	235.3783	-0.00639	1.2101	1.50E+11	0.00	0.00	34.3489
2.5224	1.6867	2587.	441.7145	-0.00639	3.2525	1.50E+11	0.00	0.00	47.4526
2.9428	1.6545	5419.	714.1564	-0.00639	6.8133	1.50E+11	0.00	0.00	60.5563
3.3632	1.6223	9793.	1053.	-0.00639	12.3117	1.50E+11	0.00	0.00	73.6601
3.7836	1.5901	16041.	1457.	-0.00639	20.1670	1.50E+11	0.00	0.00	86.7638
4.2040	1.5579	24497.	1928.	-0.00638	30.7985	1.50E+11	0.00	0.00	99.8675
4.6244	1.5257	35494.	2465.	-0.00638	44.6255	1.50E+11	0.00	0.00	112.9712
5.0448	1.4935	49367.	3068.	-0.00638	62.0673	1.50E+11	0.00	0.00	126.0749
5.4652	1.4613	66449.	3737.	-0.00638	83.5430	1.50E+11	0.00	0.00	139.1786
5.8856	1.4291	87072.	4472.	-0.00638	109.4721	1.50E+11	0.00	0.00	152.2823
6.3060	1.3969	111572.	5273.	-0.00637	140.2738	1.50E+11	0.00	0.00	165.3860
6.7264	1.3648	140280.	6141.	-0.00637	176.3673	1.50E+11	0.00	0.00	178.4897
7.1468	1.3326	173531.	7074.	-0.00636	218.1720	1.50E+11	0.00	0.00	191.5934
7.5672	1.3006	211658.	8074.	-0.00636	266.1072	1.50E+11	0.00	0.00	204.6971
7.9876	1.2685	254994.	9140.	-0.00635	320.5920	1.50E+11	0.00	0.00	217.8009
8.4080	1.2365	303873.	10272.	-0.00634	382.0459	1.50E+11	0.00	0.00	230.9046
8.8284	1.2045	358629.	11469.	-0.00633	450.8880	1.50E+11	0.00	0.00	244.0083
9.2488	1.1726	419595.	12733.	-0.00632	527.5377	1.50E+11	0.00	0.00	257.1120
9.6692	1.1408	487105.	14064.	-0.00630	612.4142	1.50E+11	0.00	0.00	270.2157
10.0896	1.1090	561491.	15460.	-0.00628	705.9369	1.50E+11	0.00	0.00	283.3194
10.5100	1.0774	643088.	16922.	-0.00626	808.5249	1.50E+11	0.00	0.00	296.4231
10.9304	1.0458	732229.	18451.	-0.00624	920.5977	1.50E+11	0.00	0.00	309.5268
11.3508	1.0144	829248.	20045.	-0.00621	1043.	1.50E+11	0.00	0.00	322.6305
11.7712	0.9831	934477.	21706.	-0.00618	1175.	1.50E+11	0.00	0.00	335.7342
12.1916	0.9520	1048251.	23433.	-0.00615	1318.	1.50E+11	0.00	0.00	348.8380
12.6120	0.9211	1170902.	25225.	-0.00611	1472.	1.50E+11	0.00	0.00	361.9417
13.0324	0.8903	1302766.	27084.	-0.00607	1638.	1.50E+11	0.00	0.00	375.0454
13.4528	0.8598	1444174.	29010.	-0.00603	1816.	1.50E+11	0.00	0.00	388.1491
13.8732	0.8295	1595460.	31001.	-0.00597	2006.	1.50E+11	0.00	0.00	401.2528
14.2936	0.7995	1756958.	33058.	-0.00592	2209.	1.50E+11	0.00	0.00	414.3565
14.7140	0.7698	1929002.	35181.	-0.00586	2425.	1.50E+11	0.00	0.00	427.4602
15.1344	0.7405	2111925.	37371.	-0.00579	2655.	1.50E+11	0.00	0.00	440.5639
15.5548	0.7114	2306059.	39627.	-0.00571	2899.	1.50E+11	0.00	0.00	453.6676
15.9752	0.6828	2511740.	41948.	-0.00563	3158.	1.50E+11	0.00	0.00	466.7713
16.3956	0.6546	2729300.	44336.	-0.00554	3431.	1.50E+11	0.00	0.00	479.8750
16.8160	0.6269	2959073.	46790.	-0.00545	3720.	1.50E+11	0.00	0.00	492.9788
17.2364	0.5997	3201392.	49310.	-0.00534	4025.	1.50E+11	0.00	0.00	506.0825
17.6568	0.5730	3456591.	51896.	-0.00523	4346.	1.50E+11	0.00	0.00	519.1862
18.0772	0.5469	3725004.	54548.	-0.00511	4683.	1.50E+11	0.00	0.00	532.2899
18.4976	0.5214	4006963.	57267.	-0.00498	5038.	1.50E+11	0.00	0.00	545.3936
18.9180	0.4966	4302802.	59753.	-0.00484	5410.	1.50E+11	0.00	0.00	440.2383
19.3384	0.4726	4609846.	60801.	-0.00473	0.00	3.03E+11	-24.588	262.4795	0.00
19.7588	0.4489	4916263.	60585.	-0.00465	0.00	3.03E+11	-61.107	686.7177	0.00

20.1792	0.4257	5221126.	60181.	-0.00457	0.00	3.03E+11	-99.008	1173.	0.00
20.5996	0.4028	5523469.	59585.	-0.00448	0.00	3.02E+11	-137.399	1721.	0.00
21.0200	0.3805	5822315.	58795.	-0.00438	0.00	3.02E+11	-175.955	2333.	0.00
21.4404	0.3586	6116683.	57810.	-0.00428	0.00	3.02E+11	-214.246	3014.	0.00
21.8608	0.3373	6405598.	56636.	-0.00418	0.00	3.02E+11	-251.245	3758.	0.00
22.2812	0.3165	6688119.	55280.	-0.00407	0.00	3.02E+11	-286.283	4563.	0.00
22.7016	0.2963	6963354.	53753.	-0.00395	0.00	3.02E+11	-319.214	5436.	0.00
23.1220	0.2766	7230466.	52065.	-0.00383	0.00	3.01E+11	-350.027	6384.	0.00
23.5424	0.2576	7488669.	48392.	-0.00371	0.00	3.01E+11	-1106.	21663.	0.00
23.9628	0.2392	7718724.	42805.	-0.00358	0.00	3.01E+11	-1109.	23394.	0.00
24.3832	0.2214	7920553.	37206.	-0.00345	0.00	3.01E+11	-1111.	25310.	0.00
24.8036	0.2043	8094114.	31601.	-0.00332	0.00	3.01E+11	-1111.	27436.	0.00
25.2240	0.1879	8239394.	25998.	-0.00318	0.00	3.01E+11	-1110.	29804.	0.00
25.6444	0.1722	8356419.	20403.	-0.00304	0.00	3.01E+11	-1108.	32452.	0.00
26.0648	0.1572	8445250.	14824.	-0.00290	0.00	3.01E+11	-1104.	35423.	0.00
26.4852	0.1429	8505985.	9268.	-0.00276	0.00	3.01E+11	-1099.	38772.	0.00
26.9056	0.1294	8538761.	3743.	-0.00262	0.00	3.01E+11	-1092.	42565.	0.00
27.3260	0.1165	8543753.	-1742.	-0.00247	0.00	3.01E+11	-1083.	46882.	0.00
27.7464	0.1044	8521180.	-7181.	-0.00233	0.00	3.01E+11	-1073.	51825.	0.00
28.1668	0.09305	8471303.	-12563.	-0.00219	0.00	3.01E+11	-1061.	57518.	0.00
28.5872	0.08237	8394427.	-18341.	-0.00205	0.00	3.01E+11	-1230.	75337.	0.00
29.0076	0.07241	8286245.	-24501.	-0.00191	0.00	3.01E+11	-1212.	84430.	0.00
29.4280	0.06315	8147223.	-30562.	-0.00177	0.00	3.01E+11	-1191.	95157.	0.00
29.8484	0.05457	7977887.	-36512.	-0.00163	0.00	3.01E+11	-1168.	107947.	0.00
30.2688	0.04668	7778831.	-42337.	-0.00150	0.00	3.01E+11	-1142.	123383.	0.00
30.6892	0.03944	7550723.	-48022.	-0.00137	0.00	3.01E+11	-1112.	142288.	0.00
31.1096	0.03283	7294306.	-53551.	-0.00125	0.00	3.01E+11	-1080.	165861.	0.00
31.5300	0.02685	7010415.	-58904.	-0.00113	0.00	3.02E+11	-1043.	195926.	0.00
31.9504	0.02146	6699986.	-64060.	-0.00101	0.00	3.02E+11	-1001.	235413.	0.00
32.3708	0.01663	6364076.	-68991.	-9.04E-04	0.00	3.02E+11	-953.743	289379.	0.00
32.7912	0.01233	6003893.	-73663.	-8.01E-04	0.00	3.02E+11	-898.469	367469.	0.00
33.2116	0.00855	5620845.	-78028.	-7.04E-04	0.00	3.02E+11	-831.932	490970.	0.00
33.6320	0.00523	5216624.	-82010.	-6.13E-04	0.00	3.03E+11	-746.710	719585.	0.00
34.0524	0.00236	4793399.	-85459.	-5.30E-04	0.00	3.03E+11	-620.700	1326638.	0.00
34.4728	-1.12E-04	4354377.	-86862.	-4.54E-04	0.00	3.03E+11	64.5637	2920010.	0.00
34.8932	-0.00222	3916998.	-85114.	-3.85E-04	0.00	3.03E+11	628.4759	1429566.	0.00
35.3136	-0.00400	3495614.	-81666.	-3.23E-04	0.00	3.04E+11	738.1780	932026.	0.00
35.7340	-0.00548	3093017.	-77762.	-2.69E-04	0.00	3.04E+11	809.7469	745388.	0.00
36.1544	-0.00671	2711028.	-73542.	-2.20E-04	0.00	3.04E+11	863.1121	649283.	0.00
36.5748	-0.00771	2351005.	-69081.	-1.79E-04	0.00	3.04E+11	905.4577	592832.	0.00
36.9952	-0.00851	2014026.	-64425.	-1.42E-04	0.00	3.05E+11	940.3157	557596.	0.00
37.4156	-0.00914	1700978.	-59608.	-1.12E-04	0.00	3.05E+11	969.7418	535164.	0.00
37.8360	-0.00963	1412610.	-54651.	-8.58E-05	0.00	3.05E+11	995.0751	521100.	0.00
38.2564	-0.01001	1149566.	-49576.	-6.46E-05	0.00	3.05E+11	1017.	512806.	0.00
38.6768	-0.01029	912412.	-44394.	-4.76E-05	0.00	3.05E+11	1037.	508626.	0.00
39.0972	-0.01049	701650.	-39117.	-3.42E-05	0.00	3.05E+11	1055.	507427.	0.00
39.5176	-0.01063	517733.	-33754.	-2.41E-05	0.00	3.05E+11	1071.	508389.	0.00
39.9380	-0.01073	361082.	-28311.	-1.69E-05	0.00	3.05E+11	1087.	510887.	0.00
40.3584	-0.01080	232088.	-22792.	-1.19E-05	0.00	3.05E+11	1101.	514432.	0.00
40.7788	-0.01085	131123.	-17200.	-8.94E-06	0.00	3.05E+11	1116.	518641.	0.00
41.1992	-0.01089	58551.	-11536.	-7.37E-06	0.00	3.05E+11	1130.	523217.	0.00
41.6196	-0.01093	14726.	-5803.	-6.77E-06	0.00	3.05E+11	1143.	527947.	0.00
42.0400	-0.01096	0.00	0.00	-6.64E-06	0.00	3.05E+11	1157.	266350.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     1.88002790 inches
Computed slope at pile head      =     -0.0063863 radians
Maximum bending moment           =       8543753. inch-lbs
Maximum shear force              =        -86862. lbs
Depth of maximum bending moment  =    27.32600000 feet below pile head
Depth of maximum shear force     =    34.47280000 feet below pile head
Number of iterations             =             35
Number of zero deflection points =              1
Pile deflection at ground        =     0.48964197 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
42.04000	1.88002790	8543753.	-86862.
39.93800	2.13949004	8428731.	-96772.
37.83600	3.19221265	8142496.	-105854.
35.73400	7.48332596	7841392.	-115911.
33.63200	30.61058126	7676767.	-131635.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                              =          0.0 lbs
```

Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.9404	7.31E-05	0.00	-0.01225	9.19E-08	1.50E+11	0.00	0.00	0.00
0.4204	3.8787	6.01E-05	-1.04E-06	-0.01225	7.55E-08	1.50E+11	0.00	0.00	0.00
0.8408	3.8169	6.27E-05	0.3648	-0.01225	7.88E-08	1.50E+11	0.00	0.00	0.1446
1.2612	3.7551	3.6812	31.5357	-0.01225	0.00463	1.50E+11	0.00	0.00	12.2130
1.6816	3.6933	318.1829	142.7299	-0.01225	0.4000	1.50E+11	0.00	0.00	31.8697
2.1020	3.6315	1444.	353.0884	-0.01225	1.8152	1.50E+11	0.00	0.00	51.5264
2.5224	3.5697	3881.	662.6111	-0.01225	4.8790	1.50E+11	0.00	0.00	71.1832
2.9428	3.5079	8129.	1071.	-0.01225	10.2205	1.50E+11	0.00	0.00	90.8399
3.3632	3.4462	14690.	1579.	-0.01225	18.4686	1.50E+11	0.00	0.00	110.4966
3.7836	3.3844	24062.	2186.	-0.01225	30.2523	1.50E+11	0.00	0.00	130.1534
4.2040	3.3226	36747.	2892.	-0.01224	46.2005	1.50E+11	0.00	0.00	149.8101
4.6244	3.2608	53245.	3698.	-0.01224	66.9423	1.50E+11	0.00	0.00	169.4668
5.0448	3.1991	74055.	4602.	-0.01224	93.1064	1.50E+11	0.00	0.00	189.1235
5.4652	3.1373	99679.	5606.	-0.01224	125.3220	1.50E+11	0.00	0.00	208.7803
5.8856	3.0756	130616.	6709.	-0.01223	164.2179	1.50E+11	0.00	0.00	228.4370
6.3060	3.0139	167367.	7911.	-0.01223	210.4231	1.50E+11	0.00	0.00	248.0937
6.7264	2.9522	210432.	9212.	-0.01222	264.5667	1.50E+11	0.00	0.00	267.7505
7.1468	2.8906	260311.	10612.	-0.01222	327.2774	1.50E+11	0.00	0.00	287.4072
7.5672	2.8290	317505.	12112.	-0.01221	399.1844	1.50E+11	0.00	0.00	307.0639
7.9876	2.7674	382514.	13710.	-0.01219	480.9165	1.50E+11	0.00	0.00	326.7207
8.4080	2.7059	455837.	15408.	-0.01218	573.1028	1.50E+11	0.00	0.00	346.3774
8.8284	2.6445	537976.	17205.	-0.01216	676.3721	1.50E+11	0.00	0.00	366.0341
9.2488	2.5832	629430.	19101.	-0.01214	791.3535	1.50E+11	0.00	0.00	385.6908
9.6692	2.5220	730701.	21097.	-0.01212	918.6758	1.50E+11	0.00	0.00	405.3476
10.0896	2.4609	842287.	23191.	-0.01209	1059.	1.50E+11	0.00	0.00	425.0043
10.5100	2.4000	964690.	25385.	-0.01206	1213.	1.50E+11	0.00	0.00	444.6610
10.9304	2.3392	1098409.	27678.	-0.01203	1381.	1.50E+11	0.00	0.00	464.3178
11.3508	2.2786	1243945.	30070.	-0.01199	1564.	1.50E+11	0.00	0.00	483.9745
11.7712	2.2182	1401799.	32561.	-0.01194	1762.	1.50E+11	0.00	0.00	503.6312
12.1916	2.1581	1572469.	35151.	-0.01189	1977.	1.50E+11	0.00	0.00	523.2879
12.6120	2.0982	1756458.	37840.	-0.01184	2208.	1.50E+11	0.00	0.00	542.9447
13.0324	2.0387	1954264.	40629.	-0.01178	2457.	1.50E+11	0.00	0.00	562.6014
13.4528	1.9794	2166389.	43517.	-0.01171	2724.	1.50E+11	0.00	0.00	582.2581
13.8732	1.9205	2393332.	46504.	-0.01163	3009.	1.50E+11	0.00	0.00	601.9149
14.2936	1.8621	2635594.	49590.	-0.01154	3314.	1.50E+11	0.00	0.00	621.5716
14.7140	1.8041	2893675.	52775.	-0.01145	3638.	1.50E+11	0.00	0.00	641.2283
15.1344	1.7465	3168075.	56060.	-0.01135	3983.	1.50E+11	0.00	0.00	660.8851
15.5548	1.6896	3459294.	59443.	-0.01124	4349.	1.50E+11	0.00	0.00	680.5418
15.9752	1.6332	3767834.	62926.	-0.01112	4737.	1.50E+11	0.00	0.00	700.1985
16.3956	1.5774	4094193.	66508.	-0.01098	5147.	1.50E+11	0.00	0.00	719.8552
16.8160	1.5223	4438873.	70189.	-0.01084	5581.	1.50E+11	0.00	0.00	739.5120
17.2364	1.4680	4802373.	73969.	-0.01068	6038.	1.50E+11	0.00	0.00	759.1687
17.6568	1.4146	5185195.	77849.	-0.01052	6519.	1.50E+11	0.00	0.00	778.8254
18.0772	1.3619	5587837.	81827.	-0.01033	7025.	1.50E+11	0.00	0.00	798.4822
18.4976	1.3103	6010801.	85905.	-0.01014	7557.	1.50E+11	0.00	0.00	818.1389
18.9180	1.2597	6454586.	89635.	-0.00993	8115.	1.50E+11	0.00	0.00	660.3966

19.3384	1.2101	6915178.	91219.	-0.00976	0.00	3.02E+11	-32.452	135.2892	0.00
19.7588	1.1612	7374945.	90932.	-0.00964	0.00	3.01E+11	-80.964	351.7570	0.00
20.1792	1.1128	7832651.	90396.	-0.00951	0.00	3.01E+11	-131.808	597.5216	0.00
20.5996	1.0652	8287003.	89599.	-0.00938	0.00	3.01E+11	-183.978	871.3483	0.00
21.0200	1.0182	8736672.	88538.	-0.00924	0.00	3.00E+11	-236.582	1172.	0.00
21.4404	0.9720	9180320.	87213.	-0.00909	0.00	3.00E+11	-288.855	1499.	0.00
21.8608	0.9265	9616617.	85627.	-0.00893	0.00	3.00E+11	-339.969	1851.	0.00
22.2812	0.8819	1.00E+07	83788.	-0.00876	0.00	3.00E+11	-389.175	2226.	0.00
22.7016	0.8381	1.05E+07	81706.	-0.00859	0.00	2.99E+11	-436.272	2626.	0.00
23.1220	0.7952	1.09E+07	79391.	-0.00841	0.00	2.99E+11	-481.210	3053.	0.00
23.5424	0.7533	1.13E+07	74529.	-0.00822	0.00	2.99E+11	-1446.	9687.	0.00
23.9628	0.7123	1.16E+07	67206.	-0.00803	0.00	2.98E+11	-1457.	10319.	0.00
24.3832	0.6723	1.19E+07	59833.	-0.00783	0.00	2.98E+11	-1466.	11003.	0.00
24.8036	0.6333	1.22E+07	52415.	-0.00763	0.00	2.98E+11	-1474.	11745.	0.00
25.2240	0.5953	1.25E+07	44960.	-0.00742	0.00	2.98E+11	-1481.	12551.	0.00
25.6444	0.5584	1.27E+07	37474.	-0.00720	0.00	2.98E+11	-1487.	13430.	0.00
26.0648	0.5226	1.28E+07	29964.	-0.00699	0.00	2.98E+11	-1491.	14389.	0.00
26.4852	0.4879	1.30E+07	22438.	-0.00677	0.00	2.97E+11	-1493.	15439.	0.00
26.9056	0.4543	1.31E+07	14902.	-0.00655	0.00	2.97E+11	-1494.	16593.	0.00
27.3260	0.4219	1.31E+07	7364.	-0.00633	0.00	2.97E+11	-1494.	17865.	0.00
27.7464	0.3905	1.31E+07	-167.601	-0.00610	0.00	2.97E+11	-1492.	19272.	0.00
28.1668	0.3603	1.31E+07	-7684.	-0.00588	0.00	2.97E+11	-1488.	20836.	0.00
28.5872	0.3312	1.31E+07	-15832.	-0.00566	0.00	2.97E+11	-1742.	26531.	0.00
29.0076	0.3032	1.30E+07	-24598.	-0.00544	0.00	2.97E+11	-1734.	28840.	0.00
29.4280	0.2764	1.28E+07	-33316.	-0.00522	0.00	2.98E+11	-1723.	31448.	0.00
29.8484	0.2506	1.26E+07	-41974.	-0.00500	0.00	2.98E+11	-1709.	34413.	0.00
30.2688	0.2259	1.24E+07	-50556.	-0.00479	0.00	2.98E+11	-1693.	37813.	0.00
30.6892	0.2023	1.21E+07	-59049.	-0.00458	0.00	2.98E+11	-1674.	41750.	0.00
31.1096	0.1797	1.18E+07	-67436.	-0.00438	0.00	2.98E+11	-1651.	46361.	0.00
31.5300	0.1581	1.14E+07	-75698.	-0.00418	0.00	2.99E+11	-1624.	51838.	0.00
31.9504	0.1375	1.10E+07	-83812.	-0.00399	0.00	2.99E+11	-1593.	58460.	0.00
32.3708	0.1178	1.06E+07	-91755.	-0.00381	0.00	2.99E+11	-1556.	66645.	0.00
32.7912	0.09900	1.01E+07	-99494.	-0.00364	0.00	2.99E+11	-1512.	77058.	0.00
33.2116	0.08109	9593050.	-106991.	-0.00347	0.00	3.00E+11	-1460.	90831.	0.00
33.6320	0.06399	9034723.	-114195.	-0.00331	0.00	3.00E+11	-1396.	110073.	0.00
34.0524	0.04765	8440864.	-121036.	-0.00317	0.00	3.01E+11	-1316.	139283.	0.00
34.4728	0.03203	7813521.	-127402.	-0.00303	0.00	3.01E+11	-1208.	190278.	0.00
34.8932	0.01707	7155428.	-133090.	-0.00291	0.00	3.01E+11	-1047.	309293.	0.00
35.3136	0.00272	6470693.	-137422.	-0.00279	0.00	3.02E+11	-670.476	1243560.	0.00
35.7340	-0.01109	5768894.	-136677.	-0.00269	0.00	3.02E+11	965.7350	439338.	0.00
36.1544	-0.02441	5091673.	-131234.	-0.00260	0.00	3.03E+11	1192.	246355.	0.00
36.5748	-0.03731	4444793.	-124839.	-0.00252	0.00	3.03E+11	1343.	181612.	0.00
36.9952	-0.04983	3832095.	-117762.	-0.00245	0.00	3.03E+11	1463.	148090.	0.00
37.4156	-0.06203	3256624.	-110124.	-0.00239	0.00	3.04E+11	1565.	127281.	0.00
37.8360	-0.07396	2720983.	-101999.	-0.00234	0.00	3.04E+11	1656.	112975.	0.00
38.2564	-0.08566	2227496.	-93432.	-0.00230	0.00	3.04E+11	1740.	102467.	0.00
38.6768	-0.09717	1778288.	-84458.	-0.00227	0.00	3.05E+11	1818.	94379.	0.00
39.0972	-0.109	1375346.	-75101.	-0.00224	0.00	3.05E+11	1892.	87933.	0.00
39.5176	-0.120	1020553.	-65378.	-0.00222	0.00	3.05E+11	1963.	82654.	0.00
39.9380	-0.131	715710.	-55304.	-0.00221	0.00	3.05E+11	2031.	78238.	0.00
40.3584	-0.142	462554.	-44891.	-0.00220	0.00	3.05E+11	2097.	74476.	0.00
40.7788	-0.153	262773.	-34148.	-0.00219	0.00	3.05E+11	2162.	71227.	0.00
41.1992	-0.164	118015.	-23081.	-0.00219	0.00	3.05E+11	2225.	68384.	0.00

```
   41.6196     -0.175     29895.    -11697.   -0.00219       0.00   3.05E+11      2288.     65873.       0.00
   42.0400     -0.186       0.00       0.00   -0.00219       0.00   3.05E+11      2349.     31818.       0.00

* This analysis computed pile response using nonlinear moment-curvature rela-
  tionships. Values of total stress due to combined axial and bending stresses
  are computed only for elastic sections only and do not equal the actual
  stresses in concrete and steel. Stresses in concrete and steel may be inter-
  polated from the output for nonlinear bending properties relative to the
  magnitude of bending moment developed in the pile.


Output Summary for Load Case No. 2:

Pile-head deflection             =     3.94043834 inches
Computed slope at pile head      =     -0.0122474 radians
Maximum bending moment           =      13148746. inch-lbs
Maximum shear force              =       -137422. lbs
Depth of maximum bending moment  =    27.74640000 feet below pile head
Depth of maximum shear force     =    35.31360000 feet below pile head
Number of iterations             =             44
Number of zero deflection points =              1
Pile deflection at ground        =     1.24528169 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs


    Pile       Pile Head       Maximum       Maximum
   Length      Deflection      Moment         Shear
    feet         inches        ln-lbs          lbs
------------  ------------  ------------  ------------
   42.04000    3.94043834     13148746.      -137422.
   39.93800    5.77195453     12719885.      -148359.
   37.83600   12.30037294     12332274.      -161613.
   35.73400   42.73931442     12102303.      -181682.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
```

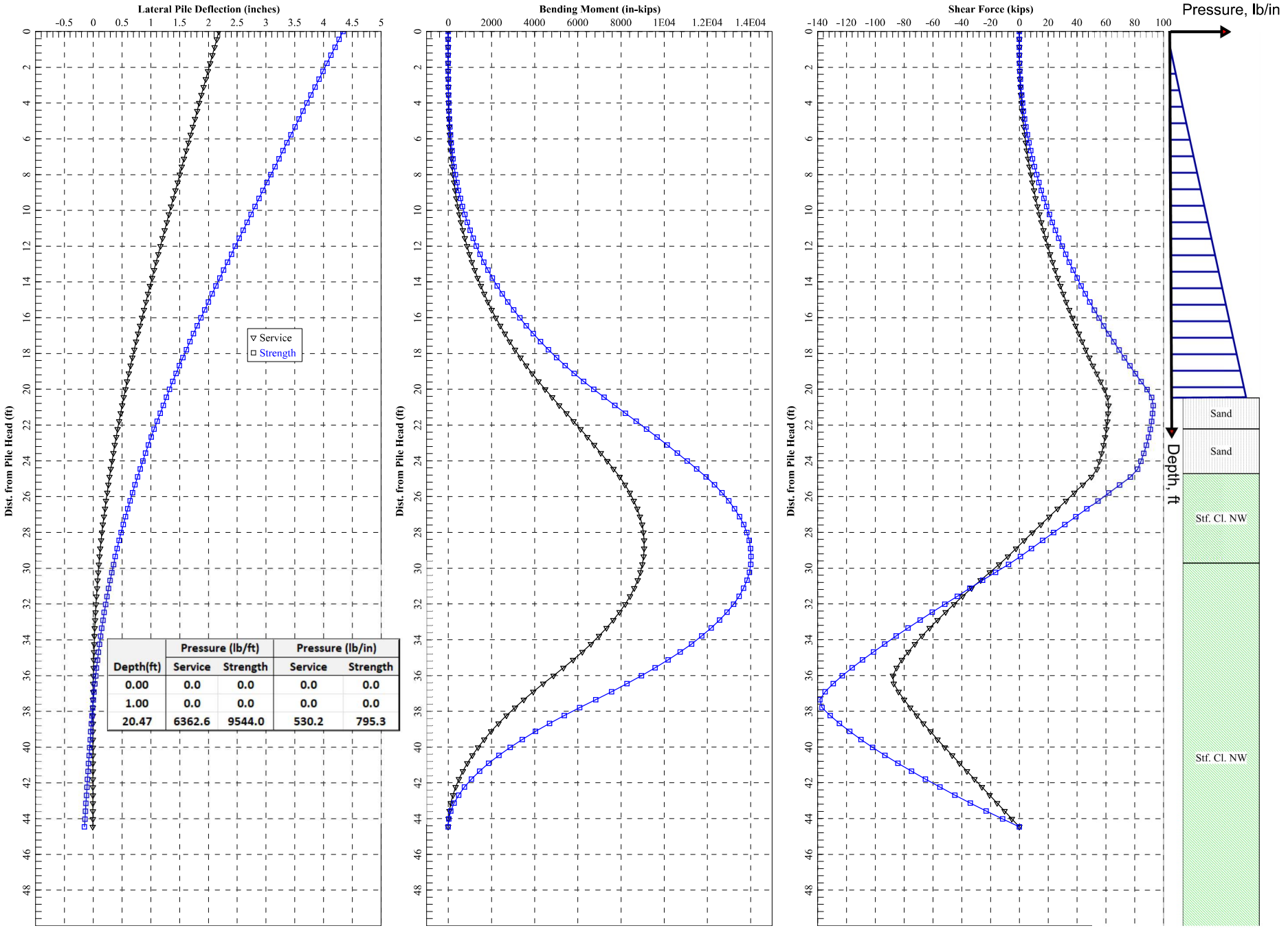
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.8800	-0.00639	-86862.	8543753.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.9404	-0.01225	-137422.	1.31E+07

Maximum pile-head deflection = 3.9404383418 inches
Maximum pile-head rotation = -0.0122473812 radians = -0.701723 deg.

The analysis ended normally.

Wall 1A (20.47ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
20.47	6362.6	9544.0	530.2	795.3

```
================================================================================

                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App E LPile March 2026\Wall 1A\

Name of input data file:
07 Wall_1A-20.47ft.lp12d

Name of output report file:
07 Wall_1A-20.47ft.lp12o

Name of plot output file:
07 Wall_1A-20.47ft.lp12p

Name of runtime message file:
07 Wall_1A-20.47ft.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 26, 2026             Time:  15:33:17
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=20.47FT) Boring B-042-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 44.470 ft
Depth of ground surface below top of pile = 20.4700 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	13.0000
2	20.470	13.0000
3	20.470	42.0000
4	44.470	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 20.470000 ft
AISC Section Type = W

AISC Section Name = W24X162

Pile width = 13.000000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 24.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W24X162

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    20.470000 ft
   Distance from top of pile to bottom of layer        =    22.210000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    22.210000 ft
   Distance from top of pile to bottom of layer        =    24.710000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    24.710000 ft
   Distance from top of pile to bottom of layer        =    29.710000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3500. psf
   Undrained cohesion at bottom of layer               =        3500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer           =    29.710000 ft
   Distance from top of pile to bottom of layer        =    58.710000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

```
   Undrained cohesion at top of layer                 =        4000. psf
   Undrained cohesion at bottom of layer              =        4000. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000


 (Depth of the lowest soil layer extends 14.240 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	20.4700	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	22.2100	57.6000	--	32.0000	--	60.0000
2	Sand	22.2100	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	24.7100	57.6000	--	32.0000	--	60.0000
3	Stiff Clay	24.7100	62.6000	3500.	--	0.00500	--
	w/o Free Water	29.7100	62.6000	3500.	--	0.00500	--
4	Stiff Clay	29.7100	62.6000	4000.	--	0.00400	--
	w/o Free Water	58.7100	62.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	20.470	0.7970	1.0000
2	45.000	0.7970	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	20.470	530.200

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	20.470	795.300

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	20.470000 ft
Flange Width	=	13.000000 in
Section Depth	=	25.000000 in
Flange Thickness	=	1.220000 in
Web Thickness	=	0.705000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	47.800000 sq. in.
Moment of Inertia	=	5170. in^4
Elastic Bending Stiffness	=	149930000. kip-in^2
Plastic Modulus, Z	=	468.000000in^3
Plastic Moment Capacity = Fy Z	=	23400.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	2390.000 kips
Nominal Axial Tensile Capacity	=	-2390.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000564	843.5817563	149661328.	12.5000000	2.0228366	
0.00001127	1687.	149661328.	12.5000000	4.0456731	
0.00001691	2531.	149661328.	12.5000000	6.0685097	
0.00002255	3374.	149661328.	12.5000000	8.0913462	

0.00002818	4218.	149661328.	12.5000000	10.1141828	
0.00003382	5061.	149661328.	12.5000000	12.1370193	
0.00003946	5905.	149661328.	12.5000000	14.1598559	
0.00004509	6749.	149661328.	12.5000000	16.1826924	
0.00005073	7592.	149661328.	12.5000000	18.2055290	
0.00005637	8436.	149661328.	12.5000000	20.2283655	
0.00006200	9279.	149661328.	12.5000000	22.2512021	
0.00006764	10123.	149661328.	12.5000000	24.2740387	
0.00007328	10967.	149661328.	12.5000000	26.2968752	
0.00007891	11810.	149661328.	12.5000000	28.3197118	
0.00008455	12654.	149661328.	12.5000000	30.3425483	
0.00009019	13497.	149661328.	12.5000000	32.3653849	
0.00009582	14341.	149661328.	12.5000000	34.3882214	
0.0001015	15184.	149661328.	12.5000000	36.4110580	
0.0001071	16028.	149661328.	12.5000000	38.4338945	
0.0001127	16872.	149661328.	12.5000000	40.4567311	
0.0001184	17715.	149661328.	12.5000000	42.4795677	
0.0001240	18559.	149661328.	12.5000000	44.5024042	
0.0001296	19402.	149661328.	12.5000000	46.5252408	
0.0001353	20246.	149661328.	12.5000000	48.5480773	
0.0001409	21044.	149335438.	12.5000000	50.0000000	Y
0.0001466	21568.	147167341.	12.5000000	50.0000000	Y
0.0001522	21830.	143443513.	12.5000000	50.0000000	Y
0.0001578	21936.	138990727.	12.5000000	50.0000000	Y
0.0001635	22031.	134778644.	12.5000000	50.0000000	Y
0.0001691	22117.	130792919.	12.5000000	50.0000000	Y
0.0001747	22195.	127019731.	12.5000000	50.0000000	Y
0.0001804	22265.	123438572.	12.5000000	50.0000000	Y
0.0001860	22329.	120041927.	12.5000000	50.0000000	Y
0.0001916	22387.	116816521.	12.5000000	50.0000000	Y
0.0001973	22441.	113750451.	12.5000000	50.0000000	Y
0.0002029	22490.	110832995.	12.5000000	50.0000000	Y
0.0002086	22535.	108054452.	12.5000000	50.0000000	Y
0.0002142	22577.	105406006.	12.5000000	50.0000000	Y
0.0002198	22616.	102879617.	12.5000000	50.0000000	Y
0.0002311	22684.	98157690.	12.5000000	50.0000000	Y
0.0002424	22744.	93839045.	12.5000000	50.0000000	Y
0.0002536	22795.	89870682.	12.5000000	50.0000000	Y
0.0002649	22841.	86216799.	12.5000000	50.0000000	Y
0.0002762	22880.	82841835.	12.5000000	50.0000000	Y
0.0002875	22916.	79715608.	12.5000000	50.0000000	Y
0.0002987	22947.	76812297.	12.5000000	50.0000000	Y
0.0003100	22975.	74109652.	12.5000000	50.0000000	Y
0.0003213	23000.	71588365.	12.5000000	50.0000000	Y
0.0003326	23023.	69228461.	12.5000000	50.0000000	Y
0.0003438	23043.	67017513.	12.5000000	50.0000000	Y
0.0003551	23062.	64943044.	12.5000000	50.0000000	Y
0.0003664	23078.	62989711.	12.5000000	50.0000000	Y
0.0003777	23094.	61150178.	12.5000000	50.0000000	Y
0.0003889	23108.	59413683.	12.5000000	50.0000000	Y
0.0004002	23120.	57772030.	12.5000000	50.0000000	Y
0.0004115	23132.	56217876.	12.5000000	50.0000000	Y
0.0004227	23143.	54744647.	12.5000000	50.0000000	Y

0.0004340	23153.	53345344.	12.5000000	50.0000000	Y
0.0004453	23163.	52016769.	12.5000000	50.0000000	Y
0.0004566	23171.	50750132.	12.5000000	50.0000000	Y
0.0004678	23179.	49544538.	12.5000000	50.0000000	Y
0.0004791	23186.	48394700.	12.5000000	50.0000000	Y
0.0004904	23193.	47295595.	12.5000000	50.0000000	Y
0.0005017	23200.	46245888.	12.5000000	50.0000000	Y
0.0005129	23206.	45241851.	12.5000000	50.0000000	Y
0.0005242	23211.	44278956.	12.5000000	50.0000000	Y
0.0005355	23216.	43356603.	12.5000000	50.0000000	Y
0.0005468	23222.	42472285.	12.5000000	50.0000000	Y
0.0005580	23226.	41622571.	12.5000000	50.0000000	Y
0.0005693	23231.	40805636.	12.5000000	50.0000000	Y
0.0005806	23235.	40020427.	12.5000000	50.0000000	Y
0.0005918	23239.	39265131.	12.5000000	50.0000000	Y
0.0006031	23243.	38537591.	12.5000000	50.0000000	Y
0.0006144	23246.	37835670.	12.5000000	50.0000000	Y
0.0006257	23249.	37159043.	12.5000000	50.0000000	Y
0.0006369	23252.	36506367.	12.5000000	50.0000000	Y
0.0006482	23255.	35876394.	12.5000000	50.0000000	Y
0.0006595	23258.	35267672.	12.5000000	50.0000000	Y
0.0006708	23261.	34678509.	12.5000000	50.0000000	Y
0.0007158	23270.	32507418.	12.5000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	23270.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

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Length of Section                                  =    24.000000 ft
Outside Diameter of Casing                         =    42.000000 in
Casing Wall Thickness                              =       0.0000 in
Moment of Inertia of Steel Casing                  =       0.0000 in^4
Width Flange of Core/Insert                        =    13.000000 in
Depth of Core/Insert                               =    25.000000 in
Flange Thickness of Core/Insert                    =     1.220000 in
Web Thickness of Core/Insert                       =     0.705000 in
Moment of Inertia of Steel Core/Insert             =        5170. in^4
Yield Stress of Casing                             =       50000. psi
Elastic Modulus of Casing                          =    29000000. psi
Yield Stress of Core/Insert                        =       50000. psi
Elastic Modulus of Core/Insert                     =    29000000. psi
Number of Reinforcing Bars                         =           0 bars
Gross Area of Pile                                 =        1385. sq. in.
Area of Concrete                                   =        1338. sq. in.
Cross-sectional Area of Steel Casing               =       0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert          =    47.800000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)  =    47.624800 sq. in.
Area Ratio of All Steel to Gross Area              =         3.44 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:
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Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As  =     8074.980 kips
Tensile Load for Cracking of Concrete                =     -779.261 kips
Nominal Axial Tensile Capacity                       =    -2390.000 kips



Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1               0.000

Definition of Run Messages:

   Y = part of pipe section has yielded.


Axial Thrust Force =      0.000 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing     Max Core   Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress        Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in          in/in         in/in          ksi           ksi           ksi           ksi
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0.00000564	1718.	304847706.	13.7046008	0.00007725	-0.000159	0.3541727	0.00000	0.00000	-3.217806 C
0.00001127	3425.	303806256.	13.7398635	0.0001549	-0.000319	0.6970854	0.00000	0.00000	-6.424083 C
0.00001691	5119.	302748789.	13.7757534	0.0002329	-0.000477	1.0285779	0.00000	0.00000	-9.618525 C
0.00002255	6802.	301674713.	13.8122935	0.0003114	-0.000636	1.3484838	0.00000	0.00000	-12.800808 C
0.00002818	8471.	300583472.	13.8495084	0.0003903	-0.000793	1.6566296	0.00000	0.00000	-15.970594 C
0.00003382	10128.	299474458.	13.8874238	0.0004697	-0.000951	1.9528350	0.00000	0.00000	-19.127527 C
0.00003946	11772.	298347008.	13.9260672	0.0005495	-0.001108	2.2369117	0.00000	0.00000	-22.271232 C
0.00004509	13402.	297200485.	13.9654676	0.0006297	-0.001264	2.5086637	0.00000	0.00000	-25.401313 C
0.00005073	15018.	296034145.	14.0056558	0.0007105	-0.001420	2.7678857	0.00000	0.00000	-28.517353 C
0.00005637	16619.	294847222.	14.0466646	0.0007918	-0.001576	3.0143633	0.00000	0.00000	-31.618914 C
0.00006200	18206.	293639579.	14.0880402	0.0008735	-0.001731	3.2477866	0.00000	0.00000	-34.706409 C
0.00006764	19778.	292411001.	14.1296532	0.0009557	-0.001885	3.4678855	0.00000	0.00000	-37.779911 C
0.00007328	21335.	291159928.	14.1721496	0.0010385	-0.002039	3.6745215	0.00000	0.00000	-40.837932 C
0.00007891	22876.	289885431.	14.2155689	0.0011218	-0.002193	3.8674417	0.00000	0.00000	-43.879948 C
0.00008455	24400.	288586520.	14.2599532	0.0012057	-0.002345	4.0463800	0.00000	0.00000	-46.905403 C
0.00009019	25907.	287262136.	14.3053478	0.0012901	-0.002498	4.2110563	0.00000	0.00000	-49.913706 C
0.00009582	26870.	280412282.	14.2403551	0.0013645	-0.002660	4.3429470	0.00000	0.00000	-50.000000 CY
0.0001015	27342.	269490053.	14.0876093	0.0014293	-0.002832	4.4477011	0.00000	0.00000	-50.000000 CY
0.0001071	27754.	259152838.	13.9382428	0.0014927	-0.003005	4.5414135	0.00000	0.00000	-50.000000 CY
0.0001127	28119.	249428935.	13.7966137	0.0015553	-0.003179	4.6253669	0.00000	0.00000	-50.000000 CY
0.0001184	28445.	240311075.	13.6635282	0.0016173	-0.003354	4.7001606	0.00000	0.00000	-50.000000 CY
0.0001240	28737.	231736626.	13.5342117	0.0016783	-0.003530	4.7655752	0.00000	0.00000	-50.000000 CY
0.0001296	28999.	223686438.	13.4121601	0.0017388	-0.003706	4.8224896	0.00000	0.00000	-50.000000 CY
0.0001353	29236.	216120146.	13.2972863	0.0017988	-0.003883	4.8711946	0.00000	0.00000	-50.000000 CY
0.0001409	29453.	209009205.	13.1880338	0.0018584	-0.004060	4.9117894	0.00000	0.00000	-50.000000 CY
0.0001466	29646.	202292420.	13.0822558	0.0019172	-0.004238	4.9443621	0.00000	0.00000	-50.000000 CY
0.0001522	29824.	195967532.	12.9829466	0.0019759	-0.004416	4.9693851	0.00000	0.00000	-50.000000 CY
0.0001578	29987.	190002013.	12.8896457	0.0020343	-0.004594	4.9869475	0.00000	0.00000	-50.000000 CY
0.0001635	30136.	184364451.	12.8015378	0.0020926	-0.004773	4.9971122	0.00000	0.00000	-50.000000 CY
0.0001691	30271.	179015211.	12.7151469	0.0021501	-0.004952	4.9974799	0.00000	0.00000	-50.000000 CY
0.0001747	30394.	173944281.	12.6338840	0.0022076	-0.005131	4.9998534	0.00000	0.00000	-50.000000 CY
0.0001804	30506.	169130713.	12.5575082	0.0022650	-0.005311	4.9987541	0.00000	0.00000	-50.000000 CY
0.0001860	30609.	164558154.	12.4856574	0.0023224	-0.005490	4.9959643	0.00000	0.00000	-50.000000 CY
0.0001916	30703.	160210480.	12.4181036	0.0023799	-0.005669	4.9998696	0.00000	0.00000	-50.000000 CY
0.0001973	30789.	156066135.	12.3528877	0.0024370	-0.005849	4.9977452	0.00000	0.00000	-50.000000 CY
0.0002029	30867.	152117325.	12.2900370	0.0024939	-0.006029	4.9993625	0.00000	0.00000	-50.000000 CY
0.0002086	30937.	148341236.	12.2304223	0.0025507	-0.006209	4.9982042	0.00000	0.00000	-50.000000 CY
0.0002142	31003.	144742598.	12.1741019	0.0026076	-0.006388	4.9982762	0.00000	0.00000	-50.000000 CY
0.0002198	31063.	141305786.	12.1213188	0.0026646	-0.006568	4.9977794	0.00000	0.00000	-50.000000 CY
0.0002311	31168.	134869056.	12.0232560	0.0027786	-0.006928	4.9961791	0.00000	0.00000	-50.000000 CY
0.0002424	31257.	128960602.	11.9329742	0.0028922	-0.007287	4.9924504	0.00000	0.00000	-50.000000 CY
0.0002536	31330.	123518353.	11.8485351	0.0030053	-0.007648	4.9999072	0.00000	0.00000	-50.000000 CY
0.0002649	31392.	118495374.	11.7721246	0.0031187	-0.008008	4.9974879	0.00000	0.00000	-50.000000 CY
0.0002762	31443.	113845757.	11.7020284	0.0032320	-0.008368	4.9906429	0.00000	0.00000	-50.000000 CY
0.0002875	31487.	109532581.	11.6381699	0.0033456	-0.008728	4.9989157	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load	Axial	Nominal Moment

No.	Thrust kips	Capacity in-kips
1	0.00000000	31487.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	20.4700	0.00	N.A.	No	0.00	2914.
2	22.2100	1.7400	Yes	No	2914.	16097.
3	24.7100	0.5104	No	No	19011.	213289.
4	29.7100	4.8992	Yes	No	232300.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.1832	3.03E-05	0.00	-0.00708	3.81E-08	1.50E+11	0.00	0.00	0.00
0.4447	2.1454	1.17E-05	-2.19E-06	-0.00708	1.47E-08	1.50E+11	0.00	0.00	0.00
0.8894	2.1076	7.00E-06	1.0202	-0.00708	8.80E-09	1.50E+11	0.00	0.00	0.3824
1.3341	2.0698	10.8885	26.3159	-0.00708	0.01369	1.50E+11	0.00	0.00	9.0981
1.7788	2.0320	280.8649	107.1787	-0.00708	0.3531	1.50E+11	0.00	0.00	21.2080
2.2235	1.9943	1155.	252.6647	-0.00708	1.4519	1.50E+11	0.00	0.00	33.3179
2.6682	1.9565	2978.	462.7740	-0.00708	3.7435	1.50E+11	0.00	0.00	45.4278
3.1129	1.9187	6094.	737.5067	-0.00708	7.6616	1.50E+11	0.00	0.00	57.5377
3.5576	1.8809	10849.	1077.	-0.00708	13.6396	1.50E+11	0.00	0.00	69.6476
4.0023	1.8431	17587.	1481.	-0.00708	22.1113	1.50E+11	0.00	0.00	81.7575
4.4470	1.8053	26653.	1949.	-0.00708	33.5102	1.50E+11	0.00	0.00	93.8675
4.8917	1.7676	38393.	2483.	-0.00708	48.2698	1.50E+11	0.00	0.00	105.9774
5.3364	1.7298	53151.	3081.	-0.00708	66.8237	1.50E+11	0.00	0.00	118.0873
5.7811	1.6920	71271.	3743.	-0.00707	89.6055	1.50E+11	0.00	0.00	130.1972
6.2258	1.6543	93099.	4470.	-0.00707	117.0487	1.50E+11	0.00	0.00	142.3071
6.6705	1.6166	118979.	5262.	-0.00707	149.5870	1.50E+11	0.00	0.00	154.4170
7.1152	1.5789	149257.	6118.	-0.00706	187.6538	1.50E+11	0.00	0.00	166.5269
7.5599	1.5412	184277.	7039.	-0.00706	231.6829	1.50E+11	0.00	0.00	178.6368
8.0046	1.5035	224384.	8025.	-0.00705	282.1076	1.50E+11	0.00	0.00	190.7467
8.4493	1.4659	269923.	9075.	-0.00704	339.3617	1.50E+11	0.00	0.00	202.8566
8.8940	1.4284	321239.	10190.	-0.00703	403.8786	1.50E+11	0.00	0.00	214.9666
9.3387	1.3909	378676.	11369.	-0.00702	476.0920	1.50E+11	0.00	0.00	227.0765
9.7834	1.3535	442580.	12613.	-0.00700	556.4354	1.50E+11	0.00	0.00	239.1864
10.2281	1.3162	513295.	13922.	-0.00699	645.3424	1.50E+11	0.00	0.00	251.2963
10.6728	1.2789	591167.	15295.	-0.00697	743.2466	1.50E+11	0.00	0.00	263.4062
11.1175	1.2418	676539.	16733.	-0.00694	850.5815	1.50E+11	0.00	0.00	275.5161
11.5622	1.2048	769758.	18236.	-0.00692	967.7807	1.50E+11	0.00	0.00	287.6260
12.0069	1.1680	871167.	19803.	-0.00689	1095.	1.50E+11	0.00	0.00	299.7359
12.4516	1.1313	981112.	21435.	-0.00686	1234.	1.50E+11	0.00	0.00	311.8458
12.8963	1.0948	1099937.	23131.	-0.00682	1383.	1.50E+11	0.00	0.00	323.9557
13.3410	1.0585	1227988.	24892.	-0.00678	1544.	1.50E+11	0.00	0.00	336.0656
13.7857	1.0225	1365609.	26718.	-0.00673	1717.	1.50E+11	0.00	0.00	348.1756
14.2304	0.9867	1513145.	28608.	-0.00668	1902.	1.50E+11	0.00	0.00	360.2855
14.6751	0.9512	1670941.	30563.	-0.00662	2101.	1.50E+11	0.00	0.00	372.3954
15.1198	0.9160	1839341.	32583.	-0.00656	2313.	1.50E+11	0.00	0.00	384.5053
15.5645	0.8812	2018691.	34667.	-0.00649	2538.	1.50E+11	0.00	0.00	396.6152
16.0092	0.8467	2209336.	36816.	-0.00642	2778.	1.50E+11	0.00	0.00	408.7251
16.4539	0.8127	2411620.	39029.	-0.00633	3032.	1.50E+11	0.00	0.00	420.8350
16.8986	0.7791	2625888.	41307.	-0.00624	3301.	1.50E+11	0.00	0.00	432.9449
17.3433	0.7461	2852486.	43650.	-0.00615	3586.	1.50E+11	0.00	0.00	445.0548
17.7880	0.7135	3091757.	46057.	-0.00604	3887.	1.50E+11	0.00	0.00	457.1647
18.2327	0.6816	3344047.	48529.	-0.00593	4204.	1.50E+11	0.00	0.00	469.2747
18.6774	0.6503	3609700.	51066.	-0.00580	4538.	1.50E+11	0.00	0.00	481.3846
19.1221	0.6197	3889062.	53667.	-0.00567	4890.	1.50E+11	0.00	0.00	493.4945
19.5668	0.5898	4182478.	56333.	-0.00552	5258.	1.50E+11	0.00	0.00	505.6044
20.0115	0.5607	4490291.	59063.	-0.00537	5645.	1.50E+11	0.00	0.00	517.7143
20.4562	0.5325	4812848.	61191.	-0.00520	6051.	1.50E+11	0.00	0.00	279.8458
20.9009	0.5052	5143373.	61844.	-0.00507	0.00	3.03E+11	-35.269	372.5604	0.00

21.3456	0.4784	5472895.	61553.	-0.00498	0.00	3.02E+11	-73.870	824.0654	0.00
21.7903	0.4520	5800313.	61052.	-0.00488	0.00	3.02E+11	-113.681	1342.	0.00
22.2350	0.4263	6124493.	60339.	-0.00477	0.00	3.02E+11	-153.706	1924.	0.00
22.6797	0.4011	6444296.	59411.	-0.00466	0.00	3.02E+11	-194.055	2582.	0.00
23.1244	0.3765	6758574.	58270.	-0.00455	0.00	3.02E+11	-233.366	3307.	0.00
23.5691	0.3526	7066205.	56925.	-0.00442	0.00	3.01E+11	-270.849	4099.	0.00
24.0138	0.3293	7366124.	55386.	-0.00430	0.00	3.01E+11	-305.875	4957.	0.00
24.4585	0.3067	7657332.	53666.	-0.00416	0.00	3.01E+11	-338.980	5897.	0.00
24.9032	0.2849	7938887.	49862.	-0.00402	0.00	3.01E+11	-1087.	20355.	0.00
25.3479	0.2638	8189498.	44054.	-0.00388	0.00	3.01E+11	-1090.	22056.	0.00
25.7926	0.2434	8409064.	38230.	-0.00373	0.00	3.01E+11	-1092.	23946.	0.00
26.2373	0.2239	8597520.	32398.	-0.00358	0.00	3.00E+11	-1093.	26054.	0.00
26.6820	0.2052	8754843.	26566.	-0.00343	0.00	3.00E+11	-1093.	28412.	0.00
27.1267	0.1873	8881054.	20742.	-0.00327	0.00	3.00E+11	-1090.	31061.	0.00
27.5714	0.1703	8976216.	14934.	-0.00311	0.00	3.00E+11	-1087.	34050.	0.00
28.0161	0.1541	9040436.	9150.	-0.00295	0.00	3.00E+11	-1081.	37439.	0.00
28.4608	0.1388	9073872.	3400.	-0.00279	0.00	3.00E+11	-1074.	41301.	0.00
28.9055	0.1243	9076726.	-2307.	-0.00263	0.00	3.00E+11	-1065.	45727.	0.00
29.3502	0.1107	9049253.	-7961.	-0.00247	0.00	3.00E+11	-1054.	50831.	0.00
29.7949	0.09792	8991759.	-14038.	-0.00231	0.00	3.00E+11	-1223.	66676.	0.00
30.2396	0.08602	8899423.	-20522.	-0.00215	0.00	3.00E+11	-1207.	74846.	0.00
30.6843	0.07497	8772730.	-26909.	-0.00199	0.00	3.00E+11	-1187.	84494.	0.00
31.1290	0.06474	8612233.	-33184.	-0.00184	0.00	3.00E+11	-1165.	96005.	0.00
31.5737	0.05534	8418567.	-39332.	-0.00169	0.00	3.01E+11	-1140.	109903.	0.00
32.0184	0.04673	8192446.	-45339.	-0.00154	0.00	3.01E+11	-1111.	126924.	0.00
32.4631	0.03889	7934675.	-51185.	-0.00140	0.00	3.01E+11	-1080.	148128.	0.00
32.9078	0.03181	7646158.	-56851.	-0.00126	0.00	3.01E+11	-1044.	175113.	0.00
33.3525	0.02545	7327915.	-62314.	-0.00113	0.00	3.01E+11	-1004.	210404.	0.00
33.7972	0.01979	6981094.	-67547.	-0.00100	0.00	3.02E+11	-957.550	258265.	0.00
34.2419	0.01478	6607004.	-72515.	-8.80E-04	0.00	3.02E+11	-904.364	326574.	0.00
34.6866	0.01039	6207161.	-77172.	-7.67E-04	0.00	3.02E+11	-841.186	431886.	0.00
35.1313	0.00659	5783363.	-81451.	-6.61E-04	0.00	3.02E+11	-762.356	616871.	0.00
35.5760	0.00334	5337855.	-85227.	-5.63E-04	0.00	3.03E+11	-652.954	1042898.	0.00
36.0207	5.90E-04	4873754.	-87848.	-4.73E-04	0.00	3.03E+11	-329.396	2981228.	0.00
36.4654	-0.00170	4400271.	-87211.	-3.91E-04	0.00	3.03E+11	568.3006	1780172.	0.00
36.9101	-0.00358	3942973.	-83842.	-3.18E-04	0.00	3.03E+11	694.3550	1034042.	0.00
37.3548	-0.00509	3505448.	-79937.	-2.52E-04	0.00	3.04E+11	769.0185	805763.	0.00
37.7995	-0.00627	3089822.	-75693.	-1.94E-04	0.00	3.04E+11	821.6314	698838.	0.00
38.2442	-0.00717	2697594.	-71203.	-1.43E-04	0.00	3.04E+11	861.2238	641378.	0.00
38.6889	-0.00780	2329891.	-66525.	-9.93E-05	0.00	3.04E+11	891.9096	609856.	0.00
39.1336	-0.00823	1987587.	-61701.	-6.14E-05	0.00	3.05E+11	915.9582	594255.	0.00
39.5783	-0.00846	1671367.	-56763.	-2.94E-05	0.00	3.05E+11	934.7802	589621.	0.00
40.0230	-0.00854	1381767.	-51736.	-2.69E-06	0.00	3.05E+11	949.3299	593268.	0.00
40.4677	-0.00849	1119201.	-46641.	1.92E-05	0.00	3.05E+11	960.2934	603669.	0.00
40.9124	-0.00833	883982.	-41495.	3.67E-05	0.00	3.05E+11	968.1936	619937.	0.00
41.3571	-0.00810	676334.	-36314.	5.04E-05	0.00	3.05E+11	973.4465	641571.	0.00
41.8018	-0.00780	496407.	-31112.	6.07E-05	0.00	3.05E+11	976.3934	668317.	0.00
42.2465	-0.00745	344285.	-25899.	6.80E-05	0.00	3.05E+11	977.3198	700102.	0.00
42.6912	-0.00707	219994.	-20686.	7.30E-05	0.00	3.05E+11	976.4640	736988.	0.00
43.1359	-0.00667	123510.	-15481.	7.60E-05	0.00	3.05E+11	974.0182	779179.	0.00
43.5806	-0.00626	54764.	-10294.	7.75E-05	0.00	3.05E+11	970.1238	827036.	0.00
44.0253	-0.00584	13644.	-5131.	7.81E-05	0.00	3.05E+11	964.8593	881142.	0.00
44.4700	-0.00543	0.00	0.00	7.82E-05	0.00	3.05E+11	958.2213	471209.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     2.18319696 inches
Computed slope at pile head      =     -0.0070812 radians
Maximum bending moment           =       9076726. inch-lbs
Maximum shear force              =        -87848. lbs
Depth of maximum bending moment  =    28.90550000 feet below pile head
Depth of maximum shear force     =    36.02070000 feet below pile head
Number of iterations             =             33
Number of zero deflection points =              1
Pile deflection at ground        =     0.53164665 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
44.47000	2.18319696	9076726.	-87848.
42.24650	2.40137716	8981765.	-97585.
40.02300	3.39695817	8694140.	-107426.
37.79950	7.53585116	8383378.	-118081.
35.57600	30.08578256	8195788.	-134276.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                              =          0.0 lbs
```

Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	4.3398	9.80E-05	-4.37E-07	-0.01304	1.23E-07	1.50E+11	0.00	0.00	0.00
0.4447	4.2702	-6.53E-05	-1.49E-05	-0.01304	8.22E-08	1.50E+11	0.00	0.00	0.00
0.8894	4.2007	-6.07E-05	1.5303	-0.01304	7.63E-08	1.50E+11	0.00	0.00	0.5735
1.3341	4.1311	16.3327	39.4739	-0.01304	0.02053	1.50E+11	0.00	0.00	13.6471
1.7788	4.0615	421.2972	160.7680	-0.01304	0.5297	1.50E+11	0.00	0.00	31.8120
2.2235	3.9920	1732.	378.9970	-0.01304	2.1778	1.50E+11	0.00	0.00	49.9769
2.6682	3.9224	4466.	694.1611	-0.01304	5.6152	1.50E+11	0.00	0.00	68.1417
3.1129	3.8528	9141.	1106.	-0.01304	11.4923	1.50E+11	0.00	0.00	86.3066
3.5576	3.7833	16273.	1615.	-0.01304	20.4595	1.50E+11	0.00	0.00	104.4715
4.0023	3.7137	26381.	2221.	-0.01303	33.1670	1.50E+11	0.00	0.00	122.6363
4.4470	3.6442	39980.	2924.	-0.01303	50.2653	1.50E+11	0.00	0.00	140.8012
4.8917	3.5746	57590.	3724.	-0.01303	72.4047	1.50E+11	0.00	0.00	158.9661
5.3364	3.5051	79726.	4621.	-0.01303	100.2356	1.50E+11	0.00	0.00	177.1309
5.7811	3.4356	106906.	5614.	-0.01303	134.4082	1.50E+11	0.00	0.00	195.2958
6.2258	3.3661	139648.	6705.	-0.01302	175.5731	1.50E+11	0.00	0.00	213.4606
6.6705	3.2966	178469.	7893.	-0.01302	224.3805	1.50E+11	0.00	0.00	231.6255
7.1152	3.2271	223885.	9177.	-0.01301	281.4808	1.50E+11	0.00	0.00	249.7904
7.5599	3.1577	276415.	10559.	-0.01300	347.5243	1.50E+11	0.00	0.00	267.9552
8.0046	3.0884	336576.	12037.	-0.01299	423.1614	1.50E+11	0.00	0.00	286.1201
8.4493	3.0191	404885.	13612.	-0.01298	509.0425	1.50E+11	0.00	0.00	304.2850
8.8940	2.9499	481858.	15285.	-0.01296	605.8179	1.50E+11	0.00	0.00	322.4498
9.3387	2.8808	568014.	17054.	-0.01294	714.1380	1.50E+11	0.00	0.00	340.6147
9.7834	2.8118	663870.	18920.	-0.01292	834.6531	1.50E+11	0.00	0.00	358.7796
10.2281	2.7429	769943.	20883.	-0.01289	968.0136	1.50E+11	0.00	0.00	376.9444
10.6728	2.6742	886750.	22943.	-0.01286	1115.	1.50E+11	0.00	0.00	395.1093
11.1175	2.6056	1014809.	25100.	-0.01283	1276.	1.50E+11	0.00	0.00	413.2742
11.5622	2.5372	1154637.	27354.	-0.01279	1452.	1.50E+11	0.00	0.00	431.4390
12.0069	2.4691	1306751.	29705.	-0.01275	1643.	1.50E+11	0.00	0.00	449.6039
12.4516	2.4012	1471668.	32152.	-0.01270	1850.	1.50E+11	0.00	0.00	467.7687
12.8963	2.3336	1649906.	34697.	-0.01264	2074.	1.50E+11	0.00	0.00	485.9336
13.3410	2.2663	1841982.	37339.	-0.01258	2316.	1.50E+11	0.00	0.00	504.0985
13.7857	2.1993	2048413.	40077.	-0.01251	2575.	1.50E+11	0.00	0.00	522.2633
14.2304	2.1327	2269717.	42913.	-0.01243	2854.	1.50E+11	0.00	0.00	540.4282
14.6751	2.0666	2506411.	45845.	-0.01235	3151.	1.50E+11	0.00	0.00	558.5931
15.1198	2.0009	2759012.	48874.	-0.01225	3469.	1.50E+11	0.00	0.00	576.7579
15.5645	1.9358	3028037.	52001.	-0.01215	3807.	1.50E+11	0.00	0.00	594.9228
16.0092	1.8713	3314004.	55224.	-0.01204	4167.	1.50E+11	0.00	0.00	613.0877
16.4539	1.8073	3617430.	58544.	-0.01191	4548.	1.50E+11	0.00	0.00	631.2525
16.8986	1.7441	3938833.	61961.	-0.01178	4952.	1.50E+11	0.00	0.00	649.4174
17.3433	1.6816	4278728.	65475.	-0.01163	5379.	1.50E+11	0.00	0.00	667.5823
17.7880	1.6199	4637635.	69086.	-0.01147	5831.	1.50E+11	0.00	0.00	685.7471
18.2327	1.5591	5016070.	72794.	-0.01130	6306.	1.50E+11	0.00	0.00	703.9120
18.6774	1.4993	5414550.	76599.	-0.01112	6807.	1.50E+11	0.00	0.00	722.0768
19.1221	1.4405	5833593.	80501.	-0.01092	7334.	1.50E+11	0.00	0.00	740.2417
19.5668	1.3828	6273716.	84499.	-0.01070	7888.	1.50E+11	0.00	0.00	758.4066
20.0115	1.3263	6735437.	88595.	-0.01047	8468.	1.50E+11	0.00	0.00	776.5714

20.4562	1.2711	7219271.	91787.	-0.01022	9076.	1.50E+11	0.00	0.00	419.7687
20.9009	1.2172	7715060.	92784.	-0.01002	0.00	3.01E+11	-45.925	201.3396	0.00
21.3456	1.1641	8209541.	92404.	-0.00988	0.00	3.01E+11	-96.525	442.4875	0.00
21.7903	1.1117	8701273.	91749.	-0.00973	0.00	3.00E+11	-149.217	716.2430	0.00
22.2350	1.0602	9188756.	90809.	-0.00957	0.00	3.00E+11	-202.863	1021.	0.00
22.6797	1.0096	9670462.	89583.	-0.00940	0.00	3.00E+11	-256.563	1356.	0.00
23.1244	0.9599	1.01E+07	88073.	-0.00923	0.00	2.99E+11	-309.360	1720.	0.00
23.5691	0.9111	1.06E+07	86286.	-0.00904	0.00	2.99E+11	-360.379	2111.	0.00
24.0138	0.8633	1.11E+07	84234.	-0.00885	0.00	2.99E+11	-408.924	2528.	0.00
24.4585	0.8166	1.15E+07	81927.	-0.00865	0.00	2.99E+11	-455.507	2977.	0.00
24.9032	0.7710	1.19E+07	76993.	-0.00844	0.00	2.98E+11	-1394.	9646.	0.00
25.3479	0.7266	1.23E+07	69527.	-0.00822	0.00	2.98E+11	-1405.	10315.	0.00
25.7926	0.6833	1.27E+07	62007.	-0.00800	0.00	2.98E+11	-1414.	11043.	0.00
26.2373	0.6412	1.30E+07	54439.	-0.00777	0.00	2.97E+11	-1422.	11835.	0.00
26.6820	0.6004	1.33E+07	46832.	-0.00753	0.00	2.97E+11	-1429.	12700.	0.00
27.1267	0.5609	1.35E+07	39193.	-0.00729	0.00	2.97E+11	-1434.	13646.	0.00
27.5714	0.5226	1.37E+07	31529.	-0.00705	0.00	2.97E+11	-1438.	14684.	0.00
28.0161	0.4857	1.38E+07	23848.	-0.00680	0.00	2.97E+11	-1440.	15827.	0.00
28.4608	0.4500	1.39E+07	16160.	-0.00655	0.00	2.97E+11	-1441.	17089.	0.00
28.9055	0.4158	1.40E+07	8472.	-0.00630	0.00	2.97E+11	-1440.	18486.	0.00
29.3502	0.3828	1.40E+07	792.6331	-0.00605	0.00	2.97E+11	-1438.	20041.	0.00
29.7949	0.3512	1.40E+07	-7536.	-0.00579	0.00	2.97E+11	-1684.	25582.	0.00
30.2396	0.3210	1.39E+07	-16503.	-0.00554	0.00	2.97E+11	-1677.	27878.	0.00
30.6843	0.2921	1.38E+07	-25426.	-0.00529	0.00	2.97E+11	-1668.	30469.	0.00
31.1290	0.2645	1.37E+07	-34294.	-0.00505	0.00	2.97E+11	-1656.	33411.	0.00
31.5737	0.2382	1.35E+07	-43093.	-0.00480	0.00	2.97E+11	-1642.	36775.	0.00
32.0184	0.2132	1.32E+07	-51807.	-0.00456	0.00	2.97E+11	-1624.	40652.	0.00
32.4631	0.1895	1.29E+07	-60421.	-0.00433	0.00	2.98E+11	-1604.	45167.	0.00
32.9078	0.1670	1.26E+07	-68917.	-0.00410	0.00	2.98E+11	-1580.	50483.	0.00
33.3525	0.1458	1.22E+07	-77276.	-0.00388	0.00	2.98E+11	-1552.	56835.	0.00
33.7972	0.1256	1.17E+07	-85473.	-0.00366	0.00	2.98E+11	-1520.	64560.	0.00
34.2419	0.1067	1.13E+07	-93484.	-0.00346	0.00	2.99E+11	-1482.	74166.	0.00
34.6866	0.08873	1.07E+07	-101276.	-0.00326	0.00	2.99E+11	-1438.	86472.	0.00
35.1313	0.07184	1.02E+07	-108807.	-0.00308	0.00	2.99E+11	-1385.	102879.	0.00
35.5760	0.05591	9586127.	-116026.	-0.00290	0.00	3.00E+11	-1321.	126043.	0.00
36.0207	0.04090	8948161.	-122858.	-0.00273	0.00	3.00E+11	-1240.	161748.	0.00
36.4654	0.02673	8274893.	-129183.	-0.00258	0.00	3.01E+11	-1131.	225796.	0.00
36.9101	0.01335	7569418.	-134774.	-0.00244	0.00	3.01E+11	-964.590	385649.	0.00
37.3548	6.80E-04	6836473.	-138407.	-0.00231	0.00	3.02E+11	-396.982	3113236.	0.00
37.7995	-0.01134	6092224.	-136925.	-0.00220	0.00	3.02E+11	952.6555	448257.	0.00
38.2442	-0.02279	5375104.	-131314.	-0.00210	0.00	3.03E+11	1150.	269306.	0.00
38.6889	-0.03373	4690733.	-124815.	-0.00201	0.00	3.03E+11	1286.	203447.	0.00
39.1336	-0.04423	4042982.	-117662.	-0.00193	0.00	3.03E+11	1395.	168276.	0.00
39.5783	-0.05435	3434949.	-109970.	-0.00187	0.00	3.04E+11	1488.	146109.	0.00
40.0230	-0.06415	2869293.	-101806.	-0.00181	0.00	3.04E+11	1572.	130733.	0.00
40.4677	-0.07368	2348391.	-93216.	-0.00177	0.00	3.04E+11	1648.	119369.	0.00
40.9124	-0.08299	1874423.	-84229.	-0.00173	0.00	3.05E+11	1720.	110582.	0.00
41.3571	-0.09213	1449427.	-74871.	-0.00170	0.00	3.05E+11	1788.	103550.	0.00
41.8018	-0.101	1075339.	-65158.	-0.00168	0.00	3.05E+11	1853.	97770.	0.00
42.2465	-0.110	754012.	-55103.	-0.00166	0.00	3.05E+11	1916.	92913.	0.00
42.6912	-0.119	487237.	-44717.	-0.00165	0.00	3.05E+11	1977.	88760.	0.00
43.1359	-0.128	276758.	-34008.	-0.00164	0.00	3.05E+11	2037.	85156.	0.00
43.5806	-0.136	124280.	-22982.	-0.00164	0.00	3.05E+11	2096.	81989.	0.00

```
   44.0253     -0.145     31477.    -11645.   -0.00164       0.00   3.05E+11      2153.     79178.       0.00
   44.4700     -0.154       0.00       0.00   -0.00164       0.00   3.05E+11      2211.     38332.       0.00

* This analysis computed pile response using nonlinear moment-curvature rela-
  tionships. Values of total stress due to combined axial and bending stresses
  are computed only for elastic sections only and do not equal the actual
  stresses in concrete and steel. Stresses in concrete and steel may be inter-
  polated from the output for nonlinear bending properties relative to the
  magnitude of bending moment developed in the pile.


Output Summary for Load Case No. 2:

Pile-head deflection             =     4.33981177 inches
Computed slope at pile head      =     -0.0130363 radians
Maximum bending moment           =      14026475. inch-lbs
Maximum shear force              =       -138407. lbs
Depth of maximum bending moment  =    29.35020000 feet below pile head
Depth of maximum shear force     =    37.35480000 feet below pile head
Number of iterations             =             44
Number of zero deflection points =              1
Pile deflection at ground        =     1.26938503 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs


    Pile       Pile Head       Maximum       Maximum
   Length      Deflection      Moment         Shear
    feet         inches        ln-lbs          lbs
------------  ------------  ------------  ------------
   44.47000    4.33981177     14026475.      -138407.
   42.24650    6.08814382     13592212.      -150501.
   40.02300   12.34960616     13167844.      -163962.
   37.79950   40.63433803     12903131.      -184305.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
```

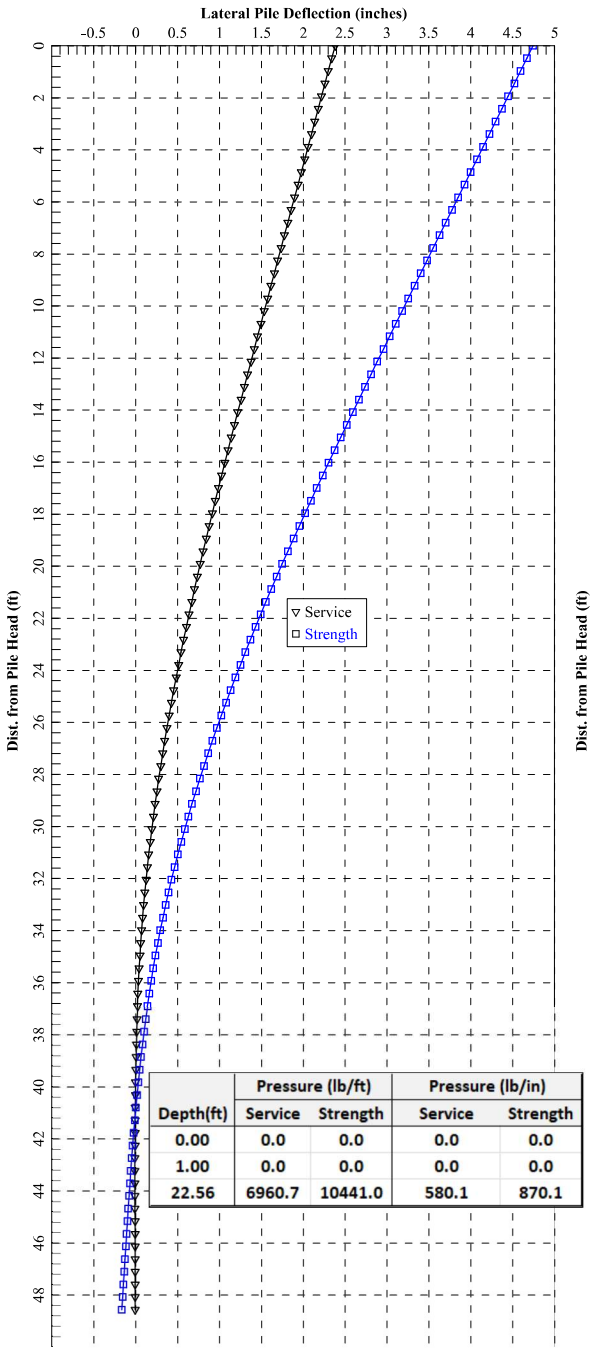
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	2.1832	-0.00708	-87848.	9076726.
2	V, lb	0.00	M, in-lb	0.00	0.00	4.3398	-0.01304	-138407.	1.40E+07

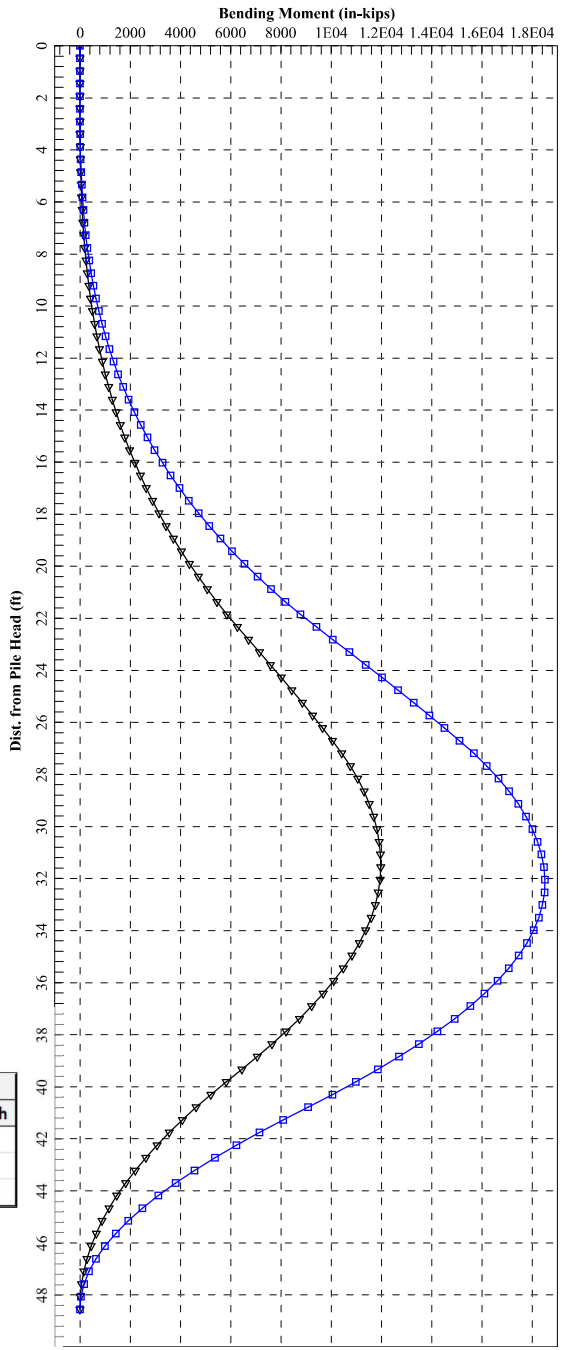
Maximum pile-head deflection = 4.3398117653 inches
Maximum pile-head rotation = -0.0130362767 radians = -0.746924 deg.

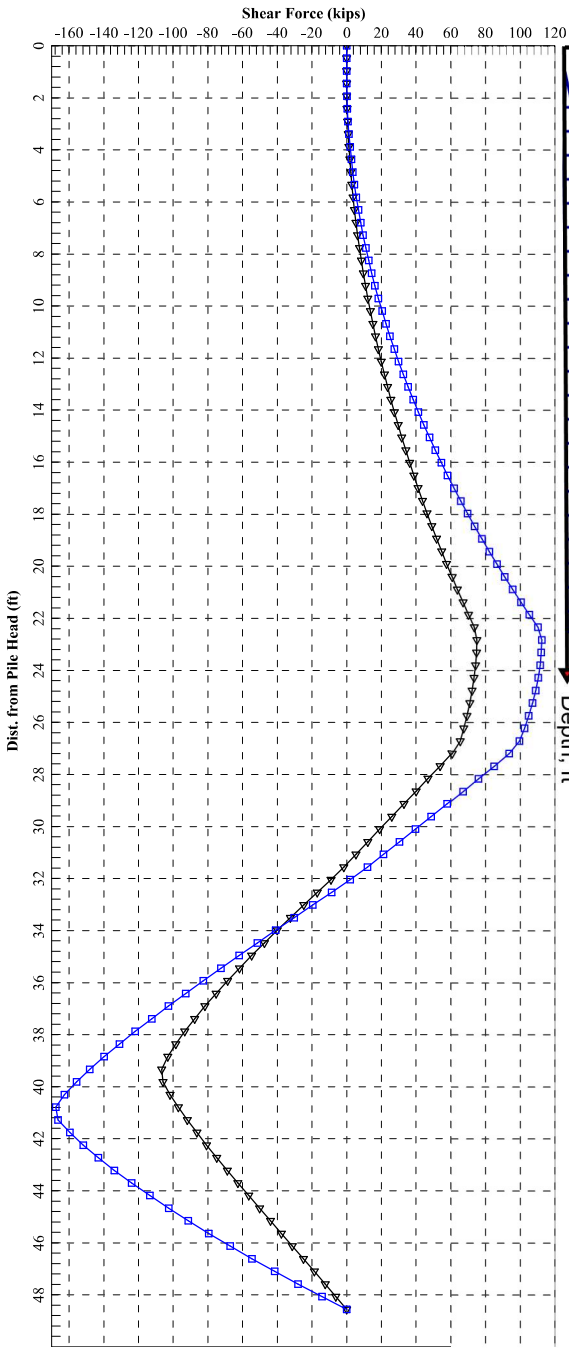
The analysis ended normally.

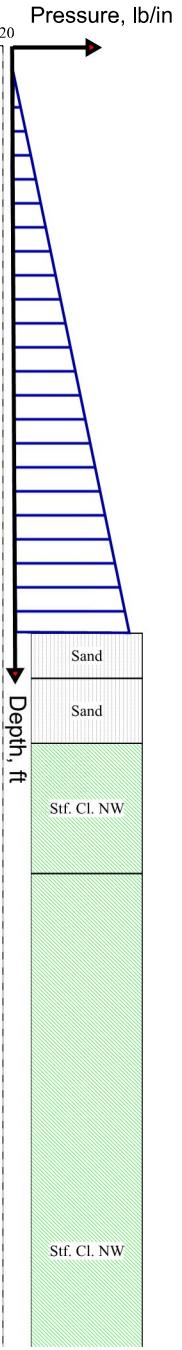
Wall 1A (22.56ft): Based on Boring B-042-0-20



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
22.56	6960.7	10441.0	580.1	870.1







```
================================================================================

                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App E LPile March 2026\Wall 1A\

Name of input data file:
08 Wall_1A-22.56ft.lp12d

Name of output report file:
08 Wall_1A-22.56ft.lp12o

Name of plot output file:
08 Wall_1A-22.56ft.lp12p

Name of runtime message file:
08 Wall_1A-22.56ft.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 26, 2026             Time:  15:41:28
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=22.56FT) Boring B-042-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 48.560 ft
Depth of ground surface below top of pile = 22.5600 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	11.5000
2	22.560	11.5000
3	22.560	42.0000
4	48.560	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 22.560000 ft
AISC Section Type = W

AISC Section Name = W33X169

Pile width = 11.500000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 26.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W33X169

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    22.560000 ft
   Distance from top of pile to bottom of layer        =    24.300000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    24.300000 ft
   Distance from top of pile to bottom of layer        =    26.800000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    26.800000 ft
   Distance from top of pile to bottom of layer        =    31.800000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3500. psf
   Undrained cohesion at bottom of layer               =        3500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer           =    31.800000 ft
   Distance from top of pile to bottom of layer        =    60.800000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

```
   Undrained cohesion at top of layer                 =        4000. psf
   Undrained cohesion at bottom of layer              =        4000. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000


 (Depth of the lowest soil layer extends 12.240 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	22.5600	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	24.3000	57.6000	--	32.0000	--	60.0000
2	Sand	24.3000	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	26.8000	57.6000	--	32.0000	--	60.0000
3	Stiff Clay	26.8000	62.6000	3500.	--	0.00500	--
	w/o Free Water	31.8000	62.6000	3500.	--	0.00500	--
4	Stiff Clay	31.8000	62.6000	4000.	--	0.00400	--
	w/o Free Water	60.8000	62.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	22.560	0.8290	1.0000
2	49.000	0.8290	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.560	580.100

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.560	870.100

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	22.560000 ft
Flange Width	=	11.500000 in
Section Depth	=	33.800000 in
Flange Thickness	=	1.220000 in
Web Thickness	=	0.670000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	49.500000 sq. in.
Moment of Inertia	=	9290. in^4
Elastic Bending Stiffness	=	269410000. kip-in^2
Plastic Modulus, Z	=	629.000000in^3
Plastic Moment Capacity = Fy Z	=	31450.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	2475.000 kips
Nominal Axial Tensile Capacity	=	-2475.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000637	1693.	265693210.	16.9000000	3.0915978	
0.00001274	3386.	265693210.	16.9000000	6.1831957	
0.00001912	5079.	265693210.	16.9000000	9.2747935	
0.00002549	6772.	265693210.	16.9000000	12.3663914	

0.00003186	8465.	265693210.	16.9000000	15.4579892	
0.00003823	10158.	265693210.	16.9000000	18.5495871	
0.00004460	11851.	265693210.	16.9000000	21.6411849	
0.00005097	13544.	265693210.	16.9000000	24.7327828	
0.00005735	15237.	265693210.	16.9000000	27.8243806	
0.00006372	16929.	265693210.	16.9000000	30.9159784	
0.00007009	18622.	265693210.	16.9000000	34.0075763	
0.00007646	20315.	265693210.	16.9000000	37.0991741	
0.00008283	22008.	265693210.	16.9000000	40.1907720	
0.00008921	23701.	265693210.	16.9000000	43.2823698	
0.00009558	25394.	265693210.	16.9000000	46.3739677	
0.0001019	27087.	265693210.	16.9000000	49.4655655	
0.0001083	28203.	260363688.	16.9000000	50.0000000	Y
0.0001147	28553.	248954951.	16.9000000	50.0000000	Y
0.0001211	28811.	237981856.	16.9000000	50.0000000	Y
0.0001274	29032.	227815021.	16.9000000	50.0000000	Y
0.0001338	29222.	218387282.	16.9000000	50.0000000	Y
0.0001402	29387.	209639324.	16.9000000	50.0000000	Y
0.0001466	29530.	201502088.	16.9000000	50.0000000	Y
0.0001529	29657.	193933140.	16.9000000	50.0000000	Y
0.0001593	29768.	186871359.	16.9000000	50.0000000	Y
0.0001657	29867.	180280704.	16.9000000	50.0000000	Y
0.0001720	29955.	174116498.	16.9000000	50.0000000	Y
0.0001784	30034.	168340016.	16.9000000	50.0000000	Y
0.0001848	30104.	162917461.	16.9000000	50.0000000	Y
0.0001912	30168.	157819143.	16.9000000	50.0000000	Y
0.0001975	30225.	153018816.	16.9000000	50.0000000	Y
0.0002039	30277.	148493137.	16.9000000	50.0000000	Y
0.0002103	30325.	144221232.	16.9000000	50.0000000	Y
0.0002166	30369.	140182713.	16.9000000	50.0000000	Y
0.0002230	30409.	136352858.	16.9000000	50.0000000	Y
0.0002294	30445.	132725391.	16.9000000	50.0000000	Y
0.0002358	30479.	129282090.	16.9000000	50.0000000	Y
0.0002421	30510.	126006054.	16.9000000	50.0000000	Y
0.0002485	30539.	122893837.	16.9000000	50.0000000	Y
0.0002612	30590.	117094882.	16.9000000	50.0000000	Y
0.0002740	30634.	111808788.	16.9000000	50.0000000	Y
0.0002867	30672.	106972176.	16.9000000	50.0000000	Y
0.0002995	30706.	102531944.	16.9000000	50.0000000	Y
0.0003122	30736.	98443169.	16.9000000	50.0000000	Y
0.0003250	30762.	94662918.	16.9000000	50.0000000	Y
0.0003377	30785.	91158778.	16.9000000	50.0000000	Y
0.0003504	30806.	87905231.	16.9000000	50.0000000	Y
0.0003632	30824.	84870101.	16.9000000	50.0000000	Y
0.0003759	30842.	82039615.	16.9000000	50.0000000	Y
0.0003887	30856.	79387115.	16.9000000	50.0000000	Y
0.0004014	30870.	76901724.	16.9000000	50.0000000	Y
0.0004142	30883.	74565833.	16.9000000	50.0000000	Y
0.0004269	30894.	72365743.	16.9000000	50.0000000	Y
0.0004397	30905.	70293195.	16.9000000	50.0000000	Y
0.0004524	30914.	68333535.	16.9000000	50.0000000	Y
0.0004651	30922.	66479585.	16.9000000	50.0000000	Y
0.0004779	30931.	64724513.	16.9000000	50.0000000	Y

```
    0.0004906        30939.     63058987.    16.9000000    50.0000000  Y
    0.0005034        30945.     61475189.    16.9000000    50.0000000  Y
    0.0005161        30951.     59969602.    16.9000000    50.0000000  Y


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

                                          Nominal
Load              Axial                   Moment
 No.             Thrust                  Capacity
                  kips                    in-kips
----         ----------------         ----------------
  1               0.00000000                  30951.

Note that the values in the above table are not factored by a strength
reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the
LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to the LRFD structural
design standard being followed.



Pile Section No. 2:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:
-------------------------------------------------------------------------------

Length of Section                                =    26.000000 ft
Outside Diameter of Casing                       =    42.000000 in
Casing Wall Thickness                            =       0.0000 in
Moment of Inertia of Steel Casing                =       0.0000 in^4
Width Flange of Core/Insert                      =    11.500000 in
Depth of Core/Insert                             =    33.800000 in
Flange Thickness of Core/Insert                  =     1.220000 in
Web Thickness of Core/Insert                     =     0.670000 in
Moment of Inertia of Steel Core/Insert           =        9290. in^4
Yield Stress of Casing                           =       50000. psi
Elastic Modulus of Casing                        =    29000000. psi
Yield Stress of Core/Insert                      =       50000. psi
Elastic Modulus of Core/Insert                   =    29000000. psi
Number of Reinforcing Bars                       =            0 bars
Gross Area of Pile                               =        1385. sq. in.
Area of Concrete                                 =        1336. sq. in.
Cross-sectional Area of Steel Casing             =       0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert        =    49.500000 sq. in.
```

Area of All Steel (Casing, Core/Insert, and Bars) = 49.071200 sq. in.
Area Ratio of All Steel to Gross Area = 3.54 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 8152.755 kips
Tensile Load for Cracking of Concrete = -784.142 kips
Nominal Axial Tensile Capacity = -2475.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000637	2667.	418613926.	13.9087969	0.00008862	-0.000179	0.4053261	0.00000	0.00000	-4.453483	C
0.00001274	5320.	417428707.	13.9481633	0.0001778	-0.000357	0.7957033	0.00000	0.00000	-8.892418	C
0.00001912	7956.	416223224.	13.9883177	0.0002674	-0.000535	1.1708969	0.00000	0.00000	-13.316367	C
0.00002549	10577.	414996700.	14.0292931	0.0003576	-0.000713	1.5306619	0.00000	0.00000	-17.724870	C
0.00003186	13182.	413748327.	14.0710963	0.0004483	-0.000890	1.8747389	0.00000	0.00000	-22.117465	C
0.00003823	15769.	412478175.	14.1127524	0.0005395	-0.001066	2.2027210	0.00000	0.00000	-26.494774	C
0.00004460	18340.	411184972.	14.1552950	0.0006314	-0.001242	2.5144333	0.00000	0.00000	-30.855542	C
0.00005097	20893.	409867771.	14.1987637	0.0007238	-0.001417	2.8095872	0.00000	0.00000	-35.199219	C
0.00005735	23427.	408525560.	14.2432008	0.0008168	-0.001592	3.0878796	0.00000	0.00000	-39.525220	C
0.00006372	25943.	407157260.	14.2886517	0.0009104	-0.001766	3.3489919	0.00000	0.00000	-43.832926	C
0.00007009	28440.	405761716.	14.3351650	0.0010048	-0.001939	3.5925887	0.00000	0.00000	-48.121675	C
0.00007646	30603.	400240328.	14.3202920	0.0010950	-0.002116	3.8072739	0.00000	0.00000	-50.000000	CY
0.00008283	31521.	380531226.	14.0819437	0.0011665	-0.002313	3.9642366	0.00000	0.00000	-50.000000	CY
0.00008921	32277.	361827271.	13.8451508	0.0012351	-0.002512	4.1043220	0.00000	0.00000	-50.000000	CY
0.00009558	32926.	344498550.	13.6213777	0.0013019	-0.002712	4.2309396	0.00000	0.00000	-50.000000	CY
0.0001019	33485.	328451778.	13.4053105	0.0013667	-0.002915	4.3443702	0.00000	0.00000	-50.000000	CY
0.0001083	33976.	313663587.	13.2026430	0.0014301	-0.003119	4.4467035	0.00000	0.00000	-50.000000	CY
0.0001147	34406.	299986634.	13.0072548	0.0014918	-0.003325	4.5378425	0.00000	0.00000	-50.000000	CY
0.0001211	34791.	287375005.	12.8250277	0.0015527	-0.003532	4.6196135	0.00000	0.00000	-50.000000	CY
0.0001274	35131.	275675860.	12.6485134	0.0016119	-0.003740	4.6915548	0.00000	0.00000	-50.000000	CY

0.0001338	35439.	264847675.	12.4830523	0.0016703	-0.003950	4.7551543	0.00000	0.00000	-50.000000 CY
0.0001402	35716.	254788961.	12.3255966	0.0017278	-0.004160	4.8105094	0.00000	0.00000	-50.000000 CY
0.0001466	35966.	245416952.	12.1742702	0.0017842	-0.004371	4.8578962	0.00000	0.00000	-50.000000 CY
0.0001529	36197.	236700756.	12.0326983	0.0018401	-0.004583	4.8981809	0.00000	0.00000	-50.000000 CY
0.0001593	36405.	228540530.	11.8961447	0.0018950	-0.004795	4.9312087	0.00000	0.00000	-50.000000 CY
0.0001657	36597.	220904186.	11.7653164	0.0019491	-0.005009	4.9574361	0.00000	0.00000	-50.000000 CY
0.0001720	36774.	213755136.	11.6422520	0.0020029	-0.005223	4.9772922	0.00000	0.00000	-50.000000 CY
0.0001784	36938.	207040152.	11.5250427	0.0020562	-0.005437	4.9908555	0.00000	0.00000	-50.000000 CY
0.0001848	37087.	200705985.	11.4101222	0.0021084	-0.005652	4.9982613	0.00000	0.00000	-50.000000 CY
0.0001912	37226.	194743286.	11.3016256	0.0021604	-0.005868	4.9949892	0.00000	0.00000	-50.000000 CY
0.0001975	37356.	189120505.	11.1991911	0.0022121	-0.006084	4.9994937	0.00000	0.00000	-50.000000 CY
0.0002039	37477.	183801519.	11.1008484	0.0022634	-0.006300	4.9960111	0.00000	0.00000	-50.000000 CY
0.0002103	37586.	178753086.	11.0041082	0.0023138	-0.006518	4.9997170	0.00000	0.00000	-50.000000 CY
0.0002166	37689.	173971117.	10.9124570	0.0023641	-0.006735	4.9954975	0.00000	0.00000	-50.000000 CY
0.0002230	37787.	169437934.	10.8255058	0.0024142	-0.006952	4.9994303	0.00000	0.00000	-50.000000 CY
0.0002294	37880.	165135964.	10.7430933	0.0024643	-0.007170	4.9931347	0.00000	0.00000	-50.000000 CY
0.0002358	37964.	161029164.	10.6616492	0.0025136	-0.007388	4.9981161	0.00000	0.00000	-50.000000 CY
0.0002421	38043.	157117288.	10.5822757	0.0025623	-0.007607	4.9999796	0.00000	0.00000	-50.000000 CY
0.0002485	38118.	153391845.	10.5070049	0.0026110	-0.007826	4.9941796	0.00000	0.00000	-50.000000 CY
0.0002612	38257.	146440648.	10.3654290	0.0027079	-0.008264	4.9999774	0.00000	0.00000	-50.000000 CY
0.0002740	38380.	140079956.	10.2326360	0.0028036	-0.008704	4.9968083	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	38380.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

	Top of	Equivalent

Layer No.	Layer Below Pile Head ft	Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	22.5600	0.00	N.A.	No	0.00	2914.
2	24.3000	1.7400	Yes	No	2914.	16097.
3	26.8000	0.5104	No	No	19011.	213289.
4	31.8000	4.8992	Yes	No	232300.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.3822	6.95E-06	-2.98E-07	-0.00691	4.30E-09	2.66E+11	0.00	0.00	0.00
0.4856	2.3419	-9.73E-05	-9.24E-06	-0.00691	6.02E-08	2.66E+11	0.00	0.00	0.00
0.9712	2.3016	-1.01E-04	3.6966	-0.00691	6.24E-08	2.66E+11	0.00	0.00	1.2687
1.4568	2.2613	43.0816	43.2037	-0.00691	0.02667	2.66E+11	0.00	0.00	12.2908
1.9424	2.2210	503.5130	152.8929	-0.00691	0.3116	2.66E+11	0.00	0.00	25.3565
2.4280	2.1807	1825.	338.7185	-0.00691	1.1295	2.66E+11	0.00	0.00	38.4222
2.9136	2.1405	4451.	600.6807	-0.00691	2.7550	2.66E+11	0.00	0.00	51.4879
3.3992	2.1002	8826.	938.7792	-0.00691	5.4625	2.66E+11	0.00	0.00	64.5536
3.8848	2.0599	15392.	1353.	-0.00691	9.5268	2.66E+11	0.00	0.00	77.6193
4.3704	2.0196	24594.	1843.	-0.00691	15.2224	2.66E+11	0.00	0.00	90.6850
4.8560	1.9793	36876.	2410.	-0.00691	22.8239	2.66E+11	0.00	0.00	103.7507
5.3416	1.9391	52680.	3053.	-0.00691	32.6060	2.66E+11	0.00	0.00	116.8164
5.8272	1.8988	72451.	3771.	-0.00691	44.8432	2.66E+11	0.00	0.00	129.8821
6.3128	1.8586	96632.	4566.	-0.00691	59.8102	2.66E+11	0.00	0.00	142.9478
6.7984	1.8183	125668.	5437.	-0.00690	77.7815	2.66E+11	0.00	0.00	156.0135
7.2840	1.7781	160001.	6384.	-0.00690	99.0317	2.66E+11	0.00	0.00	169.0792
7.7696	1.7379	200075.	7408.	-0.00690	123.8355	2.66E+11	0.00	0.00	182.1449
8.2552	1.6977	246334.	8507.	-0.00689	152.4674	2.66E+11	0.00	0.00	195.2106
8.7408	1.6576	299222.	9683.	-0.00689	185.2021	2.66E+11	0.00	0.00	208.2763

9.2264	1.6174	359182.	10935.	-0.00688	222.3142	2.66E+11	0.00	0.00	221.3421
9.7120	1.5774	426658.	12262.	-0.00687	264.0782	2.66E+11	0.00	0.00	234.4078
10.1976	1.5374	502094.	13666.	-0.00686	310.7688	2.66E+11	0.00	0.00	247.4735
10.6832	1.4974	585933.	15147.	-0.00685	362.6605	2.66E+11	0.00	0.00	260.5392
11.1688	1.4575	678619.	16703.	-0.00683	420.0280	2.66E+11	0.00	0.00	273.6049
11.6544	1.4178	780596.	18335.	-0.00682	483.1459	2.66E+11	0.00	0.00	286.6706
12.1400	1.3781	892306.	20044.	-0.00680	552.2887	2.66E+11	0.00	0.00	299.7363
12.6256	1.3385	1014195.	21829.	-0.00678	627.7311	2.66E+11	0.00	0.00	312.8020
13.1112	1.2991	1146705.	23689.	-0.00676	709.7477	2.66E+11	0.00	0.00	325.8677
13.5968	1.2598	1290281.	25626.	-0.00673	798.6131	2.66E+11	0.00	0.00	338.9334
14.0824	1.2206	1445365.	27639.	-0.00670	894.6019	2.66E+11	0.00	0.00	351.9991
14.5680	1.1817	1612403.	29729.	-0.00667	997.9886	2.66E+11	0.00	0.00	365.0648
15.0536	1.1430	1791836.	31894.	-0.00663	1109.	2.66E+11	0.00	0.00	378.1305
15.5392	1.1045	1984109.	34136.	-0.00659	1228.	2.66E+11	0.00	0.00	391.1962
16.0248	1.0662	2189666.	36453.	-0.00654	1355.	2.66E+11	0.00	0.00	404.2619
16.5104	1.0282	2408950.	38847.	-0.00649	1491.	2.66E+11	0.00	0.00	417.3276
16.9960	0.9905	2642404.	41317.	-0.00644	1636.	2.66E+11	0.00	0.00	430.3933
17.4816	0.9532	2890474.	43863.	-0.00637	1789.	2.66E+11	0.00	0.00	443.4590
17.9672	0.9163	3153601.	46485.	-0.00631	1952.	2.66E+11	0.00	0.00	456.5247
18.4528	0.8797	3432231.	49184.	-0.00624	2124.	2.66E+11	0.00	0.00	469.5904
18.9384	0.8436	3726806.	51958.	-0.00616	2307.	2.66E+11	0.00	0.00	482.6561
19.4240	0.8079	4037770.	54809.	-0.00607	2499.	2.66E+11	0.00	0.00	495.7218
19.9096	0.7728	4365567.	57735.	-0.00598	2702.	2.66E+11	0.00	0.00	508.7875
20.3952	0.7382	4710641.	60738.	-0.00588	2916.	2.66E+11	0.00	0.00	521.8532
20.8808	0.7043	5073434.	63817.	-0.00577	3140.	2.66E+11	0.00	0.00	534.9189
21.3664	0.6710	5454392.	66972.	-0.00566	3376.	2.66E+11	0.00	0.00	547.9846
21.8520	0.6383	5853957.	70204.	-0.00553	3623.	2.66E+11	0.00	0.00	561.0503
22.3376	0.6065	6272573.	73440.	-0.00540	3882.	2.66E+11	0.00	0.00	549.7346
22.8232	0.5754	6709857.	74975.	-0.00529	0.00	4.17E+11	-22.738	230.2742	0.00
23.3088	0.5449	7146368.	74713.	-0.00519	0.00	4.16E+11	-67.244	719.1659	0.00
23.7944	0.5149	7580595.	74186.	-0.00509	0.00	4.16E+11	-113.876	1289.	0.00
24.2800	0.4856	8010956.	73384.	-0.00498	0.00	4.16E+11	-161.245	1935.	0.00
24.7656	0.4569	8435842.	72305.	-0.00486	0.00	4.16E+11	-209.103	2667.	0.00
25.2512	0.4289	8853627.	70950.	-0.00474	0.00	4.16E+11	-255.923	3477.	0.00
25.7368	0.4017	9262723.	69329.	-0.00461	0.00	4.16E+11	-300.565	4360.	0.00
26.2224	0.3752	9661612.	67455.	-0.00448	0.00	4.15E+11	-342.495	5320.	0.00
26.7080	0.3495	1.00E+07	65345.	-0.00434	0.00	4.15E+11	-381.620	6363.	0.00
27.1936	0.3246	1.04E+07	60796.	-0.00420	0.00	4.15E+11	-1180.	21179.	0.00
27.6792	0.3005	1.08E+07	53904.	-0.00405	0.00	4.15E+11	-1186.	22991.	0.00
28.1648	0.2774	1.11E+07	46981.	-0.00390	0.00	4.15E+11	-1190.	25005.	0.00
28.6504	0.2551	1.13E+07	40037.	-0.00374	0.00	4.15E+11	-1193.	27251.	0.00
29.1360	0.2338	1.15E+07	33081.	-0.00358	0.00	4.14E+11	-1194.	29765.	0.00
29.6216	0.2134	1.17E+07	26124.	-0.00342	0.00	4.14E+11	-1194.	32590.	0.00
30.1072	0.1940	1.18E+07	19176.	-0.00325	0.00	4.14E+11	-1191.	35780.	0.00
30.5928	0.1755	1.19E+07	12247.	-0.00308	0.00	4.14E+11	-1187.	39397.	0.00
31.0784	0.1581	1.20E+07	5350.	-0.00292	0.00	4.14E+11	-1181.	43522.	0.00
31.5640	0.1416	1.20E+07	-1505.	-0.00275	0.00	4.14E+11	-1172.	48251.	0.00
32.0496	0.1260	1.19E+07	-8897.	-0.00258	0.00	4.14E+11	-1365.	63099.	0.00
32.5352	0.1115	1.19E+07	-16808.	-0.00241	0.00	4.14E+11	-1350.	70567.	0.00
33.0208	0.09794	1.18E+07	-24627.	-0.00225	0.00	4.14E+11	-1333.	79314.	0.00
33.5064	0.08534	1.16E+07	-32336.	-0.00208	0.00	4.14E+11	-1313.	89649.	0.00
33.9920	0.07369	1.14E+07	-39919.	-0.00192	0.00	4.15E+11	-1290.	101986.	0.00
34.4776	0.06297	1.11E+07	-47357.	-0.00176	0.00	4.15E+11	-1263.	116891.	0.00

34.9632	0.05316	1.08E+07	-54630.	-0.00161	0.00	4.15E+11	-1233.	135154.	0.00
35.4488	0.04423	1.05E+07	-61715.	-0.00146	0.00	4.15E+11	-1199.	157918.	0.00
35.9344	0.03617	1.01E+07	-68587.	-0.00131	0.00	4.15E+11	-1160.	186903.	0.00
36.4200	0.02893	9684371.	-75219.	-0.00117	0.00	4.15E+11	-1116.	224826.	0.00
36.9056	0.02248	9227103.	-81577.	-0.00104	0.00	4.16E+11	-1066.	276276.	0.00
37.3912	0.01679	8733643.	-87617.	-9.16E-04	0.00	4.16E+11	-1007.	349714.	0.00
37.8768	0.01181	8205976.	-93285.	-7.97E-04	0.00	4.16E+11	-937.768	462897.	0.00
38.3624	0.00749	7646465.	-98495.	-6.86E-04	0.00	4.16E+11	-850.652	661464.	0.00
38.8480	0.00381	7058070.	-103100.	-5.83E-04	0.00	4.17E+11	-729.605	1116986.	0.00
39.3336	6.94E-04	6444900.	-106448.	-4.89E-04	0.00	4.17E+11	-419.681	3523563.	0.00
39.8192	-0.00189	5817479.	-105830.	-4.03E-04	0.00	4.17E+11	631.9998	1945392.	0.00
40.3048	-0.00401	5211519.	-101733.	-3.26E-04	0.00	4.17E+11	773.9166	1125572.	0.00
40.7904	-0.00570	4631837.	-96979.	-2.58E-04	0.00	4.18E+11	857.7781	877491.	0.00
41.2760	-0.00701	4081283.	-91809.	-1.97E-04	0.00	4.18E+11	916.8096	762190.	0.00
41.7616	-0.00799	3561860.	-86337.	-1.44E-04	0.00	4.18E+11	961.1628	700932.	0.00
42.2472	-0.00868	3075075.	-80636.	-9.73E-05	0.00	4.18E+11	995.4429	668076.	0.00
42.7328	-0.00912	2622091.	-74758.	-5.77E-05	0.00	4.19E+11	1022.	652763.	0.00
43.2184	-0.00935	2203817.	-68741.	-2.41E-05	0.00	4.19E+11	1043.	649667.	0.00
43.7040	-0.00941	1820956.	-62617.	3.94E-06	0.00	4.19E+11	1059.	655952.	0.00
44.1896	-0.00931	1474047.	-56414.	2.69E-05	0.00	4.19E+11	1070.	670057.	0.00
44.6752	-0.00909	1163485.	-50153.	4.52E-05	0.00	4.19E+11	1078.	691138.	0.00
45.1608	-0.00878	889540.	-43855.	5.95E-05	0.00	4.19E+11	1083.	718802.	0.00
45.6464	-0.00840	652379.	-37537.	7.03E-05	0.00	4.19E+11	1085.	752965.	0.00
46.1320	-0.00796	452067.	-31215.	7.79E-05	0.00	4.19E+11	1085.	793787.	0.00
46.6176	-0.00749	288588.	-24902.	8.31E-05	0.00	4.19E+11	1082.	841652.	0.00
47.1032	-0.00699	161845.	-18613.	8.62E-05	0.00	4.19E+11	1077.	897183.	0.00
47.5888	-0.00649	71670.	-12358.	8.79E-05	0.00	4.19E+11	1070.	961313.	0.00
48.0744	-0.00597	17823.	-6150.	8.85E-05	0.00	4.19E+11	1061.	1035417.	0.00
48.5600	-0.00545	0.00	0.00	8.86E-05	0.00	4.19E+11	1050.	560780.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     2.38215549 inches
Computed slope at pile head      =     -0.0069129 radians
Maximum bending moment           =      11976325. inch-lbs
Maximum shear force              =       -106448. lbs
Depth of maximum bending moment  =    31.56400000 feet below pile head
Depth of maximum shear force     =    39.33360000 feet below pile head
Number of iterations             =             33
Number of zero deflection points =              1
Pile deflection at ground        =     0.59222657 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
48.56000	2.38215549	11976325.	-106448.
46.13200	2.61276663	11857057.	-117999.
43.70400	3.71333438	11473619.	-130113.
41.27600	7.63823341	10935408.	-140326.
38.84800	28.62386039	10653339.	-158371.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	4.7456	-1.53E-04	-5.96E-07	-0.01280	9.46E-08	2.66E+11	0.00	0.00	0.00
0.4856	4.6711	-1.39E-05	1.25E-05	-0.01280	8.60E-09	2.66E+11	0.00	0.00	0.00
0.9712	4.5965	-6.95E-06	5.5446	-0.01280	4.30E-09	2.66E+11	0.00	0.00	1.9030
1.4568	4.5219	64.6188	64.8018	-0.01280	0.04000	2.66E+11	0.00	0.00	18.4351
1.9424	4.4473	755.2262	229.3261	-0.01280	0.4674	2.66E+11	0.00	0.00	38.0326
2.4280	4.3728	2737.	508.0486	-0.01280	1.6942	2.66E+11	0.00	0.00	57.6300
2.9136	4.2982	6676.	900.9692	-0.01280	4.1322	2.66E+11	0.00	0.00	77.2274
3.3992	4.2236	13238.	1408.	-0.01280	8.1933	2.66E+11	0.00	0.00	96.8249
3.8848	4.1491	23087.	2029.	-0.01280	14.2894	2.66E+11	0.00	0.00	116.4223
4.3704	4.0745	36889.	2765.	-0.01280	22.8323	2.66E+11	0.00	0.00	136.0197
4.8560	3.9999	55310.	3615.	-0.01280	34.2339	2.66E+11	0.00	0.00	155.6171
5.3416	3.9254	79015.	4579.	-0.01279	48.9062	2.66E+11	0.00	0.00	175.2146
5.8272	3.8508	108670.	5657.	-0.01279	67.2610	2.66E+11	0.00	0.00	194.8120
6.3128	3.7763	144940.	6849.	-0.01279	89.7101	2.66E+11	0.00	0.00	214.4094
6.7984	3.7018	188491.	8155.	-0.01279	116.6655	2.66E+11	0.00	0.00	234.0069
7.2840	3.6273	239987.	9576.	-0.01278	148.5390	2.66E+11	0.00	0.00	253.6043
7.7696	3.5528	300095.	11111.	-0.01277	185.7426	2.66E+11	0.00	0.00	273.2017

8.2552	3.4784	369480.	12760.	-0.01277	228.6880	2.66E+11	0.00	0.00	292.7991
8.7408	3.4040	448808.	14523.	-0.01276	277.7872	2.66E+11	0.00	0.00	312.3966
9.2264	3.3297	538743.	16401.	-0.01275	333.4521	2.66E+11	0.00	0.00	331.9940
9.7120	3.2555	639951.	18393.	-0.01273	396.0945	2.66E+11	0.00	0.00	351.5914
10.1976	3.1813	753098.	20499.	-0.01272	466.1264	2.66E+11	0.00	0.00	371.1889
10.6832	3.1072	878849.	22719.	-0.01270	543.9595	2.66E+11	0.00	0.00	390.7863
11.1688	3.0333	1017870.	25053.	-0.01268	630.0058	2.66E+11	0.00	0.00	410.3837
11.6544	2.9595	1170826.	27501.	-0.01266	724.6772	2.66E+11	0.00	0.00	429.9811
12.1400	2.8858	1338383.	30064.	-0.01263	828.3855	2.66E+11	0.00	0.00	449.5786
12.6256	2.8123	1521205.	32741.	-0.01260	941.5426	2.66E+11	0.00	0.00	469.1760
13.1112	2.7390	1719959.	35532.	-0.01256	1065.	2.66E+11	0.00	0.00	488.7734
13.5968	2.6659	1935310.	38437.	-0.01252	1198.	2.66E+11	0.00	0.00	508.3709
14.0824	2.5930	2167924.	41457.	-0.01248	1342.	2.66E+11	0.00	0.00	527.9683
14.5680	2.5205	2418465.	44591.	-0.01243	1497.	2.66E+11	0.00	0.00	547.5657
15.0536	2.4482	2687599.	47838.	-0.01237	1663.	2.66E+11	0.00	0.00	567.1631
15.5392	2.3763	2975992.	51200.	-0.01231	1842.	2.66E+11	0.00	0.00	586.7606
16.0248	2.3047	3284310.	54677.	-0.01224	2033.	2.66E+11	0.00	0.00	606.3580
16.5104	2.2336	3613217.	58267.	-0.01216	2236.	2.66E+11	0.00	0.00	625.9554
16.9960	2.1630	3963379.	61972.	-0.01208	2453.	2.66E+11	0.00	0.00	645.5529
17.4816	2.0928	4335462.	65791.	-0.01199	2683.	2.66E+11	0.00	0.00	665.1503
17.9672	2.0232	4730130.	69724.	-0.01189	2928.	2.66E+11	0.00	0.00	684.7477
18.4528	1.9543	5148050.	73771.	-0.01178	3186.	2.66E+11	0.00	0.00	704.3451
18.9384	1.8859	5589888.	77933.	-0.01166	3460.	2.66E+11	0.00	0.00	723.9426
19.4240	1.8183	6056307.	82208.	-0.01154	3749.	2.66E+11	0.00	0.00	743.5400
19.9096	1.7515	6547974.	86598.	-0.01140	4053.	2.66E+11	0.00	0.00	763.1374
20.3952	1.6855	7065555.	91102.	-0.01125	4373.	2.66E+11	0.00	0.00	782.7349
20.8808	1.6204	7609714.	95720.	-0.01109	4710.	2.66E+11	0.00	0.00	802.3323
21.3664	1.5562	8181118.	100453.	-0.01092	5064.	2.66E+11	0.00	0.00	821.9297
21.8520	1.4931	8780431.	105299.	-0.01073	5435.	2.66E+11	0.00	0.00	841.5271
22.3376	1.4312	9408319.	110154.	-0.01053	5823.	2.66E+11	0.00	0.00	824.5545
22.8232	1.3704	1.01E+07	112469.	-0.01036	0.00	4.15E+11	-29.925	127.2423	0.00
23.3088	1.3105	1.07E+07	112123.	-0.01021	0.00	4.15E+11	-88.737	394.5757	0.00
23.7944	1.2514	1.14E+07	111425.	-0.01006	0.00	4.15E+11	-150.832	702.3368	0.00
24.2800	1.1933	1.20E+07	110360.	-0.00989	0.00	4.14E+11	-214.620	1048.	0.00
24.7656	1.1362	1.27E+07	108923.	-0.00972	0.00	4.14E+11	-278.567	1429.	0.00
25.2512	1.0801	1.33E+07	107117.	-0.00953	0.00	4.14E+11	-341.445	1842.	0.00
25.7368	1.0250	1.39E+07	104951.	-0.00934	0.00	4.13E+11	-402.023	2285.	0.00
26.2224	0.9712	1.45E+07	102440.	-0.00914	0.00	4.13E+11	-459.651	2758.	0.00
26.7080	0.9185	1.51E+07	99603.	-0.00893	0.00	4.13E+11	-514.161	3262.	0.00
27.1936	0.8671	1.57E+07	93711.	-0.00872	0.00	4.13E+11	-1508.	10136.	0.00
27.6792	0.8169	1.62E+07	84880.	-0.00849	0.00	4.12E+11	-1523.	10861.	0.00
28.1648	0.7681	1.67E+07	75971.	-0.00826	0.00	4.12E+11	-1535.	11649.	0.00
28.6504	0.7207	1.71E+07	66990.	-0.00802	0.00	4.12E+11	-1547.	12507.	0.00
29.1360	0.6746	1.74E+07	57949.	-0.00778	0.00	4.12E+11	-1556.	13444.	0.00
29.6216	0.6300	1.78E+07	48855.	-0.00753	0.00	4.11E+11	-1565.	14471.	0.00
30.1072	0.5869	1.80E+07	39720.	-0.00727	0.00	4.11E+11	-1571.	15597.	0.00
30.5928	0.5453	1.82E+07	30552.	-0.00702	0.00	4.11E+11	-1576.	16838.	0.00
31.0784	0.5051	1.84E+07	21362.	-0.00676	0.00	4.11E+11	-1578.	18208.	0.00
31.5640	0.4665	1.85E+07	12162.	-0.00650	0.00	4.11E+11	-1579.	19727.	0.00
32.0496	0.4294	1.85E+07	2158.	-0.00623	0.00	4.11E+11	-1854.	25162.	0.00
32.5352	0.3939	1.85E+07	-8638.	-0.00597	0.00	4.11E+11	-1851.	27389.	0.00
33.0208	0.3598	1.84E+07	-19410.	-0.00571	0.00	4.11E+11	-1846.	29889.	0.00
33.5064	0.3273	1.83E+07	-30140.	-0.00545	0.00	4.11E+11	-1837.	32711.	0.00

33.9920	0.2963	1.81E+07	-40815.	-0.00519	0.00	4.11E+11	-1826.	35917.	0.00
34.4776	0.2668	1.78E+07	-51415.	-0.00494	0.00	4.11E+11	-1812.	39583.	0.00
34.9632	0.2387	1.75E+07	-61925.	-0.00469	0.00	4.12E+11	-1795.	43811.	0.00
35.4488	0.2121	1.71E+07	-72323.	-0.00445	0.00	4.12E+11	-1774.	48733.	0.00
35.9344	0.1869	1.66E+07	-82587.	-0.00421	0.00	4.12E+11	-1749.	54530.	0.00
36.4200	0.1631	1.61E+07	-92694.	-0.00398	0.00	4.12E+11	-1720.	61453.	0.00
36.9056	0.1406	1.55E+07	-102615.	-0.00375	0.00	4.13E+11	-1685.	69867.	0.00
37.3912	0.1193	1.49E+07	-112319.	-0.00354	0.00	4.13E+11	-1645.	80322.	0.00
37.8768	0.09933	1.42E+07	-121765.	-0.00333	0.00	4.13E+11	-1597.	93692.	0.00
38.3624	0.08050	1.35E+07	-130905.	-0.00314	0.00	4.14E+11	-1540.	111476.	0.00
38.8480	0.06277	1.27E+07	-139676.	-0.00295	0.00	4.14E+11	-1470.	136485.	0.00
39.3336	0.04609	1.19E+07	-147987.	-0.00278	0.00	4.14E+11	-1382.	174784.	0.00
39.8192	0.03037	1.10E+07	-155700.	-0.00262	0.00	4.15E+11	-1265.	242652.	0.00
40.3048	0.01556	1.00E+07	-162551.	-0.00247	0.00	4.15E+11	-1086.	406850.	0.00
40.7904	0.00157	9080116.	-167526.	-0.00234	0.00	4.16E+11	-621.168	2310058.	0.00
41.2760	-0.01168	8093362.	-166301.	-0.00222	0.00	4.16E+11	1042.	519518.	0.00
41.7616	-0.02428	7141981.	-159569.	-0.00211	0.00	4.16E+11	1269.	304593.	0.00
42.2472	-0.03628	6233687.	-151725.	-0.00202	0.00	4.17E+11	1423.	228564.	0.00
42.7328	-0.04778	5373718.	-143073.	-0.00194	0.00	4.17E+11	1546.	188555.	0.00
43.2184	-0.05885	4566253.	-133756.	-0.00187	0.00	4.18E+11	1652.	163543.	0.00
43.7040	-0.06954	3814870.	-123858.	-0.00181	0.00	4.18E+11	1746.	146285.	0.00
44.1896	-0.07992	3122766.	-113433.	-0.00176	0.00	4.18E+11	1832.	133579.	0.00
44.6752	-0.09005	2492874.	-102522.	-0.00172	0.00	4.19E+11	1913.	123783.	0.00
45.1608	-0.09998	1927936.	-91152.	-0.00169	0.00	4.19E+11	1990.	115961.	0.00
45.6464	-0.110	1430557.	-79344.	-0.00167	0.00	4.19E+11	2063.	109541.	0.00
46.1320	-0.119	1003233.	-67114.	-0.00165	0.00	4.19E+11	2134.	104155.	0.00
46.6176	-0.129	648378.	-54476.	-0.00164	0.00	4.19E+11	2203.	99553.	0.00
47.1032	-0.138	368345.	-41439.	-0.00163	0.00	4.19E+11	2271.	95562.	0.00
47.5888	-0.148	165435.	-28010.	-0.00163	0.00	4.19E+11	2338.	92057.	0.00
48.0744	-0.157	41910.	-14195.	-0.00163	0.00	4.19E+11	2404.	88947.	0.00
48.5600	-0.167	0.00	0.00	-0.00163	0.00	4.19E+11	2468.	43083.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     4.74564561 inches
Computed slope at pile head      =     -0.0127976 radians
Maximum bending moment           =      18508205. inch-lbs
Maximum shear force              =       -167526. lbs
Depth of maximum bending moment  =    32.04960000 feet below pile head
Depth of maximum shear force     =    40.79040000 feet below pile head
Number of iterations             =             44
Number of zero deflection points =              1
Pile deflection at ground        =     1.40335992 inches
```

```
--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs


    Pile       Pile Head       Maximum       Maximum
   Length      Deflection      Moment         Shear
    feet         inches        ln-lbs          lbs
------------  ------------  ------------  ------------
   48.56000    4.74564561     18508205.      -167526.
   46.13200    6.65907831     17965011.      -182344.
   43.70400   13.71387960     17406000.      -199112.
   41.27600   39.27129565     16742815.      -217061.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

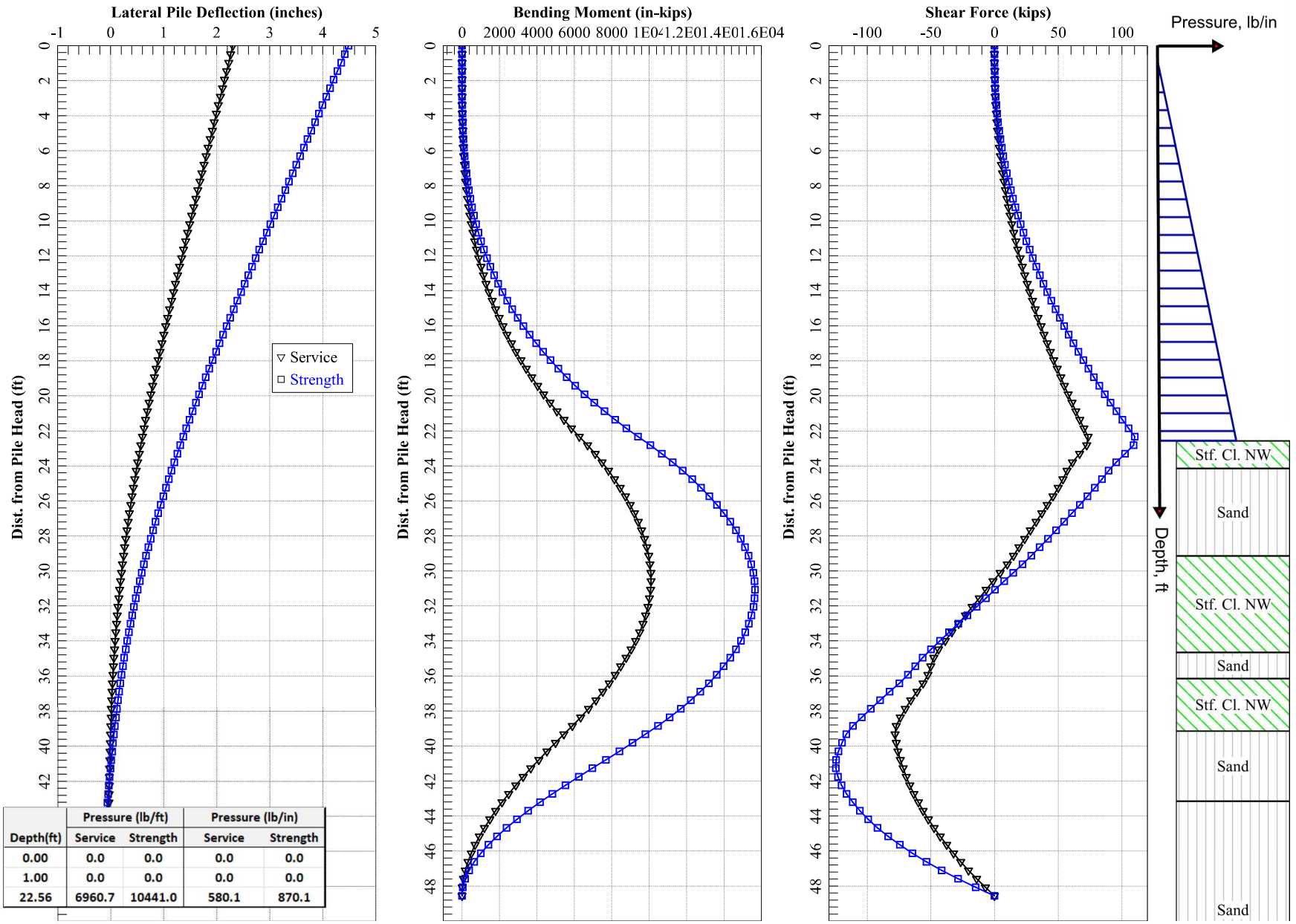
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians


Load Load                Load                  Axial    Pile-head  Pile-head  Max Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians      lbs      in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
  1  V, lb       0.00  M, in-lb        0.00       0.00     2.3822   -0.00691   -106448.   1.20E+07
  2  V, lb       0.00  M, in-lb        0.00       0.00     4.7456   -0.01280   -167526.   1.85E+07


Maximum pile-head deflection = 4.7456456133 inches
Maximum pile-head rotation   = -0.0127975651 radians = -0.733246 deg.

The analysis ended normally.
```

Wall 1A (22.56ft): Based on Boring B-001-0-02



	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
22.56	6960.7	10441.0	580.1	870.1

```
================================================================================

                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\0000 TRC projects\CUY-77-1141\App E LPile 04-05- 2026\Wall 1A\

Name of input data file:
09 Wall_1A-22.56ft_B-001-0-02.lp12d

Name of output report file:
09 Wall_1A-22.56ft_B-001-0-02.lp12o

Name of plot output file:
09 Wall_1A-22.56ft_B-001-0-02.lp12p

Name of runtime message file:
09 Wall_1A-22.56ft_B-001-0-02.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  April 10, 2026             Time:   0:05:58
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, PhD, PE

Description: LPILE FOR SOLDIER PILE WALL 1A (H=22.56FT) Boring B-001-0-02

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 48.560 ft
Depth of ground surface below top of pile = 22.5600 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	11.5000
2	22.560	11.5000
3	22.560	42.0000
4	48.560	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 22.560000 ft
AISC Section Type = W

AISC Section Name = W33X169

Pile width = 11.500000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 26.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W

Core/Insert AISC Section Name = W33X169

```
--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 7 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer           =    22.560000 ft
   Distance from top of pile to bottom of layer        =    24.140000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2500. psf
   Undrained cohesion at bottom of layer               =        2500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    24.140000 ft
   Distance from top of pile to bottom of layer        =    29.140000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    29.140000 ft
   Distance from top of pile to bottom of layer        =    34.640000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2500. psf
   Undrained cohesion at bottom of layer               =        2500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    34.640000 ft
   Distance from top of pile to bottom of layer        =    36.140000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
```

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   Friction angle at top of layer                     =    32.000000 deg.
   Friction angle at bottom of layer                  =    32.000000 deg.
   Subgrade k at top of layer                         =    60.000000 pci
   Subgrade k at bottom of layer                      =    60.000000 pci


Layer 5 is stiff clay without free water

   Distance from top of pile to top of layer          =    36.140000 ft
   Distance from top of pile to bottom of layer       =    39.140000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3000. psf
   Undrained cohesion at bottom of layer              =        3000. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000


Layer 6 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    39.140000 ft
   Distance from top of pile to bottom of layer       =    43.140000 ft
   Effective unit weight at top of layer              =    62.700000 pcf
   Effective unit weight at bottom of layer           =    62.700000 pcf
   Friction angle at top of layer                     =    34.000000 deg.
   Friction angle at bottom of layer                  =    34.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 7 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    43.140000 ft
   Distance from top of pile to bottom of layer       =    71.140000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    34.000000 deg.
   Friction angle at bottom of layer                  =    34.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


 (Depth of the lowest soil layer extends 22.580 ft below the pile tip)



--------------------------------------------------------------------------------
                       Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.           Name             Depth       Unit Wt.                 Friction        or           kpy
          (p-y Curve Type)        ft           pcf          psf          deg.        krm          pci
```

1	Stiff Clay	22.5600	57.6000	2500.	--	0.00500	--
	w/o Free Water	24.1400	57.6000	2500.	--	0.00500	--
2	Sand	24.1400	62.6000	--	32.0000	--	60.0000
	(Reese, et al.)	29.1400	62.6000	--	32.0000	--	60.0000
3	Stiff Clay	29.1400	57.6000	2500.	--	0.00500	--
	w/o Free Water	34.6400	57.6000	2500.	--	0.00500	--
4	Sand	34.6400	62.6000	--	32.0000	--	60.0000
	(Reese, et al.)	36.1400	62.6000	--	32.0000	--	60.0000
5	Stiff Clay	36.1400	62.6000	3000.	--	0.00500	--
	w/o Free Water	39.1400	62.6000	3000.	--	0.00500	--
6	Sand	39.1400	62.7000	--	34.0000	--	125.0000
	(Reese, et al.)	43.1400	62.7000	--	34.0000	--	125.0000
7	Sand	43.1400	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	71.1400	62.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	22.560	0.8290	1.0000
2	49.000	0.8290	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.560	580.100

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.560	870.100

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section = 22.560000 ft
Flange Width = 11.500000 in

Section Depth = 33.800000 in
Flange Thickness = 1.220000 in
Web Thickness = 0.670000 in
Yield Stress of Pipe = 50.000000 ksi
Elastic Modulus = 29000. ksi
Cross-sectional Area = 49.500000 sq. in.
Moment of Inertia = 9290. in^4
Elastic Bending Stiffness = 269410000. kip-in^2
Plastic Modulus, Z = 629.000000in^3
Plastic Moment Capacity = Fy Z = 31450.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As = 2475.000 kips
Nominal Axial Tensile Capacity = -2475.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000637	1693.	265693210.	16.9000000	3.0915978	
0.00001274	3386.	265693210.	16.9000000	6.1831957	
0.00001912	5079.	265693210.	16.9000000	9.2747935	
0.00002549	6772.	265693210.	16.9000000	12.3663914	
0.00003186	8465.	265693210.	16.9000000	15.4579892	
0.00003823	10158.	265693210.	16.9000000	18.5495871	
0.00004460	11851.	265693210.	16.9000000	21.6411849	
0.00005097	13544.	265693210.	16.9000000	24.7327828	
0.00005735	15237.	265693210.	16.9000000	27.8243806	
0.00006372	16929.	265693210.	16.9000000	30.9159784	
0.00007009	18622.	265693210.	16.9000000	34.0075763	
0.00007646	20315.	265693210.	16.9000000	37.0991741	
0.00008283	22008.	265693210.	16.9000000	40.1907720	
0.00008921	23701.	265693210.	16.9000000	43.2823698	
0.00009558	25394.	265693210.	16.9000000	46.3739677	

0.0001019	27087.	265693210.	16.9000000	49.4655655	
0.0001083	28203.	260363688.	16.9000000	50.0000000	Y
0.0001147	28553.	248954951.	16.9000000	50.0000000	Y
0.0001211	28811.	237981856.	16.9000000	50.0000000	Y
0.0001274	29032.	227815021.	16.9000000	50.0000000	Y
0.0001338	29222.	218387282.	16.9000000	50.0000000	Y
0.0001402	29387.	209639324.	16.9000000	50.0000000	Y
0.0001466	29530.	201502088.	16.9000000	50.0000000	Y
0.0001529	29657.	193933140.	16.9000000	50.0000000	Y
0.0001593	29768.	186871359.	16.9000000	50.0000000	Y
0.0001657	29867.	180280704.	16.9000000	50.0000000	Y
0.0001720	29955.	174116498.	16.9000000	50.0000000	Y
0.0001784	30034.	168340016.	16.9000000	50.0000000	Y
0.0001848	30104.	162917461.	16.9000000	50.0000000	Y
0.0001912	30168.	157819143.	16.9000000	50.0000000	Y
0.0001975	30225.	153018816.	16.9000000	50.0000000	Y
0.0002039	30277.	148493137.	16.9000000	50.0000000	Y
0.0002103	30325.	144221232.	16.9000000	50.0000000	Y
0.0002166	30369.	140182713.	16.9000000	50.0000000	Y
0.0002230	30409.	136352858.	16.9000000	50.0000000	Y
0.0002294	30445.	132725391.	16.9000000	50.0000000	Y
0.0002358	30479.	129282090.	16.9000000	50.0000000	Y
0.0002421	30510.	126006054.	16.9000000	50.0000000	Y
0.0002485	30539.	122893837.	16.9000000	50.0000000	Y
0.0002612	30590.	117094882.	16.9000000	50.0000000	Y
0.0002740	30634.	111808788.	16.9000000	50.0000000	Y
0.0002867	30672.	106972176.	16.9000000	50.0000000	Y
0.0002995	30706.	102531944.	16.9000000	50.0000000	Y
0.0003122	30736.	98443169.	16.9000000	50.0000000	Y
0.0003250	30762.	94662918.	16.9000000	50.0000000	Y
0.0003377	30785.	91158778.	16.9000000	50.0000000	Y
0.0003504	30806.	87905231.	16.9000000	50.0000000	Y
0.0003632	30824.	84870101.	16.9000000	50.0000000	Y
0.0003759	30842.	82039615.	16.9000000	50.0000000	Y
0.0003887	30856.	79387115.	16.9000000	50.0000000	Y
0.0004014	30870.	76901724.	16.9000000	50.0000000	Y
0.0004142	30883.	74565833.	16.9000000	50.0000000	Y
0.0004269	30894.	72365743.	16.9000000	50.0000000	Y
0.0004397	30905.	70293195.	16.9000000	50.0000000	Y
0.0004524	30914.	68333535.	16.9000000	50.0000000	Y
0.0004651	30922.	66479585.	16.9000000	50.0000000	Y
0.0004779	30931.	64724513.	16.9000000	50.0000000	Y
0.0004906	30939.	63058987.	16.9000000	50.0000000	Y
0.0005034	30945.	61475189.	16.9000000	50.0000000	Y
0.0005161	30951.	59969602.	16.9000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load	Axial	Nominal Moment

No.	Thrust kips	Capacity in-kips
1	0.00000000	30951.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	26.000000	ft
Outside Diameter of Casing	=	42.000000	in
Casing Wall Thickness	=	0.0000	in
Moment of Inertia of Steel Casing	=	0.0000	in^4
Width Flange of Core/Insert	=	11.500000	in
Depth of Core/Insert	=	33.800000	in
Flange Thickness of Core/Insert	=	1.220000	in
Web Thickness of Core/Insert	=	0.670000	in
Moment of Inertia of Steel Core/Insert	=	9290.	in^4
Yield Stress of Casing	=	50000.	psi
Elastic Modulus of Casing	=	29000000.	psi
Yield Stress of Core/Insert	=	50000.	psi
Elastic Modulus of Core/Insert	=	29000000.	psi
Number of Reinforcing Bars	=	0	bars
Gross Area of Pile	=	1385.	sq. in.
Area of Concrete	=	1336.	sq. in.
Cross-sectional Area of Steel Casing	=	0.0000	sq. in.
Cross-sectional Area of Steel Core/Insert	=	49.500000	sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	49.071200	sq. in.
Area Ratio of All Steel to Gross Area	=	3.54	percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	8152.755	kips
Tensile Load for Cracking of Concrete	=	-784.142	kips
Nominal Axial Tensile Capacity	=	-2475.000	kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000637	2667.	418613926.	13.9087969	0.00008862	-0.000179	0.4053261	0.00000	0.00000	-4.453483	C
0.00001274	5320.	417428707.	13.9481633	0.0001778	-0.000357	0.7957033	0.00000	0.00000	-8.892418	C
0.00001912	7956.	416223224.	13.9883177	0.0002674	-0.000535	1.1708969	0.00000	0.00000	-13.316367	C
0.00002549	10577.	414996700.	14.0292931	0.0003576	-0.000713	1.5306619	0.00000	0.00000	-17.724870	C
0.00003186	13182.	413748327.	14.0710963	0.0004483	-0.000890	1.8747389	0.00000	0.00000	-22.117465	C
0.00003823	15769.	412478175.	14.1127524	0.0005395	-0.001066	2.2027210	0.00000	0.00000	-26.494774	C
0.00004460	18340.	411184972.	14.1552950	0.0006314	-0.001242	2.5144333	0.00000	0.00000	-30.855542	C
0.00005097	20893.	409867771.	14.1987637	0.0007238	-0.001417	2.8095872	0.00000	0.00000	-35.199219	C
0.00005735	23427.	408525560.	14.2432008	0.0008168	-0.001592	3.0878796	0.00000	0.00000	-39.525220	C
0.00006372	25943.	407157260.	14.2886517	0.0009104	-0.001766	3.3489919	0.00000	0.00000	-43.832926	C
0.00007009	28440.	405761716.	14.3351650	0.0010048	-0.001939	3.5925887	0.00000	0.00000	-48.121675	C
0.00007646	30603.	400240328.	14.3202920	0.0010950	-0.002116	3.8072739	0.00000	0.00000	-50.000000	CY
0.00008283	31521.	380531226.	14.0819437	0.0011665	-0.002313	3.9642366	0.00000	0.00000	-50.000000	CY
0.00008921	32277.	361827271.	13.8451508	0.0012351	-0.002512	4.1043220	0.00000	0.00000	-50.000000	CY
0.00009558	32926.	344498550.	13.6213777	0.0013019	-0.002712	4.2309396	0.00000	0.00000	-50.000000	CY
0.0001019	33485.	328451778.	13.4053105	0.0013667	-0.002915	4.3443702	0.00000	0.00000	-50.000000	CY
0.0001083	33976.	313663587.	13.2026430	0.0014301	-0.003119	4.4467035	0.00000	0.00000	-50.000000	CY
0.0001147	34406.	299986634.	13.0072548	0.0014918	-0.003325	4.5378425	0.00000	0.00000	-50.000000	CY
0.0001211	34791.	287375005.	12.8250277	0.0015527	-0.003532	4.6196135	0.00000	0.00000	-50.000000	CY
0.0001274	35131.	275675860.	12.6485134	0.0016119	-0.003740	4.6915548	0.00000	0.00000	-50.000000	CY
0.0001338	35439.	264847675.	12.4830523	0.0016703	-0.003950	4.7551543	0.00000	0.00000	-50.000000	CY
0.0001402	35716.	254788961.	12.3255966	0.0017278	-0.004160	4.8105094	0.00000	0.00000	-50.000000	CY
0.0001466	35966.	245416952.	12.1742702	0.0017842	-0.004371	4.8578962	0.00000	0.00000	-50.000000	CY
0.0001529	36197.	236700756.	12.0326983	0.0018401	-0.004583	4.8981809	0.00000	0.00000	-50.000000	CY
0.0001593	36405.	228540530.	11.8961447	0.0018950	-0.004795	4.9312087	0.00000	0.00000	-50.000000	CY
0.0001657	36597.	220904186.	11.7653164	0.0019491	-0.005009	4.9574361	0.00000	0.00000	-50.000000	CY
0.0001720	36774.	213755136.	11.6422520	0.0020029	-0.005223	4.9772922	0.00000	0.00000	-50.000000	CY
0.0001784	36938.	207040152.	11.5250427	0.0020562	-0.005437	4.9908555	0.00000	0.00000	-50.000000	CY
0.0001848	37087.	200705985.	11.4101222	0.0021084	-0.005652	4.9982613	0.00000	0.00000	-50.000000	CY
0.0001912	37226.	194743286.	11.3016256	0.0021604	-0.005868	4.9949892	0.00000	0.00000	-50.000000	CY
0.0001975	37356.	189120505.	11.1991911	0.0022121	-0.006084	4.9994937	0.00000	0.00000	-50.000000	CY

0.0002039	37477.	183801519.	11.1008484	0.0022634	-0.006300	4.9960111	0.00000	0.00000	-50.000000 CY
0.0002103	37586.	178753086.	11.0041082	0.0023138	-0.006518	4.9997170	0.00000	0.00000	-50.000000 CY
0.0002166	37689.	173971117.	10.9124570	0.0023641	-0.006735	4.9954975	0.00000	0.00000	-50.000000 CY
0.0002230	37787.	169437934.	10.8255058	0.0024142	-0.006952	4.9994303	0.00000	0.00000	-50.000000 CY
0.0002294	37880.	165135964.	10.7430933	0.0024643	-0.007170	4.9931347	0.00000	0.00000	-50.000000 CY
0.0002358	37964.	161029164.	10.6616492	0.0025136	-0.007388	4.9981161	0.00000	0.00000	-50.000000 CY
0.0002421	38043.	157117288.	10.5822757	0.0025623	-0.007607	4.9999796	0.00000	0.00000	-50.000000 CY
0.0002485	38118.	153391845.	10.5070049	0.0026110	-0.007826	4.9941796	0.00000	0.00000	-50.000000 CY
0.0002612	38257.	146440648.	10.3654290	0.0027079	-0.008264	4.9999774	0.00000	0.00000	-50.000000 CY
0.0002740	38380.	140079956.	10.2326360	0.0028036	-0.008704	4.9968083	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	38380.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	22.5600	0.00	N.A.	No	0.00	43186.
2	24.1400	6.2947	No	No	43186.	98456.
3	29.1400	4.7629	No	No	141643.	204741.
4	34.6400	17.4364	No	No	346384.	74455.
5	36.1400	10.4155	No	No	420839.	155658.
6	39.1400	20.1144	No	No	576497.	338906.

7	43.1400	24.0620	Yes	No	915403.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.3046	4.17E-05	0.00	-0.00665	2.58E-08	2.66E+11	0.00	0.00	0.00
0.4856	2.2659	6.95E-05	2.68E-06	-0.00665	4.30E-08	2.66E+11	0.00	0.00	0.00
0.9712	2.2271	7.30E-05	3.6966	-0.00665	4.52E-08	2.66E+11	0.00	0.00	1.2687
1.4568	2.1884	43.0818	43.2037	-0.00665	0.02667	2.66E+11	0.00	0.00	12.2908
1.9424	2.1496	503.5131	152.8929	-0.00665	0.3116	2.66E+11	0.00	0.00	25.3565
2.4280	2.1109	1825.	338.7185	-0.00665	1.1295	2.66E+11	0.00	0.00	38.4222
2.9136	2.0722	4451.	600.6807	-0.00665	2.7550	2.66E+11	0.00	0.00	51.4879
3.3992	2.0334	8826.	938.7792	-0.00665	5.4625	2.66E+11	0.00	0.00	64.5536
3.8848	1.9947	15392.	1353.	-0.00665	9.5268	2.66E+11	0.00	0.00	77.6193
4.3704	1.9559	24594.	1843.	-0.00665	15.2224	2.66E+11	0.00	0.00	90.6850
4.8560	1.9172	36876.	2410.	-0.00665	22.8239	2.66E+11	0.00	0.00	103.7507
5.3416	1.8785	52680.	3053.	-0.00665	32.6060	2.66E+11	0.00	0.00	116.8164
5.8272	1.8398	72451.	3771.	-0.00664	44.8432	2.66E+11	0.00	0.00	129.8821
6.3128	1.8010	96632.	4566.	-0.00664	59.8102	2.66E+11	0.00	0.00	142.9478
6.7984	1.7623	125668.	5437.	-0.00664	77.7815	2.66E+11	0.00	0.00	156.0135
7.2840	1.7237	160001.	6384.	-0.00664	99.0317	2.66E+11	0.00	0.00	169.0792
7.7696	1.6850	200075.	7408.	-0.00663	123.8355	2.66E+11	0.00	0.00	182.1449
8.2552	1.6463	246334.	8507.	-0.00663	152.4674	2.66E+11	0.00	0.00	195.2106
8.7408	1.6077	299222.	9683.	-0.00662	185.2021	2.66E+11	0.00	0.00	208.2763
9.2264	1.5692	359182.	10935.	-0.00662	222.3142	2.66E+11	0.00	0.00	221.3421
9.7120	1.5306	426658.	12262.	-0.00661	264.0782	2.66E+11	0.00	0.00	234.4078
10.1976	1.4922	502094.	13666.	-0.00660	310.7688	2.66E+11	0.00	0.00	247.4735
10.6832	1.4538	585933.	15147.	-0.00658	362.6605	2.66E+11	0.00	0.00	260.5392
11.1688	1.4154	678619.	16703.	-0.00657	420.0280	2.66E+11	0.00	0.00	273.6049
11.6544	1.3772	780596.	18335.	-0.00655	483.1459	2.66E+11	0.00	0.00	286.6706
12.1400	1.3391	892306.	20044.	-0.00654	552.2887	2.66E+11	0.00	0.00	299.7363
12.6256	1.3010	1014195.	21829.	-0.00652	627.7311	2.66E+11	0.00	0.00	312.8020

13.1112	1.2631	1146705.	23689.	-0.00649	709.7477	2.66E+11	0.00	0.00	325.8677
13.5968	1.2254	1290281.	25626.	-0.00646	798.6131	2.66E+11	0.00	0.00	338.9334
14.0824	1.1878	1445365.	27639.	-0.00643	894.6019	2.66E+11	0.00	0.00	351.9991
14.5680	1.1504	1612403.	29729.	-0.00640	997.9886	2.66E+11	0.00	0.00	365.0648
15.0536	1.1132	1791836.	31894.	-0.00636	1109.	2.66E+11	0.00	0.00	378.1305
15.5392	1.0762	1984109.	34136.	-0.00632	1228.	2.66E+11	0.00	0.00	391.1962
16.0248	1.0395	2189666.	36453.	-0.00628	1355.	2.66E+11	0.00	0.00	404.2619
16.5104	1.0031	2408950.	38847.	-0.00623	1491.	2.66E+11	0.00	0.00	417.3276
16.9960	0.9669	2642404.	41317.	-0.00617	1636.	2.66E+11	0.00	0.00	430.3933
17.4816	0.9311	2890474.	43863.	-0.00611	1789.	2.66E+11	0.00	0.00	443.4590
17.9672	0.8957	3153601.	46485.	-0.00604	1952.	2.66E+11	0.00	0.00	456.5247
18.4528	0.8607	3432231.	49184.	-0.00597	2124.	2.66E+11	0.00	0.00	469.5904
18.9384	0.8261	3726806.	51958.	-0.00589	2307.	2.66E+11	0.00	0.00	482.6561
19.4240	0.7920	4037770.	54809.	-0.00581	2499.	2.66E+11	0.00	0.00	495.7218
19.9096	0.7584	4365567.	57735.	-0.00572	2702.	2.66E+11	0.00	0.00	508.7875
20.3952	0.7254	4710641.	60738.	-0.00562	2916.	2.66E+11	0.00	0.00	521.8532
20.8808	0.6930	5073434.	63817.	-0.00551	3140.	2.66E+11	0.00	0.00	534.9189
21.3664	0.6612	5454392.	66972.	-0.00539	3376.	2.66E+11	0.00	0.00	547.9846
21.8520	0.6301	5853957.	70204.	-0.00527	3623.	2.66E+11	0.00	0.00	561.0503
22.3376	0.5998	6272573.	73440.	-0.00514	3882.	2.66E+11	0.00	0.00	549.7346
22.8232	0.5703	6709857.	72305.	-0.00502	0.00	4.17E+11	-939.134	9597.	0.00
23.3088	0.5413	7115250.	66797.	-0.00492	0.00	4.17E+11	-951.501	10244.	0.00
23.7944	0.5129	7488335.	61219.	-0.00482	0.00	4.16E+11	-962.971	10941.	0.00
24.2800	0.4851	7828720.	56962.	-0.00471	0.00	4.16E+11	-497.991	5982.	0.00
24.7656	0.4579	8152196.	53755.	-0.00460	0.00	4.16E+11	-602.837	7671.	0.00
25.2512	0.4314	8455201.	49979.	-0.00449	0.00	4.16E+11	-693.011	9360.	0.00
25.7368	0.4056	8734674.	45814.	-0.00437	0.00	4.16E+11	-736.762	10584.	0.00
26.2224	0.3805	8989130.	41472.	-0.00424	0.00	4.16E+11	-753.385	11537.	0.00
26.7080	0.3562	9218004.	37053.	-0.00411	0.00	4.16E+11	-763.306	12488.	0.00
27.1936	0.3326	9420958.	32585.	-0.00398	0.00	4.15E+11	-770.282	13496.	0.00
27.6792	0.3098	9597757.	28100.	-0.00385	0.00	4.15E+11	-768.856	14464.	0.00
28.1648	0.2877	9748448.	23649.	-0.00371	0.00	4.15E+11	-758.736	15367.	0.00
28.6504	0.2665	9873375.	19250.	-0.00358	0.00	4.15E+11	-751.075	16425.	0.00
29.1360	0.2460	9972799.	14899.	-0.00344	0.00	4.15E+11	-742.456	17585.	0.00
29.6216	0.2264	1.00E+07	9969.	-0.00330	0.00	4.15E+11	-949.700	24443.	0.00
30.1072	0.2076	1.01E+07	4437.	-0.00316	0.00	4.15E+11	-948.685	26629.	0.00
30.5928	0.1896	1.01E+07	-1084.	-0.00301	0.00	4.15E+11	-946.356	29081.	0.00
31.0784	0.1725	1.01E+07	-6588.	-0.00287	0.00	4.15E+11	-942.654	31848.	0.00
31.5640	0.1561	1.00E+07	-12066.	-0.00273	0.00	4.15E+11	-937.514	34987.	0.00
32.0496	0.1406	9935721.	-17510.	-0.00259	0.00	4.15E+11	-930.856	38569.	0.00
32.5352	0.1259	9817885.	-22910.	-0.00245	0.00	4.15E+11	-922.586	42686.	0.00
33.0208	0.1121	9668722.	-28257.	-0.00232	0.00	4.15E+11	-912.587	47458.	0.00
33.5064	0.09895	9488570.	-33540.	-0.00218	0.00	4.15E+11	-900.714	53043.	0.00
33.9920	0.08662	9277834.	-38748.	-0.00205	0.00	4.16E+11	-886.782	59654.	0.00
34.4776	0.07506	9036986.	-43868.	-0.00192	0.00	4.16E+11	-870.552	67588.	0.00
34.9632	0.06423	8766577.	-47675.	-0.00180	0.00	4.16E+11	-436.005	39558.	0.00
35.4488	0.05411	8481363.	-50149.	-0.00168	0.00	4.16E+11	-413.149	44491.	0.00
35.9344	0.04469	8182120.	-52392.	-0.00156	0.00	4.16E+11	-356.767	46518.	0.00
36.4200	0.03594	7870762.	-55995.	-0.00145	0.00	4.16E+11	-879.742	142648.	0.00
36.9056	0.02783	7529532.	-61003.	-0.00134	0.00	4.16E+11	-839.067	175713.	0.00
37.3912	0.02033	7159810.	-65745.	-0.00124	0.00	4.16E+11	-788.516	226029.	0.00
37.8768	0.01341	6763313.	-70147.	-0.00114	0.00	4.17E+11	-722.222	313725.	0.00
38.3624	0.00705	6342292.	-74071.	-0.00105	0.00	4.17E+11	-624.815	516286.	0.00

38.8480	0.00121	5900055.	-77082.	-9.62E-04	0.00	4.17E+11	-408.355	1972779.	0.00
39.3336	-0.00416	5443952.	-78019.	-8.83E-04	0.00	4.17E+11	86.7564	121544.	0.00
39.8192	-0.00908	4990794.	-77198.	-8.10E-04	0.00	4.18E+11	194.9170	125062.	0.00
40.3048	-0.01360	4544255.	-75811.	-7.43E-04	0.00	4.18E+11	281.0519	120433.	0.00
40.7904	-0.01775	4107260.	-73988.	-6.83E-04	0.00	4.18E+11	344.7281	113197.	0.00
41.2760	-0.02156	3681970.	-71805.	-6.29E-04	0.00	4.18E+11	404.4723	109323.	0.00
41.7616	-0.02507	3270415.	-69281.	-5.80E-04	0.00	4.18E+11	461.7454	107311.	0.00
42.2472	-0.02832	2874539.	-66428.	-5.37E-04	0.00	4.18E+11	517.4348	106459.	0.00
42.7328	-0.03134	2496233.	-63254.	-5.00E-04	0.00	4.19E+11	572.1502	106389.	0.00
43.2184	-0.03415	2137355.	-59769.	-4.68E-04	0.00	4.19E+11	623.8374	106446.	0.00
43.7040	-0.03679	1799660.	-55977.	-4.40E-04	0.00	4.19E+11	677.7028	107340.	0.00
44.1896	-0.03928	1484977.	-51870.	-4.18E-04	0.00	4.19E+11	731.7454	108543.	0.00
44.6752	-0.04166	1195142.	-47448.	-3.99E-04	0.00	4.19E+11	786.2464	109983.	0.00
45.1608	-0.04393	932005.	-42705.	-3.84E-04	0.00	4.19E+11	841.4612	111608.	0.00
45.6464	-0.04613	697441.	-37638.	-3.73E-04	0.00	4.19E+11	897.6246	113379.	0.00
46.1320	-0.04828	493356.	-32240.	-3.65E-04	0.00	4.19E+11	954.9520	115263.	0.00
46.6176	-0.05038	321699.	-26505.	-3.59E-04	0.00	4.19E+11	1014.	117237.	0.00
47.1032	-0.05246	184460.	-20423.	-3.55E-04	0.00	4.19E+11	1074.	119282.	0.00
47.5888	-0.05452	83686.	-13985.	-3.53E-04	0.00	4.19E+11	1136.	121385.	0.00
48.0744	-0.05658	21478.	-7181.	-3.53E-04	0.00	4.19E+11	1199.	123535.	0.00
48.5600	-0.05863	0.00	0.00	-3.53E-04	0.00	4.19E+11	1265.	62862.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     2.30461365 inches
Computed slope at pile head      =     -0.0066485 radians
Maximum bending moment           =      10098726. inch-lbs
Maximum shear force              =        -78019. lbs
Depth of maximum bending moment  =    30.59280000 feet below pile head
Depth of maximum shear force     =    39.33360000 feet below pile head
Number of iterations             =             25
Number of zero deflection points =              1
Pile deflection at ground        =     0.58626097 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
48.56000	2.30461365	10098726.	-78019.
46.13200	2.44633841	9633217.	-83292.
43.70400	3.15104368	9367695.	-93090.
41.27600	4.75708579	8946825.	-98400.
38.84800	13.35870727	8634444.	-111151.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	4.4884	-2.64E-04	0.00	-0.01206	1.63E-07	2.66E+11	0.00	0.00	0.00
0.4856	4.4181	-1.46E-04	1.01E-05	-0.01206	9.03E-08	2.66E+11	0.00	0.00	0.00
0.9712	4.3478	-1.46E-04	5.5446	-0.01206	9.03E-08	2.66E+11	0.00	0.00	1.9030
1.4568	4.2775	64.6187	64.8018	-0.01206	0.04000	2.66E+11	0.00	0.00	18.4351
1.9424	4.2072	755.2260	229.3261	-0.01206	0.4674	2.66E+11	0.00	0.00	38.0326
2.4280	4.1369	2737.	508.0486	-0.01206	1.6942	2.66E+11	0.00	0.00	57.6300
2.9136	4.0666	6676.	900.9692	-0.01206	4.1322	2.66E+11	0.00	0.00	77.2274
3.3992	3.9963	13238.	1408.	-0.01206	8.1933	2.66E+11	0.00	0.00	96.8249
3.8848	3.9260	23087.	2029.	-0.01206	14.2894	2.66E+11	0.00	0.00	116.4223
4.3704	3.8557	36889.	2765.	-0.01206	22.8323	2.66E+11	0.00	0.00	136.0197
4.8560	3.7854	55310.	3615.	-0.01206	34.2339	2.66E+11	0.00	0.00	155.6171
5.3416	3.7151	79015.	4579.	-0.01206	48.9062	2.66E+11	0.00	0.00	175.2146
5.8272	3.6449	108670.	5657.	-0.01206	67.2610	2.66E+11	0.00	0.00	194.8120
6.3128	3.5746	144940.	6849.	-0.01206	89.7101	2.66E+11	0.00	0.00	214.4094
6.7984	3.5044	188491.	8155.	-0.01205	116.6655	2.66E+11	0.00	0.00	234.0069
7.2840	3.4341	239987.	9576.	-0.01205	148.5390	2.66E+11	0.00	0.00	253.6043
7.7696	3.3640	300095.	11111.	-0.01204	185.7426	2.66E+11	0.00	0.00	273.2017
8.2552	3.2938	369480.	12760.	-0.01203	228.6880	2.66E+11	0.00	0.00	292.7991
8.7408	3.2237	448808.	14523.	-0.01203	277.7872	2.66E+11	0.00	0.00	312.3966
9.2264	3.1537	538743.	16401.	-0.01201	333.4521	2.66E+11	0.00	0.00	331.9940
9.7120	3.0837	639951.	18393.	-0.01200	396.0945	2.66E+11	0.00	0.00	351.5914
10.1976	3.0138	753098.	20499.	-0.01199	466.1264	2.66E+11	0.00	0.00	371.1889
10.6832	2.9440	878849.	22719.	-0.01197	543.9595	2.66E+11	0.00	0.00	390.7863
11.1688	2.8743	1017870.	25053.	-0.01195	630.0058	2.66E+11	0.00	0.00	410.3837
11.6544	2.8047	1170826.	27501.	-0.01192	724.6772	2.66E+11	0.00	0.00	429.9811

12.1400	2.7353	1338383.	30064.	-0.01190	828.3855	2.66E+11	0.00	0.00	449.5786
12.6256	2.6661	1521205.	32741.	-0.01186	941.5426	2.66E+11	0.00	0.00	469.1760
13.1112	2.5971	1719959.	35532.	-0.01183	1065.	2.66E+11	0.00	0.00	488.7734
13.5968	2.5282	1935310.	38437.	-0.01179	1198.	2.66E+11	0.00	0.00	508.3709
14.0824	2.4597	2167924.	41457.	-0.01174	1342.	2.66E+11	0.00	0.00	527.9683
14.5680	2.3914	2418465.	44591.	-0.01169	1497.	2.66E+11	0.00	0.00	547.5657
15.0536	2.3234	2687599.	47838.	-0.01164	1663.	2.66E+11	0.00	0.00	567.1631
15.5392	2.2558	2975992.	51200.	-0.01158	1842.	2.66E+11	0.00	0.00	586.7606
16.0248	2.1885	3284310.	54677.	-0.01151	2033.	2.66E+11	0.00	0.00	606.3580
16.5104	2.1216	3613217.	58267.	-0.01143	2236.	2.66E+11	0.00	0.00	625.9554
16.9960	2.0553	3963379.	61972.	-0.01135	2453.	2.66E+11	0.00	0.00	645.5529
17.4816	1.9894	4335462.	65791.	-0.01126	2683.	2.66E+11	0.00	0.00	665.1503
17.9672	1.9241	4730130.	69724.	-0.01116	2928.	2.66E+11	0.00	0.00	684.7477
18.4528	1.8593	5148050.	73771.	-0.01105	3186.	2.66E+11	0.00	0.00	704.3451
18.9384	1.7953	5589888.	77933.	-0.01093	3460.	2.66E+11	0.00	0.00	723.9426
19.4240	1.7319	6056307.	82208.	-0.01080	3749.	2.66E+11	0.00	0.00	743.5400
19.9096	1.6694	6547974.	86598.	-0.01067	4053.	2.66E+11	0.00	0.00	763.1374
20.3952	1.6076	7065555.	91102.	-0.01052	4373.	2.66E+11	0.00	0.00	782.7349
20.8808	1.5468	7609714.	95720.	-0.01036	4710.	2.66E+11	0.00	0.00	802.3323
21.3664	1.4870	8181118.	100453.	-0.01018	5064.	2.66E+11	0.00	0.00	821.9297
21.8520	1.4281	8780431.	105299.	-0.01000	5435.	2.66E+11	0.00	0.00	841.5271
22.3376	1.3705	9408319.	110154.	-0.00980	5823.	2.66E+11	0.00	0.00	824.5545
22.8232	1.3140	1.01E+07	109185.	-0.00962	0.00	4.15E+11	-1157.	5131.	0.00
23.3088	1.2583	1.07E+07	102391.	-0.00948	0.00	4.15E+11	-1175.	5441.	0.00
23.7944	1.2035	1.13E+07	95495.	-0.00932	0.00	4.15E+11	-1192.	5771.	0.00
24.2800	1.1496	1.18E+07	89483.	-0.00916	0.00	4.14E+11	-871.396	4417.	0.00
24.7656	1.0967	1.23E+07	84249.	-0.00899	0.00	4.14E+11	-925.222	4916.	0.00
25.2512	1.0448	1.28E+07	78722.	-0.00882	0.00	4.14E+11	-971.775	5420.	0.00
25.7368	0.9940	1.32E+07	72950.	-0.00863	0.00	4.14E+11	-1009.	5916.	0.00
26.2224	0.9442	1.36E+07	66988.	-0.00844	0.00	4.13E+11	-1037.	6399.	0.00
26.7080	0.8956	1.40E+07	60884.	-0.00825	0.00	4.13E+11	-1058.	6887.	0.00
27.1936	0.8481	1.43E+07	54645.	-0.00805	0.00	4.13E+11	-1083.	7440.	0.00
27.6792	0.8018	1.46E+07	48289.	-0.00784	0.00	4.13E+11	-1099.	7984.	0.00
28.1648	0.7567	1.49E+07	41868.	-0.00764	0.00	4.13E+11	-1105.	8511.	0.00
28.6504	0.7128	1.51E+07	35387.	-0.00742	0.00	4.13E+11	-1119.	9149.	0.00
29.1360	0.6702	1.53E+07	28819.	-0.00721	0.00	4.13E+11	-1135.	9871.	0.00
29.6216	0.6288	1.55E+07	21939.	-0.00699	0.00	4.13E+11	-1226.	11362.	0.00
30.1072	0.5887	1.56E+07	14780.	-0.00677	0.00	4.13E+11	-1231.	12186.	0.00
30.5928	0.5498	1.56E+07	7596.	-0.00655	0.00	4.13E+11	-1235.	13087.	0.00
31.0784	0.5123	1.57E+07	391.8665	-0.00633	0.00	4.13E+11	-1238.	14076.	0.00
31.5640	0.4761	1.56E+07	-6823.	-0.00611	0.00	4.13E+11	-1239.	15164.	0.00
32.0496	0.4411	1.56E+07	-14042.	-0.00589	0.00	4.13E+11	-1239.	16365.	0.00
32.5352	0.4074	1.55E+07	-21256.	-0.00567	0.00	4.13E+11	-1237.	17697.	0.00
33.0208	0.3750	1.53E+07	-28457.	-0.00545	0.00	4.13E+11	-1234.	19180.	0.00
33.5064	0.3439	1.51E+07	-35636.	-0.00524	0.00	4.13E+11	-1230.	20841.	0.00
33.9920	0.3139	1.49E+07	-42784.	-0.00503	0.00	4.13E+11	-1224.	22710.	0.00
34.4776	0.2853	1.46E+07	-49891.	-0.00482	0.00	4.13E+11	-1216.	24829.	0.00
34.9632	0.2578	1.43E+07	-56389.	-0.00461	0.00	4.13E+11	-1015.	22942.	0.00
35.4488	0.2315	1.40E+07	-62260.	-0.00441	0.00	4.13E+11	-999.796	25166.	0.00
35.9344	0.2064	1.36E+07	-68025.	-0.00422	0.00	4.14E+11	-979.146	27649.	0.00
36.4200	0.1823	1.32E+07	-74725.	-0.00403	0.00	4.14E+11	-1320.	42195.	0.00
36.9056	0.1594	1.27E+07	-82354.	-0.00385	0.00	4.14E+11	-1298.	47455.	0.00
37.3912	0.1375	1.22E+07	-89841.	-0.00367	0.00	4.14E+11	-1272.	53892.	0.00

37.8768	0.1166	1.17E+07	-97158.	-0.00350	0.00	4.14E+11	-1240.	61974.	0.00
38.3624	0.09665	1.11E+07	-104273.	-0.00334	0.00	4.15E+11	-1202.	72473.	0.00
38.8480	0.07762	1.05E+07	-111143.	-0.00319	0.00	4.15E+11	-1156.	86770.	0.00
39.3336	0.05944	9804714.	-116350.	-0.00305	0.00	4.15E+11	-631.320	61887.	0.00
39.8192	0.04207	9116002.	-119748.	-0.00292	0.00	4.16E+11	-534.825	74076.	0.00
40.3048	0.02544	8409129.	-122504.	-0.00279	0.00	4.16E+11	-411.368	94211.	0.00
40.7904	0.00950	7688287.	-124331.	-0.00268	0.00	4.16E+11	-215.425	132100.	0.00
41.2760	-0.00581	6960130.	-124564.	-0.00258	0.00	4.17E+11	135.2506	135618.	0.00
41.7616	-0.02056	6236566.	-122978.	-0.00249	0.00	4.17E+11	409.2372	115997.	0.00
42.2472	-0.03480	5526898.	-120077.	-0.00240	0.00	4.17E+11	586.4362	98206.	0.00
42.7328	-0.04859	4837143.	-116192.	-0.00233	0.00	4.18E+11	746.9676	89587.	0.00
43.2184	-0.06198	4172752.	-111404.	-0.00227	0.00	4.18E+11	896.3186	84267.	0.00
43.7040	-0.07504	3538798.	-105747.	-0.00222	0.00	4.18E+11	1045.	81175.	0.00
44.1896	-0.08781	2940338.	-99224.	-0.00217	0.00	4.18E+11	1193.	79190.	0.00
44.6752	-0.100	2382397.	-91838.	-0.00213	0.00	4.19E+11	1342.	77924.	0.00
45.1608	-0.113	1870018.	-83582.	-0.00210	0.00	4.19E+11	1492.	77154.	0.00
45.6464	-0.125	1408297.	-74444.	-0.00208	0.00	4.19E+11	1644.	76741.	0.00
46.1320	-0.137	1002413.	-64409.	-0.00206	0.00	4.19E+11	1800.	76597.	0.00
46.6176	-0.149	657647.	-53457.	-0.00205	0.00	4.19E+11	1959.	76658.	0.00
47.1032	-0.161	379406.	-41565.	-0.00205	0.00	4.19E+11	2122.	76882.	0.00
47.5888	-0.173	173230.	-28710.	-0.00204	0.00	4.19E+11	2290.	77236.	0.00
48.0744	-0.185	44812.	-14864.	-0.00204	0.00	4.19E+11	2462.	77699.	0.00
48.5600	-0.197	0.00	0.00	-0.00204	0.00	4.19E+11	2639.	39126.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     4.48842512 inches
Computed slope at pile head      =     -0.0120645 radians
Maximum bending moment           =      15654756. inch-lbs
Maximum shear force              =       -124564. lbs
Depth of maximum bending moment  =    31.07840000 feet below pile head
Depth of maximum shear force     =    41.27600000 feet below pile head
Number of iterations             =             30
Number of zero deflection points =              1
Pile deflection at ground        =     1.34458354 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
```

Moment   =   0. in-lbs
Axial Load =   0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
48.56000	4.48842512	15654756.	-124564.
46.13200	5.21676006	14870477.	-133719.
43.70400	7.63308818	14417590.	-146492.
41.27600	17.28427985	13960690.	-164997.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

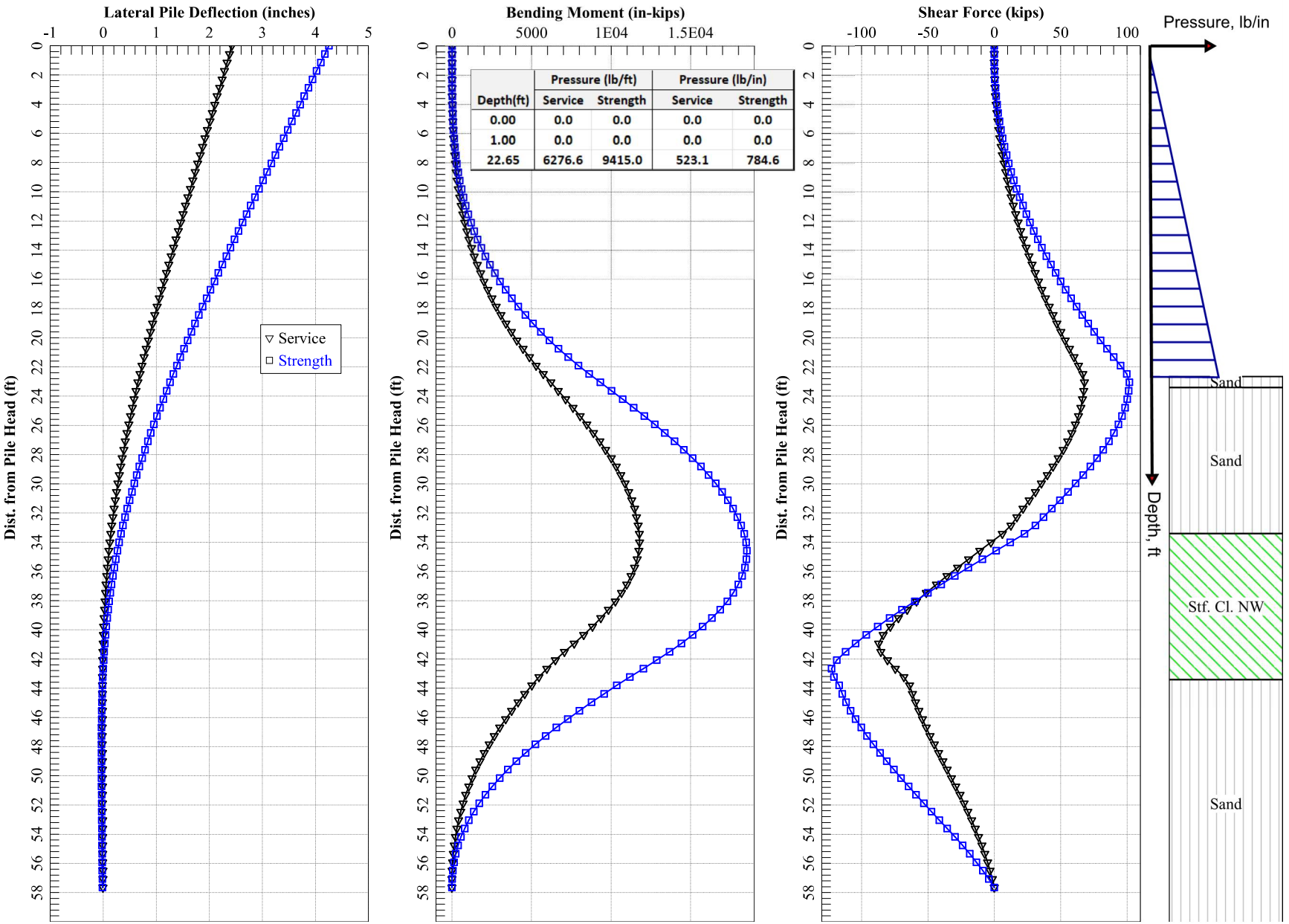
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	2.3046	-0.00665	-78019.	1.01E+07
2	V, lb	0.00	M, in-lb	0.00	0.00	4.4884	-0.01206	-124564.	1.57E+07

Maximum pile-head deflection = 4.4884251155 inches
Maximum pile-head rotation   = -0.0120645416 radians = -0.691247 deg.

The analysis ended normally.

Wall 1B (22.65ft): Boring B-043-0-20



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
22.65	6276.6	9415.0	523.1	784.6

==========

LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1B\

Name of input data file:
Wall_1B-22.65_B-043-0-02.lp12d

Name of output report file:
Wall_1B-22.65_B-043-0-02.lp12o

Name of plot output file:
Wall_1B-22.65_B-043-0-02.lp12p

Name of runtime message file:
Wall_1B-22.65_B-043-0-02.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 13:16:11

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1B (H=22.65FT)

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 57.650 ft
Depth of ground surface below top of pile = 22.6500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	15.1000
2	22.650	15.1000
3	22.650	42.0000
4	57.650	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 22.650000 ft
AISC Section Type = W
AISC Section Name = W30X211
Pile width = 15.100000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 35.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W30X211

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 22.650000 ft
Distance from top of pile to bottom of layer = 23.400000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Friction angle at top of layer = 32.000000 deg.
Friction angle at bottom of layer = 32.000000 deg.
Subgrade k at top of layer = 60.000000 pci
Subgrade k at bottom of layer = 60.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 23.400000 ft
Distance from top of pile to bottom of layer = 33.400000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Friction angle at top of layer = 33.000000 deg.
Friction angle at bottom of layer = 33.000000 deg.
Subgrade k at top of layer = 90.000000 pci
Subgrade k at bottom of layer = 90.000000 pci

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	33.400000 ft
Distance from top of pile to bottom of layer	=	43.400000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	4000. psf
Undrained cohesion at bottom of layer	=	4000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	43.400000 ft
Distance from top of pile to bottom of layer	=	60.400000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Friction angle at top of layer	=	34.000000 deg.
Friction angle at bottom of layer	=	34.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

(Depth of the lowest soil layer extends 2.750 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	22.6500	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	23.4000	57.6000	--	32.0000	--	60.0000
2	Sand	23.4000	62.6000	--	33.0000	--	90.0000
	(Reese, et al.)	33.4000	62.6000	--	33.0000	--	90.0000
3	Stiff Clay	33.4000	62.6000	4000.	--	0.00400	--
	w/o Free Water	43.4000	62.6000	4000.	--	0.00400	--
4	Sand	43.4000	67.6000	--	34.0000	--	125.0000
	(Reese, et al.)	60.4000	67.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	22.650	0.7930	1.0000
2	58.000	0.7930	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.650	523.100

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.650	784.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	22.650000 ft
Flange Width	=	15.100000 in
Section Depth	=	30.900000 in
Flange Thickness	=	1.320000 in
Web Thickness	=	0.775000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	62.300000 sq. in.
Moment of Inertia	=	10300. in^4
Elastic Bending Stiffness	=	298700000. kip-in^2
Plastic Modulus, Z	=	751.000000in^3
Plastic Moment Capacity = Fy Z	=	37550.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	3115.000 kips
Nominal Axial Tensile Capacity	=	-3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000485	1432.	295083151.	15.4500000	2.1525124	
0.00000971	2864.	295083151.	15.4500000	4.3050249	
0.00001456	4296.	295083151.	15.4500000	6.4575373	
0.00001941	5728.	295083151.	15.4500000	8.6100497	
0.00002426	7160.	295083151.	15.4500000	10.7625622	
0.00002912	8592.	295083151.	15.4500000	12.9150746	

0.00003397	10024.	295083151.	15.4500000	15.0675870	
0.00003882	11456.	295083151.	15.4500000	17.2200995	
0.00004367	12888.	295083151.	15.4500000	19.3726119	
0.00004853	14320.	295083151.	15.4500000	21.5251243	
0.00005338	15751.	295083151.	15.4500000	23.6776367	
0.00005823	17183.	295083151.	15.4500000	25.8301492	
0.00006309	18615.	295083151.	15.4500000	27.9826616	
0.00006794	20047.	295083151.	15.4500000	30.1351740	
0.00007279	21479.	295083151.	15.4500000	32.2876865	
0.00007764	22911.	295083151.	15.4500000	34.4401989	
0.00008250	24343.	295083151.	15.4500000	36.5927113	
0.00008735	25775.	295083151.	15.4500000	38.7452238	
0.00009220	27207.	295083151.	15.4500000	40.8977362	
0.00009705	28639.	295083151.	15.4500000	43.0502486	
0.0001019	30071.	295083151.	15.4500000	45.2027611	
0.0001068	31503.	295083151.	15.4500000	47.3552735	
0.0001116	32935.	295083151.	15.4500000	49.5077859	
0.0001165	34044.	292307880.	15.4500000	50.0000000	Y
0.0001213	34575.	284995783.	15.4500000	50.0000000	Y
0.0001262	34790.	275739512.	15.4500000	50.0000000	Y
0.0001310	34966.	266868715.	15.4500000	50.0000000	Y
0.0001359	35122.	258487947.	15.4500000	50.0000000	Y
0.0001407	35264.	250579303.	15.4500000	50.0000000	Y
0.0001456	35391.	243099330.	15.4500000	50.0000000	Y
0.0001504	35505.	236019417.	15.4500000	50.0000000	Y
0.0001553	35610.	229315925.	15.4500000	50.0000000	Y
0.0001601	35705.	222960902.	15.4500000	50.0000000	Y
0.0001650	35792.	216929374.	15.4500000	50.0000000	Y
0.0001698	35871.	211198919.	15.4500000	50.0000000	Y
0.0001747	35944.	205749308.	15.4500000	50.0000000	Y
0.0001796	36011.	200562216.	15.4500000	50.0000000	Y
0.0001844	36073.	195620966.	15.4500000	50.0000000	Y
0.0001893	36131.	190910319.	15.4500000	50.0000000	Y
0.0001990	36232.	182106169.	15.4500000	50.0000000	Y
0.0002087	36320.	174059609.	15.4500000	50.0000000	Y
0.0002184	36398.	166676877.	15.4500000	50.0000000	Y
0.0002281	36465.	159878558.	15.4500000	50.0000000	Y
0.0002378	36524.	153601157.	15.4500000	50.0000000	Y
0.0002475	36576.	147788407.	15.4500000	50.0000000	Y
0.0002572	36622.	142390326.	15.4500000	50.0000000	Y
0.0002669	36663.	137366631.	15.4500000	50.0000000	Y
0.0002766	36700.	132681405.	15.4500000	50.0000000	Y
0.0002863	36734.	128303239.	15.4500000	50.0000000	Y
0.0002960	36764.	124195919.	15.4500000	50.0000000	Y
0.0003057	36791.	120343276.	15.4500000	50.0000000	Y
0.0003154	36816.	116719671.	15.4500000	50.0000000	Y
0.0003251	36839.	113304545.	15.4500000	50.0000000	Y
0.0003348	36860.	110083253.	15.4500000	50.0000000	Y
0.0003445	36879.	107036760.	15.4500000	50.0000000	Y
0.0003542	36896.	104153806.	15.4500000	50.0000000	Y
0.0003640	36913.	101421133.	15.4500000	50.0000000	Y
0.0003737	36927.	98825527.	15.4500000	50.0000000	Y
0.0003834	36941.	96361344.	15.4500000	50.0000000	Y
0.0003931	36954.	94012990.	15.4500000	50.0000000	Y
0.0004028	36965.	91776809.	15.4500000	50.0000000	Y
0.0004125	36977.	89645860.	15.4500000	50.0000000	Y
0.0004222	36987.	87607806.	15.4500000	50.0000000	Y
0.0004319	36996.	85660884.	15.4500000	50.0000000	Y
0.0004416	37006.	83799541.	15.4500000	50.0000000	Y
0.0004513	37014.	82015996.	15.4500000	50.0000000	Y

0.0004610	37021.	80305397.	15.4500000	50.0000000	Y
0.0004707	37029.	78665338.	15.4500000	50.0000000	Y
0.0004804	37036.	77091545.	15.4500000	50.0000000	Y
0.0004901	37043.	75578316.	15.4500000	50.0000000	Y
0.0004998	37048.	74122177.	15.4500000	50.0000000	Y
0.0005095	37054.	72721510.	15.4500000	50.0000000	Y
0.0005192	37060.	71373205.	15.4500000	50.0000000	Y
0.0005289	37065.	70074379.	15.4500000	50.0000000	Y
0.0005387	37070.	68820390.	15.4500000	50.0000000	Y
0.0005484	37074.	67610134.	15.4500000	50.0000000	Y
0.0005581	37079.	66441975.	15.4500000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	37079.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	35.000000 ft
Outside Diameter of Casing	=	42.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	15.100000 in
Depth of Core/Insert	=	30.900000 in
Flange Thickness of Core/Insert	=	1.320000 in
Web Thickness of Core/Insert	=	0.775000 in
Moment of Inertia of Steel Core/Insert	=	10300. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1385. sq. in.
Area of Concrete	=	1324. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	62.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	61.765500 sq. in.
Area Ratio of All Steel to Gross Area	=	4.46 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 8738.355 kips
Tensile Load for Cracking of Concrete = -820.889 kips
Nominal Axial Tensile Capacity = -3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000485	4660.	960219131.	21.0000000	0.0001019	-0.000102	0.4669443	0.00000	0.00000	2.1573676	
0.00000971	4660.	480109566.	14.6786786	0.0001425	-0.000265	0.6436927	0.00000	0.00000	-6.093915	C
0.00001456	6734.	462580705.	14.7100701	0.0002142	-0.000397	0.9508630	0.00000	0.00000	-9.127620	C
0.00001941	8956.	461406788.	14.7419299	0.0002862	-0.000529	1.2480931	0.00000	0.00000	-12.152225	C
0.00002426	11167.	460217660.	14.7742726	0.0003585	-0.000661	1.5352611	0.00000	0.00000	-15.167524	C
0.00002912	13365.	459012879.	14.8071132	0.0004311	-0.000792	1.8122410	0.00000	0.00000	-18.173299	C
0.00003397	15551.	457791985.	14.8404677	0.0005041	-0.000923	2.0789023	0.00000	0.00000	-21.169324	C
0.00003882	17724.	456554495.	14.8743527	0.0005774	-0.001053	2.3351099	0.00000	0.00000	-24.155365	C
0.00004367	19885.	455299908.	14.9087857	0.0006511	-0.001183	2.5807239	0.00000	0.00000	-27.131174	C
0.00004853	22033.	454028676.	14.9430314	0.0007251	-0.001313	2.8154844	0.00000	0.00000	-30.097555	C
0.00005338	24167.	452739722.	14.9778102	0.0007995	-0.001442	3.0393377	0.00000	0.00000	-33.053473	C
0.00005823	26288.	451432452.	15.0131683	0.0008743	-0.001572	3.2521343	0.00000	0.00000	-35.998623	C
0.00006309	28395.	450106277.	15.0491257	0.0009494	-0.001700	3.4537153	0.00000	0.00000	-38.932725	C
0.00006794	30488.	448760580.	15.0857038	0.0010249	-0.001829	3.6439153	0.00000	0.00000	-41.855484	C
0.00007279	32566.	447394708.	15.1229249	0.0011008	-0.001956	3.8225624	0.00000	0.00000	-44.766591	C
0.00007764	34630.	446007975.	15.1608129	0.0011771	-0.002084	3.9894775	0.00000	0.00000	-47.665719	C
0.00008250	36619.	443885250.	15.1888294	0.0012530	-0.002212	4.1427636	0.00000	0.00000	-50.000000	CY
0.00008735	37715.	431772198.	15.0650073	0.0013159	-0.002353	4.2599390	0.00000	0.00000	-50.000000	CY
0.00009220	38343.	415858597.	14.8774049	0.0013717	-0.002501	4.3565156	0.00000	0.00000	-50.000000	CY
0.00009705	38901.	400812716.	14.6950361	0.0014262	-0.002650	4.4442692	0.00000	0.00000	-50.000000	CY
0.0001019	39401.	386642215.	14.5221595	0.0014799	-0.002800	4.5244197	0.00000	0.00000	-50.000000	CY
0.0001068	39851.	373282704.	14.3544289	0.0015325	-0.002951	4.5968136	0.00000	0.00000	-50.000000	CY
0.0001116	40259.	360705305.	14.1946038	0.0015843	-0.003103	4.6623154	0.00000	0.00000	-50.000000	CY
0.0001165	40630.	348860650.	14.0423280	0.0016354	-0.003256	4.7212629	0.00000	0.00000	-50.000000	CY
0.0001213	40966.	337675750.	13.8940820	0.0016856	-0.003410	4.7735635	0.00000	0.00000	-50.000000	CY
0.0001262	41276.	327143022.	13.7537665	0.0017353	-0.003564	4.8200409	0.00000	0.00000	-50.000000	CY
0.0001310	41560.	317198721.	13.6196466	0.0017845	-0.003718	4.8607504	0.00000	0.00000	-50.000000	CY
0.0001359	41821.	307785272.	13.4889206	0.0018328	-0.003874	4.8956719	0.00000	0.00000	-50.000000	CY
0.0001407	42061.	298883206.	13.3646702	0.0018808	-0.004030	4.9253538	0.00000	0.00000	-50.000000	CY
0.0001456	42286.	290465886.	13.2468269	0.0019285	-0.004186	4.9499494	0.00000	0.00000	-50.000000	CY

0.0001504	42493.	282468641.	13.1312251	0.0019754	-0.004343	4.9693468	0.00000	0.00000	-50.000000 CY
0.0001553	42685.	274875870.	13.0204747	0.0020219	-0.004500	4.9839136	0.00000	0.00000	-50.000000 CY
0.0001601	42864.	267666295.	12.9150032	0.0020682	-0.004658	4.9937863	0.00000	0.00000	-50.000000 CY
0.0001650	43032.	260815463.	12.8145925	0.0021143	-0.004815	4.9990376	0.00000	0.00000	-50.000000 CY
0.0001698	43187.	254273441.	12.7152196	0.0021596	-0.004974	4.9964360	0.00000	0.00000	-50.000000 CY
0.0001747	43332.	248038790.	12.6202443	0.0022047	-0.005133	4.9997717	0.00000	0.00000	-50.000000 CY
0.0001796	43467.	242089290.	12.5295562	0.0022497	-0.005291	4.9974357	0.00000	0.00000	-50.000000 CY
0.0001844	43595.	236411878.	12.4429706	0.0022945	-0.005450	4.9999277	0.00000	0.00000	-50.000000 CY
0.0001893	43714.	230980954.	12.3591473	0.0023390	-0.005610	4.9974008	0.00000	0.00000	-50.000000 CY
0.0001990	43930.	220795570.	12.1978588	0.0024269	-0.005929	4.9962111	0.00000	0.00000	-50.000000 CY
0.0002087	44123.	211450023.	12.0497208	0.0025144	-0.006250	4.9950873	0.00000	0.00000	-50.000000 CY
0.0002184	44293.	202833292.	11.9105051	0.0026009	-0.006571	4.9998261	0.00000	0.00000	-50.000000 CY
0.0002281	44444.	194864158.	11.7784583	0.0026864	-0.006893	4.9977064	0.00000	0.00000	-50.000000 CY
0.0002378	44582.	187490325.	11.6559118	0.0027716	-0.007215	4.9940076	0.00000	0.00000	-50.000000 CY
0.0002475	44708.	180645729.	11.5416950	0.0028564	-0.007538	4.9988437	0.00000	0.00000	-50.000000 CY
0.0002572	44818.	174258628.	11.4300351	0.0029397	-0.007862	4.9914191	0.00000	0.00000	-50.000000 CY
0.0002669	44920.	168304187.	11.3257314	0.0030228	-0.008187	4.9982971	0.00000	0.00000	-50.000000 CY
0.0002766	45015.	162740773.	11.2278060	0.0031057	-0.008512	4.9958902	0.00000	0.00000	-50.000000 CY
0.0002863	45101.	157526595.	11.1357237	0.0031883	-0.008837	4.9955344	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	45101.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	22.6500	0.00	N.A.	No	0.00	508.6209
2	23.4000	0.7306	Yes	No	508.6209	143022.
3	33.4000	3.1546	No	No	143531.	600894.
4	43.4000	21.9934	No	No	744424.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.4266	1.75E-04	-1.98E-07	-0.00666	1.28E-07	2.95E+11	0.00	0.00	0.00
0.5765	2.3805	6.57E-05	-7.72E-06	-0.00666	4.82E-08	2.95E+11	0.00	0.00	0.00
1.1530	2.3344	6.85E-05	14.1129	-0.00666	5.02E-08	2.95E+11	0.00	0.00	4.0801
1.7295	2.2883	195.2667	89.1940	-0.00666	0.1431	2.95E+11	0.00	0.00	17.6259
2.3060	2.2422	1234.	259.3113	-0.00666	0.9046	2.95E+11	0.00	0.00	31.5551
2.8825	2.1961	3783.	525.7908	-0.00666	2.7730	2.95E+11	0.00	0.00	45.4843
3.4590	2.1500	8509.	888.6325	-0.00666	6.2371	2.95E+11	0.00	0.00	59.4135
4.0355	2.1039	16078.	1348.	-0.00666	11.7855	2.95E+11	0.00	0.00	73.3427
4.6120	2.0578	27158.	1903.	-0.00666	19.9068	2.95E+11	0.00	0.00	87.2719
5.1885	2.0117	42414.	2555.	-0.00666	31.0896	2.95E+11	0.00	0.00	101.2011
5.7650	1.9657	62513.	3304.	-0.00666	45.8227	2.95E+11	0.00	0.00	115.1303
6.3415	1.9196	88123.	4148.	-0.00666	64.5947	2.95E+11	0.00	0.00	129.0595
6.9180	1.8735	119909.	5089.	-0.00666	87.8942	2.95E+11	0.00	0.00	142.9887
7.4945	1.8275	158538.	6127.	-0.00665	116.2099	2.95E+11	0.00	0.00	156.9179
8.0710	1.7815	204677.	7260.	-0.00665	150.0304	2.95E+11	0.00	0.00	170.8471
8.6475	1.7355	258993.	8491.	-0.00664	189.8444	2.95E+11	0.00	0.00	184.7763
9.2240	1.6896	322152.	9817.	-0.00664	236.1404	2.95E+11	0.00	0.00	198.7055
9.8005	1.6437	394821.	11240.	-0.00663	289.4073	2.95E+11	0.00	0.00	212.6347
10.3770	1.5979	477666.	12759.	-0.00662	350.1336	2.95E+11	0.00	0.00	226.5639
10.9535	1.5522	571354.	14375.	-0.00660	418.8079	2.95E+11	0.00	0.00	240.4931
11.5300	1.5065	676552.	16086.	-0.00659	495.9190	2.95E+11	0.00	0.00	254.4223
12.1065	1.4610	793926.	17895.	-0.00657	581.9554	2.95E+11	0.00	0.00	268.3515
12.6830	1.4156	924143.	19799.	-0.00655	677.4059	2.95E+11	0.00	0.00	282.2807
13.2595	1.3703	1067870.	21800.	-0.00653	782.7590	2.95E+11	0.00	0.00	296.2099
13.8360	1.3252	1225773.	23898.	-0.00650	898.5034	2.95E+11	0.00	0.00	310.1391
14.4125	1.2803	1398519.	26091.	-0.00647	1025.	2.95E+11	0.00	0.00	324.0683
14.9890	1.2357	1586774.	28382.	-0.00644	1163.	2.95E+11	0.00	0.00	337.9975
15.5655	1.1913	1791206.	30768.	-0.00640	1313.	2.95E+11	0.00	0.00	351.9267
16.1420	1.1472	2012480.	33251.	-0.00635	1475.	2.95E+11	0.00	0.00	365.8559
16.7185	1.1034	2251263.	35830.	-0.00630	1650.	2.95E+11	0.00	0.00	379.7851
17.2950	1.0600	2508223.	38505.	-0.00625	1839.	2.95E+11	0.00	0.00	393.7143
17.8715	1.0169	2784025.	41277.	-0.00618	2041.	2.95E+11	0.00	0.00	407.6435
18.4480	0.9744	3079337.	44146.	-0.00612	2257.	2.95E+11	0.00	0.00	421.5727
19.0245	0.9323	3394825.	47110.	-0.00604	2488.	2.95E+11	0.00	0.00	435.5019
19.6010	0.8908	3731155.	50171.	-0.00596	2735.	2.95E+11	0.00	0.00	449.4311
20.1775	0.8499	4088994.	53329.	-0.00587	2997.	2.95E+11	0.00	0.00	463.3603

20.7540	0.8097	4469009.	56582.	-0.00576	3276.	2.95E+11	0.00	0.00	477.2895
21.3305	0.7701	4871867.	59932.	-0.00566	3571.	2.95E+11	0.00	0.00	491.2187
21.9070	0.7314	5298233.	63379.	-0.00554	3884.	2.95E+11	0.00	0.00	505.1479
22.4835	0.6936	5748776.	66538.	-0.00541	4214.	2.95E+11	0.00	0.00	408.2939
23.0600	0.6566	6218859.	67827.	-0.00529	0.00	4.66E+11	-35.694	376.0623	0.00
23.6365	0.6203	6687233.	67376.	-0.00520	0.00	4.63E+11	-94.863	1058.	0.00
24.2130	0.5847	7151068.	66494.	-0.00509	0.00	4.62E+11	-160.053	1894.	0.00
24.7895	0.5499	7607243.	65156.	-0.00498	0.00	4.62E+11	-226.857	2854.	0.00
25.3660	0.5158	8052560.	63356.	-0.00487	0.00	4.62E+11	-293.326	3934.	0.00
25.9425	0.4825	8483840.	61107.	-0.00474	0.00	4.62E+11	-357.061	5119.	0.00
26.5190	0.4502	8898030.	58428.	-0.00461	0.00	4.61E+11	-417.312	6413.	0.00
27.0955	0.4187	9292249.	55350.	-0.00447	0.00	4.61E+11	-472.502	7806.	0.00
27.6720	0.3883	9663855.	51916.	-0.00433	0.00	4.61E+11	-520.316	9271.	0.00
28.2485	0.3588	1.00E+07	48167.	-0.00419	0.00	4.61E+11	-563.511	10866.	0.00
28.8250	0.3303	1.03E+07	44138.	-0.00403	0.00	4.61E+11	-601.258	12591.	0.00
29.4015	0.3030	1.06E+07	39881.	-0.00388	0.00	4.60E+11	-629.573	14375.	0.00
29.9780	0.2767	1.09E+07	35448.	-0.00371	0.00	4.60E+11	-651.827	16295.	0.00
30.5545	0.2516	1.11E+07	30883.	-0.00355	0.00	4.60E+11	-668.068	18369.	0.00
31.1310	0.2276	1.13E+07	26240.	-0.00338	0.00	4.60E+11	-674.233	20490.	0.00
31.7075	0.2048	1.15E+07	21583.	-0.00321	0.00	4.60E+11	-672.162	22700.	0.00
32.2840	0.1832	1.16E+07	16970.	-0.00303	0.00	4.60E+11	-661.274	24965.	0.00
32.8605	0.1629	1.17E+07	12473.	-0.00286	0.00	4.60E+11	-638.797	27136.	0.00
33.4370	0.1437	1.18E+07	5974.	-0.00268	0.00	4.60E+11	-1240.	59713.	0.00
34.0135	0.1257	1.18E+07	-2574.	-0.00251	0.00	4.60E+11	-1231.	67717.	0.00
34.5900	0.1090	1.17E+07	-11043.	-0.00233	0.00	4.60E+11	-1218.	77279.	0.00
35.1665	0.09352	1.16E+07	-19410.	-0.00215	0.00	4.60E+11	-1201.	88844.	0.00
35.7430	0.07924	1.15E+07	-27647.	-0.00198	0.00	4.60E+11	-1180.	103036.	0.00
36.3195	0.06615	1.13E+07	-35723.	-0.00181	0.00	4.60E+11	-1155.	120764.	0.00
36.8960	0.05423	1.10E+07	-43605.	-0.00164	0.00	4.60E+11	-1124.	143405.	0.00
37.4725	0.04345	1.07E+07	-51255.	-0.00148	0.00	4.60E+11	-1087.	173151.	0.00
38.0490	0.03378	1.03E+07	-58626.	-0.00132	0.00	4.61E+11	-1044.	213752.	0.00
38.6255	0.02517	9842423.	-65663.	-0.00117	0.00	4.61E+11	-990.579	272236.	0.00
39.2020	0.01759	9364464.	-72288.	-0.00103	0.00	4.61E+11	-924.813	363710.	0.00
39.7785	0.01098	8842245.	-78389.	-8.89E-04	0.00	4.61E+11	-839.042	528615.	0.00
40.3550	0.00529	8279870.	-83758.	-7.61E-04	0.00	4.62E+11	-713.131	933017.	0.00
40.9315	4.53E-04	7683366.	-87081.	-6.41E-04	0.00	4.62E+11	-247.577	3781162.	0.00
41.5080	-0.00359	7075013.	-85611.	-5.31E-04	0.00	4.62E+11	672.7123	1297862.	0.00
42.0845	-0.00689	6498855.	-80492.	-4.29E-04	0.00	4.64E+11	807.2565	810285.	0.00
42.6610	-0.00953	5961332.	-74615.	-3.37E-04	0.00	4.68E+11	891.7541	647466.	0.00
43.2375	-0.01155	5466486.	-68234.	-2.53E-04	0.00	4.72E+11	953.0045	570617.	0.00
43.8140	-0.01302	5017250.	-63910.	-1.76E-04	0.00	4.76E+11	297.0697	157784.	0.00
44.3905	-0.01399	4582232.	-61755.	-1.23E-04	0.00	9.60E+11	325.8667	161123.	0.00
44.9670	-0.01473	4162809.	-59408.	-9.17E-05	0.00	9.60E+11	352.6766	165641.	0.00
45.5435	-0.01526	3760265.	-56882.	-6.32E-05	0.00	9.60E+11	377.5633	171164.	0.00
46.1200	-0.01560	3375790.	-54190.	-3.74E-05	0.00	9.60E+11	400.5531	177592.	0.00
46.6965	-0.01578	3010486.	-51346.	-1.44E-05	0.00	9.60E+11	421.6509	184873.	0.00
47.2730	-0.01580	2665361.	-48363.	6.00E-06	0.00	9.60E+11	440.8489	192986.	0.00
47.8495	-0.01570	2341335.	-45253.	2.40E-05	0.00	9.60E+11	458.1319	201931.	0.00
48.4260	-0.01547	2039234.	-42031.	3.98E-05	0.00	9.60E+11	473.4810	211727.	0.00
49.0025	-0.01514	1759793.	-38751.	5.35E-05	0.00	9.60E+11	474.7179	216854.	0.00
49.5790	-0.01473	1503072.	-35477.	6.53E-05	0.00	9.60E+11	471.8420	221598.	0.00
50.1555	-0.01424	1268933.	-32233.	7.52E-05	0.00	9.60E+11	465.9472	226342.	0.00
50.7320	-0.01369	1057093.	-29040.	8.36E-05	0.00	9.60E+11	457.2693	231086.	0.00
51.3085	-0.01308	867137.	-25915.	9.06E-05	0.00	9.60E+11	446.0380	235830.	0.00
51.8850	-0.01244	698529.	-22877.	9.62E-05	0.00	9.60E+11	432.4742	240574.	0.00
52.4615	-0.01175	550618.	-19939.	1.01E-04	0.00	9.60E+11	416.7870	245318.	0.00
53.0380	-0.01104	422653.	-17117.	1.04E-04	0.00	9.60E+11	399.1713	250062.	0.00
53.6145	-0.01031	313793.	-14422.	1.07E-04	0.00	9.60E+11	379.8055	254806.	0.00
54.1910	-0.00956	223110.	-11867.	1.09E-04	0.00	9.60E+11	358.8498	259550.	0.00
54.7675	-0.00881	149601.	-9462.	1.10E-04	0.00	9.60E+11	336.4448	264294.	0.00

55.3440	-0.00804	92193.	-7217.	1.11E-04	0.00	9.60E+11	312.7100	269038.	0.00
55.9205	-0.00727	49752.	-5140.	1.12E-04	0.00	9.60E+11	287.7433	273782.	0.00
56.4970	-0.00650	21081.	-3239.	1.12E-04	0.00	9.60E+11	261.6204	278526.	0.00
57.0735	-0.00572	4932.	-1524.	1.12E-04	0.00	9.60E+11	234.3948	283270.	0.00
57.6500	-0.00495	0.00	0.00	1.12E-04	0.00	9.60E+11	206.0978	144007.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 2.42655192 inches
Computed slope at pile head = -0.0066628 radians
Maximum bending moment = 11792220. inch-lbs
Maximum shear force = -87081. lbs
Depth of maximum bending moment = 34.01350000 feet below pile head
Depth of maximum shear force = 40.93150000 feet below pile head
Number of iterations = 24
Number of zero deflection points = 1
Pile deflection at ground = 0.68288598 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
57.65000	2.42655192	11792220.	-87081.
54.76750	2.43404655	11782304.	-89296.
51.88500	2.52173730	11713528.	-95687.
49.00250	2.87911660	11450381.	-109434.
46.12000	3.98077545	10979086.	-122440.
43.23750	8.79618184	10403840.	-131980.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs

Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	4.2573	2.19E-05	0.00	-0.01124	1.61E-08	2.95E+11	0.00	0.00	0.00
0.5765	4.1796	-7.67E-05	-7.12E-06	-0.01124	5.62E-08	2.95E+11	0.00	0.00	0.00
1.1530	4.1018	-7.67E-05	21.1681	-0.01124	5.62E-08	2.95E+11	0.00	0.00	6.1197
1.7295	4.0241	292.8812	133.7825	-0.01124	0.2147	2.95E+11	0.00	0.00	26.4372
2.3060	3.9464	1851.	388.9421	-0.01124	1.3568	2.95E+11	0.00	0.00	47.3297
2.8825	3.8686	5674.	788.6359	-0.01124	4.1593	2.95E+11	0.00	0.00	68.2221
3.4590	3.7909	12763.	1333.	-0.01124	9.3551	2.95E+11	0.00	0.00	89.1146
4.0355	3.7132	24116.	2022.	-0.01124	17.6771	2.95E+11	0.00	0.00	110.0071
4.6120	3.6355	40734.	2855.	-0.01123	29.8583	2.95E+11	0.00	0.00	130.8995
5.1885	3.5577	63616.	3833.	-0.01123	46.6315	2.95E+11	0.00	0.00	151.7920
5.7650	3.4800	93764.	4955.	-0.01123	68.7297	2.95E+11	0.00	0.00	172.6845
6.3415	3.4023	132175.	6222.	-0.01123	96.8859	2.95E+11	0.00	0.00	193.5769
6.9180	3.3247	179852.	7633.	-0.01123	131.8329	2.95E+11	0.00	0.00	214.4694
7.4945	3.2470	237792.	9189.	-0.01122	174.3037	2.95E+11	0.00	0.00	235.3619
8.0710	3.1694	306996.	10890.	-0.01121	225.0312	2.95E+11	0.00	0.00	256.2543
8.6475	3.0919	388465.	12735.	-0.01121	284.7484	2.95E+11	0.00	0.00	277.1468
9.2240	3.0144	483197.	14725.	-0.01120	354.1881	2.95E+11	0.00	0.00	298.0393
9.8005	2.9370	592193.	16859.	-0.01118	434.0833	2.95E+11	0.00	0.00	318.9317
10.3770	2.8597	716453.	19137.	-0.01117	525.1669	2.95E+11	0.00	0.00	339.8242
10.9535	2.7825	856976.	21560.	-0.01115	628.1719	2.95E+11	0.00	0.00	360.7167
11.5300	2.7054	1014763.	24128.	-0.01113	743.8311	2.95E+11	0.00	0.00	381.6091
12.1065	2.6285	1190813.	26840.	-0.01110	872.8775	2.95E+11	0.00	0.00	402.5016
12.6830	2.5518	1386126.	29697.	-0.01107	1016.	2.95E+11	0.00	0.00	423.3941
13.2595	2.4753	1601703.	32698.	-0.01104	1174.	2.95E+11	0.00	0.00	444.2865
13.8360	2.3991	1838542.	35844.	-0.01100	1348.	2.95E+11	0.00	0.00	465.1790
14.4125	2.3232	2097644.	39135.	-0.01095	1538.	2.95E+11	0.00	0.00	486.0715
14.9890	2.2476	2380009.	42570.	-0.01090	1745.	2.95E+11	0.00	0.00	506.9639
15.5655	2.1724	2686637.	46149.	-0.01084	1969.	2.95E+11	0.00	0.00	527.8564
16.1420	2.0976	3018527.	49873.	-0.01077	2213.	2.95E+11	0.00	0.00	548.7489
16.7185	2.0234	3376680.	53742.	-0.01070	2475.	2.95E+11	0.00	0.00	569.6413
17.2950	1.9497	3762095.	57755.	-0.01061	2758.	2.95E+11	0.00	0.00	590.5338
17.8715	1.8765	4175772.	61912.	-0.01052	3061.	2.95E+11	0.00	0.00	611.4263
18.4480	1.8041	4618711.	66214.	-0.01042	3386.	2.95E+11	0.00	0.00	632.3187
19.0245	1.7324	5091912.	70661.	-0.01030	3732.	2.95E+11	0.00	0.00	653.2112
19.6010	1.6616	5596375.	75252.	-0.01018	4102.	2.95E+11	0.00	0.00	674.1037
20.1775	1.5916	6133100.	79988.	-0.01004	4496.	2.95E+11	0.00	0.00	694.9961
20.7540	1.5227	6703087.	84868.	-0.00989	4913.	2.95E+11	0.00	0.00	715.8886
21.3305	1.4548	7307334.	89893.	-0.00972	5356.	2.95E+11	0.00	0.00	736.7811
21.9070	1.3881	7946844.	95062.	-0.00955	5825.	2.95E+11	0.00	0.00	757.6735
22.4835	1.3227	8622614.	99801.	-0.00935	6320.	2.95E+11	0.00	0.00	612.4018
23.0600	1.2587	9327694.	101768.	-0.00918	0.00	4.61E+11	-43.931	241.4504	0.00
23.6365	1.1957	1.00E+07	101211.	-0.00904	0.00	4.61E+11	-116.865	676.1628	0.00
24.2130	1.1337	1.07E+07	100124.	-0.00888	0.00	4.60E+11	-197.609	1206.	0.00
24.7895	1.0728	1.14E+07	98471.	-0.00871	0.00	4.60E+11	-280.170	1807.	0.00
25.3660	1.0131	1.21E+07	96249.	-0.00854	0.00	4.60E+11	-362.092	2472.	0.00
25.9425	0.9547	1.27E+07	93471.	-0.00835	0.00	4.59E+11	-441.038	3196.	0.00
26.5190	0.8976	1.34E+07	90161.	-0.00815	0.00	4.59E+11	-516.118	3978.	0.00
27.0955	0.8419	1.40E+07	86349.	-0.00795	0.00	4.59E+11	-585.666	4812.	0.00
27.6720	0.7877	1.46E+07	82085.	-0.00773	0.00	4.58E+11	-647.301	5685.	0.00
28.2485	0.7349	1.51E+07	77408.	-0.00751	0.00	4.58E+11	-704.836	6635.	0.00
28.8250	0.6838	1.56E+07	72349.	-0.00727	0.00	4.58E+11	-757.533	7664.	0.00
29.4015	0.6343	1.61E+07	66962.	-0.00703	0.00	4.57E+11	-799.981	8725.	0.00
29.9780	0.5865	1.66E+07	61306.	-0.00679	0.00	4.57E+11	-835.235	9852.	0.00
30.5545	0.5404	1.70E+07	55431.	-0.00653	0.00	4.57E+11	-863.176	11050.	0.00

31.1310	0.4961	1.73E+07	49403.	-0.00627	0.00	4.57E+11	-879.371	12262.	0.00
31.7075	0.4536	1.77E+07	43288.	-0.00601	0.00	4.57E+11	-888.664	13552.	0.00
32.2840	0.4130	1.79E+07	37133.	-0.00574	0.00	4.56E+11	-890.744	14920.	0.00
32.8605	0.3743	1.82E+07	31010.	-0.00546	0.00	4.56E+11	-879.290	16254.	0.00
33.4370	0.3374	1.84E+07	22658.	-0.00519	0.00	4.56E+11	-1535.	31478.	0.00
34.0135	0.3025	1.85E+07	12046.	-0.00491	0.00	4.56E+11	-1533.	35056.	0.00
34.5900	0.2695	1.85E+07	1462.	-0.00463	0.00	4.56E+11	-1527.	39197.	0.00
35.1665	0.2385	1.85E+07	-9070.	-0.00435	0.00	4.56E+11	-1518.	44027.	0.00
35.7430	0.2094	1.84E+07	-19525.	-0.00407	0.00	4.56E+11	-1505.	49711.	0.00
36.3195	0.1822	1.82E+07	-29876.	-0.00379	0.00	4.56E+11	-1488.	56471.	0.00
36.8960	0.1570	1.80E+07	-40093.	-0.00351	0.00	4.56E+11	-1466.	64608.	0.00
37.4725	0.1336	1.77E+07	-50146.	-0.00324	0.00	4.57E+11	-1440.	74546.	0.00
38.0490	0.1121	1.73E+07	-60001.	-0.00298	0.00	4.57E+11	-1409.	86901.	0.00
38.6255	0.09246	1.69E+07	-69617.	-0.00272	0.00	4.57E+11	-1371.	102606.	0.00
39.2020	0.07454	1.63E+07	-78950.	-0.00247	0.00	4.57E+11	-1327.	123149.	0.00
39.7785	0.05832	1.58E+07	-87945.	-0.00222	0.00	4.58E+11	-1274.	151081.	0.00
40.3550	0.04376	1.51E+07	-96534.	-0.00199	0.00	4.58E+11	-1209.	191203.	0.00
40.9315	0.03078	1.44E+07	-104625.	-0.00177	0.00	4.58E+11	-1130.	253909.	0.00
41.5080	0.01930	1.37E+07	-112077.	-0.00156	0.00	4.59E+11	-1025.	367331.	0.00
42.0845	0.00925	1.29E+07	-118627.	-0.00136	0.00	4.59E+11	-868.928	649920.	0.00
42.6610	5.41E-04	1.20E+07	-122715.	-0.00117	0.00	4.60E+11	-312.933	4001995.	0.00
43.2375	-0.00691	1.12E+07	-120898.	-9.94E-04	0.00	4.60E+11	838.1917	838648.	0.00
43.8140	-0.01321	1.04E+07	-116963.	-8.32E-04	0.00	4.61E+11	299.5851	156929.	0.00
44.3905	-0.01842	9561239.	-114594.	-6.82E-04	0.00	4.61E+11	385.2034	144651.	0.00
44.9670	-0.02265	8777696.	-111677.	-5.45E-04	0.00	4.61E+11	458.0911	139941.	0.00
45.5435	-0.02596	8016076.	-108289.	-4.19E-04	0.00	4.62E+11	521.5209	138985.	0.00
46.1200	-0.02844	7279415.	-104489.	-3.04E-04	0.00	4.62E+11	577.0095	140352.	0.00
46.6965	-0.03017	6570370.	-100330.	-2.01E-04	0.00	4.64E+11	625.3321	143392.	0.00
47.2730	-0.03122	5891252.	-95860.	-1.08E-04	0.00	4.68E+11	666.9075	147781.	0.00
47.8495	-0.03167	5244051.	-91125.	-2.64E-05	0.00	4.74E+11	701.9988	153358.	0.00
48.4260	-0.03159	4630447.	-86169.	2.86E-05	0.00	9.60E+11	730.7505	160054.	0.00
49.0025	-0.03127	4051816.	-81024.	5.98E-05	0.00	9.60E+11	756.6290	167380.	0.00
49.5790	-0.03076	3509396.	-75710.	8.71E-05	0.00	9.60E+11	779.6187	175353.	0.00
50.1555	-0.03007	3004288.	-70247.	1.11E-04	0.00	9.60E+11	799.7061	183998.	0.00
50.7320	-0.02923	2537452.	-64656.	1.30E-04	0.00	9.60E+11	816.8801	193348.	0.00
51.3085	-0.02826	2109712.	-58955.	1.47E-04	0.00	9.60E+11	831.1325	203445.	0.00
51.8850	-0.02719	1721748.	-53166.	1.61E-04	0.00	9.60E+11	842.4565	214341.	0.00
52.4615	-0.02603	1374103.	-47309.	1.72E-04	0.00	9.60E+11	850.8443	226095.	0.00
53.0380	-0.02481	1067179.	-41404.	1.81E-04	0.00	9.60E+11	856.2844	238780.	0.00
53.6145	-0.02353	801235.	-35472.	1.88E-04	0.00	9.60E+11	858.7566	252483.	0.00
54.1910	-0.02221	576391.	-29619.	1.93E-04	0.00	9.60E+11	833.3220	259550.	0.00
54.7675	-0.02086	391428.	-23979.	1.96E-04	0.00	9.60E+11	797.0810	264294.	0.00
55.3440	-0.01950	244612.	-18600.	1.98E-04	0.00	9.60E+11	758.2336	269038.	0.00
55.9205	-0.01812	134084.	-13497.	2.00E-04	0.00	9.60E+11	717.0290	273782.	0.00
56.4970	-0.01673	57873.	-8686.	2.01E-04	0.00	9.60E+11	673.6641	278526.	0.00
57.0735	-0.01534	13902.	-4183.	2.01E-04	0.00	9.60E+11	628.2806	283270.	0.00
57.6500	-0.01395	0.00	0.00	2.01E-04	0.00	9.60E+11	580.9639	144007.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 4.25730938 inches
Computed slope at pile head = -0.0112362 radians

Maximum bending moment = 18537587. inch-lbs
Maximum shear force = -122715. lbs
Depth of maximum bending moment = 34.59000000 feet below pile head
Depth of maximum shear force = 42.66100000 feet below pile head
Number of iterations = 23
Number of zero deflection points = 1
Pile deflection at ground = 1.30422124 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
57.65000	4.25730938	18537587.	-122715.
54.76750	4.32013098	18476768.	-129385.
51.88500	4.70606973	18207065.	-144905.
49.00250	5.95986126	17513233.	-164872.
46.12000	10.79637016	17091598.	-187337.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

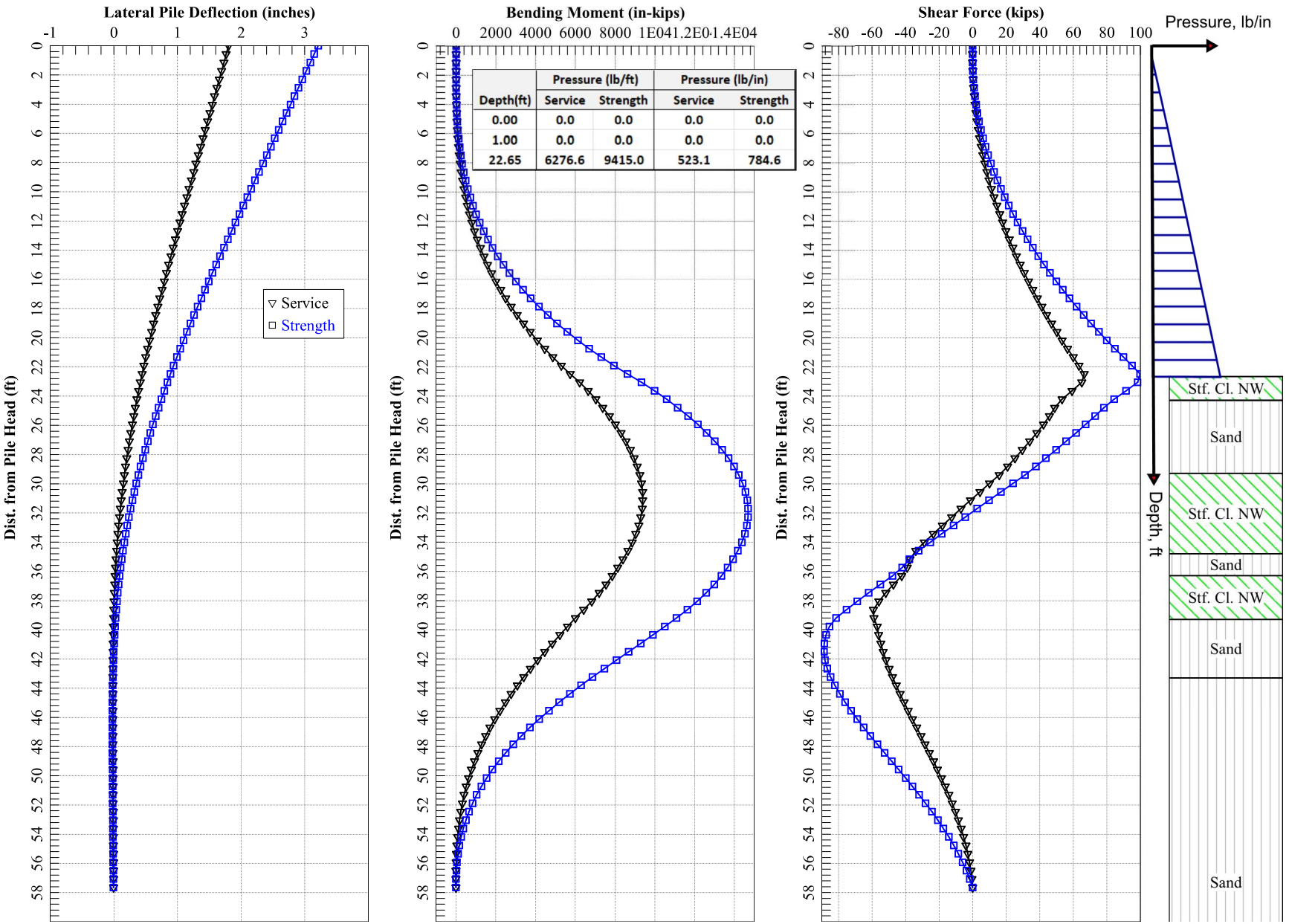
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	2.4266	-0.00666	-87081.	1.18E+07
2	V, lb	0.00	M, in-lb	0.00	0.00	4.2573	-0.01124	-122715.	1.85E+07

Maximum pile-head deflection = 4.2573093792 inches
Maximum pile-head rotation = -0.0112362122 radians = -0.643788 deg.

The analysis ended normally.

Wall 1B (22.65ft): Boring B-001-0-02



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
22.65	6276.6	9415.0	523.1	784.6

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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1B\

Name of input data file:
Wall_1B-22.65_B-001-0-02.lp12d

Name of output report file:
Wall_1B-22.65_B-001-0-02.lp12o

Name of plot output file:
Wall_1B-22.65_B-001-0-02.lp12p

Name of runtime message file:
Wall_1B-22.65_B-001-0-02.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 13:42:33

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1B (H=22.65FT), Boring B-001-0-

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Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 57.650 ft
Depth of ground surface below top of pile = 22.6500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	15.1000
2	22.650	15.1000
3	22.650	42.0000
4	57.650	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 22.650000 ft
   AISC Section Type = W
   AISC Section Name = W30X211
   Pile width = 15.100000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 35.000000 ft
   Section Diameter = 42.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W30X211

Soil and Rock Layering Information

The soil profile is modelled using 7 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer = 22.650000 ft
   Distance from top of pile to bottom of layer = 24.280000 ft
   Effective unit weight at top of layer = 57.600000 pcf
   Effective unit weight at bottom of layer = 57.600000 pcf
   Undrained cohesion at top of layer = 2500. psf
   Undrained cohesion at bottom of layer = 2500. psf
   Epsilon-50 at top of layer = 0.005000
   Epsilon-50 at bottom of layer = 0.005000

Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 24.280000 ft
   Distance from top of pile to bottom of layer = 29.280000 ft
   Effective unit weight at top of layer = 62.600000 pcf

```
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    32.000000 deg.
   Friction angle at bottom of layer                  =    32.000000 deg.
   Subgrade k at top of layer                         =    60.000000 pci
   Subgrade k at bottom of layer                      =    60.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer          =    29.280000 ft
   Distance from top of pile to bottom of layer       =    34.780000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000


Layer 4 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    34.780000 ft
   Distance from top of pile to bottom of layer       =    36.280000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Friction angle at top of layer                     =    32.000000 deg.
   Friction angle at bottom of layer                  =    32.000000 deg.
   Subgrade k at top of layer                         =    60.000000 pci
   Subgrade k at bottom of layer                      =    60.000000 pci


Layer 5 is stiff clay without free water

   Distance from top of pile to top of layer          =    36.280000 ft
   Distance from top of pile to bottom of layer       =    39.280000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3000. psf
   Undrained cohesion at bottom of layer              =        3000. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000


Layer 6 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    39.280000 ft
   Distance from top of pile to bottom of layer       =    43.280000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    34.000000 deg.
   Friction angle at bottom of layer                  =    34.000000 deg.
   Subgrade k at top of layer                         =   125.000000 pci
   Subgrade k at bottom of layer                      =   125.000000 pci


Layer 7 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    43.280000 ft
```

Distance from top of pile to bottom of layer	=	71.280000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Friction angle at top of layer	=	34.000000 deg.
Friction angle at bottom of layer	=	34.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

(Depth of the lowest soil layer extends 13.630 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay	22.6500	57.6000	2500.	--	0.00500	--
	w/o Free Water	24.2800	57.6000	2500.	--	0.00500	--
2	Sand	24.2800	62.6000	--	32.0000	--	60.0000
	(Reese, et al.)	29.2800	62.6000	--	32.0000	--	60.0000
3	Stiff Clay	29.2800	57.6000	2500.	--	0.00500	--
	w/o Free Water	34.7800	57.6000	2500.	--	0.00500	--
4	Sand	34.7800	67.6000	--	32.0000	--	60.0000
	(Reese, et al.)	36.2800	67.6000	--	32.0000	--	60.0000
5	Stiff Clay	36.2800	62.6000	3000.	--	0.00500	--
	w/o Free Water	39.2800	62.6000	3000.	--	0.00500	--
6	Sand	39.2800	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	43.2800	62.6000	--	34.0000	--	125.0000
7	Sand	43.2800	67.6000	--	34.0000	--	125.0000
	(Reese, et al.)	71.2800	67.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	22.650	0.7930	1.0000
2	58.000	0.7930	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.650	523.100

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	22.650	784.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1		Condition 2		Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M =	0.0000 in-lbs		0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M =	0.0000 in-lbs		0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	22.650000 ft
Flange Width	=	15.100000 in
Section Depth	=	30.900000 in
Flange Thickness	=	1.320000 in
Web Thickness	=	0.775000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	62.300000 sq. in.
Moment of Inertia	=	10300. in^4
Elastic Bending Stiffness	=	298700000. kip-in^2
Plastic Modulus, Z	=	751.000000in^3
Plastic Moment Capacity = Fy Z	=	37550.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	3115.000 kips
Nominal Axial Tensile Capacity	=	-3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000485	1432.	295083151.	15.4500000	2.1525124	
0.00000971	2864.	295083151.	15.4500000	4.3050249	
0.00001456	4296.	295083151.	15.4500000	6.4575373	
0.00001941	5728.	295083151.	15.4500000	8.6100497	
0.00002426	7160.	295083151.	15.4500000	10.7625622	
0.00002912	8592.	295083151.	15.4500000	12.9150746	
0.00003397	10024.	295083151.	15.4500000	15.0675870	
0.00003882	11456.	295083151.	15.4500000	17.2200995	
0.00004367	12888.	295083151.	15.4500000	19.3726119	
0.00004853	14320.	295083151.	15.4500000	21.5251243	

0.00005338	15751.	295083151.	15.4500000	23.6776367	
0.00005823	17183.	295083151.	15.4500000	25.8301492	
0.00006309	18615.	295083151.	15.4500000	27.9826616	
0.00006794	20047.	295083151.	15.4500000	30.1351740	
0.00007279	21479.	295083151.	15.4500000	32.2876865	
0.00007764	22911.	295083151.	15.4500000	34.4401989	
0.00008250	24343.	295083151.	15.4500000	36.5927113	
0.00008735	25775.	295083151.	15.4500000	38.7452238	
0.00009220	27207.	295083151.	15.4500000	40.8977362	
0.00009705	28639.	295083151.	15.4500000	43.0502486	
0.0001019	30071.	295083151.	15.4500000	45.2027611	
0.0001068	31503.	295083151.	15.4500000	47.3552735	
0.0001116	32935.	295083151.	15.4500000	49.5077859	
0.0001165	34044.	292307880.	15.4500000	50.0000000	Y
0.0001213	34575.	284995783.	15.4500000	50.0000000	Y
0.0001262	34790.	275739512.	15.4500000	50.0000000	Y
0.0001310	34966.	266868715.	15.4500000	50.0000000	Y
0.0001359	35122.	258487947.	15.4500000	50.0000000	Y
0.0001407	35264.	250579303.	15.4500000	50.0000000	Y
0.0001456	35391.	243099330.	15.4500000	50.0000000	Y
0.0001504	35505.	236019417.	15.4500000	50.0000000	Y
0.0001553	35610.	229315925.	15.4500000	50.0000000	Y
0.0001601	35705.	222960902.	15.4500000	50.0000000	Y
0.0001650	35792.	216929374.	15.4500000	50.0000000	Y
0.0001698	35871.	211198919.	15.4500000	50.0000000	Y
0.0001747	35944.	205749308.	15.4500000	50.0000000	Y
0.0001796	36011.	200562216.	15.4500000	50.0000000	Y
0.0001844	36073.	195620966.	15.4500000	50.0000000	Y
0.0001893	36131.	190910319.	15.4500000	50.0000000	Y
0.0001990	36232.	182106169.	15.4500000	50.0000000	Y
0.0002087	36320.	174059609.	15.4500000	50.0000000	Y
0.0002184	36398.	166676877.	15.4500000	50.0000000	Y
0.0002281	36465.	159878558.	15.4500000	50.0000000	Y
0.0002378	36524.	153601157.	15.4500000	50.0000000	Y
0.0002475	36576.	147788407.	15.4500000	50.0000000	Y
0.0002572	36622.	142390326.	15.4500000	50.0000000	Y
0.0002669	36663.	137366631.	15.4500000	50.0000000	Y
0.0002766	36700.	132681405.	15.4500000	50.0000000	Y
0.0002863	36734.	128303239.	15.4500000	50.0000000	Y
0.0002960	36764.	124195919.	15.4500000	50.0000000	Y
0.0003057	36791.	120343276.	15.4500000	50.0000000	Y
0.0003154	36816.	116719671.	15.4500000	50.0000000	Y
0.0003251	36839.	113304545.	15.4500000	50.0000000	Y
0.0003348	36860.	110083253.	15.4500000	50.0000000	Y
0.0003445	36879.	107036760.	15.4500000	50.0000000	Y
0.0003542	36896.	104153806.	15.4500000	50.0000000	Y
0.0003640	36913.	101421133.	15.4500000	50.0000000	Y
0.0003737	36927.	98825527.	15.4500000	50.0000000	Y
0.0003834	36941.	96361344.	15.4500000	50.0000000	Y
0.0003931	36954.	94012990.	15.4500000	50.0000000	Y
0.0004028	36965.	91776809.	15.4500000	50.0000000	Y
0.0004125	36977.	89645860.	15.4500000	50.0000000	Y
0.0004222	36987.	87607806.	15.4500000	50.0000000	Y
0.0004319	36996.	85660884.	15.4500000	50.0000000	Y
0.0004416	37006.	83799541.	15.4500000	50.0000000	Y
0.0004513	37014.	82015996.	15.4500000	50.0000000	Y
0.0004610	37021.	80305397.	15.4500000	50.0000000	Y
0.0004707	37029.	78665338.	15.4500000	50.0000000	Y

0.0004804	37036.	77091545.	15.4500000	50.0000000	Y
0.0004901	37043.	75578316.	15.4500000	50.0000000	Y
0.0004998	37048.	74122177.	15.4500000	50.0000000	Y
0.0005095	37054.	72721510.	15.4500000	50.0000000	Y
0.0005192	37060.	71373205.	15.4500000	50.0000000	Y
0.0005289	37065.	70074379.	15.4500000	50.0000000	Y
0.0005387	37070.	68820390.	15.4500000	50.0000000	Y
0.0005484	37074.	67610134.	15.4500000	50.0000000	Y
0.0005581	37079.	66441975.	15.4500000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	37079.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	35.000000 ft
Outside Diameter of Casing	=	42.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	15.100000 in
Depth of Core/Insert	=	30.900000 in
Flange Thickness of Core/Insert	=	1.320000 in
Web Thickness of Core/Insert	=	0.775000 in
Moment of Inertia of Steel Core/Insert	=	10300. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1385. sq. in.
Area of Concrete	=	1324. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.

Cross-sectional Area of Steel Core/Insert = 62.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars) = 61.765500 sq. in.
Area Ratio of All Steel to Gross Area = 4.46 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 8738.355 kips
Tensile Load for Cracking of Concrete = -820.889 kips
Nominal Axial Tensile Capacity = -3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000485	4660.	960219131.	21.0000000	0.0001019	-0.000102	0.4669443	0.00000	0.00000	2.1573676	
0.00000971	4660.	480109566.	14.6786786	0.0001425	-0.000265	0.6436927	0.00000	0.00000	-6.093915	C
0.00001456	6734.	462580705.	14.7100701	0.0002142	-0.000397	0.9508630	0.00000	0.00000	-9.127620	C
0.00001941	8956.	461406788.	14.7419299	0.0002862	-0.000529	1.2480931	0.00000	0.00000	-12.152225	C
0.00002426	11167.	460217660.	14.7742726	0.0003585	-0.000661	1.5352611	0.00000	0.00000	-15.167524	C
0.00002912	13365.	459012879.	14.8071132	0.0004311	-0.000792	1.8122410	0.00000	0.00000	-18.173299	C
0.00003397	15551.	457791985.	14.8404677	0.0005041	-0.000923	2.0789023	0.00000	0.00000	-21.169324	C
0.00003882	17724.	456554495.	14.8743527	0.0005774	-0.001053	2.3351099	0.00000	0.00000	-24.155365	C
0.00004367	19885.	455299908.	14.9087857	0.0006511	-0.001183	2.5807239	0.00000	0.00000	-27.131174	C
0.00004853	22033.	454028676.	14.9430314	0.0007251	-0.001313	2.8154844	0.00000	0.00000	-30.097555	C
0.00005338	24167.	452739722.	14.9778102	0.0007995	-0.001442	3.0393377	0.00000	0.00000	-33.053473	C
0.00005823	26288.	451432452.	15.0131683	0.0008743	-0.001572	3.2521343	0.00000	0.00000	-35.998623	C
0.00006309	28395.	450106277.	15.0491257	0.0009494	-0.001700	3.4537153	0.00000	0.00000	-38.932725	C
0.00006794	30488.	448760580.	15.0857038	0.0010249	-0.001829	3.6439153	0.00000	0.00000	-41.855484	C
0.00007279	32566.	447394708.	15.1229249	0.0011008	-0.001956	3.8225624	0.00000	0.00000	-44.766591	C
0.00007764	34630.	446007975.	15.1608129	0.0011771	-0.002084	3.9894775	0.00000	0.00000	-47.665719	C
0.00008250	36619.	443885250.	15.1888294	0.0012530	-0.002212	4.1427636	0.00000	0.00000	-50.000000	CY
0.00008735	37715.	431772198.	15.0650073	0.0013159	-0.002353	4.2599390	0.00000	0.00000	-50.000000	CY
0.00009220	38343.	415858597.	14.8774049	0.0013717	-0.002501	4.3565156	0.00000	0.00000	-50.000000	CY
0.00009705	38901.	400812716.	14.6950361	0.0014262	-0.002650	4.4442692	0.00000	0.00000	-50.000000	CY
0.0001019	39401.	386642215.	14.5221595	0.0014799	-0.002800	4.5244197	0.00000	0.00000	-50.000000	CY
0.0001068	39851.	373282704.	14.3544289	0.0015325	-0.002951	4.5968136	0.00000	0.00000	-50.000000	CY
0.0001116	40259.	360705305.	14.1946038	0.0015843	-0.003103	4.6623154	0.00000	0.00000	-50.000000	CY
0.0001165	40630.	348860650.	14.0423280	0.0016354	-0.003256	4.7212629	0.00000	0.00000	-50.000000	CY

0.0001213	40966.	337675750.	13.8940820	0.0016856	-0.003410	4.7735635	0.00000	0.00000	-50.000000 CY
0.0001262	41276.	327143022.	13.7537665	0.0017353	-0.003564	4.8200409	0.00000	0.00000	-50.000000 CY
0.0001310	41560.	317198721.	13.6196466	0.0017845	-0.003718	4.8607504	0.00000	0.00000	-50.000000 CY
0.0001359	41821.	307785272.	13.4889206	0.0018328	-0.003874	4.8956719	0.00000	0.00000	-50.000000 CY
0.0001407	42061.	298883206.	13.3646702	0.0018808	-0.004030	4.9253538	0.00000	0.00000	-50.000000 CY
0.0001456	42286.	290465886.	13.2468269	0.0019285	-0.004186	4.9499494	0.00000	0.00000	-50.000000 CY
0.0001504	42493.	282468641.	13.1312251	0.0019754	-0.004343	4.9693468	0.00000	0.00000	-50.000000 CY
0.0001553	42685.	274875870.	13.0204747	0.0020219	-0.004500	4.9839136	0.00000	0.00000	-50.000000 CY
0.0001601	42864.	267666295.	12.9150032	0.0020682	-0.004658	4.9937863	0.00000	0.00000	-50.000000 CY
0.0001650	43032.	260815463.	12.8145925	0.0021143	-0.004815	4.9990376	0.00000	0.00000	-50.000000 CY
0.0001698	43187.	254273441.	12.7152196	0.0021596	-0.004974	4.9964360	0.00000	0.00000	-50.000000 CY
0.0001747	43332.	248038790.	12.6202443	0.0022047	-0.005133	4.9997717	0.00000	0.00000	-50.000000 CY
0.0001796	43467.	242089290.	12.5295562	0.0022497	-0.005291	4.9974357	0.00000	0.00000	-50.000000 CY
0.0001844	43595.	236411878.	12.4429706	0.0022945	-0.005450	4.9999277	0.00000	0.00000	-50.000000 CY
0.0001893	43714.	230980954.	12.3591473	0.0023390	-0.005610	4.9974008	0.00000	0.00000	-50.000000 CY
0.0001990	43930.	220795570.	12.1978588	0.0024269	-0.005929	4.9962111	0.00000	0.00000	-50.000000 CY
0.0002087	44123.	211450023.	12.0497208	0.0025144	-0.006250	4.9950873	0.00000	0.00000	-50.000000 CY
0.0002184	44293.	202833292.	11.9105051	0.0026009	-0.006571	4.9998261	0.00000	0.00000	-50.000000 CY
0.0002281	44444.	194864158.	11.7784583	0.0026864	-0.006893	4.9977064	0.00000	0.00000	-50.000000 CY
0.0002378	44582.	187490325.	11.6559118	0.0027716	-0.007215	4.9940076	0.00000	0.00000	-50.000000 CY
0.0002475	44708.	180645729.	11.5416950	0.0028564	-0.007538	4.9988437	0.00000	0.00000	-50.000000 CY
0.0002572	44818.	174258628.	11.4300351	0.0029397	-0.007862	4.9914191	0.00000	0.00000	-50.000000 CY
0.0002669	44920.	168304187.	11.3257314	0.0030228	-0.008187	4.9982971	0.00000	0.00000	-50.000000 CY
0.0002766	45015.	162740773.	11.2278060	0.0031057	-0.008512	4.9958902	0.00000	0.00000	-50.000000 CY
0.0002863	45101.	157526595.	11.1357237	0.0031883	-0.008837	4.9955344	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	45101.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Top of Layer	Equivalent Top Depth	Same Layer	Layer is	F0	F1

Layer No.	Below Pile Head ft	Below Grnd Surf ft	Type As Layer Above	Rock or is Below Rock Layer	Integral for Layer lbs	Integral for Layer lbs
1	22.6500	0.00	N.A.	No	0.00	44625.
2	24.2800	6.3964	No	No	44625.	99382.
3	29.2800	4.8340	No	No	144007.	205310.
4	34.7800	17.5012	No	No	349317.	75289.
5	36.2800	10.4897	No	No	424606.	156100.
6	39.2800	20.1143	No	No	580706.	341038.
7	43.2800	24.0750	Yes	No	921745.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.8028	-1.23E-05	9.89E-08	-0.00527	9.03E-09	2.95E+11	0.00	0.00	0.00
0.5765	1.7663	2.05E-05	2.08E-06	-0.00527	1.51E-08	2.95E+11	0.00	0.00	0.00
1.1530	1.7299	1.64E-05	14.1129	-0.00527	1.20E-08	2.95E+11	0.00	0.00	4.0801
1.7295	1.6934	195.2667	89.1940	-0.00527	0.1431	2.95E+11	0.00	0.00	17.6259
2.3060	1.6569	1234.	259.3113	-0.00527	0.9046	2.95E+11	0.00	0.00	31.5551
2.8825	1.6204	3783.	525.7908	-0.00527	2.7730	2.95E+11	0.00	0.00	45.4843
3.4590	1.5839	8509.	888.6325	-0.00527	6.2371	2.95E+11	0.00	0.00	59.4135
4.0355	1.5474	16078.	1348.	-0.00527	11.7855	2.95E+11	0.00	0.00	73.3427
4.6120	1.5110	27158.	1903.	-0.00527	19.9068	2.95E+11	0.00	0.00	87.2719
5.1885	1.4745	42414.	2555.	-0.00527	31.0896	2.95E+11	0.00	0.00	101.2011
5.7650	1.4380	62513.	3304.	-0.00527	45.8227	2.95E+11	0.00	0.00	115.1303
6.3415	1.4016	88123.	4148.	-0.00527	64.5947	2.95E+11	0.00	0.00	129.0595
6.9180	1.3651	119909.	5089.	-0.00527	87.8942	2.95E+11	0.00	0.00	142.9887
7.4945	1.3287	158538.	6127.	-0.00526	116.2099	2.95E+11	0.00	0.00	156.9179
8.0710	1.2923	204677.	7260.	-0.00526	150.0304	2.95E+11	0.00	0.00	170.8471
8.6475	1.2559	258993.	8491.	-0.00525	189.8444	2.95E+11	0.00	0.00	184.7763
9.2240	1.2196	322152.	9817.	-0.00525	236.1404	2.95E+11	0.00	0.00	198.7055
9.8005	1.1834	394821.	11240.	-0.00524	289.4073	2.95E+11	0.00	0.00	212.6347
10.3770	1.1471	477666.	12759.	-0.00523	350.1336	2.95E+11	0.00	0.00	226.5639
10.9535	1.1110	571354.	14375.	-0.00522	418.8079	2.95E+11	0.00	0.00	240.4931
11.5300	1.0750	676552.	16086.	-0.00520	495.9190	2.95E+11	0.00	0.00	254.4223
12.1065	1.0391	793926.	17895.	-0.00518	581.9554	2.95E+11	0.00	0.00	268.3515

12.6830	1.0033	924143.	19799.	-0.00516	677.4059	2.95E+11	0.00	0.00	282.2807
13.2595	0.9676	1067870.	21800.	-0.00514	782.7590	2.95E+11	0.00	0.00	296.2099
13.8360	0.9321	1225773.	23898.	-0.00511	898.5034	2.95E+11	0.00	0.00	310.1391
14.4125	0.8969	1398519.	26091.	-0.00508	1025.	2.95E+11	0.00	0.00	324.0683
14.9890	0.8618	1586774.	28382.	-0.00505	1163.	2.95E+11	0.00	0.00	337.9975
15.5655	0.8270	1791206.	30768.	-0.00501	1313.	2.95E+11	0.00	0.00	351.9267
16.1420	0.7925	2012480.	33251.	-0.00496	1475.	2.95E+11	0.00	0.00	365.8559
16.7185	0.7584	2251263.	35830.	-0.00491	1650.	2.95E+11	0.00	0.00	379.7851
17.2950	0.7245	2508223.	38505.	-0.00486	1839.	2.95E+11	0.00	0.00	393.7143
17.8715	0.6911	2784025.	41277.	-0.00480	2041.	2.95E+11	0.00	0.00	407.6435
18.4480	0.6582	3079337.	44146.	-0.00473	2257.	2.95E+11	0.00	0.00	421.5727
19.0245	0.6257	3394825.	47110.	-0.00465	2488.	2.95E+11	0.00	0.00	435.5019
19.6010	0.5938	3731155.	50171.	-0.00457	2735.	2.95E+11	0.00	0.00	449.4311
20.1775	0.5625	4088994.	53329.	-0.00448	2997.	2.95E+11	0.00	0.00	463.3603
20.7540	0.5319	4469009.	56582.	-0.00438	3276.	2.95E+11	0.00	0.00	477.2895
21.3305	0.5020	4871867.	59932.	-0.00427	3571.	2.95E+11	0.00	0.00	491.2187
21.9070	0.4729	5298233.	63379.	-0.00415	3884.	2.95E+11	0.00	0.00	505.1479
22.4835	0.4446	5748776.	66538.	-0.00402	4214.	2.95E+11	0.00	0.00	408.2939
23.0600	0.4173	6218859.	65054.	-0.00390	0.00	4.66E+11	-837.540	13885.	0.00
23.6365	0.3906	6648858.	59218.	-0.00381	0.00	4.63E+11	-849.497	15045.	0.00
24.2130	0.3646	7038202.	53304.	-0.00371	0.00	4.62E+11	-860.237	16321.	0.00
24.7895	0.3393	7386375.	48895.	-0.00360	0.00	4.62E+11	-414.537	8451.	0.00
25.3660	0.3148	7714709.	45772.	-0.00348	0.00	4.62E+11	-488.234	10728.	0.00
25.9425	0.2911	8019678.	42190.	-0.00337	0.00	4.62E+11	-547.301	13005.	0.00
26.5190	0.2683	8298452.	38247.	-0.00324	0.00	4.62E+11	-592.597	15282.	0.00
27.0955	0.2462	8548866.	34036.	-0.00312	0.00	4.62E+11	-625.018	17559.	0.00
27.6720	0.2251	8769368.	29641.	-0.00299	0.00	4.61E+11	-645.486	19836.	0.00
28.2485	0.2049	8958977.	25209.	-0.00286	0.00	4.61E+11	-635.818	21467.	0.00
28.8250	0.1856	9118157.	20854.	-0.00272	0.00	4.61E+11	-623.114	23225.	0.00
29.4015	0.1673	9247515.	15822.	-0.00258	0.00	4.61E+11	-831.805	34404.	0.00
29.9780	0.1499	9337065.	10075.	-0.00244	0.00	4.61E+11	-829.551	38291.	0.00
30.5545	0.1335	9386913.	4350.	-0.00230	0.00	4.61E+11	-825.511	42791.	0.00
31.1310	0.1180	9397253.	-1340.	-0.00216	0.00	4.61E+11	-819.592	48043.	0.00
31.7075	0.1036	9368368.	-6983.	-0.00202	0.00	4.61E+11	-811.687	54226.	0.00
32.2840	0.09006	9300638.	-12563.	-0.00188	0.00	4.61E+11	-801.664	61581.	0.00
32.8605	0.07753	9194540.	-18067.	-0.00174	0.00	4.61E+11	-789.360	70435.	0.00
33.4370	0.06595	9050665.	-23476.	-0.00161	0.00	4.61E+11	-774.569	81245.	0.00
34.0135	0.05532	8869720.	-28774.	-0.00147	0.00	4.61E+11	-757.026	94672.	0.00
34.5900	0.04560	8652544.	-33940.	-0.00134	0.00	4.62E+11	-736.369	111708.	0.00
35.1665	0.03678	8400127.	-37396.	-0.00121	0.00	4.62E+11	-262.873	49439.	0.00
35.7430	0.02884	8135130.	-39051.	-0.00109	0.00	4.62E+11	-215.566	51716.	0.00
36.3195	0.02173	7859815.	-42350.	-9.68E-04	0.00	4.62E+11	-738.160	234989.	0.00
36.8960	0.01544	7549173.	-47295.	-8.53E-04	0.00	4.62E+11	-691.282	309718.	0.00
37.4725	0.00993	7205447.	-51869.	-7.42E-04	0.00	4.62E+11	-631.251	439676.	0.00
38.0490	0.00517	6831511.	-55943.	-6.37E-04	0.00	4.63E+11	-546.553	731377.	0.00
38.6255	0.00111	6431417.	-59147.	-5.38E-04	0.00	4.64E+11	-379.769	2358068.	0.00
39.2020	-0.00228	6013147.	-58864.	-4.46E-04	0.00	4.67E+11	461.7538	1401887.	0.00
39.7785	-0.00506	5616977.	-56910.	-3.60E-04	0.00	4.70E+11	103.0015	140950.	0.00
40.3550	-0.00726	5225736.	-56025.	-2.81E-04	0.00	4.74E+11	152.9088	145694.	0.00
40.9315	-0.00894	4841814.	-54824.	-2.07E-04	0.00	4.78E+11	194.3618	150438.	0.00
41.5080	-0.01013	4467193.	-53366.	-1.56E-04	0.00	9.60E+11	227.2386	155182.	0.00
42.0845	-0.01110	4103447.	-51692.	-1.25E-04	0.00	9.60E+11	256.6036	159926.	0.00
42.6610	-0.01187	3751982.	-49827.	-9.71E-05	0.00	9.60E+11	282.4304	164670.	0.00
43.2375	-0.01244	3414034.	-47796.	-7.13E-05	0.00	9.60E+11	304.7272	169414.	0.00
43.8140	-0.01285	3090670.	-45623.	-4.79E-05	0.00	9.60E+11	323.5333	174158.	0.00
44.3905	-0.01311	2782790.	-43332.	-2.67E-05	0.00	9.60E+11	338.9155	178902.	0.00
44.9670	-0.01322	2491130.	-40946.	-7.70E-06	0.00	9.60E+11	350.9641	183646.	0.00
45.5435	-0.01321	2216266.	-38487.	9.26E-06	0.00	9.60E+11	359.7898	188390.	0.00

46.1200	-0.01309	1958622.	-35978.	2.43E-05	0.00	9.60E+11	365.5196	193134.	0.00
46.6965	-0.01288	1718471.	-33440.	3.75E-05	0.00	9.60E+11	368.2935	197878.	0.00
47.2730	-0.01257	1495946.	-30892.	4.91E-05	0.00	9.60E+11	368.2612	202622.	0.00
47.8495	-0.01220	1291045.	-28354.	5.92E-05	0.00	9.60E+11	365.5791	207366.	0.00
48.4260	-0.01175	1103641.	-25843.	6.78E-05	0.00	9.60E+11	360.4068	212110.	0.00
49.0025	-0.01126	933485.	-23375.	7.51E-05	0.00	9.60E+11	352.9047	216854.	0.00
49.5790	-0.01072	780218.	-20967.	8.13E-05	0.00	9.60E+11	343.2314	221598.	0.00
50.1555	-0.01013	643379.	-18633.	8.64E-05	0.00	9.60E+11	331.5410	226342.	0.00
50.7320	-0.00952	522406.	-16387.	9.06E-05	0.00	9.60E+11	317.9815	231086.	0.00
51.3085	-0.00888	416652.	-14240.	9.40E-05	0.00	9.60E+11	302.6923	235830.	0.00
51.8850	-0.00822	325384.	-12204.	9.67E-05	0.00	9.60E+11	285.8032	240574.	0.00
52.4615	-0.00754	247794.	-10291.	9.88E-05	0.00	9.60E+11	267.4328	245318.	0.00
53.0380	-0.00685	183004.	-8509.	1.00E-04	0.00	9.60E+11	247.6874	250062.	0.00
53.6145	-0.00615	130067.	-6868.	1.01E-04	0.00	9.60E+11	226.6607	254806.	0.00
54.1910	-0.00545	87978.	-5377.	1.02E-04	0.00	9.60E+11	204.4329	259550.	0.00
54.7675	-0.00474	55673.	-4043.	1.03E-04	0.00	9.60E+11	181.0707	264294.	0.00
55.3440	-0.00403	32034.	-2875.	1.03E-04	0.00	9.60E+11	156.6277	269038.	0.00
55.9205	-0.00331	15891.	-1880.	1.03E-04	0.00	9.60E+11	131.1450	273782.	0.00
56.4970	-0.00260	6024.	-1064.	1.03E-04	0.00	9.60E+11	104.6515	278526.	0.00
57.0735	-0.00188	1165.	-435.361	1.03E-04	0.00	9.60E+11	77.1658	283270.	0.00
57.6500	-0.00117	0.00	0.00	1.03E-04	0.00	9.60E+11	48.6974	144007.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

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Pile-head deflection             =     1.80282454 inches
Computed slope at pile head      =     -0.0052736 radians
Maximum bending moment           =       9397253. inch-lbs
Maximum shear force              =         66538. lbs
Depth of maximum bending moment  =    31.13100000 feet below pile head
Depth of maximum shear force     =    22.48350000 feet below pile head
Number of iterations             =             27
Number of zero deflection points =              1
Pile deflection at ground        =     0.43673843 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs

57.65000	1.80282454	9397253.	66538.
54.76750	1.81590414	9391289.	66494.
51.88500	1.80512836	9370063.	65846.
49.00250	1.90906198	9308512.	-70174.
46.12000	2.19261134	9030668.	-80086.
43.23750	2.90980649	8468771.	-86689.
40.35500	5.44013676	8059393.	-93403.
37.47250	20.90100594	7521780.	-107255.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.2105	-9.58E-05	0.00	-0.00896	7.02E-08	2.95E+11	0.00	0.00	0.00
0.5765	3.1485	2.74E-06	7.32E-06	-0.00896	2.01E-09	2.95E+11	0.00	0.00	0.00
1.1530	3.0865	5.48E-06	21.1681	-0.00896	4.01E-09	2.95E+11	0.00	0.00	6.1197
1.7295	3.0245	292.8813	133.7825	-0.00896	0.2147	2.95E+11	0.00	0.00	26.4372
2.3060	2.9625	1851.	388.9421	-0.00896	1.3568	2.95E+11	0.00	0.00	47.3297
2.8825	2.9005	5674.	788.6359	-0.00896	4.1593	2.95E+11	0.00	0.00	68.2221
3.4590	2.8385	12763.	1333.	-0.00896	9.3551	2.95E+11	0.00	0.00	89.1146
4.0355	2.7765	24116.	2022.	-0.00896	17.6771	2.95E+11	0.00	0.00	110.0071
4.6120	2.7145	40734.	2855.	-0.00896	29.8583	2.95E+11	0.00	0.00	130.8995
5.1885	2.6526	63616.	3833.	-0.00896	46.6315	2.95E+11	0.00	0.00	151.7920
5.7650	2.5906	93764.	4955.	-0.00896	68.7297	2.95E+11	0.00	0.00	172.6845
6.3415	2.5286	132175.	6222.	-0.00895	96.8859	2.95E+11	0.00	0.00	193.5769
6.9180	2.4667	179852.	7633.	-0.00895	131.8329	2.95E+11	0.00	0.00	214.4694
7.4945	2.4048	237792.	9189.	-0.00895	174.3037	2.95E+11	0.00	0.00	235.3619
8.0710	2.3429	306996.	10890.	-0.00894	225.0312	2.95E+11	0.00	0.00	256.2543
8.6475	2.2811	388465.	12735.	-0.00893	284.7484	2.95E+11	0.00	0.00	277.1468
9.2240	2.2193	483197.	14725.	-0.00892	354.1881	2.95E+11	0.00	0.00	298.0393
9.8005	2.1577	592193.	16859.	-0.00891	434.0833	2.95E+11	0.00	0.00	318.9317
10.3770	2.0961	716453.	19137.	-0.00889	525.1669	2.95E+11	0.00	0.00	339.8242
10.9535	2.0346	856976.	21560.	-0.00887	628.1719	2.95E+11	0.00	0.00	360.7167
11.5300	1.9733	1014763.	24128.	-0.00885	743.8311	2.95E+11	0.00	0.00	381.6091
12.1065	1.9121	1190813.	26840.	-0.00883	872.8775	2.95E+11	0.00	0.00	402.5016
12.6830	1.8511	1386126.	29697.	-0.00880	1016.	2.95E+11	0.00	0.00	423.3941
13.2595	1.7904	1601703.	32698.	-0.00876	1174.	2.95E+11	0.00	0.00	444.2865
13.8360	1.7299	1838542.	35844.	-0.00872	1348.	2.95E+11	0.00	0.00	465.1790
14.4125	1.6697	2097644.	39135.	-0.00868	1538.	2.95E+11	0.00	0.00	486.0715
14.9890	1.6099	2380009.	42570.	-0.00862	1745.	2.95E+11	0.00	0.00	506.9639
15.5655	1.5504	2686637.	46149.	-0.00856	1969.	2.95E+11	0.00	0.00	527.8564
16.1420	1.4914	3018527.	49873.	-0.00850	2213.	2.95E+11	0.00	0.00	548.7489
16.7185	1.4329	3376680.	53742.	-0.00842	2475.	2.95E+11	0.00	0.00	569.6413
17.2950	1.3749	3762095.	57755.	-0.00834	2758.	2.95E+11	0.00	0.00	590.5338
17.8715	1.3175	4175772.	61912.	-0.00825	3061.	2.95E+11	0.00	0.00	611.4263

18.4480	1.2608	4618711.	66214.	-0.00814	3386.	2.95E+11	0.00	0.00	632.3187
19.0245	1.2048	5091912.	70661.	-0.00803	3732.	2.95E+11	0.00	0.00	653.2112
19.6010	1.1497	5596375.	75252.	-0.00790	4102.	2.95E+11	0.00	0.00	674.1037
20.1775	1.0955	6133100.	79988.	-0.00777	4496.	2.95E+11	0.00	0.00	694.9961
20.7540	1.0423	6703087.	84868.	-0.00761	4913.	2.95E+11	0.00	0.00	715.8886
21.3305	0.9901	7307334.	89893.	-0.00745	5356.	2.95E+11	0.00	0.00	736.7811
21.9070	0.9392	7946844.	95062.	-0.00727	5825.	2.95E+11	0.00	0.00	757.6735
22.4835	0.8895	8622614.	99801.	-0.00708	6320.	2.95E+11	0.00	0.00	612.4018
23.0600	0.8413	9327694.	98468.	-0.00691	0.00	4.61E+11	-997.981	8207.	0.00
23.6365	0.7940	9985011.	91507.	-0.00676	0.00	4.61E+11	-1014.	8838.	0.00
24.2130	0.7477	1.06E+07	84438.	-0.00661	0.00	4.60E+11	-1029.	9524.	0.00
24.7895	0.7025	1.12E+07	78305.	-0.00644	0.00	4.60E+11	-743.602	7322.	0.00
25.3660	0.6586	1.17E+07	73004.	-0.00627	0.00	4.60E+11	-788.998	8288.	0.00
25.9425	0.6158	1.22E+07	67428.	-0.00609	0.00	4.60E+11	-822.978	9246.	0.00
26.5190	0.5743	1.26E+07	61659.	-0.00591	0.00	4.59E+11	-844.673	10176.	0.00
27.0955	0.5341	1.30E+07	55750.	-0.00571	0.00	4.59E+11	-863.617	11187.	0.00
27.6720	0.4952	1.34E+07	49744.	-0.00551	0.00	4.59E+11	-872.975	12195.	0.00
28.2485	0.4578	1.37E+07	43715.	-0.00531	0.00	4.59E+11	-869.745	13144.	0.00
28.8250	0.4217	1.40E+07	37689.	-0.00510	0.00	4.59E+11	-872.621	14314.	0.00
29.4015	0.3872	1.42E+07	31121.	-0.00489	0.00	4.58E+11	-1026.	18332.	0.00
29.9780	0.3541	1.44E+07	24015.	-0.00467	0.00	4.58E+11	-1028.	20093.	0.00
30.5545	0.3225	1.46E+07	16897.	-0.00445	0.00	4.58E+11	-1029.	22077.	0.00
31.1310	0.2925	1.47E+07	9780.	-0.00423	0.00	4.58E+11	-1028.	24323.	0.00
31.7075	0.2640	1.47E+07	2676.	-0.00401	0.00	4.58E+11	-1026.	26879.	0.00
32.2840	0.2370	1.47E+07	-4403.	-0.00379	0.00	4.58E+11	-1021.	29806.	0.00
32.8605	0.2115	1.46E+07	-11444.	-0.00357	0.00	4.58E+11	-1014.	33179.	0.00
33.4370	0.1876	1.45E+07	-18432.	-0.00335	0.00	4.58E+11	-1006.	37093.	0.00
34.0135	0.1652	1.44E+07	-25354.	-0.00313	0.00	4.58E+11	-995.124	41674.	0.00
34.5900	0.1443	1.42E+07	-32193.	-0.00291	0.00	4.59E+11	-982.063	47086.	0.00
35.1665	0.1249	1.39E+07	-37785.	-0.00270	0.00	4.59E+11	-634.631	35162.	0.00
35.7430	0.1069	1.37E+07	-42107.	-0.00249	0.00	4.59E+11	-614.813	39791.	0.00
36.3195	0.09034	1.33E+07	-47879.	-0.00229	0.00	4.59E+11	-1054.	80707.	0.00
36.8960	0.07519	1.30E+07	-55077.	-0.00209	0.00	4.59E+11	-1027.	94475.	0.00
37.4725	0.06139	1.26E+07	-62071.	-0.00190	0.00	4.59E+11	-995.174	112151.	0.00
38.0490	0.04890	1.21E+07	-68827.	-0.00171	0.00	4.60E+11	-958.238	135571.	0.00
38.6255	0.03767	1.16E+07	-75306.	-0.00154	0.00	4.60E+11	-914.689	167973.	0.00
39.2020	0.02766	1.11E+07	-81453.	-0.00136	0.00	4.60E+11	-862.361	215713.	0.00
39.7785	0.01879	1.05E+07	-85510.	-0.00120	0.00	4.61E+11	-310.526	114300.	0.00
40.3550	0.01102	9909517.	-87387.	-0.00105	0.00	4.61E+11	-232.185	145694.	0.00
40.9315	0.00428	9299417.	-88512.	-9.05E-04	0.00	4.61E+11	-93.166	150438.	0.00
41.5080	-0.00149	8684859.	-88719.	-7.70E-04	0.00	4.62E+11	33.4501	155182.	0.00
42.0845	-0.00637	8071902.	-88094.	-6.44E-04	0.00	4.62E+11	147.1676	159926.	0.00
42.6610	-0.01040	7465988.	-86728.	-5.28E-04	0.00	4.62E+11	247.6588	164670.	0.00
43.2375	-0.01367	6871927.	-84714.	-4.21E-04	0.00	4.62E+11	334.7535	169414.	0.00
43.8140	-0.01622	6293887.	-82185.	-3.22E-04	0.00	4.65E+11	396.4642	169058.	0.00
44.3905	-0.01813	5734821.	-79278.	-2.33E-04	0.00	4.69E+11	443.9885	169413.	0.00
44.9670	-0.01945	5197003.	-76066.	-1.53E-04	0.00	4.74E+11	484.5325	172321.	0.00
45.5435	-0.02025	4682375.	-72596.	-8.15E-05	0.00	4.80E+11	518.6344	177188.	0.00
46.1200	-0.02058	4192568.	-68911.	-3.26E-05	0.00	9.60E+11	546.5729	183738.	0.00
46.6965	-0.02070	3728919.	-65042.	-4.08E-06	0.00	9.60E+11	571.8956	191125.	0.00
47.2730	-0.02064	3292640.	-61008.	2.12E-05	0.00	9.60E+11	594.6044	199338.	0.00
47.8495	-0.02041	2884819.	-56835.	4.35E-05	0.00	9.60E+11	611.6912	207366.	0.00
48.4260	-0.02003	2506272.	-52594.	6.29E-05	0.00	9.60E+11	614.2605	212110.	0.00
49.0025	-0.01954	2157123.	-48351.	7.97E-05	0.00	9.60E+11	612.4030	216854.	0.00
49.5790	-0.01893	1837282.	-44135.	9.41E-05	0.00	9.60E+11	606.4193	221598.	0.00
50.1555	-0.01824	1546465.	-39974.	1.06E-04	0.00	9.60E+11	596.6097	226342.	0.00
50.7320	-0.01746	1284200.	-35893.	1.16E-04	0.00	9.60E+11	583.2700	231086.	0.00
51.3085	-0.01662	1049849.	-31915.	1.25E-04	0.00	9.60E+11	566.6872	235830.	0.00

51.8850	-0.01573	842620.	-28063.	1.32E-04	0.00	9.60E+11	547.1360	240574.	0.00
52.4615	-0.01480	661576.	-24354.	1.37E-04	0.00	9.60E+11	524.8747	245318.	0.00
53.0380	-0.01384	505652.	-20809.	1.41E-04	0.00	9.60E+11	500.1433	250062.	0.00
53.6145	-0.01285	373663.	-17442.	1.44E-04	0.00	9.60E+11	473.1602	254806.	0.00
54.1910	-0.01184	264320.	-14269.	1.47E-04	0.00	9.60E+11	444.1202	259550.	0.00
54.7675	-0.01082	176232.	-11304.	1.48E-04	0.00	9.60E+11	413.1934	264294.	0.00
55.3440	-0.00978	107919.	-8558.	1.49E-04	0.00	9.60E+11	380.5233	269038.	0.00
55.9205	-0.00875	57817.	-6045.	1.50E-04	0.00	9.60E+11	346.2266	273782.	0.00
56.4970	-0.00771	24285.	-3773.	1.50E-04	0.00	9.60E+11	310.3927	278526.	0.00
57.0735	-0.00667	5608.	-1755.	1.50E-04	0.00	9.60E+11	273.0843	283270.	0.00
57.6500	-0.00563	0.00	0.00	1.50E-04	0.00	9.60E+11	234.3375	144007.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     3.21051446 inches
Computed slope at pile head      =     -0.0089619 radians
Maximum bending moment           =      14693793. inch-lbs
Maximum shear force              =         99801. lbs
Depth of maximum bending moment  =    31.70750000 feet below pile head
Depth of maximum shear force     =    22.48350000 feet below pile head
Number of iterations             =             85
Number of zero deflection points =              1
Pile deflection at ground        =     0.87558528 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
57.65000	3.21051446	14693793.	99801.
54.76750	3.23334100	14659351.	99735.
51.88500	3.26354707	14493448.	98763.
49.00250	3.70748199	14345739.	-112082.
46.12000	4.75132347	13827473.	-127039.
43.23750	7.29518162	12983960.	-134924.
40.35500	40.82692816	12485688.	-156532.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

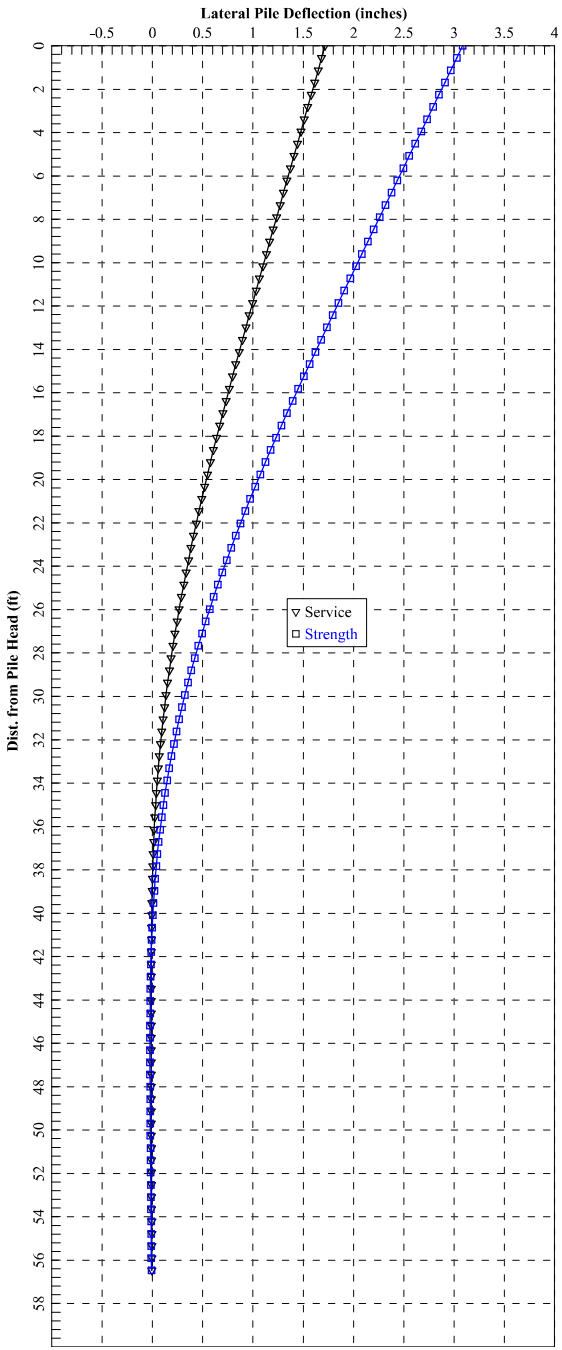
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

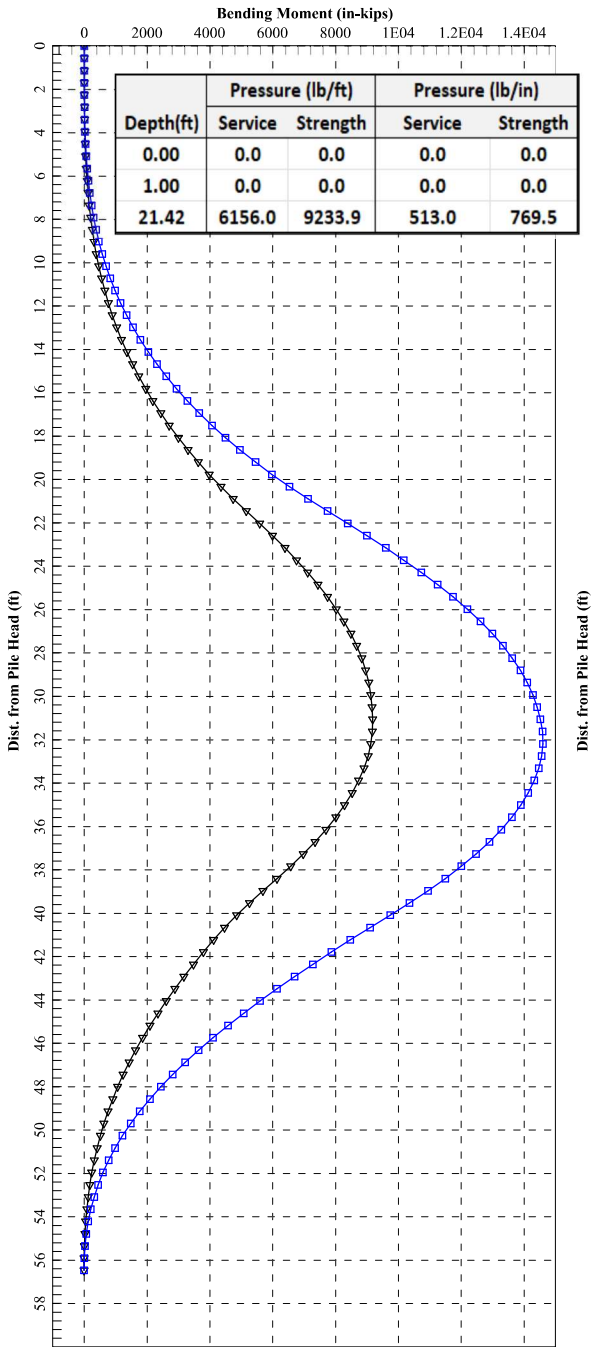
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.8028	-0.00527	66538.	9397253.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.2105	-0.00896	99801.	1.47E+07

Maximum pile-head deflection = 3.2105144572 inches
Maximum pile-head rotation = -0.0089618967 radians = -0.513479 deg.

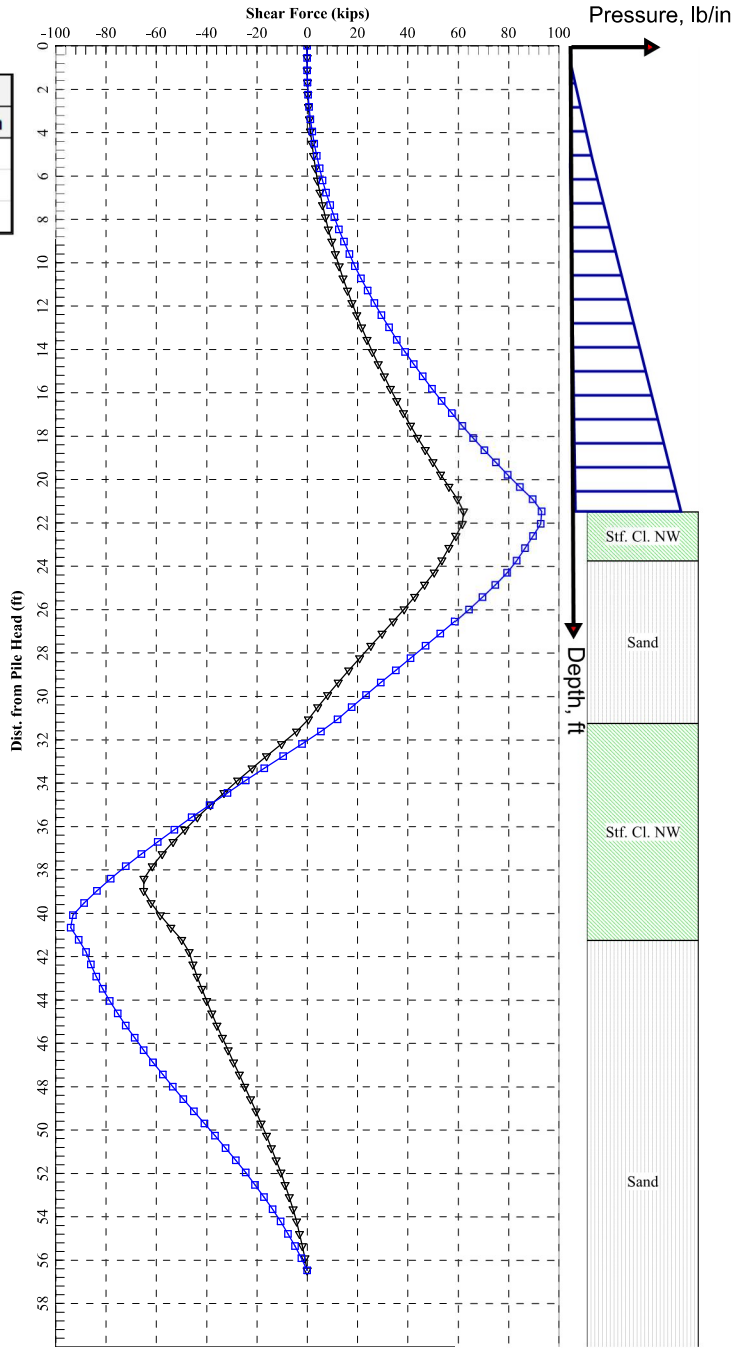
The analysis ended normally.

Wall 1C (21.42ft): Boring N-001-S-01





Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
21.42	6156.0	9233.9	513.0	769.5



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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1C\

Name of input data file:
Wall_1C-21.42ft_N-001-S-01.lp12d

Name of output report file:
Wall_1C-21.42ft_N-001-S-01.lp12o

Name of plot output file:
Wall_1C-21.42ft_N-001-S-01.lp12p

Name of runtime message file:
Wall_1C-21.42ft_N-001-S-01.lp12r

Date and Time of Analysis

Date: June 17, 2026 Time: 12:27:32

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1C (H=21.48FT) Boring N-001-

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Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	2
Total length of pile	=	56.480 ft
Depth of ground surface below top of pile	=	21.4800 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	15.1000
2	21.480	15.1000
3	21.480	42.0000
4	56.480	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 21.480000 ft
AISC Section Type = W
AISC Section Name = W30X211
Pile width = 15.100000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 35.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W30X211

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer = 21.480000 ft
Distance from top of pile to bottom of layer = 23.740000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Undrained cohesion at top of layer = 1200. psf
Undrained cohesion at bottom of layer = 1220. psf
Epsilon-50 at top of layer = 0.007000
Epsilon-50 at bottom of layer = 0.007000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 23.740000 ft
Distance from top of pile to bottom of layer = 31.240000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Friction angle at top of layer = 33.000000 deg.
Friction angle at bottom of layer = 33.000000 deg.
Subgrade k at top of layer = 90.000000 pci
Subgrade k at bottom of layer = 90.000000 pci

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	31.240000 ft
Distance from top of pile to bottom of layer	=	41.240000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	3000. psf
Undrained cohesion at bottom of layer	=	3000. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	41.240000 ft
Distance from top of pile to bottom of layer	=	71.240000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	34.000000 deg.
Friction angle at bottom of layer	=	34.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

(Depth of the lowest soil layer extends 14.760 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay	21.4800	57.6000	1200.	--	0.00700	--
	w/o Free Water	23.7400	57.6000	1220.	--	0.00700	--
2	Sand	23.7400	62.6000	--	33.0000	--	90.0000
	(Reese, et al.)	31.2400	62.6000	--	33.0000	--	90.0000
3	Stiff Clay	31.2400	62.6000	3000.	--	0.00500	--
	w/o Free Water	41.2400	62.6000	3000.	--	0.00500	--
4	Sand	41.2400	62.6000	--	34.0000	--	125.0000
	(Reese, et al.)	71.2400	62.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	21.480	0.7900	1.0000
2	57.000	0.7900	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	1.000	0.000
2	21.420	513.000

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	1.000	0.000
2	21.420	769.500

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	21.480000 ft
Flange Width	=	15.100000 in
Section Depth	=	30.900000 in
Flange Thickness	=	1.320000 in
Web Thickness	=	0.775000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	62.300000 sq. in.
Moment of Inertia	=	10300. in^4
Elastic Bending Stiffness	=	298700000. kip-in^2
Plastic Modulus, Z	=	751.000000in^3
Plastic Moment Capacity = Fy Z	=	37550.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	3115.000 kips
Nominal Axial Tensile Capacity	=	-3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000485	1432.	295083151.	15.4500000	2.1525124	
0.00000971	2864.	295083151.	15.4500000	4.3050249	
0.00001456	4296.	295083151.	15.4500000	6.4575373	
0.00001941	5728.	295083151.	15.4500000	8.6100497	
0.00002426	7160.	295083151.	15.4500000	10.7625622	
0.00002912	8592.	295083151.	15.4500000	12.9150746	
0.00003397	10024.	295083151.	15.4500000	15.0675870	
0.00003882	11456.	295083151.	15.4500000	17.2200995	
0.00004367	12888.	295083151.	15.4500000	19.3726119	
0.00004853	14320.	295083151.	15.4500000	21.5251243	
0.00005338	15751.	295083151.	15.4500000	23.6776367	
0.00005823	17183.	295083151.	15.4500000	25.8301492	
0.00006309	18615.	295083151.	15.4500000	27.9826616	
0.00006794	20047.	295083151.	15.4500000	30.1351740	
0.00007279	21479.	295083151.	15.4500000	32.2876865	
0.00007764	22911.	295083151.	15.4500000	34.4401989	
0.00008250	24343.	295083151.	15.4500000	36.5927113	

0.00008735	25775.	295083151.	15.4500000	38.7452238	
0.00009220	27207.	295083151.	15.4500000	40.8977362	
0.00009705	28639.	295083151.	15.4500000	43.0502486	
0.0001019	30071.	295083151.	15.4500000	45.2027611	
0.0001068	31503.	295083151.	15.4500000	47.3552735	
0.0001116	32935.	295083151.	15.4500000	49.5077859	
0.0001165	34044.	292307880.	15.4500000	50.0000000	Y
0.0001213	34575.	284995783.	15.4500000	50.0000000	Y
0.0001262	34790.	275739512.	15.4500000	50.0000000	Y
0.0001310	34966.	266868715.	15.4500000	50.0000000	Y
0.0001359	35122.	258487947.	15.4500000	50.0000000	Y
0.0001407	35264.	250579303.	15.4500000	50.0000000	Y
0.0001456	35391.	243099330.	15.4500000	50.0000000	Y
0.0001504	35505.	236019417.	15.4500000	50.0000000	Y
0.0001553	35610.	229315925.	15.4500000	50.0000000	Y
0.0001601	35705.	222960902.	15.4500000	50.0000000	Y
0.0001650	35792.	216929374.	15.4500000	50.0000000	Y
0.0001698	35871.	211198919.	15.4500000	50.0000000	Y
0.0001747	35944.	205749308.	15.4500000	50.0000000	Y
0.0001796	36011.	200562216.	15.4500000	50.0000000	Y
0.0001844	36073.	195620966.	15.4500000	50.0000000	Y
0.0001893	36131.	190910319.	15.4500000	50.0000000	Y
0.0001990	36232.	182106169.	15.4500000	50.0000000	Y
0.0002087	36320.	174059609.	15.4500000	50.0000000	Y
0.0002184	36398.	166676877.	15.4500000	50.0000000	Y
0.0002281	36465.	159878558.	15.4500000	50.0000000	Y
0.0002378	36524.	153601157.	15.4500000	50.0000000	Y
0.0002475	36576.	147788407.	15.4500000	50.0000000	Y
0.0002572	36622.	142390326.	15.4500000	50.0000000	Y
0.0002669	36663.	137366631.	15.4500000	50.0000000	Y
0.0002766	36700.	132681405.	15.4500000	50.0000000	Y
0.0002863	36734.	128303239.	15.4500000	50.0000000	Y
0.0002960	36764.	124195919.	15.4500000	50.0000000	Y
0.0003057	36791.	120343276.	15.4500000	50.0000000	Y
0.0003154	36816.	116719671.	15.4500000	50.0000000	Y
0.0003251	36839.	113304545.	15.4500000	50.0000000	Y
0.0003348	36860.	110083253.	15.4500000	50.0000000	Y
0.0003445	36879.	107036760.	15.4500000	50.0000000	Y
0.0003542	36896.	104153806.	15.4500000	50.0000000	Y
0.0003640	36913.	101421133.	15.4500000	50.0000000	Y
0.0003737	36927.	98825527.	15.4500000	50.0000000	Y
0.0003834	36941.	96361344.	15.4500000	50.0000000	Y
0.0003931	36954.	94012990.	15.4500000	50.0000000	Y
0.0004028	36965.	91776809.	15.4500000	50.0000000	Y
0.0004125	36977.	89645860.	15.4500000	50.0000000	Y
0.0004222	36987.	87607806.	15.4500000	50.0000000	Y
0.0004319	36996.	85660884.	15.4500000	50.0000000	Y
0.0004416	37006.	83799541.	15.4500000	50.0000000	Y
0.0004513	37014.	82015996.	15.4500000	50.0000000	Y
0.0004610	37021.	80305397.	15.4500000	50.0000000	Y
0.0004707	37029.	78665338.	15.4500000	50.0000000	Y
0.0004804	37036.	77091545.	15.4500000	50.0000000	Y
0.0004901	37043.	75578316.	15.4500000	50.0000000	Y
0.0004998	37048.	74122177.	15.4500000	50.0000000	Y
0.0005095	37054.	72721510.	15.4500000	50.0000000	Y
0.0005192	37060.	71373205.	15.4500000	50.0000000	Y
0.0005289	37065.	70074379.	15.4500000	50.0000000	Y
0.0005387	37070.	68820390.	15.4500000	50.0000000	Y
0.0005484	37074.	67610134.	15.4500000	50.0000000	Y

```
    0.0005581        37079.     66441975.    15.4500000    50.0000000  Y
```

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	37079.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	35.000000 ft
Outside Diameter of Casing	=	42.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	15.100000 in
Depth of Core/Insert	=	30.900000 in
Flange Thickness of Core/Insert	=	1.320000 in
Web Thickness of Core/Insert	=	0.775000 in
Moment of Inertia of Steel Core/Insert	=	10300. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1385. sq. in.
Area of Concrete	=	1324. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	62.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	61.765500 sq. in.
Area Ratio of All Steel to Gross Area	=	4.46 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	8738.355 kips
Tensile Load for Cracking of Concrete	=	-820.889 kips
Nominal Axial Tensile Capacity	=	-3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000485	4660.	960219131.	21.0000000	0.0001019	-0.000102	0.4669443	0.00000	0.00000	2.1573676	
0.00000971	4660.	480109566.	14.6786786	0.0001425	-0.000265	0.6436927	0.00000	0.00000	-6.093915	C
0.00001456	6734.	462580705.	14.7100701	0.0002142	-0.000397	0.9508630	0.00000	0.00000	-9.127620	C
0.00001941	8956.	461406788.	14.7419299	0.0002862	-0.000529	1.2480931	0.00000	0.00000	-12.152225	C
0.00002426	11167.	460217660.	14.7742726	0.0003585	-0.000661	1.5352611	0.00000	0.00000	-15.167524	C
0.00002912	13365.	459012879.	14.8071132	0.0004311	-0.000792	1.8122410	0.00000	0.00000	-18.173299	C
0.00003397	15551.	457791985.	14.8404677	0.0005041	-0.000923	2.0789023	0.00000	0.00000	-21.169324	C
0.00003882	17724.	456554495.	14.8743527	0.0005774	-0.001053	2.3351099	0.00000	0.00000	-24.155365	C
0.00004367	19885.	455299908.	14.9087857	0.0006511	-0.001183	2.5807239	0.00000	0.00000	-27.131174	C
0.00004853	22033.	454028676.	14.9430314	0.0007251	-0.001313	2.8154844	0.00000	0.00000	-30.097555	C
0.00005338	24167.	452739722.	14.9778102	0.0007995	-0.001442	3.0393377	0.00000	0.00000	-33.053473	C
0.00005823	26288.	451432452.	15.0131683	0.0008743	-0.001572	3.2521343	0.00000	0.00000	-35.998623	C
0.00006309	28395.	450106277.	15.0491257	0.0009494	-0.001700	3.4537153	0.00000	0.00000	-38.932725	C
0.00006794	30488.	448760580.	15.0857038	0.0010249	-0.001829	3.6439153	0.00000	0.00000	-41.855484	C
0.00007279	32566.	447394708.	15.1229249	0.0011008	-0.001956	3.8225624	0.00000	0.00000	-44.766591	C
0.00007764	34630.	446007975.	15.1608129	0.0011771	-0.002084	3.9894775	0.00000	0.00000	-47.665719	C
0.00008250	36619.	443885250.	15.1888294	0.0012530	-0.002212	4.1427636	0.00000	0.00000	-50.000000	CY
0.00008735	37715.	431772198.	15.0650073	0.0013159	-0.002353	4.2599390	0.00000	0.00000	-50.000000	CY
0.00009220	38343.	415858597.	14.8774049	0.0013717	-0.002501	4.3565156	0.00000	0.00000	-50.000000	CY
0.00009705	38901.	400812716.	14.6950361	0.0014262	-0.002650	4.4442692	0.00000	0.00000	-50.000000	CY
0.0001019	39401.	386642215.	14.5221595	0.0014799	-0.002800	4.5244197	0.00000	0.00000	-50.000000	CY
0.0001068	39851.	373282704.	14.3544289	0.0015325	-0.002951	4.5968136	0.00000	0.00000	-50.000000	CY
0.0001116	40259.	360705305.	14.1946038	0.0015843	-0.003103	4.6623154	0.00000	0.00000	-50.000000	CY
0.0001165	40630.	348860650.	14.0423280	0.0016354	-0.003256	4.7212629	0.00000	0.00000	-50.000000	CY
0.0001213	40966.	337675750.	13.8940820	0.0016856	-0.003410	4.7735635	0.00000	0.00000	-50.000000	CY
0.0001262	41276.	327143022.	13.7537665	0.0017353	-0.003564	4.8200409	0.00000	0.00000	-50.000000	CY
0.0001310	41560.	317198721.	13.6196466	0.0017845	-0.003718	4.8607504	0.00000	0.00000	-50.000000	CY
0.0001359	41821.	307785272.	13.4889206	0.0018328	-0.003874	4.8956719	0.00000	0.00000	-50.000000	CY
0.0001407	42061.	298883206.	13.3646702	0.0018808	-0.004030	4.9253538	0.00000	0.00000	-50.000000	CY
0.0001456	42286.	290465886.	13.2468269	0.0019285	-0.004186	4.9499494	0.00000	0.00000	-50.000000	CY
0.0001504	42493.	282468641.	13.1312251	0.0019754	-0.004343	4.9693468	0.00000	0.00000	-50.000000	CY
0.0001553	42685.	274875870.	13.0204747	0.0020219	-0.004500	4.9839136	0.00000	0.00000	-50.000000	CY
0.0001601	42864.	267666295.	12.9150032	0.0020682	-0.004658	4.9937863	0.00000	0.00000	-50.000000	CY
0.0001650	43032.	260815463.	12.8145925	0.0021143	-0.004815	4.9990376	0.00000	0.00000	-50.000000	CY
0.0001698	43187.	254273441.	12.7152196	0.0021596	-0.004974	4.9964360	0.00000	0.00000	-50.000000	CY
0.0001747	43332.	248038790.	12.6202443	0.0022047	-0.005133	4.9997717	0.00000	0.00000	-50.000000	CY
0.0001796	43467.	242089290.	12.5295562	0.0022497	-0.005291	4.9974357	0.00000	0.00000	-50.000000	CY
0.0001844	43595.	236411878.	12.4429706	0.0022945	-0.005450	4.9999277	0.00000	0.00000	-50.000000	CY
0.0001893	43714.	230980954.	12.3591473	0.0023390	-0.005610	4.9974008	0.00000	0.00000	-50.000000	CY

0.0001990	43930.	220795570.	12.1978588	0.0024269	-0.005929	4.9962111	0.00000	0.00000	-50.000000 CY
0.0002087	44123.	211450023.	12.0497208	0.0025144	-0.006250	4.9950873	0.00000	0.00000	-50.000000 CY
0.0002184	44293.	202833292.	11.9105051	0.0026009	-0.006571	4.9998261	0.00000	0.00000	-50.000000 CY
0.0002281	44444.	194864158.	11.7784583	0.0026864	-0.006893	4.9977064	0.00000	0.00000	-50.000000 CY
0.0002378	44582.	187490325.	11.6559118	0.0027716	-0.007215	4.9940076	0.00000	0.00000	-50.000000 CY
0.0002475	44708.	180645729.	11.5416950	0.0028564	-0.007538	4.9988437	0.00000	0.00000	-50.000000 CY
0.0002572	44818.	174258628.	11.4300351	0.0029397	-0.007862	4.9914191	0.00000	0.00000	-50.000000 CY
0.0002669	44920.	168304187.	11.3257314	0.0030228	-0.008187	4.9982971	0.00000	0.00000	-50.000000 CY
0.0002766	45015.	162740773.	11.2278060	0.0031057	-0.008512	4.9958902	0.00000	0.00000	-50.000000 CY
0.0002863	45101.	157526595.	11.1357237	0.0031883	-0.008837	4.9955344	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	45101.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	21.4800	0.00	N.A.	No	0.00	30717.
2	23.7400	5.1682	No	No	30717.	161135.
3	31.2400	5.3200	No	No	191852.	492140.
4	41.2400	21.3225	No	No	683992.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.7185	1.28E-05	0.00	-0.00508	9.41E-09	2.95E+11	0.00	0.00	0.00
0.5648	1.6841	5.71E-06	-5.26E-07	-0.00508	4.18E-09	2.95E+11	0.00	0.00	0.00
1.1296	1.6497	5.71E-06	12.7931	-0.00508	4.18E-09	2.95E+11	0.00	0.00	3.7751
1.6944	1.6153	173.4136	84.7040	-0.00508	0.1271	2.95E+11	0.00	0.00	17.4450
2.2592	1.5809	1148.	251.0235	-0.00508	0.8416	2.95E+11	0.00	0.00	31.6342
2.8240	1.5465	3576.	513.5114	-0.00507	2.6213	2.95E+11	0.00	0.00	45.8233
3.3888	1.5121	8109.	872.1676	-0.00507	5.9439	2.95E+11	0.00	0.00	60.0125
3.9536	1.4777	15398.	1327.	-0.00507	11.2872	2.95E+11	0.00	0.00	74.2016
4.5184	1.4433	26097.	1878.	-0.00507	19.1290	2.95E+11	0.00	0.00	88.3908
5.0832	1.4089	40855.	2525.	-0.00507	29.9471	2.95E+11	0.00	0.00	102.5799
5.6480	1.3746	60325.	3268.	-0.00507	44.2191	2.95E+11	0.00	0.00	116.7690
6.2128	1.3402	85160.	4108.	-0.00507	62.4230	2.95E+11	0.00	0.00	130.9582
6.7776	1.3058	116010.	5044.	-0.00507	85.0364	2.95E+11	0.00	0.00	145.1473
7.3424	1.2715	153527.	6075.	-0.00507	112.5371	2.95E+11	0.00	0.00	159.3365
7.9072	1.2372	198364.	7203.	-0.00506	145.4028	2.95E+11	0.00	0.00	173.5256
8.4720	1.2029	251172.	8428.	-0.00506	184.1115	2.95E+11	0.00	0.00	187.7148
9.0368	1.1686	312603.	9748.	-0.00505	229.1408	2.95E+11	0.00	0.00	201.9039
9.6016	1.1344	383308.	11164.	-0.00504	280.9684	2.95E+11	0.00	0.00	216.0931
10.1664	1.1003	463940.	12677.	-0.00503	340.0723	2.95E+11	0.00	0.00	230.2822
10.7312	1.0662	555150.	14286.	-0.00502	406.9300	2.95E+11	0.00	0.00	244.4714
11.2960	1.0323	657590.	15991.	-0.00501	482.0195	2.95E+11	0.00	0.00	258.6605
11.8608	0.9984	771911.	17792.	-0.00499	565.8184	2.95E+11	0.00	0.00	272.8497
12.4256	0.9646	898767.	19690.	-0.00497	658.8046	2.95E+11	0.00	0.00	287.0388
12.9904	0.9310	1038807.	21683.	-0.00495	761.4558	2.95E+11	0.00	0.00	301.2280
13.5552	0.8975	1192685.	23773.	-0.00492	874.2498	2.95E+11	0.00	0.00	315.4171
14.1200	0.8643	1361052.	25959.	-0.00489	997.6643	2.95E+11	0.00	0.00	329.6063
14.6848	0.8312	1544559.	28241.	-0.00486	1132.	2.95E+11	0.00	0.00	343.7954
15.2496	0.7984	1743860.	30619.	-0.00482	1278.	2.95E+11	0.00	0.00	357.9846
15.8144	0.7659	1959604.	33093.	-0.00478	1436.	2.95E+11	0.00	0.00	372.1737
16.3792	0.7336	2192445.	35664.	-0.00473	1607.	2.95E+11	0.00	0.00	386.3629
16.9440	0.7017	2443033.	38330.	-0.00468	1791.	2.95E+11	0.00	0.00	400.5520
17.5088	0.6702	2712021.	41093.	-0.00462	1988.	2.95E+11	0.00	0.00	414.7412
18.0736	0.6391	3000061.	43952.	-0.00455	2199.	2.95E+11	0.00	0.00	428.9303
18.6384	0.6085	3307804.	46908.	-0.00448	2425.	2.95E+11	0.00	0.00	443.1195
19.2032	0.5783	3635902.	49959.	-0.00440	2665.	2.95E+11	0.00	0.00	457.3086
19.7680	0.5488	3985007.	53106.	-0.00431	2921.	2.95E+11	0.00	0.00	471.4977
20.3328	0.5199	4355770.	56350.	-0.00422	3193.	2.95E+11	0.00	0.00	485.6869
20.8976	0.4916	4748844.	59690.	-0.00411	3481.	2.95E+11	0.00	0.00	499.8760
21.4624	0.4641	5164880.	62118.	-0.00400	3786.	2.95E+11	0.00	0.00	216.7076
22.0272	0.4374	5590871.	61570.	-0.00390	0.00	4.70E+11	-378.471	5864.	0.00
22.5920	0.4112	5999477.	58976.	-0.00382	0.00	4.67E+11	-387.181	6381.	0.00
23.1568	0.3857	6390297.	56324.	-0.00373	0.00	4.65E+11	-395.366	6948.	0.00
23.7216	0.3607	6762955.	53618.	-0.00363	0.00	4.63E+11	-403.002	7572.	0.00
24.2864	0.3365	7117101.	50448.	-0.00353	0.00	4.62E+11	-532.334	10723.	0.00

24.8512	0.3129	7446794.	46705.	-0.00342	0.00	4.62E+11	-572.317	12397.	0.00
25.4160	0.2901	7750198.	42723.	-0.00331	0.00	4.62E+11	-602.660	14081.	0.00
25.9808	0.2680	8025917.	38551.	-0.00319	0.00	4.62E+11	-628.501	15893.	0.00
26.5456	0.2468	8272766.	34228.	-0.00307	0.00	4.62E+11	-647.293	17778.	0.00
27.1104	0.2263	8489880.	29809.	-0.00295	0.00	4.62E+11	-656.564	19660.	0.00
27.6752	0.2068	8676835.	25352.	-0.00283	0.00	4.62E+11	-658.762	21595.	0.00
28.2400	0.1880	8833529.	20909.	-0.00270	0.00	4.61E+11	-652.310	23512.	0.00
28.8048	0.1702	8960259.	16546.	-0.00257	0.00	4.61E+11	-635.122	25293.	0.00
29.3696	0.1532	9057814.	12306.	-0.00243	0.00	4.61E+11	-616.189	27253.	0.00
29.9344	0.1372	9127063.	8198.	-0.00230	0.00	4.61E+11	-595.895	29438.	0.00
30.4992	0.1221	9168940.	4259.	-0.00217	0.00	4.61E+11	-566.614	31463.	0.00
31.0640	0.1078	9184789.	546.4680	-0.00203	0.00	4.61E+11	-528.781	33236.	0.00
31.6288	0.09452	9176348.	-4246.	-0.00190	0.00	4.61E+11	-885.373	63487.	0.00
32.1936	0.08212	9127236.	-10211.	-0.00176	0.00	4.61E+11	-874.876	72205.	0.00
32.7584	0.07063	9037936.	-16096.	-0.00163	0.00	4.61E+11	-861.870	82701.	0.00
33.3232	0.06004	8909046.	-21885.	-0.00150	0.00	4.61E+11	-846.151	95510.	0.00
33.8880	0.05034	8741286.	-27556.	-0.00137	0.00	4.61E+11	-827.458	111399.	0.00
34.4528	0.04151	8535517.	-33090.	-0.00124	0.00	4.62E+11	-805.444	131505.	0.00
35.0176	0.03353	8292749.	-38461.	-0.00112	0.00	4.62E+11	-779.634	157593.	0.00
35.5824	0.02637	8014168.	-43643.	-9.97E-04	0.00	4.62E+11	-749.342	192575.	0.00
36.1472	0.02001	7701166.	-48600.	-8.82E-04	0.00	4.62E+11	-713.513	241638.	0.00
36.7120	0.01442	7355387.	-53290.	-7.71E-04	0.00	4.62E+11	-670.383	315110.	0.00
37.2768	0.00956	6978814.	-57651.	-6.66E-04	0.00	4.62E+11	-616.618	437334.	0.00
37.8416	0.00539	6573916.	-61586.	-5.67E-04	0.00	4.64E+11	-544.485	685120.	0.00
38.4064	0.00187	6144006.	-64874.	-4.74E-04	0.00	4.66E+11	-425.766	1544651.	0.00
38.9712	-0.00104	5694539.	-65047.	-3.89E-04	0.00	4.70E+11	374.5045	2429615.	0.00
39.5360	-0.00340	5262275.	-62042.	-3.10E-04	0.00	4.73E+11	512.3527	1021160.	0.00
40.1008	-0.00525	4853546.	-58336.	-2.38E-04	0.00	4.78E+11	581.1458	750836.	0.00
40.6656	-0.00662	4471513.	-54243.	-1.88E-04	0.00	9.60E+11	626.7823	641271.	0.00
41.2304	-0.00779	4118271.	-49869.	-1.57E-04	0.00	9.60E+11	663.8456	577632.	0.00
41.7952	-0.00876	3795524.	-46905.	-1.29E-04	0.00	9.60E+11	210.8089	163161.	0.00
42.3600	-0.00954	3482460.	-45391.	-1.04E-04	0.00	9.60E+11	236.1207	167697.	0.00
42.9248	-0.01016	3180243.	-43715.	-8.02E-05	0.00	9.60E+11	258.2512	172233.	0.00
43.4896	-0.01063	2889889.	-41901.	-5.88E-05	0.00	9.60E+11	277.2430	176769.	0.00
44.0544	-0.01096	2612270.	-39968.	-3.93E-05	0.00	9.60E+11	293.1621	181305.	0.00
44.6192	-0.01116	2348118.	-37937.	-2.18E-05	0.00	9.60E+11	306.0952	185841.	0.00
45.1840	-0.01126	2098027.	-35828.	-6.15E-06	0.00	9.60E+11	316.1463	190378.	0.00
45.7488	-0.01125	1862458.	-33661.	7.83E-06	0.00	9.60E+11	323.4339	194914.	0.00
46.3136	-0.01115	1641746.	-31453.	2.02E-05	0.00	9.60E+11	328.0882	199450.	0.00
46.8784	-0.01097	1436106.	-29222.	3.11E-05	0.00	9.60E+11	330.2479	203986.	0.00
47.4432	-0.01073	1245635.	-26984.	4.05E-05	0.00	9.60E+11	330.0581	208522.	0.00
48.0080	-0.01042	1070326.	-24756.	4.87E-05	0.00	9.60E+11	327.6673	213058.	0.00
48.5728	-0.01007	910069.	-22550.	5.57E-05	0.00	9.60E+11	323.2251	217595.	0.00
49.1376	-0.00967	764659.	-20381.	6.16E-05	0.00	9.60E+11	316.8799	222131.	0.00
49.7024	-0.00923	633806.	-18260.	6.65E-05	0.00	9.60E+11	308.7770	226667.	0.00
50.2672	-0.00877	517136.	-16201.	7.06E-05	0.00	9.60E+11	299.0565	231203.	0.00
50.8320	-0.00828	414204.	-14212.	7.39E-05	0.00	9.60E+11	287.8515	235739.	0.00
51.3968	-0.00777	324495.	-12303.	7.65E-05	0.00	9.60E+11	275.2870	240275.	0.00
51.9616	-0.00724	247431.	-10484.	7.85E-05	0.00	9.60E+11	261.4783	244812.	0.00
52.5264	-0.00670	182378.	-8763.	8.00E-05	0.00	9.60E+11	246.5298	249348.	0.00
53.0912	-0.00615	128650.	-7146.	8.11E-05	0.00	9.60E+11	230.5343	253884.	0.00
53.6560	-0.00560	85512.	-5641.	8.19E-05	0.00	9.60E+11	213.5723	258420.	0.00
54.2208	-0.00504	52184.	-4254.	8.24E-05	0.00	9.60E+11	195.7114	262956.	0.00
54.7856	-0.00448	27847.	-2991.	8.26E-05	0.00	9.60E+11	177.0065	267492.	0.00
55.3504	-0.00392	11640.	-1857.	8.28E-05	0.00	9.60E+11	157.4992	272029.	0.00
55.9152	-0.00336	2668.	-858.720	8.28E-05	0.00	9.60E+11	137.2185	276565.	0.00
56.4800	-0.00280	0.00	0.00	8.28E-05	0.00	9.60E+11	116.1810	140550.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	1.71849548 inches
Computed slope at pile head	=	-0.0050750 radians
Maximum bending moment	=	9184789. inch-lbs
Maximum shear force	=	-65047. lbs
Depth of maximum bending moment	=	31.06400000 feet below pile head
Depth of maximum shear force	=	38.97120000 feet below pile head
Number of iterations	=	30
Number of zero deflection points	=	1
Pile deflection at ground	=	0.46327442 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear	=	0. lbs
Moment	=	0. in-lbs
Axial Load	=	0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
56.48000	1.71849548	9184789.	-65047.
53.65600	1.72067880	9161079.	-65607.
50.83200	1.71088281	9075549.	-69013.
48.00800	1.79033909	8860257.	-75678.
45.18400	2.13581529	8643048.	-85685.
42.36000	3.13693167	8255700.	-91838.
39.53600	6.92992527	7790021.	-96589.
36.71200	56.96353603	7298586.	-114968.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	0.0 lbs
Applied moment at pile head	=	0.0 in-lbs
Axial thrust load on pile head	=	0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.0875	-3.42E-05	0.00	-0.00871	2.51E-08	2.95E+11	0.00	0.00	0.00
0.5648	3.0285	5.99E-05	6.94E-06	-0.00871	4.39E-08	2.95E+11	0.00	0.00	0.00
1.1296	2.9695	5.99E-05	19.1897	-0.00871	4.39E-08	2.95E+11	0.00	0.00	5.6627
1.6944	2.9105	260.1205	127.0559	-0.00871	0.1907	2.95E+11	0.00	0.00	26.1675
2.2592	2.8515	1722.	376.5352	-0.00871	1.2624	2.95E+11	0.00	0.00	47.4512
2.8240	2.7925	5364.	770.2670	-0.00871	3.9320	2.95E+11	0.00	0.00	68.7350
3.3888	2.7335	12163.	1308.	-0.00870	8.9159	2.95E+11	0.00	0.00	90.0187
3.9536	2.6745	23098.	1990.	-0.00870	16.9309	2.95E+11	0.00	0.00	111.3024
4.5184	2.6155	39145.	2817.	-0.00870	28.6936	2.95E+11	0.00	0.00	132.5861
5.0832	2.5565	61282.	3788.	-0.00870	44.9206	2.95E+11	0.00	0.00	153.8699
5.6480	2.4975	90488.	4903.	-0.00870	66.3287	2.95E+11	0.00	0.00	175.1536
6.2128	2.4385	127740.	6162.	-0.00870	93.6344	2.95E+11	0.00	0.00	196.4373
6.7776	2.3796	174015.	7565.	-0.00869	127.5545	2.95E+11	0.00	0.00	217.7210
7.3424	2.3207	230291.	9113.	-0.00869	168.8056	2.95E+11	0.00	0.00	239.0047
7.9072	2.2618	297546.	10805.	-0.00868	218.1043	2.95E+11	0.00	0.00	260.2885
8.4720	2.2030	376758.	12641.	-0.00868	276.1672	2.95E+11	0.00	0.00	281.5722
9.0368	2.1442	468904.	14622.	-0.00867	343.7111	2.95E+11	0.00	0.00	302.8559
9.6016	2.0855	574962.	16747.	-0.00865	421.4526	2.95E+11	0.00	0.00	324.1396
10.1664	2.0269	695909.	19016.	-0.00864	510.1084	2.95E+11	0.00	0.00	345.4233
10.7312	1.9684	832724.	21429.	-0.00862	610.3950	2.95E+11	0.00	0.00	366.7071
11.2960	1.9100	986384.	23987.	-0.00860	723.0292	2.95E+11	0.00	0.00	387.9908
11.8608	1.8518	1157867.	26688.	-0.00858	848.7276	2.95E+11	0.00	0.00	409.2745
12.4256	1.7937	1348150.	29534.	-0.00855	988.2069	2.95E+11	0.00	0.00	430.5582
12.9904	1.7359	1558211.	32525.	-0.00851	1142.	2.95E+11	0.00	0.00	451.8420
13.5552	1.6783	1789028.	35659.	-0.00848	1311.	2.95E+11	0.00	0.00	473.1257
14.1200	1.6210	2041578.	38938.	-0.00843	1496.	2.95E+11	0.00	0.00	494.4094
14.6848	1.5640	2316839.	42361.	-0.00838	1698.	2.95E+11	0.00	0.00	515.6931
15.2496	1.5074	2615789.	45928.	-0.00833	1917.	2.95E+11	0.00	0.00	536.9768
15.8144	1.4511	2939406.	49640.	-0.00826	2155.	2.95E+11	0.00	0.00	558.2606
16.3792	1.3954	3288667.	53496.	-0.00819	2411.	2.95E+11	0.00	0.00	579.5443
16.9440	1.3401	3664550.	57496.	-0.00811	2686.	2.95E+11	0.00	0.00	600.8280
17.5088	1.2854	4068032.	61640.	-0.00802	2982.	2.95E+11	0.00	0.00	622.1117
18.0736	1.2314	4500091.	65928.	-0.00792	3299.	2.95E+11	0.00	0.00	643.3955
18.6384	1.1780	4961706.	70361.	-0.00781	3637.	2.95E+11	0.00	0.00	664.6792
19.2032	1.1255	5453853.	74938.	-0.00770	3998.	2.95E+11	0.00	0.00	685.9629
19.7680	1.0737	5977510.	79660.	-0.00756	4382.	2.95E+11	0.00	0.00	707.2466
20.3328	1.0229	6533655.	84525.	-0.00742	4789.	2.95E+11	0.00	0.00	728.5303
20.8976	0.9731	7123266.	89535.	-0.00726	5221.	2.95E+11	0.00	0.00	749.8141
21.4624	0.9245	7747321.	93178.	-0.00709	5679.	2.95E+11	0.00	0.00	325.0615
22.0272	0.8770	8386307.	92753.	-0.00694	0.00	4.62E+11	-450.362	3480.	0.00
22.5920	0.8304	9004605.	89663.	-0.00681	0.00	4.61E+11	-461.538	3767.	0.00
23.1568	0.7846	9601703.	86499.	-0.00668	0.00	4.61E+11	-472.185	4079.	0.00
23.7216	0.7398	1.02E+07	83264.	-0.00653	0.00	4.61E+11	-482.279	4418.	0.00
24.2864	0.6961	1.07E+07	79365.	-0.00638	0.00	4.60E+11	-668.368	6508.	0.00
24.8512	0.6534	1.13E+07	74647.	-0.00622	0.00	4.60E+11	-723.804	7508.	0.00
25.4160	0.6118	1.17E+07	69590.	-0.00605	0.00	4.60E+11	-768.437	8513.	0.00
25.9808	0.5714	1.22E+07	64250.	-0.00587	0.00	4.60E+11	-807.440	9577.	0.00
26.5456	0.5322	1.26E+07	58673.	-0.00569	0.00	4.59E+11	-838.046	10672.	0.00
27.1104	0.4943	1.30E+07	52928.	-0.00550	0.00	4.59E+11	-857.500	11757.	0.00
27.6752	0.4577	1.33E+07	47067.	-0.00530	0.00	4.59E+11	-871.986	12912.	0.00
28.2400	0.4224	1.36E+07	41134.	-0.00511	0.00	4.59E+11	-878.715	14099.	0.00
28.8048	0.3885	1.39E+07	35198.	-0.00490	0.00	4.59E+11	-872.967	15229.	0.00
29.3696	0.3560	1.41E+07	29302.	-0.00470	0.00	4.59E+11	-866.893	16505.	0.00
29.9344	0.3249	1.43E+07	23447.	-0.00449	0.00	4.58E+11	-860.714	17957.	0.00
30.4992	0.2952	1.44E+07	17673.	-0.00427	0.00	4.58E+11	-843.150	19360.	0.00

31.0640	0.2669	1.45E+07	12058.	-0.00406	0.00	4.58E+11	-813.962	20667.	0.00
31.6288	0.2402	1.46E+07	5511.	-0.00384	0.00	4.58E+11	-1118.	31547.	0.00
32.1936	0.2148	1.46E+07	-2047.	-0.00363	0.00	4.58E+11	-1113.	35102.	0.00
32.7584	0.1910	1.46E+07	-9563.	-0.00341	0.00	4.58E+11	-1105.	39222.	0.00
33.3232	0.1686	1.45E+07	-17020.	-0.00320	0.00	4.58E+11	-1095.	44036.	0.00
33.8880	0.1476	1.43E+07	-24401.	-0.00298	0.00	4.58E+11	-1083.	49711.	0.00
34.4528	0.1281	1.41E+07	-31688.	-0.00277	0.00	4.59E+11	-1068.	56476.	0.00
35.0176	0.1100	1.39E+07	-38861.	-0.00257	0.00	4.59E+11	-1049.	64639.	0.00
35.5824	0.09332	1.36E+07	-45900.	-0.00236	0.00	4.59E+11	-1028.	74643.	0.00
36.1472	0.07798	1.33E+07	-52779.	-0.00217	0.00	4.59E+11	-1002.	87129.	0.00
36.7120	0.06396	1.29E+07	-59473.	-0.00197	0.00	4.59E+11	-972.854	103085.	0.00
37.2768	0.05124	1.25E+07	-65949.	-0.00179	0.00	4.59E+11	-938.245	124100.	0.00
37.8416	0.03977	1.20E+07	-72170.	-0.00160	0.00	4.60E+11	-897.385	152947.	0.00
38.4064	0.02949	1.15E+07	-78086.	-0.00143	0.00	4.60E+11	-848.319	194964.	0.00
38.9712	0.02036	1.09E+07	-83629.	-0.00127	0.00	4.60E+11	-787.481	262112.	0.00
39.5360	0.01233	1.04E+07	-88694.	-0.00111	0.00	4.61E+11	-707.130	388805.	0.00
40.1008	0.00532	9742328.	-93068.	-9.62E-04	0.00	4.61E+11	-583.421	742711.	0.00
40.6656	-7.08E-04	9098153.	-93977.	-8.23E-04	0.00	4.61E+11	315.1327	3018108.	0.00
41.2304	-0.00583	8468453.	-90816.	-6.94E-04	0.00	4.62E+11	617.5603	717521.	0.00
41.7952	-0.01012	7867122.	-87907.	-5.74E-04	0.00	4.62E+11	241.0063	161465.	0.00
42.3600	-0.01362	7276862.	-86064.	-4.63E-04	0.00	4.62E+11	302.6788	150653.	0.00
42.9248	-0.01639	6700505.	-83836.	-3.61E-04	0.00	4.63E+11	354.8185	146685.	0.00
43.4896	-0.01851	6140447.	-81280.	-2.67E-04	0.00	4.66E+11	399.5428	146322.	0.00
44.0544	-0.02001	5598743.	-78442.	-1.82E-04	0.00	4.70E+11	437.8856	148286.	0.00
44.6192	-0.02097	5077153.	-75364.	-1.06E-04	0.00	4.75E+11	470.3773	151993.	0.00
45.1840	-0.02144	4577170.	-72085.	-5.32E-05	0.00	9.60E+11	497.2863	157166.	0.00
45.7488	-0.02170	4100031.	-68631.	-2.26E-05	0.00	9.60E+11	521.9243	163045.	0.00
46.3136	-0.02175	3646867.	-65018.	4.77E-06	0.00	9.60E+11	544.2992	169605.	0.00
46.8784	-0.02163	3218705.	-61260.	2.90E-05	0.00	9.60E+11	564.4101	176844.	0.00
47.4432	-0.02136	2816470.	-57375.	5.03E-05	0.00	9.60E+11	582.2511	184771.	0.00
48.0080	-0.02095	2440982.	-53376.	6.89E-05	0.00	9.60E+11	597.8141	193407.	0.00
48.5728	-0.02042	2092954.	-49279.	8.49E-05	0.00	9.60E+11	611.0898	202785.	0.00
49.1376	-0.01980	1772998.	-45100.	9.85E-05	0.00	9.60E+11	622.0676	212946.	0.00
49.7024	-0.01909	1481616.	-40854.	1.10E-04	0.00	9.60E+11	630.7355	223944.	0.00
50.2672	-0.01831	1219208.	-36600.	1.20E-04	0.00	9.60E+11	624.5428	231203.	0.00
50.8320	-0.01747	985489.	-32425.	1.27E-04	0.00	9.60E+11	607.6065	235739.	0.00
51.3968	-0.01658	779681.	-28374.	1.34E-04	0.00	9.60E+11	587.8754	240275.	0.00
51.9616	-0.01566	600878.	-24465.	1.38E-04	0.00	9.60E+11	565.6107	244812.	0.00
52.5264	-0.01471	448056.	-20715.	1.42E-04	0.00	9.60E+11	541.0520	249348.	0.00
53.0912	-0.01373	320088.	-17138.	1.45E-04	0.00	9.60E+11	514.4155	253884.	0.00
53.6560	-0.01274	215750.	-13748.	1.47E-04	0.00	9.60E+11	485.8917	258420.	0.00
54.2208	-0.01174	133732.	-10557.	1.48E-04	0.00	9.60E+11	455.6433	262956.	0.00
54.7856	-0.01074	72644.	-7577.	1.49E-04	0.00	9.60E+11	423.8045	267492.	0.00
55.3504	-0.00973	31024.	-4818.	1.49E-04	0.00	9.60E+11	390.4799	272029.	0.00
55.9152	-0.00872	7341.	-2289.	1.49E-04	0.00	9.60E+11	355.7436	276565.	0.00
56.4800	-0.00771	0.00	0.00	1.49E-04	0.00	9.60E+11	319.6396	140550.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     3.08745962 inches
Computed slope at pile head      =     -0.0087052 radians
Maximum bending moment           =      14599618. inch-lbs
Maximum shear force              =        -93977. lbs
Depth of maximum bending moment  =    32.19360000 feet below pile head
Depth of maximum shear force     =    40.66560000 feet below pile head
Number of iterations             =             26
Number of zero deflection points =              1
Pile deflection at ground        =     0.92298668 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
56.48000	3.08745962	14599618.	-93977.
53.65600	3.09783922	14554457.	-95651.
50.83200	3.17611402	14331262.	-105170.
48.00800	3.56682122	13855813.	-116626.
45.18400	4.74187762	13293330.	-128692.
42.36000	8.48285351	12693997.	-135443.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

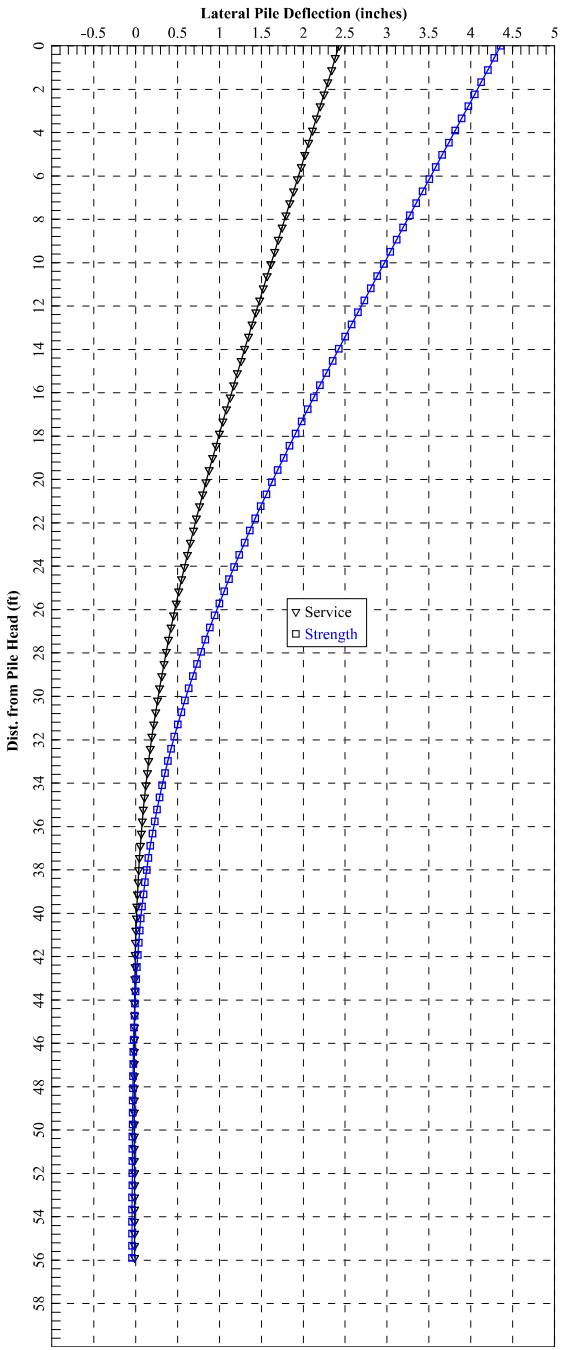
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

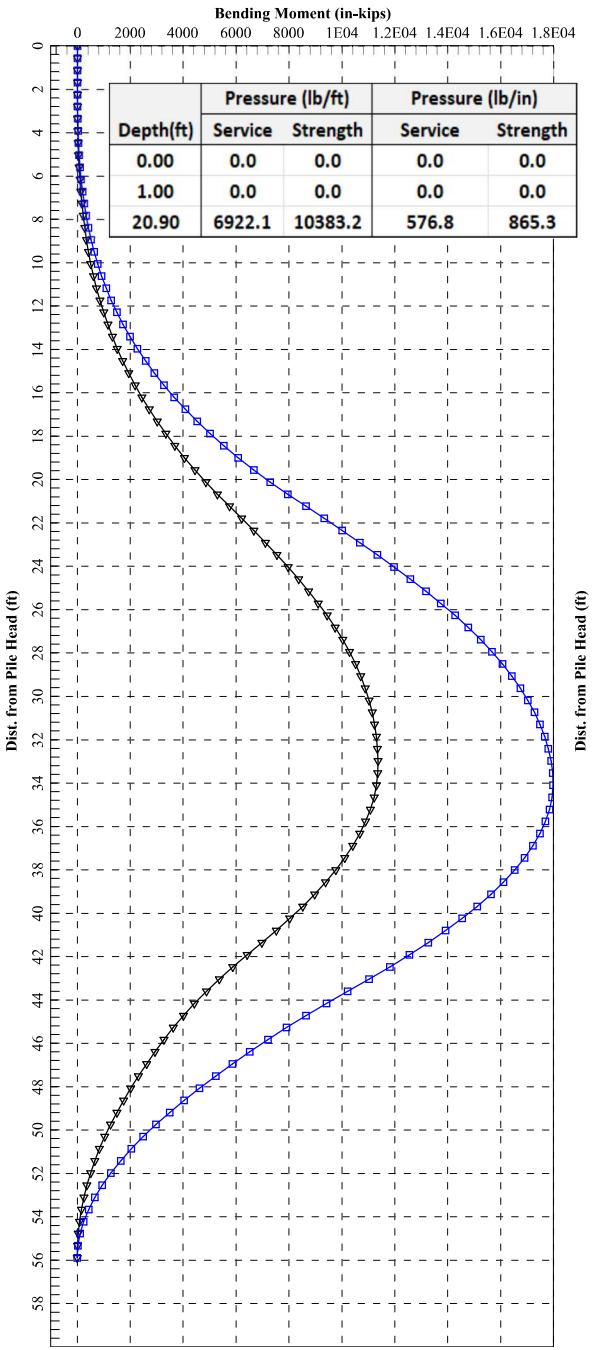
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.7185	-0.00508	-65047.	9184789.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.0875	-0.00871	-93977.	1.46E+07

```
Maximum pile-head deflection = 3.0874596201 inches
Maximum pile-head rotation   = -0.0087051819 radians = -0.498770 deg.

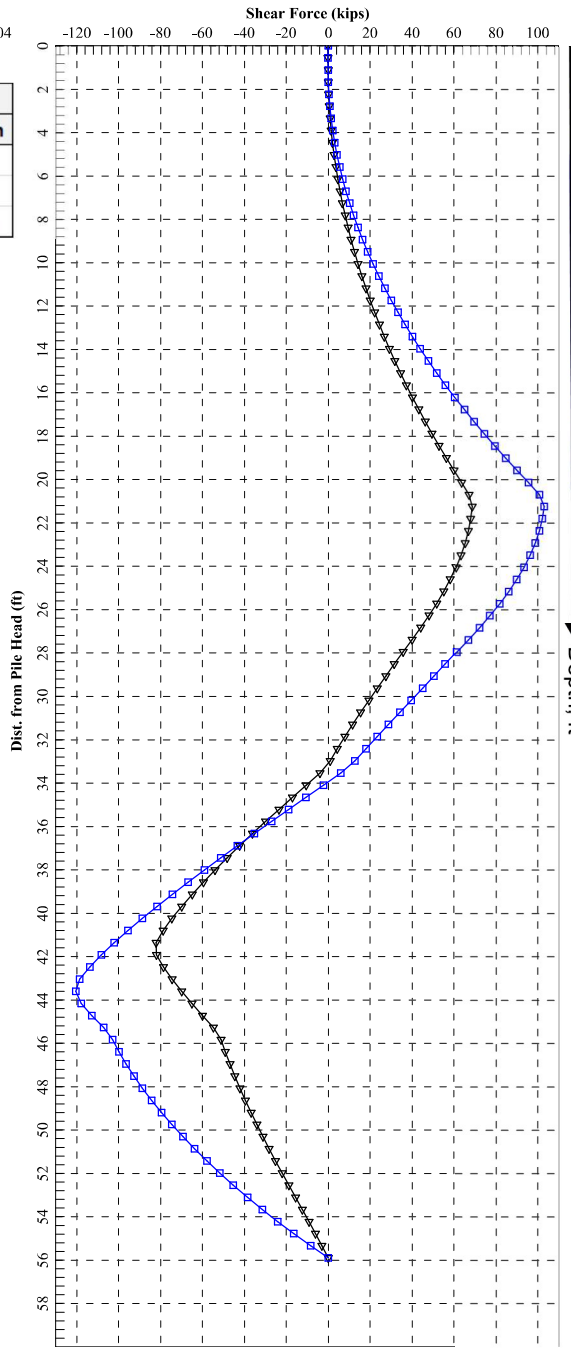
The analysis ended normally.
```

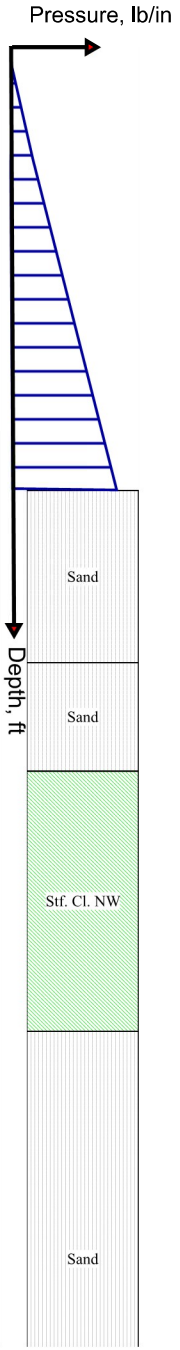
Wall 1C (20.90ft): Boring B-044-0-20





Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
20.90	6922.1	10383.2	576.8	865.3





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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1C\

Name of input data file:
Wall_1C-20.90ft_B-044-0-20.lp12d

Name of output report file:
Wall_1C-20.90ft_B-044-0-20.lp12o

Name of plot output file:
Wall_1C-20.90ft_B-044-0-20.lp12p

Name of runtime message file:
Wall_1C-20.90ft_B-044-0-20.lp12r

Date and Time of Analysis

Date: June 17, 2026 Time: 11:37:51

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1C (H=21.48FT) Boring B-044-0-20

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- Analysis includes loading by multiple distributed lateral loads acting on pile
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 55.900 ft
Depth of ground surface below top of pile = 20.5000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	15.1000
2	20.900	15.1000
3	20.900	42.0000
4	55.900	42.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 20.900000 ft
AISC Section Type = W
AISC Section Name = W30X211
Pile width = 15.100000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 35.000000 ft
Section Diameter = 42.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W30X211

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 20.500000 ft
Distance from top of pile to bottom of layer = 28.440000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Friction angle at top of layer = 32.000000 deg.
Friction angle at bottom of layer = 32.000000 deg.
Subgrade k at top of layer = 90.000000 pci
Subgrade k at bottom of layer = 90.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 28.440000 ft
Distance from top of pile to bottom of layer = 33.440000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 60.000000 pci
Subgrade k at bottom of layer = 60.000000 pci

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	33.440000 ft
Distance from top of pile to bottom of layer	=	45.440000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	3000. psf
Undrained cohesion at bottom of layer	=	3000. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	45.440000 ft
Distance from top of pile to bottom of layer	=	66.440000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	34.000000 deg.
Friction angle at bottom of layer	=	34.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

(Depth of the lowest soil layer extends 10.540 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand (Reese, et al.)	20.5000 28.4400	57.6000 57.6000	-- --	32.0000 32.0000	-- --	90.0000 90.0000
2	Sand (Reese, et al.)	28.4400 33.4400	57.6000 57.6000	-- --	30.0000 30.0000	-- --	60.0000 60.0000
3	Stiff Clay w/o Free Water	33.4400 45.4400	57.6000 57.6000	3000. 3000.	-- --	0.00500 0.00500	-- --
4	Sand (Reese, et al.)	45.4400 66.4400	62.6000 62.6000	-- --	34.0000 34.0000	-- --	125.0000 125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	20.900	0.8290	1.0000
2	57.000	0.8290	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	1.000	0.000
2	20.900	576.800

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	1.000	0.000
2	20.900	865.300

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	20.900000 ft
Flange Width	=	15.100000 in
Section Depth	=	30.900000 in
Flange Thickness	=	1.320000 in
Web Thickness	=	0.775000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	62.300000 sq. in.
Moment of Inertia	=	10300. in^4
Elastic Bending Stiffness	=	298700000. kip-in^2
Plastic Modulus, Z	=	751.000000in^3
Plastic Moment Capacity = Fy Z	=	37550.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	3115.000 kips
Nominal Axial Tensile Capacity	=	-3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000485	1432.	295083151.	15.4500000	2.1525124	
0.00000971	2864.	295083151.	15.4500000	4.3050249	
0.00001456	4296.	295083151.	15.4500000	6.4575373	
0.00001941	5728.	295083151.	15.4500000	8.6100497	
0.00002426	7160.	295083151.	15.4500000	10.7625622	
0.00002912	8592.	295083151.	15.4500000	12.9150746	
0.00003397	10024.	295083151.	15.4500000	15.0675870	
0.00003882	11456.	295083151.	15.4500000	17.2200995	
0.00004367	12888.	295083151.	15.4500000	19.3726119	
0.00004853	14320.	295083151.	15.4500000	21.5251243	
0.00005338	15751.	295083151.	15.4500000	23.6776367	
0.00005823	17183.	295083151.	15.4500000	25.8301492	

0.00006309	18615.	295083151.	15.4500000	27.9826616	
0.00006794	20047.	295083151.	15.4500000	30.1351740	
0.00007279	21479.	295083151.	15.4500000	32.2876865	
0.00007764	22911.	295083151.	15.4500000	34.4401989	
0.00008250	24343.	295083151.	15.4500000	36.5927113	
0.00008735	25775.	295083151.	15.4500000	38.7452238	
0.00009220	27207.	295083151.	15.4500000	40.8977362	
0.00009705	28639.	295083151.	15.4500000	43.0502486	
0.0001019	30071.	295083151.	15.4500000	45.2027611	
0.0001068	31503.	295083151.	15.4500000	47.3552735	
0.0001116	32935.	295083151.	15.4500000	49.5077859	
0.0001165	34044.	292307880.	15.4500000	50.0000000	Y
0.0001213	34575.	284995783.	15.4500000	50.0000000	Y
0.0001262	34790.	275739512.	15.4500000	50.0000000	Y
0.0001310	34966.	266868715.	15.4500000	50.0000000	Y
0.0001359	35122.	258487947.	15.4500000	50.0000000	Y
0.0001407	35264.	250579303.	15.4500000	50.0000000	Y
0.0001456	35391.	243099330.	15.4500000	50.0000000	Y
0.0001504	35505.	236019417.	15.4500000	50.0000000	Y
0.0001553	35610.	229315925.	15.4500000	50.0000000	Y
0.0001601	35705.	222960902.	15.4500000	50.0000000	Y
0.0001650	35792.	216929374.	15.4500000	50.0000000	Y
0.0001698	35871.	211198919.	15.4500000	50.0000000	Y
0.0001747	35944.	205749308.	15.4500000	50.0000000	Y
0.0001796	36011.	200562216.	15.4500000	50.0000000	Y
0.0001844	36073.	195620966.	15.4500000	50.0000000	Y
0.0001893	36131.	190910319.	15.4500000	50.0000000	Y
0.0001990	36232.	182106169.	15.4500000	50.0000000	Y
0.0002087	36320.	174059609.	15.4500000	50.0000000	Y
0.0002184	36398.	166676877.	15.4500000	50.0000000	Y
0.0002281	36465.	159878558.	15.4500000	50.0000000	Y
0.0002378	36524.	153601157.	15.4500000	50.0000000	Y
0.0002475	36576.	147788407.	15.4500000	50.0000000	Y
0.0002572	36622.	142390326.	15.4500000	50.0000000	Y
0.0002669	36663.	137366631.	15.4500000	50.0000000	Y
0.0002766	36700.	132681405.	15.4500000	50.0000000	Y
0.0002863	36734.	128303239.	15.4500000	50.0000000	Y
0.0002960	36764.	124195919.	15.4500000	50.0000000	Y
0.0003057	36791.	120343276.	15.4500000	50.0000000	Y
0.0003154	36816.	116719671.	15.4500000	50.0000000	Y
0.0003251	36839.	113304545.	15.4500000	50.0000000	Y
0.0003348	36860.	110083253.	15.4500000	50.0000000	Y
0.0003445	36879.	107036760.	15.4500000	50.0000000	Y
0.0003542	36896.	104153806.	15.4500000	50.0000000	Y
0.0003640	36913.	101421133.	15.4500000	50.0000000	Y
0.0003737	36927.	98825527.	15.4500000	50.0000000	Y
0.0003834	36941.	96361344.	15.4500000	50.0000000	Y
0.0003931	36954.	94012990.	15.4500000	50.0000000	Y
0.0004028	36965.	91776809.	15.4500000	50.0000000	Y
0.0004125	36977.	89645860.	15.4500000	50.0000000	Y
0.0004222	36987.	87607806.	15.4500000	50.0000000	Y
0.0004319	36996.	85660884.	15.4500000	50.0000000	Y
0.0004416	37006.	83799541.	15.4500000	50.0000000	Y
0.0004513	37014.	82015996.	15.4500000	50.0000000	Y
0.0004610	37021.	80305397.	15.4500000	50.0000000	Y
0.0004707	37029.	78665338.	15.4500000	50.0000000	Y
0.0004804	37036.	77091545.	15.4500000	50.0000000	Y

0.0004901	37043.	75578316.	15.4500000	50.0000000 Y
0.0004998	37048.	74122177.	15.4500000	50.0000000 Y
0.0005095	37054.	72721510.	15.4500000	50.0000000 Y
0.0005192	37060.	71373205.	15.4500000	50.0000000 Y
0.0005289	37065.	70074379.	15.4500000	50.0000000 Y
0.0005387	37070.	68820390.	15.4500000	50.0000000 Y
0.0005484	37074.	67610134.	15.4500000	50.0000000 Y
0.0005581	37079.	66441975.	15.4500000	50.0000000 Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	37079.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	35.000000 ft
Outside Diameter of Casing	=	42.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	15.100000 in
Depth of Core/Insert	=	30.900000 in
Flange Thickness of Core/Insert	=	1.320000 in
Web Thickness of Core/Insert	=	0.775000 in
Moment of Inertia of Steel Core/Insert	=	10300. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1385. sq. in.
Area of Concrete	=	1324. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	62.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	61.765500 sq. in.
Area Ratio of All Steel to Gross Area	=	4.46 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 8738.355 kips
Tensile Load for Cracking of Concrete = -820.889 kips
Nominal Axial Tensile Capacity = -3115.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:
Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000485	4660.	960219131.	21.0000000	0.0001019	-0.000102	0.4669443	0.00000	0.00000	2.1573676	
0.00000971	4660.	480109566.	14.6786786	0.0001425	-0.000265	0.6436927	0.00000	0.00000	-6.093915	C
0.00001456	6734.	462580705.	14.7100701	0.0002142	-0.000397	0.9508630	0.00000	0.00000	-9.127620	C
0.00001941	8956.	461406788.	14.7419299	0.0002862	-0.000529	1.2480931	0.00000	0.00000	-12.152225	C
0.00002426	11167.	460217660.	14.7742726	0.0003585	-0.000661	1.5352611	0.00000	0.00000	-15.167524	C
0.00002912	13365.	459012879.	14.8071132	0.0004311	-0.000792	1.8122410	0.00000	0.00000	-18.173299	C
0.00003397	15551.	457791985.	14.8404677	0.0005041	-0.000923	2.0789023	0.00000	0.00000	-21.169324	C
0.00003882	17724.	456554495.	14.8743527	0.0005774	-0.001053	2.3351099	0.00000	0.00000	-24.155365	C
0.00004367	19885.	455299908.	14.9087857	0.0006511	-0.001183	2.5807239	0.00000	0.00000	-27.131174	C
0.00004853	22033.	454028676.	14.9430314	0.0007251	-0.001313	2.8154844	0.00000	0.00000	-30.097555	C
0.00005338	24167.	452739722.	14.9778102	0.0007995	-0.001442	3.0393377	0.00000	0.00000	-33.053473	C
0.00005823	26288.	451432452.	15.0131683	0.0008743	-0.001572	3.2521343	0.00000	0.00000	-35.998623	C
0.00006309	28395.	450106277.	15.0491257	0.0009494	-0.001700	3.4537153	0.00000	0.00000	-38.932725	C
0.00006794	30488.	448760580.	15.0857038	0.0010249	-0.001829	3.6439153	0.00000	0.00000	-41.855484	C
0.00007279	32566.	447394708.	15.1229249	0.0011008	-0.001956	3.8225624	0.00000	0.00000	-44.766591	C
0.00007764	34630.	446007975.	15.1608129	0.0011771	-0.002084	3.9894775	0.00000	0.00000	-47.665719	C
0.00008250	36619.	443885250.	15.1888294	0.0012530	-0.002212	4.1427636	0.00000	0.00000	-50.000000	CY
0.00008735	37715.	431772198.	15.0650073	0.0013159	-0.002353	4.2599390	0.00000	0.00000	-50.000000	CY
0.00009220	38343.	415858597.	14.8774049	0.0013717	-0.002501	4.3565156	0.00000	0.00000	-50.000000	CY
0.00009705	38901.	400812716.	14.6950361	0.0014262	-0.002650	4.4442692	0.00000	0.00000	-50.000000	CY
0.0001019	39401.	386642215.	14.5221595	0.0014799	-0.002800	4.5244197	0.00000	0.00000	-50.000000	CY
0.0001068	39851.	373282704.	14.3544289	0.0015325	-0.002951	4.5968136	0.00000	0.00000	-50.000000	CY
0.0001116	40259.	360705305.	14.1946038	0.0015843	-0.003103	4.6623154	0.00000	0.00000	-50.000000	CY
0.0001165	40630.	348860650.	14.0423280	0.0016354	-0.003256	4.7212629	0.00000	0.00000	-50.000000	CY
0.0001213	40966.	337675750.	13.8940820	0.0016856	-0.003410	4.7735635	0.00000	0.00000	-50.000000	CY
0.0001262	41276.	327143022.	13.7537665	0.0017353	-0.003564	4.8200409	0.00000	0.00000	-50.000000	CY
0.0001310	41560.	317198721.	13.6196466	0.0017845	-0.003718	4.8607504	0.00000	0.00000	-50.000000	CY
0.0001359	41821.	307785272.	13.4889206	0.0018328	-0.003874	4.8956719	0.00000	0.00000	-50.000000	CY
0.0001407	42061.	298883206.	13.3646702	0.0018808	-0.004030	4.9253538	0.00000	0.00000	-50.000000	CY
0.0001456	42286.	290465886.	13.2468269	0.0019285	-0.004186	4.9499494	0.00000	0.00000	-50.000000	CY
0.0001504	42493.	282468641.	13.1312251	0.0019754	-0.004343	4.9693468	0.00000	0.00000	-50.000000	CY
0.0001553	42685.	274875870.	13.0204747	0.0020219	-0.004500	4.9839136	0.00000	0.00000	-50.000000	CY

0.0001601	42864.	267666295.	12.9150032	0.0020682	-0.004658	4.9937863	0.00000	0.00000	-50.000000 CY
0.0001650	43032.	260815463.	12.8145925	0.0021143	-0.004815	4.9990376	0.00000	0.00000	-50.000000 CY
0.0001698	43187.	254273441.	12.7152196	0.0021596	-0.004974	4.9964360	0.00000	0.00000	-50.000000 CY
0.0001747	43332.	248038790.	12.6202443	0.0022047	-0.005133	4.9997717	0.00000	0.00000	-50.000000 CY
0.0001796	43467.	242089290.	12.5295562	0.0022497	-0.005291	4.9974357	0.00000	0.00000	-50.000000 CY
0.0001844	43595.	236411878.	12.4429706	0.0022945	-0.005450	4.9999277	0.00000	0.00000	-50.000000 CY
0.0001893	43714.	230980954.	12.3591473	0.0023390	-0.005610	4.9974008	0.00000	0.00000	-50.000000 CY
0.0001990	43930.	220795570.	12.1978588	0.0024269	-0.005929	4.9962111	0.00000	0.00000	-50.000000 CY
0.0002087	44123.	211450023.	12.0497208	0.0025144	-0.006250	4.9950873	0.00000	0.00000	-50.000000 CY
0.0002184	44293.	202833292.	11.9105051	0.0026009	-0.006571	4.9998261	0.00000	0.00000	-50.000000 CY
0.0002281	44444.	194864158.	11.7784583	0.0026864	-0.006893	4.9977064	0.00000	0.00000	-50.000000 CY
0.0002378	44582.	187490325.	11.6559118	0.0027716	-0.007215	4.9940076	0.00000	0.00000	-50.000000 CY
0.0002475	44708.	180645729.	11.5416950	0.0028564	-0.007538	4.9988437	0.00000	0.00000	-50.000000 CY
0.0002572	44818.	174258628.	11.4300351	0.0029397	-0.007862	4.9914191	0.00000	0.00000	-50.000000 CY
0.0002669	44920.	168304187.	11.3257314	0.0030228	-0.008187	4.9982971	0.00000	0.00000	-50.000000 CY
0.0002766	45015.	162740773.	11.2278060	0.0031057	-0.008512	4.9958902	0.00000	0.00000	-50.000000 CY
0.0002863	45101.	157526595.	11.1357237	0.0031883	-0.008837	4.9955344	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	45101.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	20.5000	0.00	N.A.	No	0.00	68858.
2	28.4400	8.5155	Yes	No	68858.	98285.
3	33.4400	4.7076	No	No	167143.	596640.
4	45.4400	22.9244	No	No	763783.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.4311	9.03E-05	-2.17E-07	-0.00676	6.62E-08	2.95E+11	0.00	0.00	0.00
0.5590	2.3857	6.12E-05	-2.39E-06	-0.00676	4.48E-08	2.95E+11	0.00	0.00	0.00
1.1180	2.3403	5.82E-05	13.7394	-0.00676	4.27E-08	2.95E+11	0.00	0.00	4.0964
1.6770	2.2950	184.3278	93.2936	-0.00676	0.1351	2.95E+11	0.00	0.00	19.6228
2.2360	2.2496	1252.	279.2668	-0.00676	0.9175	2.95E+11	0.00	0.00	35.8254
2.7950	2.2042	3931.	573.9268	-0.00676	2.8814	2.95E+11	0.00	0.00	52.0279
3.3540	2.1589	8951.	977.2736	-0.00676	6.5615	2.95E+11	0.00	0.00	68.2305
3.9130	2.1135	17042.	1489.	-0.00676	12.4920	2.95E+11	0.00	0.00	84.4331
4.4720	2.0682	28932.	2110.	-0.00676	21.2074	2.95E+11	0.00	0.00	100.6357
5.0310	2.0228	45350.	2839.	-0.00676	33.2421	2.95E+11	0.00	0.00	116.8382
5.5900	1.9774	67026.	3678.	-0.00676	49.1306	2.95E+11	0.00	0.00	133.0408
6.1490	1.9321	94688.	4624.	-0.00676	69.4072	2.95E+11	0.00	0.00	149.2434
6.7080	1.8868	129066.	5680.	-0.00676	94.6063	2.95E+11	0.00	0.00	165.4459
7.2670	1.8415	170888.	6844.	-0.00675	125.2625	2.95E+11	0.00	0.00	181.6485
7.8260	1.7962	220884.	8117.	-0.00675	161.9100	2.95E+11	0.00	0.00	197.8511
8.3850	1.7509	279783.	9498.	-0.00674	205.0833	2.95E+11	0.00	0.00	214.0537
8.9440	1.7057	348313.	10989.	-0.00673	255.3168	2.95E+11	0.00	0.00	230.2562
9.5030	1.6606	427204.	12587.	-0.00673	313.1450	2.95E+11	0.00	0.00	246.4588
10.0620	1.6155	517186.	14295.	-0.00672	379.1023	2.95E+11	0.00	0.00	262.6614
10.6210	1.5705	618986.	16111.	-0.00670	453.7230	2.95E+11	0.00	0.00	278.8640
11.1800	1.5256	733335.	18036.	-0.00669	537.5416	2.95E+11	0.00	0.00	295.0665
11.7390	1.4808	860961.	20070.	-0.00667	631.0925	2.95E+11	0.00	0.00	311.2691
12.2980	1.4361	1002593.	22212.	-0.00665	734.9102	2.95E+11	0.00	0.00	327.4717
12.8570	1.3916	1158960.	24463.	-0.00662	849.5290	2.95E+11	0.00	0.00	343.6743
13.4160	1.3473	1330792.	26823.	-0.00659	975.4833	2.95E+11	0.00	0.00	359.8768
13.9750	1.3031	1518817.	29291.	-0.00656	1113.	2.95E+11	0.00	0.00	376.0794
14.5340	1.2592	1723765.	31868.	-0.00653	1264.	2.95E+11	0.00	0.00	392.2820
15.0930	1.2156	1946364.	34554.	-0.00648	1427.	2.95E+11	0.00	0.00	408.4845
15.6520	1.1722	2187344.	37349.	-0.00644	1603.	2.95E+11	0.00	0.00	424.6871
16.2110	1.1292	2447434.	40252.	-0.00638	1794.	2.95E+11	0.00	0.00	440.8897
16.7700	1.0866	2727363.	43264.	-0.00633	1999.	2.95E+11	0.00	0.00	457.0923
17.3290	1.0444	3027859.	46384.	-0.00626	2219.	2.95E+11	0.00	0.00	473.2948
17.8880	1.0026	3349653.	49613.	-0.00619	2455.	2.95E+11	0.00	0.00	489.4974
18.4470	0.9614	3693472.	52951.	-0.00611	2707.	2.95E+11	0.00	0.00	505.7000
19.0060	0.9207	4060047.	56398.	-0.00602	2976.	2.95E+11	0.00	0.00	521.9026
19.5650	0.8806	4450106.	59953.	-0.00592	3262.	2.95E+11	0.00	0.00	538.1051
20.1240	0.8412	4864378.	63617.	-0.00582	3566.	2.95E+11	0.00	0.00	554.3077
20.6830	0.8026	5303592.	67140.	-0.00570	3888.	2.95E+11	-9.888	82.6485	505.9188
21.2420	0.7647	5765127.	68559.	-0.00560	0.00	4.69E+11	-72.980	640.1657	0.00
21.8010	0.7274	6223378.	67869.	-0.00551	0.00	4.66E+11	-132.741	1224.	0.00
22.3600	0.6908	6675655.	66771.	-0.00542	0.00	4.63E+11	-194.491	1889.	0.00

22.9190	0.6547	7119181.	65257.	-0.00532	0.00	4.62E+11	-257.021	2633.	0.00
23.4780	0.6194	7551142.	63328.	-0.00521	0.00	4.62E+11	-318.194	3446.	0.00
24.0370	0.5848	7968785.	60998.	-0.00510	0.00	4.62E+11	-376.402	4318.	0.00
24.5960	0.5509	8369491.	58287.	-0.00498	0.00	4.62E+11	-431.858	5258.	0.00
25.1550	0.5179	8750764.	55222.	-0.00486	0.00	4.61E+11	-481.903	6241.	0.00
25.7140	0.4858	9110353.	51845.	-0.00473	0.00	4.61E+11	-525.171	7252.	0.00
26.2730	0.4545	9446311.	48180.	-0.00459	0.00	4.61E+11	-567.414	8375.	0.00
26.8320	0.4241	9756737.	44255.	-0.00445	0.00	4.61E+11	-602.824	9534.	0.00
27.3910	0.3947	1.00E+07	40120.	-0.00431	0.00	4.61E+11	-629.978	10705.	0.00
27.9500	0.3663	1.03E+07	35814.	-0.00416	0.00	4.61E+11	-654.082	11977.	0.00
28.5090	0.3389	1.05E+07	31599.	-0.00401	0.00	4.61E+11	-602.342	11922.	0.00
29.0680	0.3125	1.07E+07	27547.	-0.00386	0.00	4.60E+11	-605.965	13006.	0.00
29.6270	0.2872	1.09E+07	23492.	-0.00370	0.00	4.60E+11	-603.067	14086.	0.00
30.1860	0.2629	1.10E+07	19485.	-0.00354	0.00	4.60E+11	-591.505	15091.	0.00
30.7450	0.2397	1.12E+07	15555.	-0.00338	0.00	4.60E+11	-580.260	16237.	0.00
31.3040	0.2176	1.12E+07	11704.	-0.00321	0.00	4.60E+11	-568.063	17510.	0.00
31.8630	0.1966	1.13E+07	7959.	-0.00305	0.00	4.60E+11	-548.281	18706.	0.00
32.4220	0.1767	1.13E+07	4373.	-0.00288	0.00	4.60E+11	-521.004	19776.	0.00
32.9810	0.1579	1.14E+07	993.5872	-0.00272	0.00	4.60E+11	-486.557	20666.	0.00
33.5400	0.1403	1.14E+07	-3943.	-0.00255	0.00	4.60E+11	-985.409	47129.	0.00
34.0990	0.1237	1.13E+07	-10528.	-0.00239	0.00	4.60E+11	-977.821	53029.	0.00
34.6580	0.1082	1.12E+07	-17054.	-0.00222	0.00	4.60E+11	-967.864	59985.	0.00
35.2170	0.09387	1.11E+07	-23504.	-0.00206	0.00	4.60E+11	-955.391	68271.	0.00
35.7760	0.08059	1.09E+07	-29862.	-0.00190	0.00	4.60E+11	-940.220	78256.	0.00
36.3350	0.06838	1.07E+07	-36109.	-0.00174	0.00	4.60E+11	-922.123	90455.	0.00
36.8940	0.05722	1.04E+07	-42223.	-0.00159	0.00	4.61E+11	-900.804	105610.	0.00
37.4530	0.04707	1.01E+07	-48182.	-0.00144	0.00	4.61E+11	-875.869	124828.	0.00
38.0120	0.03791	9775471.	-53959.	-0.00129	0.00	4.61E+11	-846.768	149845.	0.00
38.5710	0.02970	9394460.	-59525.	-0.00116	0.00	4.61E+11	-812.695	183552.	0.00
39.1300	0.02241	8976880.	-64842.	-0.00102	0.00	4.61E+11	-772.387	231191.	0.00
39.6890	0.01600	8524545.	-69859.	-8.94E-04	0.00	4.62E+11	-723.688	303470.	0.00
40.2480	0.01041	8039645.	-74508.	-7.74E-04	0.00	4.62E+11	-662.393	426688.	0.00
40.8070	0.00561	7524940.	-78669.	-6.61E-04	0.00	4.62E+11	-578.185	690884.	0.00
41.3660	0.00155	6984218.	-82040.	-5.56E-04	0.00	4.62E+11	-426.703	1850490.	0.00
41.9250	-0.00184	6424296.	-81951.	-4.59E-04	0.00	4.64E+11	453.2667	1651956.	0.00
42.4840	-0.00461	5884769.	-78484.	-3.70E-04	0.00	4.68E+11	580.2689	845182.	0.00
43.0430	-0.00680	5371353.	-74355.	-2.90E-04	0.00	4.72E+11	650.8731	641625.	0.00
43.6020	-0.00849	4887224.	-69825.	-2.17E-04	0.00	4.77E+11	699.6725	552665.	0.00
44.1610	-0.00972	4434579.	-65011.	-1.67E-04	0.00	9.60E+11	735.8081	507837.	0.00
44.7200	-0.01074	4015043.	-59971.	-1.38E-04	0.00	9.60E+11	766.8132	479009.	0.00
45.2790	-0.01157	3630011.	-54736.	-1.11E-04	0.00	9.60E+11	793.8999	460308.	0.00
45.8380	-0.01223	3280703.	-51078.	-8.71E-05	0.00	9.60E+11	296.8767	162830.	0.00
46.3970	-0.01274	2944753.	-49014.	-6.53E-05	0.00	9.60E+11	318.5132	167741.	0.00
46.9560	-0.01311	2623136.	-46809.	-4.59E-05	0.00	9.60E+11	338.8822	173442.	0.00
47.5150	-0.01335	2316767.	-44471.	-2.86E-05	0.00	9.60E+11	358.0263	179861.	0.00
48.0740	-0.01349	2026509.	-42009.	-1.34E-05	0.00	9.60E+11	375.9823	186954.	0.00
48.6330	-0.01353	1753169.	-39431.	-2.40E-07	0.00	9.60E+11	392.7858	194694.	0.00
49.1920	-0.01349	1497503.	-36744.	1.11E-05	0.00	9.60E+11	408.4744	203062.	0.00
49.7510	-0.01338	1260217.	-33954.	2.07E-05	0.00	9.60E+11	423.0892	212051.	0.00
50.3100	-0.01322	1041970.	-31071.	2.88E-05	0.00	9.60E+11	436.6761	221654.	0.00
50.8690	-0.01300	843371.	-28099.	3.54E-05	0.00	9.60E+11	449.2859	231871.	0.00
51.4280	-0.01274	664989.	-25046.	4.06E-05	0.00	9.60E+11	460.9735	242703.	0.00
51.9870	-0.01245	507350.	-21918.	4.47E-05	0.00	9.60E+11	471.7970	254151.	0.00
52.5460	-0.01214	370940.	-18719.	4.78E-05	0.00	9.60E+11	481.8160	266218.	0.00
53.1050	-0.01181	256211.	-15497.	5.00E-05	0.00	9.60E+11	478.8750	271971.	0.00
53.6640	-0.01147	163029.	-12305.	5.15E-05	0.00	9.60E+11	473.0070	276634.	0.00
54.2230	-0.01112	91132.	-9154.	5.23E-05	0.00	9.60E+11	466.3440	281297.	0.00

54.7820	-0.01077	40219.	-6050.	5.28E-05	0.00	9.60E+11	459.0138	285960.	0.00
55.3410	-0.01041	9960.	-2998.	5.30E-05	0.00	9.60E+11	451.1108	290623.	0.00
55.9000	-0.01006	0.00	0.00	5.30E-05	0.00	9.60E+11	442.6935	147643.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 2.43107304 inches
Computed slope at pile head = -0.0067630 radians
Maximum bending moment = 11367174. inch-lbs
Maximum shear force = -82040. lbs
Depth of maximum bending moment = 32.98100000 feet below pile head
Depth of maximum shear force = 41.36600000 feet below pile head
Number of iterations = 29
Number of zero deflection points = 1
Pile deflection at ground = 0.81521615 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
55.90000	2.43107304	11367174.	-82040.
53.10500	2.46097349	11319917.	-86475.
50.31000	2.64144551	11129829.	-95861.
47.51500	3.18193505	10772224.	-104076.
44.72000	4.89663387	10152730.	-108204.
41.92500	14.65911212	9956502.	-121559.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	4.3591	-2.27E-04	4.34E-07	-0.01158	1.67E-07	2.95E+11	0.00	0.00	0.00
0.5590	4.2815	-2.45E-04	-1.30E-06	-0.01158	1.79E-07	2.95E+11	0.00	0.00	0.00
1.1180	4.2038	-2.45E-04	20.6115	-0.01158	1.79E-07	2.95E+11	0.00	0.00	6.1453
1.6770	4.1262	276.5234	139.9566	-0.01158	0.2027	2.95E+11	0.00	0.00	29.4376
2.2360	4.0485	1878.	418.9486	-0.01158	1.3763	2.95E+11	0.00	0.00	53.7443
2.7950	3.9709	5897.	860.9897	-0.01158	4.3227	2.95E+11	0.00	0.00	78.0509
3.3540	3.8932	13429.	1466.	-0.01158	9.8434	2.95E+11	0.00	0.00	102.3576
3.9130	3.8156	25566.	2234.	-0.01157	18.7402	2.95E+11	0.00	0.00	126.6643
4.4720	3.7379	43403.	3165.	-0.01157	31.8148	2.95E+11	0.00	0.00	150.9709
5.0310	3.6603	68033.	4260.	-0.01157	49.8690	2.95E+11	0.00	0.00	175.2776
5.5900	3.5827	100550.	5517.	-0.01157	73.7044	2.95E+11	0.00	0.00	199.5843
6.1490	3.5051	142048.	6937.	-0.01157	104.1228	2.95E+11	0.00	0.00	223.8909
6.7080	3.4275	193621.	8521.	-0.01156	141.9259	2.95E+11	0.00	0.00	248.1976
7.2670	3.3499	256361.	10267.	-0.01156	187.9154	2.95E+11	0.00	0.00	272.5043
7.8260	3.2724	331364.	12177.	-0.01155	242.8930	2.95E+11	0.00	0.00	296.8109
8.3850	3.1949	419722.	14249.	-0.01154	307.6605	2.95E+11	0.00	0.00	321.1176
8.9440	3.1175	522530.	16485.	-0.01153	383.0195	2.95E+11	0.00	0.00	345.4243
9.5030	3.0402	640881.	18883.	-0.01152	469.7718	2.95E+11	0.00	0.00	369.7309
10.0620	2.9630	775869.	21445.	-0.01150	568.7192	2.95E+11	0.00	0.00	394.0376
10.6210	2.8859	928587.	24170.	-0.01148	680.6632	2.95E+11	0.00	0.00	418.3443
11.1800	2.8089	1100130.	27058.	-0.01146	806.4056	2.95E+11	0.00	0.00	442.6510
11.7390	2.7321	1291590.	30108.	-0.01143	946.7482	2.95E+11	0.00	0.00	466.9576
12.2980	2.6555	1504063.	33322.	-0.01140	1102.	2.95E+11	0.00	0.00	491.2643
12.8570	2.5791	1738641.	36699.	-0.01137	1274.	2.95E+11	0.00	0.00	515.5710
13.4160	2.5030	1996418.	40239.	-0.01132	1463.	2.95E+11	0.00	0.00	539.8776
13.9750	2.4272	2278489.	43942.	-0.01127	1670.	2.95E+11	0.00	0.00	564.1843
14.5340	2.3518	2585946.	47808.	-0.01122	1896.	2.95E+11	0.00	0.00	588.4910
15.0930	2.2767	2919884.	51837.	-0.01116	2140.	2.95E+11	0.00	0.00	612.7976
15.6520	2.2021	3281396.	56029.	-0.01109	2405.	2.95E+11	0.00	0.00	637.1043
16.2110	2.1280	3671575.	60385.	-0.01101	2691.	2.95E+11	0.00	0.00	661.4110
16.7700	2.0544	4091517.	64903.	-0.01092	2999.	2.95E+11	0.00	0.00	685.7176
17.3290	1.9815	4542314.	69584.	-0.01082	3330.	2.95E+11	0.00	0.00	710.0243
17.8880	1.9092	5025060.	74429.	-0.01071	3683.	2.95E+11	0.00	0.00	734.3310
18.4470	1.8378	5540849.	79436.	-0.01059	4061.	2.95E+11	0.00	0.00	758.6376
19.0060	1.7671	6090774.	84607.	-0.01046	4465.	2.95E+11	0.00	0.00	782.9443
19.5650	1.6974	6675930.	89940.	-0.01031	4894.	2.95E+11	0.00	0.00	807.2510
20.1240	1.6288	7297410.	95437.	-0.01016	5349.	2.95E+11	0.00	0.00	831.5576
20.6830	1.5612	7956308.	100738.	-0.00998	5832.	2.95E+11	-9.888	42.4871	758.9660
21.2420	1.4948	8648912.	102939.	-0.00983	0.00	4.62E+11	-92.892	416.8464	0.00
21.8010	1.4293	9337337.	102060.	-0.00970	0.00	4.61E+11	-169.163	793.9024	0.00
22.3600	1.3647	1.00E+07	100661.	-0.00956	0.00	4.61E+11	-248.026	1219.	0.00
22.9190	1.3011	1.07E+07	98733.	-0.00941	0.00	4.60E+11	-326.879	1685.	0.00
23.4780	1.2385	1.13E+07	96282.	-0.00925	0.00	4.60E+11	-403.875	2187.	0.00
24.0370	1.1771	1.20E+07	93327.	-0.00908	0.00	4.60E+11	-477.180	2719.	0.00
24.5960	1.1168	1.26E+07	89892.	-0.00890	0.00	4.59E+11	-546.841	3285.	0.00
25.1550	1.0577	1.32E+07	86012.	-0.00871	0.00	4.59E+11	-610.081	3869.	0.00
25.7140	0.9999	1.37E+07	81733.	-0.00851	0.00	4.59E+11	-665.453	4464.	0.00
26.2730	0.9435	1.43E+07	77085.	-0.00831	0.00	4.58E+11	-720.590	5123.	0.00
26.8320	0.8885	1.48E+07	72091.	-0.00809	0.00	4.58E+11	-768.343	5801.	0.00
27.3910	0.8349	1.52E+07	66807.	-0.00787	0.00	4.58E+11	-807.163	6485.	0.00
27.9500	0.7828	1.57E+07	61274.	-0.00765	0.00	4.58E+11	-842.363	7218.	0.00
28.5090	0.7323	1.61E+07	55818.	-0.00741	0.00	4.57E+11	-784.303	7184.	0.00
29.0680	0.6834	1.64E+07	50507.	-0.00718	0.00	4.57E+11	-799.252	7845.	0.00

29.6270	0.6360	1.67E+07	45114.	-0.00693	0.00	4.57E+11	-808.759	8530.	0.00
30.1860	0.5904	1.70E+07	39689.	-0.00669	0.00	4.57E+11	-808.476	9186.	0.00
30.7450	0.5464	1.73E+07	34259.	-0.00643	0.00	4.57E+11	-810.622	9953.	0.00
31.3040	0.5041	1.75E+07	28812.	-0.00618	0.00	4.57E+11	-813.286	10823.	0.00
31.8630	0.4635	1.77E+07	23378.	-0.00592	0.00	4.57E+11	-806.858	11678.	0.00
32.4220	0.4246	1.78E+07	18020.	-0.00566	0.00	4.57E+11	-790.881	12494.	0.00
32.9810	0.3876	1.79E+07	12801.	-0.00540	0.00	4.56E+11	-765.063	13242.	0.00
33.5400	0.3522	1.80E+07	6074.	-0.00513	0.00	4.56E+11	-1240.	23624.	0.00
34.0990	0.3187	1.80E+07	-2241.	-0.00487	0.00	4.56E+11	-1239.	26075.	0.00
34.6580	0.2869	1.79E+07	-10538.	-0.00460	0.00	4.56E+11	-1235.	28873.	0.00
35.2170	0.2569	1.78E+07	-18802.	-0.00434	0.00	4.56E+11	-1229.	32083.	0.00
35.7760	0.2287	1.77E+07	-27016.	-0.00408	0.00	4.57E+11	-1220.	35794.	0.00
36.3350	0.2022	1.75E+07	-35165.	-0.00382	0.00	4.57E+11	-1209.	40117.	0.00
36.8940	0.1774	1.72E+07	-43229.	-0.00357	0.00	4.57E+11	-1195.	45196.	0.00
37.4530	0.1543	1.69E+07	-51192.	-0.00332	0.00	4.57E+11	-1179.	51226.	0.00
38.0120	0.1329	1.65E+07	-59031.	-0.00307	0.00	4.57E+11	-1159.	58475.	0.00
38.5710	0.1131	1.61E+07	-66725.	-0.00283	0.00	4.57E+11	-1135.	67314.	0.00
39.1300	0.09494	1.56E+07	-74250.	-0.00260	0.00	4.58E+11	-1108.	78291.	0.00
39.6890	0.07828	1.51E+07	-81576.	-0.00237	0.00	4.58E+11	-1076.	92233.	0.00
40.2480	0.06310	1.45E+07	-88671.	-0.00216	0.00	4.58E+11	-1039.	110471.	0.00
40.8070	0.04935	1.39E+07	-95496.	-0.00195	0.00	4.59E+11	-995.460	135301.	0.00
41.3660	0.03697	1.33E+07	-101997.	-0.00175	0.00	4.59E+11	-943.037	171100.	0.00
41.9250	0.02589	1.26E+07	-108106.	-0.00156	0.00	4.59E+11	-878.160	227522.	0.00
42.4840	0.01604	1.18E+07	-113710.	-0.00138	0.00	4.60E+11	-792.832	331566.	0.00
43.0430	0.00735	1.10E+07	-118595.	-0.00122	0.00	4.60E+11	-663.519	605925.	0.00
43.6020	-2.70E-04	1.02E+07	-120397.	-0.00106	0.00	4.61E+11	126.0915	3133654.	0.00
44.1610	-0.00689	9420450.	-117710.	-9.18E-04	0.00	4.61E+11	675.1064	657594.	0.00
44.7200	-0.01258	8646040.	-112770.	-7.87E-04	0.00	4.62E+11	797.8581	425302.	0.00
45.2790	-0.01744	7907532.	-107143.	-6.66E-04	0.00	4.62E+11	879.6916	338387.	0.00
45.8380	-0.02152	7208608.	-102789.	-5.57E-04	0.00	4.62E+11	418.6229	130473.	0.00
46.3970	-0.02491	6528521.	-99779.	-4.57E-04	0.00	4.64E+11	478.8373	128971.	0.00
46.9560	-0.02765	5869980.	-96383.	-3.68E-04	0.00	4.68E+11	533.5948	129433.	0.00
47.5150	-0.02984	5235449.	-92635.	-2.89E-04	0.00	4.74E+11	583.7701	131235.	0.00
48.0740	-0.03153	4627186.	-88564.	-2.35E-04	0.00	9.60E+11	629.9592	134038.	0.00
48.6330	-0.03300	4047270.	-84186.	-2.05E-04	0.00	9.60E+11	675.3139	137284.	0.00
49.1920	-0.03428	3497741.	-79506.	-1.79E-04	0.00	9.60E+11	720.0174	140901.	0.00
49.7510	-0.03540	2980611.	-74528.	-1.56E-04	0.00	9.60E+11	764.2448	144836.	0.00
50.3100	-0.03637	2497870.	-69254.	-1.37E-04	0.00	9.60E+11	808.1692	149044.	0.00
50.8690	-0.03723	2051494.	-63686.	-1.21E-04	0.00	9.60E+11	851.9643	153490.	0.00
51.4280	-0.03800	1643454.	-57824.	-1.08E-04	0.00	9.60E+11	895.8058	158142.	0.00
51.9870	-0.03869	1275723.	-51667.	-9.80E-05	0.00	9.60E+11	939.8701	162973.	0.00
52.5460	-0.03931	950284.	-45214.	-9.02E-05	0.00	9.60E+11	984.3328	167959.	0.00
53.1050	-0.03990	669137.	-38460.	-8.46E-05	0.00	9.60E+11	1029.	173076.	0.00
53.6640	-0.04045	434308.	-31401.	-8.07E-05	0.00	9.60E+11	1075.	178306.	0.00
54.2230	-0.04098	247858.	-24033.	-7.83E-05	0.00	9.60E+11	1122.	183631.	0.00
54.7820	-0.04150	111885.	-16348.	-7.71E-05	0.00	9.60E+11	1169.	189036.	0.00
55.3410	-0.04201	28533.	-8340.	-7.66E-05	0.00	9.60E+11	1218.	194512.	0.00
55.9000	-0.04253	0.00	0.00	-7.65E-05	0.00	9.60E+11	1268.	100025.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     4.35910325 inches
Computed slope at pile head      =     -0.0115755 radians
Maximum bending moment           =      17991135. inch-lbs
Maximum shear force              =       -120397. lbs
Depth of maximum bending moment  =    34.09900000 feet below pile head
Depth of maximum shear force     =    43.60200000 feet below pile head
Number of iterations             =             26
Number of zero deflection points =              1
Pile deflection at ground        =     1.58331211 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
55.90000	4.35910325	17991135.	-120397.
53.10500	4.55178662	17754702.	-131475.
50.31000	5.23448415	17181935.	-145132.
47.51500	7.34939412	16645561.	-155124.
44.72000	54.88444437	16615325.	-195706.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

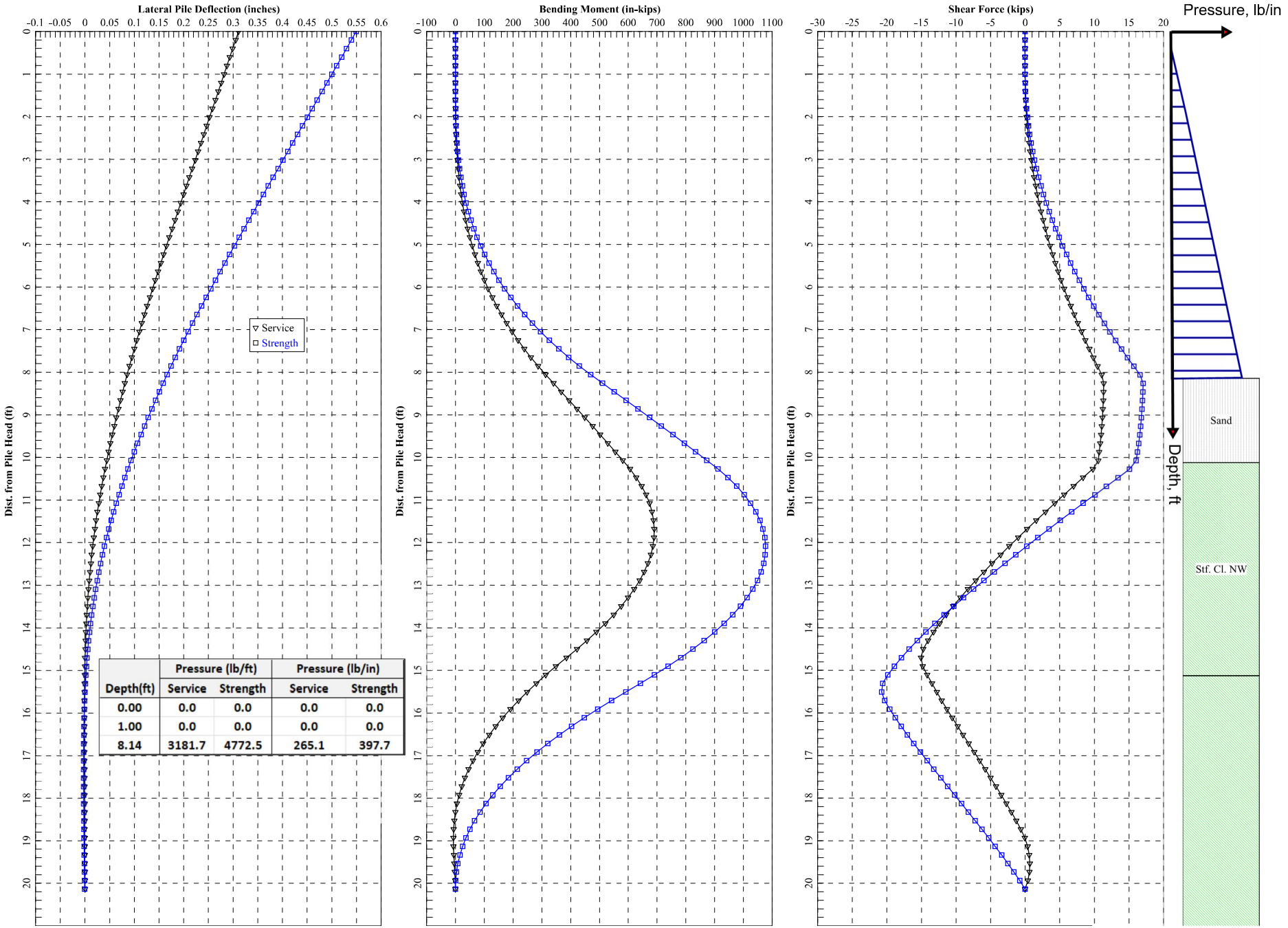
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	2.4311	-0.00676	-82040.	1.14E+07
2	V, lb	0.00	M, in-lb	0.00	0.00	4.3591	-0.01158	-120397.	1.80E+07

```
Maximum pile-head deflection = 4.3591032529 inches
Maximum pile-head rotation   = -0.0115754742 radians = -0.663226 deg.

The analysis ended normally.
```

Wall 1D (8.14ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
8.14	3181.7	4772.5	265.1	397.7

==========

LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
01 Wall_1D-8.14ft.lp12d

Name of output report file:
01 Wall_1D-8.14ft.lp12o

Name of plot output file:
01 Wall_1D-8.14ft.lp12p

Name of runtime message file:
01 Wall_1D-8.14ft.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 14:58:44

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1D (H=8.14FT) Boring B-051-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 20.140 ft
Depth of ground surface below top of pile = 8.1400 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	6.9900
2	8.140	6.9900
3	8.140	24.0000
4	20.140	24.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 8.140000 ft
   AISC Section Type = W
   AISC Section Name = W16X36
   Pile width = 6.990000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 12.000000 ft
   Section Diameter = 24.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W16X36

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 8.140000 ft
   Distance from top of pile to bottom of layer = 10.120000 ft
   Effective unit weight at top of layer = 57.600000 pcf
   Effective unit weight at bottom of layer = 57.600000 pcf
   Friction angle at top of layer = 30.000000 deg.
   Friction angle at bottom of layer = 30.000000 deg.
   Subgrade k at top of layer = 60.000000 pci
   Subgrade k at bottom of layer = 60.000000 pci

Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer = 10.120000 ft
   Distance from top of pile to bottom of layer = 15.120000 ft
   Effective unit weight at top of layer = 62.600000 pcf

```
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3500. psf
   Undrained cohesion at bottom of layer               =        3500. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    15.120000 ft
   Distance from top of pile to bottom of layer        =    27.620000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        3000. psf
   Undrained cohesion at bottom of layer               =        3000. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    27.620000 ft
   Distance from top of pile to bottom of layer        =    32.620000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    34.000000 deg.
   Friction angle at bottom of layer                   =    34.000000 deg.
   Subgrade k at top of layer                          =   120.000000 pci
   Subgrade k at bottom of layer                       =   120.000000 pci


Layer 5 is stiff clay without free water

   Distance from top of pile to top of layer           =    32.620000 ft
   Distance from top of pile to bottom of layer        =    32.620000 ft
   Effective unit weight at top of layer               =    67.600000 pcf
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =        4000. psf
   Undrained cohesion at bottom of layer               =        4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


 (Depth of the lowest soil layer extends 12.480 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.           Name             Depth       Unit Wt.                 Friction        or          kpy
         (p-y Curve Type)          ft          pcf          psf          deg.         krm         pci
-----   ------------------   ----------   ----------   ----------   ----------   ----------   ----------
  1           Sand              8.1400      57.6000       --          30.0000       --          60.0000
        (Reese, et al.)        10.1200      57.6000       --          30.0000       --          60.0000
  2         Stiff Clay         10.1200      62.6000        3500.       --          0.00400      --
```

	w/o Free Water	15.1200	62.6000	3500.	--	0.00400	--
3	Stiff Clay	15.1200	57.6000	3000.	--	0.00500	--
	w/o Free Water	27.6200	57.6000	3000.	--	0.00500	--
4	Sand	27.6200	62.6000	--	34.0000	--	120.0000
	(Reese, et al.)	32.6200	62.6000	--	34.0000	--	120.0000
5	Stiff Clay	32.6200	67.6000	4000.	--	0.00400	--
	w/o Free Water	32.6200	67.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	8.140	1.0000	1.0000
2	25.000	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	8.140	265.100

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	8.140	397.700

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	8.140000 ft
Flange Width	=	6.990000 in
Section Depth	=	15.900000 in
Flange Thickness	=	0.430000 in
Web Thickness	=	0.295000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	10.600000 sq. in.
Moment of Inertia	=	448.000000 in^4
Elastic Bending Stiffness	=	12992000. kip-in^2
Plastic Modulus, Z	=	64.000000in^3
Plastic Moment Capacity = Fy Z	=	3200.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	530.000 kips
Nominal Axial Tensile Capacity	=	-530.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00001048	134.6248988	12842265.	7.9500000	2.3926771	
0.00002097	269.2497976	12842265.	7.9500000	4.7853541	
0.00003145	403.8746964	12842265.	7.9500000	7.1780312	
0.00004193	538.4995952	12842265.	7.9500000	9.5707083	
0.00005241	673.1244941	12842265.	7.9500000	11.9633853	
0.00006290	807.7493929	12842265.	7.9500000	14.3560624	
0.00007338	942.3742917	12842265.	7.9500000	16.7487395	
0.00008386	1077.	12842265.	7.9500000	19.1414166	
0.00009435	1212.	12842265.	7.9500000	21.5340936	
0.0001048	1346.	12842265.	7.9500000	23.9267707	
0.0001153	1481.	12842265.	7.9500000	26.3194478	
0.0001258	1615.	12842265.	7.9500000	28.7121248	
0.0001363	1750.	12842265.	7.9500000	31.1048019	
0.0001468	1885.	12842265.	7.9500000	33.4974790	
0.0001572	2019.	12842265.	7.9500000	35.8901560	
0.0001677	2154.	12842265.	7.9500000	38.2828331	
0.0001782	2289.	12842265.	7.9500000	40.6755102	
0.0001887	2423.	12842265.	7.9500000	43.0681872	
0.0001992	2558.	12842265.	7.9500000	45.4608643	
0.0002097	2692.	12842265.	7.9500000	47.8535414	
0.0002201	2823.	12822698.	7.9500000	50.0000000	Y
0.0002306	2882.	12498264.	7.9500000	50.0000000	Y
0.0002411	2906.	12051812.	7.9500000	50.0000000	Y
0.0002516	2926.	11631208.	7.9500000	50.0000000	Y
0.0002621	2944.	11235221.	7.9500000	50.0000000	Y
0.0002726	2960.	10861868.	7.9500000	50.0000000	Y
0.0002830	2975.	10510181.	7.9500000	50.0000000	Y
0.0002935	2988.	10178301.	7.9500000	50.0000000	Y
0.0003040	2999.	9865275.	7.9500000	50.0000000	Y
0.0003145	3010.	9569543.	7.9500000	50.0000000	Y
0.0003250	3019.	9289604.	7.9500000	50.0000000	Y
0.0003355	3027.	9024653.	7.9500000	50.0000000	Y
0.0003459	3035.	8773603.	7.9500000	50.0000000	Y
0.0003564	3042.	8535478.	7.9500000	50.0000000	Y
0.0003669	3049.	8309288.	7.9500000	50.0000000	Y
0.0003774	3055.	8094109.	7.9500000	50.0000000	Y
0.0003879	3060.	7889392.	7.9500000	50.0000000	Y
0.0003984	3065.	7694489.	7.9500000	50.0000000	Y

0.0004088	3070.	7508760.	7.9500000	50.0000000	Y
0.0004298	3078.	7161693.	7.9500000	50.0000000	Y
0.0004508	3085.	6844498.	7.9500000	50.0000000	Y
0.0004717	3092.	6553548.	7.9500000	50.0000000	Y
0.0004927	3097.	6285777.	7.9500000	50.0000000	Y
0.0005137	3102.	6038597.	7.9500000	50.0000000	Y
0.0005346	3106.	5809804.	7.9500000	50.0000000	Y
0.0005556	3110.	5597482.	7.9500000	50.0000000	Y
0.0005766	3113.	5399674.	7.9500000	50.0000000	Y
0.0005975	3116.	5215277.	7.9500000	50.0000000	Y
0.0006185	3119.	5043016.	7.9500000	50.0000000	Y
0.0006395	3121.	4881399.	7.9500000	50.0000000	Y
0.0006604	3124.	4729915.	7.9500000	50.0000000	Y
0.0006814	3126.	4587265.	7.9500000	50.0000000	Y
0.0007024	3128.	4453067.	7.9500000	50.0000000	Y
0.0007233	3129.	4326233.	7.9500000	50.0000000	Y
0.0007443	3131.	4206544.	7.9500000	50.0000000	Y
0.0007653	3132.	4093085.	7.9500000	50.0000000	Y
0.0007862	3134.	3985611.	7.9500000	50.0000000	Y
0.0008072	3135.	3883660.	7.9500000	50.0000000	Y
0.0008282	3136.	3786612.	7.9500000	50.0000000	Y
0.0008491	3137.	3694358.	7.9500000	50.0000000	Y
0.0008701	3138.	3606517.	7.9500000	50.0000000	Y
0.0008911	3139.	3522588.	7.9500000	50.0000000	Y
0.0009120	3140.	3442518.	7.9500000	50.0000000	Y
0.0009330	3140.	3366047.	7.9500000	50.0000000	Y
0.0009539	3141.	3292832.	7.9500000	50.0000000	Y
0.0009749	3142.	3222673.	7.9500000	50.0000000	Y
0.0009959	3142.	3155468.	7.9500000	50.0000000	Y
0.0010168	3143.	3091035.	7.9500000	50.0000000	Y
0.0010378	3144.	3029168.	7.9500000	50.0000000	Y
0.0010588	3144.	2969637.	7.9500000	50.0000000	Y
0.0010797	3145.	2912418.	7.9500000	50.0000000	Y
0.0011007	3145.	2857379.	7.9500000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	3145.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	12.000000	ft
Outside Diameter of Casing	=	24.000000	in
Casing Wall Thickness	=	0.0000	in
Moment of Inertia of Steel Casing	=	0.0000	in^4
Width Flange of Core/Insert	=	6.990000	in
Depth of Core/Insert	=	15.900000	in
Flange Thickness of Core/Insert	=	0.430000	in
Web Thickness of Core/Insert	=	0.295000	in
Moment of Inertia of Steel Core/Insert	=	448.000000	in^4
Yield Stress of Casing	=	50000.	psi
Elastic Modulus of Casing	=	29000000.	psi
Yield Stress of Core/Insert	=	50000.	psi
Elastic Modulus of Core/Insert	=	29000000.	psi
Number of Reinforcing Bars	=	0	bars
Gross Area of Pile	=	452.389342	sq. in.
Area of Concrete	=	441.941142	sq. in.
Cross-sectional Area of Steel Casing	=	0.0000	sq. in.
Cross-sectional Area of Steel Core/Insert	=	10.600000	sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	10.448200	sq. in.
Area Ratio of All Steel to Gross Area	=	2.31	percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	2407.605	kips
Tensile Load for Cracking of Concrete	=	-240.075	kips
Nominal Axial Tensile Capacity	=	-530.000	kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg

0.00001048	275.9710714	26325692.	7.0897524	0.00007432	-0.000177	0.3404498	0.00000	0.00000	-3.936949	C
0.00002097	550.3541401	26249950.	7.1089178	0.0001490	-0.000354	0.6706698	0.00000	0.00000	-7.862246	C
0.00003145	823.1104857	26172977.	7.1284444	0.0002242	-0.000531	0.9905093	0.00000	0.00000	-11.775560	C
0.00004193	1094.	26094728.	7.1483464	0.0002997	-0.000707	1.2998110	0.00000	0.00000	-15.676546	C
0.00005241	1364.	26015156.	7.1686389	0.0003757	-0.000882	1.5984112	0.00000	0.00000	-19.564837	C
0.00006290	1631.	25934212.	7.1893379	0.0004522	-0.001057	1.8861389	0.00000	0.00000	-23.440049	C
0.00007338	1897.	25851842.	7.2104604	0.0005291	-0.001232	2.1628155	0.00000	0.00000	-27.301774	C
0.00008386	2161.	25767990.	7.2320244	0.0006065	-0.001406	2.4282540	0.00000	0.00000	-31.149583	C
0.00009435	2423.	25682597.	7.2540491	0.0006844	-0.001580	2.6822587	0.00000	0.00000	-34.983020	C
0.0001048	2683.	25595599.	7.2765551	0.0007628	-0.001753	2.9246242	0.00000	0.00000	-38.801603	C
0.0001153	2941.	25506928.	7.2995644	0.0008417	-0.001926	3.1551350	0.00000	0.00000	-42.604818	C
0.0001258	3197.	25416532.	7.3229984	0.0009212	-0.002098	3.3735295	0.00000	0.00000	-46.392495	C
0.0001363	3451.	25321293.	7.3459372	0.0010011	-0.002270	3.5792418	0.00000	0.00000	-50.000000	CY
0.0001468	3594.	24489418.	7.2855313	0.0010692	-0.002453	3.7432714	0.00000	0.00000	-50.000000	CY
0.0001572	3680.	23403499.	7.1919279	0.0011309	-0.002643	3.8827507	0.00000	0.00000	-50.000000	CY
0.0001677	3754.	22382211.	7.1028079	0.0011913	-0.002834	4.0114774	0.00000	0.00000	-50.000000	CY
0.0001782	3818.	21425101.	7.0158552	0.0012503	-0.003027	4.1293973	0.00000	0.00000	-50.000000	CY
0.0001887	3874.	20531508.	6.9328528	0.0013082	-0.003220	4.2378365	0.00000	0.00000	-50.000000	CY
0.0001992	3924.	19700525.	6.8549654	0.0013653	-0.003415	4.3378214	0.00000	0.00000	-50.000000	CY
0.0002097	3968.	18924909.	6.7791250	0.0014213	-0.003611	4.4288514	0.00000	0.00000	-50.000000	CY
0.0002201	4007.	18201663.	6.7071922	0.0014765	-0.003807	4.5120731	0.00000	0.00000	-50.000000	CY
0.0002306	4042.	17527309.	6.6396542	0.0015313	-0.004004	4.5880721	0.00000	0.00000	-50.000000	CY
0.0002411	4074.	16897412.	6.5751625	0.0015853	-0.004201	4.6567949	0.00000	0.00000	-50.000000	CY
0.0002516	4103.	16307415.	6.5127364	0.0016385	-0.004400	4.7183143	0.00000	0.00000	-50.000000	CY
0.0002621	4129.	15754986.	6.4540489	0.0016914	-0.004598	4.7734303	0.00000	0.00000	-50.000000	CY
0.0002726	4153.	15236886.	6.3988466	0.0017440	-0.004797	4.8223014	0.00000	0.00000	-50.000000	CY
0.0002830	4175.	14750160.	6.3462941	0.0017963	-0.004997	4.8649254	0.00000	0.00000	-50.000000	CY
0.0002935	4195.	14291162.	6.2948093	0.0018477	-0.005197	4.9011886	0.00000	0.00000	-50.000000	CY
0.0003040	4213.	13858721.	6.2462901	0.0018989	-0.005397	4.9316965	0.00000	0.00000	-50.000000	CY
0.0003145	4230.	13450667.	6.2005400	0.0019500	-0.005598	4.9565232	0.00000	0.00000	-50.000000	CY
0.0003250	4246.	13065070.	6.1573921	0.0020010	-0.005798	4.9757286	0.00000	0.00000	-50.000000	CY
0.0003355	4260.	12700119.	6.1165021	0.0020518	-0.005999	4.9893434	0.00000	0.00000	-50.000000	CY
0.0003459	4273.	12353269.	6.0757526	0.0021018	-0.006201	4.9973450	0.00000	0.00000	-50.000000	CY
0.0003564	4286.	12024310.	6.0373108	0.0021518	-0.006402	4.9999397	0.00000	0.00000	-50.000000	CY
0.0003669	4297.	11711572.	6.0010845	0.0022018	-0.006604	4.9982741	0.00000	0.00000	-50.000000	CY
0.0003774	4307.	11413747.	5.9666928	0.0022517	-0.006806	4.9969067	0.00000	0.00000	-50.000000	CY
0.0003879	4317.	11130217.	5.9344421	0.0023018	-0.007007	4.9982149	0.00000	0.00000	-50.000000	CY
0.0003984	4326.	10859971.	5.9039311	0.0023518	-0.007209	4.9982623	0.00000	0.00000	-50.000000	CY
0.0004088	4334.	10601437.	5.8747321	0.0024018	-0.007410	4.9971285	0.00000	0.00000	-50.000000	CY
0.0004298	4348.	10117424.	5.8178811	0.0025005	-0.007815	4.9940797	0.00000	0.00000	-50.000000	CY
0.0004508	4361.	9674030.	5.7667015	0.0025994	-0.008219	4.9983608	0.00000	0.00000	-50.000000	CY
0.0004717	4371.	9266282.	5.7206881	0.0026986	-0.008623	4.9987783	0.00000	0.00000	-50.000000	CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	4371.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	8.1400	0.00	N.A.	No	0.00	2047.
2	10.1200	0.09706	No	No	2047.	129262.
3	15.1200	5.7862	Yes	No	131310.	157884.
4	27.6200	19.4800	No	No	289193.	0.00
5	32.6200	24.4800	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.3112	3.05E-06	2.53E-08	-0.00242	2.38E-08	1.28E+10	0.00	0.00	0.00
0.2014	0.3053	4.88E-06	3.54E-07	-0.00242	3.81E-08	1.28E+10	0.00	0.00	0.00
0.4028	0.2995	4.76E-06	-5.05E-08	-0.00242	3.71E-08	1.28E+10	0.00	0.00	0.00
0.6042	0.2936	4.64E-06	0.00	-0.00242	3.62E-08	1.28E+10	0.00	0.00	0.00
0.8056	0.2877	4.76E-06	0.00	-0.00242	3.71E-08	1.28E+10	0.00	0.00	0.00
1.0070	0.2819	4.64E-06	1.2920	-0.00242	3.62E-08	1.28E+10	0.00	0.00	1.0692

1.2084	0.2760	6.2450	11.9342	-0.00242	0.04872	1.28E+10	0.00	0.00	7.7377
1.4098	0.2702	57.6851	39.6707	-0.00242	0.4500	1.28E+10	0.00	0.00	15.2154
1.6112	0.2643	197.9972	85.4794	-0.00242	1.5446	1.28E+10	0.00	0.00	22.6932
1.8126	0.2584	470.8582	149.3603	-0.00242	3.6733	1.28E+10	0.00	0.00	30.1709
2.0140	0.2526	919.9451	231.3134	-0.00242	7.1768	1.28E+10	0.00	0.00	37.6487
2.2154	0.2467	1589.	331.3388	-0.00242	12.3958	1.28E+10	0.00	0.00	45.1264
2.4168	0.2409	2522.	449.4364	-0.00242	19.6711	1.28E+10	0.00	0.00	52.6042
2.6182	0.2350	3761.	585.6063	-0.00242	29.3434	1.28E+10	0.00	0.00	60.0819
2.8196	0.2292	5352.	739.8484	-0.00242	41.7535	1.28E+10	0.00	0.00	67.5597
3.0210	0.2233	7337.	912.1626	-0.00242	57.2420	1.28E+10	0.00	0.00	75.0374
3.2224	0.2175	9761.	1103.	-0.00242	76.1498	1.28E+10	0.00	0.00	82.5152
3.4238	0.2116	12667.	1311.	-0.00242	98.8176	1.28E+10	0.00	0.00	89.9929
3.6252	0.2058	16098.	1538.	-0.00241	125.5860	1.28E+10	0.00	0.00	97.4707
3.8266	0.1999	20099.	1782.	-0.00241	156.7959	1.28E+10	0.00	0.00	104.9484
4.0280	0.1941	24712.	2045.	-0.00241	192.7880	1.28E+10	0.00	0.00	112.4262
4.2294	0.1883	29982.	2326.	-0.00240	233.9030	1.28E+10	0.00	0.00	119.9039
4.4308	0.1825	35953.	2624.	-0.00240	280.4817	1.28E+10	0.00	0.00	127.3817
4.6322	0.1767	42668.	2941.	-0.00239	332.8648	1.28E+10	0.00	0.00	134.8594
4.8336	0.1710	50170.	3276.	-0.00238	391.3930	1.28E+10	0.00	0.00	142.3372
5.0350	0.1652	58504.	3629.	-0.00237	456.4071	1.28E+10	0.00	0.00	149.8149
5.2364	0.1595	67712.	4000.	-0.00236	528.2479	1.28E+10	0.00	0.00	157.2927
5.4378	0.1538	77840.	4390.	-0.00234	607.2559	1.28E+10	0.00	0.00	164.7704
5.6392	0.1482	88930.	4797.	-0.00233	693.7721	1.28E+10	0.00	0.00	172.2482
5.8406	0.1426	101026.	5222.	-0.00231	788.1371	1.28E+10	0.00	0.00	179.7259
6.0420	0.1370	114172.	5666.	-0.00229	890.6917	1.28E+10	0.00	0.00	187.2037
6.2434	0.1315	128411.	6127.	-0.00227	1002.	1.28E+10	0.00	0.00	194.6814
6.4448	0.1261	143787.	6607.	-0.00224	1122.	1.28E+10	0.00	0.00	202.1592
6.6462	0.1207	160344.	7104.	-0.00221	1251.	1.28E+10	0.00	0.00	209.6369
6.8476	0.1154	178126.	7620.	-0.00218	1390.	1.28E+10	0.00	0.00	217.1147
7.0490	0.1102	197176.	8154.	-0.00215	1538.	1.28E+10	0.00	0.00	224.5924
7.2504	0.1050	217537.	8705.	-0.00211	1697.	1.28E+10	0.00	0.00	232.0702
7.4518	0.09998	239254.	9275.	-0.00206	1867.	1.28E+10	0.00	0.00	239.5479
7.6532	0.09505	262371.	9863.	-0.00202	2047.	1.28E+10	0.00	0.00	247.0257
7.8546	0.09023	286930.	10469.	-0.00196	2238.	1.28E+10	0.00	0.00	254.5034
8.0560	0.08555	312975.	11067.	-0.00191	2442.	1.28E+10	0.00	0.00	239.9735
8.2574	0.08101	340423.	11352.	-0.00186	0.00	2.63E+10	-4.346	129.6409	0.00
8.4588	0.07655	367845.	11332.	-0.00183	0.00	2.63E+10	-11.968	377.8691	0.00
8.6602	0.07216	395197.	11294.	-0.00180	0.00	2.63E+10	-19.672	658.8200	0.00
8.8616	0.06787	422434.	11237.	-0.00176	0.00	2.63E+10	-27.308	972.4312	0.00
9.0630	0.06367	449511.	11162.	-0.00172	0.00	2.63E+10	-34.732	1318.	0.00
9.2644	0.05957	476386.	11069.	-0.00167	0.00	2.63E+10	-42.072	1707.	0.00
9.4658	0.05557	503015.	10959.	-0.00163	0.00	2.63E+10	-49.260	2142.	0.00
9.6672	0.05169	529356.	10831.	-0.00158	0.00	2.63E+10	-56.063	2621.	0.00
9.8686	0.04793	555370.	10692.	-0.00153	0.00	2.62E+10	-59.648	3008.	0.00
10.0700	0.04428	581036.	10545.	-0.00148	0.00	2.62E+10	-61.537	3358.	0.00
10.2714	0.04077	606342.	9777.	-0.00143	0.00	2.62E+10	-574.188	34035.	0.00
10.4728	0.03740	628294.	8392.	-0.00137	0.00	2.62E+10	-571.759	36952.	0.00
10.6742	0.03416	646906.	7014.	-0.00131	0.00	2.62E+10	-568.598	40230.	0.00
10.8756	0.03106	662198.	5645.	-0.00125	0.00	2.62E+10	-564.678	43931.	0.00
11.0770	0.02812	674191.	4286.	-0.00119	0.00	2.62E+10	-559.975	48129.	0.00
11.2784	0.02532	682914.	2939.	-0.00113	0.00	2.62E+10	-554.461	52915.	0.00
11.4798	0.02268	688398.	1607.	-0.00106	0.00	2.62E+10	-548.102	58403.	0.00
11.6812	0.02019	690680.	290.8394	-9.98E-04	0.00	2.62E+10	-540.865	64738.	0.00
11.8826	0.01786	689803.	-1006.	-9.35E-04	0.00	2.62E+10	-532.706	72102.	0.00
12.0840	0.01567	685815.	-2283.	-8.71E-04	0.00	2.62E+10	-523.579	80731.	0.00
12.2854	0.01365	678769.	-3536.	-8.08E-04	0.00	2.62E+10	-513.424	90936.	0.00
12.4868	0.01177	668724.	-4763.	-7.46E-04	0.00	2.62E+10	-502.172	103136.	0.00
12.6882	0.01004	655745.	-5962.	-6.85E-04	0.00	2.62E+10	-489.734	117900.	0.00

12.8896	0.00846	639906.	-7129.	-6.25E-04	0.00	2.62E+10	-475.995	136038.	0.00
13.0910	0.00702	621287.	-8261.	-5.67E-04	0.00	2.62E+10	-460.803	158723.	0.00
13.2924	0.00571	599977.	-9354.	-5.11E-04	0.00	2.62E+10	-443.951	187746.	0.00
13.4938	0.00455	576073.	-10404.	-4.57E-04	0.00	2.62E+10	-425.137	225973.	0.00
13.6952	0.00351	549686.	-11406.	-4.05E-04	0.00	2.63E+10	-403.906	278335.	0.00
13.8966	0.00259	520940.	-12353.	-3.56E-04	0.00	2.63E+10	-379.514	354173.	0.00
14.0980	0.00179	489977.	-13235.	-3.09E-04	0.00	2.63E+10	-350.617	473870.	0.00
14.2994	0.00110	456966.	-14039.	-2.66E-04	0.00	2.63E+10	-314.368	693434.	0.00
14.5008	5.05E-04	422119.	-14736.	-2.25E-04	0.00	2.63E+10	-262.545	1257129.	0.00
14.7022	7.66E-06	385739.	-15058.	-1.88E-04	0.00	2.63E+10	-4.185	1320338.	0.00
14.9036	-4.04E-04	349334.	-14793.	-1.54E-04	0.00	2.63E+10	223.3400	1337086.	0.00
15.1050	-7.37E-04	314234.	-14162.	-1.24E-04	0.00	2.63E+10	299.1376	980360.	0.00
15.3064	-0.00100	280881.	-13466.	-9.63E-05	0.00	2.63E+10	277.1730	668923.	0.00
15.5078	-0.00120	249146.	-12776.	-7.20E-05	0.00	2.63E+10	293.6282	589857.	0.00
15.7092	-0.00135	219127.	-12052.	-5.05E-05	0.00	2.63E+10	305.7116	547515.	0.00
15.9106	-0.00145	190894.	-11302.	-3.17E-05	0.00	2.63E+10	314.6920	525528.	0.00
16.1120	-0.00150	164498.	-10533.	-1.54E-05	0.00	2.63E+10	321.2793	516746.	0.00
16.3134	-0.00152	139980.	-9751.	-1.40E-06	0.00	2.63E+10	325.9116	517683.	0.00
16.5148	-0.00151	117364.	-8960.	1.04E-05	0.00	2.63E+10	328.8764	526597.	0.00
16.7162	-0.00147	96670.	-8163.	2.02E-05	0.00	2.63E+10	330.3691	542720.	0.00
16.9176	-0.00141	77906.	-7365.	2.83E-05	0.00	2.63E+10	330.5241	565916.	0.00
17.1190	-0.00133	61071.	-6567.	3.46E-05	0.00	2.63E+10	329.4310	596555.	0.00
17.3204	-0.00124	46162.	-5774.	3.96E-05	0.00	2.63E+10	327.1438	635493.	0.00
17.5218	-0.00114	33163.	-4987.	4.32E-05	0.00	2.63E+10	323.6835	684156.	0.00
17.7232	-0.00104	22054.	-4211.	4.57E-05	0.00	2.63E+10	319.0366	744724.	0.00
17.9246	-9.22E-04	12809.	-3447.	4.73E-05	0.00	2.63E+10	313.1484	820505.	0.00
18.1260	-8.07E-04	5393.	-2699.	4.82E-05	0.00	2.63E+10	305.9089	916622.	0.00
18.3274	-6.90E-04	-235.745	-1970.	4.84E-05	0.00	2.63E+10	297.1256	1041372.	0.00
18.5288	-5.73E-04	-4129.	-1265.	4.82E-05	0.00	2.63E+10	286.4730	1209107.	0.00
18.7302	-4.57E-04	-6350.	-600.497	4.77E-05	0.00	2.63E+10	263.3334	1393914.	0.00
18.9316	-3.42E-04	-7032.	-41.630	4.71E-05	0.00	2.63E+10	199.1519	1407568.	0.00
19.1330	-2.29E-04	-6551.	361.6674	4.65E-05	0.00	2.63E+10	134.5928	1421221.	0.00
19.3344	-1.17E-04	-5284.	608.4369	4.59E-05	0.00	2.63E+10	69.6190	1434874.	0.00
19.5358	-6.82E-06	-3610.	697.5030	4.55E-05	0.00	2.63E+10	4.0868	1448527.	0.00
19.7372	1.03E-04	-1912.	627.2685	4.53E-05	0.00	2.63E+10	-62.209	1462180.	0.00
19.9386	2.12E-04	-578.000	395.6273	4.52E-05	0.00	2.63E+10	-129.484	1475833.	0.00
20.1400	3.21E-04	0.00	0.00	4.51E-05	0.00	2.63E+10	-197.914	744743.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.31117044	inches
Computed slope at pile head	=	-0.0024241	radians
Maximum bending moment	=	690680.	inch-lbs
Maximum shear force	=	-15058.	lbs
Depth of maximum bending moment	=	11.68120000	feet below pile head
Depth of maximum shear force	=	14.70220000	feet below pile head
Number of iterations	=	19	
Number of zero deflection points	=	2	
Pile deflection at ground	=	0.08365750	inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.14000	0.31117044	690680.	-15058.
19.13300	0.30187094	678320.	-14723.
18.12600	0.30997837	677498.	-15497.
17.11900	0.40894286	676162.	-18045.
16.11200	0.67415298	646985.	-19790.
15.10500	1.67738051	623820.	-21969.
14.09800	8.74914596	604915.	-25751.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5498	-1.22E-06	5.05E-08	-0.00410	9.52E-09	1.28E+10	0.00	0.00	0.00
0.2014	0.5399	-5.13E-06	-8.59E-07	-0.00410	4.00E-08	1.28E+10	0.00	0.00	0.00
0.4028	0.5300	-5.37E-06	0.00	-0.00410	4.19E-08	1.28E+10	0.00	0.00	0.00
0.6042	0.5201	-5.13E-06	5.05E-08	-0.00410	4.00E-08	1.28E+10	0.00	0.00	0.00
0.8056	0.5101	-5.13E-06	1.01E-07	-0.00410	4.00E-08	1.28E+10	0.00	0.00	0.00
1.0070	0.5002	-4.52E-06	1.9383	-0.00410	3.52E-08	1.28E+10	0.00	0.00	1.6040
1.2084	0.4903	9.3687	17.9035	-0.00410	0.07309	1.28E+10	0.00	0.00	11.6079
1.4098	0.4804	86.5385	59.5135	-0.00410	0.6751	1.28E+10	0.00	0.00	22.8260
1.6112	0.4705	297.0331	128.2352	-0.00410	2.3173	1.28E+10	0.00	0.00	34.0440
1.8126	0.4606	706.3760	224.0686	-0.00410	5.5107	1.28E+10	0.00	0.00	45.2620
2.0140	0.4507	1380.	347.0138	-0.00410	10.7666	1.28E+10	0.00	0.00	56.4801
2.2154	0.4408	2384.	497.0707	-0.00410	18.5961	1.28E+10	0.00	0.00	67.6981
2.4168	0.4309	3783.	674.2394	-0.00410	29.5104	1.28E+10	0.00	0.00	78.9162
2.6182	0.4210	5643.	878.5199	-0.00410	44.0207	1.28E+10	0.00	0.00	90.1342
2.8196	0.4111	8029.	1110.	-0.00410	62.6381	1.28E+10	0.00	0.00	101.3522
3.0210	0.4012	11008.	1368.	-0.00409	85.8738	1.28E+10	0.00	0.00	112.5703
3.2224	0.3913	14644.	1654.	-0.00409	114.2391	1.28E+10	0.00	0.00	123.7883

3.4238	0.3814	19003.	1967.	-0.00409	148.2450	1.28E+10	0.00	0.00	135.0063
3.6252	0.3715	24150.	2307.	-0.00408	188.4027	1.28E+10	0.00	0.00	146.2244
3.8266	0.3617	30152.	2674.	-0.00408	235.2235	1.28E+10	0.00	0.00	157.4424
4.0280	0.3518	37073.	3068.	-0.00407	289.2184	1.28E+10	0.00	0.00	168.6604
4.2294	0.3420	44979.	3489.	-0.00407	350.8987	1.28E+10	0.00	0.00	179.8785
4.4308	0.3322	53936.	3937.	-0.00406	420.7755	1.28E+10	0.00	0.00	191.0965
4.6322	0.3224	64010.	4412.	-0.00405	499.3600	1.28E+10	0.00	0.00	202.3146
4.8336	0.3126	75264.	4915.	-0.00403	587.1634	1.28E+10	0.00	0.00	213.5326
5.0350	0.3029	87767.	5445.	-0.00402	684.6968	1.28E+10	0.00	0.00	224.7506
5.2364	0.2932	101581.	6001.	-0.00400	792.4714	1.28E+10	0.00	0.00	235.9687
5.4378	0.2835	116775.	6585.	-0.00398	910.9985	1.28E+10	0.00	0.00	247.1867
5.6392	0.2740	133412.	7196.	-0.00395	1041.	1.28E+10	0.00	0.00	258.4047
5.8406	0.2644	151558.	7834.	-0.00393	1182.	1.28E+10	0.00	0.00	269.6228
6.0420	0.2550	171279.	8499.	-0.00390	1336.	1.28E+10	0.00	0.00	280.8408
6.2434	0.2456	192640.	9192.	-0.00386	1503.	1.28E+10	0.00	0.00	292.0588
6.4448	0.2363	215708.	9911.	-0.00383	1683.	1.28E+10	0.00	0.00	303.2769
6.6462	0.2271	240547.	10658.	-0.00378	1877.	1.28E+10	0.00	0.00	314.4949
6.8476	0.2180	267222.	11431.	-0.00373	2085.	1.28E+10	0.00	0.00	325.7130
7.0490	0.2090	295801.	12232.	-0.00368	2308.	1.28E+10	0.00	0.00	336.9310
7.2504	0.2002	326347.	13060.	-0.00362	2546.	1.28E+10	0.00	0.00	348.1490
7.4518	0.1915	358927.	13915.	-0.00356	2800.	1.28E+10	0.00	0.00	359.3671
7.6532	0.1830	393605.	14797.	-0.00349	3071.	1.28E+10	0.00	0.00	370.5851
7.8546	0.1747	430449.	15706.	-0.00341	3358.	1.28E+10	0.00	0.00	381.8031
8.0560	0.1665	469522.	16602.	-0.00333	3663.	1.28E+10	0.00	0.00	360.0055
8.2574	0.1586	510698.	17031.	-0.00326	0.00	2.63E+10	-5.177	78.8863	0.00
8.4588	0.1508	551844.	17008.	-0.00321	0.00	2.62E+10	-14.328	229.6387	0.00
8.6602	0.1431	592906.	16962.	-0.00316	0.00	2.62E+10	-23.674	399.8439	0.00
8.8616	0.1355	633830.	16893.	-0.00310	0.00	2.62E+10	-33.052	589.3608	0.00
9.0630	0.1281	674561.	16802.	-0.00304	0.00	2.62E+10	-42.297	797.9005	0.00
9.2644	0.1208	715045.	16689.	-0.00298	0.00	2.62E+10	-51.484	1030.	0.00
9.4658	0.1137	755228.	16553.	-0.00291	0.00	2.62E+10	-60.525	1286.	0.00
9.6672	0.1068	795058.	16397.	-0.00284	0.00	2.62E+10	-69.188	1566.	0.00
9.8686	0.1000	834483.	16220.	-0.00276	0.00	2.62E+10	-77.356	1869.	0.00
10.0700	0.09345	873457.	16024.	-0.00268	0.00	2.62E+10	-84.918	2196.	0.00
10.2714	0.08707	911935.	15082.	-0.00260	0.00	2.61E+10	-694.086	19267.	0.00
10.4728	0.08089	946358.	13406.	-0.00251	0.00	2.61E+10	-693.372	20717.	0.00
10.6742	0.07492	976732.	11732.	-0.00242	0.00	2.61E+10	-691.936	22321.	0.00
10.8756	0.06917	1003064.	10062.	-0.00233	0.00	2.61E+10	-689.758	24101.	0.00
11.0770	0.06364	1025367.	8398.	-0.00224	0.00	2.61E+10	-686.816	26081.	0.00
11.2784	0.05835	1043659.	6743.	-0.00214	0.00	2.61E+10	-683.087	28294.	0.00
11.4798	0.05329	1057960.	5098.	-0.00205	0.00	2.61E+10	-678.545	30776.	0.00
11.6812	0.04846	1068299.	3464.	-0.00195	0.00	2.61E+10	-673.163	33572.	0.00
11.8826	0.04387	1074705.	1845.	-0.00185	0.00	2.61E+10	-666.912	36738.	0.00
12.0840	0.03953	1077217.	241.7917	-0.00175	0.00	2.61E+10	-659.757	40340.	0.00
12.2854	0.03542	1075874.	-1343.	-0.00165	0.00	2.61E+10	-651.661	44462.	0.00
12.4868	0.03156	1070725.	-2907.	-0.00155	0.00	2.61E+10	-642.579	49211.	0.00
12.6882	0.02793	1061823.	-4448.	-0.00145	0.00	2.61E+10	-632.460	54722.	0.00
12.8896	0.02455	1049227.	-5963.	-0.00135	0.00	2.61E+10	-621.242	61168.	0.00
13.0910	0.02139	1033003.	-7449.	-0.00126	0.00	2.61E+10	-608.851	68781.	0.00
13.2924	0.01847	1013222.	-8904.	-0.00116	0.00	2.61E+10	-595.196	77872.	0.00
13.4938	0.01578	989964.	-10324.	-0.00107	0.00	2.61E+10	-580.158	88867.	0.00
13.6952	0.01330	963318.	-11706.	-9.79E-04	0.00	2.61E+10	-563.585	102376.	0.00
13.8966	0.01105	933380.	-13046.	-8.91E-04	0.00	2.61E+10	-545.273	119293.	0.00
14.0980	0.00900	900257.	-14340.	-8.06E-04	0.00	2.61E+10	-524.936	140999.	0.00
14.2994	0.00715	864068.	-15581.	-7.25E-04	0.00	2.62E+10	-502.158	169746.	0.00
14.5008	0.00549	824946.	-16763.	-6.47E-04	0.00	2.62E+10	-476.296	209504.	0.00
14.7022	0.00402	783042.	-17878.	-5.73E-04	0.00	2.62E+10	-446.276	268070.	0.00
14.9036	0.00273	738531.	-18913.	-5.02E-04	0.00	2.62E+10	-410.089	363430.	0.00

15.1050	0.00160	691625.	-19847.	-4.36E-04	0.00	2.62E+10	-363.190	550163.	0.00
15.3064	6.18E-04	642597.	-20583.	-3.75E-04	0.00	2.62E+10	-245.983	961985.	0.00
15.5078	-2.16E-04	592133.	-20753.	-3.18E-04	0.00	2.62E+10	105.2033	1175425.	0.00
15.7092	-9.19E-04	542283.	-20291.	-2.66E-04	0.00	2.63E+10	277.6757	730423.	0.00
15.9106	-0.00150	494056.	-19571.	-2.18E-04	0.00	2.63E+10	317.5745	511485.	0.00
16.1120	-0.00197	447683.	-18772.	-1.75E-04	0.00	2.63E+10	343.9324	421411.	0.00
16.3134	-0.00234	403319.	-17918.	-1.36E-04	0.00	2.63E+10	363.1761	374326.	0.00
16.5148	-0.00263	361076.	-17022.	-1.00E-04	0.00	2.63E+10	377.8210	347522.	0.00
16.7162	-0.00283	321040.	-16095.	-6.90E-05	0.00	2.63E+10	389.1352	332320.	0.00
16.9176	-0.00296	283277.	-15144.	-4.13E-05	0.00	2.63E+10	397.8526	324711.	0.00
17.1190	-0.00303	247838.	-14175.	-1.69E-05	0.00	2.63E+10	404.4362	322639.	0.00
17.3204	-0.00304	214761.	-13192.	4.34E-06	0.00	2.63E+10	409.1937	325003.	0.00
17.5218	-0.00301	184074.	-12199.	2.26E-05	0.00	2.63E+10	412.3368	331234.	0.00
17.7232	-0.00293	155796.	-11200.	3.82E-05	0.00	2.63E+10	414.0128	341100.	0.00
17.9246	-0.00282	129936.	-10200.	5.14E-05	0.00	2.63E+10	414.3223	354618.	0.00
18.1260	-0.00269	106495.	-9199.	6.22E-05	0.00	2.63E+10	413.3291	372021.	0.00
18.3274	-0.00252	85469.	-8203.	7.10E-05	0.00	2.63E+10	411.0649	393764.	0.00
18.5288	-0.00234	66844.	-7214.	7.80E-05	0.00	2.63E+10	407.5299	420572.	0.00
18.7302	-0.00215	50600.	-6235.	8.34E-05	0.00	2.63E+10	402.6902	453528.	0.00
18.9316	-0.00194	36707.	-5269.	8.74E-05	0.00	2.63E+10	396.4704	494244.	0.00
19.1330	-0.00172	25131.	-4320.	9.03E-05	0.00	2.63E+10	388.7396	545158.	0.00
19.3344	-0.00150	15824.	-3392.	9.21E-05	0.00	2.63E+10	379.2872	610110.	0.00
19.5358	-0.00128	8734.	-2490.	9.33E-05	0.00	2.63E+10	367.7782	695481.	0.00
19.7372	-0.00105	3791.	-1618.	9.38E-05	0.00	2.63E+10	353.6675	812748.	0.00
19.9386	-8.24E-04	914.2162	-784.318	9.41E-05	0.00	2.63E+10	336.0170	984980.	0.00
20.1400	-5.97E-04	0.00	0.00	9.41E-05	0.00	2.63E+10	313.0383	633557.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.54978219 inches
Computed slope at pile head      =     -0.0040997 radians
Maximum bending moment           =       1077217. inch-lbs
Maximum shear force              =        -20753. lbs
Depth of maximum bending moment  =    12.08400000 feet below pile head
Depth of maximum shear force     =    15.50780000 feet below pile head
Number of iterations             =             25
Number of zero deflection points =              1
Pile deflection at ground        =     0.16322876 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.14000	0.54978219	1077217.	-20753.
19.13300	0.55694810	1053242.	-21835.
18.12600	0.69025841	1035597.	-24212.
17.11900	1.27598733	1018836.	-27488.
16.11200	2.67937148	969331.	-29708.
15.10500	8.15407076	940452.	-33210.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

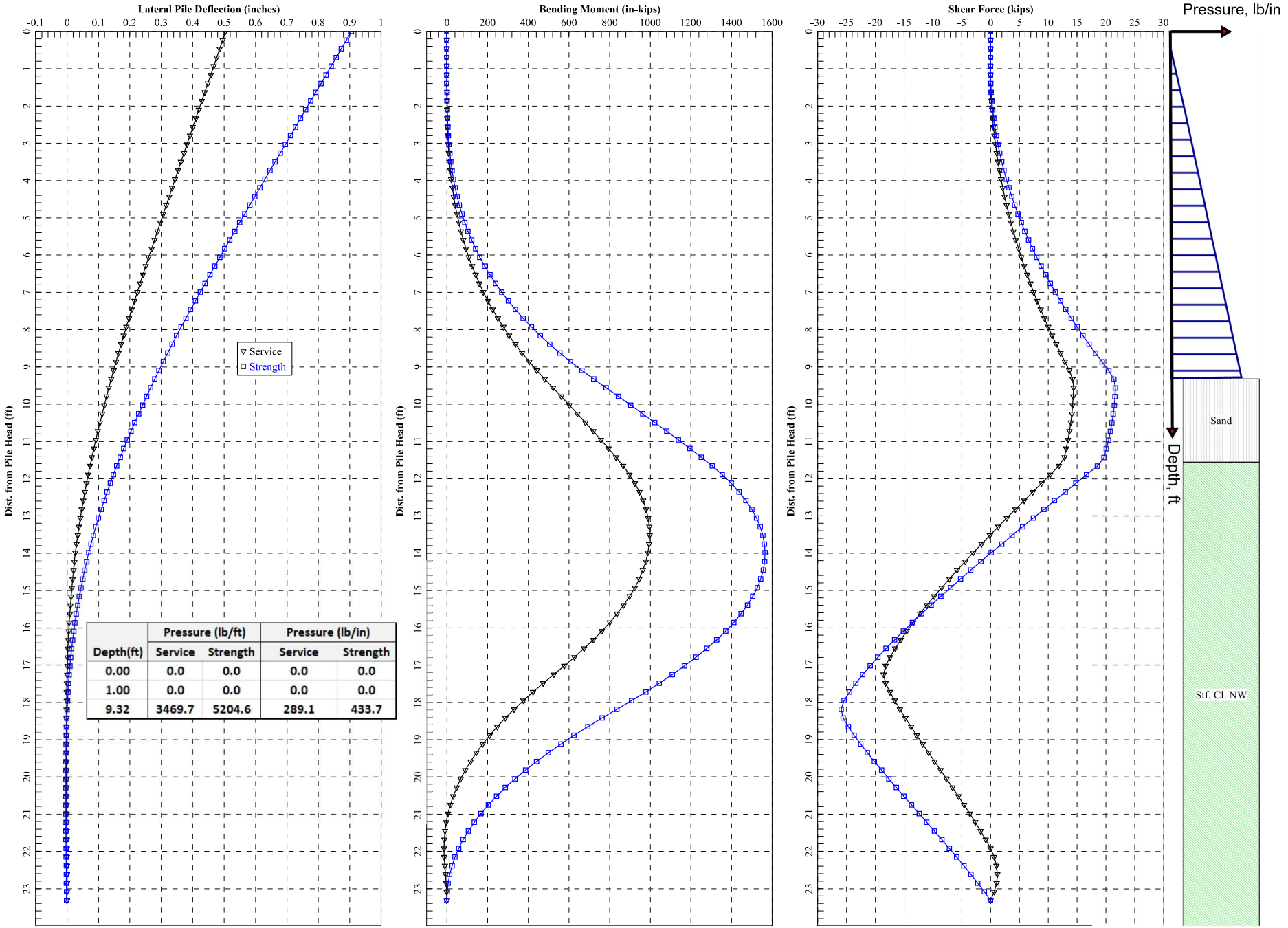
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	0.3112	-0.00242	-15058.	690680.
2	V, lb	0.00	M, in-lb	0.00	0.00	0.5498	-0.00410	-20753.	1077217.

Maximum pile-head deflection = 0.5497821878 inches
Maximum pile-head rotation = -0.0040997171 radians = -0.234896 deg.

The analysis ended normally.

Wall 1D (9.32ft)



	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.32	3469.7	5204.6	289.1	433.7

==

LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
02 Wall_1D-9.32ft.lp12d

Name of output report file:
02 Wall_1D-9.32ft.lp12o

Name of plot output file:
02 Wall_1D-9.32ft.lp12p

Name of runtime message file:
02 Wall_1D-9.32ft.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 15:04:30

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1D (H=9.32FT) Boring B-050-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 23.320 ft
Depth of ground surface below top of pile = 9.3200 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	7.0400
2	9.320	7.0400
3	9.320	24.0000
4	23.320	24.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 9.320000 ft
   AISC Section Type = W
   AISC Section Name = W16X45
   Pile width = 7.040000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 14.000000 ft
   Section Diameter = 24.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W16X45

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 9.320000 ft
   Distance from top of pile to bottom of layer = 11.550000 ft
   Effective unit weight at top of layer = 62.600000 pcf
   Effective unit weight at bottom of layer = 62.600000 pcf
   Friction angle at top of layer = 34.000000 deg.
   Friction angle at bottom of layer = 34.000000 deg.
   Subgrade k at top of layer = 120.000000 pci
   Subgrade k at bottom of layer = 120.000000 pci

Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer = 11.550000 ft
   Distance from top of pile to bottom of layer = 24.050000 ft
   Effective unit weight at top of layer = 62.600000 pcf

```
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3000. psf
   Undrained cohesion at bottom of layer               =        3000. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    24.050000 ft
   Distance from top of pile to bottom of layer        =    40.550000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        4000. psf
   Undrained cohesion at bottom of layer               =        4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


 (Depth of the lowest soil layer extends 17.230 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.          Name              Depth       Unit Wt.                 Friction        or          kpy
         (p-y Curve Type)         ft          pcf          psf         deg.         krm         pci
-----   ------------------   ----------   ----------   ----------   ----------   ----------   ----------
  1           Sand              9.3200      62.6000       --          34.0000       --          120.0000
         (Reese, et al.)       11.5500      62.6000       --          34.0000       --          120.0000
  2         Stiff Clay          11.5500      62.6000       3000.       --          0.00500       --
         w/o Free Water         24.0500      62.6000       3000.       --          0.00500       --
  3         Stiff Clay          24.0500      62.6000       4000.       --          0.00400       --
         w/o Free Water         40.5500      62.6000       4000.       --          0.00400       --


--------------------------------------------------------------------------------
                        Modification Factors for p-y Curves
--------------------------------------------------------------------------------

Distribution of p-y modifiers with depth defined using 2 points

Point       Depth X          p-mult          y-mult
 No.           ft
-----     ----------     ----------     ----------
  1            9.320         1.0000         1.0000
  2           23.500         1.0000         1.0000



--------------------------------------------------------------------------------
                               Static Loading Type
--------------------------------------------------------------------------------
```

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.320	289.100

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.320	433.700

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	9.320000 ft
Flange Width	=	7.040000 in
Section Depth	=	16.100000 in
Flange Thickness	=	0.565000 in
Web Thickness	=	0.345000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	13.300000 sq. in.
Moment of Inertia	=	586.000000 in^4
Elastic Bending Stiffness	=	16994000. kip-in^2
Plastic Modulus, Z	=	82.300000in^3
Plastic Moment Capacity = Fy Z	=	4115.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	665.000 kips
Nominal Axial Tensile Capacity	=	-665.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00001041	173.8496477	16702656.	8.0500000	2.4055664	
0.00002082	347.6992955	16702656.	8.0500000	4.8111329	
0.00003123	521.5489432	16702656.	8.0500000	7.2166993	
0.00004163	695.3985910	16702656.	8.0500000	9.6222657	
0.00005204	869.2482387	16702656.	8.0500000	12.0278322	
0.00006245	1043.	16702656.	8.0500000	14.4333986	
0.00007286	1217.	16702656.	8.0500000	16.8389651	
0.00008327	1391.	16702656.	8.0500000	19.2445315	

0.00009368	1565.	16702656.	8.0500000	21.6500979	
0.0001041	1738.	16702656.	8.0500000	24.0556644	
0.0001145	1912.	16702656.	8.0500000	26.4612308	
0.0001249	2086.	16702656.	8.0500000	28.8667972	
0.0001353	2260.	16702656.	8.0500000	31.2723637	
0.0001457	2434.	16702656.	8.0500000	33.6779301	
0.0001561	2608.	16702656.	8.0500000	36.0834965	
0.0001665	2782.	16702656.	8.0500000	38.4890630	
0.0001769	2955.	16702656.	8.0500000	40.8946294	
0.0001874	3129.	16702656.	8.0500000	43.3001959	
0.0001978	3303.	16702656.	8.0500000	45.7057623	
0.0002082	3477.	16702656.	8.0500000	48.1113287	
0.0002186	3642.	16659934.	8.0500000	50.0000000	Y
0.0002290	3725.	16269457.	8.0500000	50.0000000	Y
0.0002394	3756.	15687738.	8.0500000	50.0000000	Y
0.0002498	3780.	15131407.	8.0500000	50.0000000	Y
0.0002602	3801.	14608692.	8.0500000	50.0000000	Y
0.0002706	3820.	14117456.	8.0500000	50.0000000	Y
0.0002810	3837.	13654694.	8.0500000	50.0000000	Y
0.0002914	3853.	13219203.	8.0500000	50.0000000	Y
0.0003018	3866.	12808799.	8.0500000	50.0000000	Y
0.0003123	3879.	12421024.	8.0500000	50.0000000	Y
0.0003227	3890.	12054761.	8.0500000	50.0000000	Y
0.0003331	3900.	11708358.	8.0500000	50.0000000	Y
0.0003435	3909.	11380345.	8.0500000	50.0000000	Y
0.0003539	3917.	11069403.	8.0500000	50.0000000	Y
0.0003643	3925.	10774346.	8.0500000	50.0000000	Y
0.0003747	3932.	10493911.	8.0500000	50.0000000	Y
0.0003851	3939.	10226985.	8.0500000	50.0000000	Y
0.0003955	3945.	9972954.	8.0500000	50.0000000	Y
0.0004059	3950.	9731018.	8.0500000	50.0000000	Y
0.0004267	3960.	9279327.	8.0500000	50.0000000	Y
0.0004476	3968.	8866779.	8.0500000	50.0000000	Y
0.0004684	3976.	8488546.	8.0500000	50.0000000	Y
0.0004892	3982.	8140592.	8.0500000	50.0000000	Y
0.0005100	3988.	7819512.	8.0500000	50.0000000	Y
0.0005308	3993.	7522409.	8.0500000	50.0000000	Y
0.0005517	3998.	7246800.	8.0500000	50.0000000	Y
0.0005725	4002.	6990218.	8.0500000	50.0000000	Y
0.0005933	4005.	6750947.	8.0500000	50.0000000	Y
0.0006141	4009.	6527510.	8.0500000	50.0000000	Y
0.0006349	4011.	6317973.	8.0500000	50.0000000	Y
0.0006557	4014.	6121508.	8.0500000	50.0000000	Y
0.0006766	4016.	5936659.	8.0500000	50.0000000	Y
0.0006974	4019.	5762659.	8.0500000	50.0000000	Y
0.0007182	4021.	5598345.	8.0500000	50.0000000	Y
0.0007390	4023.	5443278.	8.0500000	50.0000000	Y
0.0007598	4024.	5296237.	8.0500000	50.0000000	Y
0.0007806	4026.	5157038.	8.0500000	50.0000000	Y
0.0008015	4027.	5024915.	8.0500000	50.0000000	Y
0.0008223	4029.	4899248.	8.0500000	50.0000000	Y
0.0008431	4030.	4779786.	8.0500000	50.0000000	Y
0.0008639	4031.	4665974.	8.0500000	50.0000000	Y
0.0008847	4032.	4557316.	8.0500000	50.0000000	Y
0.0009055	4033.	4453654.	8.0500000	50.0000000	Y
0.0009264	4034.	4354651.	8.0500000	50.0000000	Y
0.0009472	4035.	4259813.	8.0500000	50.0000000	Y
0.0009680	4036.	4169000.	8.0500000	50.0000000	Y

0.0009888	4036.	4082010.	8.0500000	50.0000000	Y
0.0010096	4037.	3998607.	8.0500000	50.0000000	Y
0.0010304	4038.	3918480.	8.0500000	50.0000000	Y
0.0010513	4038.	3841436.	8.0500000	50.0000000	Y
0.0010721	4039.	3767384.	8.0500000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	4039.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	14.000000 ft
Outside Diameter of Casing	=	24.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	7.040000 in
Depth of Core/Insert	=	16.100000 in
Flange Thickness of Core/Insert	=	0.565000 in
Web Thickness of Core/Insert	=	0.345000 in
Moment of Inertia of Steel Core/Insert	=	586.000000 in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	452.389342 sq. in.
Area of Concrete	=	439.269492 sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	13.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	13.119850 sq. in.
Area Ratio of All Steel to Gross Area	=	2.90 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 2531.130 kips
Tensile Load for Cracking of Concrete = -247.826 kips
Nominal Axial Tensile Capacity = -665.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00001041	331.7455821	31872554.	7.5272042	0.00007835	-0.000171	0.3588985	0.00000	0.00000	-3.776945	C
0.00002082	661.4613557	31775047.	7.5479424	0.0001571	-0.000342	0.7063292	0.00000	0.00000	-7.541370	C
0.00003123	989.0975110	31675945.	7.5688323	0.0002363	-0.000513	1.0420863	0.00000	0.00000	-11.293138	C
0.00004163	1315.	31575227.	7.5897901	0.0003160	-0.000683	1.3659454	0.00000	0.00000	-15.032214	C
0.00005204	1638.	31472826.	7.6111546	0.0003961	-0.000853	1.6777514	0.00000	0.00000	-18.758023	C
0.00006245	1959.	31368680.	7.6329426	0.0004767	-0.001022	1.9773115	0.00000	0.00000	-22.470168	C
0.00007286	2278.	31262720.	7.6551714	0.0005578	-0.001191	2.2644245	0.00000	0.00000	-26.168228	C
0.00008327	2594.	31154878.	7.6778598	0.0006393	-0.001359	2.5388798	0.00000	0.00000	-29.851759	C
0.00009368	2908.	31045074.	7.7010276	0.0007214	-0.001527	2.8004568	0.00000	0.00000	-33.520293	C
0.0001041	3220.	30933235.	7.7246960	0.0008040	-0.001694	3.0489248	0.00000	0.00000	-37.173327	C
0.0001145	3529.	30819273.	7.7488875	0.0008872	-0.001861	3.2840409	0.00000	0.00000	-40.810336	C
0.0001249	3835.	30703095.	7.7736264	0.0009709	-0.002027	3.5055498	0.00000	0.00000	-44.430757	C
0.0001353	4138.	30584606.	7.7989387	0.0010553	-0.002192	3.7131829	0.00000	0.00000	-48.033994	C
0.0001457	4407.	30241222.	7.8016508	0.0011368	-0.002360	3.8991473	0.00000	0.00000	-50.000000	CY
0.0001561	4518.	28939005.	7.7017087	0.0012024	-0.002545	4.0376692	0.00000	0.00000	-50.000000	CY
0.0001665	4610.	27679200.	7.6030071	0.0012662	-0.002731	4.1632492	0.00000	0.00000	-50.000000	CY
0.0001769	4689.	26498941.	7.5078909	0.0013285	-0.002918	4.2774950	0.00000	0.00000	-50.000000	CY
0.0001874	4758.	25396997.	7.4168333	0.0013896	-0.003107	4.3813262	0.00000	0.00000	-50.000000	CY
0.0001978	4820.	24370609.	7.3312881	0.0014498	-0.003296	4.4758711	0.00000	0.00000	-50.000000	CY
0.0002082	4874.	23412574.	7.2482298	0.0015089	-0.003487	4.5608076	0.00000	0.00000	-50.000000	CY
0.0002186	4922.	22519429.	7.1698324	0.0015672	-0.003679	4.6373341	0.00000	0.00000	-50.000000	CY
0.0002290	4966.	21686546.	7.0962951	0.0016250	-0.003871	4.7059438	0.00000	0.00000	-50.000000	CY
0.0002394	5005.	20907258.	7.0250269	0.0016818	-0.004064	4.7663546	0.00000	0.00000	-50.000000	CY
0.0002498	5041.	20177832.	6.9573781	0.0017380	-0.004257	4.8193052	0.00000	0.00000	-50.000000	CY
0.0002602	5073.	19495008.	6.8938781	0.0017939	-0.004451	4.8652052	0.00000	0.00000	-50.000000	CY
0.0002706	5102.	18854107.	6.8338558	0.0018494	-0.004646	4.9041417	0.00000	0.00000	-50.000000	CY
0.0002810	5129.	18250525.	6.7750157	0.0019040	-0.004841	4.9359666	0.00000	0.00000	-50.000000	CY
0.0002914	5153.	17682781.	6.7196468	0.0019584	-0.005036	4.9613042	0.00000	0.00000	-50.000000	CY

0.0003018	5176.	17147795.	6.6674904	0.0020126	-0.005232	4.9802399	0.00000	0.00000	-50.000000 CY
0.0003123	5197.	16642870.	6.6183268	0.0020666	-0.005428	4.9928446	0.00000	0.00000	-50.000000 CY
0.0003227	5216.	16164625.	6.5704566	0.0021200	-0.005624	4.9991444	0.00000	0.00000	-50.000000 CY
0.0003331	5233.	15711239.	6.5243792	0.0021731	-0.005821	4.9965081	0.00000	0.00000	-50.000000 CY
0.0003435	5249.	15281515.	6.4809112	0.0022261	-0.006017	4.9999525	0.00000	0.00000	-50.000000 CY
0.0003539	5264.	14873592.	6.4400234	0.0022791	-0.006214	4.9979985	0.00000	0.00000	-50.000000 CY
0.0003643	5277.	14486266.	6.4014597	0.0023320	-0.006411	4.9979852	0.00000	0.00000	-50.000000 CY
0.0003747	5290.	14117246.	6.3650073	0.0023850	-0.006608	4.9983197	0.00000	0.00000	-50.000000 CY
0.0003851	5301.	13764940.	6.3286565	0.0024373	-0.006805	4.9978504	0.00000	0.00000	-50.000000 CY
0.0003955	5312.	13429114.	6.2942240	0.0024895	-0.007003	4.9975619	0.00000	0.00000	-50.000000 CY
0.0004059	5321.	13108400.	6.2612772	0.0025417	-0.007201	4.9999638	0.00000	0.00000	-50.000000 CY
0.0004267	5338.	12509303.	6.2006783	0.0026461	-0.007596	4.9992346	0.00000	0.00000	-50.000000 CY
0.0004476	5353.	11960661.	6.1458796	0.0027507	-0.007991	4.9964197	0.00000	0.00000	-50.000000 CY
0.0004684	5366.	11455975.	6.0944298	0.0028545	-0.008387	4.9933771	0.00000	0.00000	-50.000000 CY
0.0004892	5376.	10990106.	6.0459551	0.0029577	-0.008783	4.9988635	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	5376.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	9.3200	0.00	N.A.	No	0.00	3678.
2	11.5500	0.2025	No	No	3678.	328305.
3	24.0500	14.7300	No	No	331983.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only

for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5050	-3.08E-06	4.23E-08	-0.00338	1.85E-08	1.67E+10	0.00	0.00	0.00
0.2332	0.4956	2.25E-06	9.10E-07	-0.00338	1.35E-08	1.67E+10	0.00	0.00	0.00
0.4664	0.4861	2.01E-06	-8.46E-08	-0.00338	1.21E-08	1.67E+10	0.00	0.00	0.00
0.6996	0.4766	1.78E-06	-2.12E-08	-0.00338	1.07E-08	1.67E+10	0.00	0.00	0.00
0.9328	0.4672	1.89E-06	0.2544	-0.00338	1.14E-08	1.67E+10	0.00	0.00	0.1818
1.1660	0.4577	1.4238	8.5795	-0.00338	0.00855	1.67E+10	0.00	0.00	5.7681
1.3992	0.4482	48.0178	36.0589	-0.00338	0.2884	1.67E+10	0.00	0.00	13.8712
1.6324	0.4388	203.2381	86.2141	-0.00338	1.2208	1.67E+10	0.00	0.00	21.9744
1.8656	0.4293	530.5407	159.0451	-0.00338	3.1869	1.67E+10	0.00	0.00	30.0775
2.0988	0.4199	1093.	254.5519	-0.00338	6.5678	1.67E+10	0.00	0.00	38.1807
2.3320	0.4104	1955.	372.7346	-0.00338	11.7446	1.67E+10	0.00	0.00	46.2838
2.5652	0.4009	3180.	513.5931	-0.00338	19.0987	1.67E+10	0.00	0.00	54.3869
2.7984	0.3915	4830.	677.1274	-0.00338	29.0111	1.67E+10	0.00	0.00	62.4901
3.0316	0.3820	6969.	863.3375	-0.00338	41.8631	1.67E+10	0.00	0.00	70.5932
3.2648	0.3726	9662.	1072.	-0.00338	58.0357	1.67E+10	0.00	0.00	78.6964
3.4980	0.3631	12970.	1304.	-0.00338	77.9102	1.67E+10	0.00	0.00	86.7995
3.7312	0.3537	16959.	1558.	-0.00337	101.8676	1.67E+10	0.00	0.00	94.9026
3.9644	0.3442	21690.	1835.	-0.00337	130.2893	1.67E+10	0.00	0.00	103.0058
4.1976	0.3348	27228.	2135.	-0.00337	163.5564	1.67E+10	0.00	0.00	111.1089
4.4308	0.3254	33637.	2457.	-0.00336	202.0500	1.67E+10	0.00	0.00	119.2121
4.6640	0.3160	40979.	2802.	-0.00336	246.1512	1.67E+10	0.00	0.00	127.3152
4.8972	0.3066	49317.	3169.	-0.00335	296.2414	1.67E+10	0.00	0.00	135.4183
5.1304	0.2972	58717.	3560.	-0.00334	352.7016	1.67E+10	0.00	0.00	143.5215
5.3636	0.2879	69240.	3973.	-0.00333	415.9130	1.67E+10	0.00	0.00	151.6246
5.5968	0.2786	80951.	4408.	-0.00332	486.2567	1.67E+10	0.00	0.00	159.7277
5.8300	0.2694	93912.	4867.	-0.00330	564.1141	1.67E+10	0.00	0.00	167.8309
6.0632	0.2601	108188.	5348.	-0.00328	649.8661	1.67E+10	0.00	0.00	175.9340
6.2964	0.2510	123841.	5851.	-0.00326	743.8940	1.67E+10	0.00	0.00	184.0372
6.5296	0.2419	140936.	6378.	-0.00324	846.5790	1.67E+10	0.00	0.00	192.1403
6.7628	0.2328	159536.	6927.	-0.00322	958.3022	1.67E+10	0.00	0.00	200.2434
6.9960	0.2239	179703.	7498.	-0.00319	1079.	1.67E+10	0.00	0.00	208.3466
7.2292	0.2150	201502.	8093.	-0.00316	1210.	1.67E+10	0.00	0.00	216.4497
7.4624	0.2062	224996.	8710.	-0.00312	1352.	1.67E+10	0.00	0.00	224.5529
7.6956	0.1975	250249.	9349.	-0.00308	1503.	1.67E+10	0.00	0.00	232.6560
7.9288	0.1890	277323.	10012.	-0.00304	1666.	1.67E+10	0.00	0.00	240.7591
8.1620	0.1805	306283.	10697.	-0.00299	1840.	1.67E+10	0.00	0.00	248.8623

8.3952	0.1722	337192.	11405.	-0.00293	2025.	1.67E+10	0.00	0.00	256.9654
8.6284	0.1641	370113.	12135.	-0.00287	2223.	1.67E+10	0.00	0.00	265.0686
8.8616	0.1562	405110.	12888.	-0.00281	2433.	1.67E+10	0.00	0.00	273.1717
9.0948	0.1484	442246.	13664.	-0.00274	2656.	1.67E+10	0.00	0.00	281.2748
9.3280	0.1408	481585.	14244.	-0.00268	0.00	3.18E+10	-0.445	8.8420	133.7537
9.5612	0.1334	521967.	14411.	-0.00264	0.00	3.18E+10	-13.940	292.4570	0.00
9.7944	0.1261	562241.	14352.	-0.00259	0.00	3.18E+10	-28.186	625.6306	0.00
10.0276	0.1189	602293.	14253.	-0.00254	0.00	3.18E+10	-42.800	1007.	0.00
10.2608	0.1119	642011.	14113.	-0.00248	0.00	3.18E+10	-57.408	1436.	0.00
10.4940	0.1050	681279.	13931.	-0.00242	0.00	3.18E+10	-72.139	1923.	0.00
10.7272	0.09831	719982.	13709.	-0.00236	0.00	3.18E+10	-86.652	2467.	0.00
10.9604	0.09178	758007.	13447.	-0.00230	0.00	3.17E+10	-100.543	3065.	0.00
11.1936	0.08545	795244.	13148.	-0.00223	0.00	3.17E+10	-113.546	3719.	0.00
11.4268	0.07931	831592.	12813.	-0.00216	0.00	3.17E+10	-125.676	4434.	0.00
11.6600	0.07337	866956.	11878.	-0.00208	0.00	3.17E+10	-542.334	20684.	0.00
11.8932	0.06765	898073.	10361.	-0.00200	0.00	3.17E+10	-542.325	22432.	0.00
12.1264	0.06216	924942.	8844.	-0.00192	0.00	3.17E+10	-541.610	24384.	0.00
12.3596	0.05689	947571.	7330.	-0.00184	0.00	3.17E+10	-540.170	26572.	0.00
12.5928	0.05185	965969.	5822.	-0.00176	0.00	3.17E+10	-537.983	29034.	0.00
12.8260	0.04706	980155.	4320.	-0.00167	0.00	3.17E+10	-535.026	31817.	0.00
13.0592	0.04250	990150.	2829.	-0.00158	0.00	3.17E+10	-531.274	34980.	0.00
13.2924	0.03819	995985.	1348.	-0.00150	0.00	3.17E+10	-526.699	38591.	0.00
13.5256	0.03413	997696.	-118.111	-0.00141	0.00	3.17E+10	-521.270	42740.	0.00
13.7588	0.03031	995324.	-1568.	-0.00132	0.00	3.17E+10	-514.951	47537.	0.00
13.9920	0.02674	988920.	-2999.	-0.00123	0.00	3.17E+10	-507.701	53124.	0.00
14.2252	0.02342	978540.	-4408.	-0.00115	0.00	3.17E+10	-499.474	59686.	0.00
14.4584	0.02033	964249.	-5793.	-0.00106	0.00	3.17E+10	-490.213	67462.	0.00
14.6916	0.01749	946118.	-7150.	-9.75E-04	0.00	3.17E+10	-479.847	76780.	0.00
14.9248	0.01488	924230.	-8477.	-8.92E-04	0.00	3.17E+10	-468.291	88084.	0.00
15.1580	0.01249	898675.	-9769.	-8.12E-04	0.00	3.17E+10	-455.434	102006.	0.00
15.3912	0.01033	869553.	-11024.	-7.34E-04	0.00	3.17E+10	-441.127	119466.	0.00
15.6244	0.00839	836977.	-12236.	-6.59E-04	0.00	3.17E+10	-425.169	141868.	0.00
15.8576	0.00665	801071.	-13401.	-5.86E-04	0.00	3.17E+10	-407.269	171462.	0.00
16.0908	0.00510	761976.	-14512.	-5.17E-04	0.00	3.17E+10	-386.985	212133.	0.00
16.3240	0.00375	719851.	-15562.	-4.52E-04	0.00	3.18E+10	-363.597	271253.	0.00
16.5572	0.00257	674878.	-16541.	-3.91E-04	0.00	3.18E+10	-335.797	364975.	0.00
16.7904	0.00156	627275.	-17432.	-3.33E-04	0.00	3.18E+10	-300.800	537982.	0.00
17.0236	7.09E-04	577317.	-18203.	-2.80E-04	0.00	3.18E+10	-250.474	988334.	0.00
17.2568	-4.04E-06	525398.	-18551.	-2.32E-04	0.00	3.18E+10	1.9363	1341083.	0.00
17.4900	-5.88E-04	473493.	-18205.	-1.88E-04	0.00	3.18E+10	244.9581	1166002.	0.00
17.7232	-0.00106	423507.	-17460.	-1.48E-04	0.00	3.18E+10	287.5713	762638.	0.00
17.9564	-0.00142	375773.	-16619.	-1.13E-04	0.00	3.18E+10	313.8486	619236.	0.00
18.1896	-0.00169	330496.	-15715.	-8.22E-05	0.00	3.19E+10	332.2199	550422.	0.00
18.4228	-0.00188	287822.	-14766.	-5.51E-05	0.00	3.19E+10	345.6344	514876.	0.00
18.6560	-0.00200	247854.	-13785.	-3.16E-05	0.00	3.19E+10	355.4987	498072.	0.00
18.8892	-0.00206	210669.	-12780.	-1.14E-05	0.00	3.19E+10	362.6003	493709.	0.00
19.1224	-0.00206	176325.	-11759.	5.55E-06	0.00	3.19E+10	367.4241	498787.	0.00
19.3556	-0.00202	144857.	-10727.	1.96E-05	0.00	3.19E+10	370.2866	511906.	0.00
19.5888	-0.00195	116290.	-9689.	3.11E-05	0.00	3.19E+10	371.4008	532594.	0.00
19.8220	-0.00185	90631.	-8650.	4.02E-05	0.00	3.19E+10	370.9095	561025.	0.00
20.0552	-0.00173	67876.	-7615.	4.72E-05	0.00	3.19E+10	368.9034	597942.	0.00
20.2884	-0.00159	48011.	-6588.	5.22E-05	0.00	3.19E+10	365.4287	644696.	0.00
20.5216	-0.00143	31007.	-5572.	5.57E-05	0.00	3.19E+10	360.4883	703425.	0.00
20.7548	-0.00127	16826.	-4572.	5.78E-05	0.00	3.19E+10	354.0353	777406.	0.00
20.9880	-0.00111	5417.	-3593.	5.88E-05	0.00	3.19E+10	345.9580	871740.	0.00
21.2212	-9.45E-04	-3282.	-2638.	5.89E-05	0.00	3.19E+10	336.0494	994711.	0.00
21.4544	-7.81E-04	-9350.	-1715.	5.83E-05	0.00	3.19E+10	323.9482	1160681.	0.00
21.6876	-6.19E-04	-12881.	-829.347	5.73E-05	0.00	3.19E+10	309.0163	1397074.	0.00

21.9208	-4.60E-04	-13992.	-3.762	5.62E-05	0.00	3.19E+10	281.0250	1709342.	0.00
22.1540	-3.05E-04	-12902.	652.5933	5.50E-05	0.00	3.19E+10	188.0681	1727754.	0.00
22.3872	-1.52E-04	-10339.	1049.	5.40E-05	0.00	3.19E+10	95.0433	1746167.	0.00
22.6204	-2.56E-06	-7032.	1184.	5.32E-05	0.00	3.19E+10	1.6162	1764580.	0.00
22.8536	1.45E-04	-3713.	1057.	5.27E-05	0.00	3.19E+10	-92.681	1782993.	0.00
23.0868	2.93E-04	-1119.	663.3490	5.25E-05	0.00	3.19E+10	-188.338	1801406.	0.00
23.3200	4.39E-04	0.00	0.00	5.25E-05	0.00	3.19E+10	-285.753	909910.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.50503207 inches
Computed slope at pile head      =     -0.0033821 radians
Maximum bending moment           =        997696. inch-lbs
Maximum shear force              =        -18551. lbs
Depth of maximum bending moment  =    13.52560000 feet below pile head
Depth of maximum shear force     =    17.25680000 feet below pile head
Number of iterations             =             22
Number of zero deflection points =              2
Pile deflection at ground        =     0.14108893 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
23.32000	0.50503207	997696.	-18551.
22.15400	0.51576795	1006154.	-18567.
20.98800	0.53659383	1002672.	-19871.
19.82200	0.67035309	976995.	-22022.
18.65600	1.13047376	933642.	-23871.
17.49000	3.52585725	901038.	-26928.
16.32400	16.53866287	871875.	-31045.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.9057	4.74E-07	4.23E-08	-0.00579	2.84E-09	1.67E+10	0.00	0.00	0.00
0.2332	0.8895	7.34E-06	1.18E-06	-0.00579	4.41E-08	1.67E+10	0.00	0.00	0.00
0.4664	0.8733	7.10E-06	4.23E-08	-0.00579	4.27E-08	1.67E+10	0.00	0.00	0.00
0.6996	0.8571	7.58E-06	-4.23E-08	-0.00579	4.55E-08	1.67E+10	0.00	0.00	0.00
0.9328	0.8409	6.87E-06	0.3816	-0.00579	4.12E-08	1.67E+10	0.00	0.00	0.2727
1.1660	0.8247	2.1359	12.8707	-0.00579	0.01283	1.67E+10	0.00	0.00	8.6531
1.3992	0.8085	72.0350	54.0945	-0.00579	0.4327	1.67E+10	0.00	0.00	20.8093
1.6324	0.7923	304.8923	129.3360	-0.00579	1.8314	1.67E+10	0.00	0.00	32.9654
1.8656	0.7761	795.9028	238.5951	-0.00579	4.7808	1.67E+10	0.00	0.00	45.1215
2.0988	0.7600	1640.	381.8719	-0.00579	9.8528	1.67E+10	0.00	0.00	57.2776
2.3320	0.7438	2933.	559.1664	-0.00578	17.6190	1.67E+10	0.00	0.00	69.4337
2.5652	0.7276	4770.	770.4785	-0.00578	28.6514	1.67E+10	0.00	0.00	81.5898
2.7984	0.7114	7245.	1016.	-0.00578	43.5217	1.67E+10	0.00	0.00	93.7459
3.0316	0.6952	10455.	1295.	-0.00578	62.8018	1.67E+10	0.00	0.00	105.9020
3.2648	0.6790	14494.	1609.	-0.00578	87.0636	1.67E+10	0.00	0.00	118.0581
3.4980	0.6629	19458.	1956.	-0.00578	116.8787	1.67E+10	0.00	0.00	130.2143
3.7312	0.6467	25441.	2337.	-0.00577	152.8191	1.67E+10	0.00	0.00	142.3704
3.9644	0.6305	32539.	2753.	-0.00577	195.4565	1.67E+10	0.00	0.00	154.5265
4.1976	0.6144	40847.	3202.	-0.00576	245.3629	1.67E+10	0.00	0.00	166.6826
4.4308	0.5983	50461.	3686.	-0.00575	303.1099	1.67E+10	0.00	0.00	178.8387
4.6640	0.5822	61475.	4203.	-0.00575	369.2694	1.67E+10	0.00	0.00	190.9948
4.8972	0.5661	73985.	4755.	-0.00573	444.4133	1.67E+10	0.00	0.00	203.1509
5.1304	0.5501	88085.	5340.	-0.00572	529.1134	1.67E+10	0.00	0.00	215.3070
5.3636	0.5341	103872.	5960.	-0.00570	623.9414	1.67E+10	0.00	0.00	227.4631
5.5968	0.5182	121440.	6613.	-0.00569	729.4692	1.67E+10	0.00	0.00	239.6192
5.8300	0.5023	140884.	7301.	-0.00566	846.2687	1.67E+10	0.00	0.00	251.7754
6.0632	0.4865	162301.	8022.	-0.00564	974.9115	1.67E+10	0.00	0.00	263.9315
6.2964	0.4708	185784.	8778.	-0.00561	1116.	1.67E+10	0.00	0.00	276.0876
6.5296	0.4551	211429.	9567.	-0.00558	1270.	1.67E+10	0.00	0.00	288.2437
6.7628	0.4396	239331.	10391.	-0.00554	1438.	1.67E+10	0.00	0.00	300.3998
6.9960	0.4241	269586.	11249.	-0.00550	1619.	1.67E+10	0.00	0.00	312.5559
7.2292	0.4088	302288.	12140.	-0.00545	1816.	1.67E+10	0.00	0.00	324.7120
7.4624	0.3936	337533.	13066.	-0.00539	2028.	1.67E+10	0.00	0.00	336.8681
7.6956	0.3786	375416.	14026.	-0.00533	2255.	1.67E+10	0.00	0.00	349.0242
7.9288	0.3638	416033.	15020.	-0.00527	2499.	1.67E+10	0.00	0.00	361.1804
8.1620	0.3491	459478.	16047.	-0.00519	2760.	1.67E+10	0.00	0.00	373.3365
8.3952	0.3347	505846.	17109.	-0.00511	3039.	1.67E+10	0.00	0.00	385.4926
8.6284	0.3205	555233.	18205.	-0.00502	3335.	1.67E+10	0.00	0.00	397.6487
8.8616	0.3066	607735.	19335.	-0.00493	3651.	1.67E+10	0.00	0.00	409.8048
9.0948	0.2929	663445.	20498.	-0.00482	3985.	1.67E+10	0.00	0.00	421.9609
9.3280	0.2796	722460.	21369.	-0.00473	0.00	3.17E+10	-0.531	5.3159	200.6536
9.5612	0.2664	783042.	21625.	-0.00467	0.00	3.17E+10	-16.728	175.6938	0.00
9.7944	0.2535	843493.	21554.	-0.00459	0.00	3.17E+10	-34.020	375.5719	0.00
10.0276	0.2407	903678.	21434.	-0.00452	0.00	3.17E+10	-51.984	604.3022	0.00
10.2608	0.2282	963455.	21263.	-0.00444	0.00	3.17E+10	-70.206	860.9410	0.00
10.4940	0.2159	1022683.	21041.	-0.00435	0.00	3.17E+10	-88.651	1149.	0.00
10.7272	0.2039	1081217.	20767.	-0.00425	0.00	3.16E+10	-106.947	1468.	0.00

10.9604	0.1921	1138913.	20443.	-0.00416	0.00	3.16E+10	-124.676	1816.	0.00
11.1936	0.1806	1195632.	20071.	-0.00405	0.00	3.16E+10	-141.525	2193.	0.00
11.4268	0.1694	1251244.	19652.	-0.00394	0.00	3.16E+10	-157.476	2601.	0.00
11.6600	0.1585	1305622.	18512.	-0.00383	0.00	3.16E+10	-657.498	11607.	0.00
11.8932	0.1480	1354851.	16669.	-0.00371	0.00	3.16E+10	-659.498	12473.	0.00
12.1264	0.1377	1398916.	14822.	-0.00359	0.00	3.15E+10	-660.798	13425.	0.00
12.3596	0.1279	1437806.	12972.	-0.00347	0.00	3.15E+10	-661.379	14475.	0.00
12.5928	0.1183	1471517.	11121.	-0.00334	0.00	3.15E+10	-661.226	15636.	0.00
12.8260	0.1092	1500049.	9272.	-0.00320	0.00	3.15E+10	-660.317	16923.	0.00
13.0592	0.1004	1523411.	7427.	-0.00307	0.00	3.15E+10	-658.633	18356.	0.00
13.2924	0.09201	1541615.	5587.	-0.00293	0.00	3.15E+10	-656.151	19957.	0.00
13.5256	0.08399	1554680.	3755.	-0.00280	0.00	3.15E+10	-652.849	21752.	0.00
13.7588	0.07635	1562633.	1934.	-0.00266	0.00	3.15E+10	-648.700	23775.	0.00
13.9920	0.06911	1565506.	126.0400	-0.00252	0.00	3.15E+10	-643.675	26063.	0.00
14.2252	0.06226	1563339.	-1667.	-0.00238	0.00	3.15E+10	-637.743	28666.	0.00
14.4584	0.05579	1556177.	-3442.	-0.00224	0.00	3.15E+10	-630.868	31644.	0.00
14.6916	0.04971	1544075.	-5196.	-0.00210	0.00	3.15E+10	-623.008	35071.	0.00
14.9248	0.04402	1527094.	-6927.	-0.00197	0.00	3.15E+10	-614.117	39044.	0.00
15.1580	0.03870	1505304.	-8632.	-0.00183	0.00	3.15E+10	-604.137	43685.	0.00
15.3912	0.03376	1478783.	-10307.	-0.00170	0.00	3.15E+10	-593.000	49156.	0.00
15.6244	0.02918	1447618.	-11949.	-0.00157	0.00	3.15E+10	-580.625	55674.	0.00
15.8576	0.02497	1411906.	-13555.	-0.00144	0.00	3.15E+10	-566.905	63533.	0.00
16.0908	0.02111	1371754.	-15120.	-0.00132	0.00	3.16E+10	-551.708	73149.	0.00
16.3240	0.01758	1327283.	-16640.	-0.00120	0.00	3.16E+10	-534.854	85126.	0.00
16.5572	0.01439	1278622.	-18111.	-0.00108	0.00	3.16E+10	-516.099	100376.	0.00
16.7904	0.01151	1225921.	-19526.	-9.74E-04	0.00	3.16E+10	-495.093	120358.	0.00
17.0236	0.00894	1169342.	-20878.	-8.68E-04	0.00	3.16E+10	-471.309	147565.	0.00
17.2568	0.00665	1109072.	-22158.	-7.67E-04	0.00	3.16E+10	-443.892	186681.	0.00
17.4900	0.00464	1045326.	-23355.	-6.72E-04	0.00	3.17E+10	-411.319	247805.	0.00
17.7232	0.00289	978359.	-24449.	-5.82E-04	0.00	3.17E+10	-370.404	358121.	0.00
17.9564	0.00139	908492.	-25404.	-4.99E-04	0.00	3.17E+10	-312.244	630575.	0.00
18.1896	1.01E-04	836179.	-25913.	-4.22E-04	0.00	3.17E+10	-51.305	1414735.	0.00
18.4228	-9.76E-04	763464.	-25574.	-3.51E-04	0.00	3.17E+10	293.5386	841428.	0.00
18.6560	-0.00187	693048.	-24674.	-2.87E-04	0.00	3.18E+10	349.5884	524390.	0.00
18.8892	-0.00258	625370.	-23647.	-2.29E-04	0.00	3.18E+10	384.0741	415937.	0.00
19.1224	-0.00315	560700.	-22538.	-1.77E-04	0.00	3.18E+10	408.5797	363161.	0.00
19.3556	-0.00357	499229.	-21369.	-1.30E-04	0.00	3.18E+10	426.9812	334262.	0.00
19.5888	-0.00388	441102.	-20154.	-8.90E-05	0.00	3.18E+10	441.0955	318301.	0.00
19.8220	-0.00407	386429.	-18905.	-5.26E-05	0.00	3.18E+10	451.9301	310522.	0.00
20.0552	-0.00417	335295.	-17629.	-2.09E-05	0.00	3.19E+10	460.1028	308579.	0.00
20.2884	-0.00419	287764.	-16333.	6.42E-06	0.00	3.19E+10	466.0178	311250.	0.00
20.5216	-0.00414	243883.	-15023.	2.98E-05	0.00	3.19E+10	469.9483	317921.	0.00
20.7548	-0.00402	203681.	-13705.	4.94E-05	0.00	3.19E+10	472.0827	328354.	0.00
20.9880	-0.00386	167177.	-12384.	6.57E-05	0.00	3.19E+10	472.5488	342583.	0.00
21.2212	-0.00366	134373.	-11063.	7.89E-05	0.00	3.19E+10	471.4271	360876.	0.00
21.4544	-0.00342	105261.	-9747.	8.94E-05	0.00	3.19E+10	468.7567	383751.	0.00
21.6876	-0.00316	79820.	-8441.	9.76E-05	0.00	3.19E+10	464.5365	412027.	0.00
21.9208	-0.00287	58017.	-7150.	1.04E-04	0.00	3.19E+10	458.7199	446937.	0.00
22.1540	-0.00258	39806.	-5876.	1.08E-04	0.00	3.19E+10	451.2044	490337.	0.00
22.3872	-0.00227	25128.	-4627.	1.11E-04	0.00	3.19E+10	441.8102	545091.	0.00
22.6204	-0.00196	13910.	-3407.	1.12E-04	0.00	3.19E+10	430.2428	615819.	0.00
22.8536	-0.00164	6062.	-2223.	1.13E-04	0.00	3.19E+10	416.0228	710473.	0.00
23.0868	-0.00132	1471.	-1083.	1.14E-04	0.00	3.19E+10	398.3432	844072.	0.00
23.3200	-0.00100	0.00	0.00	1.14E-04	0.00	3.19E+10	375.7455	524529.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual

stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.90566501 inches
Computed slope at pile head	=	-0.0057857 radians
Maximum bending moment	=	1565506. inch-lbs
Maximum shear force	=	-25913. lbs
Depth of maximum bending moment	=	13.99200000 feet below pile head
Depth of maximum shear force	=	18.18960000 feet below pile head
Number of iterations	=	28
Number of zero deflection points	=	1
Pile deflection at ground	=	0.28005914 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear	=	0. lbs
Moment	=	0. in-lbs
Axial Load	=	0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
23.32000	0.90566501	1565506.	-25913.
22.15400	0.98041872	1565781.	-28331.
20.98800	1.25570406	1531371.	-31219.
19.82200	2.08896248	1470909.	-33581.
18.65600	4.64749925	1403969.	-36045.
17.49000	20.55015056	1386775.	-41957.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

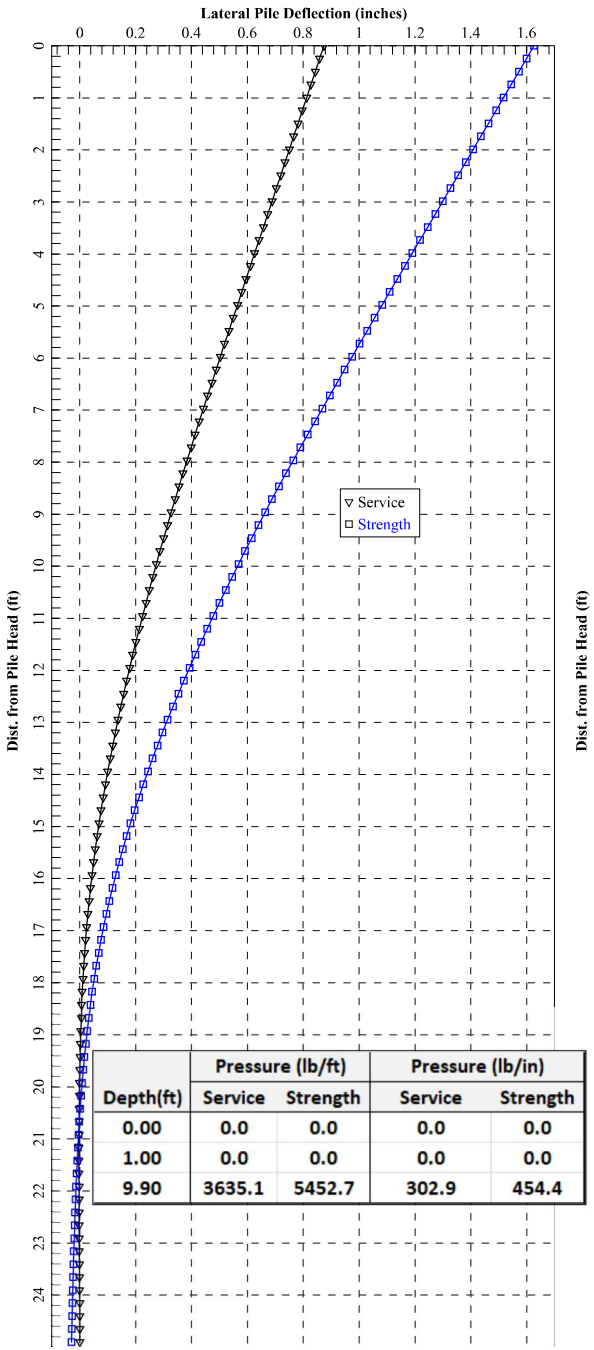
Load Case No.	Load Type	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs

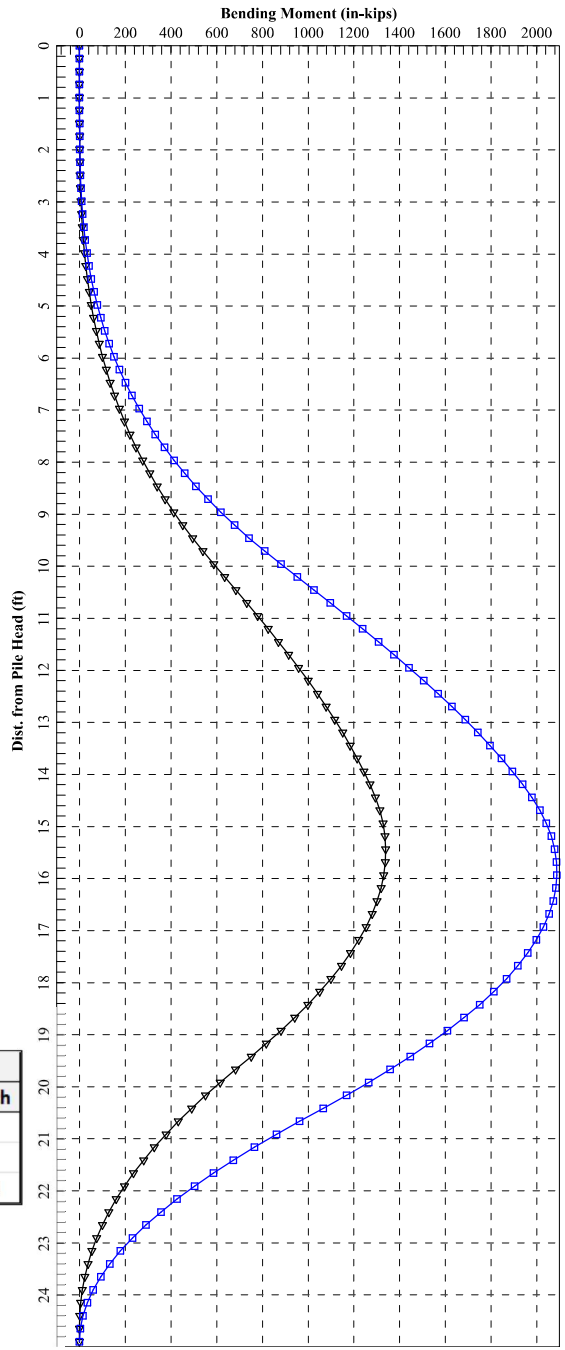
1	V, lb	0.00	M, in-lb	0.00	0.00	0.5050	-0.00338	-18551.	997696.
2	V, lb	0.00	M, in-lb	0.00	0.00	0.9057	-0.00579	-25913.	1565506.

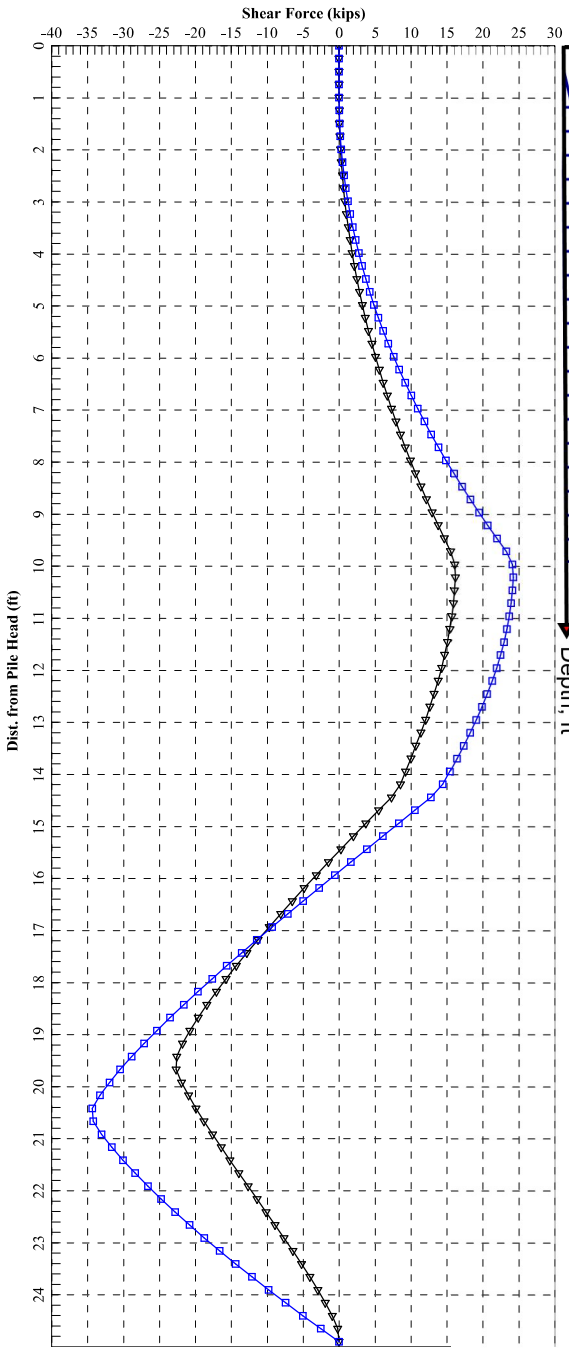
Maximum pile-head deflection = 0.9056650093 inches
Maximum pile-head rotation = -0.0057856670 radians = -0.331494 deg.

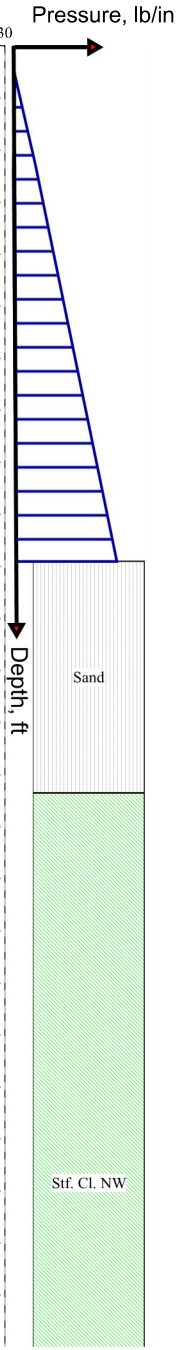
The analysis ended normally.

Wall 1D (9.9ft)









Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.90	3635.1	5452.7	302.9	454.4

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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
03 Wall_1D-9.9ft.lp12d

Name of output report file:
03 Wall_1D-9.9ft.lp12o

Name of plot output file:
03 Wall_1D-9.9ft.lp12p

Name of runtime message file:
03 Wall_1D-9.9ft.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 15:11:45

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1D (H=9.9FT) Boring B-050-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 24.900 ft
Depth of ground surface below top of pile = 9.9000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	7.0400
2	9.900	7.0400
3	9.900	24.0000
4	24.900	24.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 9.900000 ft
   AISC Section Type = W
   AISC Section Name = W16X45
   Pile width = 7.040000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 15.000000 ft
   Section Diameter = 24.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W16X45

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 9.900000 ft
   Distance from top of pile to bottom of layer = 14.350000 ft
   Effective unit weight at top of layer = 62.600000 pcf
   Effective unit weight at bottom of layer = 62.600000 pcf
   Friction angle at top of layer = 34.000000 deg.
   Friction angle at bottom of layer = 34.000000 deg.
   Subgrade k at top of layer = 120.000000 pci
   Subgrade k at bottom of layer = 120.000000 pci

Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer = 14.350000 ft
   Distance from top of pile to bottom of layer = 29.350000 ft
   Effective unit weight at top of layer = 62.600000 pcf

Effective unit weight at bottom of layer = 62.600000 pcf
Undrained cohesion at top of layer = 3000. psf
Undrained cohesion at bottom of layer = 3000. psf
Epsilon-50 at top of layer = 0.005000
Epsilon-50 at bottom of layer = 0.005000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 29.350000 ft
Distance from top of pile to bottom of layer = 40.850000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Undrained cohesion at top of layer = 4000. psf
Undrained cohesion at bottom of layer = 4000. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000

(Depth of the lowest soil layer extends 15.950 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	9.9000	62.6000	--	34.0000	--	120.0000
	(Reese, et al.)	14.3500	62.6000	--	34.0000	--	120.0000
2	Stiff Clay	14.3500	62.6000	3000.	--	0.00500	--
	w/o Free Water	29.3500	62.6000	3000.	--	0.00500	--
3	Stiff Clay	29.3500	62.6000	4000.	--	0.00400	--
	w/o Free Water	40.8500	62.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	9.900	1.0000	1.0000
2	30.000	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.900	302.900

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.900	454.400

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	9.900000 ft
Flange Width	=	7.040000 in
Section Depth	=	16.100000 in
Flange Thickness	=	0.565000 in
Web Thickness	=	0.345000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	13.300000 sq. in.
Moment of Inertia	=	586.000000 in^4
Elastic Bending Stiffness	=	16994000. kip-in^2
Plastic Modulus, Z	=	82.300000in^3
Plastic Moment Capacity = Fy Z	=	4115.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	665.000 kips
Nominal Axial Tensile Capacity	=	-665.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00001041	173.8496477	16702656.	8.0500000	2.4055664	
0.00002082	347.6992955	16702656.	8.0500000	4.8111329	
0.00003123	521.5489432	16702656.	8.0500000	7.2166993	
0.00004163	695.3985910	16702656.	8.0500000	9.6222657	
0.00005204	869.2482387	16702656.	8.0500000	12.0278322	
0.00006245	1043.	16702656.	8.0500000	14.4333986	
0.00007286	1217.	16702656.	8.0500000	16.8389651	
0.00008327	1391.	16702656.	8.0500000	19.2445315	

0.00009368	1565.	16702656.	8.0500000	21.6500979	
0.0001041	1738.	16702656.	8.0500000	24.0556644	
0.0001145	1912.	16702656.	8.0500000	26.4612308	
0.0001249	2086.	16702656.	8.0500000	28.8667972	
0.0001353	2260.	16702656.	8.0500000	31.2723637	
0.0001457	2434.	16702656.	8.0500000	33.6779301	
0.0001561	2608.	16702656.	8.0500000	36.0834965	
0.0001665	2782.	16702656.	8.0500000	38.4890630	
0.0001769	2955.	16702656.	8.0500000	40.8946294	
0.0001874	3129.	16702656.	8.0500000	43.3001959	
0.0001978	3303.	16702656.	8.0500000	45.7057623	
0.0002082	3477.	16702656.	8.0500000	48.1113287	
0.0002186	3642.	16659934.	8.0500000	50.0000000	Y
0.0002290	3725.	16269457.	8.0500000	50.0000000	Y
0.0002394	3756.	15687738.	8.0500000	50.0000000	Y
0.0002498	3780.	15131407.	8.0500000	50.0000000	Y
0.0002602	3801.	14608692.	8.0500000	50.0000000	Y
0.0002706	3820.	14117456.	8.0500000	50.0000000	Y
0.0002810	3837.	13654694.	8.0500000	50.0000000	Y
0.0002914	3853.	13219203.	8.0500000	50.0000000	Y
0.0003018	3866.	12808799.	8.0500000	50.0000000	Y
0.0003123	3879.	12421024.	8.0500000	50.0000000	Y
0.0003227	3890.	12054761.	8.0500000	50.0000000	Y
0.0003331	3900.	11708358.	8.0500000	50.0000000	Y
0.0003435	3909.	11380345.	8.0500000	50.0000000	Y
0.0003539	3917.	11069403.	8.0500000	50.0000000	Y
0.0003643	3925.	10774346.	8.0500000	50.0000000	Y
0.0003747	3932.	10493911.	8.0500000	50.0000000	Y
0.0003851	3939.	10226985.	8.0500000	50.0000000	Y
0.0003955	3945.	9972954.	8.0500000	50.0000000	Y
0.0004059	3950.	9731018.	8.0500000	50.0000000	Y
0.0004267	3960.	9279327.	8.0500000	50.0000000	Y
0.0004476	3968.	8866779.	8.0500000	50.0000000	Y
0.0004684	3976.	8488546.	8.0500000	50.0000000	Y
0.0004892	3982.	8140592.	8.0500000	50.0000000	Y
0.0005100	3988.	7819512.	8.0500000	50.0000000	Y
0.0005308	3993.	7522409.	8.0500000	50.0000000	Y
0.0005517	3998.	7246800.	8.0500000	50.0000000	Y
0.0005725	4002.	6990218.	8.0500000	50.0000000	Y
0.0005933	4005.	6750947.	8.0500000	50.0000000	Y
0.0006141	4009.	6527510.	8.0500000	50.0000000	Y
0.0006349	4011.	6317973.	8.0500000	50.0000000	Y
0.0006557	4014.	6121508.	8.0500000	50.0000000	Y
0.0006766	4016.	5936659.	8.0500000	50.0000000	Y
0.0006974	4019.	5762659.	8.0500000	50.0000000	Y
0.0007182	4021.	5598345.	8.0500000	50.0000000	Y
0.0007390	4023.	5443278.	8.0500000	50.0000000	Y
0.0007598	4024.	5296237.	8.0500000	50.0000000	Y
0.0007806	4026.	5157038.	8.0500000	50.0000000	Y
0.0008015	4027.	5024915.	8.0500000	50.0000000	Y
0.0008223	4029.	4899248.	8.0500000	50.0000000	Y
0.0008431	4030.	4779786.	8.0500000	50.0000000	Y
0.0008639	4031.	4665974.	8.0500000	50.0000000	Y
0.0008847	4032.	4557316.	8.0500000	50.0000000	Y
0.0009055	4033.	4453654.	8.0500000	50.0000000	Y
0.0009264	4034.	4354651.	8.0500000	50.0000000	Y
0.0009472	4035.	4259813.	8.0500000	50.0000000	Y
0.0009680	4036.	4169000.	8.0500000	50.0000000	Y

0.0009888	4036.	4082010.	8.0500000	50.0000000	Y
0.0010096	4037.	3998607.	8.0500000	50.0000000	Y
0.0010304	4038.	3918480.	8.0500000	50.0000000	Y
0.0010513	4038.	3841436.	8.0500000	50.0000000	Y
0.0010721	4039.	3767384.	8.0500000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	4039.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	15.000000 ft
Outside Diameter of Casing	=	24.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	7.040000 in
Depth of Core/Insert	=	16.100000 in
Flange Thickness of Core/Insert	=	0.565000 in
Web Thickness of Core/Insert	=	0.345000 in
Moment of Inertia of Steel Core/Insert	=	586.000000 in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	452.389342 sq. in.
Area of Concrete	=	439.269492 sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	13.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	13.119850 sq. in.
Area Ratio of All Steel to Gross Area	=	2.90 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 2531.130 kips
Tensile Load for Cracking of Concrete = -247.826 kips
Nominal Axial Tensile Capacity = -665.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00001041	331.7455821	31872554.	7.5272042	0.00007835	-0.000171	0.3588985	0.00000	0.00000	-3.776945	C
0.00002082	661.4613557	31775047.	7.5479424	0.0001571	-0.000342	0.7063292	0.00000	0.00000	-7.541370	C
0.00003123	989.0975110	31675945.	7.5688323	0.0002363	-0.000513	1.0420863	0.00000	0.00000	-11.293138	C
0.00004163	1315.	31575227.	7.5897901	0.0003160	-0.000683	1.3659454	0.00000	0.00000	-15.032214	C
0.00005204	1638.	31472826.	7.6111546	0.0003961	-0.000853	1.6777514	0.00000	0.00000	-18.758023	C
0.00006245	1959.	31368680.	7.6329426	0.0004767	-0.001022	1.9773115	0.00000	0.00000	-22.470168	C
0.00007286	2278.	31262720.	7.6551714	0.0005578	-0.001191	2.2644245	0.00000	0.00000	-26.168228	C
0.00008327	2594.	31154878.	7.6778598	0.0006393	-0.001359	2.5388798	0.00000	0.00000	-29.851759	C
0.00009368	2908.	31045074.	7.7010276	0.0007214	-0.001527	2.8004568	0.00000	0.00000	-33.520293	C
0.0001041	3220.	30933235.	7.7246960	0.0008040	-0.001694	3.0489248	0.00000	0.00000	-37.173327	C
0.0001145	3529.	30819273.	7.7488875	0.0008872	-0.001861	3.2840409	0.00000	0.00000	-40.810336	C
0.0001249	3835.	30703095.	7.7736264	0.0009709	-0.002027	3.5055498	0.00000	0.00000	-44.430757	C
0.0001353	4138.	30584606.	7.7989387	0.0010553	-0.002192	3.7131829	0.00000	0.00000	-48.033994	C
0.0001457	4407.	30241222.	7.8016508	0.0011368	-0.002360	3.8991473	0.00000	0.00000	-50.000000	CY
0.0001561	4518.	28939005.	7.7017087	0.0012024	-0.002545	4.0376692	0.00000	0.00000	-50.000000	CY
0.0001665	4610.	27679200.	7.6030071	0.0012662	-0.002731	4.1632492	0.00000	0.00000	-50.000000	CY
0.0001769	4689.	26498941.	7.5078909	0.0013285	-0.002918	4.2774950	0.00000	0.00000	-50.000000	CY
0.0001874	4758.	25396997.	7.4168333	0.0013896	-0.003107	4.3813262	0.00000	0.00000	-50.000000	CY
0.0001978	4820.	24370609.	7.3312881	0.0014498	-0.003296	4.4758711	0.00000	0.00000	-50.000000	CY
0.0002082	4874.	23412574.	7.2482298	0.0015089	-0.003487	4.5608076	0.00000	0.00000	-50.000000	CY
0.0002186	4922.	22519429.	7.1698324	0.0015672	-0.003679	4.6373341	0.00000	0.00000	-50.000000	CY
0.0002290	4966.	21686546.	7.0962951	0.0016250	-0.003871	4.7059438	0.00000	0.00000	-50.000000	CY
0.0002394	5005.	20907258.	7.0250269	0.0016818	-0.004064	4.7663546	0.00000	0.00000	-50.000000	CY
0.0002498	5041.	20177832.	6.9573781	0.0017380	-0.004257	4.8193052	0.00000	0.00000	-50.000000	CY
0.0002602	5073.	19495008.	6.8938781	0.0017939	-0.004451	4.8652052	0.00000	0.00000	-50.000000	CY
0.0002706	5102.	18854107.	6.8338558	0.0018494	-0.004646	4.9041417	0.00000	0.00000	-50.000000	CY
0.0002810	5129.	18250525.	6.7750157	0.0019040	-0.004841	4.9359666	0.00000	0.00000	-50.000000	CY
0.0002914	5153.	17682781.	6.7196468	0.0019584	-0.005036	4.9613042	0.00000	0.00000	-50.000000	CY

0.0003018	5176.	17147795.	6.6674904	0.0020126	-0.005232	4.9802399	0.00000	0.00000	-50.000000 CY
0.0003123	5197.	16642870.	6.6183268	0.0020666	-0.005428	4.9928446	0.00000	0.00000	-50.000000 CY
0.0003227	5216.	16164625.	6.5704566	0.0021200	-0.005624	4.9991444	0.00000	0.00000	-50.000000 CY
0.0003331	5233.	15711239.	6.5243792	0.0021731	-0.005821	4.9965081	0.00000	0.00000	-50.000000 CY
0.0003435	5249.	15281515.	6.4809112	0.0022261	-0.006017	4.9999525	0.00000	0.00000	-50.000000 CY
0.0003539	5264.	14873592.	6.4400234	0.0022791	-0.006214	4.9979985	0.00000	0.00000	-50.000000 CY
0.0003643	5277.	14486266.	6.4014597	0.0023320	-0.006411	4.9979852	0.00000	0.00000	-50.000000 CY
0.0003747	5290.	14117246.	6.3650073	0.0023850	-0.006608	4.9983197	0.00000	0.00000	-50.000000 CY
0.0003851	5301.	13764940.	6.3286565	0.0024373	-0.006805	4.9978504	0.00000	0.00000	-50.000000 CY
0.0003955	5312.	13429114.	6.2942240	0.0024895	-0.007003	4.9975619	0.00000	0.00000	-50.000000 CY
0.0004059	5321.	13108400.	6.2612772	0.0025417	-0.007201	4.9999638	0.00000	0.00000	-50.000000 CY
0.0004267	5338.	12509303.	6.2006783	0.0026461	-0.007596	4.9992346	0.00000	0.00000	-50.000000 CY
0.0004476	5353.	11960661.	6.1458796	0.0027507	-0.007991	4.9964197	0.00000	0.00000	-50.000000 CY
0.0004684	5366.	11455975.	6.0944298	0.0028545	-0.008387	4.9933771	0.00000	0.00000	-50.000000 CY
0.0004892	5376.	10990106.	6.0459551	0.0029577	-0.008783	4.9988635	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	5376.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	9.9000	0.00	N.A.	No	0.00	15480.
2	14.3500	0.8289	No	No	15480.	294557.
3	29.3500	19.4500	No	No	310037.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only

for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.8751	1.87E-06	0.00	-0.00519	1.12E-08	1.67E+10	0.00	0.00	0.00
0.2490	0.8595	1.04E-06	-2.09E-07	-0.00519	6.24E-09	1.67E+10	0.00	0.00	0.00
0.4980	0.8440	6.23E-07	-1.74E-07	-0.00519	3.74E-09	1.67E+10	0.00	0.00	0.00
0.7470	0.8285	0.00	-2.78E-07	-0.00519	0.00	1.67E+10	0.00	0.00	0.00
0.9960	0.8130	-1.04E-06	1.4825	-0.00519	6.24E-09	1.67E+10	0.00	0.00	0.9923
1.2450	0.7975	8.8596	15.4224	-0.00519	0.05322	1.67E+10	0.00	0.00	8.3383
1.4940	0.7820	92.1644	52.9979	-0.00519	0.5536	1.67E+10	0.00	0.00	16.8127
1.7430	0.7665	325.5750	115.8948	-0.00519	1.9557	1.67E+10	0.00	0.00	25.2870
1.9920	0.7510	784.7519	204.1133	-0.00519	4.7139	1.67E+10	0.00	0.00	33.7614
2.2410	0.7355	1545.	317.6532	-0.00519	9.2827	1.67E+10	0.00	0.00	42.2358
2.4900	0.7200	2683.	456.5146	-0.00519	16.1166	1.67E+10	0.00	0.00	50.7102
2.7390	0.7044	4273.	620.6975	-0.00519	25.6701	1.67E+10	0.00	0.00	59.1846
2.9880	0.6889	6392.	810.2019	-0.00519	38.3976	1.67E+10	0.00	0.00	67.6590
3.2370	0.6734	9115.	1025.	-0.00519	54.7537	1.67E+10	0.00	0.00	76.1334
3.4860	0.6579	12518.	1265.	-0.00519	75.1929	1.67E+10	0.00	0.00	84.6078
3.7350	0.6425	16676.	1531.	-0.00518	100.1695	1.67E+10	0.00	0.00	93.0822
3.9840	0.6270	21665.	1821.	-0.00518	130.1381	1.67E+10	0.00	0.00	101.5566
4.2330	0.6115	27561.	2138.	-0.00517	165.5531	1.67E+10	0.00	0.00	110.0310
4.4820	0.5960	34439.	2479.	-0.00517	206.8691	1.67E+10	0.00	0.00	118.5054
4.7310	0.5806	42375.	2846.	-0.00516	254.5405	1.67E+10	0.00	0.00	126.9798
4.9800	0.5652	51445.	3238.	-0.00515	309.0218	1.67E+10	0.00	0.00	135.4542
5.2290	0.5498	61724.	3655.	-0.00514	370.7675	1.67E+10	0.00	0.00	143.9286
5.4780	0.5345	73289.	4098.	-0.00513	440.2321	1.67E+10	0.00	0.00	152.4029
5.7270	0.5191	86214.	4566.	-0.00512	517.8700	1.67E+10	0.00	0.00	160.8773
5.9760	0.5039	100575.	5059.	-0.00510	604.1357	1.67E+10	0.00	0.00	169.3517
6.2250	0.4887	116448.	5578.	-0.00508	699.4837	1.67E+10	0.00	0.00	177.8261
6.4740	0.4735	133909.	6122.	-0.00506	804.3685	1.67E+10	0.00	0.00	186.3005
6.7230	0.4584	153033.	6691.	-0.00503	919.2446	1.67E+10	0.00	0.00	194.7749
6.9720	0.4434	173897.	7286.	-0.00500	1045.	1.67E+10	0.00	0.00	203.2493
7.2210	0.4285	196574.	7906.	-0.00497	1181.	1.67E+10	0.00	0.00	211.7237
7.4700	0.4137	221143.	8551.	-0.00493	1328.	1.67E+10	0.00	0.00	220.1981
7.7190	0.3990	247677.	9222.	-0.00489	1488.	1.67E+10	0.00	0.00	228.6725
7.9680	0.3845	276252.	9918.	-0.00484	1659.	1.67E+10	0.00	0.00	237.1469
8.2170	0.3701	306946.	10639.	-0.00479	1844.	1.67E+10	0.00	0.00	245.6213
8.4660	0.3558	339831.	11386.	-0.00473	2041.	1.67E+10	0.00	0.00	254.0957
8.7150	0.3418	374986.	12158.	-0.00467	2252.	1.67E+10	0.00	0.00	262.5701

8.9640	0.3279	412485.	12955.	-0.00460	2478.	1.67E+10	0.00	0.00	271.0444
9.2130	0.3143	452404.	13777.	-0.00452	2718.	1.67E+10	0.00	0.00	279.5188
9.4620	0.3009	494818.	14625.	-0.00444	2972.	1.67E+10	0.00	0.00	287.9932
9.7110	0.2878	539804.	15498.	-0.00435	3243.	1.67E+10	0.00	0.00	296.4676
9.9600	0.2749	587436.	16052.	-0.00427	0.00	3.18E+10	-4.020	43.6887	78.1777
10.2090	0.2623	635731.	16130.	-0.00421	0.00	3.18E+10	-21.653	246.7048	0.00
10.4580	0.2498	683832.	16038.	-0.00415	0.00	3.18E+10	-40.443	483.8467	0.00
10.7070	0.2374	731572.	15888.	-0.00408	0.00	3.17E+10	-59.891	753.6564	0.00
10.9560	0.2253	778778.	15679.	-0.00401	0.00	3.17E+10	-79.609	1056.	0.00
11.2050	0.2135	825272.	15412.	-0.00394	0.00	3.17E+10	-99.568	1394.	0.00
11.4540	0.2018	870878.	15085.	-0.00386	0.00	3.17E+10	-119.128	1764.	0.00
11.7030	0.1904	915420.	14701.	-0.00377	0.00	3.17E+10	-137.905	2164.	0.00
11.9520	0.1793	958731.	14262.	-0.00368	0.00	3.17E+10	-155.664	2595.	0.00
12.2010	0.1684	1000652.	13772.	-0.00359	0.00	3.17E+10	-172.559	3062.	0.00
12.4500	0.1578	1041033.	13234.	-0.00350	0.00	3.17E+10	-187.869	3557.	0.00
12.6990	0.1475	1079736.	12652.	-0.00340	0.00	3.16E+10	-201.305	4078.	0.00
12.9480	0.1375	1116642.	12033.	-0.00329	0.00	3.16E+10	-213.002	4628.	0.00
13.1970	0.1278	1151646.	11380.	-0.00319	0.00	3.16E+10	-224.257	5242.	0.00
13.4460	0.1185	1184648.	10696.	-0.00307	0.00	3.16E+10	-233.349	5885.	0.00
13.6950	0.1095	1215567.	9989.	-0.00296	0.00	3.16E+10	-240.086	6554.	0.00
13.9440	0.1008	1244342.	9265.	-0.00284	0.00	3.16E+10	-244.747	7256.	0.00
14.1930	0.09246	1270932.	8527.	-0.00273	0.00	3.16E+10	-249.108	8051.	0.00
14.4420	0.08449	1295298.	7270.	-0.00260	0.00	3.16E+10	-591.812	20929.	0.00
14.6910	0.07689	1314380.	5505.	-0.00248	0.00	3.16E+10	-590.030	22928.	0.00
14.9400	0.06966	1328194.	3746.	-0.00236	0.00	3.16E+10	-587.354	25192.	0.00
15.1890	0.06281	1336764.	1996.	-0.00223	0.00	3.16E+10	-583.754	27769.	0.00
15.4380	0.05634	1340123.	258.6560	-0.00210	0.00	3.16E+10	-579.195	30718.	0.00
15.6870	0.05024	1338310.	-1464.	-0.00198	0.00	3.16E+10	-573.641	34114.	0.00
15.9360	0.04453	1331376.	-3168.	-0.00185	0.00	3.16E+10	-567.048	38051.	0.00
16.1850	0.03919	1319379.	-4851.	-0.00172	0.00	3.16E+10	-559.365	42649.	0.00
16.4340	0.03422	1302388.	-6509.	-0.00160	0.00	3.16E+10	-550.534	48068.	0.00
16.6830	0.02962	1280482.	-8139.	-0.00148	0.00	3.16E+10	-540.484	54515.	0.00
16.9320	0.02539	1253750.	-9737.	-0.00136	0.00	3.16E+10	-529.127	62275.	0.00
17.1810	0.02151	1222294.	-11299.	-0.00124	0.00	3.16E+10	-516.354	71741.	0.00
17.4300	0.01797	1186228.	-12820.	-0.00113	0.00	3.16E+10	-502.021	83478.	0.00
17.6790	0.01477	1145680.	-14296.	-0.00102	0.00	3.16E+10	-485.938	98321.	0.00
17.9280	0.01189	1100793.	-15721.	-9.11E-04	0.00	3.16E+10	-467.835	117571.	0.00
18.1770	0.00932	1051730.	-17088.	-8.10E-04	0.00	3.17E+10	-447.321	143374.	0.00
18.4260	0.00705	998672.	-18390.	-7.13E-04	0.00	3.17E+10	-423.784	179567.	0.00
18.6750	0.00506	941832.	-19615.	-6.21E-04	0.00	3.17E+10	-396.185	233832.	0.00
18.9240	0.00334	881453.	-20748.	-5.35E-04	0.00	3.17E+10	-362.536	324442.	0.00
19.1730	0.00186	817839.	-21765.	-4.55E-04	0.00	3.17E+10	-318.140	510169.	0.00
19.4220	6.18E-04	751383.	-22607.	-3.81E-04	0.00	3.17E+10	-245.231	1185691.	0.00
19.6710	-4.16E-04	682739.	-22671.	-3.14E-04	0.00	3.18E+10	202.1652	1452235.	0.00
19.9200	-0.00126	615899.	-21920.	-2.53E-04	0.00	3.18E+10	300.9537	714814.	0.00
20.1690	-0.00193	551746.	-20963.	-1.98E-04	0.00	3.18E+10	339.6576	526654.	0.00
20.4180	-0.00244	490626.	-19909.	-1.49E-04	0.00	3.18E+10	365.4392	447298.	0.00
20.6670	-0.00282	432768.	-18790.	-1.06E-04	0.00	3.18E+10	384.0440	407273.	0.00
20.9160	-0.00307	378339.	-17621.	-6.76E-05	0.00	3.18E+10	397.8280	386877.	0.00
21.1650	-0.00322	327462.	-16418.	-3.45E-05	0.00	3.19E+10	407.9991	378424.	0.00
21.4140	-0.00328	280228.	-15188.	-6.01E-06	0.00	3.19E+10	415.2555	378434.	0.00
21.6630	-0.00326	236701.	-13940.	1.82E-05	0.00	3.19E+10	420.0265	385283.	0.00
21.9120	-0.00317	196925.	-12681.	3.85E-05	0.00	3.19E+10	422.5826	398339.	0.00
22.1610	-0.00303	160921.	-11417.	5.53E-05	0.00	3.19E+10	423.0884	417623.	0.00
22.4100	-0.00284	128694.	-10155.	6.89E-05	0.00	3.19E+10	421.6275	443713.	0.00
22.6590	-0.00262	100232.	-8901.	7.96E-05	0.00	3.19E+10	418.2117	477793.	0.00
22.9080	-0.00236	75504.	-7659.	8.79E-05	0.00	3.19E+10	412.7780	521859.	0.00
23.1570	-0.00209	54461.	-6437.	9.40E-05	0.00	3.19E+10	405.1710	579167.	0.00

23.4060	-0.00180	37036.	-5242.	9.82E-05	0.00	3.19E+10	395.1052	655158.	0.00
23.6550	-0.00150	23138.	-4080.	1.01E-04	0.00	3.19E+10	382.0874	759482.	0.00
23.9040	-0.00120	12651.	-2964.	1.03E-04	0.00	3.19E+10	365.2519	910986.	0.00
24.1530	-8.89E-04	5425.	-1906.	1.04E-04	0.00	3.19E+10	342.9626	1152401.	0.00
24.4020	-5.79E-04	1262.	-927.879	1.04E-04	0.00	3.19E+10	311.6120	1608201.	0.00
24.6510	-2.68E-04	-119.550	-211.160	1.04E-04	0.00	3.19E+10	168.1194	1872085.	0.00
24.9000	4.23E-05	0.00	0.00	1.04E-04	0.00	3.19E+10	-26.781	946539.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.87506029 inches
Computed slope at pile head      =     -0.0051910 radians
Maximum bending moment           =       1340123. inch-lbs
Maximum shear force              =        -22671. lbs
Depth of maximum bending moment  =    15.43800000 feet below pile head
Depth of maximum shear force     =    19.67100000 feet below pile head
Number of iterations             =             23
Number of zero deflection points =              2
Pile deflection at ground        =     0.27802189 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
24.90000	0.87506029	1340123.	-22671.
23.65500	0.90078834	1333571.	-24025.
22.41000	1.13499026	1303659.	-26999.
21.16500	1.83617039	1240388.	-29024.
19.92000	4.84466993	1166620.	-31614.
18.67500	41.12972309	1166700.	-39764.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.6272	-2.28E-05	0.00	-0.00911	1.37E-07	1.67E+10	0.00	0.00	0.00
0.2490	1.5999	-2.24E-05	2.09E-07	-0.00911	1.35E-07	1.67E+10	0.00	0.00	0.00
0.4980	1.5727	-2.16E-05	1.39E-07	-0.00911	1.30E-07	1.67E+10	0.00	0.00	0.00
0.7470	1.5455	-2.16E-05	2.09E-07	-0.00911	1.30E-07	1.67E+10	0.00	0.00	0.00
0.9960	1.5183	-2.04E-05	2.2240	-0.00911	1.22E-07	1.67E+10	0.00	0.00	1.4887
1.2450	1.4910	13.2909	23.1362	-0.00911	0.07984	1.67E+10	0.00	0.00	12.5088
1.4940	1.4638	138.2618	79.5056	-0.00911	0.8305	1.67E+10	0.00	0.00	25.2218
1.7430	1.4366	488.4162	173.8614	-0.00911	2.9338	1.67E+10	0.00	0.00	37.9347
1.9920	1.4094	1177.	306.2036	-0.00911	7.0716	1.67E+10	0.00	0.00	50.6477
2.2410	1.3822	2318.	476.5322	-0.00911	13.9256	1.67E+10	0.00	0.00	63.3607
2.4900	1.3549	4025.	684.8473	-0.00911	24.1776	1.67E+10	0.00	0.00	76.0737
2.7390	1.3277	6411.	931.1487	-0.00911	38.5094	1.67E+10	0.00	0.00	88.7867
2.9880	1.3005	9590.	1215.	-0.00911	57.6028	1.67E+10	0.00	0.00	101.4997
3.2370	1.2733	13674.	1538.	-0.00911	82.1396	1.67E+10	0.00	0.00	114.2127
3.4860	1.2461	18779.	1898.	-0.00910	112.8017	1.67E+10	0.00	0.00	126.9257
3.7350	1.2189	25017.	2296.	-0.00910	150.2707	1.67E+10	0.00	0.00	139.6387
3.9840	1.1917	32501.	2732.	-0.00909	195.2286	1.67E+10	0.00	0.00	152.3516
4.2330	1.1646	41346.	3207.	-0.00909	248.3570	1.67E+10	0.00	0.00	165.0646
4.4820	1.1374	51664.	3719.	-0.00908	310.3378	1.67E+10	0.00	0.00	177.7776
4.7310	1.1103	63570.	4269.	-0.00907	381.8528	1.67E+10	0.00	0.00	190.4906
4.9800	1.0832	77176.	4857.	-0.00906	463.5838	1.67E+10	0.00	0.00	203.2036
5.2290	1.0562	92597.	5483.	-0.00904	556.2125	1.67E+10	0.00	0.00	215.9166
5.4780	1.0292	109945.	6148.	-0.00902	660.4208	1.67E+10	0.00	0.00	228.6296
5.7270	1.0023	129335.	6850.	-0.00900	776.8905	1.67E+10	0.00	0.00	241.3426
5.9760	0.9754	150879.	7590.	-0.00898	906.3033	1.67E+10	0.00	0.00	254.0556
6.2250	0.9486	174691.	8368.	-0.00895	1049.	1.67E+10	0.00	0.00	266.7685
6.4740	0.9219	200886.	9184.	-0.00891	1207.	1.67E+10	0.00	0.00	279.4815
6.7230	0.8954	229575.	10038.	-0.00887	1379.	1.67E+10	0.00	0.00	292.1945
6.9720	0.8689	260874.	10930.	-0.00883	1567.	1.67E+10	0.00	0.00	304.9075
7.2210	0.8426	294894.	11860.	-0.00878	1771.	1.67E+10	0.00	0.00	317.6205
7.4700	0.8164	331750.	12828.	-0.00872	1993.	1.67E+10	0.00	0.00	330.3335
7.7190	0.7905	371556.	13834.	-0.00866	2232.	1.67E+10	0.00	0.00	343.0465
7.9680	0.7647	414424.	14878.	-0.00859	2489.	1.67E+10	0.00	0.00	355.7595
8.2170	0.7391	460469.	15960.	-0.00851	2766.	1.67E+10	0.00	0.00	368.4724
8.4660	0.7138	509803.	17080.	-0.00843	3062.	1.67E+10	0.00	0.00	381.1854
8.7150	0.6888	562541.	18238.	-0.00833	3379.	1.67E+10	0.00	0.00	393.8984
8.9640	0.6640	618795.	19434.	-0.00822	3717.	1.67E+10	0.00	0.00	406.6114
9.2130	0.6396	678680.	20668.	-0.00811	4077.	1.67E+10	0.00	0.00	419.3244
9.4620	0.6156	742309.	21940.	-0.00798	4459.	1.67E+10	0.00	0.00	432.0374
9.7110	0.5919	809795.	23250.	-0.00784	4864.	1.67E+10	0.00	0.00	444.7504
9.9600	0.5687	881251.	24082.	-0.00773	0.00	3.17E+10	-4.915	25.8228	117.2795
10.2090	0.5457	953711.	24211.	-0.00764	0.00	3.17E+10	-26.557	145.4102	0.00
10.4580	0.5230	1025934.	24097.	-0.00755	0.00	3.17E+10	-49.799	284.4970	0.00
10.7070	0.5006	1097712.	23911.	-0.00745	0.00	3.16E+10	-74.100	442.2799	0.00
10.9560	0.4785	1168828.	23653.	-0.00734	0.00	3.16E+10	-98.976	618.0464	0.00
11.2050	0.4567	1239061.	23320.	-0.00723	0.00	3.16E+10	-124.121	812.0082	0.00
11.4540	0.4353	1308186.	22911.	-0.00711	0.00	3.16E+10	-149.017	1023.	0.00
11.7030	0.4143	1375980.	22430.	-0.00698	0.00	3.16E+10	-173.251	1250.	0.00

11.9520	0.3936	1442228.	21877.	-0.00685	0.00	3.15E+10	-196.563	1492.	0.00
12.2010	0.3733	1506720.	21257.	-0.00671	0.00	3.15E+10	-219.007	1753.	0.00
12.4500	0.3535	1569257.	20571.	-0.00656	0.00	3.15E+10	-239.763	2027.	0.00
12.6990	0.3341	1629654.	19827.	-0.00641	0.00	3.15E+10	-258.475	2311.	0.00
12.9480	0.3152	1687743.	19029.	-0.00625	0.00	3.15E+10	-275.332	2610.	0.00
13.1970	0.2968	1743373.	18182.	-0.00609	0.00	3.14E+10	-292.040	2940.	0.00
13.4460	0.2788	1796396.	17288.	-0.00592	0.00	3.14E+10	-306.370	3283.	0.00
13.6950	0.2614	1846684.	16355.	-0.00575	0.00	3.14E+10	-318.064	3636.	0.00
13.9440	0.2445	1894133.	15390.	-0.00557	0.00	3.14E+10	-327.367	4001.	0.00
14.1930	0.2281	1938658.	14399.	-0.00539	0.00	3.14E+10	-336.143	4403.	0.00
14.4420	0.2123	1980182.	12784.	-0.00520	0.00	3.14E+10	-745.089	10487.	0.00
14.6910	0.1970	2015054.	10555.	-0.00501	0.00	3.13E+10	-746.506	11321.	0.00
14.9400	0.1824	2043261.	8324.	-0.00482	0.00	3.13E+10	-747.082	12241.	0.00
15.1890	0.1683	2064798.	6092.	-0.00462	0.00	3.13E+10	-746.794	13262.	0.00
15.4380	0.1547	2079668.	3862.	-0.00442	0.00	3.13E+10	-745.617	14397.	0.00
15.6870	0.1418	2087881.	1638.	-0.00422	0.00	3.13E+10	-743.524	15665.	0.00
15.9360	0.1295	2089455.	-579.407	-0.00402	0.00	3.13E+10	-740.485	17085.	0.00
16.1850	0.1178	2084418.	-2786.	-0.00383	0.00	3.13E+10	-736.466	18685.	0.00
16.4340	0.1066	2072806.	-4979.	-0.00363	0.00	3.13E+10	-731.426	20495.	0.00
16.6830	0.09609	2054664.	-7155.	-0.00343	0.00	3.13E+10	-725.321	22553.	0.00
16.9320	0.08614	2030045.	-9312.	-0.00324	0.00	3.13E+10	-718.097	24910.	0.00
17.1810	0.07676	1999016.	-11445.	-0.00304	0.00	3.14E+10	-709.688	27627.	0.00
17.4300	0.06795	1961650.	-13551.	-0.00286	0.00	3.14E+10	-700.016	30783.	0.00
17.6790	0.05970	1918035.	-15626.	-0.00267	0.00	3.14E+10	-688.982	34486.	0.00
17.9280	0.05199	1868268.	-17666.	-0.00249	0.00	3.14E+10	-676.461	38878.	0.00
18.1770	0.04481	1812462.	-19666.	-0.00232	0.00	3.14E+10	-662.290	44158.	0.00
18.4260	0.03815	1750742.	-21621.	-0.00215	0.00	3.14E+10	-646.252	50610.	0.00
18.6750	0.03199	1683253.	-23525.	-0.00198	0.00	3.15E+10	-628.046	58658.	0.00
18.9240	0.02631	1610157.	-25371.	-0.00183	0.00	3.15E+10	-607.244	68970.	0.00
19.1730	0.02108	1531638.	-27149.	-0.00168	0.00	3.15E+10	-583.207	82668.	0.00
19.4220	0.01629	1447913.	-28849.	-0.00154	0.00	3.15E+10	-554.915	101811.	0.00
19.6710	0.01190	1359234.	-30456.	-0.00140	0.00	3.16E+10	-520.599	130695.	0.00
19.9200	0.00790	1265907.	-31946.	-0.00128	0.00	3.16E+10	-476.733	180250.	0.00
20.1690	0.00426	1168323.	-33278.	-0.00116	0.00	3.16E+10	-414.342	290536.	0.00
20.4180	9.50E-04	1067040.	-34328.	-0.00106	0.00	3.16E+10	-288.686	908247.	0.00
20.6670	-0.00206	963180.	-34228.	-9.62E-04	0.00	3.17E+10	355.2435	515080.	0.00
20.9160	-0.00480	862491.	-33033.	-8.76E-04	0.00	3.17E+10	444.8539	276930.	0.00
21.1650	-0.00730	765774.	-31621.	-7.99E-04	0.00	3.17E+10	500.6081	205017.	0.00
21.4140	-0.00958	673526.	-30061.	-7.32E-04	0.00	3.18E+10	542.9628	169406.	0.00
21.6630	-0.01167	586126.	-28387.	-6.72E-04	0.00	3.18E+10	577.9377	147997.	0.00
21.9120	-0.01360	503886.	-26615.	-6.21E-04	0.00	3.18E+10	608.2283	133679.	0.00
22.1610	-0.01538	427077.	-24757.	-5.77E-04	0.00	3.18E+10	635.3078	123422.	0.00
22.4100	-0.01705	355939.	-22822.	-5.41E-04	0.00	3.19E+10	660.0838	115705.	0.00
22.6590	-0.01861	290695.	-20815.	-5.10E-04	0.00	3.19E+10	683.1632	109676.	0.00
22.9080	-0.02010	231550.	-18741.	-4.86E-04	0.00	3.19E+10	704.9749	104818.	0.00
23.1570	-0.02152	178699.	-16603.	-4.67E-04	0.00	3.19E+10	725.8347	100799.	0.00
23.4060	-0.02289	132329.	-14404.	-4.52E-04	0.00	3.19E+10	745.9816	97397.	0.00
23.6550	-0.02422	92619.	-12146.	-4.42E-04	0.00	3.19E+10	765.5994	94459.	0.00
23.9040	-0.02552	59744.	-9830.	-4.34E-04	0.00	3.19E+10	784.8303	91875.	0.00
24.1530	-0.02681	33877.	-7456.	-4.30E-04	0.00	3.19E+10	803.7830	89568.	0.00
24.4020	-0.02809	15185.	-5027.	-4.28E-04	0.00	3.19E+10	822.5391	87481.	0.00
24.6510	-0.02937	3838.	-2541.	-4.27E-04	0.00	3.19E+10	841.1568	85575.	0.00
24.9000	-0.03065	0.00	0.00	-4.27E-04	0.00	3.19E+10	859.6739	41910.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be inter-

polated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     1.62715302 inches
Computed slope at pile head      =     -0.0091107 radians
Maximum bending moment           =       2089455. inch-lbs
Maximum shear force              =        -34328. lbs
Depth of maximum bending moment  =    15.93600000 feet below pile head
Depth of maximum shear force     =    20.41800000 feet below pile head
Number of iterations             =             37
Number of zero deflection points =              1
Pile deflection at ground        =     0.57428715 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
24.90000	1.62715302	2089455.	-34328.
23.65500	1.99148452	2036486.	-37601.
22.41000	3.20058974	1947527.	-40380.
21.16500	8.69075296	1912351.	-45278.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

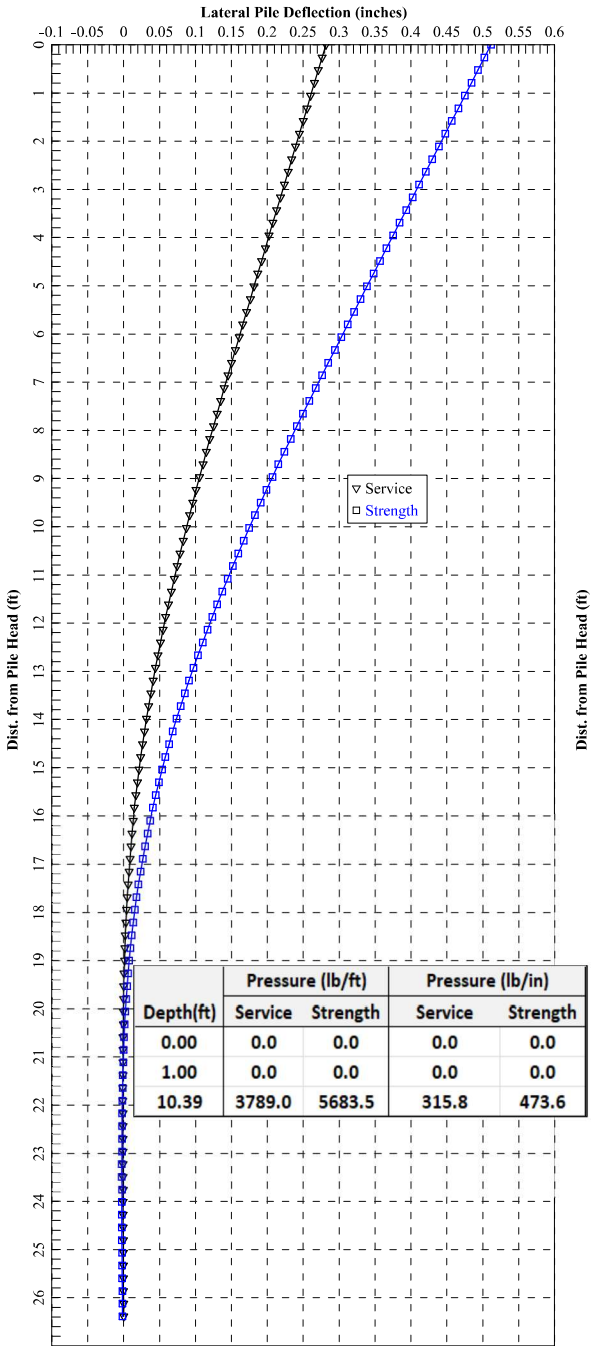
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

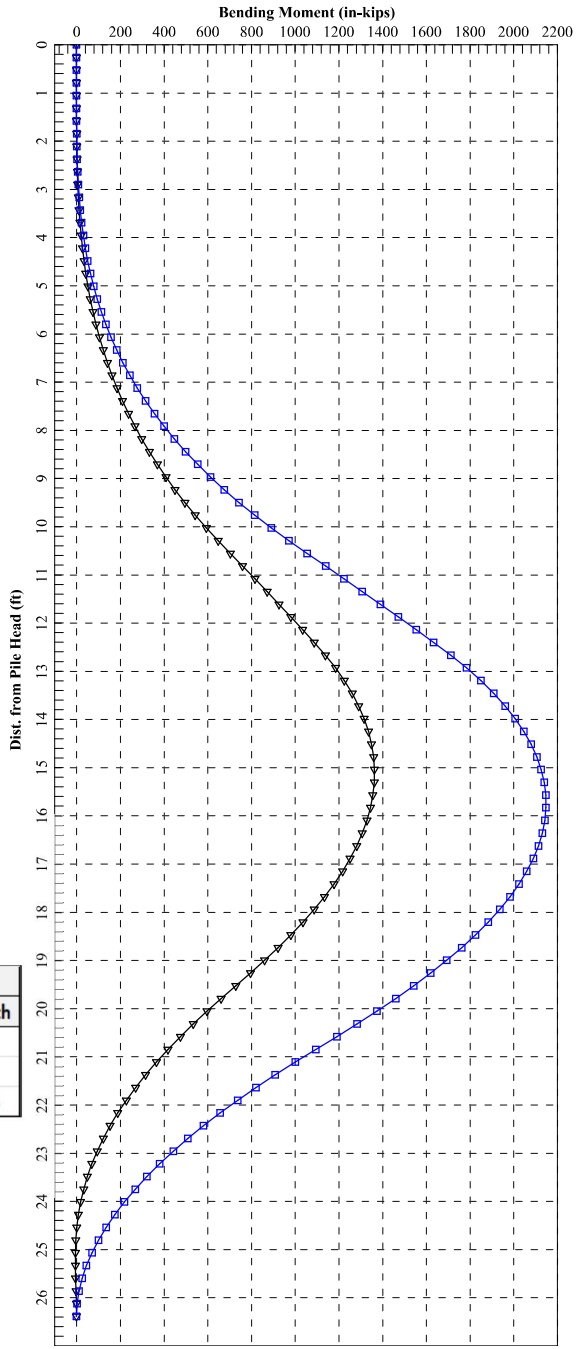
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	0.8751	-0.00519	-22671.	1340123.
2	V, lb	0.00	M, in-lb	0.00	0.00	1.6272	-0.00911	-34328.	2089455.

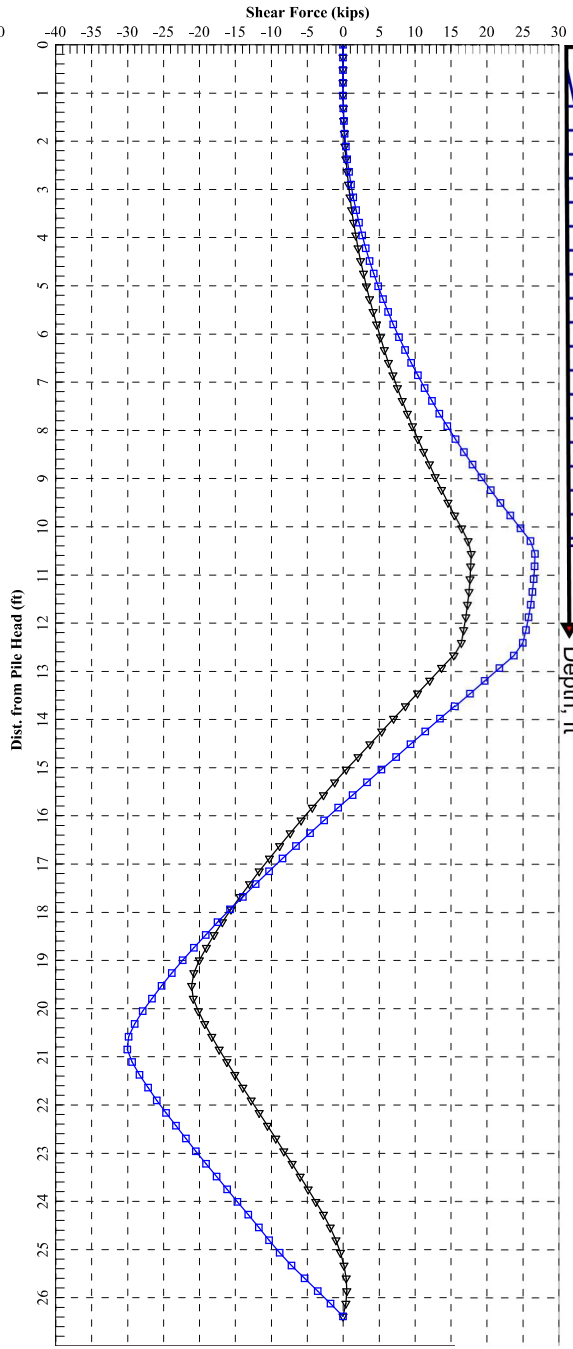
```
Maximum pile-head deflection = 1.6271530240 inches
Maximum pile-head rotation   = -0.0091106507 radians = -0.522002 deg.

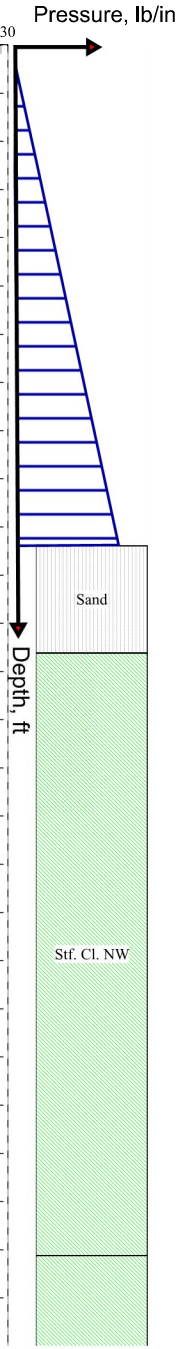
The analysis ended normally.
```

Wall 1D (10.39ft)









Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
10.39	3789.0	5683.5	315.8	473.6

==

LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
04 Wall_1D-10.39ft.lp12d

Name of output report file:
04 Wall_1D-10.39ft.lp12o

Name of plot output file:
04 Wall_1D-10.39ft.lp12p

Name of runtime message file:
04 Wall_1D-10.39ft.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 15:19:08

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1D (H=10.39FT) Boring B-050-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	2
Total length of pile	=	26.390 ft
Depth of ground surface below top of pile	=	10.3900 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	8.4200
2	10.390	8.4200
3	10.390	30.0000
4	26.390	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 10.390000 ft
   AISC Section Type = W
   AISC Section Name = W21X93
   Pile width = 8.420000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 16.000000 ft
   Section Diameter = 30.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W21X93

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 10.390000 ft
   Distance from top of pile to bottom of layer = 12.620000 ft
   Effective unit weight at top of layer = 62.600000 pcf
   Effective unit weight at bottom of layer = 62.600000 pcf
   Friction angle at top of layer = 34.000000 deg.
   Friction angle at bottom of layer = 34.000000 deg.
   Subgrade k at top of layer = 120.000000 pci
   Subgrade k at bottom of layer = 120.000000 pci

Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer = 12.620000 ft
   Distance from top of pile to bottom of layer = 25.120000 ft
   Effective unit weight at top of layer = 62.600000 pcf

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   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =       3000. psf
   Undrained cohesion at bottom of layer               =       3000. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    25.120000 ft
   Distance from top of pile to bottom of layer        =    41.620000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =       4000. psf
   Undrained cohesion at bottom of layer               =       4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


 (Depth of the lowest soil layer extends 15.230 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
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Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.          Name              Depth       Unit Wt.                 Friction        or          kpy
         (p-y Curve Type)         ft          pcf          psf         deg.         krm         pci
-----   ------------------   ----------   ----------   ----------   ----------   ----------   ----------
  1           Sand             10.3900      62.6000       --          34.0000       --          120.0000
         (Reese, et al.)       12.6200      62.6000       --          34.0000       --          120.0000
  2         Stiff Clay          12.6200      62.6000       3000.       --          0.00500       --
         w/o Free Water         25.1200      62.6000       3000.       --          0.00500       --
  3         Stiff Clay          25.1200      62.6000       4000.       --          0.00400       --
         w/o Free Water         41.6200      62.6000       4000.       --          0.00400       --


--------------------------------------------------------------------------------
                     Modification Factors for p-y Curves
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Distribution of p-y modifiers with depth defined using 2 points

Point      Depth X         p-mult         y-mult
 No.          ft
-----     ----------     ----------     ----------
  1          10.390         0.9300         1.0000
  2          27.000         0.9300         1.0000



--------------------------------------------------------------------------------
                              Static Loading Type
--------------------------------------------------------------------------------
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Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	10.390	315.800

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	10.390	473.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	10.390000 ft
Flange Width	=	8.420000 in
Section Depth	=	21.600000 in
Flange Thickness	=	0.930000 in
Web Thickness	=	0.580000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	27.300000 sq. in.
Moment of Inertia	=	2070. in^4
Elastic Bending Stiffness	=	60030000. kip-in^2
Plastic Modulus, Z	=	221.000000in^3
Plastic Moment Capacity = Fy Z	=	11050.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1365.000 kips
Nominal Axial Tensile Capacity	=	-1365.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000870	515.8765734	59278467.	10.8000000	2.6983967	
0.00001741	1032.	59278467.	10.8000000	5.3967934	
0.00002611	1548.	59278467.	10.8000000	8.0951901	
0.00003481	2064.	59278467.	10.8000000	10.7935868	
0.00004351	2579.	59278467.	10.8000000	13.4919835	
0.00005222	3095.	59278467.	10.8000000	16.1903802	
0.00006092	3611.	59278467.	10.8000000	18.8887769	
0.00006962	4127.	59278467.	10.8000000	21.5871736	

0.00007832	4643.	59278467.	10.8000000	24.2855703	
0.00008703	5159.	59278467.	10.8000000	26.9839670	
0.00009573	5675.	59278467.	10.8000000	29.6823637	
0.0001044	6191.	59278467.	10.8000000	32.3807604	
0.0001131	6706.	59278467.	10.8000000	35.0791571	
0.0001218	7222.	59278467.	10.8000000	37.7775538	
0.0001305	7738.	59278467.	10.8000000	40.4759505	
0.0001392	8254.	59278467.	10.8000000	43.1743472	
0.0001479	8770.	59278467.	10.8000000	45.8727439	
0.0001566	9286.	59278467.	10.8000000	48.5711406	
0.0001653	9743.	58925983.	10.8000000	50.0000000	Y
0.0001741	9961.	57232230.	10.8000000	50.0000000	Y
0.0001828	10054.	55011939.	10.8000000	50.0000000	Y
0.0001915	10130.	52910573.	10.8000000	50.0000000	Y
0.0002002	10197.	50942734.	10.8000000	50.0000000	Y
0.0002089	10255.	49100548.	10.8000000	50.0000000	Y
0.0002176	10307.	47374198.	10.8000000	50.0000000	Y
0.0002263	10353.	45754419.	10.8000000	50.0000000	Y
0.0002350	10393.	44233032.	10.8000000	50.0000000	Y
0.0002437	10430.	42803440.	10.8000000	50.0000000	Y
0.0002524	10463.	41457856.	10.8000000	50.0000000	Y
0.0002611	10493.	40189436.	10.8000000	50.0000000	Y
0.0002698	10519.	38992136.	10.8000000	50.0000000	Y
0.0002785	10544.	37860581.	10.8000000	50.0000000	Y
0.0002872	10566.	36789965.	10.8000000	50.0000000	Y
0.0002959	10586.	35775967.	10.8000000	50.0000000	Y
0.0003046	10604.	34814684.	10.8000000	50.0000000	Y
0.0003133	10621.	33902571.	10.8000000	50.0000000	Y
0.0003220	10637.	33033988.	10.8000000	50.0000000	Y
0.0003307	10651.	32208106.	10.8000000	50.0000000	Y
0.0003394	10665.	31422295.	10.8000000	50.0000000	Y
0.0003568	10688.	29955693.	10.8000000	50.0000000	Y
0.0003742	10709.	28617106.	10.8000000	50.0000000	Y
0.0003916	10727.	27390904.	10.8000000	50.0000000	Y
0.0004090	10742.	26263780.	10.8000000	50.0000000	Y
0.0004264	10756.	25223499.	10.8000000	50.0000000	Y
0.0004438	10768.	24261485.	10.8000000	50.0000000	Y
0.0004612	10779.	23369656.	10.8000000	50.0000000	Y
0.0004786	10789.	22540021.	10.8000000	50.0000000	Y
0.0004960	10797.	21766321.	10.8000000	50.0000000	Y
0.0005135	10805.	21044155.	10.8000000	50.0000000	Y
0.0005309	10812.	20366907.	10.8000000	50.0000000	Y
0.0005483	10819.	19732433.	10.8000000	50.0000000	Y
0.0005657	10824.	19135091.	10.8000000	50.0000000	Y
0.0005831	10830.	18573138.	10.8000000	50.0000000	Y
0.0006005	10834.	18042815.	10.8000000	50.0000000	Y
0.0006179	10839.	17541550.	10.8000000	50.0000000	Y
0.0006353	10843.	17067752.	10.8000000	50.0000000	Y
0.0006527	10847.	16618076.	10.8000000	50.0000000	Y
0.0006701	10850.	16191501.	10.8000000	50.0000000	Y
0.0006875	10853.	15786524.	10.8000000	50.0000000	Y
0.0007049	10856.	15400859.	10.8000000	50.0000000	Y
0.0007223	10859.	15033371.	10.8000000	50.0000000	Y
0.0007397	10861.	14683176.	10.8000000	50.0000000	Y
0.0007571	10864.	14349082.	10.8000000	50.0000000	Y
0.0007745	10866.	14029313.	10.8000000	50.0000000	Y
0.0007919	10868.	13723454.	10.8000000	50.0000000	Y
0.0008093	10870.	13430750.	10.8000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	10870.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	16.000000 ft
Outside Diameter of Casing	=	30.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	8.420000 in
Depth of Core/Insert	=	21.600000 in
Flange Thickness of Core/Insert	=	0.930000 in
Web Thickness of Core/Insert	=	0.580000 in
Moment of Inertia of Steel Core/Insert	=	2070. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	706.858347 sq. in.
Area of Concrete	=	679.747947 sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	27.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	27.110400 sq. in.
Area Ratio of All Steel to Gross Area	=	3.84 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 4253.123 kips
Tensile Load for Cracking of Concrete = -405.943 kips
Nominal Axial Tensile Capacity = -1365.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000870	879.2122589	101028729.	10.0918764	0.00008783	-0.000173	0.4018434	0.00000	0.00000	-4.002199	C
0.00001741	1753.	100695985.	10.1198281	0.0001761	-0.000346	0.7889729	0.00000	0.00000	-7.990289	C
0.00002611	2620.	100357725.	10.1483200	0.0002650	-0.000518	1.1611615	0.00000	0.00000	-11.963862	C
0.00003481	3482.	100013743.	10.1773739	0.0003543	-0.000690	1.5181726	0.00000	0.00000	-15.922486	C
0.00004351	4337.	99663823.	10.2070128	0.0004441	-0.000861	1.8597591	0.00000	0.00000	-19.865706	C
0.00005222	5185.	99307735.	10.2372614	0.0005345	-0.001032	2.1856626	0.00000	0.00000	-23.793043	C
0.00006092	6028.	98945235.	10.2681458	0.0006255	-0.001202	2.4956126	0.00000	0.00000	-27.703989	C
0.00006962	6863.	98576062.	10.2996939	0.0007171	-0.001372	2.7893258	0.00000	0.00000	-31.598006	C
0.00007832	7691.	98199939.	10.3319353	0.0008092	-0.001540	3.0665048	0.00000	0.00000	-35.474524	C
0.00008703	8513.	97816770.	10.3645338	0.0009020	-0.001709	3.3267491	0.00000	0.00000	-39.333867	C
0.00009573	9326.	97426435.	10.3974131	0.0009953	-0.001877	3.5696985	0.00000	0.00000	-43.175976	C
0.0001044	10133.	97028420.	10.4310494	0.0010893	-0.002044	3.7951168	0.00000	0.00000	-46.999198	C
0.0001131	10931.	96622378.	10.4654792	0.0011840	-0.002210	4.0026476	0.00000	0.00000	-50.000000	CY
0.0001218	11402.	93582278.	10.3821259	0.0012649	-0.002390	4.1641303	0.00000	0.00000	-50.000000	CY
0.0001305	11676.	89448233.	10.2419090	0.0013370	-0.002579	4.2956570	0.00000	0.00000	-50.000000	CY
0.0001392	11914.	85561206.	10.1075181	0.0014074	-0.002770	4.4132878	0.00000	0.00000	-50.000000	CY
0.0001479	12120.	81923318.	9.9780791	0.0014762	-0.002962	4.5178160	0.00000	0.00000	-50.000000	CY
0.0001566	12301.	78529754.	9.8543076	0.0015436	-0.003156	4.6102927	0.00000	0.00000	-50.000000	CY
0.0001653	12462.	75365677.	9.7371823	0.0016100	-0.003350	4.6916918	0.00000	0.00000	-50.000000	CY
0.0001741	12604.	72412532.	9.6235990	0.0016750	-0.003547	4.7620974	0.00000	0.00000	-50.000000	CY
0.0001828	12731.	69661831.	9.5169055	0.0017393	-0.003743	4.8227496	0.00000	0.00000	-50.000000	CY
0.0001915	12846.	67094893.	9.4154783	0.0018027	-0.003941	4.8738544	0.00000	0.00000	-50.000000	CY
0.0002002	12948.	64690499.	9.3174914	0.0018650	-0.004140	4.9156272	0.00000	0.00000	-50.000000	CY
0.0002089	13042.	62443191.	9.2254437	0.0019268	-0.004339	4.9488050	0.00000	0.00000	-50.000000	CY
0.0002176	13127.	60337099.	9.1383429	0.0019882	-0.004539	4.9735567	0.00000	0.00000	-50.000000	CY
0.0002263	13204.	58357255.	9.0535154	0.0020485	-0.004740	4.9899947	0.00000	0.00000	-50.000000	CY
0.0002350	13275.	56495754.	8.9734178	0.0021085	-0.004941	4.9985692	0.00000	0.00000	-50.000000	CY
0.0002437	13340.	54743654.	8.8979355	0.0021682	-0.005142	4.9971461	0.00000	0.00000	-50.000000	CY
0.0002524	13399.	53090645.	8.8258098	0.0022274	-0.005344	4.9978124	0.00000	0.00000	-50.000000	CY
0.0002611	13452.	51526323.	8.7557897	0.0022859	-0.005546	4.9996035	0.00000	0.00000	-50.000000	CY
0.0002698	13502.	50047650.	8.6897236	0.0023443	-0.005749	4.9974242	0.00000	0.00000	-50.000000	CY
0.0002785	13548.	48648700.	8.6272708	0.0024025	-0.005952	4.9994559	0.00000	0.00000	-50.000000	CY
0.0002872	13590.	47322073.	8.5682726	0.0024607	-0.006155	4.9985486	0.00000	0.00000	-50.000000	CY

0.0002959	13629.	46060080.	8.5102177	0.0025181	-0.006359	4.9956938	0.00000	0.00000	-50.000000 CY
0.0003046	13664.	44860299.	8.4544099	0.0025751	-0.006563	4.9985142	0.00000	0.00000	-50.000000 CY
0.0003133	13697.	43720739.	8.4014340	0.0026321	-0.006767	4.9972213	0.00000	0.00000	-50.000000 CY
0.0003220	13728.	42634767.	8.3510227	0.0026890	-0.006971	4.9974302	0.00000	0.00000	-50.000000 CY
0.0003307	13757.	41600126.	8.3027941	0.0027457	-0.007175	4.9999271	0.00000	0.00000	-50.000000 CY
0.0003394	13785.	40614434.	8.2572705	0.0028025	-0.007380	4.9944851	0.00000	0.00000	-50.000000 CY
0.0003568	13832.	38766902.	8.1671216	0.0029141	-0.007790	4.9989568	0.00000	0.00000	-50.000000 CY
0.0003742	13874.	37076277.	8.0843972	0.0030253	-0.008201	4.9983869	0.00000	0.00000	-50.000000 CY
0.0003916	13912.	35525012.	8.0082963	0.0031362	-0.008612	4.9911272	0.00000	0.00000	-50.000000 CY
0.0004090	13946.	34096115.	7.9374208	0.0032466	-0.009024	4.9991156	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	13946.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	10.3900	0.00	N.A.	No	0.00	4471.
2	12.6200	0.1973	No	No	4471.	415038.
3	25.1200	10.2255	Yes	No	419509.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2817	-1.31E-06	0.00	-0.00166	2.67E-09	5.93E+10	0.00	0.00	0.00
0.2639	0.2765	-4.27E-06	-4.14E-07	-0.00166	8.68E-09	5.93E+10	0.00	0.00	0.00
0.5278	0.2712	-3.94E-06	2.59E-07	-0.00166	8.01E-09	5.93E+10	0.00	0.00	0.00
0.7917	0.2659	-2.62E-06	2.59E-07	-0.00166	5.34E-09	5.93E+10	0.00	0.00	0.00
1.0556	0.2607	-2.30E-06	3.5490	-0.00166	4.67E-09	5.93E+10	0.00	0.00	2.2414
1.3195	0.2554	22.4777	24.1120	-0.00166	0.04572	5.93E+10	0.00	0.00	10.7453
1.5834	0.2501	152.7157	72.1934	-0.00166	0.3106	5.93E+10	0.00	0.00	19.6206
1.8473	0.2449	479.7216	148.3812	-0.00166	0.9757	5.93E+10	0.00	0.00	28.4960
2.1112	0.2396	1093.	252.6756	-0.00166	2.2220	5.93E+10	0.00	0.00	37.3713
2.3751	0.2343	2080.	385.0764	-0.00166	4.2305	5.93E+10	0.00	0.00	46.2467
2.6390	0.2291	3531.	545.5837	-0.00166	7.1823	5.93E+10	0.00	0.00	55.1221
2.9029	0.2238	5536.	734.1975	-0.00166	11.2583	5.93E+10	0.00	0.00	63.9974
3.1668	0.2185	8182.	950.9178	-0.00166	16.6397	5.93E+10	0.00	0.00	72.8728
3.4307	0.2133	11558.	1196.	-0.00166	23.5075	5.93E+10	0.00	0.00	81.7481
3.6946	0.2080	15755.	1469.	-0.00166	32.0426	5.93E+10	0.00	0.00	90.6235
3.9585	0.2027	20860.	1770.	-0.00166	42.4261	5.93E+10	0.00	0.00	99.4989
4.2224	0.1975	26964.	2099.	-0.00166	54.8390	5.93E+10	0.00	0.00	108.3742
4.4863	0.1922	34154.	2456.	-0.00166	69.4623	5.93E+10	0.00	0.00	117.2496
4.7502	0.1870	42520.	2841.	-0.00166	86.4772	5.93E+10	0.00	0.00	126.1249
5.0141	0.1818	52150.	3255.	-0.00165	106.0645	5.93E+10	0.00	0.00	135.0003
5.2780	0.1765	63135.	3697.	-0.00165	128.4053	5.93E+10	0.00	0.00	143.8757
5.5419	0.1713	75563.	4166.	-0.00165	153.6807	5.93E+10	0.00	0.00	152.7510
5.8058	0.1661	89522.	4664.	-0.00164	182.0716	5.93E+10	0.00	0.00	161.6264
6.0697	0.1609	105102.	5190.	-0.00164	213.7591	5.93E+10	0.00	0.00	170.5017
6.3336	0.1557	122393.	5744.	-0.00163	248.9243	5.93E+10	0.00	0.00	179.3771
6.5975	0.1506	141482.	6326.	-0.00162	287.7481	5.93E+10	0.00	0.00	188.2524
6.8614	0.1455	162459.	6936.	-0.00162	330.4115	5.93E+10	0.00	0.00	197.1278
7.1253	0.1404	185413.	7575.	-0.00161	377.0957	5.93E+10	0.00	0.00	206.0032
7.3892	0.1353	210433.	8241.	-0.00160	427.9815	5.93E+10	0.00	0.00	214.8785
7.6531	0.1302	237608.	8935.	-0.00158	483.2501	5.93E+10	0.00	0.00	223.7539
7.9170	0.1253	267026.	9658.	-0.00157	543.0825	5.93E+10	0.00	0.00	232.6292
8.1809	0.1203	298778.	10409.	-0.00155	607.6597	5.93E+10	0.00	0.00	241.5046
8.4448	0.1154	332952.	11188.	-0.00154	677.1627	5.93E+10	0.00	0.00	250.3800
8.7087	0.1106	369636.	11995.	-0.00152	751.7725	5.93E+10	0.00	0.00	259.2553
8.9726	0.1058	408921.	12830.	-0.00150	831.6702	5.93E+10	0.00	0.00	268.1307
9.2365	0.1011	450895.	13693.	-0.00148	917.0368	5.93E+10	0.00	0.00	277.0060
9.5004	0.09644	495646.	14584.	-0.00145	1008.	5.93E+10	0.00	0.00	285.8814
9.7643	0.09189	543265.	15504.	-0.00142	1105.	5.93E+10	0.00	0.00	294.7568
10.0282	0.08743	593839.	16451.	-0.00139	1208.	5.93E+10	0.00	0.00	303.6321
10.2921	0.08307	647459.	17362.	-0.00136	1317.	5.93E+10	0.00	0.00	271.6871
10.5560	0.07883	703803.	17778.	-0.00133	0.00	1.01E+11	-8.963	360.0941	0.00

10.8199	0.07465	760058.	17726.	-0.00131	0.00	1.01E+11	-23.794	1009.	0.00
11.0838	0.07054	816073.	17627.	-0.00128	0.00	1.01E+11	-39.018	1752.	0.00
11.3477	0.06652	871698.	17479.	-0.00126	0.00	1.01E+11	-54.278	2584.	0.00
11.6116	0.06259	926778.	17283.	-0.00123	0.00	1.01E+11	-69.227	3503.	0.00
11.8755	0.05874	981164.	17040.	-0.00120	0.00	1.01E+11	-84.434	4552.	0.00
12.1394	0.05500	1034703.	16749.	-0.00117	0.00	1.01E+11	-99.253	5715.	0.00
12.4033	0.05135	1087247.	16413.	-0.00113	0.00	1.01E+11	-113.352	6990.	0.00
12.6672	0.04782	1138654.	15393.	-0.00110	0.00	1.01E+11	-530.412	35126.	0.00
12.9311	0.04440	1184741.	13713.	-0.00106	0.00	1.01E+11	-530.595	37846.	0.00
13.1950	0.04109	1225508.	12034.	-0.00102	0.00	1.01E+11	-530.183	40858.	0.00
13.4589	0.03791	1260957.	10356.	-9.85E-04	0.00	1.01E+11	-529.160	44202.	0.00
13.7228	0.03485	1291100.	8683.	-9.45E-04	0.00	1.01E+11	-527.510	47928.	0.00
13.9867	0.03193	1315953.	7016.	-9.04E-04	0.00	1.01E+11	-525.214	52097.	0.00
14.2506	0.02913	1335538.	5358.	-8.62E-04	0.00	1.01E+11	-522.255	56778.	0.00
14.5145	0.02646	1349886.	3710.	-8.20E-04	0.00	1.01E+11	-518.612	62059.	0.00
14.7784	0.02393	1359033.	2074.	-7.78E-04	0.00	1.01E+11	-514.261	68044.	0.00
15.0423	0.02154	1363023.	453.5928	-7.35E-04	0.00	1.01E+11	-509.178	74863.	0.00
15.3062	0.01928	1361906.	-1150.	-6.92E-04	0.00	1.01E+11	-503.334	82677.	0.00
15.5701	0.01716	1355741.	-2733.	-6.49E-04	0.00	1.01E+11	-496.696	91687.	0.00
15.8340	0.01517	1344596.	-4294.	-6.07E-04	0.00	1.01E+11	-489.227	102152.	0.00
16.0979	0.01331	1328544.	-5830.	-5.65E-04	0.00	1.01E+11	-480.882	114404.	0.00
16.3618	0.01159	1307669.	-7338.	-5.24E-04	0.00	1.01E+11	-471.608	128881.	0.00
16.6257	0.01000	1282065.	-8816.	-4.83E-04	0.00	1.01E+11	-461.340	146168.	0.00
16.8896	0.00853	1251834.	-10259.	-4.43E-04	0.00	1.01E+11	-449.996	167069.	0.00
17.1535	0.00719	1217091.	-11664.	-4.04E-04	0.00	1.01E+11	-437.469	192716.	0.00
17.4174	0.00597	1177960.	-13027.	-3.67E-04	0.00	1.01E+11	-423.620	224756.	0.00
17.6813	0.00487	1134581.	-14345.	-3.30E-04	0.00	1.01E+11	-408.257	265694.	0.00
17.9452	0.00388	1087108.	-15610.	-2.96E-04	0.00	1.01E+11	-391.101	319539.	0.00
18.2091	0.00299	1035712.	-16818.	-2.62E-04	0.00	1.01E+11	-371.734	393180.	0.00
18.4730	0.00222	980589.	-17960.	-2.31E-04	0.00	1.01E+11	-349.473	499637.	0.00
18.7369	0.00153	921960.	-19025.	-2.01E-04	0.00	1.01E+11	-323.089	667247.	0.00
19.0008	9.43E-04	860092.	-19996.	-1.73E-04	0.00	1.01E+11	-289.986	973504.	0.00
19.2647	4.39E-04	795315.	-20758.	-1.47E-04	0.00	1.01E+11	-191.684	1383953.	0.00
19.5286	1.29E-05	728617.	-21071.	-1.23E-04	0.00	1.01E+11	-5.692	1401834.	0.00
19.7925	-3.41E-04	661861.	-20838.	-1.01E-04	0.00	1.01E+11	152.6837	1419715.	0.00
20.0564	-6.28E-04	596636.	-20160.	-8.15E-05	0.00	1.01E+11	275.3693	1387920.	0.00
20.3203	-8.57E-04	534173.	-19247.	-6.38E-05	0.00	1.01E+11	301.3341	1113736.	0.00
20.5842	-0.00103	474732.	-18264.	-4.80E-05	0.00	1.01E+11	319.6120	980481.	0.00
20.8481	-0.00116	418496.	-17230.	-3.40E-05	0.00	1.01E+11	333.1285	908927.	0.00
21.1120	-0.00125	365600.	-16159.	-2.17E-05	0.00	1.01E+11	343.2708	871418.	0.00
21.3759	-0.00130	316148.	-15060.	-1.10E-05	0.00	1.01E+11	350.8124	855898.	0.00
21.6398	-0.00132	270213.	-13941.	-1.81E-06	0.00	1.01E+11	356.2291	856482.	0.00
21.9037	-0.00131	227852.	-12807.	6.00E-06	0.00	1.01E+11	359.8314	870217.	0.00
22.1676	-0.00128	189098.	-11664.	1.25E-05	0.00	1.01E+11	361.8294	895775.	0.00
22.4315	-0.00123	153974.	-10518.	1.79E-05	0.00	1.01E+11	362.3656	932888.	0.00
22.6954	-0.00117	122483.	-9372.	2.22E-05	0.00	1.01E+11	361.5329	982125.	0.00
22.9593	-0.00109	94618.	-8230.	2.56E-05	0.00	1.01E+11	359.3839	1044864.	0.00
23.2232	-0.00100	70357.	-7097.	2.82E-05	0.00	1.01E+11	355.9331	1123432.	0.00
23.4871	-9.10E-04	49666.	-5978.	3.01E-05	0.00	1.01E+11	351.1548	1221430.	0.00
23.7510	-8.13E-04	32496.	-4876.	3.14E-05	0.00	1.01E+11	344.9739	1344369.	0.00
24.0149	-7.12E-04	18786.	-3795.	3.22E-05	0.00	1.01E+11	337.2483	1500886.	0.00
24.2788	-6.09E-04	8458.	-2742.	3.26E-05	0.00	1.01E+11	327.7346	1705143.	0.00
24.5427	-5.05E-04	1417.	-1784.	3.28E-05	0.00	1.01E+11	277.6822	1741581.	0.00
24.8066	-4.01E-04	-2840.	-991.290	3.28E-05	0.00	1.01E+11	222.8134	1759462.	0.00
25.0705	-2.97E-04	-4862.	-374.171	3.26E-05	0.00	1.01E+11	166.9295	1777344.	0.00
25.3344	-1.94E-04	-5210.	110.8058	3.25E-05	0.00	1.01E+11	139.3586	2271282.	0.00
25.5983	-9.17E-05	-4160.	436.7308	3.23E-05	0.00	1.01E+11	66.4801	2295896.	0.00
25.8622	1.05E-05	-2443.	529.8179	3.22E-05	0.00	1.01E+11	-7.691	2320510.	0.00

26.1261	1.12E-04	-804.173	385.7896	3.22E-05	0.00	1.01E+11	-83.271	2345125.	0.00
26.3900	2.14E-04	0.00	0.00	3.22E-05	0.00	1.01E+11	-160.376	1184870.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.28174350 inches
Computed slope at pile head      =     -0.0016635 radians
Maximum bending moment           =       1363023. inch-lbs
Maximum shear force              =        -21071. lbs
Depth of maximum bending moment  =    15.04230000 feet below pile head
Depth of maximum shear force     =    19.52860000 feet below pile head
Number of iterations             =             20
Number of zero deflection points =              2
Pile deflection at ground        =     0.08149836 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
26.39000	0.28174350	1363023.	-21071.
25.07050	0.28713086	1378649.	-21310.
23.75100	0.30877305	1372728.	-23481.
22.43150	0.40622739	1335654.	-25924.
21.11200	0.71278462	1276495.	-27943.
19.79250	1.93037261	1223679.	-30732.
18.47300	8.63978994	1183070.	-35217.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                          =          0.0 lbs
Applied moment at pile head                       =          0.0 in-lbs
```

Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5117	-5.25E-06	0.00	-0.00287	1.07E-08	5.93E+10	0.00	0.00	0.00
0.2639	0.5026	1.12E-05	2.59E-06	-0.00287	2.27E-08	5.93E+10	0.00	0.00	0.00
0.5278	0.4935	1.12E-05	-5.18E-08	-0.00287	2.27E-08	5.93E+10	0.00	0.00	0.00
0.7917	0.4844	1.08E-05	-1.55E-07	-0.00287	2.20E-08	5.93E+10	0.00	0.00	0.00
1.0556	0.4753	1.02E-05	5.3223	-0.00287	2.07E-08	5.93E+10	0.00	0.00	3.3613
1.3195	0.4662	33.7095	36.1604	-0.00287	0.06856	5.93E+10	0.00	0.00	16.1145
1.5834	0.4572	229.0253	108.2672	-0.00287	0.4658	5.93E+10	0.00	0.00	29.4247
1.8473	0.4481	719.4306	222.5248	-0.00287	1.4632	5.93E+10	0.00	0.00	42.7350
2.1112	0.4390	1638.	378.9333	-0.00287	3.3322	5.93E+10	0.00	0.00	56.0452
2.3751	0.4299	3119.	577.4927	-0.00287	6.3444	5.93E+10	0.00	0.00	69.3554
2.6390	0.4208	5296.	818.2028	-0.00287	10.7711	5.93E+10	0.00	0.00	82.6656
2.9029	0.4117	8302.	1101.	-0.00287	16.8840	5.93E+10	0.00	0.00	95.9759
3.1668	0.4026	12270.	1426.	-0.00287	24.9543	5.93E+10	0.00	0.00	109.2861
3.4307	0.3935	17334.	1793.	-0.00287	35.2538	5.93E+10	0.00	0.00	122.5963
3.6946	0.3844	23627.	2203.	-0.00287	48.0537	5.93E+10	0.00	0.00	135.9066
3.9585	0.3753	31284.	2654.	-0.00287	63.6257	5.93E+10	0.00	0.00	149.2168
4.2224	0.3663	40437.	3148.	-0.00286	82.2411	5.93E+10	0.00	0.00	162.5270
4.4863	0.3572	51220.	3683.	-0.00286	104.1715	5.93E+10	0.00	0.00	175.8372
4.7502	0.3481	63766.	4261.	-0.00286	129.6884	5.93E+10	0.00	0.00	189.1475
5.0141	0.3391	78209.	4881.	-0.00286	159.0631	5.93E+10	0.00	0.00	202.4577
5.2780	0.3301	94683.	5544.	-0.00285	192.5673	5.93E+10	0.00	0.00	215.7679
5.5419	0.3210	113320.	6248.	-0.00285	230.4723	5.93E+10	0.00	0.00	229.0782
5.8058	0.3120	134255.	6994.	-0.00284	273.0497	5.93E+10	0.00	0.00	242.3884
6.0697	0.3031	157620.	7783.	-0.00283	320.5710	5.93E+10	0.00	0.00	255.6986
6.3336	0.2941	183550.	8614.	-0.00282	373.3076	5.93E+10	0.00	0.00	269.0088
6.5975	0.2852	212178.	9487.	-0.00281	431.5310	5.93E+10	0.00	0.00	282.3191
6.8614	0.2763	243637.	10402.	-0.00280	495.5126	5.93E+10	0.00	0.00	295.6293
7.1253	0.2675	278061.	11359.	-0.00278	565.5241	5.93E+10	0.00	0.00	308.9395
7.3892	0.2587	315582.	12359.	-0.00277	641.8368	5.93E+10	0.00	0.00	322.2497
7.6531	0.2499	356336.	13400.	-0.00275	724.7222	5.93E+10	0.00	0.00	335.5600
7.9170	0.2412	400455.	14484.	-0.00273	814.4518	5.93E+10	0.00	0.00	348.8702
8.1809	0.2326	448072.	15610.	-0.00271	911.2971	5.93E+10	0.00	0.00	362.1804
8.4448	0.2241	499322.	16778.	-0.00268	1016.	5.93E+10	0.00	0.00	375.4907
8.7087	0.2156	554338.	17988.	-0.00265	1127.	5.93E+10	0.00	0.00	388.8009
8.9726	0.2073	613252.	19240.	-0.00262	1247.	5.93E+10	0.00	0.00	402.1111
9.2365	0.1990	676199.	20535.	-0.00259	1375.	5.93E+10	0.00	0.00	415.4213
9.5004	0.1909	743312.	21872.	-0.00255	1512.	5.93E+10	0.00	0.00	428.7316
9.7643	0.1829	814725.	23250.	-0.00251	1657.	5.93E+10	0.00	0.00	442.0418
10.0282	0.1750	890571.	24671.	-0.00246	1811.	5.93E+10	0.00	0.00	455.3520
10.2921	0.1673	970983.	26037.	-0.00241	1975.	5.93E+10	0.00	0.00	407.4447
10.5560	0.1597	1055482.	26666.	-0.00237	0.00	1.01E+11	-10.777	213.7084	0.00
10.8199	0.1522	1139872.	26603.	-0.00234	0.00	1.01E+11	-28.761	598.3034	0.00
11.0838	0.1449	1223974.	26482.	-0.00230	0.00	1.01E+11	-47.436	1037.	0.00
11.3477	0.1377	1307601.	26302.	-0.00226	0.00	1.01E+11	-66.403	1528.	0.00
11.6116	0.1306	1390561.	26062.	-0.00222	0.00	1.01E+11	-85.270	2068.	0.00
11.8755	0.1236	1472666.	25761.	-0.00217	0.00	1.01E+11	-104.460	2676.	0.00
12.1394	0.1168	1553724.	25401.	-0.00213	0.00	1.01E+11	-123.336	3344.	0.00
12.4033	0.1101	1633545.	24981.	-0.00208	0.00	1.01E+11	-141.529	4069.	0.00
12.6672	0.1037	1711946.	23738.	-0.00202	0.00	1.01E+11	-643.584	19662.	0.00
12.9311	0.09734	1783893.	21697.	-0.00197	0.00	1.01E+11	-645.632	21005.	0.00
13.1950	0.09119	1849366.	19650.	-0.00191	0.00	1.01E+11	-647.091	22471.	0.00
13.4589	0.08523	1908349.	17599.	-0.00185	0.00	1.01E+11	-647.947	24074.	0.00

13.7228	0.07947	1960834.	15547.	-0.00179	0.00	1.01E+11	-648.188	25831.	0.00
13.9867	0.07389	2006818.	13495.	-0.00173	0.00	1.01E+11	-647.798	27763.	0.00
14.2506	0.06852	2046306.	11445.	-0.00166	0.00	1.01E+11	-646.762	29892.	0.00
14.5145	0.06335	2079308.	9400.	-0.00160	0.00	1.01E+11	-645.064	32246.	0.00
14.7784	0.05839	2105841.	7361.	-0.00153	0.00	1.01E+11	-642.686	34857.	0.00
15.0423	0.05364	2125928.	5330.	-0.00147	0.00	1.01E+11	-639.610	37764.	0.00
15.3062	0.04910	2139601.	3311.	-0.00140	0.00	1.01E+11	-635.816	41011.	0.00
15.5701	0.04477	2146898.	1305.	-0.00133	0.00	1.01E+11	-631.281	44653.	0.00
15.8340	0.04066	2147864.	-686.189	-0.00126	0.00	1.01E+11	-625.980	48756.	0.00
16.0979	0.03676	2142552.	-2659.	-0.00120	0.00	1.01E+11	-619.887	53400.	0.00
16.3618	0.03308	2131023.	-4611.	-0.00113	0.00	1.01E+11	-612.971	58685.	0.00
16.6257	0.02961	2113348.	-6540.	-0.00106	0.00	1.01E+11	-605.197	64733.	0.00
16.8896	0.02635	2089603.	-8443.	-9.97E-04	0.00	1.01E+11	-596.523	71701.	0.00
17.1535	0.02329	2059875.	-10316.	-9.31E-04	0.00	1.01E+11	-586.902	79787.	0.00
17.4174	0.02045	2024262.	-12158.	-8.67E-04	0.00	1.01E+11	-576.275	89248.	0.00
17.6813	0.01780	1982870.	-13965.	-8.04E-04	0.00	1.01E+11	-564.575	100423.	0.00
17.9452	0.01536	1935815.	-15732.	-7.42E-04	0.00	1.01E+11	-551.712	113770.	0.00
18.2091	0.01310	1883228.	-17457.	-6.82E-04	0.00	1.01E+11	-537.575	129923.	0.00
18.4730	0.01104	1825250.	-19135.	-6.24E-04	0.00	1.01E+11	-522.021	149781.	0.00
18.7369	0.00915	1762036.	-20761.	-5.67E-04	0.00	1.01E+11	-504.852	174676.	0.00
19.0008	0.00744	1693760.	-22329.	-5.13E-04	0.00	1.01E+11	-485.794	206665.	0.00
19.2647	0.00590	1620611.	-23834.	-4.61E-04	0.00	1.01E+11	-464.448	249125.	0.00
19.5286	0.00453	1542805.	-25266.	-4.11E-04	0.00	1.01E+11	-440.190	308052.	0.00
19.7925	0.00330	1460585.	-26616.	-3.64E-04	0.00	1.01E+11	-411.974	395339.	0.00
20.0564	0.00222	1374233.	-27866.	-3.19E-04	0.00	1.01E+11	-377.819	538887.	0.00
20.3203	0.00128	1284092.	-28992.	-2.78E-04	0.00	1.01E+11	-333.143	825995.	0.00
20.5842	4.62E-04	1190609.	-29860.	-2.39E-04	0.00	1.01E+11	-214.919	1473360.	0.00
20.8481	-2.35E-04	1094972.	-30025.	-2.03E-04	0.00	1.01E+11	110.6473	1491241.	0.00
21.1120	-8.23E-04	1000444.	-29360.	-1.70E-04	0.00	1.01E+11	309.4588	1190689.	0.00
21.3759	-0.00131	909020.	-28313.	-1.40E-04	0.00	1.01E+11	351.8354	849403.	0.00
21.6398	-0.00171	821124.	-27153.	-1.13E-04	0.00	1.01E+11	380.3678	704344.	0.00
21.9037	-0.00203	737043.	-25915.	-8.85E-05	0.00	1.01E+11	401.4846	627213.	0.00
22.1676	-0.00227	656988.	-24618.	-6.67E-05	0.00	1.01E+11	417.7798	582610.	0.00
22.4315	-0.00245	581122.	-23275.	-4.73E-05	0.00	1.01E+11	430.5855	556697.	0.00
22.6954	-0.00257	509575.	-21895.	-3.02E-05	0.00	1.01E+11	440.6863	542965.	0.00
22.9593	-0.00264	442448.	-20487.	-1.53E-05	0.00	1.01E+11	448.5874	537989.	0.00
23.2232	-0.00267	379819.	-19057.	-2.37E-06	0.00	1.01E+11	454.6356	539854.	0.00
23.4871	-0.00266	321749.	-17610.	8.62E-06	0.00	1.01E+11	459.0809	547461.	0.00
23.7510	-0.00261	268284.	-16151.	1.79E-05	0.00	1.01E+11	462.1103	560204.	0.00
24.0149	-0.00254	219452.	-14685.	2.55E-05	0.00	1.01E+11	463.8679	577798.	0.00
24.2788	-0.00245	175273.	-13215.	3.17E-05	0.00	1.01E+11	464.4670	600192.	0.00
24.5427	-0.00234	135752.	-11745.	3.66E-05	0.00	1.01E+11	463.9977	627520.	0.00
24.8066	-0.00222	100884.	-10278.	4.03E-05	0.00	1.01E+11	462.5315	660090.	0.00
25.0705	-0.00209	70654.	-8817.	4.30E-05	0.00	1.01E+11	460.1238	698382.	0.00
25.3344	-0.00195	45039.	-7174.	4.48E-05	0.00	1.01E+11	577.9519	940124.	0.00
25.5983	-0.00180	25220.	-5351.	4.59E-05	0.00	1.01E+11	573.1498	1006820.	0.00
25.8622	-0.00166	11149.	-3545.	4.65E-05	0.00	1.01E+11	567.2090	1084564.	0.00
26.1261	-0.00151	2766.	-1760.	4.67E-05	0.00	1.01E+11	560.0748	1175764.	0.00
26.3900	-0.00136	0.00	0.00	4.67E-05	0.00	1.01E+11	551.6289	641982.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.51170944 inches
Computed slope at pile head	=	-0.0028713 radians
Maximum bending moment	=	2147864. inch-lbs
Maximum shear force	=	-30025. lbs
Depth of maximum bending moment	=	15.83400000 feet below pile head
Depth of maximum shear force	=	20.84810000 feet below pile head
Number of iterations	=	27
Number of zero deflection points	=	1
Pile deflection at ground	=	0.16444768 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear	=	0. lbs
Moment	=	0. in-lbs
Axial Load	=	0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
26.39000	0.51170944	2147864.	-30025.
25.07050	0.57767351	2142601.	-33647.
23.75100	0.78519653	2091924.	-36720.
22.43150	1.36832048	2011954.	-39396.
21.11200	2.94900876	1910487.	-41896.
19.79250	9.71651657	1847772.	-46562.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

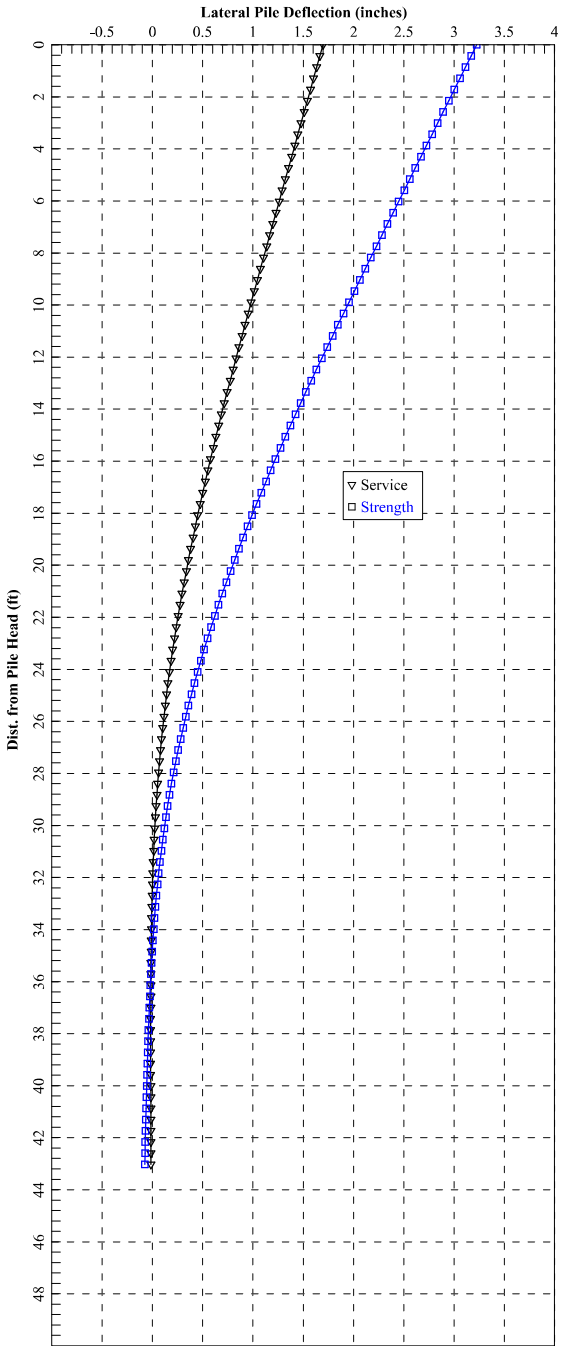
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	0.2817	-0.00166	-21071.	1363023.
2	V, lb	0.00	M, in-lb	0.00	0.00	0.5117	-0.00287	-30025.	2147864.

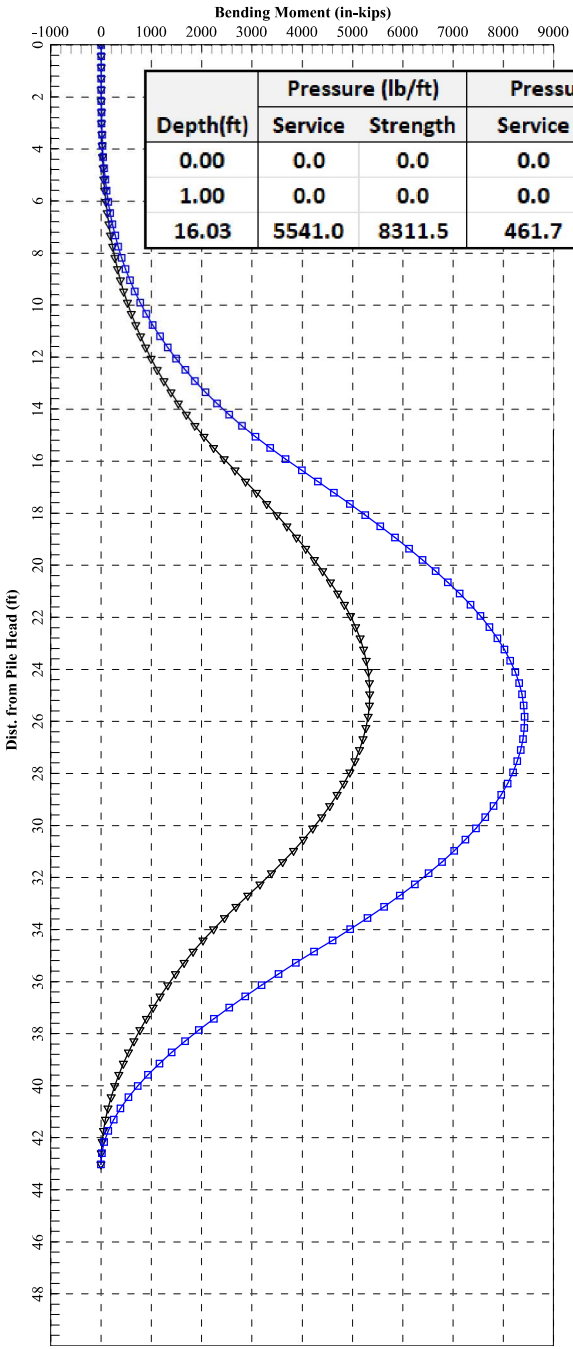
Maximum pile-head deflection = 0.5117094399 inches

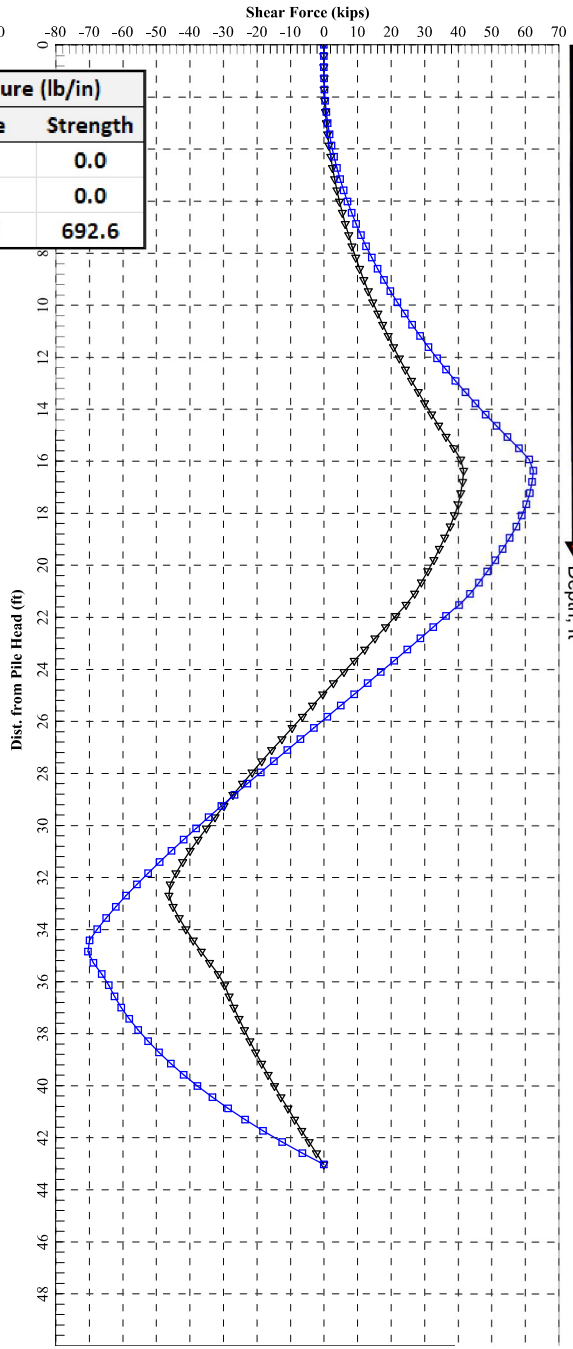
Maximum pile-head rotation = -0.0028712993 radians = -0.164513 deg.

The analysis ended normally.

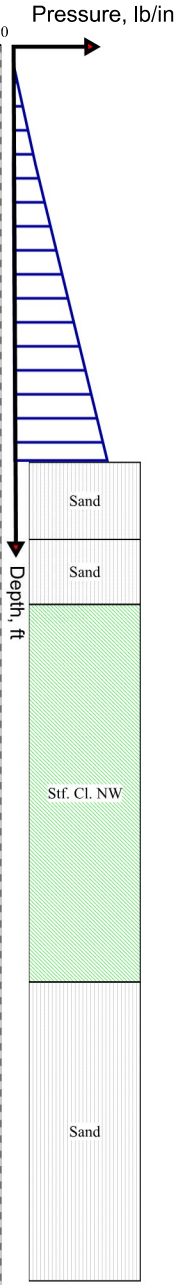
Wall 1D (16.38ft)







Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
16.03	5541.0	8311.5	461.7	692.6



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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
05 Wall_1D-16.03ft.lp12d

Name of output report file:
05 Wall_1D-16.03ft.lp12o

Name of plot output file:
05 Wall_1D-16.03ft.lp12p

Name of runtime message file:
05 Wall_1D-16.03ft.lp12r

Date and Time of Analysis

Date: June 18, 2026 Time: 21:30:19

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1D (H=16.03FT) Boring B-049-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	2
Total length of pile	=	43.030 ft
Depth of ground surface below top of pile	=	16.0300 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	10.1000
2	16.030	10.1000
3	16.030	36.0000
4	43.030	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 16.030000 ft
AISC Section Type = W
AISC Section Name = W27X114
Pile width = 10.100000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 27.000000 ft
Section Diameter = 36.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W27X114

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 16.030000 ft
Distance from top of pile to bottom of layer = 19.000000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Friction angle at top of layer = 34.000000 deg.
Friction angle at bottom of layer = 34.000000 deg.
Subgrade k at top of layer = 120.000000 pci
Subgrade k at bottom of layer = 120.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 19.000000 ft
Distance from top of pile to bottom of layer = 21.500000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 60.000000 pci
Subgrade k at bottom of layer = 60.000000 pci

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	21.500000 ft
Distance from top of pile to bottom of layer	=	36.000000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	2000. psf
Undrained cohesion at bottom of layer	=	2000. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	36.000000 ft
Distance from top of pile to bottom of layer	=	47.500000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	34.000000 deg.
Friction angle at bottom of layer	=	34.000000 deg.
Subgrade k at top of layer	=	120.000000 pci
Subgrade k at bottom of layer	=	120.000000 pci

(Depth of the lowest soil layer extends 4.470 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	16.0300	62.6000	--	34.0000	--	120.0000
	(Reese, et al.)	19.0000	62.6000	--	34.0000	--	120.0000
2	Sand	19.0000	57.6000	--	30.0000	--	60.0000
	(Reese, et al.)	21.5000	57.6000	--	30.0000	--	60.0000
3	Stiff Clay	21.5000	57.6000	2000.	--	0.00700	--
	w/o Free Water	36.0000	57.6000	2000.	--	0.00700	--
4	Sand	36.0000	62.6000	--	34.0000	--	120.0000
	(Reese, et al.)	47.5000	62.6000	--	34.0000	--	120.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	16.030	0.8740	1.0000
2	44.000	0.8740	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	16.030	461.700

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	16.030	692.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	16.030000 ft
Flange Width	=	10.100000 in
Section Depth	=	27.300000 in
Flange Thickness	=	0.930000 in
Web Thickness	=	0.570000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	33.600000 sq. in.
Moment of Inertia	=	4080. in^4
Elastic Bending Stiffness	=	118320000. kip-in^2
Plastic Modulus, Z	=	343.000000in^3
Plastic Moment Capacity = Fy Z	=	17150.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1680.000 kips
Nominal Axial Tensile Capacity	=	-1680.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000726	850.9888267	117296295.	13.6500000	2.8431869	
0.00001451	1702.	117296295.	13.6500000	5.6863738	
0.00002177	2553.	117296295.	13.6500000	8.5295607	
0.00002902	3404.	117296295.	13.6500000	11.3727476	
0.00003628	4255.	117296295.	13.6500000	14.2159345	
0.00004353	5106.	117296295.	13.6500000	17.0591214	
0.00005079	5957.	117296295.	13.6500000	19.9023083	
0.00005804	6808.	117296295.	13.6500000	22.7454952	
0.00006530	7659.	117296295.	13.6500000	25.5886821	
0.00007255	8510.	117296295.	13.6500000	28.4318690	
0.00007981	9361.	117296295.	13.6500000	31.2750559	
0.00008706	10212.	117296295.	13.6500000	34.1182428	
0.00009432	11063.	117296295.	13.6500000	36.9614297	
0.0001016	11914.	117296295.	13.6500000	39.8046166	
0.0001088	12765.	117296295.	13.6500000	42.6478035	
0.0001161	13616.	117296295.	13.6500000	45.4909904	

0.0001233	14467.	117296295.	13.6500000	48.3341773	
0.0001306	15220.	116544211.	13.6500000	50.0000000	Y
0.0001378	15501.	112450817.	13.6500000	50.0000000	Y
0.0001451	15646.	107829744.	13.6500000	50.0000000	Y
0.0001524	15771.	103513204.	13.6500000	50.0000000	Y
0.0001596	15879.	99484994.	13.6500000	50.0000000	Y
0.0001669	15973.	95722589.	13.6500000	50.0000000	Y
0.0001741	16056.	92210068.	13.6500000	50.0000000	Y
0.0001814	16129.	88923792.	13.6500000	50.0000000	Y
0.0001886	16194.	85849232.	13.6500000	50.0000000	Y
0.0001959	16251.	82962330.	13.6500000	50.0000000	Y
0.0002031	16303.	80253023.	13.6500000	50.0000000	Y
0.0002104	16349.	77706048.	13.6500000	50.0000000	Y
0.0002177	16391.	75307996.	13.6500000	50.0000000	Y
0.0002249	16429.	73047017.	13.6500000	50.0000000	Y
0.0002322	16463.	70912571.	13.6500000	50.0000000	Y
0.0002394	16495.	68895236.	13.6500000	50.0000000	Y
0.0002467	16523.	66984770.	13.6500000	50.0000000	Y
0.0002539	16549.	65172693.	13.6500000	50.0000000	Y
0.0002612	16573.	63454354.	13.6500000	50.0000000	Y
0.0002684	16596.	61823108.	13.6500000	50.0000000	Y
0.0002757	16615.	60268358.	13.6500000	50.0000000	Y
0.0002829	16634.	58790217.	13.6500000	50.0000000	Y
0.0002975	16668.	56034924.	13.6500000	50.0000000	Y
0.0003120	16697.	53521647.	13.6500000	50.0000000	Y
0.0003265	16722.	51220539.	13.6500000	50.0000000	Y
0.0003410	16745.	49106339.	13.6500000	50.0000000	Y
0.0003555	16764.	47155585.	13.6500000	50.0000000	Y
0.0003700	16781.	45352509.	13.6500000	50.0000000	Y
0.0003845	16796.	43681790.	13.6500000	50.0000000	Y
0.0003990	16810.	42126725.	13.6500000	50.0000000	Y
0.0004135	16822.	40678409.	13.6500000	50.0000000	Y
0.0004280	16833.	39325104.	13.6500000	50.0000000	Y
0.0004426	16843.	38058301.	13.6500000	50.0000000	Y
0.0004571	16852.	36869608.	13.6500000	50.0000000	Y
0.0004716	16860.	35753088.	13.6500000	50.0000000	Y
0.0004861	16867.	34700514.	13.6500000	50.0000000	Y
0.0005006	16875.	33708960.	13.6500000	50.0000000	Y
0.0005151	16881.	32771254.	13.6500000	50.0000000	Y
0.0005296	16886.	31884008.	13.6500000	50.0000000	Y
0.0005441	16892.	31044082.	13.6500000	50.0000000	Y
0.0005586	16897.	30246282.	13.6500000	50.0000000	Y
0.0005731	16901.	29488093.	13.6500000	50.0000000	Y
0.0005877	16905.	28767345.	13.6500000	50.0000000	Y
0.0006022	16910.	28081247.	13.6500000	50.0000000	Y
0.0006167	16913.	27425775.	13.6500000	50.0000000	Y
0.0006312	16916.	26800439.	13.6500000	50.0000000	Y
0.0006457	16919.	26203208.	13.6500000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	16919.

Note that the values in the above table are not factored by a strength
reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the
LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to the LRFD structural
design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	27.000000 ft
Outside Diameter of Casing	=	36.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	10.100000 in
Depth of Core/Insert	=	27.300000 in
Flange Thickness of Core/Insert	=	0.930000 in
Web Thickness of Core/Insert	=	0.570000 in
Moment of Inertia of Steel Core/Insert	=	4080. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1018. sq. in.
Area of Concrete	=	984.589220 sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	33.600000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	33.286800 sq. in.
Area Ratio of All Steel to Gross Area	=	3.27 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	5863.173 kips
Tensile Load for Cracking of Concrete	=	-568.159 kips
Nominal Axial Tensile Capacity	=	-1680.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000726	1433.	197514938.	11.6694668	0.00008466	-0.000177	0.3874463	0.00000	0.00000	-4.172266	C
0.00001451	2858.	196933000.	11.7024376	0.0001698	-0.000353	0.7613586	0.00000	0.00000	-8.330657	C
0.00002177	4273.	196341404.	11.7352712	0.0002554	-0.000528	1.1214540	0.00000	0.00000	-12.475262	C
0.00002902	5680.	195739799.	11.7687536	0.0003415	-0.000703	1.4675411	0.00000	0.00000	-16.605504	C
0.00003628	7078.	195127805.	11.8029118	0.0004282	-0.000878	1.7993939	0.00000	0.00000	-20.720947	C
0.00004353	8467.	194505019.	11.8377743	0.0005153	-0.001052	2.1167760	0.00000	0.00000	-24.821126	C
0.00005079	9846.	193871012.	11.8733714	0.0006030	-0.001225	2.4194403	0.00000	0.00000	-28.905554	C
0.00005804	11215.	193225328.	11.9097355	0.0006912	-0.001398	2.7071275	0.00000	0.00000	-32.973712	C
0.00006530	12574.	192567480.	11.9469011	0.0007801	-0.001571	2.9795659	0.00000	0.00000	-37.025051	C
0.00007255	13922.	191896940.	11.9849053	0.0008695	-0.001742	3.2364694	0.00000	0.00000	-41.058988	C
0.00007981	15260.	191213175.	12.0237877	0.0009596	-0.001913	3.4775378	0.00000	0.00000	-45.074898	C
0.00008706	16586.	190515673.	12.0634920	0.0010503	-0.002084	3.7024331	0.00000	0.00000	-49.072372	C
0.00009432	17460.	185118607.	11.9781778	0.0011297	-0.002266	3.8843863	0.00000	0.00000	-50.000000	CY
0.0001016	17920.	176427895.	11.7990008	0.0011984	-0.002458	4.0302370	0.00000	0.00000	-50.000000	CY
0.0001088	18313.	168277773.	11.6263276	0.0012652	-0.002652	4.1622059	0.00000	0.00000	-50.000000	CY
0.0001161	18651.	160675611.	11.4599153	0.0013303	-0.002849	4.2813328	0.00000	0.00000	-50.000000	CY
0.0001233	18947.	153620849.	11.3022066	0.0013940	-0.003046	4.3891078	0.00000	0.00000	-50.000000	CY
0.0001306	19206.	147068071.	11.1500148	0.0014561	-0.003245	4.4857505	0.00000	0.00000	-50.000000	CY
0.0001378	19436.	140995448.	11.0073206	0.0015173	-0.003445	4.5728317	0.00000	0.00000	-50.000000	CY
0.0001451	19639.	135348533.	10.8693243	0.0015771	-0.003646	4.6501005	0.00000	0.00000	-50.000000	CY
0.0001524	19822.	130103676.	10.7390099	0.0016361	-0.003849	4.7187320	0.00000	0.00000	-50.000000	CY
0.0001596	19988.	125229383.	10.6168495	0.0016946	-0.004051	4.7792918	0.00000	0.00000	-50.000000	CY
0.0001669	20135.	120667961.	10.4970631	0.0017516	-0.004256	4.8313220	0.00000	0.00000	-50.000000	CY
0.0001741	20271.	116417126.	10.3848233	0.0018082	-0.004460	4.8760522	0.00000	0.00000	-50.000000	CY
0.0001814	20394.	112441848.	10.2791627	0.0018644	-0.004665	4.9136335	0.00000	0.00000	-50.000000	CY
0.0001886	20506.	108711816.	10.1762451	0.0019196	-0.004871	4.9439361	0.00000	0.00000	-50.000000	CY
0.0001959	20609.	105210620.	10.0784252	0.0019742	-0.005078	4.9675282	0.00000	0.00000	-50.000000	CY
0.0002031	20704.	101919503.	9.9860561	0.0020286	-0.005284	4.9846361	0.00000	0.00000	-50.000000	CY
0.0002104	20792.	98823455.	9.8989447	0.0020827	-0.005492	4.9953826	0.00000	0.00000	-50.000000	CY
0.0002177	20872.	95894633.	9.8126027	0.0021357	-0.005700	4.9998280	0.00000	0.00000	-50.000000	CY
0.0002249	20945.	93129503.	9.7311128	0.0021886	-0.005908	4.9980378	0.00000	0.00000	-50.000000	CY
0.0002322	21014.	90515845.	9.6541170	0.0022413	-0.006116	4.9968827	0.00000	0.00000	-50.000000	CY
0.0002394	21078.	88039024.	9.5812445	0.0022939	-0.006325	4.9989553	0.00000	0.00000	-50.000000	CY
0.0002467	21136.	85686898.	9.5106177	0.0023460	-0.006534	4.9938894	0.00000	0.00000	-50.000000	CY
0.0002539	21190.	83449701.	9.4416236	0.0023975	-0.006744	4.9988925	0.00000	0.00000	-50.000000	CY
0.0002612	21241.	81325386.	9.3762309	0.0024489	-0.006954	4.9951690	0.00000	0.00000	-50.000000	CY
0.0002684	21287.	79301798.	9.3139550	0.0025002	-0.007164	4.9978651	0.00000	0.00000	-50.000000	CY
0.0002757	21332.	77375152.	9.2545427	0.0025514	-0.007373	4.9999808	0.00000	0.00000	-50.000000	CY
0.0002829	21374.	75539949.	9.1984930	0.0026027	-0.007583	4.9950331	0.00000	0.00000	-50.000000	CY
0.0002975	21447.	72101605.	9.0878104	0.0027032	-0.008005	4.9976276	0.00000	0.00000	-50.000000	CY
0.0003120	21512.	68956012.	8.9858440	0.0028033	-0.008428	4.9985725	0.00000	0.00000	-50.000000	CY
0.0003265	21571.	66070903.	8.8922775	0.0029031	-0.008850	4.9914356	0.00000	0.00000	-50.000000	CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	21571.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	16.0300	0.00	N.A.	No	0.00	9635.
2	19.0000	3.3462	Yes	No	9635.	20243.
3	21.5000	1.5782	No	No	29878.	411550.
4	36.0000	18.9063	No	No	441428.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.6978	-3.22E-05	-9.46E-08	-0.00603	3.99E-08	1.17E+11	0.00	0.00	0.00
0.4303	1.6666	6.84E-06	3.69E-06	-0.00603	8.46E-09	1.17E+11	0.00	0.00	0.00
0.8606	1.6355	5.86E-06	0.5288	-0.00603	7.25E-09	1.17E+11	0.00	0.00	0.2048
1.2909	1.6043	5.4610	24.1286	-0.00603	0.00676	1.17E+11	0.00	0.00	8.9360
1.7212	1.5732	249.1812	104.3975	-0.00603	0.3084	1.17E+11	0.00	0.00	22.1542
2.1515	1.5421	1084.	252.9198	-0.00603	1.3412	1.17E+11	0.00	0.00	35.3724
2.5818	1.5109	2861.	469.6956	-0.00603	3.5414	1.17E+11	0.00	0.00	48.5906
3.0121	1.4798	5934.	754.7249	-0.00603	7.3451	1.17E+11	0.00	0.00	61.8088
3.4424	1.4487	10655.	1108.	-0.00603	13.1886	1.17E+11	0.00	0.00	75.0270

3.8727	1.4175	17377.	1530.	-0.00603	21.5081	1.17E+11	0.00	0.00	88.2452
4.3030	1.3864	26451.	2019.	-0.00603	32.7399	1.17E+11	0.00	0.00	101.4634
4.7333	1.3553	38231.	2577.	-0.00603	47.3201	1.17E+11	0.00	0.00	114.6816
5.1636	1.3242	53068.	3204.	-0.00602	65.6851	1.17E+11	0.00	0.00	127.8998
5.5939	1.2931	71316.	3898.	-0.00602	88.2709	1.17E+11	0.00	0.00	141.1180
6.0242	1.2620	93326.	4661.	-0.00602	115.5139	1.17E+11	0.00	0.00	154.3362
6.4545	1.2309	119451.	5492.	-0.00601	147.8502	1.17E+11	0.00	0.00	167.5544
6.8848	1.1999	150044.	6391.	-0.00601	185.7161	1.17E+11	0.00	0.00	180.7726
7.3151	1.1689	185456.	7359.	-0.00600	229.5478	1.17E+11	0.00	0.00	193.9908
7.7454	1.1379	226041.	8395.	-0.00599	279.7816	1.17E+11	0.00	0.00	207.2090
8.1757	1.1070	272151.	9499.	-0.00598	336.8536	1.17E+11	0.00	0.00	220.4272
8.6060	1.0762	324138.	10671.	-0.00597	401.2000	1.17E+11	0.00	0.00	233.6454
9.0363	1.0454	382354.	11912.	-0.00595	473.2572	1.17E+11	0.00	0.00	246.8636
9.4666	1.0147	447153.	13221.	-0.00593	553.4613	1.17E+11	0.00	0.00	260.0818
9.8969	0.9841	518886.	14598.	-0.00591	642.2485	1.17E+11	0.00	0.00	273.3000
10.3272	0.9536	597906.	16043.	-0.00589	740.0551	1.17E+11	0.00	0.00	286.5182
10.7575	0.9233	684565.	17557.	-0.00586	847.3173	1.17E+11	0.00	0.00	299.7364
11.1878	0.8931	779216.	19138.	-0.00583	964.4713	1.17E+11	0.00	0.00	312.9546
11.6181	0.8631	882212.	20789.	-0.00579	1092.	1.17E+11	0.00	0.00	326.1728
12.0484	0.8333	993904.	22507.	-0.00575	1230.	1.17E+11	0.00	0.00	339.3910
12.4787	0.8038	1114645.	24294.	-0.00570	1380.	1.17E+11	0.00	0.00	352.6092
12.9090	0.7745	1244788.	26148.	-0.00565	1541.	1.17E+11	0.00	0.00	365.8274
13.3393	0.7454	1384684.	28071.	-0.00559	1714.	1.17E+11	0.00	0.00	379.0456
13.7696	0.7167	1534687.	30063.	-0.00553	1900.	1.17E+11	0.00	0.00	392.2638
14.1999	0.6883	1695149.	32122.	-0.00546	2098.	1.17E+11	0.00	0.00	405.4820
14.6302	0.6603	1866422.	34250.	-0.00538	2310.	1.17E+11	0.00	0.00	418.7002
15.0605	0.6328	2048859.	36446.	-0.00529	2536.	1.17E+11	0.00	0.00	431.9184
15.4908	0.6057	2242812.	38711.	-0.00520	2776.	1.17E+11	0.00	0.00	445.1366
15.9211	0.5791	2448634.	40748.	-0.00510	3031.	1.17E+11	0.00	0.00	343.9485
16.3514	0.5531	2663626.	41554.	-0.00501	0.00	1.97E+11	-31.638	295.3916	0.00
16.7817	0.5274	2877775.	41272.	-0.00493	0.00	1.97E+11	-77.569	759.4739	0.00
17.2120	0.5021	3089855.	40746.	-0.00486	0.00	1.97E+11	-126.193	1298.	0.00
17.6423	0.4772	3298571.	39966.	-0.00477	0.00	1.97E+11	-176.211	1907.	0.00
18.0726	0.4528	3502588.	38925.	-0.00468	0.00	1.97E+11	-226.965	2588.	0.00
18.5029	0.4289	3700554.	37624.	-0.00459	0.00	1.97E+11	-276.824	3333.	0.00
18.9332	0.4055	3891140.	36071.	-0.00449	0.00	1.96E+11	-324.579	4134.	0.00
19.3635	0.3825	4073070.	34428.	-0.00438	0.00	1.96E+11	-312.015	4212.	0.00
19.7938	0.3602	4246682.	32751.	-0.00427	0.00	1.96E+11	-337.365	4836.	0.00
20.2241	0.3384	4411299.	30952.	-0.00416	0.00	1.96E+11	-359.415	5484.	0.00
20.6544	0.3172	4566332.	29041.	-0.00404	0.00	1.96E+11	-380.913	6200.	0.00
21.0847	0.2967	4711210.	27029.	-0.00392	0.00	1.96E+11	-398.374	6934.	0.00
21.5150	0.2767	4845466.	24479.	-0.00379	0.00	1.96E+11	-589.436	10998.	0.00
21.9453	0.2575	4964005.	21424.	-0.00366	0.00	1.96E+11	-593.662	11905.	0.00
22.3756	0.2389	5066716.	18350.	-0.00353	0.00	1.96E+11	-597.126	12906.	0.00
22.8059	0.2210	5153506.	15259.	-0.00340	0.00	1.96E+11	-599.807	14014.	0.00
23.2362	0.2038	5224304.	12157.	-0.00326	0.00	1.96E+11	-601.686	15244.	0.00
23.6665	0.1873	5279059.	9048.	-0.00312	0.00	1.96E+11	-602.741	16615.	0.00
24.0968	0.1716	5317743.	5935.	-0.00298	0.00	1.96E+11	-602.946	18148.	0.00
24.5271	0.1565	5340351.	2823.	-0.00284	0.00	1.96E+11	-602.276	19869.	0.00
24.9574	0.1422	5346900.	-282.472	-0.00270	0.00	1.96E+11	-600.700	21812.	0.00
25.3877	0.1286	5337434.	-3378.	-0.00256	0.00	1.96E+11	-598.183	24015.	0.00
25.8180	0.1158	5312018.	-6457.	-0.00242	0.00	1.96E+11	-594.688	26527.	0.00
26.2483	0.1036	5270746.	-9517.	-0.00228	0.00	1.96E+11	-590.169	29409.	0.00
26.6786	0.09220	5213738.	-12550.	-0.00214	0.00	1.96E+11	-584.574	32738.	0.00
27.1089	0.08149	5141144.	-15551.	-0.00201	0.00	1.96E+11	-577.842	36613.	0.00
27.5392	0.07148	5053144.	-18514.	-0.00187	0.00	1.96E+11	-569.896	41166.	0.00
27.9695	0.06216	4949948.	-21433.	-0.00174	0.00	1.96E+11	-560.644	46571.	0.00
28.3998	0.05351	4831804.	-24300.	-0.00161	0.00	1.96E+11	-549.966	53068.	0.00
28.8301	0.04552	4698996.	-27108.	-0.00149	0.00	1.96E+11	-537.709	60995.	0.00

29.2604	0.03817	4551852.	-29848.	-0.00136	0.00	1.96E+11	-523.667	70846.	0.00
29.6907	0.03143	4390745.	-32511.	-0.00125	0.00	1.96E+11	-507.554	83378.	0.00
30.1210	0.02529	4216105.	-35084.	-0.00113	0.00	1.96E+11	-488.958	99814.	0.00
30.5513	0.01973	4028429.	-37552.	-0.00102	0.00	1.96E+11	-467.247	122288.	0.00
30.9816	0.01471	3828294.	-39898.	-9.22E-04	0.00	1.96E+11	-441.380	154928.	0.00
31.4119	0.01021	3616391.	-42095.	-8.24E-04	0.00	1.97E+11	-409.451	207043.	0.00
31.8422	0.00620	3393571.	-44100.	-7.32E-04	0.00	1.97E+11	-367.281	305738.	0.00
32.2725	0.00265	3160958.	-45828.	-6.46E-04	0.00	1.97E+11	-301.781	587022.	0.00
32.7028	-4.66E-04	2920299.	-46238.	-5.66E-04	0.00	1.97E+11	142.9864	1585783.	0.00
33.1331	-0.00319	2683452.	-45028.	-4.92E-04	0.00	1.97E+11	325.6680	527110.	0.00
33.5634	-0.00555	2455288.	-43207.	-4.25E-04	0.00	1.97E+11	379.7057	353162.	0.00
33.9937	-0.00758	2237249.	-41151.	-3.64E-04	0.00	1.97E+11	416.5599	283734.	0.00
34.4240	-0.00931	2030316.	-38927.	-3.08E-04	0.00	1.97E+11	444.9010	246824.	0.00
34.8543	-0.01076	1835245.	-36570.	-2.57E-04	0.00	1.97E+11	467.9713	224587.	0.00
35.2846	-0.01196	1652652.	-34103.	-2.12E-04	0.00	1.97E+11	487.3739	210361.	0.00
35.7149	-0.01294	1483053.	-31544.	-1.71E-04	0.00	1.97E+11	504.0313	201069.	0.00
36.1452	-0.01372	1326893.	-29595.	-1.34E-04	0.00	1.98E+11	250.8658	94385.	0.00
36.5755	-0.01433	1177423.	-28253.	-1.01E-04	0.00	1.98E+11	268.7193	96859.	0.00
37.0058	-0.01477	1035116.	-26823.	-7.21E-05	0.00	1.98E+11	285.4124	99795.	0.00
37.4361	-0.01507	900420.	-25309.	-4.68E-05	0.00	1.98E+11	301.0220	103139.	0.00
37.8664	-0.01525	773750.	-23716.	-2.49E-05	0.00	1.98E+11	315.6179	106856.	0.00
38.2967	-0.01533	655495.	-22052.	-6.27E-06	0.00	1.98E+11	329.2681	110921.	0.00
38.7270	-0.01532	546020.	-20318.	9.44E-06	0.00	1.98E+11	342.0412	115313.	0.00
39.1573	-0.01523	445664.	-18521.	2.24E-05	0.00	1.98E+11	354.0083	120018.	0.00
39.5876	-0.01508	354747.	-16664.	3.29E-05	0.00	1.98E+11	365.2434	125023.	0.00
40.0179	-0.01489	273568.	-14751.	4.11E-05	0.00	1.98E+11	375.8232	130318.	0.00
40.4482	-0.01466	202410.	-12785.	4.73E-05	0.00	1.98E+11	385.8256	135890.	0.00
40.8785	-0.01440	141539.	-10768.	5.18E-05	0.00	1.98E+11	395.3285	141730.	0.00
41.3088	-0.01413	91208.	-8703.	5.48E-05	0.00	1.98E+11	404.4071	147828.	0.00
41.7391	-0.01384	51660.	-6592.	5.67E-05	0.00	1.98E+11	413.1303	154174.	0.00
42.1694	-0.01354	23128.	-4437.	5.77E-05	0.00	1.98E+11	421.5574	160762.	0.00
42.5997	-0.01324	5835.	-2239.	5.81E-05	0.00	1.98E+11	429.7330	167585.	0.00
43.0300	-0.01294	0.00	0.00	5.81E-05	0.00	1.98E+11	437.6817	87322.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	1.69776088 inches
Computed slope at pile head	=	-0.0060301 radians
Maximum bending moment	=	5346900. inch-lbs
Maximum shear force	=	-46238. lbs
Depth of maximum bending moment	=	24.95740000 feet below pile head
Depth of maximum shear force	=	32.70280000 feet below pile head
Number of iterations	=	27
Number of zero deflection points	=	1
Pile deflection at ground	=	0.57249837 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.03000	1.69776088	5346900.	-46238.
40.87850	1.77199742	5328460.	-49913.
38.72700	2.00800286	5230016.	-54362.
36.57550	2.82235094	5032291.	-58071.
34.42400	5.77840301	4761615.	-61932.
32.27250	24.67588558	4729464.	-72174.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.2264	7.81E-05	0.00	-0.01073	9.67E-08	1.17E+11	0.00	0.00	0.00
0.4303	3.1710	8.21E-05	-1.89E-07	-0.01073	1.02E-07	1.17E+11	0.00	0.00	0.00
0.8606	3.1156	7.62E-05	0.7932	-0.01073	9.43E-08	1.17E+11	0.00	0.00	0.3072
1.2909	3.0602	8.1921	36.1956	-0.01073	0.01014	1.17E+11	0.00	0.00	13.4050
1.7212	3.0047	373.7989	156.6075	-0.01073	0.4627	1.17E+11	0.00	0.00	33.2337
2.1515	2.9493	1626.	379.4070	-0.01073	2.0120	1.17E+11	0.00	0.00	53.0625
2.5818	2.8939	4292.	704.5942	-0.01073	5.3124	1.17E+11	0.00	0.00	72.8912
3.0121	2.8385	8902.	1132.	-0.01073	11.0184	1.17E+11	0.00	0.00	92.7199
3.4424	2.7831	15984.	1662.	-0.01073	19.7843	1.17E+11	0.00	0.00	112.5487
3.8727	2.7276	26067.	2294.	-0.01073	32.2645	1.17E+11	0.00	0.00	132.3774
4.3030	2.6722	39680.	3029.	-0.01073	49.1134	1.17E+11	0.00	0.00	152.2061
4.7333	2.6168	57351.	3866.	-0.01073	70.9853	1.17E+11	0.00	0.00	172.0348
5.1636	2.5614	79608.	4806.	-0.01072	98.5347	1.17E+11	0.00	0.00	191.8636
5.5939	2.5061	106982.	5848.	-0.01072	132.4159	1.17E+11	0.00	0.00	211.6923
6.0242	2.4507	139999.	6992.	-0.01072	173.2833	1.17E+11	0.00	0.00	231.5210
6.4545	2.3954	179190.	8239.	-0.01071	221.7913	1.17E+11	0.00	0.00	251.3497
6.8848	2.3401	225082.	9588.	-0.01070	278.5943	1.17E+11	0.00	0.00	271.1785
7.3151	2.2849	278205.	11039.	-0.01069	344.3466	1.17E+11	0.00	0.00	291.0072
7.7454	2.2298	339087.	12593.	-0.01067	419.7027	1.17E+11	0.00	0.00	310.8359

8.1757	2.1747	408256.	14249.	-0.01066	505.3168	1.17E+11	0.00	0.00	330.6647
8.6060	2.1197	486242.	16008.	-0.01064	601.8435	1.17E+11	0.00	0.00	350.4934
9.0363	2.0648	573573.	17869.	-0.01062	709.9371	1.17E+11	0.00	0.00	370.3221
9.4666	2.0101	670778.	19832.	-0.01059	830.2519	1.17E+11	0.00	0.00	390.1508
9.8969	1.9555	778385.	21898.	-0.01056	963.4423	1.17E+11	0.00	0.00	409.9796
10.3272	1.9010	896924.	24066.	-0.01052	1110.	1.17E+11	0.00	0.00	429.8083
10.7575	1.8468	1026922.	26337.	-0.01048	1271.	1.17E+11	0.00	0.00	449.6370
11.1878	1.7928	1168909.	28710.	-0.01043	1447.	1.17E+11	0.00	0.00	469.4658
11.6181	1.7391	1323413.	31185.	-0.01037	1638.	1.17E+11	0.00	0.00	489.2945
12.0484	1.6857	1490963.	33763.	-0.01031	1845.	1.17E+11	0.00	0.00	509.1232
12.4787	1.6326	1672088.	36443.	-0.01024	2070.	1.17E+11	0.00	0.00	528.9519
12.9090	1.5799	1867316.	39225.	-0.01016	2311.	1.17E+11	0.00	0.00	548.7807
13.3393	1.5277	2077176.	42110.	-0.01008	2571.	1.17E+11	0.00	0.00	568.6094
13.7696	1.4759	2302197.	45098.	-0.00998	2850.	1.17E+11	0.00	0.00	588.4381
14.1999	1.4246	2542908.	48187.	-0.00987	3147.	1.17E+11	0.00	0.00	608.2668
14.6302	1.3739	2799836.	51379.	-0.00976	3465.	1.17E+11	0.00	0.00	628.0956
15.0605	1.3238	3073511.	54674.	-0.00963	3804.	1.17E+11	0.00	0.00	647.9243
15.4908	1.2745	3364461.	58070.	-0.00949	4164.	1.17E+11	0.00	0.00	667.7530
15.9211	1.2259	3673216.	61127.	-0.00933	4547.	1.17E+11	0.00	0.00	515.9600
16.3514	1.1781	3995728.	62354.	-0.00920	0.00	1.96E+11	-40.511	177.5569	0.00
16.7817	1.1309	4317159.	61993.	-0.00909	0.00	1.96E+11	-99.511	454.3596	0.00
17.2120	1.0843	4635937.	61317.	-0.00897	0.00	1.96E+11	-162.334	773.0858	0.00
17.6423	1.0383	4950387.	60311.	-0.00884	0.00	1.96E+11	-227.227	1130.	0.00
18.0726	0.9929	5258779.	58969.	-0.00871	0.00	1.96E+11	-292.549	1521.	0.00
18.5029	0.9483	5559370.	57292.	-0.00857	0.00	1.96E+11	-356.922	1943.	0.00
18.9332	0.9045	5850445.	55289.	-0.00842	0.00	1.96E+11	-418.971	2392.	0.00
19.3635	0.8614	6130348.	53163.	-0.00826	0.00	1.96E+11	-404.284	2423.	0.00
19.7938	0.8192	6399473.	50988.	-0.00809	0.00	1.95E+11	-438.162	2762.	0.00
20.2241	0.7778	6656915.	48648.	-0.00792	0.00	1.95E+11	-468.434	3110.	0.00
20.6544	0.7374	6901867.	46150.	-0.00774	0.00	1.95E+11	-498.844	3493.	0.00
21.0847	0.6979	7133519.	43507.	-0.00756	0.00	1.95E+11	-524.936	3884.	0.00
21.5150	0.6594	7351174.	40261.	-0.00736	0.00	1.95E+11	-732.307	5735.	0.00
21.9453	0.6218	7549304.	36460.	-0.00717	0.00	1.95E+11	-740.061	6145.	0.00
22.3756	0.5853	7727702.	32620.	-0.00696	0.00	1.95E+11	-747.072	6590.	0.00
22.8059	0.5499	7886181.	28747.	-0.00676	0.00	1.95E+11	-753.327	7074.	0.00
23.2362	0.5156	8024574.	24843.	-0.00655	0.00	1.95E+11	-758.810	7600.	0.00
23.6665	0.4823	8142735.	20912.	-0.00633	0.00	1.95E+11	-763.505	8174.	0.00
24.0968	0.4502	8240539.	16960.	-0.00611	0.00	1.95E+11	-767.395	8802.	0.00
24.5271	0.4192	8317882.	12989.	-0.00589	0.00	1.95E+11	-770.460	9491.	0.00
24.9574	0.3893	8374682.	9005.	-0.00567	0.00	1.95E+11	-772.680	10248.	0.00
25.3877	0.3606	8410881.	5012.	-0.00545	0.00	1.95E+11	-774.032	11084.	0.00
25.8180	0.3330	8426442.	1014.	-0.00523	0.00	1.95E+11	-774.492	12008.	0.00
26.2483	0.3066	8421353.	-2984.	-0.00500	0.00	1.95E+11	-774.031	13035.	0.00
26.6786	0.2814	8395626.	-6977.	-0.00478	0.00	1.95E+11	-772.619	14179.	0.00
27.1089	0.2573	8349299.	-10960.	-0.00456	0.00	1.95E+11	-770.221	15460.	0.00
27.5392	0.2343	8282436.	-14929.	-0.00434	0.00	1.95E+11	-766.796	16899.	0.00
27.9695	0.2125	8195127.	-18877.	-0.00412	0.00	1.95E+11	-762.299	18526.	0.00
28.3998	0.1918	8087494.	-22798.	-0.00390	0.00	1.95E+11	-756.675	20374.	0.00
28.8301	0.1722	7959686.	-26688.	-0.00369	0.00	1.95E+11	-749.857	22489.	0.00
29.2604	0.1537	7811884.	-30539.	-0.00348	0.00	1.95E+11	-741.769	24925.	0.00
29.6907	0.1362	7644305.	-34345.	-0.00328	0.00	1.95E+11	-732.311	27757.	0.00
30.1210	0.1198	7457200.	-38098.	-0.00308	0.00	1.95E+11	-721.362	31081.	0.00
30.5513	0.1045	7250862.	-41790.	-0.00288	0.00	1.95E+11	-708.767	35031.	0.00
30.9816	0.09009	7025626.	-45413.	-0.00269	0.00	1.95E+11	-694.319	39793.	0.00
31.4119	0.07668	6781878.	-48955.	-0.00251	0.00	1.95E+11	-677.745	45641.	0.00
31.8422	0.06418	6520059.	-52405.	-0.00233	0.00	1.95E+11	-658.662	52990.	0.00
32.2725	0.05258	6240679.	-55749.	-0.00216	0.00	1.95E+11	-636.518	62508.	0.00
32.7028	0.04183	5944327.	-58969.	-0.00200	0.00	1.96E+11	-610.473	75359.	0.00
33.1331	0.03189	5631698.	-62040.	-0.00185	0.00	1.96E+11	-579.156	93780.	0.00

33.5634	0.02271	5303627.	-64930.	-0.00171	0.00	1.96E+11	-540.078	122771.	0.00
33.9937	0.01426	4961157.	-67584.	-0.00157	0.00	1.96E+11	-487.898	176632.	0.00
34.4240	0.00649	4605678.	-69893.	-0.00145	0.00	1.96E+11	-406.516	323638.	0.00
34.8543	-6.65E-04	4239359.	-70375.	-0.00133	0.00	1.96E+11	219.8982	1707007.	0.00
35.2846	-0.00724	3878904.	-68697.	-0.00122	0.00	1.96E+11	429.8749	306563.	0.00
35.7149	-0.01329	3529911.	-66277.	-0.00113	0.00	1.97E+11	507.3655	197134.	0.00
36.1452	-0.01886	3194445.	-64182.	-0.00104	0.00	1.97E+11	304.3518	83328.	0.00
36.5755	-0.02400	2867094.	-62446.	-9.57E-04	0.00	1.97E+11	367.7233	79125.	0.00
37.0058	-0.02875	2549548.	-60392.	-8.86E-04	0.00	1.97E+11	427.9034	76863.	0.00
37.4361	-0.03315	2243411.	-58032.	-8.24E-04	0.00	1.97E+11	486.1319	75721.	0.00
37.8664	-0.03725	1950235.	-55375.	-7.69E-04	0.00	1.97E+11	543.1984	75296.	0.00
38.2967	-0.04109	1671543.	-52424.	-7.21E-04	0.00	1.97E+11	599.6661	75361.	0.00
38.7270	-0.04470	1408839.	-49182.	-6.81E-04	0.00	1.98E+11	655.9722	75777.	0.00
39.1573	-0.04812	1163625.	-45649.	-6.47E-04	0.00	1.98E+11	712.4791	76454.	0.00
39.5876	-0.05138	937408.	-41823.	-6.20E-04	0.00	1.98E+11	769.4992	77328.	0.00
40.0179	-0.05452	731708.	-37701.	-5.98E-04	0.00	1.98E+11	827.3116	78353.	0.00
40.4482	-0.05756	548067.	-33277.	-5.81E-04	0.00	1.98E+11	886.1695	79497.	0.00
40.8785	-0.06052	388053.	-28546.	-5.69E-04	0.00	1.98E+11	946.3035	80734.	0.00
41.3088	-0.06344	253270.	-23500.	-5.61E-04	0.00	1.98E+11	1008.	82043.	0.00
41.7391	-0.06631	145361.	-18132.	-5.55E-04	0.00	1.98E+11	1071.	83410.	0.00
42.1694	-0.06917	66014.	-12433.	-5.53E-04	0.00	1.98E+11	1136.	84824.	0.00
42.5997	-0.07202	16964.	-6392.	-5.52E-04	0.00	1.98E+11	1203.	86277.	0.00
43.0300	-0.07487	0.00	0.00	-5.51E-04	0.00	1.98E+11	1273.	43881.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     3.22643297 inches
Computed slope at pile head      =     -0.0107334 radians
Maximum bending moment           =       8426442. inch-lbs
Maximum shear force              =        -70375. lbs
Depth of maximum bending moment  =    25.81800000 feet below pile head
Depth of maximum shear force     =    34.85430000 feet below pile head
Number of iterations             =             33
Number of zero deflection points =              1
Pile deflection at ground        =     1.21379203 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.03000	3.22643297	8426442.	-70375.
40.87850	3.62918583	8269243.	-78002.
38.72700	4.70625378	7999753.	-83652.
36.57550	10.31035707	7846751.	-90650.
34.42400	49.86443098	7685391.	-104641.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

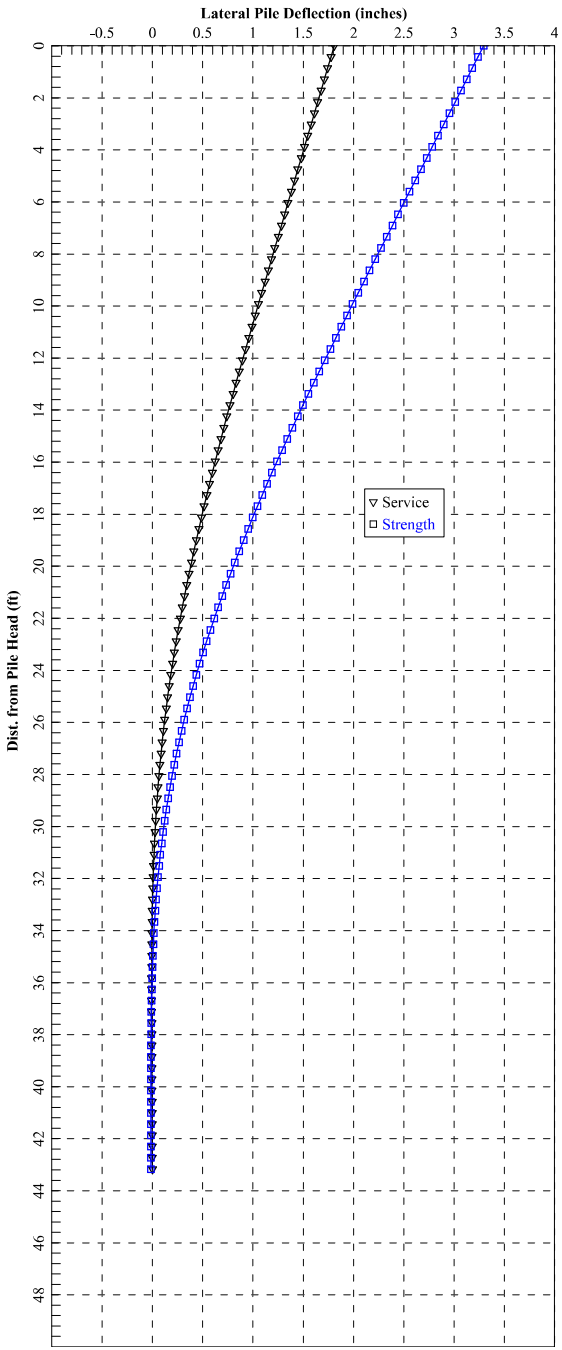
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

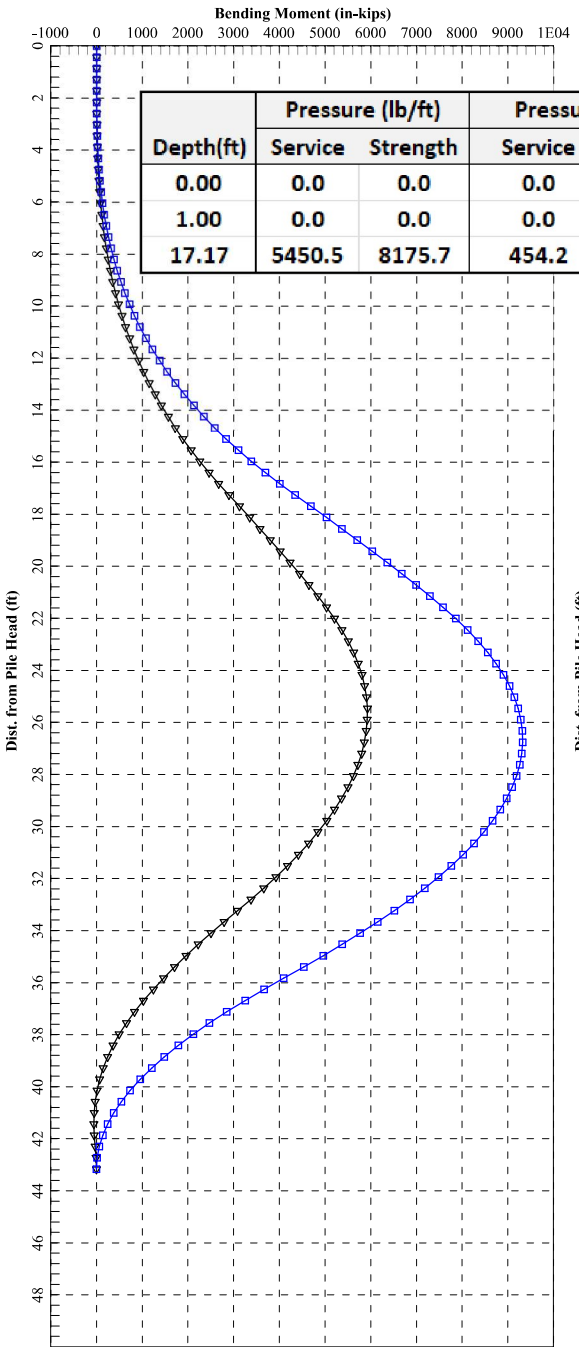
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.6978	-0.00603	-46238.	5346900.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.2264	-0.01073	-70375.	8426442.

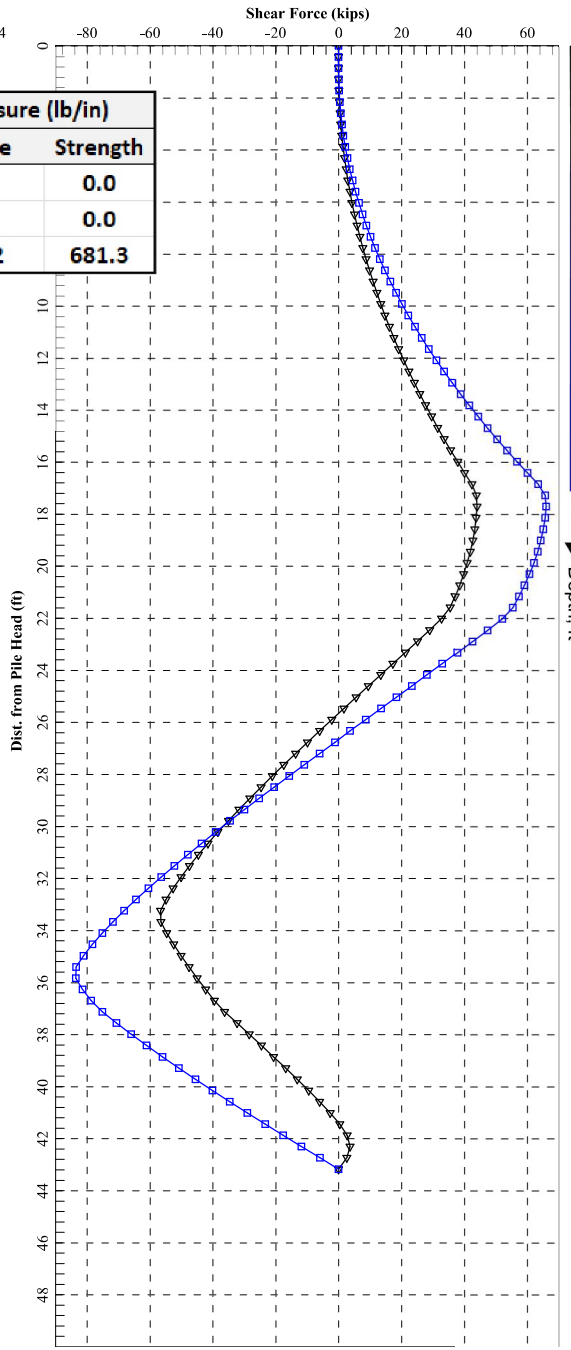
Maximum pile-head deflection = 3.2264329667 inches
Maximum pile-head rotation = -0.0107334389 radians = -0.614981 deg.

The analysis ended normally.

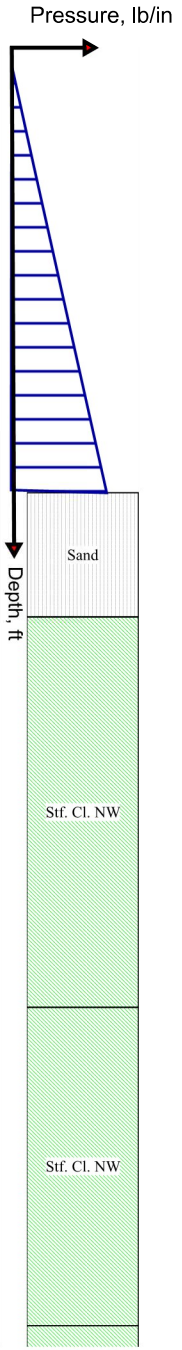
Wall 1D (17.17ft)







Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
17.17	5450.5	8175.7	454.2	681.3



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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
06(a) Wall_1D-17.17ft S=6.75ft.lp12d

Name of output report file:
06(a) Wall_1D-17.17ft S=6.75ft.lp12o

Name of plot output file:
06(a) Wall_1D-17.17ft S=6.75ft.lp12p

Name of runtime message file:
06(a) Wall_1D-17.17ft S=6.75ft.lp12r

Date and Time of Analysis

Date: June 18, 2026 Time: 22:03:24

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SP WALL 1D (H=17.17FT),S=6.75ft Boring B-048-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	2
Total length of pile	=	43.170 ft
Depth of ground surface below top of pile	=	17.1700 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	10.1000
2	17.170	10.1000
3	17.170	36.0000
4	43.170	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 17.170000 ft
AISC Section Type = W
AISC Section Name = W27X114
Pile width = 10.100000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 26.000000 ft
Section Diameter = 36.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W27X114

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 17.170000 ft
Distance from top of pile to bottom of layer = 21.940000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 60.000000 pci
Subgrade k at bottom of layer = 60.000000 pci

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer = 21.940000 ft
Distance from top of pile to bottom of layer = 36.940000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Undrained cohesion at top of layer = 2500. psf
Undrained cohesion at bottom of layer = 2500. psf
Epsilon-50 at top of layer = 0.005000
Epsilon-50 at bottom of layer = 0.005000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	36.940000 ft
Distance from top of pile to bottom of layer	=	58.440000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	4000. psf
Undrained cohesion at bottom of layer	=	4000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

(Depth of the lowest soil layer extends 15.270 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	17.1700	57.6000	--	30.0000	--	60.0000
	(Reese, et al.)	21.9400	57.6000	--	30.0000	--	60.0000
2	Stiff Clay	21.9400	62.6000	2500.	--	0.00500	--
	w/o Free Water	36.9400	62.6000	2500.	--	0.00500	--
3	Stiff Clay	36.9400	67.6000	4000.	--	0.00400	--
	w/o Free Water	58.4400	67.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	17.170	0.8430	1.0000
2	44.000	0.8430	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	17.170	454.200

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	17.170	681.300

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	17.170000 ft
Flange Width	=	10.100000 in
Section Depth	=	27.300000 in
Flange Thickness	=	0.930000 in
Web Thickness	=	0.570000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	33.600000 sq. in.
Moment of Inertia	=	4080. in^4
Elastic Bending Stiffness	=	118320000. kip-in^2
Plastic Modulus, Z	=	343.000000in^3
Plastic Moment Capacity = Fy Z	=	17150.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1680.000 kips
Nominal Axial Tensile Capacity	=	-1680.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:
Y = part of pipe section has yielded.
Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000726	850.9888267	117296295.	13.6500000	2.8431869	
0.00001451	1702.	117296295.	13.6500000	5.6863738	
0.00002177	2553.	117296295.	13.6500000	8.5295607	
0.00002902	3404.	117296295.	13.6500000	11.3727476	
0.00003628	4255.	117296295.	13.6500000	14.2159345	
0.00004353	5106.	117296295.	13.6500000	17.0591214	
0.00005079	5957.	117296295.	13.6500000	19.9023083	
0.00005804	6808.	117296295.	13.6500000	22.7454952	
0.00006530	7659.	117296295.	13.6500000	25.5886821	
0.00007255	8510.	117296295.	13.6500000	28.4318690	
0.00007981	9361.	117296295.	13.6500000	31.2750559	
0.00008706	10212.	117296295.	13.6500000	34.1182428	
0.00009432	11063.	117296295.	13.6500000	36.9614297	
0.0001016	11914.	117296295.	13.6500000	39.8046166	
0.0001088	12765.	117296295.	13.6500000	42.6478035	
0.0001161	13616.	117296295.	13.6500000	45.4909904	
0.0001233	14467.	117296295.	13.6500000	48.3341773	
0.0001306	15220.	116544211.	13.6500000	50.0000000	Y
0.0001378	15501.	112450817.	13.6500000	50.0000000	Y
0.0001451	15646.	107829744.	13.6500000	50.0000000	Y
0.0001524	15771.	103513204.	13.6500000	50.0000000	Y
0.0001596	15879.	99484994.	13.6500000	50.0000000	Y
0.0001669	15973.	95722589.	13.6500000	50.0000000	Y
0.0001741	16056.	92210068.	13.6500000	50.0000000	Y
0.0001814	16129.	88923792.	13.6500000	50.0000000	Y
0.0001886	16194.	85849232.	13.6500000	50.0000000	Y
0.0001959	16251.	82962330.	13.6500000	50.0000000	Y
0.0002031	16303.	80253023.	13.6500000	50.0000000	Y
0.0002104	16349.	77706048.	13.6500000	50.0000000	Y
0.0002177	16391.	75307996.	13.6500000	50.0000000	Y
0.0002249	16429.	73047017.	13.6500000	50.0000000	Y
0.0002322	16463.	70912571.	13.6500000	50.0000000	Y
0.0002394	16495.	68895236.	13.6500000	50.0000000	Y
0.0002467	16523.	66984770.	13.6500000	50.0000000	Y
0.0002539	16549.	65172693.	13.6500000	50.0000000	Y
0.0002612	16573.	63454354.	13.6500000	50.0000000	Y
0.0002684	16596.	61823108.	13.6500000	50.0000000	Y
0.0002757	16615.	60268358.	13.6500000	50.0000000	Y
0.0002829	16634.	58790217.	13.6500000	50.0000000	Y
0.0002975	16668.	56034924.	13.6500000	50.0000000	Y
0.0003120	16697.	53521647.	13.6500000	50.0000000	Y
0.0003265	16722.	51220539.	13.6500000	50.0000000	Y
0.0003410	16745.	49106339.	13.6500000	50.0000000	Y
0.0003555	16764.	47155585.	13.6500000	50.0000000	Y
0.0003700	16781.	45352509.	13.6500000	50.0000000	Y
0.0003845	16796.	43681790.	13.6500000	50.0000000	Y
0.0003990	16810.	42126725.	13.6500000	50.0000000	Y
0.0004135	16822.	40678409.	13.6500000	50.0000000	Y
0.0004280	16833.	39325104.	13.6500000	50.0000000	Y
0.0004426	16843.	38058301.	13.6500000	50.0000000	Y
0.0004571	16852.	36869608.	13.6500000	50.0000000	Y
0.0004716	16860.	35753088.	13.6500000	50.0000000	Y
0.0004861	16867.	34700514.	13.6500000	50.0000000	Y
0.0005006	16875.	33708960.	13.6500000	50.0000000	Y
0.0005151	16881.	32771254.	13.6500000	50.0000000	Y
0.0005296	16886.	31884008.	13.6500000	50.0000000	Y

0.0005441	16892.	31044082.	13.6500000	50.0000000 Y
0.0005586	16897.	30246282.	13.6500000	50.0000000 Y
0.0005731	16901.	29488093.	13.6500000	50.0000000 Y
0.0005877	16905.	28767345.	13.6500000	50.0000000 Y
0.0006022	16910.	28081247.	13.6500000	50.0000000 Y
0.0006167	16913.	27425775.	13.6500000	50.0000000 Y
0.0006312	16916.	26800439.	13.6500000	50.0000000 Y
0.0006457	16919.	26203208.	13.6500000	50.0000000 Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	16919.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	26.000000 ft
Outside Diameter of Casing	=	36.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	10.100000 in
Depth of Core/Insert	=	27.300000 in
Flange Thickness of Core/Insert	=	0.930000 in
Web Thickness of Core/Insert	=	0.570000 in
Moment of Inertia of Steel Core/Insert	=	4080. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1018. sq. in.
Area of Concrete	=	984.589220 sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	33.600000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	33.286800 sq. in.
Area Ratio of All Steel to Gross Area	=	3.27 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 5863.173 kips
Tensile Load for Cracking of Concrete = -568.159 kips
Nominal Axial Tensile Capacity = -1680.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000726	1433.	197514938.	11.6694668	0.00008466	-0.000177	0.3874463	0.00000	0.00000	-4.172266	C
0.00001451	2858.	196933000.	11.7024376	0.0001698	-0.000353	0.7613586	0.00000	0.00000	-8.330657	C
0.00002177	4273.	196341404.	11.7352712	0.0002554	-0.000528	1.1214540	0.00000	0.00000	-12.475262	C
0.00002902	5680.	195739799.	11.7687536	0.0003415	-0.000703	1.4675411	0.00000	0.00000	-16.605504	C
0.00003628	7078.	195127805.	11.8029118	0.0004282	-0.000878	1.7993939	0.00000	0.00000	-20.720947	C
0.00004353	8467.	194505019.	11.8377743	0.0005153	-0.001052	2.1167760	0.00000	0.00000	-24.821126	C
0.00005079	9846.	193871012.	11.8733714	0.0006030	-0.001225	2.4194403	0.00000	0.00000	-28.905554	C
0.00005804	11215.	193225328.	11.9097355	0.0006912	-0.001398	2.7071275	0.00000	0.00000	-32.973712	C
0.00006530	12574.	192567480.	11.9469011	0.0007801	-0.001571	2.9795659	0.00000	0.00000	-37.025051	C
0.00007255	13922.	191896940.	11.9849053	0.0008695	-0.001742	3.2364694	0.00000	0.00000	-41.058988	C
0.00007981	15260.	191213175.	12.0237877	0.0009596	-0.001913	3.4775378	0.00000	0.00000	-45.074898	C
0.00008706	16586.	190515673.	12.0634920	0.0010503	-0.002084	3.7024331	0.00000	0.00000	-49.072372	C
0.00009432	17460.	185118607.	11.9781778	0.0011297	-0.002266	3.8843863	0.00000	0.00000	-50.000000	CY
0.0001016	17920.	176427895.	11.7990008	0.0011984	-0.002458	4.0302370	0.00000	0.00000	-50.000000	CY
0.0001088	18313.	168277773.	11.6263276	0.0012652	-0.002652	4.1622059	0.00000	0.00000	-50.000000	CY
0.0001161	18651.	160675611.	11.4599153	0.0013303	-0.002849	4.2813328	0.00000	0.00000	-50.000000	CY
0.0001233	18947.	153620849.	11.3022066	0.0013940	-0.003046	4.3891078	0.00000	0.00000	-50.000000	CY
0.0001306	19206.	147068071.	11.1500148	0.0014561	-0.003245	4.4857505	0.00000	0.00000	-50.000000	CY
0.0001378	19436.	140995448.	11.0073206	0.0015173	-0.003445	4.5728317	0.00000	0.00000	-50.000000	CY
0.0001451	19639.	135348533.	10.8693243	0.0015771	-0.003646	4.6501005	0.00000	0.00000	-50.000000	CY
0.0001524	19822.	130103676.	10.7390099	0.0016361	-0.003849	4.7187320	0.00000	0.00000	-50.000000	CY
0.0001596	19988.	125229383.	10.6168495	0.0016946	-0.004051	4.7792918	0.00000	0.00000	-50.000000	CY
0.0001669	20135.	120667961.	10.4970631	0.0017516	-0.004256	4.8313220	0.00000	0.00000	-50.000000	CY
0.0001741	20271.	116417126.	10.3848233	0.0018082	-0.004460	4.8760522	0.00000	0.00000	-50.000000	CY
0.0001814	20394.	112441848.	10.2791627	0.0018644	-0.004665	4.9136335	0.00000	0.00000	-50.000000	CY
0.0001886	20506.	108711816.	10.1762451	0.0019196	-0.004871	4.9439361	0.00000	0.00000	-50.000000	CY
0.0001959	20609.	105210620.	10.0784252	0.0019742	-0.005078	4.9675282	0.00000	0.00000	-50.000000	CY
0.0002031	20704.	101919503.	9.9860561	0.0020286	-0.005284	4.9846361	0.00000	0.00000	-50.000000	CY
0.0002104	20792.	98823455.	9.8989447	0.0020827	-0.005492	4.9953826	0.00000	0.00000	-50.000000	CY
0.0002177	20872.	95894633.	9.8126027	0.0021357	-0.005700	4.9998280	0.00000	0.00000	-50.000000	CY
0.0002249	20945.	93129503.	9.7311128	0.0021886	-0.005908	4.9980378	0.00000	0.00000	-50.000000	CY
0.0002322	21014.	90515845.	9.6541170	0.0022413	-0.006116	4.9968827	0.00000	0.00000	-50.000000	CY
0.0002394	21078.	88039024.	9.5812445	0.0022939	-0.006325	4.9989553	0.00000	0.00000	-50.000000	CY
0.0002467	21136.	85686898.	9.5106177	0.0023460	-0.006534	4.9938894	0.00000	0.00000	-50.000000	CY
0.0002539	21190.	83449701.	9.4416236	0.0023975	-0.006744	4.9988925	0.00000	0.00000	-50.000000	CY
0.0002612	21241.	81325386.	9.3762309	0.0024489	-0.006954	4.9951690	0.00000	0.00000	-50.000000	CY

0.0002684	21287.	79301798.	9.3139550	0.0025002	-0.007164	4.9978651	0.00000	0.00000	-50.000000 CY
0.0002757	21332.	77375152.	9.2545427	0.0025514	-0.007373	4.9999808	0.00000	0.00000	-50.000000 CY
0.0002829	21374.	75539949.	9.1984930	0.0026027	-0.007583	4.9950331	0.00000	0.00000	-50.000000 CY
0.0002975	21447.	72101605.	9.0878104	0.0027032	-0.008005	4.9976276	0.00000	0.00000	-50.000000 CY
0.0003120	21512.	68956012.	8.9858440	0.0028033	-0.008428	4.9985725	0.00000	0.00000	-50.000000 CY
0.0003265	21571.	66070903.	8.8922775	0.0029031	-0.008850	4.9914356	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	21571.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	17.1700	0.00	N.A.	No	0.00	18479.
2	21.9400	0.8010	No	No	18479.	516492.
3	36.9400	11.1135	Yes	No	534971.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)
Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.8105	6.79E-05	0.00	-0.00635	8.41E-08	1.17E+11	0.00	0.00	0.00
0.4317	1.7776	5.05E-05	-1.78E-06	-0.00635	6.25E-08	1.17E+11	0.00	0.00	0.00
0.8634	1.7447	4.95E-05	0.5292	-0.00635	6.13E-08	1.17E+11	0.00	0.00	0.2043
1.2951	1.7118	5.4835	22.5289	-0.00635	0.00679	1.17E+11	0.00	0.00	8.2891
1.7268	1.6789	233.4171	96.8785	-0.00635	0.2889	1.17E+11	0.00	0.00	20.4151
2.1585	1.6461	1009.	234.0459	-0.00635	1.2492	1.17E+11	0.00	0.00	32.5412
2.5902	1.6132	2658.	434.0310	-0.00635	3.2903	1.17E+11	0.00	0.00	44.6672
3.0219	1.5803	5506.	696.8339	-0.00635	6.8152	1.17E+11	0.00	0.00	56.7933
3.4536	1.5474	9878.	1022.	-0.00635	12.2265	1.17E+11	0.00	0.00	68.9193
3.8853	1.5145	16100.	1411.	-0.00635	19.9272	1.17E+11	0.00	0.00	81.0453
4.3170	1.4816	24496.	1862.	-0.00635	30.3199	1.17E+11	0.00	0.00	93.1714
4.7487	1.4488	35393.	2376.	-0.00634	43.8074	1.17E+11	0.00	0.00	105.2974
5.1804	1.4159	49116.	2953.	-0.00634	60.7926	1.17E+11	0.00	0.00	117.4235
5.6121	1.3831	65990.	3593.	-0.00634	81.6783	1.17E+11	0.00	0.00	129.5495
6.0438	1.3502	86340.	4295.	-0.00634	106.8671	1.17E+11	0.00	0.00	141.6756
6.4755	1.3174	110493.	5061.	-0.00633	136.7620	1.17E+11	0.00	0.00	153.8016
6.9072	1.2846	138773.	5889.	-0.00633	171.7656	1.17E+11	0.00	0.00	165.9277
7.3389	1.2518	171506.	6780.	-0.00632	212.2809	1.17E+11	0.00	0.00	178.0537
7.7706	1.2191	209018.	7734.	-0.00631	258.7105	1.17E+11	0.00	0.00	190.1797
8.2023	1.1864	251633.	8750.	-0.00630	311.4573	1.17E+11	0.00	0.00	202.3058
8.6340	1.1538	299677.	9830.	-0.00629	370.9240	1.17E+11	0.00	0.00	214.4318
9.0657	1.1213	353476.	10972.	-0.00628	437.5135	1.17E+11	0.00	0.00	226.5579
9.4974	1.0888	413355.	12177.	-0.00626	511.6285	1.17E+11	0.00	0.00	238.6839
9.9291	1.0564	479640.	13445.	-0.00624	593.6718	1.17E+11	0.00	0.00	250.8100
10.3608	1.0242	552655.	14776.	-0.00622	684.0462	1.17E+11	0.00	0.00	262.9360
10.7925	0.9920	632727.	16169.	-0.00619	783.1546	1.17E+11	0.00	0.00	275.0621
11.2242	0.9601	720180.	17625.	-0.00616	891.3996	1.17E+11	0.00	0.00	287.1881
11.6559	0.9282	815341.	19145.	-0.00613	1009.	1.17E+11	0.00	0.00	299.3141
12.0876	0.8966	918534.	20727.	-0.00609	1137.	1.17E+11	0.00	0.00	311.4402
12.5193	0.8652	1030085.	22371.	-0.00604	1275.	1.17E+11	0.00	0.00	323.5662
12.9510	0.8340	1150319.	24079.	-0.00600	1424.	1.17E+11	0.00	0.00	335.6923
13.3827	0.8030	1279563.	25849.	-0.00594	1584.	1.17E+11	0.00	0.00	347.8183
13.8144	0.7724	1418140.	27683.	-0.00588	1755.	1.17E+11	0.00	0.00	359.9444
14.2461	0.7421	1566377.	29579.	-0.00582	1939.	1.17E+11	0.00	0.00	372.0704
14.6778	0.7121	1724600.	31538.	-0.00574	2135.	1.17E+11	0.00	0.00	384.1965
15.1095	0.6826	1893132.	33559.	-0.00566	2343.	1.17E+11	0.00	0.00	396.3225
15.5412	0.6534	2072301.	35644.	-0.00558	2565.	1.17E+11	0.00	0.00	408.4485
15.9729	0.6248	2262431.	37791.	-0.00548	2800.	1.17E+11	0.00	0.00	420.5746
16.4046	0.5966	2463848.	40001.	-0.00538	3050.	1.17E+11	0.00	0.00	432.7006
16.8363	0.5691	2676877.	42274.	-0.00526	3313.	1.17E+11	0.00	0.00	444.8267
17.2680	0.5421	2901844.	43729.	-0.00517	0.00	1.97E+11	-6.703	64.0570	123.5404
17.6997	0.5156	3129946.	43934.	-0.00509	0.00	1.97E+11	-37.672	378.5396	0.00
18.1314	0.4894	3357037.	43655.	-0.00500	0.00	1.97E+11	-70.267	743.7699	0.00
18.5631	0.4637	3582242.	43204.	-0.00491	0.00	1.97E+11	-103.527	1157.	0.00
18.9948	0.4385	3804669.	42581.	-0.00481	0.00	1.96E+11	-137.040	1619.	0.00
19.4265	0.4139	4023419.	41786.	-0.00471	0.00	1.96E+11	-170.003	2128.	0.00
19.8582	0.3898	4237606.	40824.	-0.00460	0.00	1.96E+11	-201.534	2679.	0.00
20.2899	0.3662	4446385.	39703.	-0.00449	0.00	1.96E+11	-231.182	3270.	0.00

20.7216	0.3433	4648959.	38433.	-0.00437	0.00	1.96E+11	-258.962	3908.	0.00
21.1533	0.3210	4844584.	37028.	-0.00424	0.00	1.96E+11	-283.678	4578.	0.00
21.5850	0.2993	5032596.	35504.	-0.00411	0.00	1.96E+11	-304.764	5274.	0.00
22.0167	0.2784	5212429.	32798.	-0.00397	0.00	1.96E+11	-739.828	13767.	0.00
22.4484	0.2582	5372408.	28952.	-0.00383	0.00	1.96E+11	-744.834	14946.	0.00
22.8801	0.2387	5512398.	25083.	-0.00369	0.00	1.96E+11	-748.840	16254.	0.00
23.3118	0.2199	5632291.	21196.	-0.00354	0.00	1.96E+11	-751.815	17708.	0.00
23.7435	0.2020	5732009.	17297.	-0.00339	0.00	1.96E+11	-753.725	19333.	0.00
24.1752	0.1848	5811499.	13390.	-0.00324	0.00	1.96E+11	-754.535	21153.	0.00
24.6069	0.1684	5870740.	9482.	-0.00309	0.00	1.96E+11	-754.211	23201.	0.00
25.0386	0.1528	5909741.	5579.	-0.00293	0.00	1.96E+11	-752.716	25516.	0.00
25.4703	0.1381	5928541.	1686.	-0.00277	0.00	1.96E+11	-750.011	28144.	0.00
25.9020	0.1241	5927214.	-2189.	-0.00262	0.00	1.96E+11	-746.051	31143.	0.00
26.3337	0.1110	5905865.	-6040.	-0.00246	0.00	1.96E+11	-740.790	34586.	0.00
26.7654	0.09863	5864636.	-9860.	-0.00230	0.00	1.96E+11	-734.175	38563.	0.00
27.1971	0.08710	5803704.	-13643.	-0.00215	0.00	1.96E+11	-726.147	43189.	0.00
27.6288	0.07637	5723285.	-17380.	-0.00200	0.00	1.96E+11	-716.635	48613.	0.00
28.0605	0.06642	5623634.	-21064.	-0.00185	0.00	1.96E+11	-705.559	55029.	0.00
28.4922	0.05725	5505048.	-24686.	-0.00170	0.00	1.96E+11	-692.821	62696.	0.00
28.9239	0.04883	5367869.	-28237.	-0.00155	0.00	1.96E+11	-678.301	71968.	0.00
29.3556	0.04114	5212488.	-31709.	-0.00141	0.00	1.96E+11	-661.847	83341.	0.00
29.7873	0.03417	5039344.	-35089.	-0.00128	0.00	1.96E+11	-643.264	97527.	0.00
30.2190	0.02789	4848937.	-38367.	-0.00115	0.00	1.96E+11	-622.284	115596.	0.00
30.6507	0.02227	4641831.	-41529.	-0.00102	0.00	1.96E+11	-598.537	139229.	0.00
31.0824	0.01729	4418661.	-44560.	-9.03E-04	0.00	1.96E+11	-571.471	171244.	0.00
31.5141	0.01291	4180156.	-47439.	-7.90E-04	0.00	1.96E+11	-540.217	216777.	0.00
31.9458	0.00910	3927152.	-50142.	-6.83E-04	0.00	1.96E+11	-503.271	286407.	0.00
32.3775	0.00583	3660643.	-52631.	-5.83E-04	0.00	1.97E+11	-457.658	406482.	0.00
32.8092	0.00306	3381852.	-54842.	-4.90E-04	0.00	1.97E+11	-395.904	669781.	0.00
33.2409	7.53E-04	3092436.	-56602.	-4.05E-04	0.00	1.97E+11	-283.583	1950651.	0.00
33.6726	-0.00113	2795410.	-56513.	-3.28E-04	0.00	1.97E+11	318.1252	1453062.	0.00
34.1043	-0.00264	2506921.	-54654.	-2.58E-04	0.00	1.97E+11	399.2483	783273.	0.00
34.5360	-0.00381	2229147.	-52470.	-1.96E-04	0.00	1.97E+11	444.1153	604582.	0.00
34.9677	-0.00467	1963291.	-50091.	-1.40E-04	0.00	1.97E+11	474.3415	526544.	0.00
35.3994	-0.00526	1710165.	-47578.	-9.23E-05	0.00	1.97E+11	495.9505	488352.	0.00
35.8311	-0.00562	1470348.	-44968.	-5.05E-05	0.00	1.97E+11	511.5571	471324.	0.00
36.2628	-0.00578	1244260.	-42290.	-1.49E-05	0.00	1.98E+11	522.5423	467979.	0.00
36.6945	-0.00578	1032195.	-39564.	1.49E-05	0.00	1.98E+11	529.7180	475001.	0.00
37.1262	-0.00563	834346.	-36240.	3.94E-05	0.00	1.98E+11	753.6492	693508.	0.00
37.5579	-0.00537	656722.	-32328.	5.90E-05	0.00	1.98E+11	756.3965	729856.	0.00
37.9896	-0.00502	499397.	-28413.	7.41E-05	0.00	1.98E+11	755.1918	779527.	0.00
38.4213	-0.00460	362339.	-24514.	8.54E-05	0.00	1.98E+11	750.1473	844662.	0.00
38.8530	-0.00413	245412.	-20651.	9.34E-05	0.00	1.98E+11	741.2323	928955.	0.00
39.2847	-0.00363	148378.	-16845.	9.86E-05	0.00	1.98E+11	728.2507	1038428.	0.00
39.7164	-0.00311	70887.	-13117.	1.01E-04	0.00	1.98E+11	710.7798	1183074.	0.00
40.1481	-0.00258	12471.	-9494.	1.03E-04	0.00	1.98E+11	688.0417	1380444.	0.00
40.5798	-0.00205	-27480.	-6006.	1.02E-04	0.00	1.98E+11	658.6270	1664363.	0.00
41.0115	-0.00152	-49756.	-2695.	1.01E-04	0.00	1.98E+11	619.8371	2110107.	0.00
41.4432	-0.00100	-55398.	376.3673	9.99E-05	0.00	1.98E+11	565.7544	2930225.	0.00
41.8749	-4.86E-04	-45857.	2766.	9.86E-05	0.00	1.98E+11	356.7107	3800578.	0.00
42.3066	2.15E-05	-26743.	3648.	9.77E-05	0.00	1.98E+11	-16.017	3851283.	0.00
42.7383	5.26E-04	-8058.	2581.	9.72E-05	0.00	1.98E+11	-395.947	3901991.	0.00
43.1700	0.00103	0.00	0.00	9.71E-05	0.00	1.98E+11	-600.553	1512148.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	1.81048294 inches
Computed slope at pile head	=	-0.0063481 radians
Maximum bending moment	=	5928541. inch-lbs
Maximum shear force	=	-56602. lbs
Depth of maximum bending moment	=	25.47030000 feet below pile head
Depth of maximum shear force	=	33.24090000 feet below pile head
Number of iterations	=	26
Number of zero deflection points	=	2
Pile deflection at ground	=	0.54823563 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear	=	0. lbs
Moment	=	0. in-lbs
Axial Load	=	0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.17000	1.81048294	5928541.	-56602.
41.01150	1.82908627	5953732.	-57011.
38.85300	2.04726601	5872408.	-63132.
36.69450	3.24012167	5613207.	-69299.
34.53600	7.59451895	5414617.	-76040.
32.37750	30.90898699	5305555.	-87077.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	0.0 lbs
Applied moment at pile head	=	0.0 in-lbs
Axial thrust load on pile head	=	0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.2971	1.75E-05	0.00	-0.01097	2.16E-08	1.17E+11	0.00	0.00	0.00
0.4317	3.2403	-5.82E-06	-2.06E-06	-0.01097	7.21E-09	1.17E+11	0.00	0.00	0.00
0.8634	3.1835	-3.88E-06	0.7939	-0.01097	4.80E-09	1.17E+11	0.00	0.00	0.3065
1.2951	3.1266	8.2251	33.7933	-0.01097	0.01018	1.17E+11	0.00	0.00	12.4336
1.7268	3.0698	350.1256	145.3177	-0.01097	0.4334	1.17E+11	0.00	0.00	30.6227
2.1585	3.0129	1514.	351.0688	-0.01097	1.8737	1.17E+11	0.00	0.00	48.8118
2.5902	2.9561	3987.	651.0466	-0.01097	4.9355	1.17E+11	0.00	0.00	67.0008
3.0219	2.8992	8259.	1045.	-0.01097	10.2228	1.17E+11	0.00	0.00	85.1899
3.4536	2.8424	14817.	1534.	-0.01097	18.3398	1.17E+11	0.00	0.00	103.3790
3.8853	2.7856	24149.	2116.	-0.01097	29.8908	1.17E+11	0.00	0.00	121.5680
4.3170	2.7287	36744.	2793.	-0.01097	45.4798	1.17E+11	0.00	0.00	139.7571

4.7487	2.6719	53089.	3564.	-0.01097	65.7111	1.17E+11	0.00	0.00	157.9462
5.1804	2.6151	73673.	4430.	-0.01096	91.1889	1.17E+11	0.00	0.00	176.1352
5.6121	2.5583	98984.	5389.	-0.01096	122.5174	1.17E+11	0.00	0.00	194.3243
6.0438	2.5015	129510.	6443.	-0.01096	160.3007	1.17E+11	0.00	0.00	212.5134
6.4755	2.4448	165739.	7591.	-0.01095	205.1430	1.17E+11	0.00	0.00	230.7024
6.9072	2.3881	208160.	8833.	-0.01094	257.6485	1.17E+11	0.00	0.00	248.8915
7.3389	2.3314	257259.	10170.	-0.01093	318.4213	1.17E+11	0.00	0.00	267.0806
7.7706	2.2748	313526.	11600.	-0.01092	388.0658	1.17E+11	0.00	0.00	285.2696
8.2023	2.2183	377449.	13125.	-0.01090	467.1859	1.17E+11	0.00	0.00	303.4587
8.6340	2.1619	449516.	14745.	-0.01088	556.3860	1.17E+11	0.00	0.00	321.6478
9.0657	2.1055	530214.	16458.	-0.01086	656.2702	1.17E+11	0.00	0.00	339.8368
9.4974	2.0493	620033.	18266.	-0.01084	767.4428	1.17E+11	0.00	0.00	358.0259
9.9291	1.9933	719460.	20167.	-0.01081	890.5077	1.17E+11	0.00	0.00	376.2150
10.3608	1.9374	828983.	22163.	-0.01077	1026.	1.17E+11	0.00	0.00	394.4040
10.7925	1.8816	949090.	24254.	-0.01073	1175.	1.17E+11	0.00	0.00	412.5931
11.2242	1.8261	1080270.	26438.	-0.01069	1337.	1.17E+11	0.00	0.00	430.7822
11.6559	1.7709	1223011.	28717.	-0.01064	1514.	1.17E+11	0.00	0.00	448.9712
12.0876	1.7159	1377801.	31090.	-0.01058	1705.	1.17E+11	0.00	0.00	467.1603
12.5193	1.6612	1545127.	33557.	-0.01052	1912.	1.17E+11	0.00	0.00	485.3494
12.9510	1.6069	1725479.	36119.	-0.01044	2136.	1.17E+11	0.00	0.00	503.5384
13.3827	1.5530	1919344.	38774.	-0.01036	2376.	1.17E+11	0.00	0.00	521.7275
13.8144	1.4996	2127210.	41524.	-0.01027	2633.	1.17E+11	0.00	0.00	539.9166
14.2461	1.4466	2349566.	44368.	-0.01018	2908.	1.17E+11	0.00	0.00	558.1056
14.6778	1.3941	2586899.	47306.	-0.01007	3202.	1.17E+11	0.00	0.00	576.2947
15.1095	1.3423	2839699.	50339.	-0.00995	3515.	1.17E+11	0.00	0.00	594.4838
15.5412	1.2911	3108452.	53466.	-0.00982	3847.	1.17E+11	0.00	0.00	612.6728
15.9729	1.2406	3393647.	56687.	-0.00967	4200.	1.17E+11	0.00	0.00	630.8619
16.4046	1.1908	3695772.	60002.	-0.00952	4574.	1.17E+11	0.00	0.00	649.0510
16.8363	1.1420	4015315.	63411.	-0.00935	4970.	1.17E+11	0.00	0.00	667.2400
17.2680	1.0940	4352765.	65598.	-0.00920	0.00	1.96E+11	-8.352	39.5491	185.3107
17.6997	1.0467	4694964.	65935.	-0.00908	0.00	1.96E+11	-47.000	232.6261	0.00
18.1314	0.9999	5035902.	65585.	-0.00895	0.00	1.96E+11	-87.856	455.1538	0.00
18.5631	0.9539	5374482.	65022.	-0.00881	0.00	1.96E+11	-129.846	705.1459	0.00
18.9948	0.9086	5709577.	64240.	-0.00867	0.00	1.96E+11	-171.997	980.6126	0.00
19.4265	0.8641	6040056.	63241.	-0.00851	0.00	1.96E+11	-213.448	1280.	0.00
19.8582	0.8204	6364807.	62032.	-0.00835	0.00	1.95E+11	-253.356	1600.	0.00
20.2899	0.7776	6682759.	60622.	-0.00817	0.00	1.95E+11	-291.217	1940.	0.00
20.7216	0.7358	6992896.	59020.	-0.00799	0.00	1.95E+11	-327.013	2302.	0.00
21.1533	0.6948	7294257.	57242.	-0.00780	0.00	1.95E+11	-359.514	2680.	0.00
21.5850	0.6549	7585969.	55306.	-0.00761	0.00	1.95E+11	-388.129	3070.	0.00
22.0167	0.6160	7867266.	51963.	-0.00740	0.00	1.95E+11	-902.321	7588.	0.00
22.4484	0.5782	8124348.	47266.	-0.00719	0.00	1.95E+11	-911.185	8163.	0.00
22.8801	0.5416	8356976.	42525.	-0.00697	0.00	1.95E+11	-919.068	8791.	0.00
23.3118	0.5060	8564940.	37746.	-0.00674	0.00	1.94E+11	-925.938	9479.	0.00
23.7435	0.4717	8748055.	32934.	-0.00651	0.00	1.94E+11	-931.767	10233.	0.00
24.1752	0.4386	8906164.	28095.	-0.00628	0.00	1.94E+11	-936.528	11062.	0.00
24.6069	0.4067	9039140.	23234.	-0.00604	0.00	1.94E+11	-940.191	11976.	0.00
25.0386	0.3760	9146885.	18357.	-0.00579	0.00	1.94E+11	-942.727	12987.	0.00
25.4703	0.3466	9229330.	13469.	-0.00555	0.00	1.94E+11	-944.108	14109.	0.00
25.9020	0.3185	9286439.	8578.	-0.00530	0.00	1.94E+11	-944.301	15357.	0.00
26.3337	0.2917	9318206.	3689.	-0.00505	0.00	1.94E+11	-943.274	16751.	0.00
26.7654	0.2662	9324659.	-1192.	-0.00481	0.00	1.94E+11	-940.992	18314.	0.00
27.1971	0.2419	9305858.	-6057.	-0.00456	0.00	1.94E+11	-937.419	20073.	0.00
27.6288	0.2190	9261901.	-10901.	-0.00431	0.00	1.94E+11	-932.513	22062.	0.00
28.0605	0.1973	9192918.	-15715.	-0.00406	0.00	1.94E+11	-926.229	24322.	0.00
28.4922	0.1769	9099079.	-20493.	-0.00382	0.00	1.94E+11	-918.519	26902.	0.00
28.9239	0.1577	8980589.	-25228.	-0.00358	0.00	1.94E+11	-909.326	29867.	0.00
29.3556	0.1398	8837697.	-29911.	-0.00334	0.00	1.94E+11	-898.585	33296.	0.00
29.7873	0.1231	8670689.	-34534.	-0.00311	0.00	1.94E+11	-886.222	37290.	0.00
30.2190	0.1076	8479899.	-39088.	-0.00288	0.00	1.94E+11	-872.146	41981.	0.00
30.6507	0.09330	8265702.	-43565.	-0.00266	0.00	1.95E+11	-856.249	47543.	0.00

31.0824	0.08011	8028528.	-47955.	-0.00244	0.00	1.95E+11	-838.398	54213.	0.00
31.5141	0.06804	7768853.	-52246.	-0.00223	0.00	1.95E+11	-818.420	62316.	0.00
31.9458	0.05703	7487215.	-56428.	-0.00203	0.00	1.95E+11	-796.093	72316.	0.00
32.3775	0.04705	7184213.	-60488.	-0.00183	0.00	1.95E+11	-771.115	84899.	0.00
32.8092	0.03806	6860516.	-64410.	-0.00164	0.00	1.95E+11	-743.062	101128.	0.00
33.2409	0.03002	6516878.	-68177.	-0.00147	0.00	1.95E+11	-711.312	122751.	0.00
33.6726	0.02287	6154152.	-71767.	-0.00130	0.00	1.96E+11	-674.891	152877.	0.00
34.1043	0.01656	5773313.	-75153.	-0.00114	0.00	1.96E+11	-632.155	197700.	0.00
34.5360	0.01105	5375509.	-78292.	-9.93E-04	0.00	1.96E+11	-579.954	271857.	0.00
34.9677	0.00627	4962142.	-81118.	-8.56E-04	0.00	1.96E+11	-510.928	421815.	0.00
35.3994	0.00218	4535063.	-83472.	-7.31E-04	0.00	1.96E+11	-397.931	946631.	0.00
35.8311	-0.00130	4097305.	-83584.	-6.17E-04	0.00	1.96E+11	354.6723	1414233.	0.00
36.2628	-0.00422	3669065.	-81415.	-5.15E-04	0.00	1.97E+11	482.8760	593313.	0.00
36.6945	-0.00663	3253784.	-78743.	-4.24E-04	0.00	1.97E+11	548.3836	428348.	0.00
37.1262	-0.00860	2853219.	-75152.	-3.43E-04	0.00	1.97E+11	838.0751	504589.	0.00
37.5579	-0.01019	2475146.	-70682.	-2.73E-04	0.00	1.97E+11	887.8796	451496.	0.00
37.9896	-0.01143	2120900.	-65978.	-2.13E-04	0.00	1.97E+11	927.9254	420432.	0.00
38.4213	-0.01239	1791557.	-61085.	-1.61E-04	0.00	1.97E+11	961.1138	401823.	0.00
38.8530	-0.01310	1488006.	-56034.	-1.18E-04	0.00	1.97E+11	989.2131	391048.	0.00
39.2847	-0.01362	1211003.	-50846.	-8.28E-05	0.00	1.98E+11	1013.	385568.	0.00
39.7164	-0.01396	961196.	-45542.	-5.44E-05	0.00	1.98E+11	1035.	383846.	0.00
40.1481	-0.01418	739154.	-40133.	-3.21E-05	0.00	1.98E+11	1053.	384869.	0.00
40.5798	-0.01430	545383.	-34632.	-1.52E-05	0.00	1.98E+11	1070.	387918.	0.00
41.0115	-0.01434	380338.	-29046.	-3.08E-06	0.00	1.98E+11	1086.	392449.	0.00
41.4432	-0.01433	244442.	-23381.	5.11E-06	0.00	1.98E+11	1101.	398036.	0.00
41.8749	-0.01428	138087.	-17642.	1.01E-05	0.00	1.98E+11	1115.	404332.	0.00
42.3066	-0.01422	61652.	-11832.	1.28E-05	0.00	1.98E+11	1129.	411065.	0.00
42.7383	-0.01415	15503.	-5951.	1.38E-05	0.00	1.98E+11	1142.	418029.	0.00
43.1700	-0.01408	0.00	0.00	1.40E-05	0.00	1.98E+11	1155.	212548.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     3.29714946 inches
Computed slope at pile head      =     -0.0109727 radians
Maximum bending moment           =       9324659. inch-lbs
Maximum shear force              =        -83584. lbs
Depth of maximum bending moment  =    26.76540000 feet below pile head
Depth of maximum shear force     =    35.83110000 feet below pile head
Number of iterations             =             38
Number of zero deflection points =              1
Pile deflection at ground        =     1.10490730 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.17000	3.29714946	9324659.	-83584.
41.01150	3.70587639	9210014.	-91827.
38.85300	5.42786126	8892065.	-97702.
36.69450	13.90935579	8600120.	-107548.
34.53600	60.51614557	8489446.	-124689.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

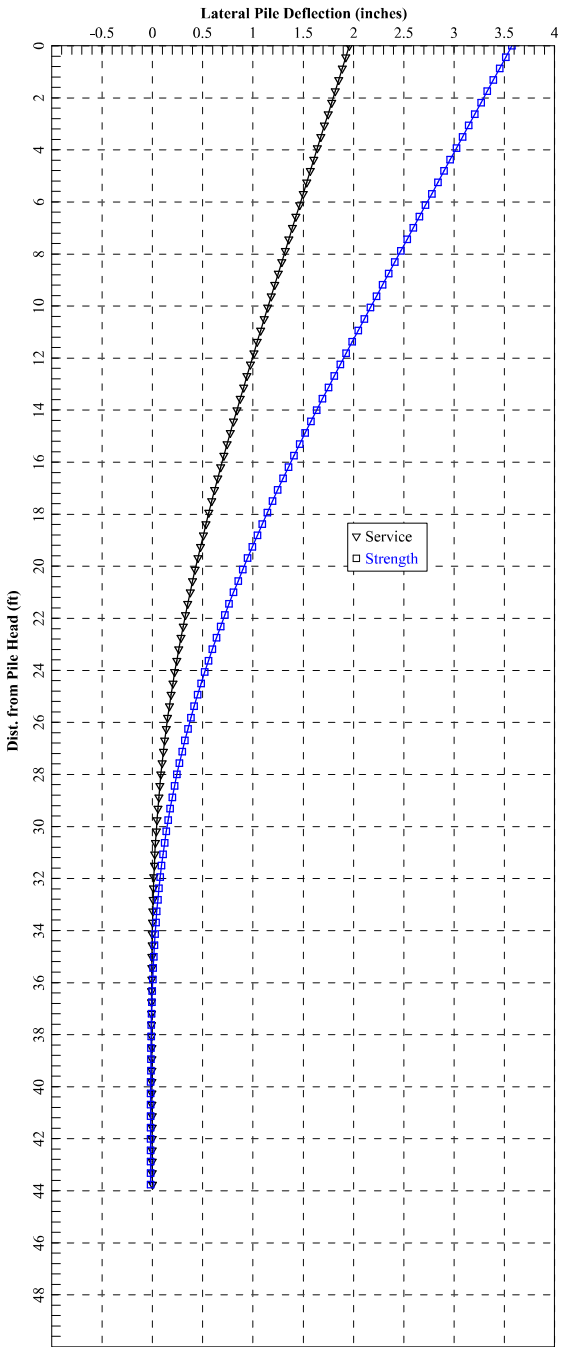
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

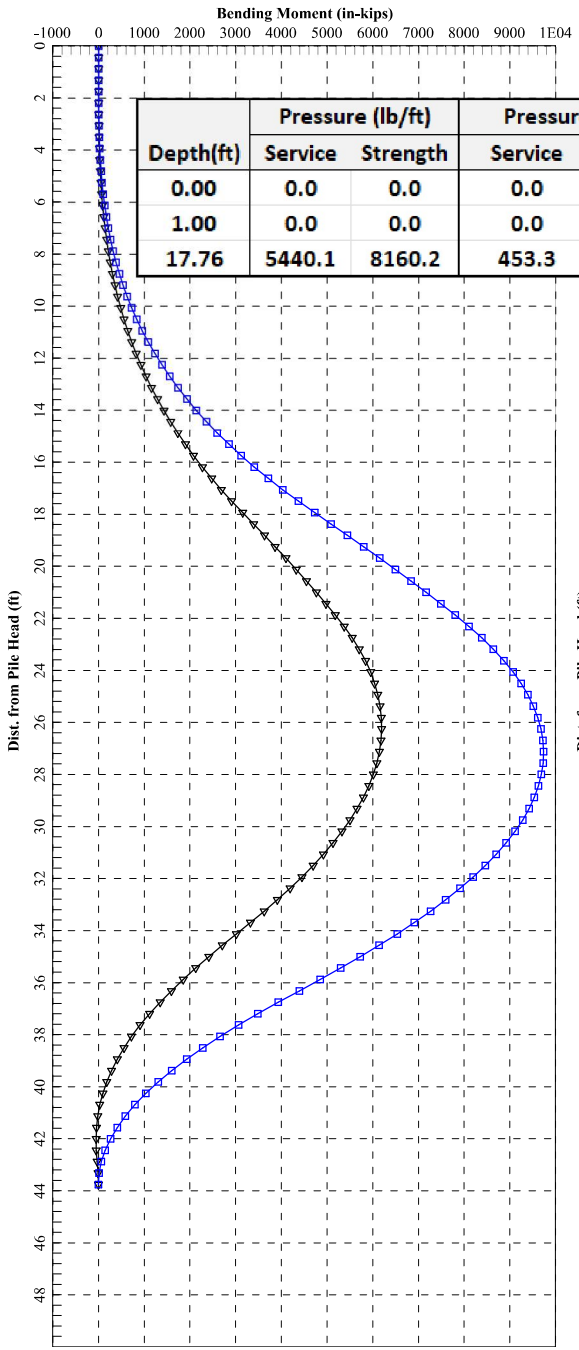
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.8105	-0.00635	-56602.	5928541.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.2971	-0.01097	-83584.	9324659.

Maximum pile-head deflection = 3.2971494615 inches
Maximum pile-head rotation = -0.0109727326 radians = -0.628691 deg.

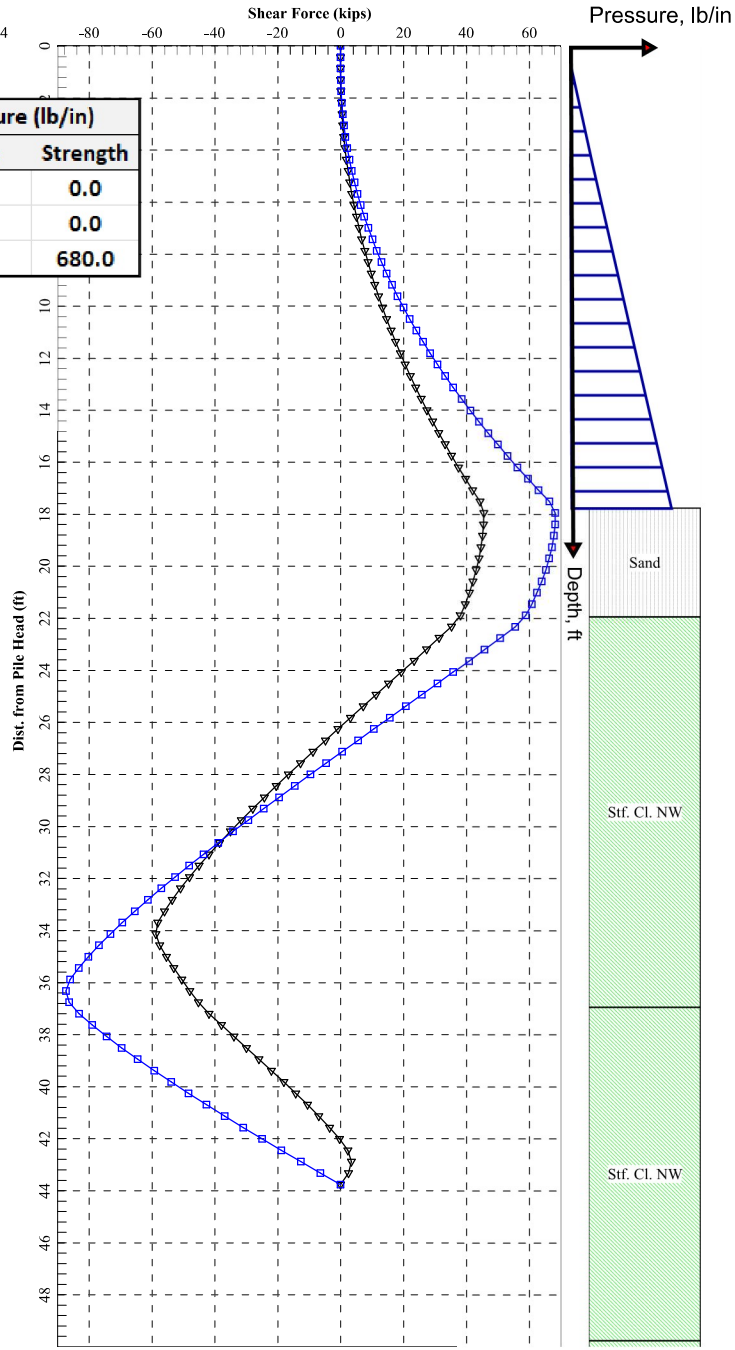
The analysis ended normally.

Wall 1D (17.76ft)





	Pressure (lb/ft)		Pressure (lb/in)	
Depth(ft)	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
17.76	5440.1	8160.2	453.3	680.0



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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
06 Wall_1D-17.76ft S=6.5ft.lp12d

Name of output report file:
06 Wall_1D-17.76ft S=6.5ft.lp12o

Name of plot output file:
06 Wall_1D-17.76ft S=6.5ft.lp12p

Name of runtime message file:
06 Wall_1D-17.76ft S=6.5ft.lp12r

Date and Time of Analysis

Date: June 18, 2026 Time: 11:40:54

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SP WALL 1D (H=17.76FT), S=6.5ft Boring B-048-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 43.760 ft
Depth of ground surface below top of pile = 17.7600 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	10.1000
2	17.760	10.1000
3	17.760	36.0000
4	43.760	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 17.760000 ft
AISC Section Type = W
AISC Section Name = W27X114
Pile width = 10.100000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 26.000000 ft
Section Diameter = 36.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W27X114

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 17.760000 ft
Distance from top of pile to bottom of layer = 21.940000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 60.000000 pci
Subgrade k at bottom of layer = 60.000000 pci

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer = 21.940000 ft
Distance from top of pile to bottom of layer = 36.940000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Undrained cohesion at top of layer = 2500. psf
Undrained cohesion at bottom of layer = 2500. psf
Epsilon-50 at top of layer = 0.005000
Epsilon-50 at bottom of layer = 0.005000

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer	=	36.940000 ft
Distance from top of pile to bottom of layer	=	58.440000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Undrained cohesion at top of layer	=	4000. psf
Undrained cohesion at bottom of layer	=	4000. psf
Epsilon-50 at top of layer	=	0.004000
Epsilon-50 at bottom of layer	=	0.004000

(Depth of the lowest soil layer extends 14.680 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	17.7600	57.6000	--	30.0000	--	60.0000
	(Reese, et al.)	21.9400	57.6000	--	30.0000	--	60.0000
2	Stiff Clay	21.9400	62.6000	2500.	--	0.00500	--
	w/o Free Water	36.9400	62.6000	2500.	--	0.00500	--
3	Stiff Clay	36.9400	67.6000	4000.	--	0.00400	--
	w/o Free Water	58.4400	67.6000	4000.	--	0.00400	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	17.760	0.8320	1.0000
2	44.000	0.8320	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	17.760	453.300

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	17.760	680.000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	17.760000 ft
Flange Width	=	10.100000 in
Section Depth	=	27.300000 in
Flange Thickness	=	0.930000 in
Web Thickness	=	0.570000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	33.600000 sq. in.
Moment of Inertia	=	4080. in^4
Elastic Bending Stiffness	=	118320000. kip-in^2
Plastic Modulus, Z	=	343.000000in^3
Plastic Moment Capacity = Fy Z	=	17150.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1680.000 kips
Nominal Axial Tensile Capacity	=	-1680.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:
Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000726	850.9888267	117296295.	13.6500000	2.8431869	
0.00001451	1702.	117296295.	13.6500000	5.6863738	
0.00002177	2553.	117296295.	13.6500000	8.5295607	
0.00002902	3404.	117296295.	13.6500000	11.3727476	
0.00003628	4255.	117296295.	13.6500000	14.2159345	
0.00004353	5106.	117296295.	13.6500000	17.0591214	
0.00005079	5957.	117296295.	13.6500000	19.9023083	
0.00005804	6808.	117296295.	13.6500000	22.7454952	
0.00006530	7659.	117296295.	13.6500000	25.5886821	
0.00007255	8510.	117296295.	13.6500000	28.4318690	
0.00007981	9361.	117296295.	13.6500000	31.2750559	
0.00008706	10212.	117296295.	13.6500000	34.1182428	
0.00009432	11063.	117296295.	13.6500000	36.9614297	
0.0001016	11914.	117296295.	13.6500000	39.8046166	
0.0001088	12765.	117296295.	13.6500000	42.6478035	
0.0001161	13616.	117296295.	13.6500000	45.4909904	
0.0001233	14467.	117296295.	13.6500000	48.3341773	
0.0001306	15220.	116544211.	13.6500000	50.0000000	Y
0.0001378	15501.	112450817.	13.6500000	50.0000000	Y
0.0001451	15646.	107829744.	13.6500000	50.0000000	Y
0.0001524	15771.	103513204.	13.6500000	50.0000000	Y
0.0001596	15879.	99484994.	13.6500000	50.0000000	Y
0.0001669	15973.	95722589.	13.6500000	50.0000000	Y
0.0001741	16056.	92210068.	13.6500000	50.0000000	Y
0.0001814	16129.	88923792.	13.6500000	50.0000000	Y
0.0001886	16194.	85849232.	13.6500000	50.0000000	Y
0.0001959	16251.	82962330.	13.6500000	50.0000000	Y
0.0002031	16303.	80253023.	13.6500000	50.0000000	Y
0.0002104	16349.	77706048.	13.6500000	50.0000000	Y
0.0002177	16391.	75307996.	13.6500000	50.0000000	Y
0.0002249	16429.	73047017.	13.6500000	50.0000000	Y
0.0002322	16463.	70912571.	13.6500000	50.0000000	Y
0.0002394	16495.	68895236.	13.6500000	50.0000000	Y
0.0002467	16523.	66984770.	13.6500000	50.0000000	Y
0.0002539	16549.	65172693.	13.6500000	50.0000000	Y
0.0002612	16573.	63454354.	13.6500000	50.0000000	Y
0.0002684	16596.	61823108.	13.6500000	50.0000000	Y
0.0002757	16615.	60268358.	13.6500000	50.0000000	Y
0.0002829	16634.	58790217.	13.6500000	50.0000000	Y
0.0002975	16668.	56034924.	13.6500000	50.0000000	Y
0.0003120	16697.	53521647.	13.6500000	50.0000000	Y
0.0003265	16722.	51220539.	13.6500000	50.0000000	Y
0.0003410	16745.	49106339.	13.6500000	50.0000000	Y
0.0003555	16764.	47155585.	13.6500000	50.0000000	Y
0.0003700	16781.	45352509.	13.6500000	50.0000000	Y

0.0003845	16796.	43681790.	13.6500000	50.0000000 Y
0.0003990	16810.	42126725.	13.6500000	50.0000000 Y
0.0004135	16822.	40678409.	13.6500000	50.0000000 Y
0.0004280	16833.	39325104.	13.6500000	50.0000000 Y
0.0004426	16843.	38058301.	13.6500000	50.0000000 Y
0.0004571	16852.	36869608.	13.6500000	50.0000000 Y
0.0004716	16860.	35753088.	13.6500000	50.0000000 Y
0.0004861	16867.	34700514.	13.6500000	50.0000000 Y
0.0005006	16875.	33708960.	13.6500000	50.0000000 Y
0.0005151	16881.	32771254.	13.6500000	50.0000000 Y
0.0005296	16886.	31884008.	13.6500000	50.0000000 Y
0.0005441	16892.	31044082.	13.6500000	50.0000000 Y
0.0005586	16897.	30246282.	13.6500000	50.0000000 Y
0.0005731	16901.	29488093.	13.6500000	50.0000000 Y
0.0005877	16905.	28767345.	13.6500000	50.0000000 Y
0.0006022	16910.	28081247.	13.6500000	50.0000000 Y
0.0006167	16913.	27425775.	13.6500000	50.0000000 Y
0.0006312	16916.	26800439.	13.6500000	50.0000000 Y
0.0006457	16919.	26203208.	13.6500000	50.0000000 Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	16919.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	26.000000 ft
Outside Diameter of Casing	=	36.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	10.100000 in
Depth of Core/Insert	=	27.300000 in
Flange Thickness of Core/Insert	=	0.930000 in
Web Thickness of Core/Insert	=	0.570000 in
Moment of Inertia of Steel Core/Insert	=	4080. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1018. sq. in.
Area of Concrete	=	984.589220 sq. in.

Cross-sectional Area of Steel Casing = 0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert = 33.600000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars) = 33.286800 sq. in.
Area Ratio of All Steel to Gross Area = 3.27 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 5863.173 kips
Tensile Load for Cracking of Concrete = -568.159 kips
Nominal Axial Tensile Capacity = -1680.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000726	1433.	197514938.	11.6694668	0.00008466	-0.000177	0.3874463	0.00000	0.00000	-4.172266	C
0.00001451	2858.	196933000.	11.7024376	0.0001698	-0.000353	0.7613586	0.00000	0.00000	-8.330657	C
0.00002177	4273.	196341404.	11.7352712	0.0002554	-0.000528	1.1214540	0.00000	0.00000	-12.475262	C
0.00002902	5680.	195739799.	11.7687536	0.0003415	-0.000703	1.4675411	0.00000	0.00000	-16.605504	C
0.00003628	7078.	195127805.	11.8029118	0.0004282	-0.000878	1.7993939	0.00000	0.00000	-20.720947	C
0.00004353	8467.	194505019.	11.8377743	0.0005153	-0.001052	2.1167760	0.00000	0.00000	-24.821126	C
0.00005079	9846.	193871012.	11.8733714	0.0006030	-0.001225	2.4194403	0.00000	0.00000	-28.905554	C
0.00005804	11215.	193225328.	11.9097355	0.0006912	-0.001398	2.7071275	0.00000	0.00000	-32.973712	C
0.00006530	12574.	192567480.	11.9469011	0.0007801	-0.001571	2.9795659	0.00000	0.00000	-37.025051	C
0.00007255	13922.	191896940.	11.9849053	0.0008695	-0.001742	3.2364694	0.00000	0.00000	-41.058988	C
0.00007981	15260.	191213175.	12.0237877	0.0009596	-0.001913	3.4775378	0.00000	0.00000	-45.074898	C
0.00008706	16586.	190515673.	12.0634920	0.0010503	-0.002084	3.7024331	0.00000	0.00000	-49.072372	C
0.00009432	17460.	185118607.	11.9781778	0.0011297	-0.002266	3.8843863	0.00000	0.00000	-50.000000	CY
0.0001016	17920.	176427895.	11.7990008	0.0011984	-0.002458	4.0302370	0.00000	0.00000	-50.000000	CY
0.0001088	18313.	168277773.	11.6263276	0.0012652	-0.002652	4.1622059	0.00000	0.00000	-50.000000	CY
0.0001161	18651.	160675611.	11.4599153	0.0013303	-0.002849	4.2813328	0.00000	0.00000	-50.000000	CY
0.0001233	18947.	153620849.	11.3022066	0.0013940	-0.003046	4.3891078	0.00000	0.00000	-50.000000	CY
0.0001306	19206.	147068071.	11.1500148	0.0014561	-0.003245	4.4857505	0.00000	0.00000	-50.000000	CY
0.0001378	19436.	140995448.	11.0073206	0.0015173	-0.003445	4.5728317	0.00000	0.00000	-50.000000	CY
0.0001451	19639.	135348533.	10.8693243	0.0015771	-0.003646	4.6501005	0.00000	0.00000	-50.000000	CY
0.0001524	19822.	130103676.	10.7390099	0.0016361	-0.003849	4.7187320	0.00000	0.00000	-50.000000	CY
0.0001596	19988.	125229383.	10.6168495	0.0016946	-0.004051	4.7792918	0.00000	0.00000	-50.000000	CY
0.0001669	20135.	120667961.	10.4970631	0.0017516	-0.004256	4.8313220	0.00000	0.00000	-50.000000	CY
0.0001741	20271.	116417126.	10.3848233	0.0018082	-0.004460	4.8760522	0.00000	0.00000	-50.000000	CY
0.0001814	20394.	112441848.	10.2791627	0.0018644	-0.004665	4.9136335	0.00000	0.00000	-50.000000	CY
0.0001886	20506.	108711816.	10.1762451	0.0019196	-0.004871	4.9439361	0.00000	0.00000	-50.000000	CY
0.0001959	20609.	105210620.	10.0784252	0.0019742	-0.005078	4.9675282	0.00000	0.00000	-50.000000	CY
0.0002031	20704.	101919503.	9.9860561	0.0020286	-0.005284	4.9846361	0.00000	0.00000	-50.000000	CY
0.0002104	20792.	98823455.	9.8989447	0.0020827	-0.005492	4.9953826	0.00000	0.00000	-50.000000	CY
0.0002177	20872.	95894633.	9.8126027	0.0021357	-0.005700	4.9998280	0.00000	0.00000	-50.000000	CY
0.0002249	20945.	93129503.	9.7311128	0.0021886	-0.005908	4.9980378	0.00000	0.00000	-50.000000	CY

0.0002322	21014.	90515845.	9.6541170	0.0022413	-0.006116	4.9968827	0.00000	0.00000	-50.000000 CY
0.0002394	21078.	88039024.	9.5812445	0.0022939	-0.006325	4.9989553	0.00000	0.00000	-50.000000 CY
0.0002467	21136.	85686898.	9.5106177	0.0023460	-0.006534	4.9938894	0.00000	0.00000	-50.000000 CY
0.0002539	21190.	83449701.	9.4416236	0.0023975	-0.006744	4.9988925	0.00000	0.00000	-50.000000 CY
0.0002612	21241.	81325386.	9.3762309	0.0024489	-0.006954	4.9951690	0.00000	0.00000	-50.000000 CY
0.0002684	21287.	79301798.	9.3139550	0.0025002	-0.007164	4.9978651	0.00000	0.00000	-50.000000 CY
0.0002757	21332.	77375152.	9.2545427	0.0025514	-0.007373	4.9999808	0.00000	0.00000	-50.000000 CY
0.0002829	21374.	75539949.	9.1984930	0.0026027	-0.007583	4.9950331	0.00000	0.00000	-50.000000 CY
0.0002975	21447.	72101605.	9.0878104	0.0027032	-0.008005	4.9976276	0.00000	0.00000	-50.000000 CY
0.0003120	21512.	68956012.	8.9858440	0.0028033	-0.008428	4.9985725	0.00000	0.00000	-50.000000 CY
0.0003265	21571.	66070903.	8.8922775	0.0029031	-0.008850	4.9914356	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	21571.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	17.7600	0.00	N.A.	No	0.00	14079.
2	21.9400	0.6138	No	No	14079.	512521.
3	36.9400	10.9739	Yes	No	526601.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.9613	-2.46E-05	-1.80E-07	-0.00675	3.04E-08	1.17E+11	0.00	0.00	0.00
0.4376	1.9258	3.78E-06	2.79E-06	-0.00675	4.68E-09	1.17E+11	0.00	0.00	0.00
0.8752	1.8904	4.72E-06	0.7169	-0.00675	5.85E-09	1.17E+11	0.00	0.00	0.2731
1.3128	1.8549	7.5297	23.6469	-0.00675	0.00932	1.17E+11	0.00	0.00	8.4602
1.7504	1.8195	248.3491	99.1483	-0.00675	0.3074	1.17E+11	0.00	0.00	20.2957
2.1880	1.7840	1049.	236.8007	-0.00675	1.2982	1.17E+11	0.00	0.00	32.1313
2.6256	1.7486	2735.	436.6040	-0.00675	3.3856	1.17E+11	0.00	0.00	43.9669
3.0632	1.7131	5634.	698.5582	-0.00675	6.9737	1.17E+11	0.00	0.00	55.8024
3.5008	1.6777	10072.	1023.	-0.00675	12.4664	1.17E+11	0.00	0.00	67.6380
3.9384	1.6422	16375.	1409.	-0.00675	20.2676	1.17E+11	0.00	0.00	79.4736
4.3760	1.6068	24869.	1857.	-0.00675	30.7814	1.17E+11	0.00	0.00	91.3091
4.8136	1.5713	35881.	2368.	-0.00675	44.4116	1.17E+11	0.00	0.00	103.1447
5.2512	1.5359	49737.	2941.	-0.00675	61.5622	1.17E+11	0.00	0.00	114.9802
5.6888	1.5005	66764.	3575.	-0.00674	82.6372	1.17E+11	0.00	0.00	126.8158
6.1264	1.4651	87288.	4272.	-0.00674	108.0405	1.17E+11	0.00	0.00	138.6514
6.5640	1.4297	111635.	5032.	-0.00674	138.1762	1.17E+11	0.00	0.00	150.4869
7.0016	1.3943	140132.	5853.	-0.00673	173.4481	1.17E+11	0.00	0.00	162.3225
7.4392	1.3590	173105.	6736.	-0.00672	214.2603	1.17E+11	0.00	0.00	174.1581
7.8768	1.3237	210881.	7682.	-0.00671	261.0166	1.17E+11	0.00	0.00	185.9936
8.3144	1.2885	253785.	8690.	-0.00670	314.1210	1.17E+11	0.00	0.00	197.8292
8.7520	1.2533	302144.	9760.	-0.00669	373.9776	1.17E+11	0.00	0.00	209.6648
9.1896	1.2182	356285.	10892.	-0.00668	440.9902	1.17E+11	0.00	0.00	221.5003
9.6272	1.1832	416534.	12086.	-0.00666	515.5628	1.17E+11	0.00	0.00	233.3359
10.0648	1.1483	483217.	13342.	-0.00664	598.0994	1.17E+11	0.00	0.00	245.1715
10.5024	1.1135	556661.	14661.	-0.00662	689.0040	1.17E+11	0.00	0.00	257.0070
10.9400	1.0788	637191.	16042.	-0.00659	788.6804	1.17E+11	0.00	0.00	268.8426
11.3776	1.0443	725135.	17484.	-0.00656	897.5327	1.17E+11	0.00	0.00	280.6782
11.8152	1.0099	820819.	18989.	-0.00652	1016.	1.17E+11	0.00	0.00	292.5137
12.2528	0.9757	924569.	20556.	-0.00649	1144.	1.17E+11	0.00	0.00	304.3493
12.6904	0.9418	1036711.	22186.	-0.00644	1283.	1.17E+11	0.00	0.00	316.1849
13.1280	0.9081	1157572.	23877.	-0.00639	1433.	1.17E+11	0.00	0.00	328.0204
13.5656	0.8747	1287479.	25631.	-0.00634	1594.	1.17E+11	0.00	0.00	339.8560
14.0032	0.8415	1426757.	27446.	-0.00628	1766.	1.17E+11	0.00	0.00	351.6916
14.4408	0.8087	1575732.	29324.	-0.00621	1950.	1.17E+11	0.00	0.00	363.5271
14.8784	0.7763	1734733.	31264.	-0.00614	2147.	1.17E+11	0.00	0.00	375.3627
15.3160	0.7443	1904083.	33267.	-0.00605	2357.	1.17E+11	0.00	0.00	387.1983
15.7536	0.7127	2084111.	35331.	-0.00596	2580.	1.17E+11	0.00	0.00	399.0338
16.1912	0.6817	2275142.	37457.	-0.00587	2816.	1.17E+11	0.00	0.00	410.8694
16.6288	0.6511	2477503.	39646.	-0.00576	3067.	1.17E+11	0.00	0.00	422.7050
17.0664	0.6212	2691521.	41897.	-0.00564	3331.	1.17E+11	0.00	0.00	434.5405
17.5040	0.5918	2917520.	44210.	-0.00552	3611.	1.17E+11	0.00	0.00	446.3761
17.9416	0.5632	3155829.	45450.	-0.00541	0.00	1.97E+11	-12.519	116.7289	38.4919
18.3792	0.5350	3394853.	45402.	-0.00532	0.00	1.97E+11	-44.312	434.9282	0.00
18.8168	0.5073	3632656.	45082.	-0.00523	0.00	1.97E+11	-77.592	803.1978	0.00
19.2544	0.4801	3868319.	44586.	-0.00513	0.00	1.96E+11	-111.367	1218.	0.00
19.6920	0.4534	4100911.	43911.	-0.00502	0.00	1.96E+11	-145.391	1684.	0.00
20.1296	0.4273	4329495.	43061.	-0.00491	0.00	1.96E+11	-178.550	2194.	0.00

20.5672	0.4018	4553154.	42041.	-0.00479	0.00	1.96E+11	-210.050	2745.	0.00
21.0048	0.3770	4771021.	40860.	-0.00467	0.00	1.96E+11	-239.738	3339.	0.00
21.4424	0.3528	4982278.	39529.	-0.00454	0.00	1.96E+11	-267.111	3976.	0.00
21.8800	0.3293	5186169.	38063.	-0.00440	0.00	1.96E+11	-291.166	4643.	0.00
22.3176	0.3066	5382031.	35321.	-0.00426	0.00	1.96E+11	-753.122	12899.	0.00
22.7552	0.2846	5557126.	31352.	-0.00411	0.00	1.96E+11	-758.560	13996.	0.00
23.1928	0.2634	5711303.	27357.	-0.00396	0.00	1.96E+11	-762.989	15211.	0.00
23.6304	0.2430	5844441.	23342.	-0.00381	0.00	1.96E+11	-766.374	16561.	0.00
24.0680	0.2234	5956445.	19311.	-0.00365	0.00	1.96E+11	-768.685	18066.	0.00
24.5056	0.2047	6047254.	15271.	-0.00349	0.00	1.96E+11	-769.886	19751.	0.00
24.9432	0.1868	6116832.	11228.	-0.00332	0.00	1.96E+11	-769.943	21643.	0.00
25.3808	0.1698	6165180.	7188.	-0.00316	0.00	1.95E+11	-768.821	23777.	0.00
25.8184	0.1536	6192327.	3157.	-0.00299	0.00	1.95E+11	-766.481	26197.	0.00
26.2560	0.1384	6198338.	-858.272	-0.00283	0.00	1.95E+11	-762.880	28952.	0.00
26.6936	0.1240	6183313.	-4851.	-0.00266	0.00	1.95E+11	-757.974	32108.	0.00
27.1312	0.1104	6147387.	-8815.	-0.00249	0.00	1.96E+11	-751.713	35744.	0.00
27.5688	0.09777	6090732.	-12743.	-0.00233	0.00	1.96E+11	-744.039	39961.	0.00
28.0064	0.08597	6013560.	-16626.	-0.00217	0.00	1.96E+11	-734.887	44888.	0.00
28.4440	0.07501	5916123.	-20457.	-0.00201	0.00	1.96E+11	-724.183	50695.	0.00
28.8816	0.06489	5798717.	-24227.	-0.00185	0.00	1.96E+11	-711.836	57603.	0.00
29.3192	0.05559	5661682.	-27928.	-0.00170	0.00	1.96E+11	-697.738	65913.	0.00
29.7568	0.04708	5505407.	-31550.	-0.00155	0.00	1.96E+11	-681.751	76040.	0.00
30.1944	0.03935	5330333.	-35083.	-0.00140	0.00	1.96E+11	-663.703	88572.	0.00
30.6320	0.03237	5136957.	-38514.	-0.00126	0.00	1.96E+11	-643.364	104375.	0.00
31.0696	0.02611	4925840.	-41833.	-0.00113	0.00	1.96E+11	-620.417	124778.	0.00
31.5072	0.02054	4697615.	-45022.	-9.97E-04	0.00	1.96E+11	-594.408	151930.	0.00
31.9448	0.01564	4452999.	-48065.	-8.74E-04	0.00	1.96E+11	-564.642	189582.	0.00
32.3824	0.01136	4192813.	-50939.	-7.59E-04	0.00	1.96E+11	-529.974	244963.	0.00
32.8200	0.00767	3918013.	-53613.	-6.50E-04	0.00	1.96E+11	-488.298	334281.	0.00
33.2576	0.00453	3629748.	-56037.	-5.50E-04	0.00	1.97E+11	-434.999	504213.	0.00
33.6952	0.00190	3329488.	-58113.	-4.57E-04	0.00	1.97E+11	-355.664	983332.	0.00
34.1328	-2.65E-04	3019421.	-58773.	-3.72E-04	0.00	1.97E+11	104.2488	2066391.	0.00
34.5704	-0.00201	2712228.	-57524.	-2.95E-04	0.00	1.97E+11	371.5666	972585.	0.00
35.0080	-0.00337	2415281.	-55421.	-2.27E-04	0.00	1.97E+11	429.4112	669573.	0.00
35.4456	-0.00439	2130176.	-53071.	-1.67E-04	0.00	1.97E+11	465.7411	556951.	0.00
35.8832	-0.00512	1857913.	-50559.	-1.13E-04	0.00	1.97E+11	491.0216	503921.	0.00
36.3208	-0.00558	1599190.	-47933.	-6.74E-05	0.00	1.97E+11	509.1175	478895.	0.00
36.7584	-0.00583	1354506.	-45225.	-2.82E-05	0.00	1.98E+11	521.9150	470502.	0.00
37.1960	-0.00588	1124214.	-41886.	4.79E-06	0.00	1.98E+11	750.1095	670084.	0.00
37.6336	-0.00577	914606.	-37924.	3.19E-05	0.00	1.98E+11	758.6361	689863.	0.00
38.0712	-0.00554	725918.	-33930.	5.37E-05	0.00	1.98E+11	762.6567	722460.	0.00
38.5088	-0.00521	558260.	-29926.	7.08E-05	0.00	1.98E+11	762.5033	768430.	0.00
38.9464	-0.00480	411628.	-25932.	8.37E-05	0.00	1.98E+11	758.3382	829607.	0.00
39.3840	-0.00433	285907.	-21972.	9.29E-05	0.00	1.98E+11	750.1699	909345.	0.00
39.8216	-0.00382	180873.	-18065.	9.91E-05	0.00	1.98E+11	737.8368	1013209.	0.00
40.2592	-0.00329	96184.	-14235.	1.03E-04	0.00	1.98E+11	720.9533	1150450.	0.00
40.6968	-0.00274	31376.	-10507.	1.05E-04	0.00	1.98E+11	698.7900	1337228.	0.00
41.1344	-0.00219	-14163.	-6913.	1.05E-04	0.00	1.98E+11	670.0185	1604345.	0.00
41.5720	-0.00164	-41226.	-3494.	1.04E-04	0.00	1.98E+11	632.1105	2019100.	0.00
42.0096	-0.00110	-50859.	-312.533	1.03E-04	0.00	1.98E+11	579.6221	2765380.	0.00
42.4472	-5.64E-04	-44509.	2297.	1.02E-04	0.00	1.98E+11	414.1951	3853493.	0.00
42.8848	-3.44E-05	-26737.	3452.	1.01E-04	0.00	1.98E+11	25.5973	3904925.	0.00
43.3224	4.92E-04	-8259.	2546.	1.00E-04	0.00	1.98E+11	-370.571	3956361.	0.00
43.7600	0.00102	0.00	0.00	1.00E-04	0.00	1.98E+11	-599.033	1546573.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	1.96127282 inches
Computed slope at pile head	=	-0.0067515 radians
Maximum bending moment	=	6198338. inch-lbs
Maximum shear force	=	-58773. lbs
Depth of maximum bending moment	=	26.25600000 feet below pile head
Depth of maximum shear force	=	34.13280000 feet below pile head
Number of iterations	=	26
Number of zero deflection points	=	2
Pile deflection at ground	=	0.57509024 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear	=	0. lbs
Moment	=	0. in-lbs
Axial Load	=	0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.76000	1.96127282	6198338.	-58773.
41.57200	1.93072947	6134185.	-58380.
39.38400	2.12940296	6068286.	-64485.
37.19600	3.33582493	5809504.	-70484.
35.00800	8.05907442	5612535.	-77828.
32.82000	30.64322422	5469290.	-88145.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	0.0 lbs
Applied moment at pile head	=	0.0 in-lbs
Axial thrust load on pile head	=	0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.5772	-3.59E-05	-1.80E-07	-0.01168	4.44E-08	1.17E+11	0.00	0.00	0.00
0.4376	3.5158	-4.16E-05	0.00	-0.01168	5.14E-08	1.17E+11	0.00	0.00	0.00
0.8752	3.4545	-3.59E-05	1.0755	-0.01168	4.44E-08	1.17E+11	0.00	0.00	0.4096
1.3128	3.3931	11.2953	35.4729	-0.01168	0.01398	1.17E+11	0.00	0.00	12.6912
1.7504	3.3318	372.5510	148.7334	-0.01168	0.4611	1.17E+11	0.00	0.00	30.4458
2.1880	3.2704	1573.	355.2272	-0.01168	1.9474	1.17E+11	0.00	0.00	48.2005
2.6256	3.2091	4103.	654.9541	-0.01168	5.0788	1.17E+11	0.00	0.00	65.9551
3.0632	3.1478	8452.	1048.	-0.01168	10.4614	1.17E+11	0.00	0.00	83.7098
3.5008	3.0864	15109.	1534.	-0.01168	18.7010	1.17E+11	0.00	0.00	101.4644
3.9384	3.0251	24564.	2114.	-0.01168	30.4037	1.17E+11	0.00	0.00	119.2191

4.3760	2.9637	37306.	2786.	-0.01168	46.1754	1.17E+11	0.00	0.00	136.9737
4.8136	2.9024	53825.	3552.	-0.01168	66.6222	1.17E+11	0.00	0.00	154.7284
5.2512	2.8411	74612.	4411.	-0.01167	92.3501	1.17E+11	0.00	0.00	172.4831
5.6888	2.7798	100154.	5364.	-0.01167	123.9649	1.17E+11	0.00	0.00	190.2377
6.1264	2.7185	130942.	6409.	-0.01166	162.0727	1.17E+11	0.00	0.00	207.9924
6.5640	2.6573	167465.	7548.	-0.01166	207.2795	1.17E+11	0.00	0.00	225.7470
7.0016	2.5961	210214.	8780.	-0.01165	260.1913	1.17E+11	0.00	0.00	243.5017
7.4392	2.5350	259677.	10105.	-0.01164	321.4140	1.17E+11	0.00	0.00	261.2563
7.8768	2.4739	316344.	11524.	-0.01163	391.5536	1.17E+11	0.00	0.00	279.0110
8.3144	2.4128	380705.	13036.	-0.01161	471.2162	1.17E+11	0.00	0.00	296.7656
8.7520	2.3519	453250.	14641.	-0.01159	561.0076	1.17E+11	0.00	0.00	314.5203
9.1896	2.2911	534467.	16339.	-0.01157	661.5339	1.17E+11	0.00	0.00	332.2749
9.6272	2.2304	624847.	18130.	-0.01154	773.4011	1.17E+11	0.00	0.00	350.0296
10.0648	2.1699	724879.	20015.	-0.01151	897.2151	1.17E+11	0.00	0.00	367.7842
10.5024	2.1095	835052.	21993.	-0.01148	1034.	1.17E+11	0.00	0.00	385.5389
10.9400	2.0493	955857.	24064.	-0.01144	1183.	1.17E+11	0.00	0.00	403.2936
11.3776	1.9894	1087783.	26228.	-0.01139	1346.	1.17E+11	0.00	0.00	421.0482
11.8152	1.9297	1231319.	28486.	-0.01134	1524.	1.17E+11	0.00	0.00	438.8029
12.2528	1.8702	1386955.	30837.	-0.01128	1717.	1.17E+11	0.00	0.00	456.5575
12.6904	1.8112	1555181.	33281.	-0.01122	1925.	1.17E+11	0.00	0.00	474.3122
13.1280	1.7524	1736486.	35818.	-0.01114	2149.	1.17E+11	0.00	0.00	492.0668
13.5656	1.6941	1931360.	38449.	-0.01106	2391.	1.17E+11	0.00	0.00	509.8215
14.0032	1.6363	2140292.	41173.	-0.01097	2649.	1.17E+11	0.00	0.00	527.5761
14.4408	1.5789	2363772.	43990.	-0.01087	2926.	1.17E+11	0.00	0.00	545.3308
14.8784	1.5221	2602290.	46900.	-0.01076	3221.	1.17E+11	0.00	0.00	563.0854
15.3160	1.4659	2856335.	49903.	-0.01064	3535.	1.17E+11	0.00	0.00	580.8401
15.7536	1.4104	3126397.	53000.	-0.01050	3870.	1.17E+11	0.00	0.00	598.5947
16.1912	1.3556	3412965.	56190.	-0.01036	4224.	1.17E+11	0.00	0.00	616.3494
16.6288	1.3017	3716528.	59473.	-0.01020	4600.	1.17E+11	0.00	0.00	634.1041
17.0664	1.2486	4037578.	62850.	-0.01002	4997.	1.17E+11	0.00	0.00	651.8587
17.5040	1.1964	4376602.	66319.	-0.00983	5417.	1.17E+11	0.00	0.00	669.6134
17.9416	1.1453	4734091.	68188.	-0.00967	0.00	1.96E+11	-15.743	72.1840	57.7421
18.3792	1.0948	5092738.	68152.	-0.00954	0.00	1.96E+11	-55.784	267.5619	0.00
18.8168	1.0451	5449847.	67748.	-0.00940	0.00	1.96E+11	-97.874	491.7845	0.00
19.2544	0.9961	5804257.	67121.	-0.00925	0.00	1.96E+11	-140.897	742.7691	0.00
19.6920	0.9480	6154782.	66269.	-0.00909	0.00	1.96E+11	-183.814	1018.	0.00
20.1296	0.9007	6500238.	65193.	-0.00892	0.00	1.95E+11	-225.749	1316.	0.00
20.5672	0.8543	6839469.	63903.	-0.00874	0.00	1.95E+11	-265.838	1634.	0.00
21.0048	0.8089	7171369.	62407.	-0.00855	0.00	1.95E+11	-303.877	1973.	0.00
21.4424	0.7645	7494890.	60718.	-0.00835	0.00	1.95E+11	-339.326	2331.	0.00
21.8800	0.7212	7809054.	58853.	-0.00815	0.00	1.95E+11	-371.154	2703.	0.00
22.3176	0.6789	8112984.	55466.	-0.00793	0.00	1.95E+11	-918.716	7106.	0.00
22.7552	0.6379	8391580.	50617.	-0.00771	0.00	1.95E+11	-928.130	7641.	0.00
23.1928	0.5980	8644582.	45721.	-0.00748	0.00	1.94E+11	-936.552	8224.	0.00
23.6304	0.5593	8871759.	40783.	-0.00724	0.00	1.94E+11	-943.950	8862.	0.00
24.0680	0.5219	9072907.	35810.	-0.00700	0.00	1.94E+11	-950.298	9561.	0.00
24.5056	0.4858	9247850.	30806.	-0.00675	0.00	1.94E+11	-955.567	10329.	0.00
24.9432	0.4510	9396443.	25777.	-0.00650	0.00	1.94E+11	-959.728	11175.	0.00
25.3808	0.4175	9518571.	20729.	-0.00624	0.00	1.94E+11	-962.753	12108.	0.00
25.8184	0.3854	9614152.	15669.	-0.00598	0.00	1.94E+11	-964.614	13142.	0.00
26.2560	0.3547	9683133.	10602.	-0.00572	0.00	1.94E+11	-965.279	14291.	0.00
26.6936	0.3253	9725496.	5534.	-0.00546	0.00	1.94E+11	-964.716	15573.	0.00
27.1312	0.2973	9741258.	473.3069	-0.00520	0.00	1.94E+11	-962.892	17006.	0.00
27.5688	0.2707	9730467.	-4575.	-0.00493	0.00	1.94E+11	-959.771	18617.	0.00
28.0064	0.2455	9693211.	-9603.	-0.00467	0.00	1.94E+11	-955.313	20433.	0.00
28.4440	0.2217	9629612.	-14604.	-0.00441	0.00	1.94E+11	-949.476	22492.	0.00
28.8816	0.1992	9539831.	-19571.	-0.00415	0.00	1.94E+11	-942.212	24838.	0.00
29.3192	0.1781	9424068.	-24496.	-0.00389	0.00	1.94E+11	-933.467	27525.	0.00
29.7568	0.1583	9282565.	-29371.	-0.00364	0.00	1.94E+11	-923.182	30621.	0.00
30.1944	0.1399	9115605.	-34187.	-0.00339	0.00	1.94E+11	-911.284	34215.	0.00
30.6320	0.1227	8923517.	-38937.	-0.00315	0.00	1.94E+11	-897.692	38418.	0.00
31.0696	0.1068	8706674.	-43610.	-0.00291	0.00	1.94E+11	-882.303	43379.	0.00

31.5072	0.09215	8465502.	-48198.	-0.00268	0.00	1.95E+11	-864.996	49293.	0.00
31.9448	0.07869	8200478.	-52690.	-0.00245	0.00	1.95E+11	-845.612	56430.	0.00
32.3824	0.06639	7912135.	-57073.	-0.00223	0.00	1.95E+11	-823.953	65168.	0.00
32.8200	0.05522	7601072.	-61336.	-0.00203	0.00	1.95E+11	-799.747	76056.	0.00
33.2576	0.04512	7267956.	-65465.	-0.00183	0.00	1.95E+11	-772.626	89926.	0.00
33.6952	0.03604	6913535.	-69442.	-0.00163	0.00	1.95E+11	-742.051	108107.	0.00
34.1328	0.02795	6538652.	-73247.	-0.00145	0.00	1.95E+11	-707.210	132878.	0.00
34.5704	0.02078	6144267.	-76854.	-0.00128	0.00	1.96E+11	-666.774	168536.	0.00
35.0080	0.01447	5731496.	-80229.	-0.00112	0.00	1.96E+11	-618.349	224419.	0.00
35.4456	0.00897	5301673.	-83314.	-9.76E-04	0.00	1.96E+11	-556.877	326007.	0.00
35.8832	0.00422	4856495.	-86005.	-8.40E-04	0.00	1.96E+11	-467.916	582602.	0.00
36.3208	1.48E-04	4398414.	-87398.	-7.16E-04	0.00	1.96E+11	-62.767	2225389.	0.00
36.7584	-0.00330	3938602.	-86374.	-6.05E-04	0.00	1.96E+11	452.9591	720056.	0.00
37.1960	-0.00620	3491281.	-83188.	-5.05E-04	0.00	1.97E+11	760.3007	643754.	0.00
37.6336	-0.00861	3064925.	-78991.	-4.18E-04	0.00	1.97E+11	838.4054	511293.	0.00
38.0712	-0.01059	2661688.	-74435.	-3.41E-04	0.00	1.97E+11	896.7145	444638.	0.00
38.5088	-0.01220	2283178.	-69604.	-2.76E-04	0.00	1.97E+11	943.2444	406093.	0.00
38.9464	-0.01348	1930678.	-64550.	-2.19E-04	0.00	1.97E+11	981.8663	382363.	0.00
39.3840	-0.01450	1605253.	-59307.	-1.72E-04	0.00	1.97E+11	1015.	367468.	0.00
39.8216	-0.01530	1307812.	-53903.	-1.34E-04	0.00	1.98E+11	1044.	358277.	0.00
40.2592	-0.01591	1039147.	-48356.	-1.02E-04	0.00	1.98E+11	1069.	352957.	0.00
40.6968	-0.01637	799963.	-42681.	-7.80E-05	0.00	1.98E+11	1092.	350342.	0.00
41.1344	-0.01673	590897.	-36889.	-5.95E-05	0.00	1.98E+11	1114.	349629.	0.00
41.5720	-0.01700	412538.	-30989.	-4.62E-05	0.00	1.98E+11	1134.	350237.	0.00
42.0096	-0.01721	265438.	-24986.	-3.72E-05	0.00	1.98E+11	1153.	351728.	0.00
42.4472	-0.01739	150125.	-18884.	-3.17E-05	0.00	1.98E+11	1171.	353766.	0.00
42.8848	-0.01754	67112.	-12685.	-2.88E-05	0.00	1.98E+11	1190.	356100.	0.00
43.3224	-0.01769	16903.	-6390.	-2.76E-05	0.00	1.98E+11	1208.	358550.	0.00
43.7600	-0.01783	0.00	0.00	-2.74E-05	0.00	1.98E+11	1226.	180506.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     3.57717375 inches
Computed slope at pile head      =     -0.0116822 radians
Maximum bending moment           =       9741258. inch-lbs
Maximum shear force              =        -87398. lbs
Depth of maximum bending moment  =    27.13120000 feet below pile head
Depth of maximum shear force     =    36.32080000 feet below pile head
Number of iterations             =             38
Number of zero deflection points =              1
Pile deflection at ground        =     1.16650168 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.76000	3.57717375	9741258.	-87398.
41.57200	3.89351730	9507164.	-94393.
39.38400	5.57836723	9217413.	-100724.
37.19600	13.71727834	8861776.	-108606.
35.00800	59.96661346	8729945.	-126018.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

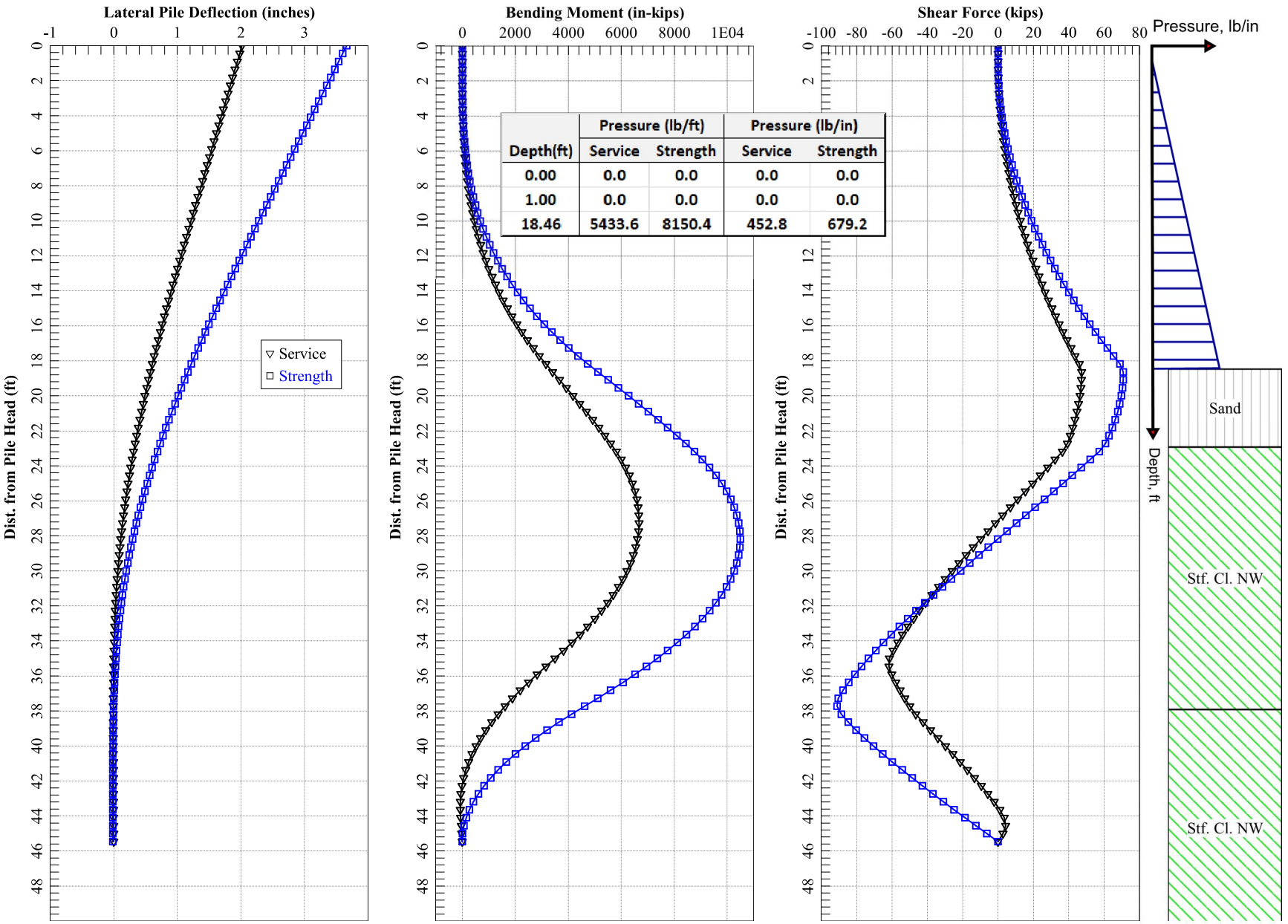
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.9613	-0.00675	-58773.	6198338.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.5772	-0.01168	-87398.	9741258.

Maximum pile-head deflection = 3.5771737485 inches
Maximum pile-head rotation = -0.0116821982 radians = -0.669341 deg.

The analysis ended normally.

Wall 1D (18.46ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
18.46	5433.6	8150.4	452.8	679.2

==========

LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 1D\

Name of input data file:
07 Wall_1D-18.46ft.lp12d

Name of output report file:
07 Wall_1D-18.46ft.lp12o

Name of plot output file:
07 Wall_1D-18.46ft.lp12p

Name of runtime message file:
07 Wall_1D-18.46ft.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 15:37:42

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 1D (H=18.46FT) Boring B-048-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 45.460 ft
Depth of ground surface below top of pile = 18.4600 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	10.0000
2	18.460	10.0000
3	18.460	36.0000
4	45.460	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 18.460000 ft
   AISC Section Type = W
   AISC Section Name = W27X129
   Pile width = 10.000000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 27.000000 ft
   Section Diameter = 36.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W27X129

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 18.460000 ft
   Distance from top of pile to bottom of layer = 22.910000 ft
   Effective unit weight at top of layer = 57.600000 pcf
   Effective unit weight at bottom of layer = 57.600000 pcf
   Friction angle at top of layer = 30.000000 deg.
   Friction angle at bottom of layer = 30.000000 deg.
   Subgrade k at top of layer = 60.000000 pci
   Subgrade k at bottom of layer = 60.000000 pci

Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer = 22.910000 ft
   Distance from top of pile to bottom of layer = 37.910000 ft
   Effective unit weight at top of layer = 62.600000 pcf

```
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =       2500. psf
   Undrained cohesion at bottom of layer               =       2500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    37.910000 ft
   Distance from top of pile to bottom of layer        =    59.410000 ft
   Effective unit weight at top of layer               =    67.600000 pcf
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =       4000. psf
   Undrained cohesion at bottom of layer               =       4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


 (Depth of the lowest soil layer extends 13.950 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.          Name              Depth       Unit Wt.                 Friction        or          kpy
         (p-y Curve Type)         ft          pcf          psf         deg.         krm         pci
-----   ------------------   ----------   ----------   ----------   ----------   ----------   ----------
  1           Sand             18.4600      57.6000       --          30.0000       --          60.0000
         (Reese, et al.)       22.9100      57.6000       --          30.0000       --          60.0000
  2         Stiff Clay          22.9100      62.6000       2500.       --          0.00500       --
         w/o Free Water         37.9100      62.6000       2500.       --          0.00500       --
  3         Stiff Clay          37.9100      67.6000       4000.       --          0.00400       --
         w/o Free Water         59.4100      67.6000       4000.       --          0.00400       --


--------------------------------------------------------------------------------
                        Modification Factors for p-y Curves
--------------------------------------------------------------------------------

Distribution of p-y modifiers with depth defined using 2 points

Point      Depth X         p-mult         y-mult
 No.          ft
-----     ----------     ----------     ----------
  1          18.460         0.8320         1.0000
  2          46.000         0.8320         1.0000



--------------------------------------------------------------------------------
                               Static Loading Type
--------------------------------------------------------------------------------
```

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	18.460	452.800

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	18.460	679.200

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	18.460000 ft
Flange Width	=	10.000000 in
Section Depth	=	27.600000 in
Flange Thickness	=	1.100000 in
Web Thickness	=	0.610000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	37.800000 sq. in.
Moment of Inertia	=	4760. in^4
Elastic Bending Stiffness	=	138040000. kip-in^2
Plastic Modulus, Z	=	395.000000in^3
Plastic Moment Capacity = Fy Z	=	19750.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	1890.000 kips
Nominal Axial Tensile Capacity	=	-1890.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000733	998.1344063	136215990.	13.8000000	2.9031750	
0.00001466	1996.	136215990.	13.8000000	5.8063500	
0.00002198	2994.	136215990.	13.8000000	8.7095251	
0.00002931	3993.	136215990.	13.8000000	11.6127001	
0.00003664	4991.	136215990.	13.8000000	14.5158751	
0.00004397	5989.	136215990.	13.8000000	17.4190501	
0.00005129	6987.	136215990.	13.8000000	20.3222251	
0.00005862	7985.	136215990.	13.8000000	23.2254002	

0.00006595	8983.	136215990.	13.8000000	26.1285752	
0.00007328	9981.	136215990.	13.8000000	29.0317502	
0.00008060	10979.	136215990.	13.8000000	31.9349252	
0.00008793	11978.	136215990.	13.8000000	34.8381003	
0.00009526	12976.	136215990.	13.8000000	37.7412753	
0.0001026	13974.	136215990.	13.8000000	40.6444503	
0.0001099	14972.	136215990.	13.8000000	43.5476253	
0.0001172	15970.	136215990.	13.8000000	46.4508003	
0.0001246	16968.	136215990.	13.8000000	49.3539754	
0.0001319	17697.	134172382.	13.8000000	50.0000000	Y
0.0001392	17934.	128816136.	13.8000000	50.0000000	Y
0.0001466	18087.	123414582.	13.8000000	50.0000000	Y
0.0001539	18217.	118388218.	13.8000000	50.0000000	Y
0.0001612	18331.	113708874.	13.8000000	50.0000000	Y
0.0001685	18429.	109351208.	13.8000000	50.0000000	Y
0.0001759	18517.	105291553.	13.8000000	50.0000000	Y
0.0001832	18593.	101495332.	13.8000000	50.0000000	Y
0.0001905	18661.	97948692.	13.8000000	50.0000000	Y
0.0001978	18722.	94628537.	13.8000000	50.0000000	Y
0.0002052	18776.	91513170.	13.8000000	50.0000000	Y
0.0002125	18825.	88586071.	13.8000000	50.0000000	Y
0.0002198	18868.	85832960.	13.8000000	50.0000000	Y
0.0002272	18908.	83239680.	13.8000000	50.0000000	Y
0.0002345	18944.	80790909.	13.8000000	50.0000000	Y
0.0002418	18977.	78477408.	13.8000000	50.0000000	Y
0.0002491	19007.	76289296.	13.8000000	50.0000000	Y
0.0002565	19034.	74217653.	13.8000000	50.0000000	Y
0.0002638	19059.	72251223.	13.8000000	50.0000000	Y
0.0002711	19082.	70383062.	13.8000000	50.0000000	Y
0.0002784	19104.	68609134.	13.8000000	50.0000000	Y
0.0002858	19123.	66917587.	13.8000000	50.0000000	Y
0.0003004	19159.	63770731.	13.8000000	50.0000000	Y
0.0003151	19189.	60901114.	13.8000000	50.0000000	Y
0.0003297	19215.	58274449.	13.8000000	50.0000000	Y
0.0003444	19239.	55862032.	13.8000000	50.0000000	Y
0.0003591	19259.	53639601.	13.8000000	50.0000000	Y
0.0003737	19277.	51583818.	13.8000000	50.0000000	Y
0.0003884	19293.	49678096.	13.8000000	50.0000000	Y
0.0004030	19308.	47908515.	13.8000000	50.0000000	Y
0.0004177	19320.	46256847.	13.8000000	50.0000000	Y
0.0004323	19332.	44716609.	13.8000000	50.0000000	Y
0.0004470	19342.	43272769.	13.8000000	50.0000000	Y
0.0004616	19352.	41920602.	13.8000000	50.0000000	Y
0.0004763	19360.	40647785.	13.8000000	50.0000000	Y
0.0004909	19368.	39450656.	13.8000000	50.0000000	Y
0.0005056	19376.	38321579.	13.8000000	50.0000000	Y
0.0005203	19382.	37254146.	13.8000000	50.0000000	Y
0.0005349	19388.	36245203.	13.8000000	50.0000000	Y
0.0005496	19394.	35288931.	13.8000000	50.0000000	Y
0.0005642	19399.	34380890.	13.8000000	50.0000000	Y
0.0005789	19403.	33518825.	13.8000000	50.0000000	Y
0.0005935	19408.	32699332.	13.8000000	50.0000000	Y
0.0006082	19412.	31917545.	13.8000000	50.0000000	Y
0.0006228	19416.	31172364.	13.8000000	50.0000000	Y
0.0006375	19419.	30461444.	13.8000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	19419.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	27.000000 ft
Outside Diameter of Casing	=	36.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	10.000000 in
Depth of Core/Insert	=	27.600000 in
Flange Thickness of Core/Insert	=	1.100000 in
Web Thickness of Core/Insert	=	0.610000 in
Moment of Inertia of Steel Core/Insert	=	4760. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1018. sq. in.
Area of Concrete	=	980.382020 sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	37.800000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	37.494000 sq. in.
Area Ratio of All Steel to Gross Area	=	3.68 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	6055.323 kips
Tensile Load for Cracking of Concrete	=	-580.217 kips
Nominal Axial Tensile Capacity	=	-1890.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000733	1617.	220633117.	12.0193140	0.00008807	-0.000176	0.4029049	0.00000	0.00000	-4.216146	C
0.00001466	3224.	219969863.	12.0532800	0.0001766	-0.000351	0.7910535	0.00000	0.00000	-8.417856	C
0.00002198	4821.	219295539.	12.0872556	0.0002657	-0.000526	1.1641537	0.00000	0.00000	-12.605125	C
0.00002931	6408.	218609832.	12.1217418	0.0003553	-0.000700	1.5219696	0.00000	0.00000	-16.777519	C
0.00003664	7984.	217912285.	12.1569247	0.0004454	-0.000874	1.8642637	0.00000	0.00000	-20.934517	C
0.00004397	9549.	217202438.	12.1928339	0.0005361	-0.001047	2.1907770	0.00000	0.00000	-25.075637	C
0.00005129	11104.	216479803.	12.2295006	0.0006273	-0.001219	2.5012384	0.00000	0.00000	-29.200368	C
0.00005862	12647.	215743859.	12.2669583	0.0007191	-0.001391	2.7953639	0.00000	0.00000	-33.308171	C
0.00006595	14178.	214994050.	12.3052427	0.0008115	-0.001563	3.0728552	0.00000	0.00000	-37.398473	C
0.00007328	15698.	214229773.	12.3443920	0.0009045	-0.001733	3.3333988	0.00000	0.00000	-41.470669	C
0.00008060	17205.	213450419.	12.3844472	0.0009982	-0.001903	3.5766652	0.00000	0.00000	-45.524106	C
0.00008793	18699.	212655448.	12.4253113	0.0010926	-0.002073	3.8022778	0.00000	0.00000	-49.558457	C
0.00009526	19729.	207114992.	12.3473140	0.0011762	-0.002253	3.9856605	0.00000	0.00000	-50.000000	CY
0.0001026	20235.	197244719.	12.1532927	0.0012468	-0.002446	4.1281752	0.00000	0.00000	-50.000000	CY
0.0001099	20666.	188017392.	11.9668879	0.0013153	-0.002642	4.2562418	0.00000	0.00000	-50.000000	CY
0.0001172	21039.	179447020.	11.7889372	0.0013822	-0.002839	4.3712170	0.00000	0.00000	-50.000000	CY
0.0001246	21363.	171498403.	11.6193127	0.0014474	-0.003037	4.4741314	0.00000	0.00000	-50.000000	CY
0.0001319	21649.	164133688.	11.4576181	0.0015112	-0.003237	4.5658451	0.00000	0.00000	-50.000000	CY
0.0001392	21902.	157316093.	11.3052107	0.0015740	-0.003438	4.6474227	0.00000	0.00000	-50.000000	CY
0.0001466	22127.	150984930.	11.1585080	0.0016353	-0.003641	4.7189495	0.00000	0.00000	-50.000000	CY
0.0001539	22330.	145111495.	11.0211423	0.0016959	-0.003844	4.7816701	0.00000	0.00000	-50.000000	CY
0.0001612	22511.	139641100.	10.8889586	0.0017554	-0.004048	4.8354704	0.00000	0.00000	-50.000000	CY
0.0001685	22676.	134546364.	10.7635918	0.0018140	-0.004253	4.8810971	0.00000	0.00000	-50.000000	CY
0.0001759	22826.	129794245.	10.6458410	0.0018722	-0.004459	4.9190305	0.00000	0.00000	-50.000000	CY
0.0001832	22962.	125345143.	10.5317479	0.0019293	-0.004666	4.9491953	0.00000	0.00000	-50.000000	CY
0.0001905	23086.	121174266.	10.4231333	0.0019858	-0.004873	4.9721401	0.00000	0.00000	-50.000000	CY
0.0001978	23201.	117266491.	10.3210296	0.0020420	-0.005080	4.9881737	0.00000	0.00000	-50.000000	CY
0.0002052	23306.	113592333.	10.2232546	0.0020975	-0.005289	4.9973756	0.00000	0.00000	-50.000000	CY
0.0002125	23402.	110127237.	10.1283212	0.0021523	-0.005498	4.9977367	0.00000	0.00000	-50.000000	CY
0.0002198	23491.	106860931.	10.0387441	0.0022068	-0.005707	4.9995123	0.00000	0.00000	-50.000000	CY
0.0002272	23574.	103777447.	9.9541589	0.0022611	-0.005916	4.9969348	0.00000	0.00000	-50.000000	CY
0.0002345	23650.	100859551.	9.8728607	0.0023150	-0.006126	4.9999726	0.00000	0.00000	-50.000000	CY
0.0002418	23719.	98089860.	9.7934500	0.0023682	-0.006337	4.9976789	0.00000	0.00000	-50.000000	CY
0.0002491	23784.	95466509.	9.7181048	0.0024211	-0.006548	4.9999968	0.00000	0.00000	-50.000000	CY
0.0002565	23846.	92977465.	9.6469152	0.0024741	-0.006759	4.9971570	0.00000	0.00000	-50.000000	CY
0.0002638	23902.	90610233.	9.5787685	0.0025268	-0.006970	4.9998997	0.00000	0.00000	-50.000000	CY

0.0002711	23955.	88355879.	9.5127808	0.0025791	-0.007181	4.9950101	0.00000	0.00000	-50.000000 CY
0.0002784	24004.	86207187.	9.4480664	0.0026308	-0.007393	4.9990253	0.00000	0.00000	-50.000000 CY
0.0002858	24050.	84155901.	9.3858474	0.0026822	-0.007606	4.9966749	0.00000	0.00000	-50.000000 CY
0.0003004	24134.	80332472.	9.2702387	0.0027851	-0.008030	4.9991891	0.00000	0.00000	-50.000000 CY
0.0003151	24210.	76836547.	9.1633954	0.0028873	-0.008456	4.9941090	0.00000	0.00000	-50.000000 CY
0.0003297	24276.	73620394.	9.0598772	0.0029874	-0.008883	4.9998435	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	24276.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	18.4600	0.00	N.A.	No	0.00	16022.
2	22.9100	0.6967	No	No	16022.	514279.
3	37.9100	11.0357	Yes	No	530300.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.0167	2.44E-05	0.00	-0.00668	2.56E-08	1.36E+11	0.00	0.00	0.00
0.4546	1.9803	3.25E-05	4.66E-07	-0.00668	3.42E-08	1.36E+11	0.00	0.00	0.00
0.9092	1.9438	2.95E-05	1.4496	-0.00668	3.10E-08	1.36E+11	0.00	0.00	0.5315
1.3638	1.9073	15.8158	28.6331	-0.00668	0.01661	1.36E+11	0.00	0.00	9.4346
1.8184	1.8709	312.3986	112.2577	-0.00668	0.3281	1.36E+11	0.00	0.00	21.2240
2.2730	1.8344	1241.	260.1957	-0.00668	1.3031	1.36E+11	0.00	0.00	33.0134
2.7276	1.7979	3151.	472.4473	-0.00668	3.3101	1.36E+11	0.00	0.00	44.8028
3.1822	1.7615	6395.	749.0124	-0.00668	6.7176	1.36E+11	0.00	0.00	56.5922
3.6368	1.7250	11323.	1090.	-0.00668	11.8942	1.36E+11	0.00	0.00	68.3816
4.0914	1.6886	18286.	1495.	-0.00668	19.2083	1.36E+11	0.00	0.00	80.1710
4.5460	1.6521	27635.	1965.	-0.00668	29.0286	1.36E+11	0.00	0.00	91.9604
5.0006	1.6157	39721.	2498.	-0.00668	41.7235	1.36E+11	0.00	0.00	103.7498
5.4552	1.5792	54894.	3097.	-0.00668	57.6616	1.36E+11	0.00	0.00	115.5392
5.9098	1.5428	73505.	3759.	-0.00668	77.2114	1.36E+11	0.00	0.00	127.3286
6.3644	1.5064	95906.	4486.	-0.00667	100.7415	1.36E+11	0.00	0.00	139.1180
6.8190	1.4700	122447.	5277.	-0.00667	128.6203	1.36E+11	0.00	0.00	150.9074
7.2736	1.4336	153478.	6132.	-0.00666	161.2165	1.36E+11	0.00	0.00	162.6968
7.7282	1.3973	189351.	7052.	-0.00666	198.8985	1.36E+11	0.00	0.00	174.4862
8.1828	1.3610	230417.	8036.	-0.00665	242.0349	1.36E+11	0.00	0.00	186.2756
8.6374	1.3248	277027.	9084.	-0.00664	290.9942	1.36E+11	0.00	0.00	198.0650
9.0920	1.2886	329530.	10197.	-0.00663	346.1450	1.36E+11	0.00	0.00	209.8544
9.5466	1.2525	388279.	11374.	-0.00661	407.8557	1.36E+11	0.00	0.00	221.6438
10.0012	1.2164	453623.	12615.	-0.00659	476.4950	1.36E+11	0.00	0.00	233.4332
10.4558	1.1805	525915.	13921.	-0.00657	552.4313	1.36E+11	0.00	0.00	245.2226
10.9104	1.1447	605504.	15291.	-0.00655	636.0331	1.36E+11	0.00	0.00	257.0120
11.3650	1.1090	692741.	16725.	-0.00653	727.6691	1.36E+11	0.00	0.00	268.8014
11.8196	1.0735	787978.	18223.	-0.00650	827.7077	1.36E+11	0.00	0.00	280.5908
12.2742	1.0382	891565.	19786.	-0.00646	936.5175	1.36E+11	0.00	0.00	292.3802
12.7288	1.0030	1003853.	21413.	-0.00642	1054.	1.36E+11	0.00	0.00	304.1696
13.1834	0.9681	1125192.	23105.	-0.00638	1182.	1.36E+11	0.00	0.00	315.9590
13.6380	0.9334	1255935.	24861.	-0.00633	1319.	1.36E+11	0.00	0.00	327.7484
14.0926	0.8990	1396431.	26681.	-0.00628	1467.	1.36E+11	0.00	0.00	339.5378
14.5472	0.8648	1547031.	28565.	-0.00622	1625.	1.36E+11	0.00	0.00	351.3272
15.0018	0.8311	1708087.	30514.	-0.00616	1794.	1.36E+11	0.00	0.00	363.1166
15.4564	0.7977	1879948.	32527.	-0.00609	1975.	1.36E+11	0.00	0.00	374.9060
15.9110	0.7647	2062967.	34604.	-0.00601	2167.	1.36E+11	0.00	0.00	386.6953
16.3656	0.7321	2257493.	36746.	-0.00592	2371.	1.36E+11	0.00	0.00	398.4847
16.8202	0.7001	2463878.	38952.	-0.00583	2588.	1.36E+11	0.00	0.00	410.2741
17.2748	0.6686	2682473.	41222.	-0.00572	2818.	1.36E+11	0.00	0.00	422.0635
17.7294	0.6377	2913627.	43557.	-0.00561	3061.	1.36E+11	0.00	0.00	433.8529
18.1840	0.6074	3157693.	45956.	-0.00549	3317.	1.36E+11	0.00	0.00	445.6423
18.6386	0.5778	3415021.	47269.	-0.00538	0.00	2.20E+11	-12.390	116.9833	48.4395
19.0932	0.5486	3673421.	47243.	-0.00530	0.00	2.20E+11	-45.686	454.2607	0.00
19.5478	0.5200	3930462.	46899.	-0.00520	0.00	2.20E+11	-80.614	845.6920	0.00
20.0024	0.4919	4185104.	46362.	-0.00510	0.00	2.20E+11	-116.114	1288.	0.00

20.4570	0.4644	4436290.	45631.	-0.00499	0.00	2.19E+11	-151.806	1783.	0.00
20.9116	0.4374	4682959.	44709.	-0.00488	0.00	2.19E+11	-186.480	2326.	0.00
21.3662	0.4111	4924078.	43602.	-0.00476	0.00	2.19E+11	-219.258	2909.	0.00
21.8208	0.3855	5158673.	42321.	-0.00463	0.00	2.19E+11	-250.231	3541.	0.00
22.2754	0.3606	5385820.	40880.	-0.00450	0.00	2.19E+11	-278.346	4211.	0.00
22.7300	0.3364	5604685.	39295.	-0.00437	0.00	2.19E+11	-302.722	4909.	0.00
23.1846	0.3129	5814540.	36407.	-0.00422	0.00	2.19E+11	-756.069	13180.	0.00
23.6392	0.2903	6001896.	32266.	-0.00408	0.00	2.19E+11	-762.166	14323.	0.00
24.0938	0.2685	6166570.	28094.	-0.00392	0.00	2.19E+11	-767.210	15590.	0.00
24.5484	0.2475	6308412.	23898.	-0.00377	0.00	2.19E+11	-771.167	17000.	0.00
25.0030	0.2273	6427306.	19683.	-0.00361	0.00	2.19E+11	-774.001	18573.	0.00
25.4576	0.2081	6523165.	15456.	-0.00345	0.00	2.19E+11	-775.677	20336.	0.00
25.9122	0.1897	6595941.	11224.	-0.00328	0.00	2.19E+11	-776.159	22318.	0.00
26.3668	0.1722	6645619.	6992.	-0.00312	0.00	2.18E+11	-775.408	24558.	0.00
26.8214	0.1557	6672222.	2767.	-0.00295	0.00	2.18E+11	-773.385	27101.	0.00
27.2760	0.1400	6675809.	-1443.	-0.00279	0.00	2.18E+11	-770.046	30001.	0.00
27.7306	0.1253	6656481.	-5631.	-0.00262	0.00	2.18E+11	-765.342	33327.	0.00
28.1852	0.1114	6614376.	-9789.	-0.00245	0.00	2.18E+11	-759.221	37167.	0.00
28.6398	0.09850	6549678.	-13910.	-0.00229	0.00	2.19E+11	-751.625	41628.	0.00
29.0944	0.08645	6462612.	-17985.	-0.00213	0.00	2.19E+11	-742.484	46853.	0.00
29.5490	0.07528	6353450.	-22006.	-0.00197	0.00	2.19E+11	-731.719	53023.	0.00
30.0036	0.06498	6222512.	-25964.	-0.00181	0.00	2.19E+11	-719.237	60382.	0.00
30.4582	0.05552	6070171.	-29849.	-0.00166	0.00	2.19E+11	-704.924	69258.	0.00
30.9128	0.04689	5896852.	-33650.	-0.00151	0.00	2.19E+11	-688.636	80109.	0.00
31.3674	0.03907	5703039.	-37356.	-0.00136	0.00	2.19E+11	-670.190	93585.	0.00
31.8220	0.03201	5489283.	-40955.	-0.00122	0.00	2.19E+11	-649.344	110648.	0.00
32.2766	0.02571	5256202.	-44433.	-0.00109	0.00	2.19E+11	-625.761	132785.	0.00
32.7312	0.02012	5004499.	-47774.	-9.63E-04	0.00	2.19E+11	-598.955	162430.	0.00
33.1858	0.01520	4734972.	-50957.	-8.42E-04	0.00	2.19E+11	-568.174	203872.	0.00
33.6404	0.01093	4448536.	-53958.	-7.27E-04	0.00	2.19E+11	-532.166	265533.	0.00
34.0950	0.00727	4146263.	-56743.	-6.21E-04	0.00	2.20E+11	-488.580	366812.	0.00
34.5496	0.00416	3829451.	-59254.	-5.22E-04	0.00	2.20E+11	-432.080	566418.	0.00
35.0042	0.00158	3499780.	-61372.	-4.31E-04	0.00	2.20E+11	-344.519	1192930.	0.00
35.4588	-5.37E-04	3159857.	-61727.	-3.48E-04	0.00	2.20E+11	214.4127	2179660.	0.00
35.9134	-0.00222	2826314.	-60086.	-2.74E-04	0.00	2.20E+11	387.1711	950856.	0.00
36.3680	-0.00352	2504294.	-57826.	-2.08E-04	0.00	2.20E+11	441.2929	683189.	0.00
36.8226	-0.00449	2195406.	-55324.	-1.50E-04	0.00	2.20E+11	475.9674	578593.	0.00
37.2772	-0.00515	1900682.	-52662.	-9.88E-05	0.00	2.20E+11	500.1717	529306.	0.00
37.7318	-0.00557	1620843.	-49886.	-5.53E-05	0.00	2.21E+11	517.4085	507139.	0.00
38.1864	-0.00576	1356402.	-46434.	-1.84E-05	0.00	2.21E+11	748.4289	709098.	0.00
38.6410	-0.00577	1114233.	-42316.	1.21E-05	0.00	2.21E+11	761.0370	719899.	0.00
39.0956	-0.00563	894712.	-38144.	3.69E-05	0.00	2.21E+11	768.5729	745266.	0.00
39.5502	-0.00536	698063.	-33943.	5.66E-05	0.00	2.21E+11	771.5620	784682.	0.00
40.0048	-0.00501	524376.	-29738.	7.17E-05	0.00	2.21E+11	770.3164	839100.	0.00
40.4594	-0.00458	373612.	-25550.	8.28E-05	0.00	2.21E+11	764.9820	910900.	0.00
40.9140	-0.00410	245614.	-21403.	9.05E-05	0.00	2.21E+11	755.5489	1004248.	0.00
41.3686	-0.00359	140100.	-17318.	9.53E-05	0.00	2.21E+11	741.8290	1125989.	0.00
41.8232	-0.00306	56662.	-13322.	9.77E-05	0.00	2.21E+11	723.3909	1287558.	0.00
42.2778	-0.00253	-5248.	-9441.	9.83E-05	0.00	2.21E+11	699.4201	1509199.	0.00
42.7324	-0.00199	-46344.	-5710.	9.77E-05	0.00	2.21E+11	668.4131	1830396.	0.00
43.1870	-0.00146	-67548.	-2176.	9.63E-05	0.00	2.21E+11	627.4360	2340691.	0.00
43.6416	-9.42E-04	-70080.	1090.	9.46E-05	0.00	2.21E+11	569.8837	3301608.	0.00
44.0962	-4.30E-04	-55654.	3525.	9.30E-05	0.00	2.21E+11	322.9435	4093449.	0.00
44.5508	7.34E-05	-31616.	4254.	9.19E-05	0.00	2.21E+11	-55.789	4148958.	0.00
45.0054	5.73E-04	-9239.	2898.	9.14E-05	0.00	2.21E+11	-441.486	4204471.	0.00
45.4600	0.00107	0.00	0.00	9.13E-05	0.00	2.21E+11	-620.912	1581273.	0.00

* This analysis computed pile response using nonlinear moment-curvature rela-

tionships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	2.01672406	inches
Computed slope at pile head	=	-0.0066843	radians
Maximum bending moment	=	6675809.	inch-lbs
Maximum shear force	=	-61727.	lbs
Depth of maximum bending moment	=	27.27600000	feet below pile head
Depth of maximum shear force	=	35.45880000	feet below pile head
Number of iterations	=	27	
Number of zero deflection points	=	2	
Pile deflection at ground	=	0.58940528	inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear	=	0. lbs
Moment	=	0. in-lbs
Axial Load	=	0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
45.46000	2.01672406	6675809.	-61727.
43.18700	2.03424890	6707343.	-62248.
40.91400	2.15142354	6552101.	-67080.
38.64100	3.40851033	6347770.	-74306.
36.36800	7.82067723	6058018.	-80881.
34.09500	35.47252015	5983983.	-94159.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	0.0 lbs
Applied moment at pile head	=	0.0 in-lbs
Axial thrust load on pile head	=	0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch

0.00	3.6640	3.25E-05	0.00	-0.01154	3.42E-08	1.36E+11	0.00	0.00	0.00
0.4546	3.6010	8.13E-06	-2.98E-06	-0.01154	8.54E-09	1.36E+11	0.00	0.00	0.00
0.9092	3.5381	0.00	2.1744	-0.01154	0.00	1.36E+11	0.00	0.00	0.7972
1.3638	3.4751	23.7236	42.9497	-0.01154	0.02492	1.36E+11	0.00	0.00	14.1519
1.8184	3.4122	468.5979	168.3865	-0.01154	0.4922	1.36E+11	0.00	0.00	31.8360
2.2730	3.3492	1861.	390.2936	-0.01154	1.9547	1.36E+11	0.00	0.00	49.5201
2.7276	3.2863	4727.	708.6710	-0.01154	4.9652	1.36E+11	0.00	0.00	67.2042
3.1822	3.2233	9593.	1124.	-0.01154	10.0764	1.36E+11	0.00	0.00	84.8883
3.6368	3.1604	16985.	1635.	-0.01154	17.8413	1.36E+11	0.00	0.00	102.5724
4.0914	3.0974	27429.	2243.	-0.01154	28.8125	1.36E+11	0.00	0.00	120.2565
4.5460	3.0345	41453.	2947.	-0.01154	43.5429	1.36E+11	0.00	0.00	137.9406
5.0006	2.9716	59581.	3748.	-0.01153	62.5853	1.36E+11	0.00	0.00	155.6247
5.4552	2.9087	82341.	4645.	-0.01153	86.4924	1.36E+11	0.00	0.00	173.3088
5.9098	2.8458	110258.	5638.	-0.01153	115.8171	1.36E+11	0.00	0.00	190.9929
6.3644	2.7829	143859.	6729.	-0.01152	151.1122	1.36E+11	0.00	0.00	208.6770
6.8190	2.7201	183670.	7915.	-0.01152	192.9305	1.36E+11	0.00	0.00	226.3611
7.2736	2.6573	230217.	9198.	-0.01151	241.8248	1.36E+11	0.00	0.00	244.0452
7.7282	2.5945	284027.	10578.	-0.01150	298.3478	1.36E+11	0.00	0.00	261.7293
8.1828	2.5318	345626.	12054.	-0.01148	363.0524	1.36E+11	0.00	0.00	279.4134
8.6374	2.4692	415540.	13626.	-0.01147	436.4914	1.36E+11	0.00	0.00	297.0975
9.0920	2.4067	494295.	15295.	-0.01145	519.2175	1.36E+11	0.00	0.00	314.7816
9.5466	2.3443	582418.	17061.	-0.01143	611.7836	1.36E+11	0.00	0.00	332.4657
10.0012	2.2820	680435.	18923.	-0.01140	714.7425	1.36E+11	0.00	0.00	350.1498
10.4558	2.2199	788872.	20881.	-0.01137	828.6469	1.36E+11	0.00	0.00	367.8339
10.9104	2.1579	908255.	22936.	-0.01134	954.0497	1.36E+11	0.00	0.00	385.5180
11.3650	2.0961	1039112.	25087.	-0.01130	1092.	1.36E+11	0.00	0.00	403.2021
11.8196	2.0346	1181967.	27335.	-0.01126	1242.	1.36E+11	0.00	0.00	420.8862
12.2742	1.9733	1337347.	29679.	-0.01121	1405.	1.36E+11	0.00	0.00	438.5703
12.7288	1.9123	1505779.	32120.	-0.01115	1582.	1.36E+11	0.00	0.00	456.2544
13.1834	1.8517	1687789.	34657.	-0.01109	1773.	1.36E+11	0.00	0.00	473.9384
13.6380	1.7914	1883902.	37291.	-0.01101	1979.	1.36E+11	0.00	0.00	491.6225
14.0926	1.7315	2094646.	40021.	-0.01093	2200.	1.36E+11	0.00	0.00	509.3066
14.5472	1.6721	2320547.	42848.	-0.01085	2438.	1.36E+11	0.00	0.00	526.9907
15.0018	1.6132	2562130.	45771.	-0.01075	2691.	1.36E+11	0.00	0.00	544.6748
15.4564	1.5548	2819923.	48790.	-0.01064	2962.	1.36E+11	0.00	0.00	562.3589
15.9110	1.4971	3094451.	51906.	-0.01052	3250.	1.36E+11	0.00	0.00	580.0430
16.3656	1.4400	3386240.	55119.	-0.01039	3557.	1.36E+11	0.00	0.00	597.7271
16.8202	1.3837	3695817.	58428.	-0.01025	3882.	1.36E+11	0.00	0.00	615.4112
17.2748	1.3282	4023709.	61833.	-0.01010	4227.	1.36E+11	0.00	0.00	633.0953
17.7294	1.2735	4370441.	65335.	-0.00993	4591.	1.36E+11	0.00	0.00	650.7794
18.1840	1.2198	4736539.	68933.	-0.00975	4975.	1.36E+11	0.00	0.00	668.4635
18.6386	1.1672	5122531.	70912.	-0.00959	0.00	2.19E+11	-15.596	72.8907	72.6593
19.0932	1.1152	5510220.	70911.	-0.00945	0.00	2.19E+11	-57.565	281.5795	0.00
19.5478	1.0640	5896197.	70476.	-0.00931	0.00	2.19E+11	-101.771	521.7624	0.00
20.0024	1.0136	6279145.	69798.	-0.00916	0.00	2.19E+11	-146.956	790.8848	0.00
20.4570	0.9641	6657720.	68873.	-0.00900	0.00	2.18E+11	-191.947	1086.	0.00
20.9116	0.9155	7030582.	67707.	-0.00883	0.00	2.18E+11	-235.765	1405.	0.00
21.3662	0.8678	7396428.	66307.	-0.00865	0.00	2.18E+11	-277.444	1744.	0.00
21.8208	0.8211	7754018.	64686.	-0.00846	0.00	2.18E+11	-317.017	2106.	0.00
22.2754	0.7755	8102174.	62857.	-0.00826	0.00	2.18E+11	-353.384	2486.	0.00
22.7300	0.7310	8439813.	60841.	-0.00805	0.00	2.18E+11	-385.631	2878.	0.00
23.1846	0.6876	8765976.	57279.	-0.00784	0.00	2.18E+11	-920.528	7303.	0.00
23.6392	0.6455	9064745.	52229.	-0.00761	0.00	2.17E+11	-930.706	7866.	0.00
24.0938	0.6046	9335817.	47127.	-0.00738	0.00	2.17E+11	-939.844	8480.	0.00
24.5484	0.5649	9578920.	41978.	-0.00714	0.00	2.17E+11	-947.910	9153.	0.00
25.0030	0.5266	9793814.	36788.	-0.00690	0.00	2.17E+11	-954.875	9891.	0.00
25.4576	0.4896	9980291.	31563.	-0.00665	0.00	2.17E+11	-960.707	10703.	0.00

25.9122	0.4540	1.01E+07	26309.	-0.00640	0.00	2.17E+11	-965.376	11599.	0.00
26.3668	0.4198	1.03E+07	21034.	-0.00614	0.00	2.17E+11	-968.853	12589.	0.00
26.8214	0.3870	1.04E+07	15742.	-0.00588	0.00	2.17E+11	-971.106	13689.	0.00
27.2760	0.3556	1.04E+07	10442.	-0.00562	0.00	2.17E+11	-972.102	14912.	0.00
27.7306	0.3257	1.05E+07	5140.	-0.00536	0.00	2.17E+11	-971.808	16278.	0.00
28.1852	0.2972	1.05E+07	-157.297	-0.00509	0.00	2.17E+11	-970.187	17811.	0.00
28.6398	0.2701	1.05E+07	-5442.	-0.00483	0.00	2.17E+11	-967.201	19536.	0.00
29.0944	0.2444	1.04E+07	-10706.	-0.00457	0.00	2.17E+11	-962.809	21486.	0.00
29.5490	0.2202	1.04E+07	-15942.	-0.00431	0.00	2.17E+11	-956.964	23702.	0.00
30.0036	0.1975	1.03E+07	-21143.	-0.00405	0.00	2.17E+11	-949.617	26234.	0.00
30.4582	0.1761	1.01E+07	-26299.	-0.00379	0.00	2.17E+11	-940.711	29141.	0.00
30.9128	0.1561	9974927.	-31402.	-0.00354	0.00	2.17E+11	-930.182	32503.	0.00
31.3674	0.1375	9789783.	-36443.	-0.00329	0.00	2.17E+11	-917.955	36417.	0.00
31.8220	0.1202	9577321.	-41412.	-0.00305	0.00	2.17E+11	-903.942	41012.	0.00
32.2766	0.1043	9337959.	-46300.	-0.00281	0.00	2.17E+11	-888.038	46455.	0.00
32.7312	0.08960	9072169.	-51096.	-0.00258	0.00	2.17E+11	-870.112	52974.	0.00
33.1858	0.07617	8780485.	-55787.	-0.00235	0.00	2.18E+11	-850.000	60879.	0.00
33.6404	0.06393	8463506.	-60363.	-0.00214	0.00	2.18E+11	-827.492	70610.	0.00
34.0950	0.05285	8121902.	-64808.	-0.00193	0.00	2.18E+11	-802.303	82811.	0.00
34.5496	0.04288	7756421.	-69108.	-0.00173	0.00	2.18E+11	-774.038	98465.	0.00
35.0042	0.03397	7367906.	-73243.	-0.00154	0.00	2.18E+11	-742.127	119165.	0.00
35.4588	0.02607	6957306.	-77193.	-0.00136	0.00	2.18E+11	-705.692	147674.	0.00
35.9134	0.01911	6525705.	-80927.	-0.00119	0.00	2.19E+11	-663.282	189319.	0.00
36.3680	0.01304	6074365.	-84406.	-0.00104	0.00	2.19E+11	-612.220	256029.	0.00
36.8226	0.00780	5604806.	-87566.	-8.91E-04	0.00	2.19E+11	-546.636	382153.	0.00
37.2772	0.00332	5118980.	-90280.	-7.57E-04	0.00	2.19E+11	-448.250	735702.	0.00
37.7318	-4.61E-04	4619814.	-90961.	-6.36E-04	0.00	2.19E+11	198.4821	2351248.	0.00
38.1864	-0.00362	4126554.	-88602.	-5.28E-04	0.00	2.20E+11	666.4151	1004816.	0.00
38.6410	-0.00622	3653127.	-84669.	-4.31E-04	0.00	2.20E+11	775.5133	680585.	0.00
39.0956	-0.00832	3202778.	-80242.	-3.46E-04	0.00	2.20E+11	847.6230	555802.	0.00
39.5502	-0.00999	2777654.	-75471.	-2.72E-04	0.00	2.20E+11	901.4165	492259.	0.00
40.0048	-0.01128	2379355.	-70438.	-2.08E-04	0.00	2.20E+11	943.8646	456310.	0.00
40.4594	-0.01226	2009145.	-65195.	-1.53E-04	0.00	2.20E+11	978.4565	435486.	0.00
40.9140	-0.01296	1668053.	-59779.	-1.08E-04	0.00	2.21E+11	1007.	424031.	0.00
41.3686	-0.01343	1356937.	-54217.	-7.06E-05	0.00	2.21E+11	1032.	418881.	0.00
41.8232	-0.01373	1076520.	-48533.	-4.05E-05	0.00	2.21E+11	1053.	418229.	0.00
42.2778	-0.01388	827424.	-42742.	-1.70E-05	0.00	2.21E+11	1071.	420907.	0.00
42.7324	-0.01391	610192.	-36857.	8.13E-07	0.00	2.21E+11	1087.	426097.	0.00
43.1870	-0.01387	425301.	-30889.	1.36E-05	0.00	2.21E+11	1101.	433187.	0.00
43.6416	-0.01376	273181.	-24845.	2.22E-05	0.00	2.21E+11	1115.	441688.	0.00
44.0962	-0.01363	154228.	-18732.	2.75E-05	0.00	2.21E+11	1127.	451205.	0.00
44.5508	-0.01346	68812.	-12551.	3.03E-05	0.00	2.21E+11	1139.	461412.	0.00
45.0054	-0.01329	17288.	-6307.	3.14E-05	0.00	2.21E+11	1150.	472063.	0.00
45.4600	-0.01312	0.00	0.00	3.16E-05	0.00	2.21E+11	1162.	241500.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection = 3.66395314 inches
Computed slope at pile head = -0.0115391 radians
Maximum bending moment = 10495167. inch-lbs

```
Maximum shear force              =        -90961. lbs
Depth of maximum bending moment  =    28.18520000 feet below pile head
Depth of maximum shear force     =    37.73180000 feet below pile head
Number of iterations             =             37
Number of zero deflection points =              1
Pile deflection at ground        =     1.18788220 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
45.46000	3.66395314	10495167.	-90961.
43.18700	4.07877888	10373830.	-100557.
40.91400	5.45881842	9958779.	-105197.
38.64100	14.10304078	9719391.	-115406.
36.36800	54.91508433	9423486.	-130335.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

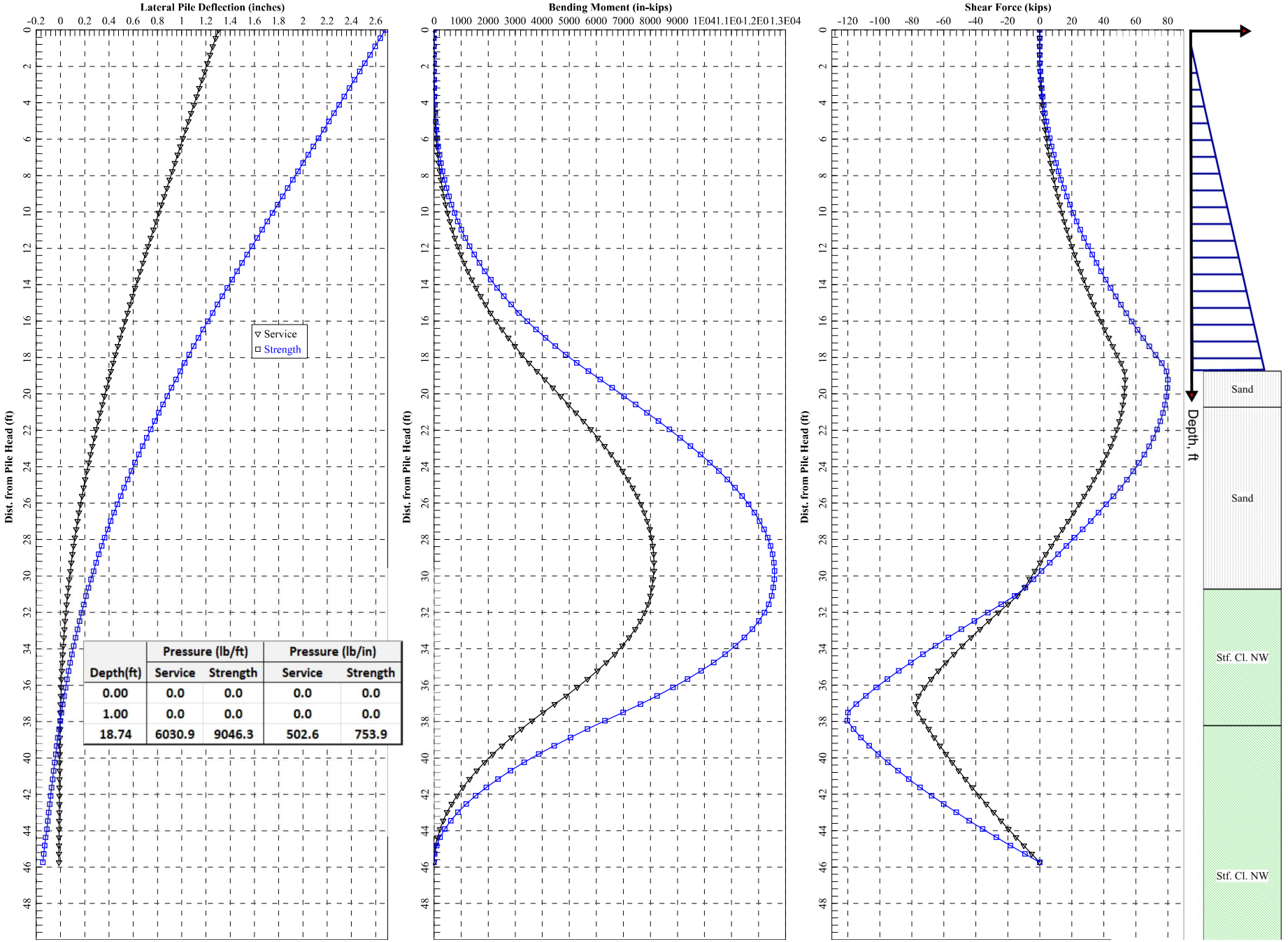
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	2.0167	-0.00668	-61727.	6675809.
2	V, lb	0.00	M, in-lb	0.00	0.00	3.6640	-0.01154	-90961.	1.05E+07

```
Maximum pile-head deflection = 3.6639531397 inches
Maximum pile-head rotation   = -0.0115390807 radians = -0.661141 deg.

The analysis ended normally.
```

Wall 2 (18.74 ft): Boring B-046-0-20



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
18.74	6030.9	9046.3	502.6	753.9

==

LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 2\

Name of input data file:
Wall_2-18.74 ft_B-0460-20.lp12d

Name of output report file:
Wall_2-18.74 ft_B-0460-20.lp12o

Name of plot output file:
Wall_2-18.74 ft_B-0460-20.lp12p

Name of runtime message file:
Wall_2-18.74 ft_B-0460-20.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 19:53:30

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 2(H=18.74FT) Boring B-046-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	2
Total length of pile	=	45.740 ft
Depth of ground surface below top of pile	=	18.7400 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	11.5000
2	18.740	11.5000
3	18.740	48.0000
4	45.740	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 18.740000 ft
   AISC Section Type = W
   AISC Section Name = W33X169
   Pile width = 11.500000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 27.000000 ft
   Section Diameter = 48.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W33X169

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 18.740000 ft
   Distance from top of pile to bottom of layer = 20.720000 ft
   Effective unit weight at top of layer = 57.600000 pcf
   Effective unit weight at bottom of layer = 57.600000 pcf
   Friction angle at top of layer = 30.000000 deg.
   Friction angle at bottom of layer = 30.000000 deg.
   Subgrade k at top of layer = 60.000000 pci
   Subgrade k at bottom of layer = 60.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 20.720000 ft
   Distance from top of pile to bottom of layer = 30.720000 ft
   Effective unit weight at top of layer = 62.600000 pcf

```
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    33.000000 deg.
   Friction angle at bottom of layer                  =    33.000000 deg.
   Subgrade k at top of layer                         =    90.000000 pci
   Subgrade k at bottom of layer                      =    90.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer          =    30.720000 ft
   Distance from top of pile to bottom of layer       =    38.220000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        4000. psf
   Undrained cohesion at bottom of layer              =        4000. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer          =    38.220000 ft
   Distance from top of pile to bottom of layer       =    54.720000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        3000. psf
   Undrained cohesion at bottom of layer              =        3000. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000


 (Depth of the lowest soil layer extends 8.980 ft below the pile tip)


-------------------------------------------------------------------------------
                      Summary of Input Soil Properties
-------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.           Name             Depth       Unit Wt.                 Friction        or          kpy
         (p-y Curve Type)          ft          pcf          psf         deg.         krm         pci
-----   ------------------   ----------   ----------   ----------   ----------   ----------   ----------
  1           Sand             18.7400      57.6000       --          30.0000       --          60.0000
         (Reese, et al.)       20.7200      57.6000       --          30.0000       --          60.0000
  2           Sand             20.7200      62.6000       --          33.0000       --          90.0000
         (Reese, et al.)       30.7200      62.6000       --          33.0000       --          90.0000
  3         Stiff Clay         30.7200      62.6000       4000.       --          0.00400       --
         w/o Free Water        38.2200      62.6000       4000.       --          0.00400       --
  4         Stiff Clay         38.2200      62.6000       3000.       --          0.00500       --
         w/o Free Water        54.7200      62.6000       3000.       --          0.00500       --


-------------------------------------------------------------------------------
                    Modification Factors for p-y Curves
-------------------------------------------------------------------------------

Distribution of p-y modifiers with depth defined using 2 points
```

Point No.	Depth X ft	p-mult	y-mult
1	18.740	0.7930	1.0000
2	46.000	0.7930	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	18.740	502.600

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	18.740	753.900

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1		Condition 2		Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M =	0.0000 in-lbs		0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M =	0.0000 in-lbs		0.0000000	Yes	Yes

V = shear force applied normal to pile axis

M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	18.740000 ft
Flange Width	=	11.500000 in
Section Depth	=	33.800000 in
Flange Thickness	=	1.220000 in
Web Thickness	=	0.670000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	49.500000 sq. in.
Moment of Inertia	=	9290. in^4
Elastic Bending Stiffness	=	269410000. kip-in^2
Plastic Modulus, Z	=	629.000000in^3
Plastic Moment Capacity = Fy Z	=	31450.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	2475.000 kips
Nominal Axial Tensile Capacity	=	-2475.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000637	1693.	265693210.	16.9000000	3.0915978	
0.00001274	3386.	265693210.	16.9000000	6.1831957	
0.00001912	5079.	265693210.	16.9000000	9.2747935	
0.00002549	6772.	265693210.	16.9000000	12.3663914	
0.00003186	8465.	265693210.	16.9000000	15.4579892	
0.00003823	10158.	265693210.	16.9000000	18.5495871	
0.00004460	11851.	265693210.	16.9000000	21.6411849	
0.00005097	13544.	265693210.	16.9000000	24.7327828	
0.00005735	15237.	265693210.	16.9000000	27.8243806	
0.00006372	16929.	265693210.	16.9000000	30.9159784	
0.00007009	18622.	265693210.	16.9000000	34.0075763	
0.00007646	20315.	265693210.	16.9000000	37.0991741	
0.00008283	22008.	265693210.	16.9000000	40.1907720	
0.00008921	23701.	265693210.	16.9000000	43.2823698	
0.00009558	25394.	265693210.	16.9000000	46.3739677	
0.0001019	27087.	265693210.	16.9000000	49.4655655	
0.0001083	28203.	260363688.	16.9000000	50.0000000	Y
0.0001147	28553.	248954951.	16.9000000	50.0000000	Y
0.0001211	28811.	237981856.	16.9000000	50.0000000	Y
0.0001274	29032.	227815021.	16.9000000	50.0000000	Y
0.0001338	29222.	218387282.	16.9000000	50.0000000	Y
0.0001402	29387.	209639324.	16.9000000	50.0000000	Y
0.0001466	29530.	201502088.	16.9000000	50.0000000	Y
0.0001529	29657.	193933140.	16.9000000	50.0000000	Y
0.0001593	29768.	186871359.	16.9000000	50.0000000	Y
0.0001657	29867.	180280704.	16.9000000	50.0000000	Y
0.0001720	29955.	174116498.	16.9000000	50.0000000	Y
0.0001784	30034.	168340016.	16.9000000	50.0000000	Y
0.0001848	30104.	162917461.	16.9000000	50.0000000	Y
0.0001912	30168.	157819143.	16.9000000	50.0000000	Y
0.0001975	30225.	153018816.	16.9000000	50.0000000	Y
0.0002039	30277.	148493137.	16.9000000	50.0000000	Y
0.0002103	30325.	144221232.	16.9000000	50.0000000	Y
0.0002166	30369.	140182713.	16.9000000	50.0000000	Y
0.0002230	30409.	136352858.	16.9000000	50.0000000	Y
0.0002294	30445.	132725391.	16.9000000	50.0000000	Y
0.0002358	30479.	129282090.	16.9000000	50.0000000	Y
0.0002421	30510.	126006054.	16.9000000	50.0000000	Y
0.0002485	30539.	122893837.	16.9000000	50.0000000	Y
0.0002612	30590.	117094882.	16.9000000	50.0000000	Y
0.0002740	30634.	111808788.	16.9000000	50.0000000	Y
0.0002867	30672.	106972176.	16.9000000	50.0000000	Y
0.0002995	30706.	102531944.	16.9000000	50.0000000	Y
0.0003122	30736.	98443169.	16.9000000	50.0000000	Y
0.0003250	30762.	94662918.	16.9000000	50.0000000	Y
0.0003377	30785.	91158778.	16.9000000	50.0000000	Y
0.0003504	30806.	87905231.	16.9000000	50.0000000	Y
0.0003632	30824.	84870101.	16.9000000	50.0000000	Y
0.0003759	30842.	82039615.	16.9000000	50.0000000	Y
0.0003887	30856.	79387115.	16.9000000	50.0000000	Y
0.0004014	30870.	76901724.	16.9000000	50.0000000	Y
0.0004142	30883.	74565833.	16.9000000	50.0000000	Y

0.0004269	30894.	72365743.	16.9000000	50.0000000	Y
0.0004397	30905.	70293195.	16.9000000	50.0000000	Y
0.0004524	30914.	68333535.	16.9000000	50.0000000	Y
0.0004651	30922.	66479585.	16.9000000	50.0000000	Y
0.0004779	30931.	64724513.	16.9000000	50.0000000	Y
0.0004906	30939.	63058987.	16.9000000	50.0000000	Y
0.0005034	30945.	61475189.	16.9000000	50.0000000	Y
0.0005161	30951.	59969602.	16.9000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	30951.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	27.000000	ft
Outside Diameter of Casing	=	48.000000	in
Casing Wall Thickness	=	0.0000	in
Moment of Inertia of Steel Casing	=	0.0000	in^4
Width Flange of Core/Insert	=	11.500000	in
Depth of Core/Insert	=	33.800000	in
Flange Thickness of Core/Insert	=	1.220000	in
Web Thickness of Core/Insert	=	0.670000	in
Moment of Inertia of Steel Core/Insert	=	9290.	in^4
Yield Stress of Casing	=	50000.	psi
Elastic Modulus of Casing	=	29000000.	psi
Yield Stress of Core/Insert	=	50000.	psi
Elastic Modulus of Core/Insert	=	29000000.	psi
Number of Reinforcing Bars	=	0	bars
Gross Area of Pile	=	1810.	sq. in.
Area of Concrete	=	1760.	sq. in.
Cross-sectional Area of Steel Casing	=	0.0000	sq. in.
Cross-sectional Area of Steel Core/Insert	=	49.500000	sq. in.

Area of All Steel (Casing, Core/Insert, and Bars) = 49.071200 sq. in.
Area Ratio of All Steel to Gross Area = 2.71 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 9955.244 kips
Tensile Load for Cracking of Concrete = -980.682 kips
Nominal Axial Tensile Capacity = -2475.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000637	3181.	499178080.	14.8162556	0.00009441	-0.000211	0.4307050	0.00000	0.00000	-4.845692	C
0.00001274	6339.	497400575.	14.8656104	0.0001894	-0.000422	0.8447338	0.00000	0.00000	-9.673144	C
0.00001912	9473.	495587357.	14.9161188	0.0002851	-0.000632	1.2417803	0.00000	0.00000	-14.481717	C
0.00002549	12584.	493736819.	14.9678371	0.0003815	-0.000842	1.6215227	0.00000	0.00000	-19.270729	C
0.00003186	15670.	491847238.	15.0208257	0.0004785	-0.001051	1.9836217	0.00000	0.00000	-24.039454	C
0.00003823	18730.	489916760.	15.0751499	0.0005763	-0.001259	2.3277193	0.00000	0.00000	-28.787116	C
0.00004460	21764.	487943816.	15.1305606	0.0006749	-0.001466	2.6533909	0.00000	0.00000	-33.513296	C
0.00005097	24770.	485928475.	15.1860684	0.0007741	-0.001673	2.9600619	0.00000	0.00000	-38.218855	C
0.00005735	27748.	483867301.	15.2430493	0.0008741	-0.001878	3.2474904	0.00000	0.00000	-42.901451	C
0.00006372	30697.	481757924.	15.3015858	0.0009750	-0.002083	3.5152366	0.00000	0.00000	-47.560113	C
0.00007009	33323.	475431495.	15.3091324	0.0010730	-0.002291	3.7541156	0.00000	0.00000	-50.000000	CY
0.00007646	34422.	450181858.	15.0685311	0.0011522	-0.002518	3.9310694	0.00000	0.00000	-50.000000	CY
0.00008283	35305.	426211846.	14.8286444	0.0012283	-0.002748	4.0883984	0.00000	0.00000	-50.000000	CY
0.00008921	36049.	404111662.	14.6027760	0.0013026	-0.002979	4.2298515	0.00000	0.00000	-50.000000	CY
0.00009558	36681.	383781384.	14.3855100	0.0013749	-0.003213	4.3558910	0.00000	0.00000	-50.000000	CY
0.0001019	37226.	365142991.	14.1836793	0.0014460	-0.003448	4.4688300	0.00000	0.00000	-50.000000	CY
0.0001083	37698.	348019714.	13.9897331	0.0015154	-0.003684	4.5685010	0.00000	0.00000	-50.000000	CY
0.0001147	38112.	332294401.	13.8089269	0.0015838	-0.003921	4.6566271	0.00000	0.00000	-50.000000	CY
0.0001211	38478.	317831075.	13.6397065	0.0016513	-0.004160	4.7337126	0.00000	0.00000	-50.000000	CY
0.0001274	38801.	304471869.	13.4771784	0.0017175	-0.004399	4.7997769	0.00000	0.00000	-50.000000	CY
0.0001338	39090.	292137435.	13.3263417	0.0017832	-0.004640	4.8560308	0.00000	0.00000	-50.000000	CY
0.0001402	39350.	280710552.	13.1852928	0.0018483	-0.004880	4.9026648	0.00000	0.00000	-50.000000	CY
0.0001466	39581.	270082456.	13.0483173	0.0019123	-0.005122	4.9395765	0.00000	0.00000	-50.000000	CY
0.0001529	39791.	260199812.	12.9207350	0.0019759	-0.005364	4.9676123	0.00000	0.00000	-50.000000	CY
0.0001593	39981.	250984532.	12.8016148	0.0020392	-0.005607	4.9869094	0.00000	0.00000	-50.000000	CY

0.0001657	40153.	242372733.	12.6889758	0.0021021	-0.005850	4.9975662	0.00000	0.00000	-50.000000 CY
0.0001720	40307.	234291477.	12.5795466	0.0021642	-0.006094	4.9947078	0.00000	0.00000	-50.000000 CY
0.0001784	40448.	226711311.	12.4774070	0.0022261	-0.006338	4.9998573	0.00000	0.00000	-50.000000 CY
0.0001848	40576.	219586671.	12.3821718	0.0022880	-0.006582	4.9979556	0.00000	0.00000	-50.000000 CY
0.0001912	40693.	212882499.	12.2931726	0.0023499	-0.006826	4.9948580	0.00000	0.00000	-50.000000 CY
0.0001975	40799.	206548862.	12.2079387	0.0024114	-0.007070	4.9990302	0.00000	0.00000	-50.000000 CY
0.0002039	40892.	200553121.	12.1245954	0.0024722	-0.007315	4.9933079	0.00000	0.00000	-50.000000 CY
0.0002103	40979.	194886397.	12.0465296	0.0025330	-0.007560	4.9989831	0.00000	0.00000	-50.000000 CY
0.0002166	41059.	189524967.	11.9733249	0.0025939	-0.007805	4.9924337	0.00000	0.00000	-50.000000 CY
0.0002230	41131.	184431146.	11.9038425	0.0026547	-0.008050	4.9979258	0.00000	0.00000	-50.000000 CY
0.0002294	41199.	179604747.	11.8385575	0.0027156	-0.008295	4.9995126	0.00000	0.00000	-50.000000 CY
0.0002358	41260.	175010735.	11.7770504	0.0027765	-0.008540	4.9948087	0.00000	0.00000	-50.000000 CY
0.0002421	41315.	170633974.	11.7157407	0.0028367	-0.008785	4.9991413	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	41315.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	18.7400	0.00	N.A.	No	0.00	3845.
2	20.7200	1.8242	Yes	No	3845.	193183.
3	30.7200	3.7717	No	No	197027.	486592.
4	38.2200	14.1366	Yes	No	683620.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for

peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.3021	7.64E-05	0.00	-0.00408	4.73E-08	2.66E+11	0.00	0.00	0.00
0.4574	1.2797	3.92E-05	-3.75E-06	-0.00408	2.42E-08	2.66E+11	0.00	0.00	0.00
0.9148	1.2573	3.52E-05	1.7502	-0.00408	2.18E-08	2.66E+11	0.00	0.00	0.6377
1.3722	1.2350	19.2133	32.4401	-0.00408	0.01189	2.66E+11	0.00	0.00	10.5450
1.8296	1.2126	356.1140	125.8834	-0.00408	0.2204	2.66E+11	0.00	0.00	23.5038
2.2870	1.1902	1401.	290.4551	-0.00408	0.8672	2.66E+11	0.00	0.00	36.4626
2.7444	1.1678	3545.	526.1551	-0.00408	2.1939	2.66E+11	0.00	0.00	49.4214
3.2018	1.1454	7177.	832.9833	-0.00408	4.4422	2.66E+11	0.00	0.00	62.3802
3.6592	1.1231	12689.	1211.	-0.00408	7.8537	2.66E+11	0.00	0.00	75.3390
4.1166	1.1007	20470.	1660.	-0.00408	12.6700	2.66E+11	0.00	0.00	88.2978
4.5740	1.0783	30912.	2180.	-0.00408	19.1327	2.66E+11	0.00	0.00	101.2566
5.0314	1.0559	44404.	2772.	-0.00408	27.4837	2.66E+11	0.00	0.00	114.2154
5.4888	1.0336	61337.	3434.	-0.00407	37.9643	2.66E+11	0.00	0.00	127.1742
5.9462	1.0112	82102.	4168.	-0.00407	50.8164	2.66E+11	0.00	0.00	140.1330
6.4036	0.9888	107088.	4972.	-0.00407	66.2815	2.66E+11	0.00	0.00	153.0918
6.8610	0.9665	136686.	5848.	-0.00407	84.6014	2.66E+11	0.00	0.00	166.0507
7.3184	0.9442	171287.	6795.	-0.00407	106.0175	2.66E+11	0.00	0.00	179.0095
7.7758	0.9219	211281.	7813.	-0.00406	130.7716	2.66E+11	0.00	0.00	191.9683
8.2332	0.8996	257059.	8903.	-0.00406	159.1054	2.66E+11	0.00	0.00	204.9271
8.6906	0.8773	309010.	10063.	-0.00405	191.2604	2.66E+11	0.00	0.00	217.8859
9.1480	0.8551	367526.	11294.	-0.00404	227.4783	2.66E+11	0.00	0.00	230.8447
9.6054	0.8330	432996.	12597.	-0.00404	268.0007	2.66E+11	0.00	0.00	243.8035
10.0628	0.8108	505811.	13971.	-0.00403	313.0693	2.66E+11	0.00	0.00	256.7623
10.5202	0.7888	586362.	15416.	-0.00401	362.9258	2.66E+11	0.00	0.00	269.7211
10.9776	0.7668	675038.	16932.	-0.00400	417.8117	2.66E+11	0.00	0.00	282.6799
11.4350	0.7448	772231.	18519.	-0.00399	477.9687	2.66E+11	0.00	0.00	295.6387
11.8924	0.7230	878331.	20177.	-0.00397	543.6385	2.66E+11	0.00	0.00	308.5975
12.3498	0.7013	993727.	21906.	-0.00395	615.0627	2.66E+11	0.00	0.00	321.5563
12.8072	0.6796	1118811.	23707.	-0.00393	692.4828	2.66E+11	0.00	0.00	334.5151
13.2646	0.6581	1253973.	25579.	-0.00390	776.1407	2.66E+11	0.00	0.00	347.4740
13.7220	0.6368	1399604.	27521.	-0.00388	866.2779	2.66E+11	0.00	0.00	360.4328
14.1794	0.6156	1556093.	29535.	-0.00385	963.1360	2.66E+11	0.00	0.00	373.3916
14.6368	0.5946	1723831.	31620.	-0.00381	1067.	2.66E+11	0.00	0.00	386.3504
15.0942	0.5737	1903209.	33777.	-0.00377	1178.	2.66E+11	0.00	0.00	399.3092
15.5516	0.5531	2094617.	36004.	-0.00373	1296.	2.66E+11	0.00	0.00	412.2680
16.0090	0.5327	2298445.	38302.	-0.00369	1423.	2.66E+11	0.00	0.00	425.2268
16.4664	0.5126	2515083.	40672.	-0.00364	1557.	2.66E+11	0.00	0.00	438.1856

16.9238	0.4928	2744924.	43112.	-0.00358	1699.	2.66E+11	0.00	0.00	451.1444
17.3812	0.4733	2988355.	45624.	-0.00352	1850.	2.66E+11	0.00	0.00	464.1032
17.8386	0.4541	3245769.	48207.	-0.00346	2009.	2.66E+11	0.00	0.00	477.0620
18.2960	0.4353	3517555.	50861.	-0.00339	2177.	2.66E+11	0.00	0.00	490.0208
18.7534	0.4169	3804104.	52849.	-0.00333	0.00	4.99E+11	-0.985	12.9741	235.1402
19.2108	0.3987	4097707.	53393.	-0.00329	0.00	4.98E+11	-35.666	490.9756	0.00
19.6682	0.3808	4390236.	53098.	-0.00324	0.00	4.98E+11	-71.854	1036.	0.00
20.1256	0.3631	4680600.	52603.	-0.00319	0.00	4.98E+11	-108.791	1644.	0.00
20.5830	0.3457	4967686.	51904.	-0.00314	0.00	4.98E+11	-145.729	2314.	0.00
21.0404	0.3287	5250382.	50940.	-0.00308	0.00	4.98E+11	-205.698	3435.	0.00
21.4978	0.3119	5526881.	49676.	-0.00302	0.00	4.98E+11	-254.581	4480.	0.00
21.9552	0.2955	5795711.	48148.	-0.00296	0.00	4.98E+11	-302.423	5618.	0.00
22.4126	0.2794	6055429.	46362.	-0.00290	0.00	4.97E+11	-348.405	6845.	0.00
22.8700	0.2637	6304651.	44330.	-0.00283	0.00	4.97E+11	-391.752	8155.	0.00
23.3274	0.2483	6542070.	42066.	-0.00276	0.00	4.97E+11	-433.431	9580.	0.00
23.7848	0.2334	6766432.	39582.	-0.00268	0.00	4.97E+11	-471.688	11093.	0.00
24.2422	0.2189	6976583.	36899.	-0.00261	0.00	4.97E+11	-505.827	12685.	0.00
24.6996	0.2048	7171495.	34042.	-0.00253	0.00	4.97E+11	-535.287	14348.	0.00
25.1570	0.1911	7350281.	31029.	-0.00245	0.00	4.97E+11	-562.467	16155.	0.00
25.6144	0.1779	7512121.	27875.	-0.00237	0.00	4.97E+11	-586.922	18110.	0.00
26.0718	0.1651	7656279.	24600.	-0.00228	0.00	4.96E+11	-606.246	20152.	0.00
26.5292	0.1528	7782173.	21235.	-0.00220	0.00	4.96E+11	-620.069	22271.	0.00
26.9866	0.1410	7889386.	17806.	-0.00211	0.00	4.96E+11	-629.363	24501.	0.00
27.4440	0.1296	7977638.	14327.	-0.00202	0.00	4.96E+11	-638.412	27029.	0.00
27.9014	0.1188	8046656.	10812.	-0.00193	0.00	4.96E+11	-642.208	29677.	0.00
28.3588	0.1084	8096327.	7291.	-0.00185	0.00	4.96E+11	-640.593	32435.	0.00
28.8162	0.09852	8126699.	3795.	-0.00176	0.00	4.96E+11	-633.457	35292.	0.00
29.2736	0.08913	8137987.	352.7446	-0.00167	0.00	4.96E+11	-620.819	38233.	0.00
29.7310	0.08023	8130572.	-3004.	-0.00158	0.00	4.96E+11	-602.262	41203.	0.00
30.1884	0.07183	8105012.	-6242.	-0.00149	0.00	4.96E+11	-577.820	44156.	0.00
30.6458	0.06391	8062044.	-9331.	-0.00140	0.00	4.96E+11	-547.688	47034.	0.00
31.1032	0.05649	8002576.	-13880.	-0.00131	0.00	4.96E+11	-1110.	107816.	0.00
31.5606	0.04956	7909677.	-19925.	-0.00122	0.00	4.96E+11	-1093.	121080.	0.00
32.0180	0.04310	7783845.	-25874.	-0.00113	0.00	4.96E+11	-1074.	136812.	0.00
32.4754	0.03712	7625648.	-31711.	-0.00105	0.00	4.96E+11	-1053.	155691.	0.00
32.9328	0.03160	7435733.	-37423.	-9.65E-04	0.00	4.97E+11	-1028.	178670.	0.00
33.3902	0.02653	7214833.	-42993.	-8.84E-04	0.00	4.97E+11	-1001.	207125.	0.00
33.8476	0.02189	6963777.	-48401.	-8.05E-04	0.00	4.97E+11	-969.767	243130.	0.00
34.3050	0.01768	6683506.	-53626.	-7.30E-04	0.00	4.97E+11	-934.240	289988.	0.00
34.7624	0.01388	6375089.	-58642.	-6.58E-04	0.00	4.97E+11	-893.347	353322.	0.00
35.2198	0.01046	6039757.	-63414.	-5.90E-04	0.00	4.97E+11	-845.424	443664.	0.00
35.6772	0.00741	5678956.	-67895.	-5.25E-04	0.00	4.98E+11	-787.509	583637.	0.00
36.1346	0.00470	5294430.	-72015.	-4.64E-04	0.00	4.98E+11	-713.455	833750.	0.00
36.5920	0.00231	4888409.	-75636.	-4.08E-04	0.00	4.98E+11	-606.293	1441818.	0.00
37.0494	2.15E-04	4464123.	-77604.	-3.57E-04	0.00	4.98E+11	-110.679	2824912.	0.00
37.5068	-0.00161	4036502.	-76343.	-3.10E-04	0.00	4.98E+11	570.3095	1946718.	0.00
37.9642	-0.00319	3626063.	-72894.	-2.68E-04	0.00	4.99E+11	686.3805	1182096.	0.00
38.4216	-0.00455	3236303.	-69376.	-2.30E-04	0.00	4.99E+11	595.3929	718702.	0.00
38.8790	-0.00571	2864480.	-65990.	-1.96E-04	0.00	4.99E+11	638.5846	613658.	0.00
39.3364	-0.00670	2511895.	-62389.	-1.67E-04	0.00	4.99E+11	673.2646	551262.	0.00
39.7938	-0.00754	2179594.	-58614.	-1.41E-04	0.00	4.99E+11	702.2946	510986.	0.00
40.2512	-0.00825	1868451.	-54691.	-1.19E-04	0.00	4.99E+11	727.2970	483736.	0.00
40.7086	-0.00885	1579219.	-50639.	-9.99E-05	0.00	4.99E+11	749.3050	464811.	0.00
41.1660	-0.00935	1312561.	-46472.	-8.40E-05	0.00	4.99E+11	769.0332	451506.	0.00
41.6234	-0.00977	1069072.	-42201.	-7.09E-05	0.00	4.99E+11	787.0079	442132.	0.00
42.0808	-0.01013	849293.	-37836.	-6.03E-05	0.00	4.99E+11	803.6352	435565.	0.00
42.5382	-0.01043	653725.	-33382.	-5.21E-05	0.00	4.99E+11	819.2392	431017.	0.00
42.9956	-0.01070	482839.	-28845.	-4.58E-05	0.00	4.99E+11	834.0846	427912.	0.00

43.4530	-0.01094	337080.	-24227.	-4.13E-05	0.00	4.99E+11	848.3890	425818.	0.00
43.9104	-0.01115	216881.	-19532.	-3.83E-05	0.00	4.99E+11	862.3312	424408.	0.00
44.3678	-0.01136	122662.	-14762.	-3.64E-05	0.00	4.99E+11	876.0551	423434.	0.00
44.8252	-0.01155	54835.	-9916.	-3.54E-05	0.00	4.99E+11	889.6718	422715.	0.00
45.2826	-0.01174	13811.	-4995.	-3.51E-05	0.00	4.99E+11	903.2605	422125.	0.00
45.7400	-0.01194	0.00	0.00	-3.50E-05	0.00	4.99E+11	916.8688	210796.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     1.30210238 inches
Computed slope at pile head      =     -0.0040777 radians
Maximum bending moment           =       8137987. inch-lbs
Maximum shear force              =        -77604. lbs
Depth of maximum bending moment  =    29.27360000 feet below pile head
Depth of maximum shear force     =    37.04940000 feet below pile head
Number of iterations             =             31
Number of zero deflection points =              1
Pile deflection at ground        =     0.41743781 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
45.74000	1.30210238	8137987.	-77604.
43.45300	1.47859343	7967531.	-85606.
41.16600	2.07473224	7651479.	-92995.
38.87900	3.58247981	7289212.	-97779.
36.59200	7.78917645	6919744.	-101071.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.6817	4.70E-05	3.57E-07	-0.00774	2.91E-08	2.66E+11	0.00	0.00	0.00
0.4574	2.6393	1.06E-04	4.64E-06	-0.00774	6.55E-08	2.66E+11	0.00	0.00	0.00
0.9148	2.5968	9.79E-05	2.6253	-0.00774	6.06E-08	2.66E+11	0.00	0.00	0.9566
1.3722	2.5543	28.8200	48.6601	-0.00774	0.01784	2.66E+11	0.00	0.00	15.8175
1.8296	2.5119	534.1711	188.8251	-0.00774	0.3306	2.66E+11	0.00	0.00	35.2557
2.2870	2.4694	2102.	435.6826	-0.00774	1.3008	2.66E+11	0.00	0.00	54.6939
2.7444	2.4269	5317.	789.2326	-0.00774	3.2909	2.66E+11	0.00	0.00	74.1321
3.2018	2.3845	10766.	1249.	-0.00774	6.6633	2.66E+11	0.00	0.00	93.5703
3.6592	2.3420	19033.	1816.	-0.00774	11.7805	2.66E+11	0.00	0.00	113.0085
4.1166	2.2995	30705.	2490.	-0.00774	19.0049	2.66E+11	0.00	0.00	132.4467
4.5740	2.2571	46368.	3270.	-0.00774	28.6991	2.66E+11	0.00	0.00	151.8849
5.0314	2.2146	66606.	4157.	-0.00773	41.2255	2.66E+11	0.00	0.00	171.3231
5.4888	2.1722	92006.	5151.	-0.00773	56.9465	2.66E+11	0.00	0.00	190.7613
5.9462	2.1297	123152.	6251.	-0.00773	76.2246	2.66E+11	0.00	0.00	210.1996
6.4036	2.0873	160632.	7459.	-0.00773	99.4223	2.66E+11	0.00	0.00	229.6378
6.8610	2.0449	205030.	8772.	-0.00772	126.9020	2.66E+11	0.00	0.00	249.0760
7.3184	2.0025	256931.	10193.	-0.00772	159.0263	2.66E+11	0.00	0.00	268.5142
7.7758	1.9601	316922.	11720.	-0.00771	196.1575	2.66E+11	0.00	0.00	287.9524
8.2332	1.9178	385588.	13354.	-0.00771	238.6581	2.66E+11	0.00	0.00	307.3906
8.6906	1.8756	463515.	15094.	-0.00770	286.8906	2.66E+11	0.00	0.00	326.8288
9.1480	1.8333	551289.	16942.	-0.00769	341.2174	2.66E+11	0.00	0.00	346.2670
9.6054	1.7912	649494.	18896.	-0.00767	402.0011	2.66E+11	0.00	0.00	365.7052
10.0628	1.7491	758717.	20956.	-0.00766	469.6040	2.66E+11	0.00	0.00	385.1435
10.5202	1.7071	879543.	23124.	-0.00764	544.3887	2.66E+11	0.00	0.00	404.5817
10.9776	1.6652	1012558.	25398.	-0.00762	626.7175	2.66E+11	0.00	0.00	424.0199
11.4350	1.6234	1158347.	27778.	-0.00760	716.9531	2.66E+11	0.00	0.00	443.4581
11.8924	1.5817	1317496.	30266.	-0.00758	815.4577	2.66E+11	0.00	0.00	462.8963
12.3498	1.5402	1490591.	32860.	-0.00755	922.5940	2.66E+11	0.00	0.00	482.3345
12.8072	1.4989	1678217.	35561.	-0.00751	1039.	2.66E+11	0.00	0.00	501.7727
13.2646	1.4578	1880960.	38368.	-0.00748	1164.	2.66E+11	0.00	0.00	521.2109
13.7220	1.4168	2099406.	41282.	-0.00744	1299.	2.66E+11	0.00	0.00	540.6491
14.1794	1.3761	2334139.	44303.	-0.00739	1445.	2.66E+11	0.00	0.00	560.0874
14.6368	1.3357	2585747.	47431.	-0.00734	1600.	2.66E+11	0.00	0.00	579.5256
15.0942	1.2956	2854813.	50665.	-0.00728	1767.	2.66E+11	0.00	0.00	598.9638
15.5516	1.2558	3141925.	54006.	-0.00722	1945.	2.66E+11	0.00	0.00	618.4020
16.0090	1.2163	3447667.	57453.	-0.00715	2134.	2.66E+11	0.00	0.00	637.8402
16.4664	1.1772	3772625.	61008.	-0.00708	2335.	2.66E+11	0.00	0.00	657.2784
16.9238	1.1386	4117385.	64669.	-0.00700	2548.	2.66E+11	0.00	0.00	676.7166
17.3812	1.1004	4482533.	68436.	-0.00691	2774.	2.66E+11	0.00	0.00	696.1548
17.8386	1.0628	4868653.	72311.	-0.00681	3013.	2.66E+11	0.00	0.00	715.5930
18.2960	1.0257	5276332.	76292.	-0.00671	3266.	2.66E+11	0.00	0.00	735.0313
18.7534	0.9891	5706156.	79274.	-0.00662	0.00	4.98E+11	-1.237	6.8648	352.7103
19.2108	0.9530	6146568.	80115.	-0.00656	0.00	4.97E+11	-45.004	259.2054	0.00
19.6682	0.9172	6585624.	79741.	-0.00648	0.00	4.97E+11	-91.200	545.7780	0.00
20.1256	0.8818	7021933.	79109.	-0.00641	0.00	4.97E+11	-139.010	865.2836	0.00
20.5830	0.8468	7454054.	78213.	-0.00633	0.00	4.97E+11	-187.635	1216.	0.00
21.0404	0.8123	7880521.	76967.	-0.00625	0.00	4.96E+11	-266.192	1799.	0.00
21.4978	0.7783	8298970.	75328.	-0.00616	0.00	4.96E+11	-331.079	2335.	0.00
21.9552	0.7447	8707444.	73334.	-0.00606	0.00	4.96E+11	-395.399	2914.	0.00
22.4126	0.7117	9104006.	70992.	-0.00596	0.00	4.96E+11	-458.145	3533.	0.00

22.8700	0.6793	9486765.	68312.	-0.00586	0.00	4.96E+11	-518.358	4189.	0.00
23.3274	0.6474	9853908.	65306.	-0.00575	0.00	4.95E+11	-576.903	4891.	0.00
23.7848	0.6161	1.02E+07	61989.	-0.00564	0.00	4.95E+11	-631.805	5629.	0.00
24.2422	0.5855	1.05E+07	58383.	-0.00553	0.00	4.95E+11	-682.187	6396.	0.00
24.6996	0.5554	1.08E+07	54515.	-0.00541	0.00	4.95E+11	-727.301	7187.	0.00
25.1570	0.5261	1.11E+07	50404.	-0.00529	0.00	4.94E+11	-770.479	8039.	0.00
25.6144	0.4974	1.14E+07	46064.	-0.00516	0.00	4.94E+11	-811.150	8951.	0.00
26.0718	0.4694	1.16E+07	41516.	-0.00503	0.00	4.94E+11	-845.990	9892.	0.00
26.5292	0.4422	1.19E+07	36794.	-0.00490	0.00	4.94E+11	-874.448	10855.	0.00
26.9866	0.4156	1.20E+07	31931.	-0.00477	0.00	4.94E+11	-897.442	11852.	0.00
27.4440	0.3898	1.22E+07	26945.	-0.00464	0.00	4.94E+11	-919.606	12949.	0.00
27.9014	0.3647	1.23E+07	21854.	-0.00450	0.00	4.94E+11	-935.315	14075.	0.00
28.3588	0.3404	1.24E+07	16696.	-0.00436	0.00	4.94E+11	-944.239	15225.	0.00
28.8162	0.3169	1.25E+07	11508.	-0.00422	0.00	4.94E+11	-946.090	16389.	0.00
29.2736	0.2941	1.26E+07	6317.	-0.00408	0.00	4.94E+11	-945.359	17645.	0.00
29.7310	0.2720	1.26E+07	1148.	-0.00394	0.00	4.94E+11	-937.992	18925.	0.00
30.1884	0.2508	1.26E+07	-3958.	-0.00380	0.00	4.94E+11	-922.729	20196.	0.00
30.6458	0.2303	1.25E+07	-8959.	-0.00366	0.00	4.94E+11	-899.383	21436.	0.00
31.1032	0.2106	1.25E+07	-15658.	-0.00352	0.00	4.94E+11	-1542.	40191.	0.00
31.5606	0.1916	1.24E+07	-24097.	-0.00339	0.00	4.94E+11	-1533.	43912.	0.00
32.0180	0.1734	1.22E+07	-32479.	-0.00325	0.00	4.94E+11	-1521.	48161.	0.00
32.4754	0.1559	1.20E+07	-40791.	-0.00311	0.00	4.94E+11	-1507.	53055.	0.00
32.9328	0.1392	1.18E+07	-49016.	-0.00298	0.00	4.94E+11	-1490.	58753.	0.00
33.3902	0.1232	1.15E+07	-57138.	-0.00285	0.00	4.94E+11	-1469.	65470.	0.00
33.8476	0.1079	1.11E+07	-65136.	-0.00273	0.00	4.94E+11	-1445.	73513.	0.00
34.3050	0.09324	1.08E+07	-72986.	-0.00261	0.00	4.95E+11	-1416.	83335.	0.00
34.7624	0.07927	1.03E+07	-80662.	-0.00249	0.00	4.95E+11	-1381.	95630.	0.00
35.2198	0.06592	9880358.	-88128.	-0.00238	0.00	4.95E+11	-1339.	111536.	0.00
35.6772	0.05317	9376465.	-95341.	-0.00227	0.00	4.96E+11	-1289.	133067.	0.00
36.1346	0.04099	8833737.	-102244.	-0.00217	0.00	4.96E+11	-1226.	164190.	0.00
36.5920	0.02935	8254066.	-108752.	-0.00208	0.00	4.96E+11	-1145.	214092.	0.00
37.0494	0.01821	7639902.	-114724.	-0.00199	0.00	4.96E+11	-1031.	310743.	0.00
37.5068	0.00754	6994673.	-119857.	-0.00191	0.00	4.97E+11	-839.079	610955.	0.00
37.9642	-0.00271	6324164.	-120350.	-0.00183	0.00	4.97E+11	659.3655	1333902.	0.00
38.4216	-0.01258	5673520.	-116433.	-0.00177	0.00	4.98E+11	767.8818	334993.	0.00
38.8790	-0.02211	5046010.	-111867.	-0.00171	0.00	4.98E+11	895.6529	222381.	0.00
39.3364	-0.03133	4445484.	-106693.	-0.00166	0.00	4.98E+11	989.8431	173436.	0.00
39.7938	-0.04028	3874778.	-101047.	-0.00161	0.00	4.99E+11	1067.	145475.	0.00
40.2512	-0.04899	3336232.	-95002.	-0.00157	0.00	4.99E+11	1135.	127179.	0.00
40.7086	-0.05751	2831887.	-88603.	-0.00154	0.00	4.99E+11	1196.	114182.	0.00
41.1660	-0.06585	2363584.	-81882.	-0.00151	0.00	4.99E+11	1253.	104418.	0.00
41.6234	-0.07405	1933022.	-74860.	-0.00148	0.00	4.99E+11	1306.	96780.	0.00
42.0808	-0.08214	1541799.	-67555.	-0.00146	0.00	4.99E+11	1356.	90619.	0.00
42.5382	-0.09013	1191431.	-59979.	-0.00145	0.00	4.99E+11	1404.	85526.	0.00
42.9956	-0.09805	883374.	-52142.	-0.00144	0.00	4.99E+11	1451.	81232.	0.00
43.4530	-0.106	619034.	-44053.	-0.00143	0.00	4.99E+11	1497.	77552.	0.00
43.9104	-0.114	399780.	-35717.	-0.00142	0.00	4.99E+11	1541.	74355.	0.00
44.3678	-0.122	226948.	-27140.	-0.00142	0.00	4.99E+11	1584.	71546.	0.00
44.8252	-0.129	101851.	-18326.	-0.00142	0.00	4.99E+11	1627.	69054.	0.00
45.2826	-0.137	25777.	-9278.	-0.00142	0.00	4.99E+11	1669.	66824.	0.00
45.7400	-0.145	0.00	0.00	-0.00142	0.00	4.99E+11	1711.	32408.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     2.68174320 inches
Computed slope at pile head      =     -0.0077375 radians
Maximum bending moment           =      12590832. inch-lbs
Maximum shear force              =       -120350. lbs
Depth of maximum bending moment  =    29.73100000 feet below pile head
Depth of maximum shear force     =    37.96420000 feet below pile head
Number of iterations             =             38
Number of zero deflection points =              1
Pile deflection at ground        =     0.99021322 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
45.74000	2.68174320	12590832.	-120350.
43.45300	3.70961913	12078102.	-129395.
41.16600	6.08113248	11451508.	-136510.
38.87900	17.16021123	11331155.	-154486.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

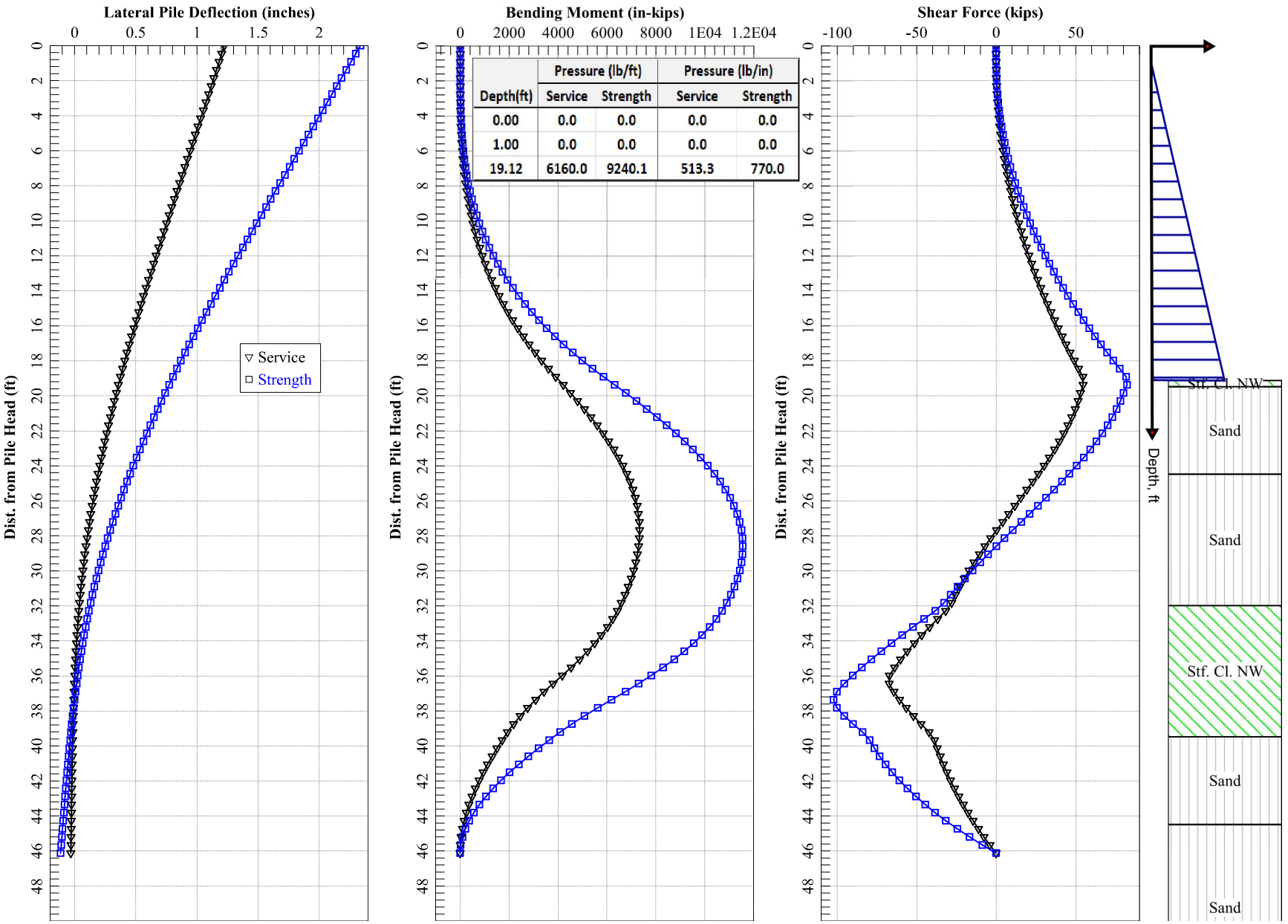
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.3021	-0.00408	-77604.	8137987.
2	V, lb	0.00	M, in-lb	0.00	0.00	2.6817	-0.00774	-120350.	1.26E+07

Maximum pile-head deflection = 2.6817432013 inches

Maximum pile-head rotation = -0.0077375460 radians = -0.443329 deg.

The analysis ended normally.

Wall 2 (18.74 ft): Boring N-003-N-01



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
19.12	6160.0	9240.1	513.3	770.0

==========

LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 2\

Name of input data file:
Wall_2-19.12 ft_ N-003-N-01.lp12d

Name of output report file:
Wall_2-19.12 ft_ N-003-N-01.lp12o

Name of plot output file:
Wall_2-19.12 ft_ N-003-N-01.lp12p

Name of runtime message file:
Wall_2-19.12 ft_ N-003-N-01.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 20:01:19

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 2(H=19.01FT) Boring N-003-N-01

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 46.120 ft
Depth of ground surface below top of pile = 19.1200 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	11.5000
2	19.120	11.5000
3	19.120	48.0000
4	46.120	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 19.120000 ft
AISC Section Type = W
AISC Section Name = W33X169
Pile width = 11.500000 in

Pile Section No. 2:

Section 2 is a drilled shaft with casing and AISC section core/insert
Length of section = 27.000000 ft
Section Diameter = 48.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W33X169

Soil and Rock Layering Information

The soil profile is modelled using 7 layers

Layer 1 is stiff clay without free water

Distance from top of pile to top of layer = 19.120000 ft
Distance from top of pile to bottom of layer = 19.470000 ft
Effective unit weight at top of layer = 57.600000 pcf
Effective unit weight at bottom of layer = 57.600000 pcf
Undrained cohesion at top of layer = 1300. psf
Undrained cohesion at bottom of layer = 1300. psf
Epsilon-50 at top of layer = 0.007000
Epsilon-50 at bottom of layer = 0.007000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 19.470000 ft
Distance from top of pile to bottom of layer = 24.470000 ft
Effective unit weight at top of layer = 62.600000 pcf

Effective unit weight at bottom of layer	=	62.600000	pcf
Friction angle at top of layer	=	33.000000	deg.
Friction angle at bottom of layer	=	33.000000	deg.
Subgrade k at top of layer	=	90.000000	pci
Subgrade k at bottom of layer	=	90.000000	pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	24.470000	ft
Distance from top of pile to bottom of layer	=	31.970000	ft
Effective unit weight at top of layer	=	62.600000	pcf
Effective unit weight at bottom of layer	=	62.600000	pcf
Friction angle at top of layer	=	33.000000	deg.
Friction angle at bottom of layer	=	33.000000	deg.
Subgrade k at top of layer	=	90.000000	pci
Subgrade k at bottom of layer	=	90.000000	pci

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	31.970000	ft
Distance from top of pile to bottom of layer	=	39.470000	ft
Effective unit weight at top of layer	=	62.600000	pcf
Effective unit weight at bottom of layer	=	62.600000	pcf
Undrained cohesion at top of layer	=	3500.	psf
Undrained cohesion at bottom of layer	=	3500.	psf
Epsilon-50 at top of layer	=	0.004000	
Epsilon-50 at bottom of layer	=	0.004000	

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	39.470000	ft
Distance from top of pile to bottom of layer	=	44.470000	ft
Effective unit weight at top of layer	=	62.600000	pcf
Effective unit weight at bottom of layer	=	62.600000	pcf
Friction angle at top of layer	=	34.000000	deg.
Friction angle at bottom of layer	=	34.000000	deg.
Subgrade k at top of layer	=	120.000000	pci
Subgrade k at bottom of layer	=	120.000000	pci

Layer 6 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	44.470000	ft
Distance from top of pile to bottom of layer	=	53.970000	ft
Effective unit weight at top of layer	=	62.600000	pcf
Effective unit weight at bottom of layer	=	62.600000	pcf
Friction angle at top of layer	=	34.000000	deg.
Friction angle at bottom of layer	=	34.000000	deg.
Subgrade k at top of layer	=	120.000000	pci
Subgrade k at bottom of layer	=	120.000000	pci

Layer 7 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	53.970000	ft

Distance from top of pile to bottom of layer	=	75.970000 ft
Effective unit weight at top of layer	=	67.600000 pcf
Effective unit weight at bottom of layer	=	67.600000 pcf
Friction angle at top of layer	=	34.000000 deg.
Friction angle at bottom of layer	=	34.000000 deg.
Subgrade k at top of layer	=	125.000000 pci
Subgrade k at bottom of layer	=	125.000000 pci

(Depth of the lowest soil layer extends 29.850 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Stiff Clay	19.1200	57.6000	1300.	--	0.00700	--
	w/o Free Water	19.4700	57.6000	1300.	--	0.00700	--
2	Sand	19.4700	62.6000	--	33.0000	--	90.0000
	(Reese, et al.)	24.4700	62.6000	--	33.0000	--	90.0000
3	Sand	24.4700	62.6000	--	33.0000	--	90.0000
	(Reese, et al.)	31.9700	62.6000	--	33.0000	--	90.0000
4	Stiff Clay	31.9700	62.6000	3500.	--	0.00400	--
	w/o Free Water	39.4700	62.6000	3500.	--	0.00400	--
5	Sand	39.4700	62.6000	--	34.0000	--	120.0000
	(Reese, et al.)	44.4700	62.6000	--	34.0000	--	120.0000
6	Sand	44.4700	62.6000	--	34.0000	--	120.0000
	(Reese, et al.)	53.9700	62.6000	--	34.0000	--	120.0000
7	Sand	53.9700	67.6000	--	34.0000	--	125.0000
	(Reese, et al.)	75.9700	67.6000	--	34.0000	--	125.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	19.120	0.7930	1.0000
2	47.000	0.7930	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	19.120	513.300

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	19.120	770.000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1		Condition 2		Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V =	0.0000 lbs	M =	0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V =	0.0000 lbs	M =	0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	19.120000 ft
Flange Width	=	11.500000 in
Section Depth	=	33.800000 in
Flange Thickness	=	1.220000 in
Web Thickness	=	0.670000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	49.500000 sq. in.
Moment of Inertia	=	9290. in^4
Elastic Bending Stiffness	=	269410000. kip-in^2
Plastic Modulus, Z	=	629.000000in^3
Plastic Moment Capacity = Fy Z	=	31450.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	2475.000 kips
Nominal Axial Tensile Capacity	=	-2475.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000637	1693.	265693210.	16.9000000	3.0915978	
0.00001274	3386.	265693210.	16.9000000	6.1831957	
0.00001912	5079.	265693210.	16.9000000	9.2747935	
0.00002549	6772.	265693210.	16.9000000	12.3663914	
0.00003186	8465.	265693210.	16.9000000	15.4579892	
0.00003823	10158.	265693210.	16.9000000	18.5495871	
0.00004460	11851.	265693210.	16.9000000	21.6411849	
0.00005097	13544.	265693210.	16.9000000	24.7327828	
0.00005735	15237.	265693210.	16.9000000	27.8243806	
0.00006372	16929.	265693210.	16.9000000	30.9159784	

0.00007009	18622.	265693210.	16.9000000	34.0075763	
0.00007646	20315.	265693210.	16.9000000	37.0991741	
0.00008283	22008.	265693210.	16.9000000	40.1907720	
0.00008921	23701.	265693210.	16.9000000	43.2823698	
0.00009558	25394.	265693210.	16.9000000	46.3739677	
0.0001019	27087.	265693210.	16.9000000	49.4655655	
0.0001083	28203.	260363688.	16.9000000	50.0000000	Y
0.0001147	28553.	248954951.	16.9000000	50.0000000	Y
0.0001211	28811.	237981856.	16.9000000	50.0000000	Y
0.0001274	29032.	227815021.	16.9000000	50.0000000	Y
0.0001338	29222.	218387282.	16.9000000	50.0000000	Y
0.0001402	29387.	209639324.	16.9000000	50.0000000	Y
0.0001466	29530.	201502088.	16.9000000	50.0000000	Y
0.0001529	29657.	193933140.	16.9000000	50.0000000	Y
0.0001593	29768.	186871359.	16.9000000	50.0000000	Y
0.0001657	29867.	180280704.	16.9000000	50.0000000	Y
0.0001720	29955.	174116498.	16.9000000	50.0000000	Y
0.0001784	30034.	168340016.	16.9000000	50.0000000	Y
0.0001848	30104.	162917461.	16.9000000	50.0000000	Y
0.0001912	30168.	157819143.	16.9000000	50.0000000	Y
0.0001975	30225.	153018816.	16.9000000	50.0000000	Y
0.0002039	30277.	148493137.	16.9000000	50.0000000	Y
0.0002103	30325.	144221232.	16.9000000	50.0000000	Y
0.0002166	30369.	140182713.	16.9000000	50.0000000	Y
0.0002230	30409.	136352858.	16.9000000	50.0000000	Y
0.0002294	30445.	132725391.	16.9000000	50.0000000	Y
0.0002358	30479.	129282090.	16.9000000	50.0000000	Y
0.0002421	30510.	126006054.	16.9000000	50.0000000	Y
0.0002485	30539.	122893837.	16.9000000	50.0000000	Y
0.0002612	30590.	117094882.	16.9000000	50.0000000	Y
0.0002740	30634.	111808788.	16.9000000	50.0000000	Y
0.0002867	30672.	106972176.	16.9000000	50.0000000	Y
0.0002995	30706.	102531944.	16.9000000	50.0000000	Y
0.0003122	30736.	98443169.	16.9000000	50.0000000	Y
0.0003250	30762.	94662918.	16.9000000	50.0000000	Y
0.0003377	30785.	91158778.	16.9000000	50.0000000	Y
0.0003504	30806.	87905231.	16.9000000	50.0000000	Y
0.0003632	30824.	84870101.	16.9000000	50.0000000	Y
0.0003759	30842.	82039615.	16.9000000	50.0000000	Y
0.0003887	30856.	79387115.	16.9000000	50.0000000	Y
0.0004014	30870.	76901724.	16.9000000	50.0000000	Y
0.0004142	30883.	74565833.	16.9000000	50.0000000	Y
0.0004269	30894.	72365743.	16.9000000	50.0000000	Y
0.0004397	30905.	70293195.	16.9000000	50.0000000	Y
0.0004524	30914.	68333535.	16.9000000	50.0000000	Y
0.0004651	30922.	66479585.	16.9000000	50.0000000	Y
0.0004779	30931.	64724513.	16.9000000	50.0000000	Y
0.0004906	30939.	63058987.	16.9000000	50.0000000	Y
0.0005034	30945.	61475189.	16.9000000	50.0000000	Y
0.0005161	30951.	59969602.	16.9000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load	Axial	Nominal Moment

No.	Thrust kips	Capacity in-kips
1	0.00000000	30951.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	27.000000 ft
Outside Diameter of Casing	=	48.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	11.500000 in
Depth of Core/Insert	=	33.800000 in
Flange Thickness of Core/Insert	=	1.220000 in
Web Thickness of Core/Insert	=	0.670000 in
Moment of Inertia of Steel Core/Insert	=	9290. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1810. sq. in.
Area of Concrete	=	1760. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	49.500000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	49.071200 sq. in.
Area Ratio of All Steel to Gross Area	=	2.71 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	9955.244 kips
Tensile Load for Cracking of Concrete	=	-980.682 kips
Nominal Axial Tensile Capacity	=	-2475.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000637	3181.	499178080.	14.8162556	0.00009441	-0.000211	0.4307050	0.00000	0.00000	-4.845692	C
0.00001274	6339.	497400575.	14.8656104	0.0001894	-0.000422	0.8447338	0.00000	0.00000	-9.673144	C
0.00001912	9473.	495587357.	14.9161188	0.0002851	-0.000632	1.2417803	0.00000	0.00000	-14.481717	C
0.00002549	12584.	493736819.	14.9678371	0.0003815	-0.000842	1.6215227	0.00000	0.00000	-19.270729	C
0.00003186	15670.	491847238.	15.0208257	0.0004785	-0.001051	1.9836217	0.00000	0.00000	-24.039454	C
0.00003823	18730.	489916760.	15.0751499	0.0005763	-0.001259	2.3277193	0.00000	0.00000	-28.787116	C
0.00004460	21764.	487943816.	15.1305606	0.0006749	-0.001466	2.6533909	0.00000	0.00000	-33.513296	C
0.00005097	24770.	485928475.	15.1860684	0.0007741	-0.001673	2.9600619	0.00000	0.00000	-38.218855	C
0.00005735	27748.	483867301.	15.2430493	0.0008741	-0.001878	3.2474904	0.00000	0.00000	-42.901451	C
0.00006372	30697.	481757924.	15.3015858	0.0009750	-0.002083	3.5152366	0.00000	0.00000	-47.560113	C
0.00007009	33323.	475431495.	15.3091324	0.0010730	-0.002291	3.7541156	0.00000	0.00000	-50.000000	CY
0.00007646	34422.	450181858.	15.0685311	0.0011522	-0.002518	3.9310694	0.00000	0.00000	-50.000000	CY
0.00008283	35305.	426211846.	14.8286444	0.0012283	-0.002748	4.0883984	0.00000	0.00000	-50.000000	CY
0.00008921	36049.	404111662.	14.6027760	0.0013026	-0.002979	4.2298515	0.00000	0.00000	-50.000000	CY
0.00009558	36681.	383781384.	14.3855100	0.0013749	-0.003213	4.3558910	0.00000	0.00000	-50.000000	CY
0.0001019	37226.	365142991.	14.1836793	0.0014460	-0.003448	4.4688300	0.00000	0.00000	-50.000000	CY
0.0001083	37698.	348019714.	13.9897331	0.0015154	-0.003684	4.5685010	0.00000	0.00000	-50.000000	CY
0.0001147	38112.	332294401.	13.8089269	0.0015838	-0.003921	4.6566271	0.00000	0.00000	-50.000000	CY
0.0001211	38478.	317831075.	13.6397065	0.0016513	-0.004160	4.7337126	0.00000	0.00000	-50.000000	CY
0.0001274	38801.	304471869.	13.4771784	0.0017175	-0.004399	4.7997769	0.00000	0.00000	-50.000000	CY
0.0001338	39090.	292137435.	13.3263417	0.0017832	-0.004640	4.8560308	0.00000	0.00000	-50.000000	CY
0.0001402	39350.	280710552.	13.1852928	0.0018483	-0.004880	4.9026648	0.00000	0.00000	-50.000000	CY
0.0001466	39581.	270082456.	13.0483173	0.0019123	-0.005122	4.9395765	0.00000	0.00000	-50.000000	CY
0.0001529	39791.	260199812.	12.9207350	0.0019759	-0.005364	4.9676123	0.00000	0.00000	-50.000000	CY
0.0001593	39981.	250984532.	12.8016148	0.0020392	-0.005607	4.9869094	0.00000	0.00000	-50.000000	CY
0.0001657	40153.	242372733.	12.6889758	0.0021021	-0.005850	4.9975662	0.00000	0.00000	-50.000000	CY
0.0001720	40307.	234291477.	12.5795466	0.0021642	-0.006094	4.9947078	0.00000	0.00000	-50.000000	CY
0.0001784	40448.	226711311.	12.4774070	0.0022261	-0.006338	4.9998573	0.00000	0.00000	-50.000000	CY
0.0001848	40576.	219586671.	12.3821718	0.0022880	-0.006582	4.9979556	0.00000	0.00000	-50.000000	CY
0.0001912	40693.	212882499.	12.2931726	0.0023499	-0.006826	4.9948580	0.00000	0.00000	-50.000000	CY
0.0001975	40799.	206548862.	12.2079387	0.0024114	-0.007070	4.9990302	0.00000	0.00000	-50.000000	CY
0.0002039	40892.	200553121.	12.1245954	0.0024722	-0.007315	4.9933079	0.00000	0.00000	-50.000000	CY
0.0002103	40979.	194886397.	12.0465296	0.0025330	-0.007560	4.9989831	0.00000	0.00000	-50.000000	CY
0.0002166	41059.	189524967.	11.9733249	0.0025939	-0.007805	4.9924337	0.00000	0.00000	-50.000000	CY
0.0002230	41131.	184431146.	11.9038425	0.0026547	-0.008050	4.9979258	0.00000	0.00000	-50.000000	CY
0.0002294	41199.	179604747.	11.8385575	0.0027156	-0.008295	4.9995126	0.00000	0.00000	-50.000000	CY
0.0002358	41260.	175010735.	11.7770504	0.0027765	-0.008540	4.9948087	0.00000	0.00000	-50.000000	CY
0.0002421	41315.	170633974.	11.7157407	0.0028367	-0.008785	4.9991413	0.00000	0.00000	-50.000000	CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	41315.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	19.1200	0.00	N.A.	No	0.00	5500.
2	19.4700	2.1633	No	No	5500.	67545.
3	24.4700	7.1213	Yes	No	73045.	229967.
4	31.9700	6.2766	No	No	303012.	465398.
5	39.4700	21.6484	No	No	768410.	524456.
6	44.4700	26.6462	Yes	No	1292866.	218933.
7	53.9700	34.8500	No	No	1511799.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.2250	5.78E-06	0.00	-0.00390	3.58E-09	2.66E+11	0.00	0.00	0.00
0.4612	1.2034	-4.82E-05	-4.70E-06	-0.00390	2.98E-08	2.66E+11	0.00	0.00	0.00
0.9224	1.1819	-4.62E-05	1.9894	-0.00390	2.86E-08	2.66E+11	0.00	0.00	0.7189
1.3836	1.1603	22.0200	34.0487	-0.00390	0.01363	2.66E+11	0.00	0.00	10.8665
1.8448	1.1387	376.8779	130.3414	-0.00390	0.2333	2.66E+11	0.00	0.00	23.9313
2.3060	1.1172	1465.	298.9399	-0.00390	0.9066	2.66E+11	0.00	0.00	36.9961
2.7672	1.0956	3686.	539.8441	-0.00389	2.2813	2.66E+11	0.00	0.00	50.0609
3.2284	1.0741	7440.	853.0541	-0.00389	4.6051	2.66E+11	0.00	0.00	63.1257
3.6896	1.0525	13128.	1239.	-0.00389	8.1256	2.66E+11	0.00	0.00	76.1905
4.1508	1.0310	21150.	1696.	-0.00389	13.0905	2.66E+11	0.00	0.00	89.2553
4.6120	1.0094	31905.	2227.	-0.00389	19.7475	2.66E+11	0.00	0.00	102.3201
5.0732	0.9879	45795.	2829.	-0.00389	28.3443	2.66E+11	0.00	0.00	115.3849
5.5344	0.9663	63218.	3504.	-0.00389	39.1286	2.66E+11	0.00	0.00	128.4496
5.9956	0.9448	84576.	4251.	-0.00389	52.3480	2.66E+11	0.00	0.00	141.5144
6.4568	0.9233	110269.	5070.	-0.00389	68.2503	2.66E+11	0.00	0.00	154.5792
6.9180	0.9017	140696.	5962.	-0.00389	87.0831	2.66E+11	0.00	0.00	167.6440
7.3792	0.8802	176258.	6926.	-0.00388	109.0941	2.66E+11	0.00	0.00	180.7088
7.8404	0.8588	217355.	7962.	-0.00388	134.5309	2.66E+11	0.00	0.00	193.7736
8.3016	0.8373	264388.	9071.	-0.00387	163.6414	2.66E+11	0.00	0.00	206.8384
8.7628	0.8159	317755.	10251.	-0.00387	196.6730	2.66E+11	0.00	0.00	219.9032
9.2240	0.7945	377858.	11505.	-0.00386	233.8737	2.66E+11	0.00	0.00	232.9679
9.6852	0.7732	445097.	12830.	-0.00385	275.4909	2.66E+11	0.00	0.00	246.0327
10.1464	0.7519	519872.	14228.	-0.00384	321.7724	2.66E+11	0.00	0.00	259.0975
10.6076	0.7307	602583.	15698.	-0.00383	372.9659	2.66E+11	0.00	0.00	272.1623
11.0688	0.7095	693630.	17240.	-0.00382	429.3191	2.66E+11	0.00	0.00	285.2271
11.5300	0.6884	793414.	18855.	-0.00380	491.0796	2.66E+11	0.00	0.00	298.2919
11.9912	0.6674	902334.	20542.	-0.00378	558.4951	2.66E+11	0.00	0.00	311.3567
12.4524	0.6465	1020791.	22301.	-0.00376	631.8133	2.66E+11	0.00	0.00	324.4215
12.9136	0.6258	1149184.	24133.	-0.00374	711.2820	2.66E+11	0.00	0.00	337.4863
13.3748	0.6051	1287915.	26037.	-0.00371	797.1487	2.66E+11	0.00	0.00	350.5510
13.8360	0.5847	1437383.	28013.	-0.00369	889.6612	2.66E+11	0.00	0.00	363.6158
14.2972	0.5643	1597988.	30062.	-0.00365	989.0671	2.66E+11	0.00	0.00	376.6806
14.7584	0.5442	1770131.	32183.	-0.00362	1096.	2.66E+11	0.00	0.00	389.7454
15.2196	0.5243	1954212.	34376.	-0.00358	1210.	2.66E+11	0.00	0.00	402.8102
15.6808	0.5046	2150631.	36641.	-0.00354	1331.	2.66E+11	0.00	0.00	415.8750
16.1420	0.4851	2359787.	38979.	-0.00349	1461.	2.66E+11	0.00	0.00	428.9398
16.6032	0.4659	2582082.	41389.	-0.00344	1598.	2.66E+11	0.00	0.00	442.0046
17.0644	0.4470	2817915.	43872.	-0.00338	1744.	2.66E+11	0.00	0.00	455.0693
17.5256	0.4285	3067687.	46426.	-0.00332	1899.	2.66E+11	0.00	0.00	468.1341
17.9868	0.4103	3331798.	49053.	-0.00326	2062.	2.66E+11	0.00	0.00	481.1989
18.4480	0.3924	3610648.	51753.	-0.00318	2235.	2.66E+11	0.00	0.00	494.2637
18.9092	0.3750	3904636.	54463.	-0.00311	2417.	2.66E+11	0.00	0.00	485.2797
19.3704	0.3581	4213489.	54637.	-0.00304	0.00	4.98E+11	-422.383	6528.	0.00
19.8316	0.3414	4509404.	52893.	-0.00299	0.00	4.98E+11	-208.044	3373.	0.00
20.2928	0.3249	4798947.	51457.	-0.00294	0.00	4.98E+11	-310.755	5293.	0.00
20.7540	0.3088	5078971.	49599.	-0.00289	0.00	4.98E+11	-360.660	6464.	0.00
21.2152	0.2930	5347949.	47473.	-0.00283	0.00	4.98E+11	-407.494	7697.	0.00
21.6764	0.2775	5604446.	45094.	-0.00277	0.00	4.98E+11	-452.272	9020.	0.00
22.1376	0.2624	5847089.	42476.	-0.00270	0.00	4.98E+11	-493.796	10416.	0.00
22.5988	0.2476	6074608.	39640.	-0.00264	0.00	4.97E+11	-531.170	11873.	0.00

23.0600	0.2332	6285857.	36610.	-0.00257	0.00	4.97E+11	-563.826	13382.	0.00
23.5212	0.2192	6479836.	33407.	-0.00250	0.00	4.97E+11	-593.745	14994.	0.00
23.9824	0.2055	6655629.	30044.	-0.00242	0.00	4.97E+11	-621.576	16737.	0.00
24.4436	0.1923	6812384.	26541.	-0.00235	0.00	4.97E+11	-644.250	18539.	0.00
24.9048	0.1795	6949406.	22935.	-0.00227	0.00	4.97E+11	-658.718	20305.	0.00
25.3660	0.1672	7066251.	19257.	-0.00219	0.00	4.97E+11	-670.621	22201.	0.00
25.8272	0.1552	7162555.	15510.	-0.00212	0.00	4.97E+11	-683.353	24361.	0.00
26.2884	0.1438	7237929.	11708.	-0.00204	0.00	4.97E+11	-690.756	26592.	0.00
26.7496	0.1327	7292145.	7880.	-0.00195	0.00	4.97E+11	-692.628	28882.	0.00
27.2108	0.1221	7325146.	4057.	-0.00187	0.00	4.97E+11	-688.812	31213.	0.00
27.6720	0.1120	7337049.	269.5965	-0.00179	0.00	4.97E+11	-679.801	33594.	0.00
28.1332	0.1023	7328130.	-3451.	-0.00171	0.00	4.97E+11	-664.911	35968.	0.00
28.5944	0.09307	7298845.	-7073.	-0.00163	0.00	4.97E+11	-643.833	38283.	0.00
29.0556	0.08429	7249840.	-10561.	-0.00155	0.00	4.97E+11	-616.657	40488.	0.00
29.5168	0.07595	7181947.	-13894.	-0.00147	0.00	4.97E+11	-587.799	42830.	0.00
29.9780	0.06806	7096049.	-17073.	-0.00139	0.00	4.97E+11	-561.027	45620.	0.00
30.4392	0.06060	6992968.	-20091.	-0.00131	0.00	4.97E+11	-529.440	48348.	0.00
30.9004	0.05358	6873670.	-22921.	-0.00123	0.00	4.97E+11	-493.410	50966.	0.00
31.3616	0.04698	6739260.	-25541.	-0.00116	0.00	4.97E+11	-453.429	53418.	0.00
31.8228	0.04079	6590961.	-27931.	-0.00108	0.00	4.97E+11	-410.105	55641.	0.00
32.2840	0.03501	6430100.	-31688.	-0.00101	0.00	4.97E+11	-947.564	149785.	0.00
32.7452	0.02963	6240216.	-36867.	-9.38E-04	0.00	4.97E+11	-924.020	172607.	0.00
33.2064	0.02463	6022030.	-41905.	-8.70E-04	0.00	4.97E+11	-896.807	201535.	0.00
33.6676	0.02000	5776375.	-46781.	-8.04E-04	0.00	4.98E+11	-865.098	239411.	0.00
34.1288	0.01572	5504222.	-51465.	-7.42E-04	0.00	4.98E+11	-827.614	291285.	0.00
34.5900	0.01179	5206720.	-55920.	-6.82E-04	0.00	4.98E+11	-782.205	367186.	0.00
35.0512	0.00818	4885259.	-60090.	-6.26E-04	0.00	4.98E+11	-724.828	490684.	0.00
35.5124	0.00486	4541597.	-63884.	-5.74E-04	0.00	4.98E+11	-646.220	735694.	0.00
35.9736	0.00183	4178142.	-67094.	-5.25E-04	0.00	4.98E+11	-513.682	1556381.	0.00
36.4348	-9.51E-04	3798953.	-67299.	-4.81E-04	0.00	4.99E+11	439.5465	2557261.	0.00
36.8960	-0.00350	3433227.	-64362.	-4.41E-04	0.00	4.99E+11	621.5198	983971.	0.00
37.3572	-0.00583	3086537.	-60660.	-4.05E-04	0.00	4.99E+11	716.4738	680204.	0.00
37.8184	-0.00797	2761793.	-56503.	-3.72E-04	0.00	4.99E+11	785.8115	545407.	0.00
38.2796	-0.00995	2461118.	-51998.	-3.43E-04	0.00	4.99E+11	842.0920	468449.	0.00
38.7408	-0.01177	2186237.	-47204.	-3.17E-04	0.00	4.99E+11	890.3612	418566.	0.00
39.2020	-0.01346	1938626.	-42158.	-2.95E-04	0.00	4.99E+11	933.2048	383643.	0.00
39.6632	-0.01503	1719599.	-38769.	-2.74E-04	0.00	4.99E+11	291.6327	107364.	0.00
40.1244	-0.01650	1509505.	-37074.	-2.56E-04	0.00	4.99E+11	320.5840	107541.	0.00
40.5856	-0.01787	1309230.	-35221.	-2.41E-04	0.00	4.99E+11	349.3648	108194.	0.00
41.0468	-0.01916	1119656.	-33207.	-2.27E-04	0.00	4.99E+11	378.1365	109207.	0.00
41.5080	-0.02039	941664.	-31035.	-2.16E-04	0.00	4.99E+11	407.0395	110499.	0.00
41.9692	-0.02155	776140.	-28701.	-2.06E-04	0.00	4.99E+11	436.1998	112010.	0.00
42.4304	-0.02267	623976.	-26205.	-1.99E-04	0.00	4.99E+11	465.7332	113695.	0.00
42.8916	-0.02375	486077.	-23545.	-1.92E-04	0.00	4.99E+11	495.7475	115519.	0.00
43.3528	-0.02480	363363.	-20716.	-1.88E-04	0.00	4.99E+11	526.3431	117455.	0.00
43.8140	-0.02583	256771.	-17717.	-1.84E-04	0.00	4.99E+11	557.6132	119482.	0.00
44.2752	-0.02684	167258.	-14542.	-1.82E-04	0.00	4.99E+11	589.6429	121581.	0.00
44.7364	-0.02784	95805.	-11188.	-1.80E-04	0.00	4.99E+11	622.4161	123721.	0.00
45.1976	-0.02884	43417.	-7650.	-1.80E-04	0.00	4.99E+11	656.1788	125928.	0.00
45.6588	-0.02983	11128.	-3922.	-1.79E-04	0.00	4.99E+11	690.8948	128176.	0.00
46.1200	-0.03082	0.00	0.00	-1.79E-04	0.00	4.99E+11	726.6020	65230.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	1.22496446	inches
Computed slope at pile head	=	-0.0038950	radians
Maximum bending moment	=	7337049.	inch-lbs
Maximum shear force	=	-67299.	lbs
Depth of maximum bending moment	=	27.67200000	feet below pile head
Depth of maximum shear force	=	36.43480000	feet below pile head
Number of iterations	=	23	
Number of zero deflection points	=	1	
Pile deflection at ground	=	0.36727646	inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear	=	0.	lbs
Moment	=	0.	in-lbs
Axial Load	=	0.	lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
46.12000	1.22496446	7337049.	-67299.
43.81400	1.31223756	7224026.	-73892.
41.50800	1.63629532	7176591.	-80140.
39.20200	2.07083204	6787885.	-80915.
36.89600	3.75709853	6416650.	-81759.
34.59000	9.40626000	6145508.	-86394.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	0.0	lbs
Applied moment at pile head	=	0.0	in-lbs
Axial thrust load on pile head	=	0.0	lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.3370	-1.12E-04	0.00	-0.00698	6.91E-08	2.66E+11	0.00	0.00	0.00
0.4612	2.2984	-5.78E-05	4.87E-06	-0.00698	3.58E-08	2.66E+11	0.00	0.00	0.00
0.9224	2.2598	-5.78E-05	2.9843	-0.00698	3.58E-08	2.66E+11	0.00	0.00	1.0784
1.3836	2.2212	33.0321	51.0763	-0.00698	0.02045	2.66E+11	0.00	0.00	16.3009

1.8448	2.1825	565.3535	195.5248	-0.00698	0.3499	2.66E+11	0.00	0.00	35.8993
2.3060	2.1439	2197.	448.4389	-0.00698	1.3600	2.66E+11	0.00	0.00	55.4978
2.7672	2.1053	5529.	809.8187	-0.00698	3.4222	2.66E+11	0.00	0.00	75.0962
3.2284	2.0667	11161.	1280.	-0.00698	6.9080	2.66E+11	0.00	0.00	94.6947
3.6896	2.0280	19693.	1858.	-0.00698	12.1891	2.66E+11	0.00	0.00	114.2932
4.1508	1.9894	31727.	2545.	-0.00698	19.6370	2.66E+11	0.00	0.00	133.8916
4.6120	1.9508	47861.	3340.	-0.00698	29.6232	2.66E+11	0.00	0.00	153.4901
5.0732	1.9122	68696.	4244.	-0.00698	42.5192	2.66E+11	0.00	0.00	173.0885
5.5344	1.8736	94833.	5256.	-0.00697	58.6967	2.66E+11	0.00	0.00	192.6870
5.9956	1.8350	126873.	6377.	-0.00697	78.5271	2.66E+11	0.00	0.00	212.2854
6.4568	1.7964	165414.	7606.	-0.00697	102.3821	2.66E+11	0.00	0.00	231.8839
6.9180	1.7579	211058.	8943.	-0.00696	130.6331	2.66E+11	0.00	0.00	251.4823
7.3792	1.7193	264404.	10389.	-0.00696	163.6517	2.66E+11	0.00	0.00	271.0808
7.8404	1.6808	326054.	11944.	-0.00695	201.8095	2.66E+11	0.00	0.00	290.6792
8.3016	1.6424	396607.	13607.	-0.00695	245.4780	2.66E+11	0.00	0.00	310.2777
8.7628	1.6040	476664.	15378.	-0.00694	295.0287	2.66E+11	0.00	0.00	329.8762
9.2240	1.5656	566825.	17258.	-0.00693	350.8333	2.66E+11	0.00	0.00	349.4746
9.6852	1.5273	667690.	19246.	-0.00691	413.2632	2.66E+11	0.00	0.00	369.0731
10.1464	1.4891	779859.	21343.	-0.00690	482.6899	2.66E+11	0.00	0.00	388.6715
10.6076	1.4509	903933.	23549.	-0.00688	559.4852	2.66E+11	0.00	0.00	408.2700
11.0688	1.4129	1040513.	25862.	-0.00686	644.0204	2.66E+11	0.00	0.00	427.8684
11.5300	1.3750	1190198.	28285.	-0.00684	736.6672	2.66E+11	0.00	0.00	447.4669
11.9912	1.3372	1353589.	30815.	-0.00681	837.7971	2.66E+11	0.00	0.00	467.0653
12.4524	1.2996	1531285.	33454.	-0.00678	947.7816	2.66E+11	0.00	0.00	486.6638
12.9136	1.2622	1723888.	36202.	-0.00675	1067.	2.66E+11	0.00	0.00	506.2623
13.3748	1.2249	1931998.	39058.	-0.00671	1196.	2.66E+11	0.00	0.00	525.8607
13.8360	1.1879	2156214.	42023.	-0.00667	1335.	2.66E+11	0.00	0.00	545.4592
14.2972	1.1512	2397138.	45096.	-0.00662	1484.	2.66E+11	0.00	0.00	565.0576
14.7584	1.1147	2655369.	48277.	-0.00657	1644.	2.66E+11	0.00	0.00	584.6561
15.2196	1.0785	2931508.	51567.	-0.00651	1814.	2.66E+11	0.00	0.00	604.2545
15.6808	1.0426	3226155.	54966.	-0.00644	1997.	2.66E+11	0.00	0.00	623.8530
16.1420	1.0072	3539911.	58472.	-0.00637	2191.	2.66E+11	0.00	0.00	643.4514
16.6032	0.9721	3873375.	62088.	-0.00630	2397.	2.66E+11	0.00	0.00	663.0499
17.0644	0.9375	4227148.	65812.	-0.00621	2616.	2.66E+11	0.00	0.00	682.6483
17.5256	0.9033	4601830.	69644.	-0.00612	2848.	2.66E+11	0.00	0.00	702.2468
17.9868	0.8697	4998022.	73585.	-0.00602	3094.	2.66E+11	0.00	0.00	721.8453
18.4480	0.8367	5416323.	77634.	-0.00591	3352.	2.66E+11	0.00	0.00	741.4437
18.9092	0.8043	5857335.	81700.	-0.00579	3625.	2.66E+11	0.00	0.00	727.9669
19.3704	0.7726	6320644.	82298.	-0.00570	0.00	4.97E+11	-511.915	3667.	0.00
19.8316	0.7412	6768273.	79991.	-0.00562	0.00	4.97E+11	-321.638	2401.	0.00
20.2928	0.7103	7206051.	78023.	-0.00555	0.00	4.97E+11	-389.719	3036.	0.00
20.7540	0.6798	7631891.	75687.	-0.00546	0.00	4.96E+11	-454.247	3698.	0.00
21.2152	0.6498	8043819.	73004.	-0.00538	0.00	4.96E+11	-515.616	4391.	0.00
21.6764	0.6203	8439953.	69986.	-0.00528	0.00	4.96E+11	-574.812	5128.	0.00
22.1376	0.5913	8818481.	66651.	-0.00519	0.00	4.96E+11	-630.494	5901.	0.00
22.5988	0.5629	9177697.	63020.	-0.00509	0.00	4.96E+11	-681.613	6702.	0.00
23.0600	0.5350	9516035.	59121.	-0.00498	0.00	4.96E+11	-727.453	7525.	0.00
23.5212	0.5077	9832093.	54975.	-0.00488	0.00	4.95E+11	-770.619	8400.	0.00
23.9824	0.4810	1.01E+07	50596.	-0.00476	0.00	4.95E+11	-811.991	9342.	0.00
24.4436	0.4550	1.04E+07	46004.	-0.00465	0.00	4.95E+11	-847.562	10310.	0.00
24.9048	0.4296	1.06E+07	41243.	-0.00453	0.00	4.95E+11	-872.937	11246.	0.00
25.3660	0.4048	1.08E+07	36347.	-0.00441	0.00	4.95E+11	-896.097	12251.	0.00
25.8272	0.3807	1.10E+07	31323.	-0.00429	0.00	4.95E+11	-919.614	13367.	0.00
26.2884	0.3573	1.12E+07	26186.	-0.00416	0.00	4.94E+11	-936.766	14508.	0.00
26.7496	0.3346	1.13E+07	20973.	-0.00404	0.00	4.94E+11	-947.221	15665.	0.00
27.2108	0.3126	1.14E+07	15721.	-0.00391	0.00	4.94E+11	-950.686	16829.	0.00
27.6720	0.2913	1.15E+07	10459.	-0.00378	0.00	4.94E+11	-950.931	18064.	0.00
28.1332	0.2708	1.15E+07	5211.	-0.00365	0.00	4.94E+11	-945.393	19324.	0.00

28.5944	0.2509	1.16E+07	15.5972	-0.00352	0.00	4.94E+11	-932.104	20560.	0.00
29.0556	0.2318	1.15E+07	-5084.	-0.00340	0.00	4.94E+11	-910.885	21753.	0.00
29.5168	0.2133	1.15E+07	-10062.	-0.00327	0.00	4.94E+11	-888.009	23039.	0.00
29.9780	0.1956	1.14E+07	-14924.	-0.00314	0.00	4.94E+11	-868.924	24586.	0.00
30.4392	0.1786	1.13E+07	-19661.	-0.00301	0.00	4.94E+11	-842.824	26120.	0.00
30.9004	0.1623	1.12E+07	-24234.	-0.00288	0.00	4.94E+11	-809.753	27617.	0.00
31.3616	0.1467	1.11E+07	-28605.	-0.00276	0.00	4.95E+11	-769.866	29053.	0.00
31.8228	0.1317	1.09E+07	-32737.	-0.00264	0.00	4.95E+11	-723.451	30396.	0.00
32.2840	0.1175	1.07E+07	-38288.	-0.00252	0.00	4.95E+11	-1282.	60418.	0.00
32.7452	0.1039	1.05E+07	-45335.	-0.00240	0.00	4.95E+11	-1264.	67363.	0.00
33.2064	0.09093	1.02E+07	-52274.	-0.00228	0.00	4.95E+11	-1243.	75658.	0.00
33.6676	0.07862	9895392.	-59084.	-0.00217	0.00	4.95E+11	-1218.	85747.	0.00
34.1288	0.06692	9549741.	-65744.	-0.00206	0.00	4.96E+11	-1189.	98303.	0.00
34.5900	0.05581	9167684.	-72226.	-0.00196	0.00	4.96E+11	-1154.	114410.	0.00
35.0512	0.04526	8750291.	-78494.	-0.00186	0.00	4.96E+11	-1112.	135933.	0.00
35.5124	0.03526	8298848.	-84504.	-0.00176	0.00	4.96E+11	-1060.	166430.	0.00
35.9736	0.02577	7814928.	-90192.	-0.00167	0.00	4.96E+11	-994.993	213716.	0.00
36.4348	0.01676	7300532.	-95454.	-0.00159	0.00	4.97E+11	-906.702	299461.	0.00
36.8960	0.00820	6758365.	-100092.	-0.00151	0.00	4.97E+11	-769.326	519378.	0.00
37.3572	5.51E-05	6192633.	-102293.	-0.00144	0.00	4.97E+11	-26.201	2631584.	0.00
37.8184	-0.00771	5626098.	-100210.	-0.00137	0.00	4.98E+11	779.1927	559590.	0.00
38.2796	-0.01512	5083430.	-95466.	-0.00131	0.00	4.98E+11	935.0658	342232.	0.00
38.7408	-0.02222	4569403.	-89990.	-0.00126	0.00	4.98E+11	1044.	259913.	0.00
39.2020	-0.02905	4087344.	-83973.	-0.00121	0.00	4.98E+11	1131.	215517.	0.00
39.6632	-0.03562	3639928.	-79479.	-0.00117	0.00	4.99E+11	492.7121	76565.	0.00
40.1244	-0.04196	3207604.	-76551.	-0.00113	0.00	4.99E+11	565.5101	74586.	0.00
40.5856	-0.04811	2792601.	-73221.	-0.00110	0.00	4.99E+11	637.9499	73385.	0.00
41.0468	-0.05409	2397138.	-69489.	-0.00107	0.00	4.99E+11	710.6359	72711.	0.00
41.5080	-0.05992	2023442.	-65353.	-0.00104	0.00	4.99E+11	784.0165	72413.	0.00
41.9692	-0.06563	1673760.	-60808.	-0.00102	0.00	4.99E+11	858.4450	72392.	0.00
42.4304	-0.07123	1350372.	-55847.	-0.00101	0.00	4.99E+11	934.2124	72583.	0.00
42.8916	-0.07675	1055598.	-50463.	-9.92E-04	0.00	4.99E+11	1012.	72939.	0.00
43.3528	-0.08221	791808.	-44645.	-9.82E-04	0.00	4.99E+11	1091.	73426.	0.00
43.8140	-0.08762	561427.	-38384.	-9.74E-04	0.00	4.99E+11	1172.	74020.	0.00
44.2752	-0.09299	366939.	-31668.	-9.69E-04	0.00	4.99E+11	1255.	74700.	0.00
44.7364	-0.09834	210897.	-24485.	-9.66E-04	0.00	4.99E+11	1341.	75442.	0.00
45.1976	-0.104	95916.	-16822.	-9.64E-04	0.00	4.99E+11	1429.	76256.	0.00
45.6588	-0.109	24692.	-8665.	-9.63E-04	0.00	4.99E+11	1519.	77123.	0.00
46.1200	-0.114	0.00	0.00	-9.63E-04	0.00	4.99E+11	1612.	39018.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection	=	2.33703476	inches
Computed slope at pile head	=	-0.0069788	radians
Maximum bending moment	=	11557607.	inch-lbs
Maximum shear force	=	-102293.	lbs
Depth of maximum bending moment	=	28.59440000	feet below pile head
Depth of maximum shear force	=	37.35720000	feet below pile head
Number of iterations	=	25	
Number of zero deflection points	=	1	

Pile deflection at ground = 0.78979849 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
46.12000	2.33703476	11557607.	-102293.
43.81400	2.73752357	11244489.	-111846.
41.50800	3.86222075	10964236.	-119475.
39.20200	5.95353457	10223851.	-119934.
36.89600	20.68958574	10053942.	-137031.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

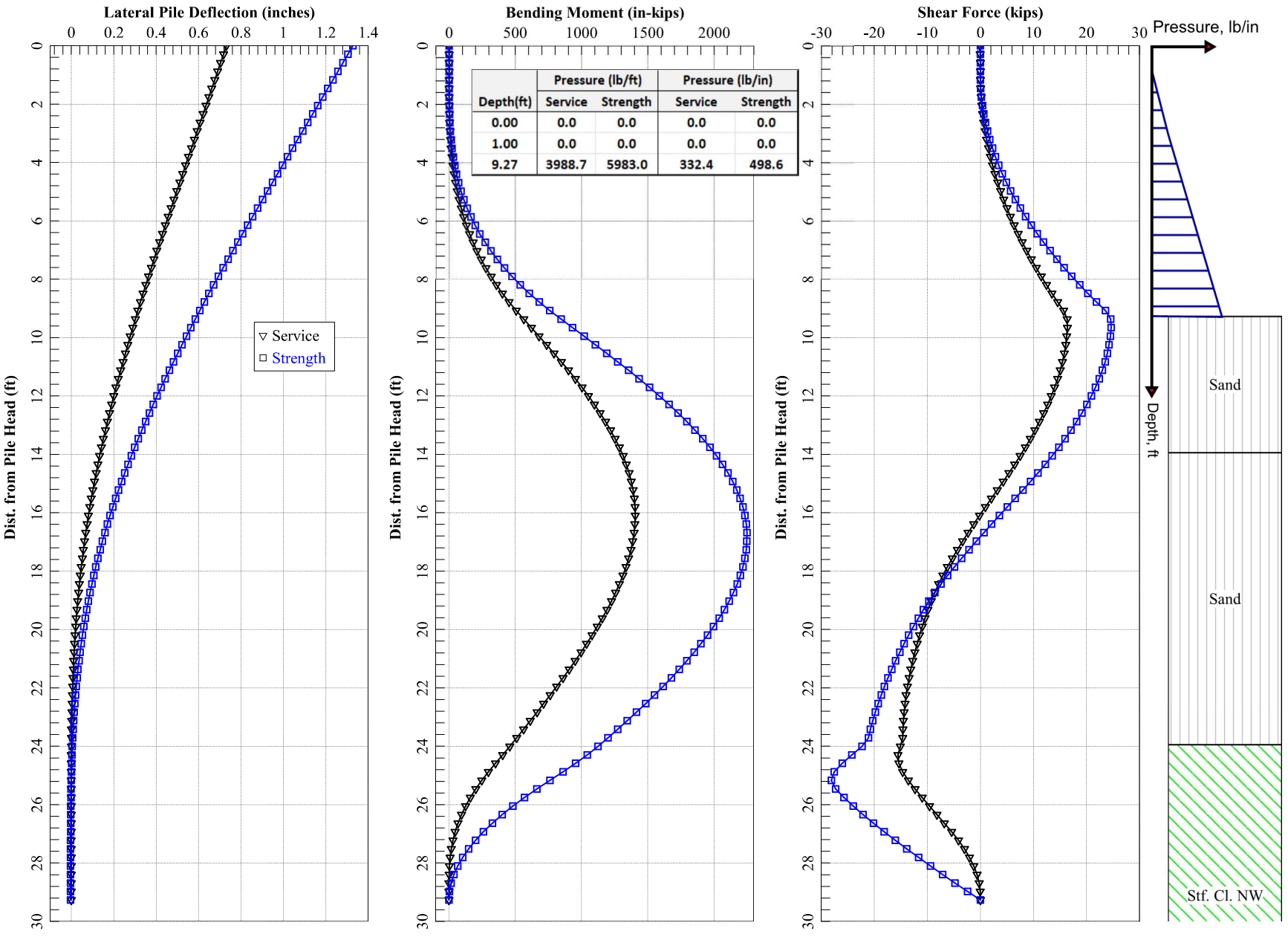
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.2250	-0.00390	-67299.	7337049.
2	V, lb	0.00	M, in-lb	0.00	0.00	2.3370	-0.00698	-102293.	1.16E+07

Maximum pile-head deflection = 2.3370347586 inches
Maximum pile-head rotation = -0.0069788275 radians = -0.399857 deg.

The analysis ended normally.

Wall 2A (9.27 ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.0
9.27	3988.7	5983.0	332.4	498.6

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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 2A\

Name of input data file:
Wall_2A-9.27ft.lp12d

Name of output report file:
Wall_2A-9.27ft.lp12o

Name of plot output file:
Wall_2A-9.27ft.lp12p

Name of runtime message file:
Wall_2A-9.27ft.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 21:42:44

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 2A(H=9.27FT) Boring B-002-0-02

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 29.270 ft
Depth of ground surface below top of pile = 9.2700 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	8.1400
2	9.270	8.1400
3	9.270	30.0000
4	29.270	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a AISC strong axis steel pile
   Length of section = 9.270000 ft
   AISC Section Type = W
   AISC Section Name = W21X48
   Pile width = 8.140000 in

Pile Section No. 2:

   Section 2 is a drilled shaft with casing and AISC section core/insert
   Length of section = 20.000000 ft
   Section Diameter = 30.000000 in
   Core/Insert AISC Section Type = W
   Core/Insert AISC Section Name = W21X48

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 9.270000 ft
   Distance from top of pile to bottom of layer = 13.940000 ft
   Effective unit weight at top of layer = 57.600000 pcf
   Effective unit weight at bottom of layer = 57.600000 pcf
   Friction angle at top of layer = 32.000000 deg.
   Friction angle at bottom of layer = 32.000000 deg.
   Subgrade k at top of layer = 90.000000 pci
   Subgrade k at bottom of layer = 90.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer = 13.940000 ft
   Distance from top of pile to bottom of layer = 23.940000 ft
   Effective unit weight at top of layer = 62.600000 pcf

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   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    33.000000 deg.
   Friction angle at bottom of layer                   =    33.000000 deg.
   Subgrade k at top of layer                          =    90.000000 pci
   Subgrade k at bottom of layer                       =    90.000000 pci


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer           =    23.940000 ft
   Distance from top of pile to bottom of layer        =    45.000000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        4000. psf
   Undrained cohesion at bottom of layer               =        4000. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000


 (Depth of the lowest soil layer extends 15.730 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.          Name              Depth       Unit Wt.                 Friction        or          kpy
        (p-y Curve Type)          ft          pcf          psf          deg.         krm         pci
-----   ------------------   ----------   ----------   ----------   ----------   ----------   ----------
  1           Sand              9.2700      57.6000       --          32.0000       --          90.0000
        (Reese, et al.)        13.9400      57.6000       --          32.0000       --          90.0000
  2           Sand             13.9400      62.6000       --          33.0000       --          90.0000
        (Reese, et al.)        23.9400      62.6000       --          33.0000       --          90.0000
  3         Stiff Clay         23.9400      62.6000        4000.       --          0.00400       --
        w/o Free Water         45.0000      62.6000        4000.       --          0.00400       --


--------------------------------------------------------------------------------
                        Modification Factors for p-y Curves
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Distribution of p-y modifiers with depth defined using 2 points

Point      Depth X         p-mult         y-mult
 No.          ft
-----     ----------     ----------     ----------
  1           9.270         0.9300         1.0000
  2          30.000         0.9300         1.0000



--------------------------------------------------------------------------------
                               Static Loading Type
--------------------------------------------------------------------------------
```

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.270	332.400

Distributed lateral load intensity for Load Case 2 defined using 3 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	1.000	0.000
3	9.270	498.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	9.270000 ft
Flange Width	=	8.140000 in
Section Depth	=	20.600000 in
Flange Thickness	=	0.430000 in
Web Thickness	=	0.350000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	14.100000 sq. in.
Moment of Inertia	=	959.000000 in^4
Elastic Bending Stiffness	=	27811000. kip-in^2
Plastic Modulus, Z	=	107.000000in^3
Plastic Moment Capacity = Fy Z	=	5350.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	705.000 kips
Nominal Axial Tensile Capacity	=	-705.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000900	244.3185254	27140626.	10.3000000	2.6619933	
0.00001800	488.6370509	27140626.	10.3000000	5.3239865	
0.00002701	732.9555763	27140626.	10.3000000	7.9859798	
0.00003601	977.2741017	27140626.	10.3000000	10.6479731	
0.00004501	1222.	27140626.	10.3000000	13.3099663	
0.00005401	1466.	27140626.	10.3000000	15.9719596	
0.00006301	1710.	27140626.	10.3000000	18.6339529	
0.00007202	1955.	27140626.	10.3000000	21.2959462	

0.00008102	2199.	27140626.	10.3000000	23.9579394	
0.00009002	2443.	27140626.	10.3000000	26.6199327	
0.00009902	2688.	27140626.	10.3000000	29.2819260	
0.0001080	2932.	27140626.	10.3000000	31.9439192	
0.0001170	3176.	27140626.	10.3000000	34.6059125	
0.0001260	3420.	27140626.	10.3000000	37.2679058	
0.0001350	3665.	27140626.	10.3000000	39.9298990	
0.0001440	3909.	27140626.	10.3000000	42.5918923	
0.0001530	4153.	27140626.	10.3000000	45.2538856	
0.0001620	4398.	27140626.	10.3000000	47.9158788	
0.0001710	4622.	27025086.	10.3000000	50.0000000	Y
0.0001800	4699.	26097207.	10.3000000	50.0000000	Y
0.0001890	4748.	25116944.	10.3000000	50.0000000	Y
0.0001980	4791.	24192917.	10.3000000	50.0000000	Y
0.0002070	4829.	23323100.	10.3000000	50.0000000	Y
0.0002160	4862.	22503691.	10.3000000	50.0000000	Y
0.0002250	4891.	21732866.	10.3000000	50.0000000	Y
0.0002341	4917.	21007412.	10.3000000	50.0000000	Y
0.0002431	4940.	20324453.	10.3000000	50.0000000	Y
0.0002521	4960.	19679845.	10.3000000	50.0000000	Y
0.0002611	4979.	19071981.	10.3000000	50.0000000	Y
0.0002701	4996.	18498003.	10.3000000	50.0000000	Y
0.0002791	5011.	17955375.	10.3000000	50.0000000	Y
0.0002881	5024.	17441835.	10.3000000	50.0000000	Y
0.0002971	5037.	16955353.	10.3000000	50.0000000	Y
0.0003061	5048.	16494093.	10.3000000	50.0000000	Y
0.0003151	5059.	16056087.	10.3000000	50.0000000	Y
0.0003241	5068.	15639249.	10.3000000	50.0000000	Y
0.0003331	5077.	15242974.	10.3000000	50.0000000	Y
0.0003421	5085.	14866014.	10.3000000	50.0000000	Y
0.0003511	5093.	14505792.	10.3000000	50.0000000	Y
0.0003691	5106.	13834632.	10.3000000	50.0000000	Y
0.0003871	5118.	13221115.	10.3000000	50.0000000	Y
0.0004051	5128.	12658289.	10.3000000	50.0000000	Y
0.0004231	5136.	12140325.	10.3000000	50.0000000	Y
0.0004411	5144.	11662286.	10.3000000	50.0000000	Y
0.0004591	5151.	11219957.	10.3000000	50.0000000	Y
0.0004771	5157.	10809570.	10.3000000	50.0000000	Y
0.0004951	5163.	10427181.	10.3000000	50.0000000	Y
0.0005131	5168.	10070951.	10.3000000	50.0000000	Y
0.0005311	5172.	9737768.	10.3000000	50.0000000	Y
0.0005491	5176.	9425723.	10.3000000	50.0000000	Y
0.0005671	5179.	9132825.	10.3000000	50.0000000	Y
0.0005851	5183.	8857446.	10.3000000	50.0000000	Y
0.0006031	5186.	8597884.	10.3000000	50.0000000	Y
0.0006211	5189.	8353308.	10.3000000	50.0000000	Y
0.0006391	5191.	8121659.	10.3000000	50.0000000	Y
0.0006571	5193.	7902703.	10.3000000	50.0000000	Y
0.0006751	5195.	7695196.	10.3000000	50.0000000	Y
0.0006932	5197.	7497971.	10.3000000	50.0000000	Y
0.0007112	5199.	7310732.	10.3000000	50.0000000	Y
0.0007292	5201.	7132696.	10.3000000	50.0000000	Y
0.0007472	5202.	6962717.	10.3000000	50.0000000	Y
0.0007652	5204.	6800737.	10.3000000	50.0000000	Y
0.0007832	5205.	6646204.	10.3000000	50.0000000	Y
0.0008012	5206.	6498518.	10.3000000	50.0000000	Y
0.0008192	5208.	6356990.	10.3000000	50.0000000	Y
0.0008372	5209.	6221549.	10.3000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	5209.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	20.000000 ft
Outside Diameter of Casing	=	30.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	8.140000 in
Depth of Core/Insert	=	20.600000 in
Flange Thickness of Core/Insert	=	0.430000 in
Web Thickness of Core/Insert	=	0.350000 in
Moment of Inertia of Steel Core/Insert	=	959.000000 in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	706.858347 sq. in.
Area of Concrete	=	692.948947 sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	14.100000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	13.909400 sq. in.
Area Ratio of All Steel to Gross Area	=	1.97 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 3649.223 kips
Tensile Load for Cracking of Concrete = -368.047 kips
Nominal Axial Tensile Capacity = -705.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000900	516.2026224	57343431.	8.4878467	0.00007641	-0.000194	0.3495694	0.00000	0.00000	-4.401975	C
0.00001800	1029.	57179428.	8.5128157	0.0001533	-0.000387	0.6884519	0.00000	0.00000	-8.790913	C
0.00002701	1540.	57012512.	8.5382994	0.0002306	-0.000580	1.0164771	0.00000	0.00000	-13.166412	C
0.00003601	2047.	56842633.	8.5638426	0.0003084	-0.000772	1.3333976	0.00000	0.00000	-17.528543	C
0.00004501	2551.	56669742.	8.5895232	0.0003866	-0.000964	1.6389956	0.00000	0.00000	-21.877158	C
0.00005401	3051.	56493689.	8.6157499	0.0004654	-0.001155	1.9331252	0.00000	0.00000	-26.211510	C
0.00006301	3549.	56314345.	8.6425470	0.0005446	-0.001346	2.2155870	0.00000	0.00000	-30.531126	C
0.00007202	4042.	56131571.	8.6699405	0.0006244	-0.001536	2.4861724	0.00000	0.00000	-34.835505	C
0.00008102	4533.	55945220.	8.6979583	0.0007047	-0.001726	2.7446617	0.00000	0.00000	-39.124115	C
0.00009002	5019.	55755133.	8.7266302	0.0007856	-0.001915	2.9908242	0.00000	0.00000	-43.396389	C
0.00009902	5502.	55561141.	8.7559882	0.0008670	-0.002104	3.2244164	0.00000	0.00000	-47.651723	C
0.0001080	5912.	54727095.	8.7478982	0.0009450	-0.002296	3.4342602	0.00000	0.00000	-50.000000	CY
0.0001170	6108.	52192509.	8.6352203	0.0010105	-0.002500	3.6000093	0.00000	0.00000	-50.000000	CY
0.0001260	6272.	49769910.	8.5241277	0.0010743	-0.002707	3.7521591	0.00000	0.00000	-50.000000	CY
0.0001350	6412.	47485645.	8.4138697	0.0011361	-0.002915	3.8913487	0.00000	0.00000	-50.000000	CY
0.0001440	6532.	45351873.	8.3089359	0.0011967	-0.003124	4.0197536	0.00000	0.00000	-50.000000	CY
0.0001530	6636.	43364563.	8.2077800	0.0012561	-0.003335	4.1376782	0.00000	0.00000	-50.000000	CY
0.0001620	6727.	41518697.	8.1100630	0.0013141	-0.003547	4.2457217	0.00000	0.00000	-50.000000	CY
0.0001710	6808.	39804155.	8.0180319	0.0013714	-0.003760	4.3451868	0.00000	0.00000	-50.000000	CY
0.0001800	6880.	38212590.	7.9308456	0.0014279	-0.003973	4.4363735	0.00000	0.00000	-50.000000	CY
0.0001890	6943.	36729926.	7.8457407	0.0014832	-0.004188	4.5189978	0.00000	0.00000	-50.000000	CY
0.0001980	7001.	35349266.	7.7657334	0.0015379	-0.004403	4.5943715	0.00000	0.00000	-50.000000	CY
0.0002070	7053.	34064396.	7.6909133	0.0015924	-0.004619	4.6628747	0.00000	0.00000	-50.000000	CY
0.0002160	7100.	32862056.	7.6188393	0.0016460	-0.004835	4.7242077	0.00000	0.00000	-50.000000	CY
0.0002250	7142.	31736526.	7.5490921	0.0016989	-0.005053	4.7786163	0.00000	0.00000	-50.000000	CY
0.0002341	7181.	30682704.	7.4836016	0.0017515	-0.005270	4.8268238	0.00000	0.00000	-50.000000	CY
0.0002431	7217.	29693043.	7.4218527	0.0018039	-0.005488	4.8689122	0.00000	0.00000	-50.000000	CY
0.0002521	7250.	28763356.	7.3638407	0.0018561	-0.005706	4.9050395	0.00000	0.00000	-50.000000	CY
0.0002611	7280.	27886001.	7.3066752	0.0019075	-0.005924	4.9349108	0.00000	0.00000	-50.000000	CY
0.0002701	7307.	27058234.	7.2520059	0.0019585	-0.006143	4.9590052	0.00000	0.00000	-50.000000	CY
0.0002791	7333.	26276216.	7.2003740	0.0020093	-0.006362	4.9775113	0.00000	0.00000	-50.000000	CY
0.0002881	7356.	25536445.	7.1516169	0.0020601	-0.006582	4.9904820	0.00000	0.00000	-50.000000	CY
0.0002971	7378.	24836132.	7.1056862	0.0021108	-0.006801	4.9979570	0.00000	0.00000	-50.000000	CY

0.0003061	7398.	24172404.	7.0625020	0.0021616	-0.007020	4.9969981	0.00000	0.00000	-50.000000 CY
0.0003151	7417.	23540024.	7.0197538	0.0022117	-0.007240	4.9982906	0.00000	0.00000	-50.000000 CY
0.0003241	7433.	22937618.	6.9783471	0.0022615	-0.007461	4.9970163	0.00000	0.00000	-50.000000 CY
0.0003331	7449.	22364579.	6.9396229	0.0023114	-0.007681	4.9974822	0.00000	0.00000	-50.000000 CY
0.0003421	7463.	21817845.	6.9026797	0.0023612	-0.007901	4.9999798	0.00000	0.00000	-50.000000 CY
0.0003511	7477.	21296193.	6.8680710	0.0024112	-0.008121	4.9950538	0.00000	0.00000	-50.000000 CY
0.0003691	7500.	20321766.	6.8041286	0.0025113	-0.008561	4.9934281	0.00000	0.00000	-50.000000 CY
0.0003871	7521.	19429367.	6.7466657	0.0026115	-0.009001	4.9995524	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	7521.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	9.2700	0.00	N.A.	No	0.00	17009.
2	13.9400	4.5178	Yes	No	17009.	180893.
3	23.9400	5.5083	No	No	197903.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.7317	5.62E-06	-3.48E-08	-0.00392	2.38E-08	2.71E+10	0.00	0.00	0.00
0.2927	0.7179	2.44E-06	-3.48E-07	-0.00392	1.04E-08	2.71E+10	0.00	0.00	0.00
0.5854	0.7042	3.18E-06	1.39E-07	-0.00392	1.35E-08	2.71E+10	0.00	0.00	0.00
0.8781	0.6904	3.42E-06	0.07208	-0.00392	1.45E-08	2.71E+10	0.00	0.00	0.04105
1.1708	0.6766	0.5064	12.2006	-0.00392	0.00215	2.71E+10	0.00	0.00	6.8650
1.4635	0.6629	85.7065	56.9744	-0.00392	0.3637	2.71E+10	0.00	0.00	18.6297
1.7562	0.6491	400.7400	143.0703	-0.00392	1.7007	2.71E+10	0.00	0.00	30.3943
2.0489	0.6354	1091.	270.4883	-0.00392	4.6291	2.71E+10	0.00	0.00	42.1589
2.3416	0.6216	2301.	439.2283	-0.00392	9.7649	2.71E+10	0.00	0.00	53.9236
2.6343	0.6079	4176.	649.2905	-0.00392	17.7240	2.71E+10	0.00	0.00	65.6882
2.9270	0.5941	6862.	900.6747	-0.00391	29.1224	2.71E+10	0.00	0.00	77.4528
3.2197	0.5804	10503.	1193.	-0.00391	44.5760	2.71E+10	0.00	0.00	89.2174
3.5124	0.5666	15245.	1527.	-0.00391	64.7010	2.71E+10	0.00	0.00	100.9821
3.8051	0.5529	21233.	1903.	-0.00391	90.1131	2.71E+10	0.00	0.00	112.7467
4.0978	0.5392	28612.	2319.	-0.00391	121.4285	2.71E+10	0.00	0.00	124.5113
4.3905	0.5254	37527.	2777.	-0.00390	159.2630	2.71E+10	0.00	0.00	136.2760
4.6832	0.5118	48123.	3277.	-0.00390	204.2327	2.71E+10	0.00	0.00	148.0406
4.9759	0.4981	60545.	3817.	-0.00389	256.9535	2.71E+10	0.00	0.00	159.8052
5.2686	0.4844	74939.	4399.	-0.00388	318.0414	2.71E+10	0.00	0.00	171.5698
5.5613	0.4708	91450.	5023.	-0.00387	388.1124	2.71E+10	0.00	0.00	183.3345
5.8540	0.4572	110222.	5687.	-0.00386	467.7824	2.71E+10	0.00	0.00	195.0991
6.1467	0.4437	131401.	6393.	-0.00384	557.6674	2.71E+10	0.00	0.00	206.8637
6.4394	0.4303	155133.	7140.	-0.00382	658.3834	2.71E+10	0.00	0.00	218.6284
6.7321	0.4169	181561.	7929.	-0.00380	770.5464	2.71E+10	0.00	0.00	230.3930
7.0248	0.4036	210832.	8759.	-0.00378	894.7723	2.71E+10	0.00	0.00	242.1576
7.3175	0.3903	243091.	9630.	-0.00375	1032.	2.71E+10	0.00	0.00	253.9222
7.6102	0.3772	278482.	10543.	-0.00371	1182.	2.71E+10	0.00	0.00	265.6869
7.9029	0.3643	317150.	11496.	-0.00367	1346.	2.71E+10	0.00	0.00	277.4515
8.1956	0.3514	359242.	12492.	-0.00363	1525.	2.71E+10	0.00	0.00	289.2161
8.4883	0.3388	404902.	13528.	-0.00358	1718.	2.71E+10	0.00	0.00	300.9808
8.7810	0.3263	454275.	14606.	-0.00353	1928.	2.71E+10	0.00	0.00	312.7454
9.0737	0.3140	507506.	15725.	-0.00346	2154.	2.71E+10	0.00	0.00	324.5100
9.3664	0.3020	564741.	16384.	-0.00341	0.00	5.73E+10	-6.062	70.5125	56.5536
9.6591	0.2900	622598.	16428.	-0.00338	0.00	5.73E+10	-25.363	307.1568	0.00
9.9518	0.2782	680143.	16303.	-0.00334	0.00	5.73E+10	-45.662	576.4372	0.00
10.2445	0.2666	737125.	16106.	-0.00329	0.00	5.72E+10	-66.517	876.3887	0.00
10.5372	0.2551	793285.	15836.	-0.00325	0.00	5.72E+10	-87.520	1205.	0.00
10.8299	0.2438	848366.	15491.	-0.00320	0.00	5.72E+10	-108.872	1569.	0.00
11.1226	0.2327	902104.	15071.	-0.00314	0.00	5.72E+10	-129.883	1961.	0.00
11.4153	0.2217	954240.	14579.	-0.00308	0.00	5.72E+10	-150.210	2380.	0.00
11.7080	0.2110	1004522.	14018.	-0.00302	0.00	5.72E+10	-169.524	2822.	0.00
12.0007	0.2005	1052713.	13390.	-0.00296	0.00	5.72E+10	-188.103	3296.	0.00
12.2934	0.1902	1098584.	12699.	-0.00290	0.00	5.71E+10	-205.425	3794.	0.00

12.5861	0.1801	1141920.	11950.	-0.00283	0.00	5.71E+10	-221.090	4311.	0.00
12.8788	0.1703	1182528.	11149.	-0.00276	0.00	5.71E+10	-234.848	4843.	0.00
13.1715	0.1608	1220240.	10302.	-0.00268	0.00	5.71E+10	-247.662	5411.	0.00
13.4642	0.1515	1254895.	9411.	-0.00261	0.00	5.71E+10	-259.580	6019.	0.00
13.7569	0.1425	1286349.	8482.	-0.00253	0.00	5.71E+10	-269.411	6642.	0.00
14.0496	0.1337	1314478.	7497.	-0.00245	0.00	5.71E+10	-291.341	7652.	0.00
14.3423	0.1253	1339014.	6459.	-0.00237	0.00	5.71E+10	-299.673	8401.	0.00
14.6350	0.1171	1359852.	5393.	-0.00228	0.00	5.71E+10	-307.503	9222.	0.00
14.9277	0.1093	1376897.	4302.	-0.00220	0.00	5.71E+10	-313.724	10086.	0.00
15.2204	0.1017	1390071.	3193.	-0.00211	0.00	5.70E+10	-317.435	10965.	0.00
15.5131	0.09441	1399329.	2076.	-0.00203	0.00	5.70E+10	-318.541	11850.	0.00
15.8058	0.08745	1404658.	959.7394	-0.00194	0.00	5.70E+10	-317.309	12745.	0.00
16.0985	0.08078	1406071.	-148.397	-0.00185	0.00	5.70E+10	-313.676	13639.	0.00
16.3912	0.07442	1403615.	-1239.	-0.00177	0.00	5.70E+10	-307.178	14497.	0.00
16.6839	0.06837	1397369.	-2301.	-0.00168	0.00	5.70E+10	-297.817	15301.	0.00
16.9766	0.06261	1387450.	-3328.	-0.00160	0.00	5.70E+10	-286.695	16083.	0.00
17.2693	0.05716	1373993.	-4319.	-0.00151	0.00	5.71E+10	-277.678	17064.	0.00
17.5620	0.05200	1357110.	-5274.	-0.00143	0.00	5.71E+10	-266.397	17994.	0.00
17.8547	0.04714	1336941.	-6187.	-0.00134	0.00	5.71E+10	-252.984	18851.	0.00
18.1474	0.04256	1313651.	-7048.	-0.00126	0.00	5.71E+10	-237.622	19609.	0.00
18.4401	0.03827	1287429.	-7853.	-0.00118	0.00	5.71E+10	-220.543	20240.	0.00
18.7328	0.03426	1258487.	-8595.	-0.00110	0.00	5.71E+10	-202.028	20712.	0.00
19.0255	0.03052	1227052.	-9270.	-0.00103	0.00	5.71E+10	-182.408	20992.	0.00
19.3182	0.02704	1193366.	-9875.	-9.53E-04	0.00	5.71E+10	-162.059	21047.	0.00
19.6109	0.02383	1157682.	-10424.	-8.80E-04	0.00	5.71E+10	-150.556	22193.	0.00
19.9036	0.02086	1120140.	-10940.	-8.10E-04	0.00	5.71E+10	-143.509	24164.	0.00
20.1963	0.01813	1080827.	-11431.	-7.43E-04	0.00	5.72E+10	-135.825	26307.	0.00
20.4890	0.01564	1039839.	-11894.	-6.78E-04	0.00	5.72E+10	-127.573	28645.	0.00
20.7817	0.01337	997277.	-12326.	-6.15E-04	0.00	5.72E+10	-118.829	31206.	0.00
21.0744	0.01132	953249.	-12728.	-5.55E-04	0.00	5.72E+10	-109.674	34023.	0.00
21.3671	0.00948	907868.	-13096.	-4.98E-04	0.00	5.72E+10	-100.193	37140.	0.00
21.6598	0.00782	861251.	-13431.	-4.44E-04	0.00	5.72E+10	-90.477	40617.	0.00
21.9525	0.00636	813518.	-13732.	-3.92E-04	0.00	5.72E+10	-80.900	44687.	0.00
22.2452	0.00507	764787.	-13990.	-3.44E-04	0.00	5.72E+10	-66.056	45775.	0.00
22.5379	0.00394	715240.	-14198.	-2.98E-04	0.00	5.73E+10	-52.550	46807.	0.00
22.8306	0.00297	665046.	-14362.	-2.56E-04	0.00	5.73E+10	-40.483	47840.	0.00
23.1233	0.00214	614352.	-14485.	-2.17E-04	0.00	5.73E+10	-29.838	48872.	0.00
23.4160	0.00145	563290.	-14574.	-1.81E-04	0.00	5.73E+10	-20.586	49905.	0.00
23.7087	8.75E-04	511973.	-14632.	-1.48E-04	0.00	5.73E+10	-12.683	50938.	0.00
24.0014	4.10E-04	460501.	-15068.	-1.18E-04	0.00	5.73E+10	-235.340	2014264.	0.00
24.2941	4.53E-05	406125.	-15527.	-9.15E-05	0.00	5.73E+10	-26.361	2044510.	0.00
24.5868	-2.32E-04	351424.	-15333.	-6.83E-05	0.00	5.73E+10	137.2949	2074757.	0.00
24.8795	-4.35E-04	298416.	-14634.	-4.84E-05	0.00	5.73E+10	260.4225	2105006.	0.00
25.1722	-5.72E-04	248622.	-13566.	-3.16E-05	0.00	5.73E+10	348.0020	2135255.	0.00
25.4649	-6.57E-04	203121.	-12290.	-1.78E-05	0.00	5.73E+10	378.3902	2023328.	0.00
25.7576	-6.98E-04	162288.	-10941.	-6.62E-06	0.00	5.73E+10	389.4917	1961119.	0.00
26.0503	-7.03E-04	126260.	-9562.	2.21E-06	0.00	5.73E+10	395.6791	1975831.	0.00
26.3430	-6.82E-04	95113.	-8169.	8.99E-06	0.00	5.73E+10	397.9786	2049549.	0.00
26.6357	-6.40E-04	68877.	-6773.	1.40E-05	0.00	5.73E+10	396.9864	2177992.	0.00
26.9284	-5.84E-04	47538.	-5399.	1.76E-05	0.00	5.73E+10	384.9230	2316774.	0.00
27.2211	-5.17E-04	30947.	-4117.	2.00E-05	0.00	5.73E+10	345.2684	2347030.	0.00
27.5138	-4.43E-04	18617.	-2984.	2.15E-05	0.00	5.73E+10	299.9556	2377287.	0.00
27.8065	-3.66E-04	9987.	-2017.	2.24E-05	0.00	5.73E+10	250.6308	2407545.	0.00
28.0992	-2.86E-04	4449.	-1228.	2.28E-05	0.00	5.73E+10	198.4791	2437803.	0.00
28.3919	-2.05E-04	1359.	-626.203	2.30E-05	0.00	5.73E+10	144.2821	2468062.	0.00
28.6846	-1.24E-04	49.5698	-217.412	2.30E-05	0.00	5.73E+10	88.4877	2498322.	0.00
28.9773	-4.35E-05	-168.235	-7.056	2.30E-05	0.00	5.73E+10	31.2913	2528582.	0.00
29.2700	3.74E-05	0.00	0.00	2.30E-05	0.00	5.73E+10	-27.273	1279422.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.73166541	inches
Computed slope at pile head	=	-0.0039162	radians
Maximum bending moment	=	1406071.	inch-lbs
Maximum shear force	=	16428.	lbs
Depth of maximum bending moment	=	16.09850000	feet below pile head
Depth of maximum shear force	=	9.65910000	feet below pile head
Number of iterations	=	16	
Number of zero deflection points	=	2	
Pile deflection at ground	=	0.30591987	inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear	=	0.	lbs
Moment	=	0.	in-lbs
Axial Load	=	0.	lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
29.27000	0.73166541	1406071.	16428.
27.80650	0.73544407	1405328.	16474.
26.34300	0.76784061	1391162.	-17674.
24.87950	0.96596230	1348454.	-18157.
23.41600	1.62081034	1276651.	-20458.
21.95250	2.72824665	1208601.	-22353.
20.48900	6.34169283	1177898.	-25780.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	0.0 lbs
Applied moment at pile head	=	0.0 in-lbs
Axial thrust load on pile head	=	0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.3286	9.77E-07	0.00	-0.00676	4.15E-09	2.71E+10	0.00	0.00	0.00
0.2927	1.3049	6.84E-06	9.74E-07	-0.00676	2.90E-08	2.71E+10	0.00	0.00	0.00
0.5854	1.2811	7.82E-06	1.39E-07	-0.00676	3.32E-08	2.71E+10	0.00	0.00	0.00
0.8781	1.2574	7.82E-06	0.1081	-0.00676	3.32E-08	2.71E+10	0.00	0.00	0.06157
1.1708	1.2337	0.7596	18.3008	-0.00676	0.00322	2.71E+10	0.00	0.00	10.2976
1.4635	1.2099	128.5597	85.4616	-0.00676	0.5456	2.71E+10	0.00	0.00	27.9445
1.7562	1.1862	601.1100	214.6054	-0.00676	2.5511	2.71E+10	0.00	0.00	45.5915
2.0489	1.1625	1636.	405.7324	-0.00676	6.9437	2.71E+10	0.00	0.00	63.2384
2.3416	1.1387	3451.	658.8425	-0.00676	14.6473	2.71E+10	0.00	0.00	80.8853
2.6343	1.1150	6264.	973.9358	-0.00676	26.5860	2.71E+10	0.00	0.00	98.5323
2.9270	1.0913	10293.	1351.	-0.00675	43.6835	2.71E+10	0.00	0.00	116.1792
3.2197	1.0676	15755.	1790.	-0.00675	66.8641	2.71E+10	0.00	0.00	133.8262
3.5124	1.0438	22868.	2291.	-0.00675	97.0515	2.71E+10	0.00	0.00	151.4731
3.8051	1.0201	31850.	2854.	-0.00675	135.1697	2.71E+10	0.00	0.00	169.1201
4.0978	0.9965	42918.	3479.	-0.00674	182.1427	2.71E+10	0.00	0.00	186.7670
4.3905	0.9728	56290.	4166.	-0.00674	238.8945	2.71E+10	0.00	0.00	204.4139
4.6832	0.9491	72184.	4915.	-0.00673	306.3490	2.71E+10	0.00	0.00	222.0609
4.9759	0.9255	90818.	5726.	-0.00672	385.4303	2.71E+10	0.00	0.00	239.7078
5.2686	0.9020	112408.	6599.	-0.00670	477.0621	2.71E+10	0.00	0.00	257.3548
5.5613	0.8784	137174.	7534.	-0.00669	582.1685	2.71E+10	0.00	0.00	275.0017
5.8540	0.8550	165333.	8531.	-0.00667	701.6736	2.71E+10	0.00	0.00	292.6487
6.1467	0.8316	197102.	9590.	-0.00664	836.5011	2.71E+10	0.00	0.00	310.2956
6.4394	0.8083	232699.	10711.	-0.00662	987.5751	2.71E+10	0.00	0.00	327.9425
6.7321	0.7851	272342.	11893.	-0.00658	1156.	2.71E+10	0.00	0.00	345.5895
7.0248	0.7621	316248.	13138.	-0.00655	1342.	2.71E+10	0.00	0.00	363.2364
7.3175	0.7391	364636.	14445.	-0.00650	1548.	2.71E+10	0.00	0.00	380.8834
7.6102	0.7164	417722.	15814.	-0.00645	1773.	2.71E+10	0.00	0.00	398.5303
7.9029	0.6938	475726.	17245.	-0.00639	2019.	2.71E+10	0.00	0.00	416.1773
8.1956	0.6715	538863.	18738.	-0.00633	2287.	2.71E+10	0.00	0.00	433.8242
8.4883	0.6494	607353.	20292.	-0.00625	2578.	2.71E+10	0.00	0.00	451.4711
8.7810	0.6275	681412.	21909.	-0.00617	2892.	2.71E+10	0.00	0.00	469.1181
9.0737	0.6060	761259.	23588.	-0.00608	3231.	2.71E+10	0.00	0.00	486.7650
9.3664	0.5849	847111.	24579.	-0.00600	0.00	5.72E+10	-7.215	43.3277	84.8304
9.6591	0.5639	933921.	24662.	-0.00595	0.00	5.72E+10	-30.297	188.7251	0.00
9.9518	0.5431	1020357.	24513.	-0.00589	0.00	5.72E+10	-54.781	354.2983	0.00
10.2445	0.5225	1106117.	24276.	-0.00582	0.00	5.71E+10	-80.198	539.0954	0.00
10.5372	0.5022	1190887.	23948.	-0.00575	0.00	5.71E+10	-106.104	742.1085	0.00
10.8299	0.4821	1274349.	23530.	-0.00567	0.00	5.71E+10	-132.383	964.4582	0.00
11.1226	0.4623	1356177.	23019.	-0.00559	0.00	5.71E+10	-158.438	1204.	0.00
11.4153	0.4428	1436051.	22418.	-0.00551	0.00	5.70E+10	-183.869	1458.	0.00
11.7080	0.4236	1513657.	21729.	-0.00542	0.00	5.70E+10	-208.287	1727.	0.00
12.0007	0.4048	1588692.	20956.	-0.00532	0.00	5.70E+10	-231.931	2013.	0.00
12.2934	0.3862	1660867.	20102.	-0.00522	0.00	5.70E+10	-254.218	2312.	0.00
12.5861	0.3681	1729905.	19173.	-0.00512	0.00	5.69E+10	-274.688	2621.	0.00
12.8788	0.3503	1795554.	18176.	-0.00501	0.00	5.69E+10	-293.037	2938.	0.00
13.1715	0.3329	1857589.	17116.	-0.00490	0.00	5.69E+10	-310.486	3276.	0.00
13.4642	0.3159	1915792.	15996.	-0.00478	0.00	5.69E+10	-327.105	3637.	0.00
13.7569	0.2993	1969961.	14822.	-0.00466	0.00	5.69E+10	-341.392	4006.	0.00
14.0496	0.2832	2019917.	13572.	-0.00454	0.00	5.68E+10	-370.723	4598.	0.00
14.3423	0.2675	2065300.	12247.	-0.00441	0.00	5.68E+10	-383.780	5040.	0.00
14.6350	0.2522	2105948.	10877.	-0.00428	0.00	5.68E+10	-396.078	5516.	0.00
14.9277	0.2374	2141710.	9468.	-0.00415	0.00	5.68E+10	-406.412	6013.	0.00
15.2204	0.2231	2172458.	8027.	-0.00402	0.00	5.68E+10	-413.784	6515.	0.00
15.5131	0.2092	2198101.	6567.	-0.00388	0.00	5.68E+10	-418.045	7019.	0.00

15.8058	0.1958	2218587.	5094.	-0.00374	0.00	5.68E+10	-420.296	7539.	0.00
16.0985	0.1829	2233888.	3617.	-0.00361	0.00	5.68E+10	-420.688	8079.	0.00
16.3912	0.1705	2243998.	2145.	-0.00347	0.00	5.68E+10	-417.651	8605.	0.00
16.6839	0.1585	2248956.	689.6166	-0.00333	0.00	5.68E+10	-411.091	9108.	0.00
16.9766	0.1471	2248843.	-739.093	-0.00319	0.00	5.68E+10	-402.433	9610.	0.00
17.2693	0.1361	2243764.	-2143.	-0.00305	0.00	5.68E+10	-397.021	10244.	0.00
17.5620	0.1257	2233788.	-3523.	-0.00291	0.00	5.68E+10	-388.589	10862.	0.00
17.8547	0.1157	2219017.	-4868.	-0.00277	0.00	5.68E+10	-377.155	11452.	0.00
18.1474	0.1062	2199594.	-6167.	-0.00264	0.00	5.68E+10	-362.789	12002.	0.00
18.4401	0.09714	2175695.	-7411.	-0.00250	0.00	5.68E+10	-345.615	12496.	0.00
18.7328	0.08859	2147532.	-8590.	-0.00237	0.00	5.68E+10	-325.815	12918.	0.00
19.0255	0.08050	2115350.	-9696.	-0.00224	0.00	5.68E+10	-303.637	13248.	0.00
19.3182	0.07288	2079421.	-10720.	-0.00211	0.00	5.68E+10	-279.399	13466.	0.00
19.6109	0.06570	2040046.	-11678.	-0.00198	0.00	5.68E+10	-266.238	14233.	0.00
19.9036	0.05897	1997386.	-12600.	-0.00186	0.00	5.69E+10	-258.839	15417.	0.00
20.1963	0.05267	1951533.	-13494.	-0.00173	0.00	5.69E+10	-250.266	16690.	0.00
20.4890	0.04679	1902592.	-14356.	-0.00161	0.00	5.69E+10	-240.574	18058.	0.00
20.7817	0.04133	1850683.	-15182.	-0.00150	0.00	5.69E+10	-229.830	19532.	0.00
21.0744	0.03627	1795939.	-15969.	-0.00139	0.00	5.69E+10	-218.112	21123.	0.00
21.3671	0.03159	1738504.	-16713.	-0.00128	0.00	5.69E+10	-205.503	22846.	0.00
21.6598	0.02730	1678534.	-17411.	-0.00117	0.00	5.70E+10	-192.101	24717.	0.00
21.9525	0.02337	1616194.	-18062.	-0.00107	0.00	5.70E+10	-178.484	26830.	0.00
22.2452	0.01978	1551652.	-18671.	-9.72E-04	0.00	5.70E+10	-168.279	29877.	0.00
22.5379	0.01654	1485034.	-19243.	-8.79E-04	0.00	5.70E+10	-157.284	33408.	0.00
22.8306	0.01361	1416475.	-19775.	-7.89E-04	0.00	5.70E+10	-145.511	37550.	0.00
23.1233	0.01099	1346121.	-20264.	-7.04E-04	0.00	5.71E+10	-132.961	42488.	0.00
23.4160	0.00866	1274127.	-20707.	-6.24E-04	0.00	5.71E+10	-119.619	48497.	0.00
23.7087	0.00661	1200658.	-21086.	-5.48E-04	0.00	5.71E+10	-95.867	50938.	0.00
24.0014	0.00482	1126005.	-22271.	-4.76E-04	0.00	5.71E+10	-579.203	422332.	0.00
24.2941	0.00327	1044207.	-24225.	-4.09E-04	0.00	5.72E+10	-533.493	573618.	0.00
24.5868	0.00194	955827.	-25997.	-3.48E-04	0.00	5.72E+10	-475.344	859866.	0.00
24.8795	8.23E-04	861583.	-27515.	-2.92E-04	0.00	5.72E+10	-389.058	1660697.	0.00
25.1722	-1.10E-04	762540.	-28081.	-2.42E-04	0.00	5.72E+10	66.9782	2135255.	0.00
25.4649	-8.79E-04	664322.	-27248.	-1.98E-04	0.00	5.73E+10	407.1114	1627041.	0.00
25.7576	-0.00150	571127.	-25704.	-1.61E-04	0.00	5.73E+10	472.1288	1102279.	0.00
26.0503	-0.00201	483757.	-23971.	-1.28E-04	0.00	5.73E+10	514.3873	900186.	0.00
26.3430	-0.00241	402732.	-22110.	-1.01E-04	0.00	5.73E+10	545.5295	796516.	0.00
26.6357	-0.00272	328438.	-20151.	-7.87E-05	0.00	5.73E+10	569.9580	736667.	0.00
26.9284	-0.00296	261175.	-18114.	-6.07E-05	0.00	5.73E+10	589.9180	700296.	0.00
27.2211	-0.00314	201190.	-16012.	-4.65E-05	0.00	5.73E+10	606.7649	677894.	0.00
27.5138	-0.00329	148691.	-13856.	-3.58E-05	0.00	5.73E+10	621.4132	664302.	0.00
27.8065	-0.00340	103858.	-11650.	-2.81E-05	0.00	5.73E+10	634.5275	656388.	0.00
28.0992	-0.00348	66853.	-9400.	-2.28E-05	0.00	5.73E+10	646.6132	652096.	0.00
28.3919	-0.00356	37826.	-7109.	-1.96E-05	0.00	5.73E+10	658.0598	650004.	0.00
28.6846	-0.00362	16917.	-4778.	-1.80E-05	0.00	5.73E+10	669.1623	649119.	0.00
28.9773	-0.00368	4263.	-2408.	-1.73E-05	0.00	5.73E+10	680.1294	648777.	0.00
29.2700	-0.00374	0.00	0.00	-1.72E-05	0.00	5.73E+10	691.0869	324298.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     1.32859627 inches
Computed slope at pile head      =     -0.0067567 radians
Maximum bending moment           =       2248956. inch-lbs
Maximum shear force              =        -28081. lbs
Depth of maximum bending moment  =    16.68390000 feet below pile head
Depth of maximum shear force     =    25.17220000 feet below pile head
Number of iterations             =             26
Number of zero deflection points =              1
Pile deflection at ground        =     0.59182920 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
29.27000	1.32859627	2248956.	-28081.
27.80650	1.40608799	2222904.	-29341.
26.34300	1.61409097	2170140.	-30149.
24.87950	2.33199736	2065857.	-29965.
23.41600	4.01209098	1973777.	-32825.
21.95250	12.22298059	1970178.	-41279.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

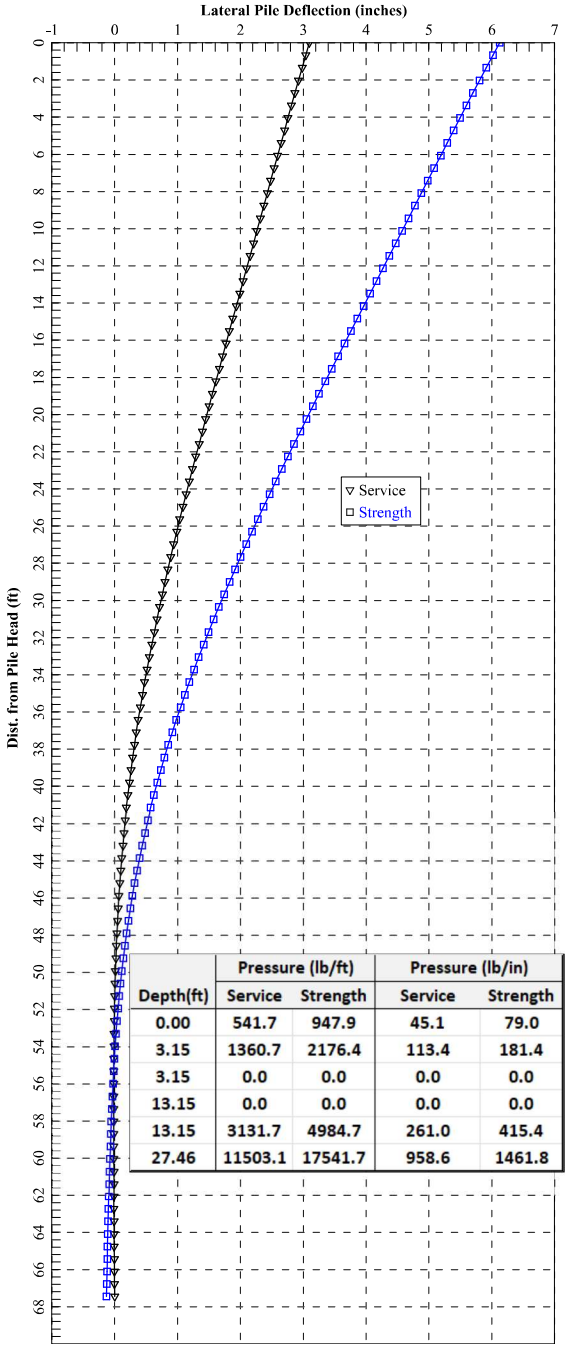
```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians
```

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	0.7317	-0.00392	16428.	1406071.
2	V, lb	0.00	M, in-lb	0.00	0.00	1.3286	-0.00676	-28081.	2248956.

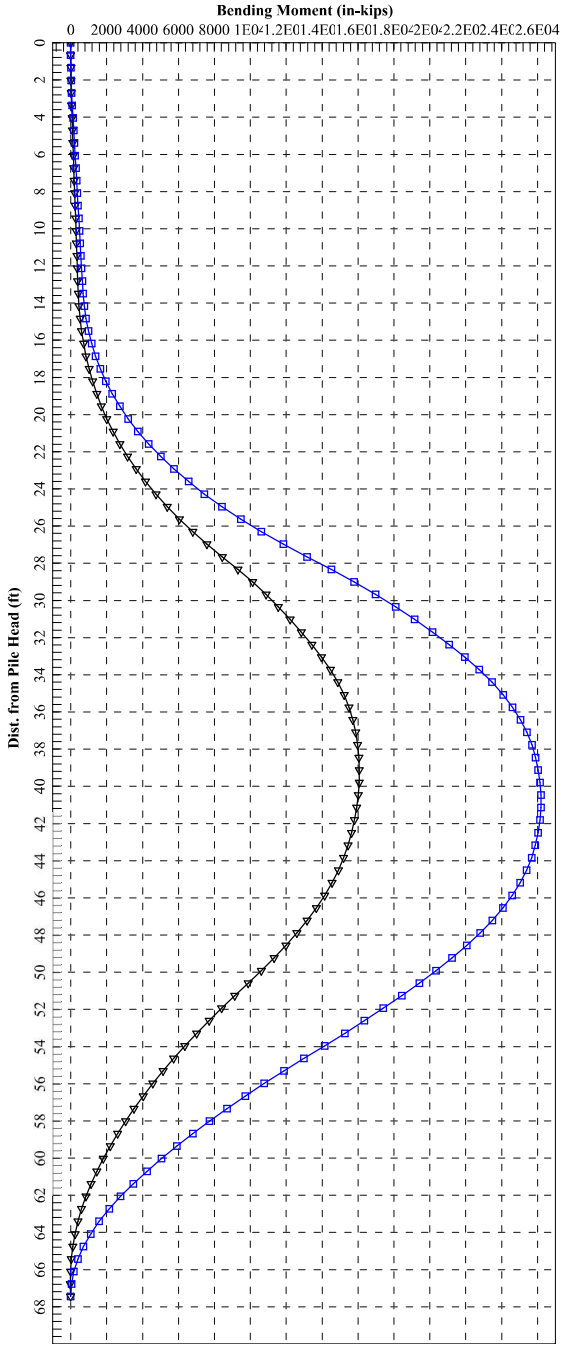
```
Maximum pile-head deflection = 1.3285962714 inches
Maximum pile-head rotation   = -0.0067566520 radians = -0.387128 deg.
```

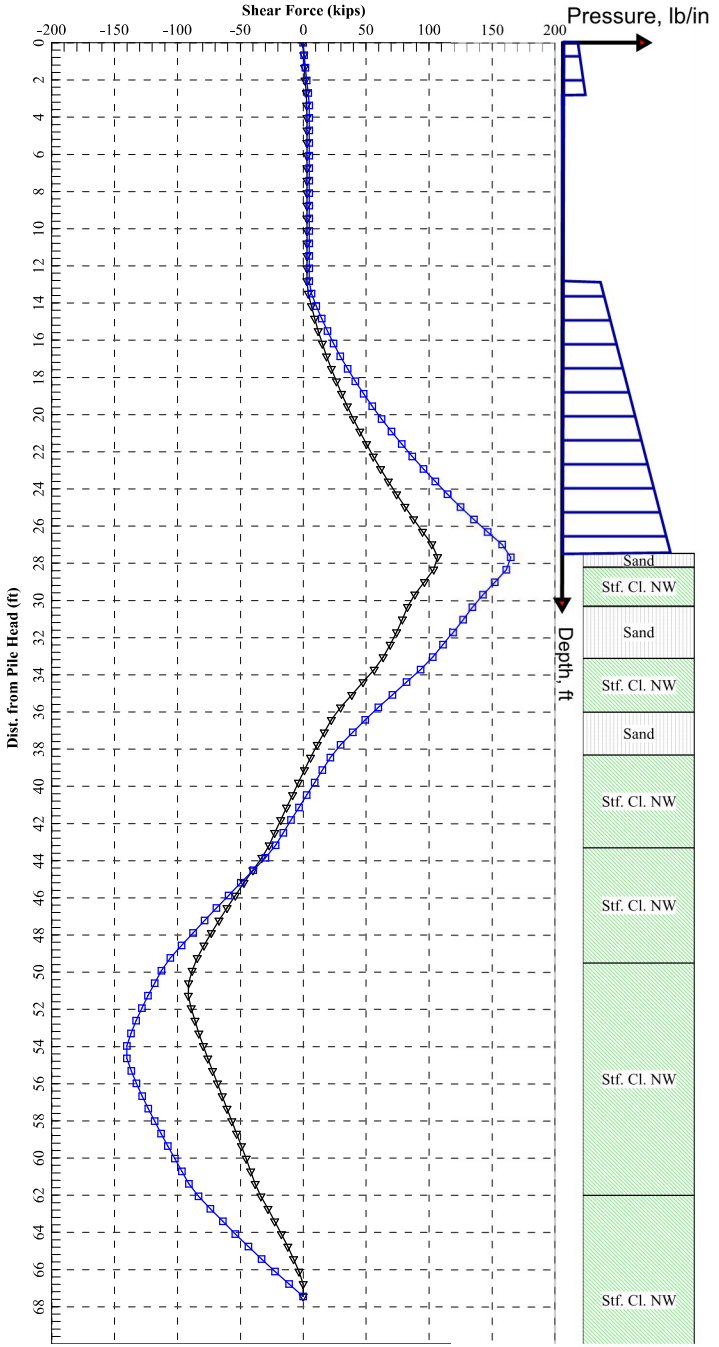
The analysis ended normally.

Wall 5B (27.46ft): Based on B-026-0-20



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	541.7	947.9	45.1	79.0
3.15	1360.7	2176.4	113.4	181.4
3.15	0.0	0.0	0.0	0.0
13.15	0.0	0.0	0.0	0.0
13.15	3131.7	4984.7	261.0	415.4
27.46	11503.1	17541.7	958.6	1461.8





```
================================================================================

                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App E LPile March 2026\Wall 5B\

Name of input data file:
01 Wall_5B-27.46ft-EPS W36x256_B-026.lp12d

Name of output report file:
01 Wall_5B-27.46ft-EPS W36x256_B-026.lp12o

Name of plot output file:
01 Wall_5B-27.46ft-EPS W36x256_B-026.lp12p

Name of runtime message file:
01 Wall_5B-27.46ft-EPS W36x256_B-026.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 27, 2026             Time:  12:19:38
```

```
--------------------------------------------------------------------------------
                                Problem Title
--------------------------------------------------------------------------------

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin (Dean) Almohd, PhD, PE

Description: LPILE FOR SP WALL 5B_with EPS (H=27.46FT) Boring B-026-0-18




--------------------------------------------------------------------------------
                          Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed                =          500
 - Deflection tolerance for convergence                =   1.0000E-05 in
 - Maximum allowable deflection                        =     100.0000 in
 - Number of pile increments                           =          100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
```

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 3
Total length of pile = 67.460 ft
Depth of ground surface below top of pile = 27.4600 ft

Pile diameters used for p-y curve computations are defined using 6 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	5.6630
2	3.000	5.6630
3	3.000	12.2000
4	27.460	12.2000
5	27.460	48.0000
6	67.460	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional Shape = General Section
Length of section = 3.000000 ft
Width of top of section = 5.663000 in
Width of bottom of section = 5.663000 in
Top Area = 21.519000 sq. in
Bottom Area = 21.519000 sq. in
Moment of Inertia at Top = 50.483751 in^4
Moment of Inertia at Bottom = 50.483751 in^4
Elastic Modulus = 29000000. psi

Pile Section No. 2:

Section 2 is a AISC strong axis steel pile
Length of section = 24.460000 ft
AISC Section Type = W

```
   AISC Section Name                                = W36X256


   Pile width                                       =    12.200000 in

Pile Section No. 3:

   Section 3 is a drilled shaft with casing and AISC section core/insert
   Length of section                                =    40.000000 ft
   Section Diameter                                 =    48.000000 in
   Core/Insert AISC Section Type                    = W


   Core/Insert AISC Section Name                    = W36X256




--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 11 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer        =    27.460000 ft
   Distance from top of pile to bottom of layer     =    28.200000 ft
   Effective unit weight at top of layer            =    57.600000 pcf
   Effective unit weight at bottom of layer         =    57.600000 pcf
   Friction angle at top of layer                   =    32.000000 deg.
   Friction angle at bottom of layer                =    32.000000 deg.
   Subgrade k at top of layer                       =    60.000000 pci
   Subgrade k at bottom of layer                    =    60.000000 pci


Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer        =    28.200000 ft
   Distance from top of pile to bottom of layer     =    30.300000 ft
   Effective unit weight at top of layer            =    57.600000 pcf
   Effective unit weight at bottom of layer         =    57.600000 pcf
   Undrained cohesion at top of layer               =        2200. psf
   Undrained cohesion at bottom of layer            =        2200. psf
   Epsilon-50 at top of layer                       =     0.005000
   Epsilon-50 at bottom of layer                    =     0.005000


Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer        =    30.300000 ft
```

```
   Distance from top of pile to bottom of layer        =    33.100000 ft
   Effective unit weight at top of layer               =    55.600000 pcf
   Effective unit weight at bottom of layer            =    55.600000 pcf
   Friction angle at top of layer                      =    28.000000 deg.
   Friction angle at bottom of layer                   =    28.000000 deg.
   Subgrade k at top of layer                          =    25.000000 pci
   Subgrade k at bottom of layer                       =    25.000000 pci


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer           =    33.100000 ft
   Distance from top of pile to bottom of layer        =    36.000000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2500. psf
   Undrained cohesion at bottom of layer               =        2500. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 5 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    36.000000 ft
   Distance from top of pile to bottom of layer        =    38.300000 ft
   Effective unit weight at top of layer               =    52.600000 pcf
   Effective unit weight at bottom of layer            =    52.600000 pcf
   Friction angle at top of layer                      =    28.000000 deg.
   Friction angle at bottom of layer                   =    28.000000 deg.
   Subgrade k at top of layer                          =    25.000000 pci
   Subgrade k at bottom of layer                       =    25.000000 pci


Layer 6 is stiff clay without free water

   Distance from top of pile to top of layer           =    38.300000 ft
   Distance from top of pile to bottom of layer        =    43.300000 ft
   Effective unit weight at top of layer               =    52.600000 pcf
   Effective unit weight at bottom of layer            =    52.600000 pcf
   Undrained cohesion at top of layer                  =        1100. psf
   Undrained cohesion at bottom of layer               =        1100. psf
   Epsilon-50 at top of layer                          =     0.007000
   Epsilon-50 at bottom of layer                       =     0.007000


Layer 7 is stiff clay without free water

   Distance from top of pile to top of layer           =    43.300000 ft
   Distance from top of pile to bottom of layer        =    49.500000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2200. psf
   Undrained cohesion at bottom of layer               =        2200. psf
```

```
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 8 is stiff clay without free water

   Distance from top of pile to top of layer           =    49.500000 ft
   Distance from top of pile to bottom of layer        =    62.000000 ft
   Effective unit weight at top of layer               =    52.600000 pcf
   Effective unit weight at bottom of layer            =    52.600000 pcf
   Undrained cohesion at top of layer                  =        1100. psf
   Undrained cohesion at bottom of layer               =        1100. psf
   Epsilon-50 at top of layer                          =     0.007000
   Epsilon-50 at bottom of layer                       =     0.007000


Layer 9 is stiff clay without free water

   Distance from top of pile to top of layer           =    62.000000 ft
   Distance from top of pile to bottom of layer        =    73.300000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2000. psf
   Undrained cohesion at bottom of layer               =        2000. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 10 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    73.300000 ft
   Distance from top of pile to bottom of layer        =    75.800000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    60.000000 pci
   Subgrade k at bottom of layer                       =    60.000000 pci


Layer 11 is stiff clay without free water

   Distance from top of pile to top of layer           =    75.800000 ft
   Distance from top of pile to bottom of layer        =    86.500000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2100. psf
   Undrained cohesion at bottom of layer               =        2100. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


 (Depth of the lowest soil layer extends 19.040 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	27.4600	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	28.2000	57.6000	--	32.0000	--	60.0000
2	Stiff Clay	28.2000	57.6000	2200.	--	0.00500	--
	w/o Free Water	30.3000	57.6000	2200.	--	0.00500	--
3	Sand	30.3000	55.6000	--	28.0000	--	25.0000
	(Reese, et al.)	33.1000	55.6000	--	28.0000	--	25.0000
4	Stiff Clay	33.1000	57.6000	2500.	--	0.00500	--
	w/o Free Water	36.0000	57.6000	2500.	--	0.00500	--
5	Sand	36.0000	52.6000	--	28.0000	--	25.0000
	(Reese, et al.)	38.3000	52.6000	--	28.0000	--	25.0000
6	Stiff Clay	38.3000	52.6000	1100.	--	0.00700	--
	w/o Free Water	43.3000	52.6000	1100.	--	0.00700	--
7	Stiff Clay	43.3000	57.6000	2200.	--	0.00500	--
	w/o Free Water	49.5000	57.6000	2200.	--	0.00500	--
8	Stiff Clay	49.5000	52.6000	1100.	--	0.00700	--
	w/o Free Water	62.0000	52.6000	1100.	--	0.00700	--
9	Stiff Clay	62.0000	57.6000	2000.	--	0.00500	--
	w/o Free Water	73.3000	57.6000	2000.	--	0.00500	--
10	Sand	73.3000	57.6000	--	32.0000	--	60.0000
	(Reese, et al.)	75.8000	57.6000	--	32.0000	--	60.0000
11	Stiff Clay	75.8000	57.6000	2100.	--	0.00500	--
	w/o Free Water	86.5000	57.6000	2100.	--	0.00500	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	27.460	0.7550	1.0000
2	67.460	0.7550	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 6 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	45.100
2	3.150	113.400
3	3.150	0.000
4	13.150	0.000
5	13.150	261.000
6	27.460	958.600

Distributed lateral load intensity for Load Case 2 defined using 6 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	79.000
2	3.150	181.400
3	3.150	0.000
4	13.150	0.000
5	13.150	415.400
6	27.460	1461.800

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis

S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 3

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 2:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	24.460000 ft
Flange Width	=	12.200000 in
Section Depth	=	37.400000 in
Flange Thickness	=	1.730000 in
Web Thickness	=	0.960000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	75.300000 sq. in.
Moment of Inertia	=	16800. in^4
Elastic Bending Stiffness	=	487200000. kip-in^2
Plastic Modulus, Z	=	1040.in^3
Plastic Moment Capacity = Fy Z	=	52000.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	3765.000 kips
Nominal Axial Tensile Capacity	=	-3765.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips

1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000601	2883.	480006160.	18.7000000	3.2246004	
0.00001201	5766.	480006160.	18.7000000	6.4492009	
0.00001802	8649.	480006160.	18.7000000	9.6738013	
0.00002402	11532.	480006160.	18.7000000	12.8984017	
0.00003003	14415.	480006160.	18.7000000	16.1230021	
0.00003604	17298.	480006160.	18.7000000	19.3476026	
0.00004204	20181.	480006160.	18.7000000	22.5722030	
0.00004805	23064.	480006160.	18.7000000	25.7968034	
0.00005406	25947.	480006160.	18.7000000	29.0214038	
0.00006006	28830.	480006160.	18.7000000	32.2460043	
0.00006607	31713.	480006160.	18.7000000	35.4706047	
0.00007207	34596.	480006160.	18.7000000	38.6952051	
0.00007808	37479.	480006160.	18.7000000	41.9198056	
0.00008409	40362.	480006160.	18.7000000	45.1444060	
0.00009009	43245.	480006160.	18.7000000	48.3690064	
0.00009610	45768.	476254989.	18.7000000	50.0000000	Y
0.0001021	46884.	459172815.	18.7000000	50.0000000	Y
0.0001081	47378.	438228174.	18.7000000	50.0000000	Y
0.0001141	47795.	418820022.	18.7000000	50.0000000	Y
0.0001201	48151.	400842510.	18.7000000	50.0000000	Y
0.0001261	48458.	384187517.	18.7000000	50.0000000	Y
0.0001321	48722.	368724884.	18.7000000	50.0000000	Y
0.0001381	48955.	354376948.	18.7000000	50.0000000	Y
0.0001441	49157.	341015611.	18.7000000	50.0000000	Y
0.0001502	49337.	328574040.	18.7000000	50.0000000	Y
0.0001562	49497.	316961793.	18.7000000	50.0000000	Y
0.0001622	49639.	306094927.	18.7000000	50.0000000	Y
0.0001682	49766.	295916894.	18.7000000	50.0000000	Y
0.0001742	49880.	286369075.	18.7000000	50.0000000	Y
0.0001802	49982.	277392071.	18.7000000	50.0000000	Y
0.0001862	50075.	268939208.	18.7000000	50.0000000	Y
0.0001922	50159.	260972045.	18.7000000	50.0000000	Y
0.0001982	50236.	253453843.	18.7000000	50.0000000	Y
0.0002042	50307.	246346608.	18.7000000	50.0000000	Y
0.0002102	50370.	239608120.	18.7000000	50.0000000	Y
0.0002162	50429.	233228130.	18.7000000	50.0000000	Y
0.0002222	50483.	227167553.	18.7000000	50.0000000	Y
0.0002282	50533.	221407941.	18.7000000	50.0000000	Y
0.0002342	50580.	215929857.	18.7000000	50.0000000	Y

0.0002463	50662.	205731080.	18.7000000	50.0000000	Y
0.0002583	50733.	196436688.	18.7000000	50.0000000	Y
0.0002703	50795.	187935028.	18.7000000	50.0000000	Y
0.0002823	50850.	180132463.	18.7000000	50.0000000	Y
0.0002943	50898.	172942285.	18.7000000	50.0000000	Y
0.0003063	50939.	166295713.	18.7000000	50.0000000	Y
0.0003183	50978.	160143156.	18.7000000	50.0000000	Y
0.0003303	51010.	154416527.	18.7000000	50.0000000	Y
0.0003424	51042.	149090413.	18.7000000	50.0000000	Y
0.0003544	51067.	144108704.	18.7000000	50.0000000	Y
0.0003664	51093.	139453665.	18.7000000	50.0000000	Y
0.0003784	51114.	135082646.	18.7000000	50.0000000	Y
0.0003904	51134.	130977791.	18.7000000	50.0000000	Y
0.0004024	51154.	127116521.	18.7000000	50.0000000	Y
0.0004144	51169.	123469366.	18.7000000	50.0000000	Y
0.0004264	51185.	120027684.	18.7000000	50.0000000	Y
0.0004385	51200.	116774587.	18.7000000	50.0000000	Y
0.0004505	51212.	113686848.	18.7000000	50.0000000	Y
0.0004625	51224.	110759099.	18.7000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	51224.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section = 40.000000 ft
Outside Diameter of Casing = 48.000000 in

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Casing Wall Thickness                                =       0.0000 in
Moment of Inertia of Steel Casing                    =       0.0000 in^4
Width Flange of Core/Insert                          =    12.200000 in
Depth of Core/Insert                                 =    37.400000 in
Flange Thickness of Core/Insert                      =     1.730000 in
Web Thickness of Core/Insert                         =     0.960000 in
Moment of Inertia of Steel Core/Insert               =       16800. in^4
Yield Stress of Casing                               =       50000. psi
Elastic Modulus of Casing                            =    29000000. psi
Yield Stress of Core/Insert                          =       50000. psi
Elastic Modulus of Core/Insert                       =    29000000. psi
Number of Reinforcing Bars                           =           0 bars
Gross Area of Pile                                   =        1810. sq. in.
Area of Concrete                                     =        1735. sq. in.
Cross-sectional Area of Steel Casing                 =       0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert            =    75.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)    =    74.794400 sq. in.
Area Ratio of All Steel to Gross Area                =         4.13 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:
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Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As   =    11135.594 kips
Tensile Load for Cracking of Concrete                =    -1054.751 kips
Nominal Axial Tensile Capacity                       =    -3765.000 kips



Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                      kips
   ------     ------------------
      1               0.000

Definition of Run Messages:

   Y = part of pipe section has yielded.


Axial Thrust Force =      0.000 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max Steel    Max Casing     Max Core   Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress        Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi           ksi           ksi
------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ------------- ---
   0.00000601         4560.    759183196.    16.4692674    0.00009892     -0.000189     0.4515297       0.00000       0.00000     -4.530558 C
   0.00001201         9089.    756616928.    16.5194733     0.0001984     -0.000378     0.8842905       0.00000       0.00000     -9.043626 C
   0.00001802        13586.    754003712.    16.5705177     0.0002986     -0.000566     1.2979449       0.00000       0.00000    -13.538766 C
   0.00002402        18051.    751342794.    16.6217445     0.0003993     -0.000754     1.6920788       0.00000       0.00000    -18.015998 C
```

0.00003003	22482.	748631949.	16.6740969	0.0005007	-0.000941	2.0663935	0.00000	0.00000	-22.474403 C
0.00003604	26879.	745869062.	16.7276268	0.0006028	-0.001127	2.4205265	0.00000	0.00000	-26.913341 C
0.00004204	31241.	743051873.	16.7823897	0.0007056	-0.001312	2.7540971	0.00000	0.00000	-31.332127 C
0.00004805	35565.	740177961.	16.8384453	0.0008091	-0.001497	3.0667042	0.00000	0.00000	-35.730035 C
0.00005406	39852.	737244729.	16.8958575	0.0009133	-0.001681	3.3579250	0.00000	0.00000	-40.106289 C
0.00006006	44101.	734249389.	16.9546953	0.0010183	-0.001865	3.6273127	0.00000	0.00000	-44.460059 C
0.00006607	48308.	731188911.	17.0150330	0.0011242	-0.002047	3.8743944	0.00000	0.00000	-48.790461 C
0.00007207	51435.	713640973.	16.9316549	0.0012203	-0.002239	4.0774628	0.00000	0.00000	-50.000000 CY
0.00007808	52943.	678049923.	16.6569658	0.0013006	-0.002447	4.2309924	0.00000	0.00000	-50.000000 CY
0.00008409	54216.	644759896.	16.3913011	0.0013783	-0.002658	4.3662763	0.00000	0.00000	-50.000000 CY
0.00009009	55309.	613911690.	16.1387406	0.0014540	-0.002870	4.4854285	0.00000	0.00000	-50.000000 CY
0.00009610	56253.	585357485.	15.8960406	0.0015276	-0.003085	4.5893533	0.00000	0.00000	-50.000000 CY
0.0001021	57077.	558998302.	15.6670853	0.0015997	-0.003301	4.6797558	0.00000	0.00000	-50.000000 CY
0.0001081	57803.	534661062.	15.4484957	0.0016702	-0.003519	4.7572337	0.00000	0.00000	-50.000000 CY
0.0001141	58447.	512158230.	15.2418646	0.0017394	-0.003738	4.8228751	0.00000	0.00000	-50.000000 CY
0.0001201	59022.	491338882.	15.0463716	0.0018074	-0.003959	4.8773429	0.00000	0.00000	-50.000000 CY
0.0001261	59536.	472022384.	14.8594540	0.0018742	-0.004180	4.9210785	0.00000	0.00000	-50.000000 CY
0.0001321	60002.	454086725.	14.6842895	0.0019403	-0.004402	4.9548994	0.00000	0.00000	-50.000000 CY
0.0001381	60421.	437376487.	14.5156317	0.0020052	-0.004626	4.9789499	0.00000	0.00000	-50.000000 CY
0.0001441	60801.	421792463.	14.3557517	0.0020694	-0.004850	4.9938204	0.00000	0.00000	-50.000000 CY
0.0001502	61152.	407258653.	14.2060505	0.0021331	-0.005074	4.9998425	0.00000	0.00000	-50.000000 CY
0.0001562	61467.	393612598.	14.0610209	0.0021958	-0.005300	4.9992656	0.00000	0.00000	-50.000000 CY
0.0001622	61755.	380810726.	13.9229703	0.0022579	-0.005526	4.9976564	0.00000	0.00000	-50.000000 CY
0.0001682	62022.	368794956.	13.7931403	0.0023196	-0.005753	4.9960417	0.00000	0.00000	-50.000000 CY
0.0001742	62268.	357492287.	13.6705624	0.0023811	-0.005980	4.9995324	0.00000	0.00000	-50.000000 CY
0.0001802	62491.	346810652.	13.5498912	0.0024415	-0.006207	4.9963972	0.00000	0.00000	-50.000000 CY
0.0001862	62698.	336738394.	13.4357722	0.0025016	-0.006436	4.9998997	0.00000	0.00000	-50.000000 CY
0.0001922	62892.	327225206.	13.3280248	0.0025616	-0.006664	4.9966378	0.00000	0.00000	-50.000000 CY
0.0001982	63073.	318221022.	13.2253781	0.0026213	-0.006893	4.9998679	0.00000	0.00000	-50.000000 CY
0.0002042	63238.	309667770.	13.1243877	0.0026801	-0.007122	4.9951170	0.00000	0.00000	-50.000000 CY
0.0002102	63392.	301555487.	13.0272070	0.0027385	-0.007352	4.9992256	0.00000	0.00000	-50.000000 CY
0.0002162	63539.	293856699.	12.9348029	0.0027968	-0.007582	4.9941105	0.00000	0.00000	-50.000000 CY
0.0002222	63675.	286525456.	12.8462455	0.0028548	-0.007812	4.9967070	0.00000	0.00000	-50.000000 CY
0.0002282	63806.	279560836.	12.7620423	0.0029128	-0.008043	4.9996436	0.00000	0.00000	-50.000000 CY
0.0002342	63927.	272908127.	12.6792608	0.0029700	-0.008274	4.9920906	0.00000	0.00000	-50.000000 CY
0.0002463	64146.	260486378.	12.5198612	0.0030831	-0.008737	4.9989503	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 3

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	64146.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the

LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	27.4600	0.00	N.A.	No	0.00	561.5204
2	28.2000	0.02125	No	No	561.5204	58433.
3	30.3000	7.8791	No	No	58994.	47232.
4	33.1000	3.2767	No	No	106226.	107249.
5	36.0000	15.4804	No	No	213476.	68469.
6	38.3000	14.8732	No	No	281944.	133223.
7	43.3000	12.0791	Yes	No	415167.	287604.
8	49.5000	28.8601	Yes	No	702771.	485190.
9	62.0000	28.6561	Yes	No	1187961.	339753.
10	73.3000	45.8400	No	No	1527714.	0.00
11	75.8000	48.3400	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil Res.	Soil Spr.	Distrib.

X feet	y inches	Moment in-lbs	Force lbs	S radians	Stress psi*	Stiffness lb-in^2	p lb/inch	Es*H lb/inch	Lat. Load lb/inch
0.00	3.1002	2.98E-08	6.13E-10	-0.00714	1.67E-09	1.46E+09	0.00	0.00	48.7568
0.6746	3.0424	1598.	439.0990	-0.00713	89.6035	1.46E+09	0.00	0.00	59.7270
1.3492	2.9847	7109.	981.8058	-0.00711	398.7356	1.46E+09	0.00	0.00	74.3541
2.0238	2.9274	17493.	1643.	-0.00704	981.1585	1.46E+09	0.00	0.00	88.9811
2.6984	2.8708	33709.	2422.	-0.00690	1891.	1.46E+09	0.00	0.00	103.6082
3.3730	2.8157	56714.	2919.	-0.00680	20.5925	4.80E+11	0.00	0.00	19.0038
4.0476	2.7606	80964.	2996.	-0.00680	29.3977	4.80E+11	0.00	0.00	0.00
4.7222	2.7055	105215.	2996.	-0.00680	38.2029	4.80E+11	0.00	0.00	0.00
5.3968	2.6505	129465.	2996.	-0.00680	47.0081	4.80E+11	0.00	0.00	0.00
6.0714	2.5954	153715.	2996.	-0.00680	55.8133	4.80E+11	0.00	0.00	0.00
6.7460	2.5404	177966.	2996.	-0.00679	64.6185	4.80E+11	0.00	0.00	0.00
7.4206	2.4854	202216.	2996.	-0.00679	73.4237	4.80E+11	0.00	0.00	0.00
8.0952	2.4305	226466.	2996.	-0.00679	82.2289	4.80E+11	0.00	0.00	0.00
8.7698	2.3755	250717.	2996.	-0.00678	91.0341	4.80E+11	0.00	0.00	0.00
9.4444	2.3206	274967.	2996.	-0.00678	99.8393	4.80E+11	0.00	0.00	0.00
10.1190	2.2658	299218.	2996.	-0.00677	108.6445	4.80E+11	0.00	0.00	0.00
10.7936	2.2110	323468.	2996.	-0.00677	117.4497	4.80E+11	0.00	0.00	0.00
11.4682	2.1562	347718.	2996.	-0.00676	126.2549	4.80E+11	0.00	0.00	0.00
12.1428	2.1015	371969.	2996.	-0.00676	135.0601	4.80E+11	0.00	0.00	0.00
12.8174	2.0468	396219.	3003.	-0.00675	143.8653	4.80E+11	0.00	0.00	1.8192
13.4920	1.9922	420589.	4134.	-0.00674	152.7138	4.80E+11	0.00	0.00	277.6722
14.1666	1.9376	463155.	6515.	-0.00674	168.1693	4.80E+11	0.00	0.00	310.5584
14.8412	1.8831	526073.	9162.	-0.00673	191.0144	4.80E+11	0.00	0.00	343.4445
15.5158	1.8287	611497.	12076.	-0.00672	222.0316	4.80E+11	0.00	0.00	376.3307
16.1904	1.7743	721583.	15255.	-0.00671	262.0034	4.80E+11	0.00	0.00	409.2168
16.8650	1.7201	858486.	18701.	-0.00669	311.7122	4.80E+11	0.00	0.00	442.1030
17.5396	1.6659	1024361.	22413.	-0.00668	371.9407	4.80E+11	0.00	0.00	474.9892
18.2142	1.6120	1221363.	26391.	-0.00666	443.4713	4.80E+11	0.00	0.00	507.8753
18.8888	1.5581	1451648.	30636.	-0.00664	527.0865	4.80E+11	0.00	0.00	540.7615
19.5634	1.5045	1717370.	35147.	-0.00661	623.5688	4.80E+11	0.00	0.00	573.6476
20.2380	1.4511	2020684.	39923.	-0.00658	733.7007	4.80E+11	0.00	0.00	606.5338
20.9126	1.3980	2363746.	44967.	-0.00654	858.2648	4.80E+11	0.00	0.00	639.4200
21.5872	1.3452	2748710.	50276.	-0.00650	998.0435	4.80E+11	0.00	0.00	672.3061
22.2618	1.2928	3177732.	55851.	-0.00645	1154.	4.80E+11	0.00	0.00	705.1923
22.9364	1.2408	3652967.	61693.	-0.00639	1326.	4.80E+11	0.00	0.00	738.0785
23.6110	1.1893	4176570.	67801.	-0.00632	1516.	4.80E+11	0.00	0.00	770.9646
24.2856	1.1384	4750696.	74175.	-0.00625	1725.	4.80E+11	0.00	0.00	803.8508
24.9602	1.0881	5377500.	80816.	-0.00616	1953.	4.80E+11	0.00	0.00	836.7369
25.6348	1.0386	6059137.	87723.	-0.00607	2200.	4.80E+11	0.00	0.00	869.6231
26.3094	0.9899	6797763.	94895.	-0.00596	2468.	4.80E+11	0.00	0.00	902.5093
26.9840	0.9421	7595532.	102335.	-0.00584	2758.	4.80E+11	0.00	0.00	935.3954
27.6586	0.8954	8454600.	106838.	-0.00573	0.00	7.57E+11	-19.161	173.2382	196.3962
28.3332	0.8494	9325282.	103860.	-0.00563	0.00	7.56E+11	-912.949	8701.	0.00
29.0078	0.8042	1.01E+07	96397.	-0.00553	0.00	7.56E+11	-930.932	9371.	0.00
29.6824	0.7599	1.09E+07	88793.	-0.00542	0.00	7.55E+11	-947.783	10097.	0.00
30.3570	0.7165	1.16E+07	83053.	-0.00530	0.00	7.55E+11	-470.133	5312.	0.00
31.0316	0.6741	1.22E+07	78943.	-0.00517	0.00	7.55E+11	-545.332	6549.	0.00
31.7062	0.6328	1.29E+07	74273.	-0.00503	0.00	7.54E+11	-608.604	7786.	0.00
32.3808	0.5926	1.34E+07	69136.	-0.00489	0.00	7.54E+11	-660.496	9023.	0.00
33.0554	0.5536	1.40E+07	63623.	-0.00475	0.00	7.54E+11	-701.585	10260.	0.00

33.7300	0.5158	1.45E+07	56397.	-0.00459	0.00	7.53E+11	-1083.	17006.	0.00
34.4046	0.4792	1.49E+07	47586.	-0.00444	0.00	7.53E+11	-1093.	18471.	0.00
35.0792	0.4440	1.52E+07	38700.	-0.00427	0.00	7.53E+11	-1102.	20092.	0.00
35.7538	0.4100	1.55E+07	29752.	-0.00411	0.00	7.53E+11	-1109.	21890.	0.00
36.4284	0.3774	1.57E+07	22423.	-0.00394	0.00	7.53E+11	-702.085	15058.	0.00
37.1030	0.3462	1.59E+07	16759.	-0.00377	0.00	7.52E+11	-697.196	16301.	0.00
37.7776	0.3164	1.60E+07	11125.	-0.00360	0.00	7.52E+11	-694.900	17779.	0.00
38.4522	0.2880	1.61E+07	5893.	-0.00343	0.00	7.52E+11	-597.657	16801.	0.00
39.1268	0.2609	1.61E+07	1065.	-0.00325	0.00	7.52E+11	-595.078	18462.	0.00
39.8014	0.2353	1.61E+07	-3738.	-0.00308	0.00	7.52E+11	-591.565	20353.	0.00
40.4760	0.2111	1.60E+07	-8509.	-0.00291	0.00	7.52E+11	-587.074	22518.	0.00
41.1506	0.1882	1.59E+07	-13239.	-0.00274	0.00	7.52E+11	-581.554	25014.	0.00
41.8252	0.1668	1.58E+07	-17920.	-0.00257	0.00	7.52E+11	-574.951	27912.	0.00
42.4998	0.1467	1.56E+07	-22543.	-0.00240	0.00	7.53E+11	-567.197	31305.	0.00
43.1744	0.1280	1.54E+07	-27098.	-0.00223	0.00	7.53E+11	-558.216	35315.	0.00
43.8490	0.1106	1.52E+07	-32951.	-0.00206	0.00	7.53E+11	-887.807	64990.	0.00
44.5236	0.09454	1.49E+07	-40072.	-0.00190	0.00	7.53E+11	-871.442	74621.	0.00
45.1982	0.07979	1.46E+07	-47049.	-0.00174	0.00	7.53E+11	-852.285	86474.	0.00
45.8728	0.06630	1.41E+07	-53858.	-0.00159	0.00	7.54E+11	-829.998	101340.	0.00
46.5474	0.05405	1.37E+07	-60472.	-0.00144	0.00	7.54E+11	-804.115	120441.	0.00
47.2220	0.04298	1.32E+07	-66859.	-0.00130	0.00	7.54E+11	-773.958	145768.	0.00
47.8966	0.03306	1.26E+07	-72981.	-0.00116	0.00	7.54E+11	-738.491	180826.	0.00
48.5712	0.02423	1.20E+07	-78787.	-0.00103	0.00	7.55E+11	-695.990	232486.	0.00
49.2458	0.01645	1.13E+07	-84208.	-9.01E-04	0.00	7.55E+11	-643.243	316567.	0.00
49.9204	0.00965	1.06E+07	-88305.	-7.83E-04	0.00	7.55E+11	-368.997	309662.	0.00
50.5950	0.00377	9896089.	-90997.	-6.74E-04	0.00	7.56E+11	-295.964	636312.	0.00
51.2696	-0.00126	9149754.	-91274.	-5.72E-04	0.00	7.57E+11	227.4565	1463721.	0.00
51.9442	-0.00549	8418325.	-89002.	-4.78E-04	0.00	7.57E+11	333.9031	492473.	0.00
52.6188	-0.00899	7708778.	-86100.	-3.91E-04	0.00	7.57E+11	382.9942	344858.	0.00
53.2934	-0.01182	7024329.	-82867.	-3.13E-04	0.00	7.57E+11	415.7237	284600.	0.00
53.9680	-0.01405	6367123.	-79404.	-2.41E-04	0.00	7.58E+11	439.8476	253398.	0.00
54.6426	-0.01573	5738741.	-75769.	-1.76E-04	0.00	7.58E+11	458.3746	235931.	0.00
55.3172	-0.01691	5140398.	-72014.	-1.18E-04	0.00	7.59E+11	469.1606	224629.	0.00
55.9918	-0.01764	4572800.	-68196.	-6.65E-05	0.00	7.59E+11	474.1903	217567.	0.00
56.6664	-0.01798	4036277.	-64348.	-2.06E-05	0.00	7.59E+11	476.4706	214466.	0.00
57.3410	-0.01798	3530978.	-60491.	1.97E-05	0.00	7.59E+11	476.4260	214532.	0.00
58.0156	-0.01767	3056900.	-56643.	5.48E-05	0.00	7.59E+11	474.3476	217369.	0.00
58.6902	-0.01709	2613908.	-52819.	8.51E-05	0.00	7.59E+11	470.4354	222840.	0.00
59.3648	-0.01629	2201744.	-49033.	1.11E-04	0.00	7.59E+11	464.8210	231016.	0.00
60.0394	-0.01530	1820040.	-45300.	1.32E-04	0.00	7.59E+11	457.5803	242159.	0.00
60.7140	-0.01415	1468324.	-41631.	1.50E-04	0.00	7.59E+11	448.7376	256760.	0.00
61.3886	-0.01287	1146013.	-38041.	1.64E-04	0.00	7.59E+11	438.2637	275613.	0.00
62.0632	-0.01150	852424.	-33473.	1.74E-04	0.00	7.59E+11	690.3752	486053.	0.00
62.7378	-0.01005	604076.	-27939.	1.82E-04	0.00	7.59E+11	676.9096	545231.	0.00
63.4124	-0.00855	400087.	-22531.	1.87E-04	0.00	7.59E+11	659.1067	624031.	0.00
64.0870	-0.00702	239292.	-17289.	1.91E-04	0.00	7.59E+11	635.8757	733725.	0.00
64.7616	-0.00546	120166.	-12266.	1.93E-04	0.00	7.59E+11	605.3081	897390.	0.00
65.4362	-0.00389	40708.	-7534.	1.94E-04	0.00	7.59E+11	563.6751	1171591.	0.00
66.1108	-0.00233	-1811.	-3220.	1.94E-04	0.00	7.59E+11	502.0013	1747404.	0.00
66.7854	-7.57E-04	-11433.	111.8602	1.94E-04	0.00	7.59E+11	321.2912	3437436.	0.00
67.4600	8.11E-04	0.00	0.00	1.94E-04	0.00	7.59E+11	-348.927	1740708.	0.00

* This analysis computed pile response using nonlinear moment-curvature rela-

tionships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     3.10019615 inches
Computed slope at pile head      =     -0.0071360 radians
Maximum bending moment           =      16082114. inch-lbs
Maximum shear force              =        106838. lbs
Depth of maximum bending moment  =    39.12680000 feet below pile head
Depth of maximum shear force     =    27.65860000 feet below pile head
Number of iterations             =             29
Number of zero deflection points =              2
Pile deflection at ground        =     0.90914538 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
67.46000	3.10019615	16082114.	106838.
64.08700	3.20887348	16158943.	107347.
60.71400	3.75314414	15408472.	107527.
57.34100	5.11597295	14815068.	-111282.
53.96800	7.74885666	14105404.	-115462.
50.59500	13.73545858	13533149.	-122359.
47.22200	47.06160175	12838710.	-134312.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                          =          0.0 lbs
```

Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	6.1290	-5.95E-08	0.00	-0.01324	3.34E-09	1.46E+09	0.00	0.00	84.4825
0.6746	6.0218	2768.	750.4749	-0.01323	155.2590	1.46E+09	0.00	0.00	100.9299
1.3492	5.9147	12150.	1656.	-0.01319	681.4888	1.46E+09	0.00	0.00	122.8597
2.0238	5.8082	29584.	2740.	-0.01308	1659.	1.46E+09	0.00	0.00	144.7896
2.6984	5.7030	56506.	4000.	-0.01284	3169.	1.46E+09	0.00	0.00	166.7194
3.3730	5.6003	94354.	4798.	-0.01268	34.2593	4.80E+11	0.00	0.00	30.4205
4.0476	5.4976	134195.	4922.	-0.01268	48.7254	4.80E+11	0.00	0.00	0.00
4.7222	5.3950	174036.	4922.	-0.01268	63.1915	4.80E+11	0.00	0.00	0.00
5.3968	5.2924	213877.	4922.	-0.01267	77.6576	4.80E+11	0.00	0.00	0.00
6.0714	5.1898	253718.	4922.	-0.01267	92.1237	4.80E+11	0.00	0.00	0.00
6.7460	5.0872	293559.	4922.	-0.01267	106.5897	4.80E+11	0.00	0.00	0.00
7.4206	4.9847	333400.	4922.	-0.01266	121.0558	4.80E+11	0.00	0.00	0.00
8.0952	4.8823	373241.	4922.	-0.01265	135.5219	4.80E+11	0.00	0.00	0.00
8.7698	4.7798	413082.	4922.	-0.01265	149.9880	4.80E+11	0.00	0.00	0.00
9.4444	4.6775	452923.	4922.	-0.01264	164.4541	4.80E+11	0.00	0.00	0.00
10.1190	4.5752	492764.	4922.	-0.01263	178.9201	4.80E+11	0.00	0.00	0.00
10.7936	4.4729	532605.	4922.	-0.01262	193.3862	4.80E+11	0.00	0.00	0.00
11.4682	4.3708	572446.	4922.	-0.01261	207.8523	4.80E+11	0.00	0.00	0.00
12.1428	4.2687	612287.	4922.	-0.01260	222.3184	4.80E+11	0.00	0.00	0.00
12.8174	4.1667	652128.	4933.	-0.01259	236.7845	4.80E+11	0.00	0.00	2.8953
13.4920	4.0648	692158.	6728.	-0.01258	251.3195	4.80E+11	0.00	0.00	440.4083
14.1666	3.9630	761050.	10492.	-0.01257	276.3337	4.80E+11	0.00	0.00	489.7375
14.8412	3.8613	862036.	14657.	-0.01256	313.0010	4.80E+11	0.00	0.00	539.0668
15.5158	3.7597	998347.	19220.	-0.01254	362.4951	4.80E+11	0.00	0.00	588.3960
16.1904	3.6582	1173218.	24183.	-0.01252	425.9897	4.80E+11	0.00	0.00	637.7253
16.8650	3.5569	1389880.	29545.	-0.01250	504.6587	4.80E+11	0.00	0.00	687.0545
17.5396	3.4558	1651566.	35307.	-0.01248	599.6757	4.80E+11	0.00	0.00	736.3837
18.2142	3.3549	1961509.	41468.	-0.01245	712.2146	4.80E+11	0.00	0.00	785.7130
18.8888	3.2543	2322942.	48028.	-0.01241	843.4492	4.80E+11	0.00	0.00	835.0422
19.5634	3.1540	2739097.	54987.	-0.01237	994.5531	4.80E+11	0.00	0.00	884.3715
20.2380	3.0541	3213207.	62346.	-0.01232	1167.	4.80E+11	0.00	0.00	933.7007
20.9126	2.9546	3748504.	70104.	-0.01226	1361.	4.80E+11	0.00	0.00	983.0300
21.5872	2.8557	4348222.	78262.	-0.01219	1579.	4.80E+11	0.00	0.00	1032.
22.2618	2.7573	5015592.	86818.	-0.01211	1821.	4.80E+11	0.00	0.00	1082.
22.9364	2.6596	5753848.	95775.	-0.01202	2089.	4.80E+11	0.00	0.00	1131.
23.6110	2.5627	6566222.	105130.	-0.01192	2384.	4.80E+11	0.00	0.00	1180.
24.2856	2.4667	7455947.	114885.	-0.01180	2707.	4.80E+11	0.00	0.00	1230.
24.9602	2.3717	8426255.	125039.	-0.01166	3060.	4.80E+11	0.00	0.00	1279.
25.6348	2.2778	9480379.	135593.	-0.01151	3442.	4.80E+11	0.00	0.00	1328.
26.3094	2.1853	1.06E+07	146545.	-0.01134	3857.	4.80E+11	0.00	0.00	1378.
26.9840	2.0942	1.19E+07	157897.	-0.01115	4304.	4.80E+11	0.00	0.00	1427.
27.6586	2.0047	1.32E+07	164786.	-0.01098	0.00	7.54E+11	-24.629	99.4557	299.5083
28.3332	1.9164	1.45E+07	161370.	-0.01083	0.00	7.53E+11	-1119.	4726.	0.00
29.0078	1.8293	1.58E+07	152213.	-0.01067	0.00	7.52E+11	-1143.	5059.	0.00
29.6824	1.7436	1.70E+07	142864.	-0.01049	0.00	7.52E+11	-1167.	5416.	0.00
30.3570	1.6594	1.81E+07	134433.	-0.01031	0.00	7.51E+11	-916.546	4471.	0.00

31.0316	1.5768	1.92E+07	126872.	-0.01010	0.00	7.51E+11	-951.345	4884.	0.00
31.7062	1.4958	2.02E+07	119065.	-0.00989	0.00	7.50E+11	-977.609	5291.	0.00
32.3808	1.4166	2.11E+07	111087.	-0.00967	0.00	7.49E+11	-993.513	5677.	0.00
33.0554	1.3392	2.20E+07	102945.	-0.00944	0.00	7.49E+11	-1018.	6153.	0.00
33.7300	1.2638	2.28E+07	93338.	-0.00920	0.00	7.48E+11	-1356.	8683.	0.00
34.4046	1.1904	2.35E+07	82295.	-0.00895	0.00	7.48E+11	-1373.	9335.	0.00
35.0792	1.1190	2.41E+07	71119.	-0.00869	0.00	7.48E+11	-1388.	10044.	0.00
35.7538	1.0497	2.46E+07	59823.	-0.00842	0.00	7.47E+11	-1402.	10816.	0.00
36.4284	0.9826	2.51E+07	49296.	-0.00816	0.00	7.47E+11	-1198.	9874.	0.00
37.1030	0.9177	2.54E+07	39538.	-0.00788	0.00	7.47E+11	-1212.	10696.	0.00
37.7776	0.8550	2.57E+07	29654.	-0.00760	0.00	7.47E+11	-1229.	11641.	0.00
38.4522	0.7945	2.59E+07	21560.	-0.00732	0.00	7.46E+11	-770.263	7848.	0.00
39.1268	0.7364	2.60E+07	15320.	-0.00704	0.00	7.46E+11	-771.282	8479.	0.00
39.8014	0.6805	2.61E+07	9076.	-0.00676	0.00	7.46E+11	-771.442	9177.	0.00
40.4760	0.6269	2.62E+07	2834.	-0.00648	0.00	7.46E+11	-770.714	9952.	0.00
41.1506	0.5757	2.62E+07	-3399.	-0.00619	0.00	7.46E+11	-769.065	10815.	0.00
41.8252	0.5267	2.61E+07	-9614.	-0.00591	0.00	7.46E+11	-766.461	11781.	0.00
42.4998	0.4800	2.60E+07	-15804.	-0.00563	0.00	7.46E+11	-762.862	12866.	0.00
43.1744	0.4356	2.59E+07	-21961.	-0.00534	0.00	7.46E+11	-758.225	14091.	0.00
43.8490	0.3935	2.57E+07	-29965.	-0.00506	0.00	7.47E+11	-1219.	25085.	0.00
44.5236	0.3536	2.54E+07	-39806.	-0.00479	0.00	7.47E+11	-1212.	27742.	0.00
45.1982	0.3160	2.50E+07	-49577.	-0.00451	0.00	7.47E+11	-1202.	30801.	0.00
45.8728	0.2805	2.46E+07	-59261.	-0.00424	0.00	7.47E+11	-1190.	34348.	0.00
46.5474	0.2473	2.41E+07	-68839.	-0.00398	0.00	7.48E+11	-1176.	38500.	0.00
47.2220	0.2161	2.35E+07	-78289.	-0.00372	0.00	7.48E+11	-1159.	43413.	0.00
47.8966	0.1870	2.28E+07	-87589.	-0.00347	0.00	7.48E+11	-1139.	49303.	0.00
48.5712	0.1599	2.21E+07	-96712.	-0.00323	0.00	7.49E+11	-1115.	56478.	0.00
49.2458	0.1347	2.12E+07	-105629.	-0.00300	0.00	7.49E+11	-1088.	65395.	0.00
49.9204	0.1113	2.04E+07	-112784.	-0.00277	0.00	7.50E+11	-679.902	49437.	0.00
50.5950	0.08978	1.94E+07	-118181.	-0.00256	0.00	7.50E+11	-653.481	58922.	0.00
51.2696	0.06993	1.84E+07	-123346.	-0.00235	0.00	7.51E+11	-622.525	72069.	0.00
51.9442	0.05168	1.74E+07	-128234.	-0.00216	0.00	7.52E+11	-585.200	91669.	0.00
52.6188	0.03495	1.64E+07	-132780.	-0.00198	0.00	7.52E+11	-537.944	124599.	0.00
53.2934	0.01965	1.53E+07	-136869.	-0.00181	0.00	7.53E+11	-472.083	194508.	0.00
53.9680	0.00567	1.41E+07	-140199.	-0.00165	0.00	7.54E+11	-350.651	500268.	0.00
54.6426	-0.00707	1.30E+07	-140099.	-0.00150	0.00	7.54E+11	375.4126	429903.	0.00
55.3172	-0.01868	1.19E+07	-136632.	-0.00137	0.00	7.55E+11	481.1063	208461.	0.00
55.9918	-0.02927	1.08E+07	-132506.	-0.00125	0.00	7.55E+11	538.2237	148880.	0.00
56.6664	-0.03891	9732755.	-127988.	-0.00114	0.00	7.56E+11	577.9532	120237.	0.00
57.3410	-0.04771	8715604.	-123187.	-0.00104	0.00	7.57E+11	608.1830	103183.	0.00
58.0156	-0.05576	7738308.	-118166.	-9.53E-04	0.00	7.57E+11	632.3490	91799.	0.00
58.6902	-0.06314	6802452.	-112966.	-8.75E-04	0.00	7.57E+11	652.3014	83630.	0.00
59.3648	-0.06993	5909342.	-107617.	-8.07E-04	0.00	7.58E+11	669.1714	77463.	0.00
60.0394	-0.07621	5060085.	-102141.	-7.49E-04	0.00	7.59E+11	683.7112	72625.	0.00
60.7140	-0.08205	4255633.	-96555.	-6.99E-04	0.00	7.59E+11	696.4529	68711.	0.00
61.3886	-0.08753	3496821.	-90871.	-6.58E-04	0.00	7.59E+11	707.7899	65462.	0.00
62.0632	-0.09270	2784392.	-83297.	-6.24E-04	0.00	7.59E+11	1163.	101600.	0.00
62.7378	-0.09763	2148206.	-73750.	-5.98E-04	0.00	7.59E+11	1195.	99099.	0.00
63.4124	-0.102	1590344.	-63950.	-5.78E-04	0.00	7.59E+11	1226.	96957.	0.00
64.0870	-0.107	1112837.	-53900.	-5.64E-04	0.00	7.59E+11	1257.	95089.	0.00
64.7616	-0.112	717686.	-43604.	-5.54E-04	0.00	7.59E+11	1287.	93430.	0.00
65.4362	-0.116	406869.	-33065.	-5.48E-04	0.00	7.59E+11	1317.	91934.	0.00
66.1108	-0.120	182347.	-22285.	-5.45E-04	0.00	7.59E+11	1347.	90566.	0.00

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   66.7854     -0.125     46074.    -11263.  -5.43E-04       0.00   7.59E+11      1376.     89302.       0.00
   67.4600     -0.129       0.00       0.00  -5.43E-04       0.00   7.59E+11      1406.     44063.       0.00

* This analysis computed pile response using nonlinear moment-curvature rela-
  tionships. Values of total stress due to combined axial and bending stresses
  are computed only for elastic sections only and do not equal the actual
  stresses in concrete and steel. Stresses in concrete and steel may be inter-
  polated from the output for nonlinear bending properties relative to the
  magnitude of bending moment developed in the pile.


Output Summary for Load Case No. 2:

Pile-head deflection             =     6.12895627 inches
Computed slope at pile head      =     -0.0132416 radians
Maximum bending moment           =      26193387. inch-lbs
Maximum shear force              =        164786. lbs
Depth of maximum bending moment  =    40.47600000 feet below pile head
Depth of maximum shear force     =    27.65860000 feet below pile head
Number of iterations             =             40
Number of zero deflection points =              1
Pile deflection at ground        =     2.03105525 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs


    Pile       Pile Head       Maximum       Maximum
   Length      Deflection      Moment         Shear
    feet         inches        ln-lbs          lbs
------------  ------------  ------------  ------------
   67.46000    6.12895627     26193387.       164786.
   64.08700    7.56711419     25691263.       165632.
   60.71400   11.62777692     24585617.       165879.
   57.34100   26.17880542     23622588.      -180633.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
```

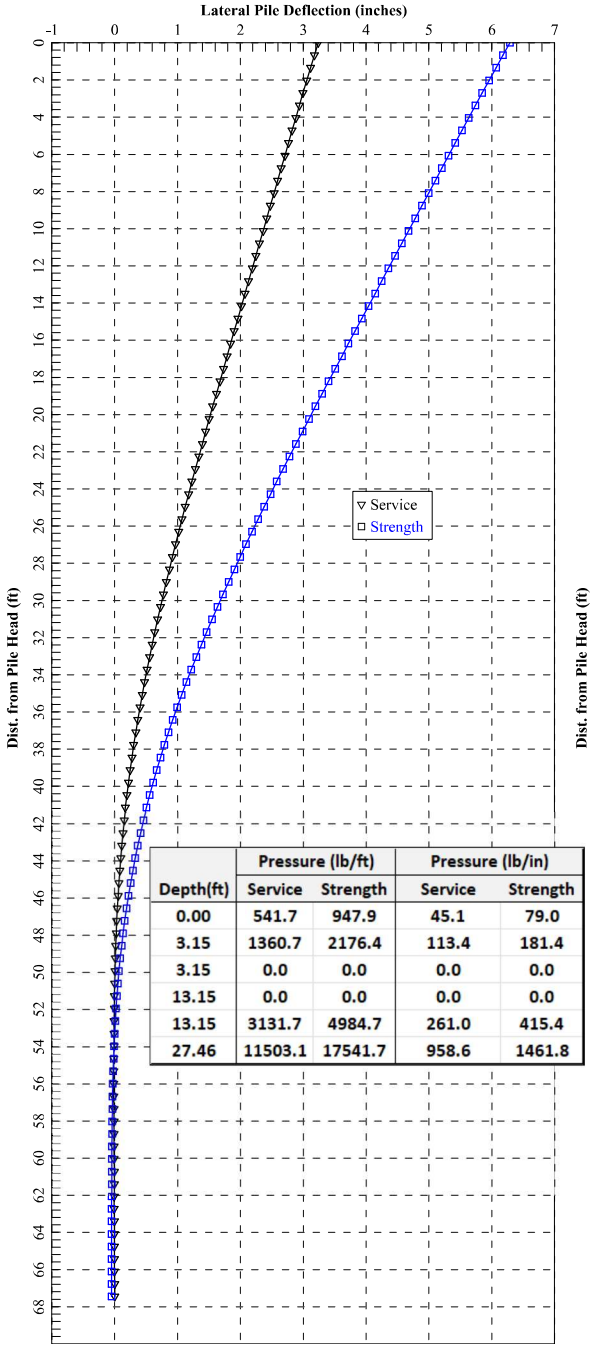
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

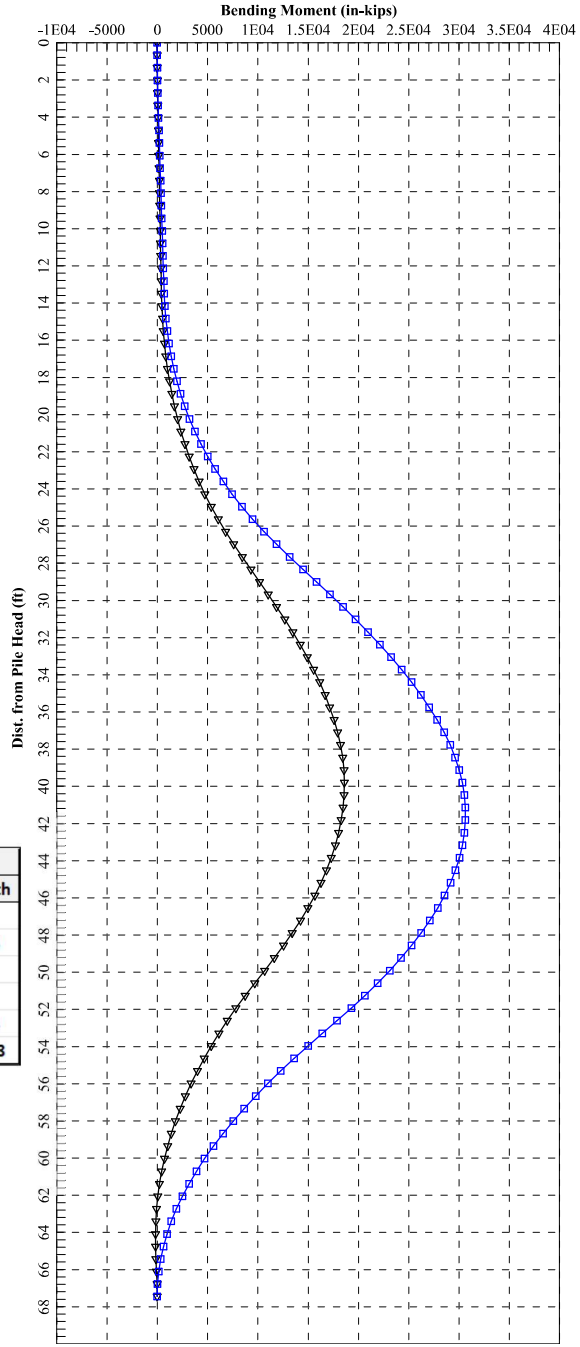
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	3.1002	-0.00714	106838.	1.61E+07
2	V, lb	0.00	M, in-lb	0.00	0.00	6.1290	-0.01324	164786.	2.62E+07

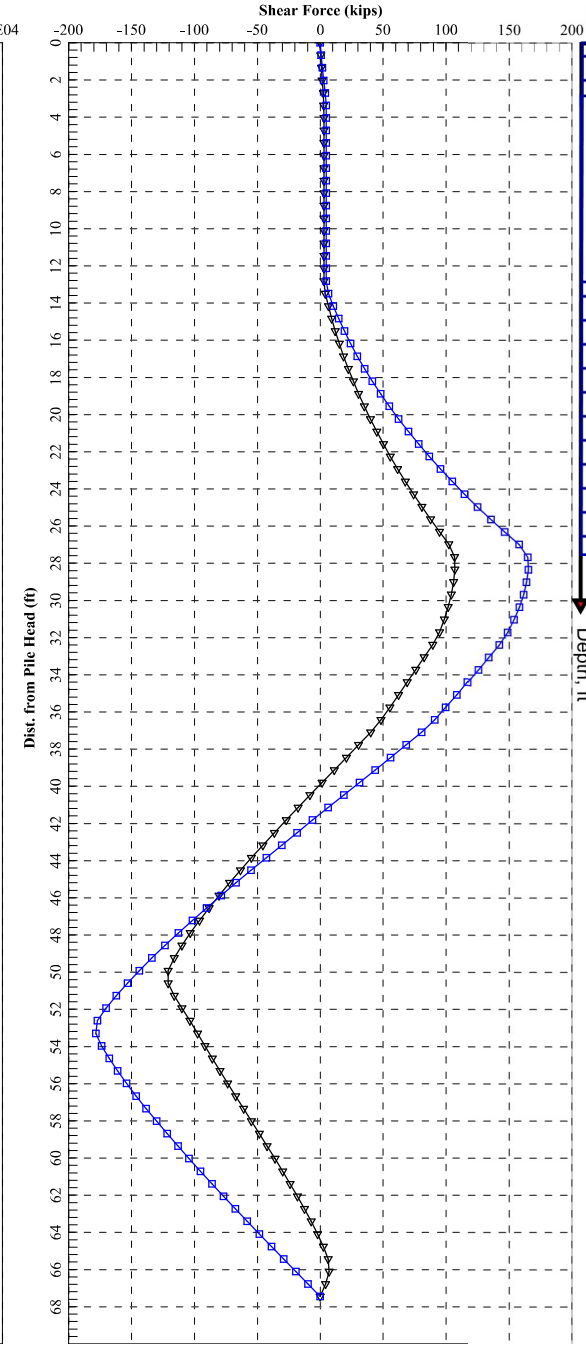
Maximum pile-head deflection = 6.1289562722 inches
Maximum pile-head rotation = -0.0132416465 radians = -0.758690 deg.

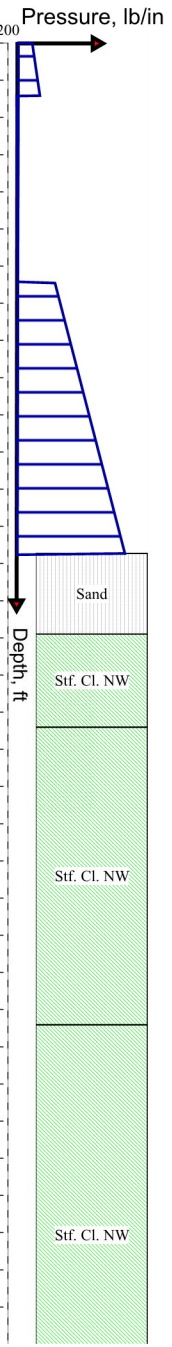
The analysis ended normally.

Wall 5B (27.46ft): Based on B-070-0-20









Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	541.7	947.9	45.1	79.0
3.15	1360.7	2176.4	113.4	181.4
3.15	0.0	0.0	0.0	0.0
13.15	0.0	0.0	0.0	0.0
13.15	3131.7	4984.7	261.0	415.4
27.46	11503.1	17541.7	958.6	1461.8

```
================================================================================

                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App E LPile March 2026\Wall 5B\

Name of input data file:
02 Wall_5B-27.46ft-EPS W36x256_B-070.lp12d

Name of output report file:
02 Wall_5B-27.46ft-EPS W36x256_B-070.lp12o

Name of plot output file:
02 Wall_5B-27.46ft-EPS W36x256_B-070.lp12p

Name of runtime message file:
02 Wall_5B-27.46ft-EPS W36x256_B-070.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 27, 2026             Time:  12:29:31
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Nizar Altarawneh, P.E

Description: LPILE FOR SP WALL 5B_with EPS (H=27.46FT) Boring B-070-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 3
Total length of pile = 67.460 ft
Depth of ground surface below top of pile = 27.4600 ft

Pile diameters used for p-y curve computations are defined using 6 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	5.6630
2	3.000	5.6630
3	3.000	12.2000
4	27.460	12.2000
5	27.460	48.0000
6	67.460	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional Shape = General Section
Length of section = 3.000000 ft
Width of top of section = 5.663000 in
Width of bottom of section = 5.663000 in
Top Area = 21.519000 sq. in
Bottom Area = 21.519000 sq. in
Moment of Inertia at Top = 50.483751 in^4
Moment of Inertia at Bottom = 50.483751 in^4
Elastic Modulus = 29000000. psi

Pile Section No. 2:

Section 2 is a AISC strong axis steel pile
Length of section = 24.460000 ft
AISC Section Type = W

```
   AISC Section Name                                = W36X256


   Pile width                                       =    12.200000 in

Pile Section No. 3:

   Section 3 is a drilled shaft with casing and AISC section core/insert
   Length of section                                =    40.000000 ft
   Section Diameter                                 =    48.000000 in
   Core/Insert AISC Section Type                    = W


   Core/Insert AISC Section Name                    = W36X256




--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer        =    27.460000 ft
   Distance from top of pile to bottom of layer     =    31.800000 ft
   Effective unit weight at top of layer            =    62.600000 pcf
   Effective unit weight at bottom of layer         =    62.600000 pcf
   Friction angle at top of layer                   =    32.000000 deg.
   Friction angle at bottom of layer                =    32.000000 deg.
   Subgrade k at top of layer                       =    90.000000 pci
   Subgrade k at bottom of layer                    =    90.000000 pci


Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer        =    31.800000 ft
   Distance from top of pile to bottom of layer     =    36.800000 ft
   Effective unit weight at top of layer            =    57.600000 pcf
   Effective unit weight at bottom of layer         =    57.600000 pcf
   Undrained cohesion at top of layer               =        2000. psf
   Undrained cohesion at bottom of layer            =        2000. psf
   Epsilon-50 at top of layer                       =     0.005000
   Epsilon-50 at bottom of layer                    =     0.005000


Layer 3 is stiff clay without free water

   Distance from top of pile to top of layer        =    36.800000 ft
```

```
   Distance from top of pile to bottom of layer        =    52.810000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Undrained cohesion at top of layer                  =        3000. psf
   Undrained cohesion at bottom of layer               =        3000. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer           =    52.810000 ft
   Distance from top of pile to bottom of layer        =    90.000000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Undrained cohesion at top of layer                  =        2000. psf
   Undrained cohesion at bottom of layer               =        2000. psf
   Epsilon-50 at top of layer                          =     0.005000
   Epsilon-50 at bottom of layer                       =     0.005000


 (Depth of the lowest soil layer extends 22.540 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of        E50
 Num.           Name             Depth       Unit Wt.                 Friction        or          kpy
          (p-y Curve Type)         ft          pcf          psf         deg.         krm         pci
-----   ------------------   ----------   ----------   ----------   ----------   ----------   ----------
  1           Sand             27.4600      62.6000       --          32.0000       --          90.0000
          (Reese, et al.)      31.8000      62.6000       --          32.0000       --          90.0000
  2         Stiff Clay         31.8000      57.6000        2000.       --          0.00500       --
          w/o Free Water       36.8000      57.6000        2000.       --          0.00500       --
  3         Stiff Clay         36.8000      62.6000        3000.       --          0.00500       --
          w/o Free Water       52.8100      62.6000        3000.       --          0.00500       --
  4         Stiff Clay         52.8100      57.6000        2000.       --          0.00500       --
          w/o Free Water       90.0000      57.6000        2000.       --          0.00500       --


--------------------------------------------------------------------------------
                      Modification Factors for p-y Curves
--------------------------------------------------------------------------------

Distribution of p-y modifiers with depth defined using 2 points

Point      Depth X         p-mult         y-mult
 No.          ft
-----     ----------     ----------     ----------
  1          27.460         0.7550         1.0000
```

2	67.460	0.7550	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 6 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	45.100
2	3.150	113.400
3	3.150	0.000
4	13.150	0.000
5	13.150	261.000
6	27.460	958.600

Distributed lateral load intensity for Load Case 2 defined using 6 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	79.000
2	3.150	181.400
3	3.150	0.000
4	13.150	0.000
5	13.150	415.400
6	27.460	1461.800

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load	Load	Condition	Condition	Axial Thrust	Compute Top y	Run Analysis

No.	Type	1	2	Force, lbs	vs. Pile Length	
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 3

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 2:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	24.460000 ft
Flange Width	=	12.200000 in
Section Depth	=	37.400000 in
Flange Thickness	=	1.730000 in
Web Thickness	=	0.960000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	75.300000 sq. in.
Moment of Inertia	=	16800. in^4
Elastic Bending Stiffness	=	487200000. kip-in^2
Plastic Modulus, Z	=	1040.in^3
Plastic Moment Capacity = Fy Z	=	52000.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	3765.000 kips
Nominal Axial Tensile Capacity	=	-3765.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000601	2883.	480006160.	18.7000000	3.2246004	
0.00001201	5766.	480006160.	18.7000000	6.4492009	
0.00001802	8649.	480006160.	18.7000000	9.6738013	
0.00002402	11532.	480006160.	18.7000000	12.8984017	
0.00003003	14415.	480006160.	18.7000000	16.1230021	
0.00003604	17298.	480006160.	18.7000000	19.3476026	
0.00004204	20181.	480006160.	18.7000000	22.5722030	
0.00004805	23064.	480006160.	18.7000000	25.7968034	
0.00005406	25947.	480006160.	18.7000000	29.0214038	
0.00006006	28830.	480006160.	18.7000000	32.2460043	
0.00006607	31713.	480006160.	18.7000000	35.4706047	
0.00007207	34596.	480006160.	18.7000000	38.6952051	
0.00007808	37479.	480006160.	18.7000000	41.9198056	
0.00008409	40362.	480006160.	18.7000000	45.1444060	
0.00009009	43245.	480006160.	18.7000000	48.3690064	
0.00009610	45768.	476254989.	18.7000000	50.0000000	Y
0.0001021	46884.	459172815.	18.7000000	50.0000000	Y
0.0001081	47378.	438228174.	18.7000000	50.0000000	Y
0.0001141	47795.	418820022.	18.7000000	50.0000000	Y
0.0001201	48151.	400842510.	18.7000000	50.0000000	Y
0.0001261	48458.	384187517.	18.7000000	50.0000000	Y
0.0001321	48722.	368724884.	18.7000000	50.0000000	Y
0.0001381	48955.	354376948.	18.7000000	50.0000000	Y
0.0001441	49157.	341015611.	18.7000000	50.0000000	Y
0.0001502	49337.	328574040.	18.7000000	50.0000000	Y
0.0001562	49497.	316961793.	18.7000000	50.0000000	Y
0.0001622	49639.	306094927.	18.7000000	50.0000000	Y
0.0001682	49766.	295916894.	18.7000000	50.0000000	Y
0.0001742	49880.	286369075.	18.7000000	50.0000000	Y
0.0001802	49982.	277392071.	18.7000000	50.0000000	Y
0.0001862	50075.	268939208.	18.7000000	50.0000000	Y

```
    0.0001922        50159.    260972045.    18.7000000    50.0000000  Y
    0.0001982        50236.    253453843.    18.7000000    50.0000000  Y
    0.0002042        50307.    246346608.    18.7000000    50.0000000  Y
    0.0002102        50370.    239608120.    18.7000000    50.0000000  Y
    0.0002162        50429.    233228130.    18.7000000    50.0000000  Y
    0.0002222        50483.    227167553.    18.7000000    50.0000000  Y
    0.0002282        50533.    221407941.    18.7000000    50.0000000  Y
    0.0002342        50580.    215929857.    18.7000000    50.0000000  Y
    0.0002463        50662.    205731080.    18.7000000    50.0000000  Y
    0.0002583        50733.    196436688.    18.7000000    50.0000000  Y
    0.0002703        50795.    187935028.    18.7000000    50.0000000  Y
    0.0002823        50850.    180132463.    18.7000000    50.0000000  Y
    0.0002943        50898.    172942285.    18.7000000    50.0000000  Y
    0.0003063        50939.    166295713.    18.7000000    50.0000000  Y
    0.0003183        50978.    160143156.    18.7000000    50.0000000  Y
    0.0003303        51010.    154416527.    18.7000000    50.0000000  Y
    0.0003424        51042.    149090413.    18.7000000    50.0000000  Y
    0.0003544        51067.    144108704.    18.7000000    50.0000000  Y
    0.0003664        51093.    139453665.    18.7000000    50.0000000  Y
    0.0003784        51114.    135082646.    18.7000000    50.0000000  Y
    0.0003904        51134.    130977791.    18.7000000    50.0000000  Y
    0.0004024        51154.    127116521.    18.7000000    50.0000000  Y
    0.0004144        51169.    123469366.    18.7000000    50.0000000  Y
    0.0004264        51185.    120027684.    18.7000000    50.0000000  Y
    0.0004385        51200.    116774587.    18.7000000    50.0000000  Y
    0.0004505        51212.    113686848.    18.7000000    50.0000000  Y
    0.0004625        51224.    110759099.    18.7000000    50.0000000  Y


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
--------------------------------------------------------------------------------

                                          Nominal
Load              Axial                   Moment
 No.             Thrust                  Capacity
                  kips                    in-kips
----         ----------------         ----------------
  1               0.00000000                  51224.

Note that the values in the above table are not factored by a strength
reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the
LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to the LRFD structural
design standard being followed.
```

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	40.000000 ft
Outside Diameter of Casing	=	48.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	12.200000 in
Depth of Core/Insert	=	37.400000 in
Flange Thickness of Core/Insert	=	1.730000 in
Web Thickness of Core/Insert	=	0.960000 in
Moment of Inertia of Steel Core/Insert	=	16800. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1810. sq. in.
Area of Concrete	=	1735. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	75.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	74.794400 sq. in.
Area Ratio of All Steel to Gross Area	=	4.13 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	11135.594 kips
Tensile Load for Cracking of Concrete	=	-1054.751 kips
Nominal Axial Tensile Capacity	=	-3765.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000601	4560.	759183196.	16.4692674	0.00009892	-0.000189	0.4515297	0.00000	0.00000	-4.530558	C
0.00001201	9089.	756616928.	16.5194733	0.0001984	-0.000378	0.8842905	0.00000	0.00000	-9.043626	C
0.00001802	13586.	754003712.	16.5705177	0.0002986	-0.000566	1.2979449	0.00000	0.00000	-13.538766	C
0.00002402	18051.	751342794.	16.6217445	0.0003993	-0.000754	1.6920788	0.00000	0.00000	-18.015998	C
0.00003003	22482.	748631949.	16.6740969	0.0005007	-0.000941	2.0663935	0.00000	0.00000	-22.474403	C
0.00003604	26879.	745869062.	16.7276268	0.0006028	-0.001127	2.4205265	0.00000	0.00000	-26.913341	C
0.00004204	31241.	743051873.	16.7823897	0.0007056	-0.001312	2.7540971	0.00000	0.00000	-31.332127	C
0.00004805	35565.	740177961.	16.8384453	0.0008091	-0.001497	3.0667042	0.00000	0.00000	-35.730035	C
0.00005406	39852.	737244729.	16.8958575	0.0009133	-0.001681	3.3579250	0.00000	0.00000	-40.106289	C
0.00006006	44101.	734249389.	16.9546953	0.0010183	-0.001865	3.6273127	0.00000	0.00000	-44.460059	C
0.00006607	48308.	731188911.	17.0150330	0.0011242	-0.002047	3.8743944	0.00000	0.00000	-48.790461	C
0.00007207	51435.	713640973.	16.9316549	0.0012203	-0.002239	4.0774628	0.00000	0.00000	-50.000000	CY
0.00007808	52943.	678049923.	16.6569658	0.0013006	-0.002447	4.2309924	0.00000	0.00000	-50.000000	CY
0.00008409	54216.	644759896.	16.3913011	0.0013783	-0.002658	4.3662763	0.00000	0.00000	-50.000000	CY
0.00009009	55309.	613911690.	16.1387406	0.0014540	-0.002870	4.4854285	0.00000	0.00000	-50.000000	CY
0.00009610	56253.	585357485.	15.8960406	0.0015276	-0.003085	4.5893533	0.00000	0.00000	-50.000000	CY
0.0001021	57077.	558998302.	15.6670853	0.0015997	-0.003301	4.6797558	0.00000	0.00000	-50.000000	CY
0.0001081	57803.	534661062.	15.4484957	0.0016702	-0.003519	4.7572337	0.00000	0.00000	-50.000000	CY
0.0001141	58447.	512158230.	15.2418646	0.0017394	-0.003738	4.8228751	0.00000	0.00000	-50.000000	CY
0.0001201	59022.	491338882.	15.0463716	0.0018074	-0.003959	4.8773429	0.00000	0.00000	-50.000000	CY
0.0001261	59536.	472022384.	14.8594540	0.0018742	-0.004180	4.9210785	0.00000	0.00000	-50.000000	CY
0.0001321	60002.	454086725.	14.6842895	0.0019403	-0.004402	4.9548994	0.00000	0.00000	-50.000000	CY
0.0001381	60421.	437376487.	14.5156317	0.0020052	-0.004626	4.9789499	0.00000	0.00000	-50.000000	CY
0.0001441	60801.	421792463.	14.3557517	0.0020694	-0.004850	4.9938204	0.00000	0.00000	-50.000000	CY
0.0001502	61152.	407258653.	14.2060505	0.0021331	-0.005074	4.9998425	0.00000	0.00000	-50.000000	CY
0.0001562	61467.	393612598.	14.0610209	0.0021958	-0.005300	4.9992656	0.00000	0.00000	-50.000000	CY
0.0001622	61755.	380810726.	13.9229703	0.0022579	-0.005526	4.9976564	0.00000	0.00000	-50.000000	CY
0.0001682	62022.	368794956.	13.7931403	0.0023196	-0.005753	4.9960417	0.00000	0.00000	-50.000000	CY
0.0001742	62268.	357492287.	13.6705624	0.0023811	-0.005980	4.9995324	0.00000	0.00000	-50.000000	CY
0.0001802	62491.	346810652.	13.5498912	0.0024415	-0.006207	4.9963972	0.00000	0.00000	-50.000000	CY
0.0001862	62698.	336738394.	13.4357722	0.0025016	-0.006436	4.9998997	0.00000	0.00000	-50.000000	CY
0.0001922	62892.	327225206.	13.3280248	0.0025616	-0.006664	4.9966378	0.00000	0.00000	-50.000000	CY
0.0001982	63073.	318221022.	13.2253781	0.0026213	-0.006893	4.9998679	0.00000	0.00000	-50.000000	CY
0.0002042	63238.	309667770.	13.1243877	0.0026801	-0.007122	4.9951170	0.00000	0.00000	-50.000000	CY
0.0002102	63392.	301555487.	13.0272070	0.0027385	-0.007352	4.9992256	0.00000	0.00000	-50.000000	CY
0.0002162	63539.	293856699.	12.9348029	0.0027968	-0.007582	4.9941105	0.00000	0.00000	-50.000000	CY
0.0002222	63675.	286525456.	12.8462455	0.0028548	-0.007812	4.9967070	0.00000	0.00000	-50.000000	CY
0.0002282	63806.	279560836.	12.7620423	0.0029128	-0.008043	4.9996436	0.00000	0.00000	-50.000000	CY
0.0002342	63927.	272908127.	12.6792608	0.0029700	-0.008274	4.9920906	0.00000	0.00000	-50.000000	CY
0.0002463	64146.	260486378.	12.5198612	0.0030831	-0.008737	4.9989503	0.00000	0.00000	-50.000000	CY

Summary of Results for Nominal Moment Capacity for Section 3

Load No.	Axial Thrust	Nominal Moment Capacity

	kips	in-kips
1	0.00000000	64146.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	27.4600	0.00	N.A.	No	0.00	24462.
2	31.8000	0.9935	No	No	24462.	141829.
3	36.8000	4.1941	Yes	No	166291.	916175.
4	52.8100	26.6541	Yes	No	1082465.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	3.2403	-9.92E-08	0.00	-0.00748	5.56E-09	1.46E+09	0.00	0.00	48.7568
0.6746	3.1797	1598.	439.0990	-0.00748	89.6035	1.46E+09	0.00	0.00	59.7270
1.3492	3.1192	7109.	981.8058	-0.00745	398.7356	1.46E+09	0.00	0.00	74.3541
2.0238	3.0591	17493.	1643.	-0.00738	981.1585	1.46E+09	0.00	0.00	88.9811
2.6984	2.9997	33709.	2422.	-0.00724	1891.	1.46E+09	0.00	0.00	103.6082
3.3730	2.9418	56714.	2919.	-0.00715	20.5925	4.80E+11	0.00	0.00	19.0038
4.0476	2.8840	80964.	2996.	-0.00715	29.3977	4.80E+11	0.00	0.00	0.00
4.7222	2.8261	105215.	2996.	-0.00715	38.2029	4.80E+11	0.00	0.00	0.00
5.3968	2.7683	129465.	2996.	-0.00714	47.0081	4.80E+11	0.00	0.00	0.00
6.0714	2.7105	153715.	2996.	-0.00714	55.8133	4.80E+11	0.00	0.00	0.00
6.7460	2.6527	177966.	2996.	-0.00714	64.6185	4.80E+11	0.00	0.00	0.00
7.4206	2.5949	202216.	2996.	-0.00714	73.4237	4.80E+11	0.00	0.00	0.00
8.0952	2.5371	226466.	2996.	-0.00713	82.2289	4.80E+11	0.00	0.00	0.00
8.7698	2.4794	250717.	2996.	-0.00713	91.0341	4.80E+11	0.00	0.00	0.00
9.4444	2.4217	274967.	2996.	-0.00712	99.8393	4.80E+11	0.00	0.00	0.00
10.1190	2.3641	299218.	2996.	-0.00712	108.6445	4.80E+11	0.00	0.00	0.00
10.7936	2.3065	323468.	2996.	-0.00711	117.4497	4.80E+11	0.00	0.00	0.00
11.4682	2.2489	347718.	2996.	-0.00711	126.2549	4.80E+11	0.00	0.00	0.00
12.1428	2.1914	371969.	2996.	-0.00710	135.0601	4.80E+11	0.00	0.00	0.00
12.8174	2.1339	396219.	3003.	-0.00709	143.8653	4.80E+11	0.00	0.00	1.8192
13.4920	2.0765	420589.	4134.	-0.00709	152.7138	4.80E+11	0.00	0.00	277.6722
14.1666	2.0192	463155.	6515.	-0.00708	168.1693	4.80E+11	0.00	0.00	310.5584
14.8412	1.9619	526073.	9162.	-0.00707	191.0144	4.80E+11	0.00	0.00	343.4445
15.5158	1.9047	611497.	12076.	-0.00706	222.0316	4.80E+11	0.00	0.00	376.3307
16.1904	1.8476	721583.	15255.	-0.00705	262.0034	4.80E+11	0.00	0.00	409.2168
16.8650	1.7905	858486.	18701.	-0.00704	311.7122	4.80E+11	0.00	0.00	442.1030
17.5396	1.7336	1024361.	22413.	-0.00702	371.9407	4.80E+11	0.00	0.00	474.9892
18.2142	1.6768	1221363.	26391.	-0.00700	443.4713	4.80E+11	0.00	0.00	507.8753
18.8888	1.6202	1451648.	30636.	-0.00698	527.0865	4.80E+11	0.00	0.00	540.7615
19.5634	1.5638	1717370.	35147.	-0.00695	623.5688	4.80E+11	0.00	0.00	573.6476
20.2380	1.5076	2020684.	39923.	-0.00692	733.7007	4.80E+11	0.00	0.00	606.5338
20.9126	1.4517	2363746.	44967.	-0.00689	858.2648	4.80E+11	0.00	0.00	639.4200
21.5872	1.3961	2748710.	50276.	-0.00684	998.0435	4.80E+11	0.00	0.00	672.3061
22.2618	1.3409	3177732.	55851.	-0.00679	1154.	4.80E+11	0.00	0.00	705.1923
22.9364	1.2862	3652967.	61693.	-0.00673	1326.	4.80E+11	0.00	0.00	738.0785
23.6110	1.2319	4176570.	67801.	-0.00667	1516.	4.80E+11	0.00	0.00	770.9646
24.2856	1.1782	4750696.	74175.	-0.00659	1725.	4.80E+11	0.00	0.00	803.8508
24.9602	1.1252	5377500.	80816.	-0.00651	1953.	4.80E+11	0.00	0.00	836.7369
25.6348	1.0728	6059137.	87723.	-0.00641	2200.	4.80E+11	0.00	0.00	869.6231
26.3094	1.0213	6797763.	94895.	-0.00630	2468.	4.80E+11	0.00	0.00	902.5093
26.9840	0.9708	7595532.	102335.	-0.00618	2758.	4.80E+11	0.00	0.00	935.3954
27.6586	0.9213	8454600.	106831.	-0.00607	0.00	7.57E+11	-20.995	184.4821	196.3962
28.3332	0.8725	9325162.	107147.	-0.00598	0.00	7.56E+11	-97.324	903.0245	0.00
29.0078	0.8245	1.02E+07	106028.	-0.00587	0.00	7.56E+11	-178.967	1757.	0.00
29.6824	0.7774	1.10E+07	104239.	-0.00576	0.00	7.55E+11	-263.136	2740.	0.00
30.3570	0.7312	1.19E+07	101766.	-0.00564	0.00	7.55E+11	-347.713	3849.	0.00
31.0316	0.6861	1.27E+07	98620.	-0.00550	0.00	7.54E+11	-429.551	5068.	0.00
31.7062	0.6421	1.35E+07	94830.	-0.00536	0.00	7.54E+11	-506.934	6391.	0.00
32.3808	0.5993	1.42E+07	89473.	-0.00522	0.00	7.54E+11	-816.566	11031.	0.00

33.0554	0.5577	1.49E+07	82817.	-0.00506	0.00	7.53E+11	-827.868	12017.	0.00
33.7300	0.5174	1.56E+07	76075.	-0.00490	0.00	7.53E+11	-837.818	13109.	0.00
34.4046	0.4784	1.62E+07	69258.	-0.00472	0.00	7.52E+11	-846.393	14322.	0.00
35.0792	0.4409	1.67E+07	62377.	-0.00455	0.00	7.52E+11	-853.560	15673.	0.00
35.7538	0.4048	1.72E+07	55444.	-0.00437	0.00	7.52E+11	-859.283	17184.	0.00
36.4284	0.3702	1.76E+07	48471.	-0.00418	0.00	7.52E+11	-863.522	18883.	0.00
37.1030	0.3371	1.79E+07	40144.	-0.00399	0.00	7.51E+11	-1194.	28661.	0.00
37.7776	0.3056	1.82E+07	30472.	-0.00379	0.00	7.51E+11	-1196.	31677.	0.00
38.4522	0.2757	1.84E+07	20789.	-0.00359	0.00	7.51E+11	-1196.	35116.	0.00
39.1268	0.2475	1.86E+07	11115.	-0.00339	0.00	7.51E+11	-1194.	39058.	0.00
39.8014	0.2208	1.86E+07	1469.	-0.00319	0.00	7.51E+11	-1189.	43604.	0.00
40.4760	0.1957	1.86E+07	-8129.	-0.00299	0.00	7.51E+11	-1182.	48884.	0.00
41.1506	0.1723	1.85E+07	-17657.	-0.00279	0.00	7.51E+11	-1172.	55064.	0.00
41.8252	0.1505	1.83E+07	-27093.	-0.00260	0.00	7.51E+11	-1159.	62358.	0.00
42.4998	0.1303	1.81E+07	-36415.	-0.00240	0.00	7.51E+11	-1144.	71055.	0.00
43.1744	0.1116	1.77E+07	-45596.	-0.00221	0.00	7.51E+11	-1125.	81544.	0.00
43.8490	0.09456	1.73E+07	-54609.	-0.00202	0.00	7.52E+11	-1102.	94369.	0.00
44.5236	0.07897	1.68E+07	-63427.	-0.00183	0.00	7.52E+11	-1076.	110309.	0.00
45.1982	0.06486	1.63E+07	-72015.	-0.00166	0.00	7.52E+11	-1046.	130523.	0.00
45.8728	0.05216	1.57E+07	-80337.	-0.00148	0.00	7.53E+11	-1010.	156823.	0.00
46.5474	0.04082	1.50E+07	-88351.	-0.00132	0.00	7.53E+11	-969.354	192216.	0.00
47.2220	0.03080	1.42E+07	-96002.	-0.00116	0.00	7.54E+11	-921.065	242122.	0.00
47.8966	0.02200	1.34E+07	-103224.	-0.00101	0.00	7.54E+11	-863.093	317523.	0.00
48.5712	0.01438	1.26E+07	-109918.	-8.74E-04	0.00	7.54E+11	-790.662	445076.	0.00
49.2458	0.00785	1.17E+07	-115920.	-7.44E-04	0.00	7.55E+11	-692.206	713926.	0.00
49.9204	0.00233	1.07E+07	-120828.	-6.25E-04	0.00	7.55E+11	-520.361	1809048.	0.00
50.5950	-0.00226	9695742.	-120808.	-5.15E-04	0.00	7.56E+11	525.2784	1877840.	0.00
51.2696	-0.00602	8734990.	-115918.	-4.17E-04	0.00	7.57E+11	682.6687	918444.	0.00
51.9442	-0.00901	7818975.	-110046.	-3.28E-04	0.00	7.57E+11	768.2975	690042.	0.00
52.6188	-0.01133	6953309.	-103587.	-2.49E-04	0.00	7.57E+11	827.3550	591003.	0.00
53.2934	-0.01305	6141861.	-97411.	-1.79E-04	0.00	7.58E+11	698.4312	433241.	0.00
53.9680	-0.01424	5376183.	-91654.	-1.18E-04	0.00	7.58E+11	724.0431	411694.	0.00
54.6426	-0.01496	4657953.	-85714.	-6.44E-05	0.00	7.59E+11	743.4289	402312.	0.00
55.3172	-0.01528	3988442.	-79637.	-1.83E-05	0.00	7.59E+11	757.8011	401501.	0.00
55.9918	-0.01525	3368591.	-73462.	2.10E-05	0.00	7.59E+11	767.9227	407513.	0.00
56.6664	-0.01494	2799063.	-67220.	5.38E-05	0.00	7.59E+11	774.2949	419560.	0.00
57.3410	-0.01438	2280277.	-60940.	8.09E-05	0.00	7.59E+11	777.2489	437463.	0.00
58.0156	-0.01363	1812426.	-54649.	1.03E-04	0.00	7.59E+11	776.9952	461498.	0.00
58.6902	-0.01272	1395493.	-48372.	1.20E-04	0.00	7.59E+11	773.6472	492384.	0.00
59.3648	-0.01169	1029259.	-42135.	1.33E-04	0.00	7.59E+11	767.2294	531346.	0.00
60.0394	-0.01057	713304.	-35963.	1.42E-04	0.00	7.59E+11	757.6724	580294.	0.00
60.7140	-0.00939	447000.	-29882.	1.48E-04	0.00	7.59E+11	744.7923	642174.	0.00
61.3886	-0.00817	229504.	-23920.	1.52E-04	0.00	7.59E+11	728.2481	721638.	0.00
62.0632	-0.00693	59732.	-18108.	1.53E-04	0.00	7.59E+11	707.4602	826400.	0.00
62.7378	-0.00569	-63679.	-12487.	1.53E-04	0.00	7.59E+11	681.4502	970240.	0.00
63.4124	-0.00445	-142432.	-7104.	1.52E-04	0.00	7.59E+11	648.4984	1180572.	0.00
64.0870	-0.00322	-178688.	-2029.	1.51E-04	0.00	7.59E+11	605.2931	1521662.	0.00
64.7616	-0.00201	-175278.	2624.	1.49E-04	0.00	7.59E+11	544.2262	2193000.	0.00
65.4362	-8.13E-04	-136204.	6379.	1.47E-04	0.00	7.59E+11	383.5775	3819922.	0.00
66.1108	3.71E-04	-71992.	7223.	1.46E-04	0.00	7.59E+11	-175.269	3819922.	0.00
66.7854	0.00155	-19267.	4447.	1.45E-04	0.00	7.59E+11	-510.568	2667363.	0.00
67.4600	0.00273	0.00	0.00	1.45E-04	0.00	7.59E+11	-588.010	873099.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     3.24028380 inches
Computed slope at pile head      =     -0.0074802 radians
Maximum bending moment           =      18621981. inch-lbs
Maximum shear force              =       -120828. lbs
Depth of maximum bending moment  =    39.80140000 feet below pile head
Depth of maximum shear force     =    49.92040000 feet below pile head
Number of iterations             =             32
Number of zero deflection points =              2
Pile deflection at ground        =     0.93583768 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
67.46000	3.24028380	18621981.	-120828.
64.08700	3.22022609	18543934.	-120418.
60.71400	3.44669274	18382891.	-131104.
57.34100	4.52069466	17762594.	-145864.
53.96800	7.87955308	16864893.	-157634.
50.59500	22.15869513	16111811.	-172458.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                          =          0.0 lbs
```

Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	6.2934	-1.59E-07	1.23E-09	-0.01376	8.90E-09	1.46E+09	0.00	0.00	84.4825
0.6746	6.1821	2768.	750.4749	-0.01375	155.2590	1.46E+09	0.00	0.00	100.9299
1.3492	6.0708	12150.	1656.	-0.01371	681.4888	1.46E+09	0.00	0.00	122.8597
2.0238	5.9601	29584.	2740.	-0.01359	1659.	1.46E+09	0.00	0.00	144.7896
2.6984	5.8508	56506.	4000.	-0.01335	3169.	1.46E+09	0.00	0.00	166.7194
3.3730	5.7439	94354.	4798.	-0.01320	34.2593	4.80E+11	0.00	0.00	30.4205
4.0476	5.6371	134195.	4922.	-0.01320	48.7254	4.80E+11	0.00	0.00	0.00
4.7222	5.5303	174036.	4922.	-0.01319	63.1915	4.80E+11	0.00	0.00	0.00
5.3968	5.4235	213877.	4922.	-0.01319	77.6576	4.80E+11	0.00	0.00	0.00
6.0714	5.3168	253718.	4922.	-0.01319	92.1237	4.80E+11	0.00	0.00	0.00
6.7460	5.2100	293559.	4922.	-0.01318	106.5897	4.80E+11	0.00	0.00	0.00
7.4206	5.1033	333400.	4922.	-0.01318	121.0558	4.80E+11	0.00	0.00	0.00
8.0952	4.9967	373241.	4922.	-0.01317	135.5219	4.80E+11	0.00	0.00	0.00
8.7698	4.8901	413082.	4922.	-0.01316	149.9880	4.80E+11	0.00	0.00	0.00
9.4444	4.7836	452923.	4922.	-0.01316	164.4541	4.80E+11	0.00	0.00	0.00
10.1190	4.6771	492764.	4922.	-0.01315	178.9201	4.80E+11	0.00	0.00	0.00
10.7936	4.5707	532605.	4922.	-0.01314	193.3862	4.80E+11	0.00	0.00	0.00
11.4682	4.4644	572446.	4922.	-0.01313	207.8523	4.80E+11	0.00	0.00	0.00
12.1428	4.3581	612287.	4922.	-0.01312	222.3184	4.80E+11	0.00	0.00	0.00
12.8174	4.2520	652128.	4933.	-0.01311	236.7845	4.80E+11	0.00	0.00	2.8953
13.4920	4.1459	692158.	6728.	-0.01310	251.3195	4.80E+11	0.00	0.00	440.4083
14.1666	4.0399	761050.	10492.	-0.01309	276.3337	4.80E+11	0.00	0.00	489.7375
14.8412	3.9340	862036.	14657.	-0.01307	313.0010	4.80E+11	0.00	0.00	539.0668
15.5158	3.8283	998347.	19220.	-0.01306	362.4951	4.80E+11	0.00	0.00	588.3960
16.1904	3.7227	1173218.	24183.	-0.01304	425.9897	4.80E+11	0.00	0.00	637.7253
16.8650	3.6172	1389880.	29545.	-0.01302	504.6587	4.80E+11	0.00	0.00	687.0545
17.5396	3.5119	1651566.	35307.	-0.01299	599.6757	4.80E+11	0.00	0.00	736.3837
18.2142	3.4069	1961509.	41468.	-0.01296	712.2146	4.80E+11	0.00	0.00	785.7130
18.8888	3.3021	2322942.	48028.	-0.01292	843.4492	4.80E+11	0.00	0.00	835.0422
19.5634	3.1976	2739097.	54987.	-0.01288	994.5531	4.80E+11	0.00	0.00	884.3715
20.2380	3.0935	3213207.	62346.	-0.01283	1167.	4.80E+11	0.00	0.00	933.7007
20.9126	2.9899	3748504.	70104.	-0.01277	1361.	4.80E+11	0.00	0.00	983.0300
21.5872	2.8867	4348222.	78262.	-0.01270	1579.	4.80E+11	0.00	0.00	1032.
22.2618	2.7842	5015592.	86818.	-0.01263	1821.	4.80E+11	0.00	0.00	1082.
22.9364	2.6823	5753848.	95775.	-0.01253	2089.	4.80E+11	0.00	0.00	1131.
23.6110	2.5813	6566222.	105130.	-0.01243	2384.	4.80E+11	0.00	0.00	1180.
24.2856	2.4811	7455947.	114885.	-0.01231	2707.	4.80E+11	0.00	0.00	1230.
24.9602	2.3819	8426255.	125039.	-0.01218	3060.	4.80E+11	0.00	0.00	1279.
25.6348	2.2839	9480379.	135593.	-0.01203	3442.	4.80E+11	0.00	0.00	1328.
26.3094	2.1872	1.06E+07	146545.	-0.01186	3857.	4.80E+11	0.00	0.00	1378.
26.9840	2.0919	1.19E+07	157897.	-0.01167	4304.	4.80E+11	0.00	0.00	1427.
27.6586	1.9983	1.32E+07	164777.	-0.01150	0.00	7.54E+11	-26.767	108.4375	299.5083
28.3332	1.9058	1.45E+07	165368.	-0.01135	0.00	7.53E+11	-126.890	538.9944	0.00
29.0078	1.8145	1.59E+07	163887.	-0.01119	0.00	7.52E+11	-239.011	1066.	0.00
29.6824	1.7247	1.72E+07	161491.	-0.01101	0.00	7.52E+11	-352.780	1656.	0.00
30.3570	1.6363	1.85E+07	158183.	-0.01082	0.00	7.51E+11	-464.679	2299.	0.00

31.0316	1.5496	1.97E+07	153983.	-0.01061	0.00	7.50E+11	-572.758	2992.	0.00
31.7062	1.4645	2.10E+07	148933.	-0.01039	0.00	7.49E+11	-674.883	3730.	0.00
32.3808	1.3813	2.21E+07	142129.	-0.01016	0.00	7.49E+11	-1006.	5896.	0.00
33.0554	1.3001	2.33E+07	133916.	-0.00991	0.00	7.48E+11	-1023.	6370.	0.00
33.7300	1.2209	2.43E+07	125573.	-0.00965	0.00	7.47E+11	-1038.	6885.	0.00
34.4046	1.1438	2.53E+07	117110.	-0.00939	0.00	7.47E+11	-1052.	7449.	0.00
35.0792	1.0689	2.62E+07	108539.	-0.00911	0.00	7.46E+11	-1065.	8066.	0.00
35.7538	0.9963	2.71E+07	99871.	-0.00882	0.00	7.46E+11	-1076.	8745.	0.00
36.4284	0.9262	2.78E+07	91119.	-0.00852	0.00	7.45E+11	-1086.	9492.	0.00
37.1030	0.8584	2.85E+07	80620.	-0.00821	0.00	7.45E+11	-1508.	14219.	0.00
37.7776	0.7932	2.91E+07	68373.	-0.00790	0.00	7.44E+11	-1518.	15493.	0.00
38.4522	0.7305	2.96E+07	56052.	-0.00758	0.00	7.44E+11	-1526.	16910.	0.00
39.1268	0.6705	3.00E+07	43675.	-0.00725	0.00	7.44E+11	-1532.	18494.	0.00
39.8014	0.6131	3.03E+07	31262.	-0.00693	0.00	7.44E+11	-1535.	20271.	0.00
40.4760	0.5583	3.05E+07	18831.	-0.00659	0.00	7.43E+11	-1536.	22271.	0.00
41.1506	0.5063	3.06E+07	6402.	-0.00626	0.00	7.43E+11	-1535.	24535.	0.00
41.8252	0.4570	3.07E+07	-6003.	-0.00593	0.00	7.43E+11	-1530.	27110.	0.00
42.4998	0.4103	3.06E+07	-18364.	-0.00559	0.00	7.43E+11	-1523.	30055.	0.00
43.1744	0.3664	3.04E+07	-30657.	-0.00526	0.00	7.44E+11	-1514.	33445.	0.00
43.8490	0.3251	3.01E+07	-42859.	-0.00493	0.00	7.44E+11	-1501.	37373.	0.00
44.5236	0.2865	2.97E+07	-54945.	-0.00461	0.00	7.44E+11	-1485.	41963.	0.00
45.1982	0.2505	2.92E+07	-66890.	-0.00429	0.00	7.44E+11	-1466.	47374.	0.00
45.8728	0.2171	2.86E+07	-78664.	-0.00398	0.00	7.45E+11	-1443.	53823.	0.00
46.5474	0.1861	2.79E+07	-90238.	-0.00367	0.00	7.45E+11	-1416.	61604.	0.00
47.2220	0.1577	2.71E+07	-101579.	-0.00337	0.00	7.46E+11	-1385.	71137.	0.00
47.8966	0.1316	2.62E+07	-112649.	-0.00308	0.00	7.46E+11	-1350.	83036.	0.00
48.5712	0.1078	2.53E+07	-123406.	-0.00280	0.00	7.47E+11	-1308.	98245.	0.00
49.2458	0.08622	2.42E+07	-133800.	-0.00253	0.00	7.47E+11	-1260.	118296.	0.00
49.9204	0.06678	2.31E+07	-143771.	-0.00228	0.00	7.48E+11	-1203.	145877.	0.00
50.5950	0.04937	2.19E+07	-153239.	-0.00203	0.00	7.49E+11	-1136.	186231.	0.00
51.2696	0.03388	2.06E+07	-162094.	-0.00180	0.00	7.50E+11	-1052.	251340.	0.00
51.9442	0.02019	1.93E+07	-170156.	-0.00159	0.00	7.50E+11	-940.064	376943.	0.00
52.6188	0.00818	1.79E+07	-177049.	-0.00139	0.00	7.51E+11	-762.829	754461.	0.00
53.2934	-0.00226	1.64E+07	-178313.	-0.00120	0.00	7.52E+11	450.4820	1614577.	0.00
53.9680	-0.01127	1.50E+07	-173725.	-0.00103	0.00	7.53E+11	683.0085	490573.	0.00
54.6426	-0.01898	1.36E+07	-167767.	-8.79E-04	0.00	7.54E+11	789.0413	336587.	0.00
55.3172	-0.02550	1.23E+07	-161087.	-7.40E-04	0.00	7.55E+11	861.3785	273454.	0.00
55.9918	-0.03096	1.10E+07	-153890.	-6.15E-04	0.00	7.55E+11	916.5983	239699.	0.00
56.6664	-0.03546	9794348.	-146290.	-5.04E-04	0.00	7.56E+11	961.1057	219436.	0.00
57.3410	-0.03911	8641592.	-138360.	-4.05E-04	0.00	7.57E+11	998.1372	206613.	0.00
58.0156	-0.04201	7554245.	-130153.	-3.18E-04	0.00	7.57E+11	1030.	198396.	0.00
58.6902	-0.04426	6534370.	-121708.	-2.43E-04	0.00	7.58E+11	1057.	193273.	0.00
59.3648	-0.04594	5583744.	-113058.	-1.78E-04	0.00	7.58E+11	1080.	190355.	0.00
60.0394	-0.04715	4703916.	-104228.	-1.23E-04	0.00	7.59E+11	1101.	189078.	0.00
60.7140	-0.04794	3896250.	-95239.	-7.75E-05	0.00	7.59E+11	1120.	189063.	0.00
61.3886	-0.04840	3161958.	-86108.	-3.99E-05	0.00	7.59E+11	1136.	190044.	0.00
62.0632	-0.04859	2502127.	-76849.	-9.65E-06	0.00	7.59E+11	1151.	191818.	0.00
62.7378	-0.04856	1917740.	-67474.	1.39E-05	0.00	7.59E+11	1165.	194228.	0.00
63.4124	-0.04836	1409699.	-57991.	3.17E-05	0.00	7.59E+11	1178.	197144.	0.00
64.0870	-0.04804	978839.	-48409.	4.44E-05	0.00	7.59E+11	1190.	200459.	0.00
64.7616	-0.04764	625942.	-38732.	5.29E-05	0.00	7.59E+11	1201.	204080.	0.00
65.4362	-0.04719	351754.	-29015.	5.82E-05	0.00	7.59E+11	1199.	205780.	0.00
66.1108	-0.04670	156170.	-19318.	6.09E-05	0.00	7.59E+11	1196.	207385.	0.00

```
   66.7854   -0.04620     38989.     -9646.   6.19E-05       0.00   7.59E+11      1193.    209064.       0.00
   67.4600   -0.04570       0.00       0.00   6.21E-05       0.00   7.59E+11      1190.    105394.       0.00

* This analysis computed pile response using nonlinear moment-curvature rela-
  tionships. Values of total stress due to combined axial and bending stresses
  are computed only for elastic sections only and do not equal the actual
  stresses in concrete and steel. Stresses in concrete and steel may be inter-
  polated from the output for nonlinear bending properties relative to the
  magnitude of bending moment developed in the pile.


Output Summary for Load Case No. 2:

Pile-head deflection             =     6.29344535 inches
Computed slope at pile head      =     -0.0137566 radians
Maximum bending moment           =      30650283. inch-lbs
Maximum shear force              =       -178313. lbs
Depth of maximum bending moment  =    41.82520000 feet below pile head
Depth of maximum shear force     =    53.29340000 feet below pile head
Number of iterations             =             42
Number of zero deflection points =              1
Pile deflection at ground        =     2.02584189 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs


    Pile       Pile Head       Maximum       Maximum
   Length      Deflection      Moment         Shear
    feet         inches        ln-lbs          lbs
------------  ------------  ------------  ------------
   67.46000    6.29344535     30650283.      -178313.
   64.08700    6.95142478     30089120.      -193945.
   60.71400    9.79238231     29253391.      -213369.
   57.34100   18.55398991     28158911.      -234797.
   53.96800   46.31174957     27017055.      -255817.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
```

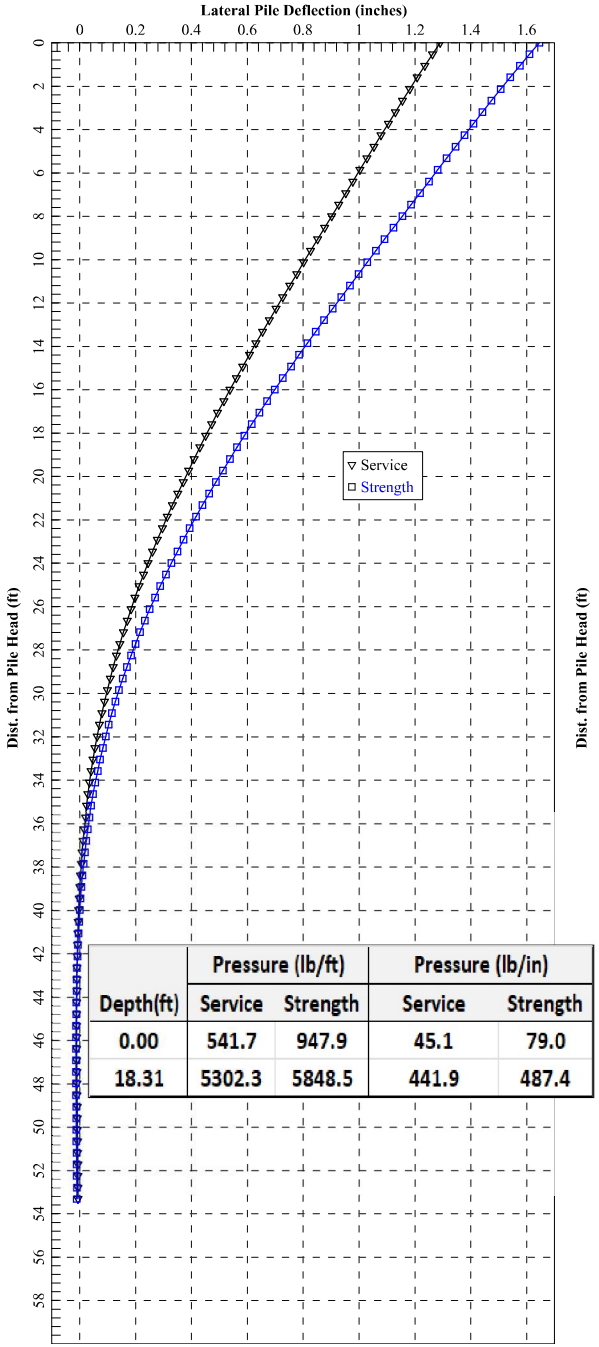
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

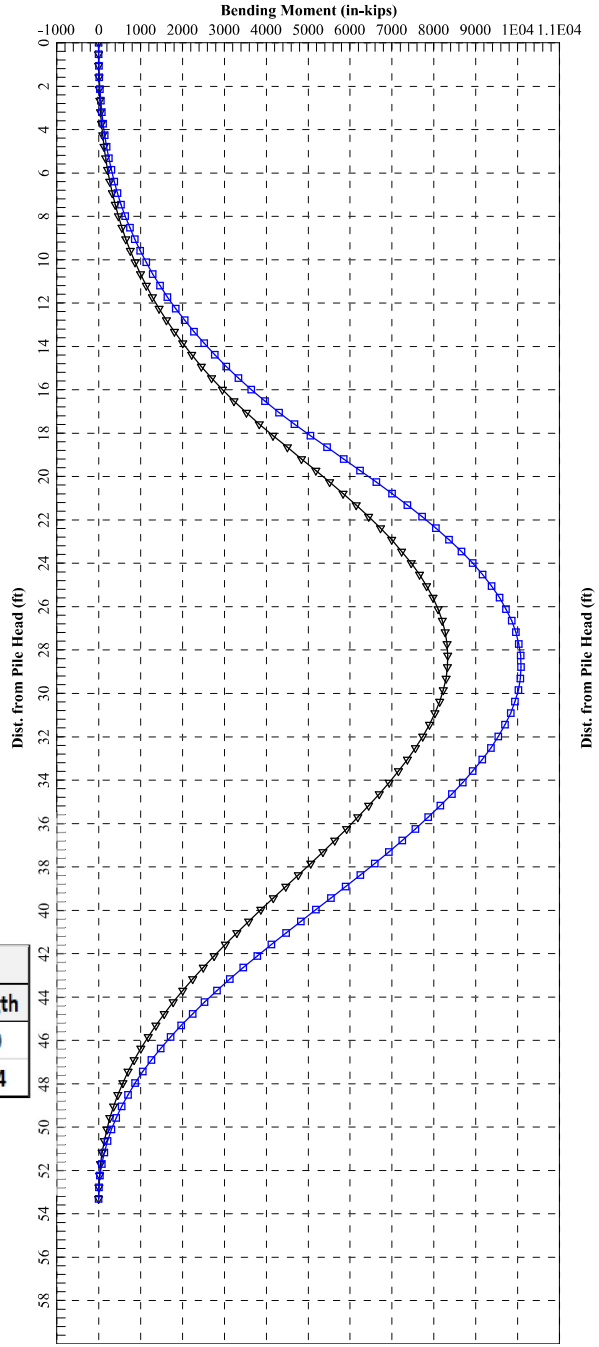
Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	3.2403	-0.00748	-120828.	1.86E+07
2	V, lb	0.00	M, in-lb	0.00	0.00	6.2934	-0.01376	-178313.	3.07E+07

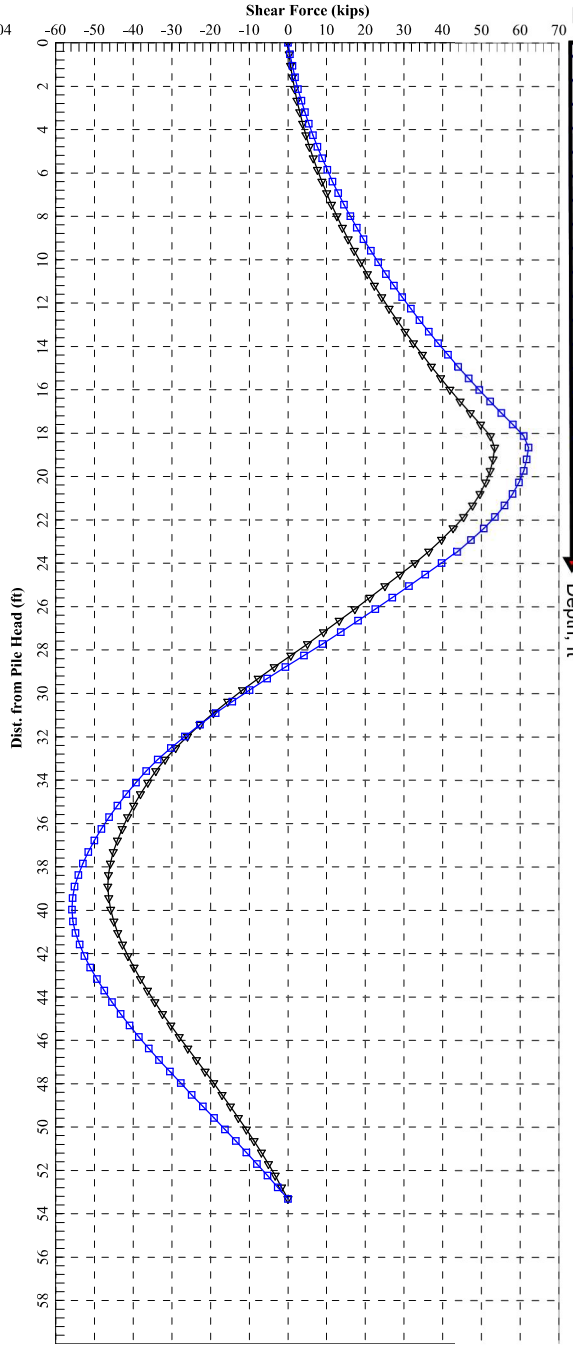
Maximum pile-head deflection = 6.2934453476 inches
Maximum pile-head rotation = -0.0137566454 radians = -0.788198 deg.

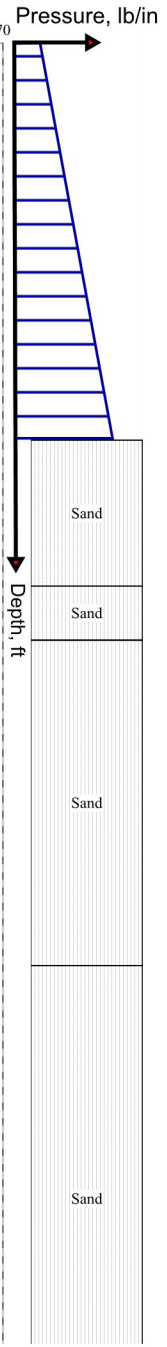
The analysis ended normally.

Wall 5C (18.31ft)









Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	541.7	947.9	45.1	79.0
18.31	5302.3	5848.5	441.9	487.4

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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App F LPile 04-05- 2026\Wall 5C\

Name of input data file:
Wall_5C-18.31ft.lp12d

Name of output report file:
Wall_5C-18.31ft.lp12o

Name of plot output file:
Wall_5C-18.31ft.lp12p

Name of runtime message file:
Wall_5C-18.31ft.lp12r

Date and Time of Analysis

Date: June 9, 2026 Time: 22:17:47

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Izzaldin Almohd, PhD, P.E
Description: LPILE FOR SOLDIER PILE WALL 5C (H=18.3FT) Boring B-006-0-12

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 3
Total length of pile = 53.310 ft
Depth of ground surface below top of pile = 18.3100 ft

Pile diameters used for p-y curve computations are defined using 6 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	5.6630
2	3.000	5.6630
3	3.000	12.1000
4	18.310	12.1000
5	18.310	48.0000
6	53.310	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional Shape = General Section
Length of section = 3.000000 ft
Width of top of section = 5.663000 in
Width of bottom of section = 5.663000 in
Top Area = 21.519000 sq. in
Bottom Area = 21.519000 sq. in
Moment of Inertia at Top = 50.483751 in^4
Moment of Inertia at Bottom = 50.483751 in^4
Elastic Modulus = 29000000. psi

Pile Section No. 2:

Section 2 is a AISC strong axis steel pile
Length of section = 15.310000 ft
AISC Section Type = W
AISC Section Name = W36X194
Pile width = 12.100000 in

Pile Section No. 3:

Section 3 is a drilled shaft with casing and AISC section core/insert
Length of section = 35.000000 ft
Section Diameter = 48.000000 in
Core/Insert AISC Section Type = W
Core/Insert AISC Section Name = W36X194

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

```
   Distance from top of pile to top of layer           =    18.310000 ft
   Distance from top of pile to bottom of layer        =    25.040000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    34.000000 deg.
   Friction angle at bottom of layer                   =    34.000000 deg.
   Subgrade k at top of layer                          =   120.000000 pci
   Subgrade k at bottom of layer                       =   120.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    25.040000 ft
   Distance from top of pile to bottom of layer        =    27.540000 ft
   Effective unit weight at top of layer               =    57.600000 pcf
   Effective unit weight at bottom of layer            =    57.600000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =    90.000000 pci
   Subgrade k at bottom of layer                       =    90.000000 pci


Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    27.540000 ft
   Distance from top of pile to bottom of layer        =    42.540000 ft
   Effective unit weight at top of layer               =    62.600000 pcf
   Effective unit weight at bottom of layer            =    62.600000 pcf
   Friction angle at top of layer                      =    33.000000 deg.
   Friction angle at bottom of layer                   =    33.000000 deg.
   Subgrade k at top of layer                          =   120.000000 pci
   Subgrade k at bottom of layer                       =   120.000000 pci


Layer 4 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    42.540000 ft
   Distance from top of pile to bottom of layer        =    64.040000 ft
   Effective unit weight at top of layer               =    67.600000 pcf
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Friction angle at top of layer                      =    34.000000 deg.
   Friction angle at bottom of layer                   =    34.000000 deg.
   Subgrade k at top of layer                          =   120.000000 pci
   Subgrade k at bottom of layer                       =   120.000000 pci


 (Depth of the lowest soil layer extends 10.730 ft below the pile tip)


--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
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Layer         Soil Type          Layer      Effective    Angle of
 Num.          Name              Depth       Unit Wt.    Friction        kpy
         (p-y Curve Type)          ft          pcf          deg.         pci
-----   -------------------   ----------   ----------   ----------   ----------
```

1	Sand	18.3100	62.6000	34.0000	120.0000
	(Reese, et al.)	25.0400	62.6000	34.0000	120.0000
2	Sand	25.0400	57.6000	32.0000	90.0000
	(Reese, et al.)	27.5400	57.6000	32.0000	90.0000
3	Sand	27.5400	62.6000	33.0000	120.0000
	(Reese, et al.)	42.5400	62.6000	33.0000	120.0000
4	Sand	42.5400	67.6000	34.0000	120.0000
	(Reese, et al.)	64.0400	67.6000	34.0000	120.0000

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	18.310	0.7550	1.0000
2	55.000	0.7550	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	45.100
2	18.310	441.900

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	79.000
2	18.310	487.400

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1		Condition 2		Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V =	0.0000 lbs	M =	0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V =	0.0000 lbs	M =	0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 3

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 2:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	15.310000 ft
Flange Width	=	12.100000 in
Section Depth	=	36.500000 in
Flange Thickness	=	1.260000 in
Web Thickness	=	0.765000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	57.000000 sq. in.
Moment of Inertia	=	12100. in^4
Elastic Bending Stiffness	=	350900000. kip-in^2
Plastic Modulus, Z	=	767.000000in^3
Plastic Moment Capacity = Fy Z	=	38350.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As = 2850.000 kips
Nominal Axial Tensile Capacity = -2850.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000606	2100.	346799304.	18.2500000	3.1730114	
0.00001211	4200.	346799304.	18.2500000	6.3460228	
0.00001817	6301.	346799304.	18.2500000	9.5190341	
0.00002422	8401.	346799304.	18.2500000	12.6920455	
0.00003028	10501.	346799304.	18.2500000	15.8650569	
0.00003634	12601.	346799304.	18.2500000	19.0380683	
0.00004239	14701.	346799304.	18.2500000	22.2110797	
0.00004845	16801.	346799304.	18.2500000	25.3840910	
0.00005450	18902.	346799304.	18.2500000	28.5571024	
0.00006056	21002.	346799304.	18.2500000	31.7301138	
0.00006661	23102.	346799304.	18.2500000	34.9031252	
0.00007267	25202.	346799304.	18.2500000	38.0761366	
0.00007873	27302.	346799304.	18.2500000	41.2491480	
0.00008478	29402.	346799304.	18.2500000	44.4221593	
0.00009084	31503.	346799304.	18.2500000	47.5951707	
0.00009689	33480.	345534059.	18.2500000	50.0000000	Y
0.0001029	34309.	333261776.	18.2500000	50.0000000	Y
0.0001090	34696.	318295760.	18.2500000	50.0000000	Y
0.0001151	35022.	304379850.	18.2500000	50.0000000	Y
0.0001211	35301.	291465325.	18.2500000	50.0000000	Y
0.0001272	35542.	279475707.	18.2500000	50.0000000	Y
0.0001332	35751.	268342145.	18.2500000	50.0000000	Y
0.0001393	35932.	257971857.	18.2500000	50.0000000	Y
0.0001453	36092.	248328346.	18.2500000	50.0000000	Y
0.0001514	36232.	239317345.	18.2500000	50.0000000	Y
0.0001575	36356.	230903815.	18.2500000	50.0000000	Y
0.0001635	36468.	223031958.	18.2500000	50.0000000	Y
0.0001696	36567.	215653295.	18.2500000	50.0000000	Y
0.0001756	36656.	208725435.	18.2500000	50.0000000	Y
0.0001817	36737.	202211065.	18.2500000	50.0000000	Y
0.0001877	36810.	196077131.	18.2500000	50.0000000	Y
0.0001938	36877.	190294169.	18.2500000	50.0000000	Y
0.0001998	36937.	184828825.	18.2500000	50.0000000	Y
0.0002059	36991.	179656663.	18.2500000	50.0000000	Y

0.0002120	37042.	174763129.	18.2500000	50.0000000	Y
0.0002180	37088.	170121210.	18.2500000	50.0000000	Y
0.0002241	37130.	165710793.	18.2500000	50.0000000	Y
0.0002301	37171.	161525158.	18.2500000	50.0000000	Y
0.0002362	37206.	157532075.	18.2500000	50.0000000	Y
0.0002483	37270.	150108076.	18.2500000	50.0000000	Y
0.0002604	37326.	143341213.	18.2500000	50.0000000	Y
0.0002725	37375.	137150485.	18.2500000	50.0000000	Y
0.0002846	37418.	131464521.	18.2500000	50.0000000	Y
0.0002967	37455.	126222024.	18.2500000	50.0000000	Y
0.0003088	37488.	121380676.	18.2500000	50.0000000	Y
0.0003210	37518.	116891767.	18.2500000	50.0000000	Y
0.0003331	37544.	112719379.	18.2500000	50.0000000	Y
0.0003452	37568.	108833469.	18.2500000	50.0000000	Y
0.0003573	37589.	105202873.	18.2500000	50.0000000	Y
0.0003694	37608.	101805327.	18.2500000	50.0000000	Y
0.0003815	37626.	98620295.	18.2500000	50.0000000	Y
0.0003936	37641.	95623997.	18.2500000	50.0000000	Y
0.0004057	37656.	92806583.	18.2500000	50.0000000	Y
0.0004179	37669.	90147648.	18.2500000	50.0000000	Y
0.0004300	37680.	87635187.	18.2500000	50.0000000	Y
0.0004421	37692.	85260394.	18.2500000	50.0000000	Y
0.0004542	37702.	83009997.	18.2500000	50.0000000	Y
0.0004663	37711.	80872527.	18.2500000	50.0000000	Y
0.0004784	37720.	78843283.	18.2500000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	37720.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section = 35.000000 ft

Outside Diameter of Casing	=	48.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	12.100000 in
Depth of Core/Insert	=	36.500000 in
Flange Thickness of Core/Insert	=	1.260000 in
Web Thickness of Core/Insert	=	0.765000 in
Moment of Inertia of Steel Core/Insert	=	12100. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1810. sq. in.
Area of Concrete	=	1753. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	57.000000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	56.486700 sq. in.
Area Ratio of All Steel to Gross Area	=	3.12 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	10298.369 kips
Tensile Load for Cracking of Concrete	=	-1002.214 kips
Nominal Axial Tensile Capacity	=	-2850.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000606	3602.	594793601.	15.3787837	0.00009313	-0.000198	0.4252689	0.00000	0.00000	-4.759511	C
0.00001211	7180.	592840449.	15.4270300	0.0001868	-0.000395	0.8341693	0.00000	0.00000	-9.502076	C
0.00001817	10734.	590850352.	15.4763418	0.0002812	-0.000591	1.2264175	0.00000	0.00000	-14.227134	C
0.00002422	14263.	588821741.	15.5267679	0.0003761	-0.000787	1.6017154	0.00000	0.00000	-18.934089	C
0.00003028	17766.	586752939.	15.5783609	0.0004717	-0.000982	1.9597502	0.00000	0.00000	-23.622307	C
0.00003634	21243.	584643228.	15.6303401	0.0005679	-0.001176	2.3000866	0.00000	0.00000	-28.291997	C
0.00004239	24692.	582491367.	15.6829609	0.0006648	-0.001370	2.6223745	0.00000	0.00000	-32.942641	C
0.00004845	28113.	580294896.	15.7368581	0.0007624	-0.001563	2.9263208	0.00000	0.00000	-37.573009	C

0.00005450	31505.	578051714.	15.7920968	0.0008607	-0.001755	3.2115477	0.00000	0.00000	-42.182326 C
0.00006056	34867.	575759559.	15.8487475	0.0009598	-0.001947	3.4776561	0.00000	0.00000	-46.769761 C
0.00006661	38130.	572400167.	15.8955357	0.0010589	-0.002139	3.7224111	0.00000	0.00000	-50.000000 CY
0.00007267	39684.	546076524.	15.6790518	0.0011394	-0.002349	3.9049186	0.00000	0.00000	-50.000000 CY
0.00007873	40800.	518250552.	15.4308917	0.0012148	-0.002564	4.0628945	0.00000	0.00000	-50.000000 CY
0.00008478	41741.	492335572.	15.1930806	0.0012881	-0.002781	4.2045512	0.00000	0.00000	-50.000000 CY
0.00009084	42544.	468354784.	14.9641416	0.0013593	-0.003001	4.3310133	0.00000	0.00000	-50.000000 CY
0.00009689	43238.	446238706.	14.7472380	0.0014289	-0.003222	4.4439966	0.00000	0.00000	-50.000000 CY
0.0001029	43842.	425857987.	14.5410435	0.0014970	-0.003445	4.5443572	0.00000	0.00000	-50.000000 CY
0.0001090	44372.	407059704.	14.3447105	0.0015637	-0.003669	4.6329117	0.00000	0.00000	-50.000000 CY
0.0001151	44843.	389735800.	14.1617826	0.0016295	-0.003893	4.7109551	0.00000	0.00000	-50.000000 CY
0.0001211	45259.	373679510.	13.9838106	0.0016937	-0.004120	4.7780718	0.00000	0.00000	-50.000000 CY
0.0001272	45633.	358824831.	13.8176165	0.0017572	-0.004347	4.8357695	0.00000	0.00000	-50.000000 CY
0.0001332	45972.	345059289.	13.6619081	0.0018202	-0.004575	4.8843541	0.00000	0.00000	-50.000000 CY
0.0001393	46272.	332214972.	13.5099032	0.0018817	-0.004804	4.9236395	0.00000	0.00000	-50.000000 CY
0.0001453	46549.	320272444.	13.3680592	0.0019429	-0.005033	4.9546365	0.00000	0.00000	-50.000000 CY
0.0001514	46800.	309122407.	13.2348670	0.0020037	-0.005263	4.9774782	0.00000	0.00000	-50.000000 CY
0.0001575	47027.	298673215.	13.1054577	0.0020635	-0.005494	4.9922142	0.00000	0.00000	-50.000000 CY
0.0001635	47234.	288879039.	12.9823359	0.0021227	-0.005726	4.9992724	0.00000	0.00000	-50.000000 CY
0.0001696	47425.	279687879.	12.8667734	0.0021817	-0.005957	4.9972721	0.00000	0.00000	-50.000000 CY
0.0001756	47601.	271047583.	12.7581960	0.0022406	-0.006189	4.9976800	0.00000	0.00000	-50.000000 CY
0.0001817	47761.	262889820.	12.6527333	0.0022987	-0.006422	4.9991040	0.00000	0.00000	-50.000000 CY
0.0001877	47906.	255186117.	12.5514134	0.0023563	-0.006655	4.9948004	0.00000	0.00000	-50.000000 CY
0.0001938	48042.	247911869.	12.4559930	0.0024138	-0.006888	4.9995200	0.00000	0.00000	-50.000000 CY
0.0001998	48166.	241020840.	12.3654572	0.0024712	-0.007121	4.9945817	0.00000	0.00000	-50.000000 CY
0.0002059	48283.	234497227.	12.2799593	0.0025284	-0.007355	4.9992847	0.00000	0.00000	-50.000000 CY
0.0002120	48390.	228304599.	12.1968256	0.0025852	-0.007589	4.9921995	0.00000	0.00000	-50.000000 CY
0.0002180	48487.	222408240.	12.1153836	0.0026413	-0.007823	4.9979040	0.00000	0.00000	-50.000000 CY
0.0002241	48579.	216804497.	12.0377438	0.0026973	-0.008058	4.9999885	0.00000	0.00000	-50.000000 CY
0.0002301	48665.	211475359.	11.9646616	0.0027533	-0.008293	4.9939169	0.00000	0.00000	-50.000000 CY
0.0002362	48745.	206388982.	11.8941876	0.0028092	-0.008527	4.9984906	0.00000	0.00000	-50.000000 CY
0.0002483	48893.	196917042.	11.7636567	0.0029208	-0.008997	4.9924482	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 3

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	48893.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	18.3100	0.00	N.A.	No	0.00	69878.
2	25.0400	7.1847	Yes	No	69878.	56768.
3	27.5400	9.4245	Yes	No	126646.	819341.
4	42.5400	23.6291	Yes	No	945987.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.2908	-7.94E-09	0.00	-0.00427	4.46E-10	1.46E+09	0.00	0.00	47.9882
0.5331	1.2634	981.9392	334.7052	-0.00427	55.0744	1.46E+09	0.00	0.00	56.6529
1.0662	1.2361	4282.	734.0785	-0.00426	240.1858	1.46E+09	0.00	0.00	68.2059
1.5993	1.2090	10374.	1207.	-0.00423	581.8521	1.46E+09	0.00	0.00	79.7588
2.1324	1.1821	19730.	1755.	-0.00416	1107.	1.46E+09	0.00	0.00	91.3117
2.6655	1.1557	32822.	2376.	-0.00405	1841.	1.46E+09	0.00	0.00	102.8646
3.1986	1.1303	50125.	3071.	-0.00397	25.0623	3.47E+11	0.00	0.00	114.4176
3.7317	1.1049	72109.	3840.	-0.00397	36.0547	3.47E+11	0.00	0.00	125.9705
4.2648	1.0794	99249.	4682.	-0.00397	49.6246	3.47E+11	0.00	0.00	137.5234
4.7979	1.0540	132017.	5599.	-0.00397	66.0086	3.47E+11	0.00	0.00	149.0763
5.3310	1.0287	170886.	6590.	-0.00397	85.4430	3.47E+11	0.00	0.00	160.6293
5.8641	1.0033	216328.	7654.	-0.00396	108.1642	3.47E+11	0.00	0.00	172.1822
6.3972	0.9780	268817.	8793.	-0.00396	134.4086	3.47E+11	0.00	0.00	183.7351
6.9303	0.9526	328825.	10005.	-0.00395	164.4126	3.47E+11	0.00	0.00	195.2880
7.4634	0.9274	396825.	11291.	-0.00395	198.4126	3.47E+11	0.00	0.00	206.8410
7.9965	0.9022	473290.	12651.	-0.00394	236.6450	3.47E+11	0.00	0.00	218.3939
8.5296	0.8770	558692.	14085.	-0.00393	279.3462	3.47E+11	0.00	0.00	229.9468
9.0627	0.8519	653505.	15593.	-0.00392	326.7526	3.47E+11	0.00	0.00	241.4997

9.5958	0.8269	758201.	17175.	-0.00390	379.1006	3.47E+11	0.00	0.00	253.0527
10.1289	0.8019	873253.	18831.	-0.00389	436.6266	3.47E+11	0.00	0.00	264.6056
10.6620	0.7771	999134.	20561.	-0.00387	499.5669	3.47E+11	0.00	0.00	276.1585
11.1951	0.7524	1136316.	22364.	-0.00385	568.1581	3.47E+11	0.00	0.00	287.7115
11.7282	0.7278	1285273.	24242.	-0.00383	642.6364	3.47E+11	0.00	0.00	299.2644
12.2613	0.7034	1446476.	26193.	-0.00381	723.2382	3.47E+11	0.00	0.00	310.8173
12.7944	0.6791	1620400.	28219.	-0.00378	810.2001	3.47E+11	0.00	0.00	322.3702
13.3275	0.6550	1807517.	30318.	-0.00375	903.7583	3.47E+11	0.00	0.00	333.9232
13.8606	0.6312	2008299.	32491.	-0.00371	1004.	3.47E+11	0.00	0.00	345.4761
14.3937	0.6076	2223219.	34738.	-0.00367	1112.	3.47E+11	0.00	0.00	357.0290
14.9268	0.5842	2452750.	37059.	-0.00363	1226.	3.47E+11	0.00	0.00	368.5819
15.4599	0.5612	2697366.	39454.	-0.00358	1349.	3.47E+11	0.00	0.00	380.1349
15.9930	0.5384	2957538.	41923.	-0.00353	1479.	3.47E+11	0.00	0.00	391.6878
16.5261	0.5160	3233739.	44465.	-0.00347	1617.	3.47E+11	0.00	0.00	403.2407
17.0592	0.4940	3526443.	47082.	-0.00341	1763.	3.47E+11	0.00	0.00	414.7936
17.5923	0.4724	3836122.	49772.	-0.00334	1918.	3.47E+11	0.00	0.00	426.3466
18.1254	0.4513	4163248.	52319.	-0.00327	2082.	3.47E+11	0.00	0.00	369.8326
18.6585	0.4306	4505510.	53393.	-0.00320	0.00	5.94E+11	-33.998	505.0843	0.00
19.1916	0.4103	4846381.	52998.	-0.00315	0.00	5.94E+11	-89.633	1398.	0.00
19.7247	0.3902	5183583.	52237.	-0.00310	0.00	5.94E+11	-148.104	2428.	0.00
20.2578	0.3706	5514724.	51099.	-0.00304	0.00	5.93E+11	-207.682	3585.	0.00
20.7909	0.3513	5837367.	49576.	-0.00298	0.00	5.93E+11	-268.542	4890.	0.00
21.3240	0.3325	6149019.	47666.	-0.00292	0.00	5.93E+11	-328.673	6324.	0.00
21.8571	0.3140	6447220.	45378.	-0.00285	0.00	5.93E+11	-386.596	7876.	0.00
22.3902	0.2960	6729601.	42730.	-0.00278	0.00	5.93E+11	-441.340	9538.	0.00
22.9233	0.2785	6993920.	39739.	-0.00270	0.00	5.93E+11	-493.534	11338.	0.00
23.4564	0.2614	7238041.	36431.	-0.00263	0.00	5.93E+11	-540.727	13232.	0.00
23.9895	0.2449	7460034.	32840.	-0.00255	0.00	5.93E+11	-581.930	15204.	0.00
24.5226	0.2288	7658212.	28999.	-0.00247	0.00	5.92E+11	-618.834	17301.	0.00
25.0557	0.2133	7831064.	25110.	-0.00238	0.00	5.92E+11	-597.056	17906.	0.00
25.5888	0.1983	7979483.	21244.	-0.00230	0.00	5.92E+11	-611.553	19725.	0.00
26.1219	0.1839	8102874.	17296.	-0.00221	0.00	5.92E+11	-622.985	21669.	0.00
26.6550	0.1701	8200770.	13282.	-0.00212	0.00	5.92E+11	-631.939	23771.	0.00
27.1881	0.1568	8272804.	9230.	-0.00203	0.00	5.92E+11	-634.841	25905.	0.00
27.7212	0.1441	8318858.	5045.	-0.00194	0.00	5.92E+11	-673.440	29906.	0.00
28.2543	0.1319	8337352.	749.4216	-0.00185	0.00	5.92E+11	-669.524	32469.	0.00
28.7874	0.1203	8328447.	-3501.	-0.00176	0.00	5.92E+11	-659.164	35039.	0.00
29.3205	0.1094	8292565.	-7659.	-0.00167	0.00	5.92E+11	-641.015	37500.	0.00
29.8536	0.09893	8230451.	-11677.	-0.00158	0.00	5.92E+11	-615.112	39774.	0.00
30.3867	0.08908	8143163.	-15527.	-0.00150	0.00	5.92E+11	-588.557	42265.	0.00
30.9198	0.07980	8031790.	-19208.	-0.00141	0.00	5.92E+11	-562.095	45062.	0.00
31.4529	0.07107	7897413.	-22700.	-0.00132	0.00	5.92E+11	-529.634	47677.	0.00
31.9860	0.06288	7741361.	-25966.	-0.00124	0.00	5.92E+11	-491.687	50024.	0.00
32.5191	0.05523	7565188.	-28975.	-0.00116	0.00	5.93E+11	-448.946	52003.	0.00
33.0522	0.04810	7370641.	-31698.	-0.00107	0.00	5.93E+11	-402.292	53506.	0.00
33.5853	0.04148	7159632.	-34113.	-9.96E-04	0.00	5.93E+11	-352.791	54411.	0.00
34.1184	0.03535	6934184.	-36207.	-9.20E-04	0.00	5.93E+11	-301.866	54624.	0.00
34.6515	0.02971	6696383.	-38076.	-8.47E-04	0.00	5.93E+11	-282.261	60786.	0.00
35.1846	0.02452	6447031.	-39810.	-7.76E-04	0.00	5.93E+11	-260.153	67872.	0.00
35.7177	0.01978	6187032.	-41396.	-7.08E-04	0.00	5.93E+11	-235.561	76184.	0.00
36.2508	0.01547	5917393.	-42816.	-6.42E-04	0.00	5.93E+11	-208.459	86220.	0.00
36.7839	0.01156	5639223.	-44055.	-5.80E-04	0.00	5.93E+11	-178.712	98883.	0.00
37.3170	0.00805	5353739.	-45093.	-5.21E-04	0.00	5.94E+11	-145.951	116049.	0.00
37.8501	0.00490	5062282.	-45893.	-4.65E-04	0.00	5.94E+11	-104.064	135902.	0.00
38.3832	0.00210	4766567.	-46372.	-4.12E-04	0.00	5.94E+11	-45.840	139610.	0.00
38.9163	-3.69E-04	4468975.	-46493.	-3.62E-04	0.00	5.94E+11	8.2690	143318.	0.00
39.4494	-0.00253	4171722.	-46280.	-3.15E-04	0.00	5.94E+11	58.1645	147025.	0.00
39.9825	-0.00441	3876850.	-45762.	-2.72E-04	0.00	5.95E+11	103.7965	150733.	0.00

40.5156	-0.00601	3586225.	-44966.	-2.32E-04	0.00	5.95E+11	145.1585	154441.	0.00
41.0487	-0.00737	3301541.	-43925.	-1.95E-04	0.00	5.95E+11	180.1089	156261.	0.00
41.5818	-0.00851	3024227.	-42694.	-1.61E-04	0.00	5.95E+11	204.9204	154096.	0.00
42.1149	-0.00943	2755300.	-41311.	-1.30E-04	0.00	5.95E+11	227.3849	154212.	0.00
42.6480	-0.01017	2495678.	-39774.	-1.02E-04	0.00	5.95E+11	253.1989	159290.	0.00
43.1811	-0.01073	2246418.	-38091.	-7.61E-05	0.00	5.95E+11	273.0441	162744.	0.00
43.7142	-0.01114	2008332.	-36286.	-5.32E-05	0.00	5.95E+11	291.2349	167204.	0.00
44.2473	-0.01141	1782165.	-34369.	-3.29E-05	0.00	5.95E+11	307.8535	172541.	0.00
44.7804	-0.01156	1568597.	-32352.	-1.48E-05	0.00	5.95E+11	322.9608	178677.	0.00
45.3135	-0.01160	1368245.	-30242.	9.54E-07	0.00	5.95E+11	336.6060	185569.	0.00
45.8466	-0.01155	1181669.	-28059.	1.47E-05	0.00	5.95E+11	345.8052	191518.	0.00
46.3797	-0.01142	1009244.	-25839.	2.64E-05	0.00	5.95E+11	348.3960	195226.	0.00
46.9128	-0.01121	851077.	-23609.	3.65E-05	0.00	5.95E+11	348.6716	198933.	0.00
47.4459	-0.01095	707180.	-21384.	4.48E-05	0.00	5.95E+11	346.8559	202641.	0.00
47.9790	-0.01064	577477.	-19177.	5.17E-05	0.00	5.95E+11	343.1664	206349.	0.00
48.5121	-0.01029	461818.	-16999.	5.73E-05	0.00	5.95E+11	337.8117	210057.	0.00
49.0452	-0.00991	359983.	-14860.	6.17E-05	0.00	5.95E+11	330.9884	213764.	0.00
49.5783	-0.00950	271694.	-12768.	6.51E-05	0.00	5.95E+11	322.8797	217472.	0.00
50.1114	-0.00907	196619.	-10732.	6.77E-05	0.00	5.95E+11	313.6523	221180.	0.00
50.6445	-0.00863	134380.	-8759.	6.94E-05	0.00	5.95E+11	303.4555	224888.	0.00
51.1776	-0.00818	84559.	-6853.	7.06E-05	0.00	5.95E+11	292.4186	228595.	0.00
51.7107	-0.00773	46705.	-5020.	7.13E-05	0.00	5.95E+11	280.6502	232303.	0.00
52.2438	-0.00727	20337.	-3264.	7.17E-05	0.00	5.95E+11	268.2362	236011.	0.00
52.7769	-0.00681	4946.	-1589.	7.18E-05	0.00	5.95E+11	255.2389	239719.	0.00
53.3100	-0.00635	0.00	0.00	7.19E-05	0.00	5.95E+11	241.6963	121713.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	1.29077928	inches
Computed slope at pile head	=	-0.0042728	radians
Maximum bending moment	=	8337352.	inch-lbs
Maximum shear force	=	53393.	lbs
Depth of maximum bending moment	=	28.25430000	feet below pile head
Depth of maximum shear force	=	18.65850000	feet below pile head
Number of iterations	=	18	
Number of zero deflection points	=	1	
Pile deflection at ground	=	0.44410539	inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear	=	0.	lbs
Moment	=	0.	in-lbs
Axial Load	=	0.	lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
53.31000	1.29077928	8337352.	53393.
50.64450	1.30022790	8318878.	53373.
47.97900	1.36631704	8248734.	-53587.
45.31350	1.55157326	8112299.	-60221.
42.64800	2.05788955	7889139.	-67785.
39.98250	3.30394544	7590895.	-76214.
37.31700	6.43921928	7235898.	-85066.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	1.6459	7.94E-08	0.00	-0.00546	4.46E-09	1.46E+09	0.00	0.00	81.9727
0.5331	1.6110	1677.	552.9206	-0.00546	94.0771	1.46E+09	0.00	0.00	90.8907
1.0662	1.5761	7074.	1172.	-0.00544	396.7781	1.46E+09	0.00	0.00	102.7813
1.5993	1.5414	16677.	1868.	-0.00539	935.3960	1.46E+09	0.00	0.00	114.6720
2.1324	1.5071	30974.	2640.	-0.00528	1737.	1.46E+09	0.00	0.00	126.5627
2.6655	1.4738	50449.	3487.	-0.00511	2830.	1.46E+09	0.00	0.00	138.4533
3.1986	1.4418	75591.	4411.	-0.00499	37.7953	3.47E+11	0.00	0.00	150.3440
3.7317	1.4099	106885.	5411.	-0.00499	53.4425	3.47E+11	0.00	0.00	162.2346
4.2648	1.3779	144819.	6487.	-0.00499	72.4093	3.47E+11	0.00	0.00	174.1253
4.7979	1.3460	189878.	7639.	-0.00499	94.9391	3.47E+11	0.00	0.00	186.0160
5.3310	1.3141	242550.	8867.	-0.00498	121.2751	3.47E+11	0.00	0.00	197.9066
5.8641	1.2823	303322.	10171.	-0.00498	151.6608	3.47E+11	0.00	0.00	209.7973
6.3972	1.2504	372679.	11551.	-0.00497	186.3393	3.47E+11	0.00	0.00	221.6880
6.9303	1.2187	451108.	13007.	-0.00496	225.5540	3.47E+11	0.00	0.00	233.5786
7.4634	1.1869	539097.	14539.	-0.00496	269.5483	3.47E+11	0.00	0.00	245.4693
7.9965	1.1552	637131.	16148.	-0.00494	318.5653	3.47E+11	0.00	0.00	257.3599
8.5296	1.1237	745697.	17832.	-0.00493	372.8485	3.47E+11	0.00	0.00	269.2506
9.0627	1.0921	865282.	19593.	-0.00492	432.6411	3.47E+11	0.00	0.00	281.1413
9.5958	1.0607	996373.	21429.	-0.00490	498.1864	3.47E+11	0.00	0.00	293.0319
10.1289	1.0295	1139456.	23342.	-0.00488	569.7278	3.47E+11	0.00	0.00	304.9226
10.6620	0.9983	1295017.	25330.	-0.00486	647.5085	3.47E+11	0.00	0.00	316.8133
11.1951	0.9673	1463544.	27395.	-0.00483	731.7719	3.47E+11	0.00	0.00	328.7039
11.7282	0.9365	1645522.	29536.	-0.00480	822.7612	3.47E+11	0.00	0.00	340.5946
12.2613	0.9058	1841440.	31753.	-0.00477	920.7199	3.47E+11	0.00	0.00	352.4852
12.7944	0.8754	2051782.	34046.	-0.00474	1026.	3.47E+11	0.00	0.00	364.3759
13.3275	0.8453	2277036.	36415.	-0.00470	1139.	3.47E+11	0.00	0.00	376.2666
13.8606	0.8154	2517689.	38860.	-0.00465	1259.	3.47E+11	0.00	0.00	388.1572
14.3937	0.7857	2774227.	41381.	-0.00460	1387.	3.47E+11	0.00	0.00	400.0479
14.9268	0.7565	3047136.	43978.	-0.00455	1524.	3.47E+11	0.00	0.00	411.9386

15.4599	0.7275	3336903.	46652.	-0.00449	1668.	3.47E+11	0.00	0.00	423.8292
15.9930	0.6990	3644016.	49401.	-0.00443	1822.	3.47E+11	0.00	0.00	435.7199
16.5261	0.6709	3968959.	52226.	-0.00436	1984.	3.47E+11	0.00	0.00	447.6106
17.0592	0.6433	4312221.	55128.	-0.00428	2156.	3.47E+11	0.00	0.00	459.5012
17.5923	0.6162	4674288.	58105.	-0.00420	2337.	3.47E+11	0.00	0.00	471.3919
18.1254	0.5896	5055646.	60919.	-0.00411	2528.	3.47E+11	0.00	0.00	408.2172
18.6585	0.5636	5453710.	62108.	-0.00403	0.00	5.93E+11	-36.482	414.0643	0.00
19.1916	0.5380	5850281.	61683.	-0.00397	0.00	5.93E+11	-96.402	1146.	0.00
19.7247	0.5129	6242906.	60864.	-0.00390	0.00	5.93E+11	-159.687	1992.	0.00
20.2578	0.4881	6628997.	59635.	-0.00383	0.00	5.93E+11	-224.538	2943.	0.00
20.7909	0.4638	7005899.	57987.	-0.00376	0.00	5.93E+11	-290.797	4011.	0.00
21.3240	0.4400	7370900.	55916.	-0.00368	0.00	5.93E+11	-356.466	5183.	0.00
21.8571	0.4167	7721313.	53433.	-0.00360	0.00	5.92E+11	-420.004	6449.	0.00
22.3902	0.3939	8054537.	50553.	-0.00352	0.00	5.92E+11	-480.356	7802.	0.00
22.9233	0.3717	8368104.	47295.	-0.00343	0.00	5.92E+11	-538.098	9262.	0.00
23.4564	0.3500	8659649.	43685.	-0.00334	0.00	5.92E+11	-590.677	10796.	0.00
23.9895	0.3290	8927021.	39758.	-0.00324	0.00	5.92E+11	-637.021	12387.	0.00
24.5226	0.3086	9168324.	35548.	-0.00314	0.00	5.92E+11	-678.999	14078.	0.00
25.0557	0.2888	9381839.	31273.	-0.00304	0.00	5.91E+11	-657.646	14570.	0.00
25.5888	0.2696	9568441.	27008.	-0.00294	0.00	5.91E+11	-675.648	16031.	0.00
26.1219	0.2511	9727393.	22639.	-0.00284	0.00	5.91E+11	-690.313	17584.	0.00
26.6550	0.2333	9858093.	18185.	-0.00273	0.00	5.91E+11	-702.228	19253.	0.00
27.1881	0.2162	9960056.	13675.	-0.00262	0.00	5.91E+11	-707.673	20939.	0.00
27.7212	0.1998	1.00E+07	9004.	-0.00251	0.00	5.91E+11	-752.715	24104.	0.00
28.2543	0.1840	1.01E+07	4192.	-0.00241	0.00	5.91E+11	-751.549	26125.	0.00
28.7874	0.1690	1.01E+07	-593.179	-0.00230	0.00	5.91E+11	-744.586	28187.	0.00
29.3205	0.1546	1.01E+07	-5307.	-0.00219	0.00	5.91E+11	-729.232	30167.	0.00
29.8536	0.1410	1.00E+07	-9896.	-0.00208	0.00	5.91E+11	-705.406	32006.	0.00
30.3867	0.1280	9941051.	-14331.	-0.00197	0.00	5.91E+11	-681.164	34033.	0.00
30.9198	0.1158	9835433.	-18612.	-0.00186	0.00	5.91E+11	-657.273	36318.	0.00
31.4529	0.1042	9702917.	-22719.	-0.00176	0.00	5.91E+11	-626.534	38469.	0.00
31.9860	0.09328	9544760.	-26608.	-0.00165	0.00	5.91E+11	-589.335	40419.	0.00
32.5191	0.08302	9362485.	-30240.	-0.00155	0.00	5.91E+11	-546.251	42090.	0.00
33.0522	0.07342	9157856.	-33580.	-0.00145	0.00	5.92E+11	-498.054	43397.	0.00
33.5853	0.06445	8932844.	-36599.	-0.00135	0.00	5.92E+11	-445.723	44244.	0.00
34.1184	0.05609	8689591.	-39274.	-0.00126	0.00	5.92E+11	-390.656	44552.	0.00
34.6515	0.04834	8430351.	-41713.	-0.00117	0.00	5.92E+11	-371.616	49178.	0.00
35.1846	0.04117	8155903.	-44020.	-0.00108	0.00	5.92E+11	-349.766	54347.	0.00
35.7177	0.03457	7867141.	-46179.	-9.90E-04	0.00	5.92E+11	-325.181	60184.	0.00
36.2508	0.02850	7565071.	-48172.	-9.07E-04	0.00	5.93E+11	-297.930	66869.	0.00
36.7839	0.02296	7250808.	-49982.	-8.27E-04	0.00	5.93E+11	-268.058	74680.	0.00
37.3170	0.01792	6925576.	-51593.	-7.50E-04	0.00	5.93E+11	-235.556	84077.	0.00
37.8501	0.01336	6590704.	-52987.	-6.77E-04	0.00	5.93E+11	-200.297	95899.	0.00
38.3832	0.00925	6247634.	-54156.	-6.08E-04	0.00	5.93E+11	-165.114	114134.	0.00
38.9163	0.00558	5897808.	-55084.	-5.43E-04	0.00	5.93E+11	-124.989	143318.	0.00
39.4494	0.00231	5542866.	-55654.	-4.81E-04	0.00	5.93E+11	-53.097	147025.	0.00
39.9825	-5.76E-04	5185752.	-55780.	-4.23E-04	0.00	5.94E+11	13.5769	150733.	0.00
40.5156	-0.00311	4829193.	-55497.	-3.69E-04	0.00	5.94E+11	74.9656	154441.	0.00
41.0487	-0.00530	4475702.	-54838.	-3.19E-04	0.00	5.94E+11	131.0578	158148.	0.00
41.5818	-0.00719	4127574.	-53837.	-2.73E-04	0.00	5.94E+11	181.8943	161856.	0.00
42.1149	-0.00879	3786891.	-52558.	-2.30E-04	0.00	5.95E+11	217.8763	158516.	0.00
42.6480	-0.01014	3455124.	-51053.	-1.91E-04	0.00	5.95E+11	252.6993	159492.	0.00
43.1811	-0.01124	3133698.	-49346.	-1.56E-04	0.00	5.95E+11	280.8302	159820.	0.00
43.7142	-0.01213	2823765.	-47467.	-1.24E-04	0.00	5.95E+11	306.6722	161727.	0.00
44.2473	-0.01283	2526382.	-45429.	-9.51E-05	0.00	5.95E+11	330.4729	164831.	0.00
44.7804	-0.01335	2242524.	-43245.	-6.95E-05	0.00	5.95E+11	352.4061	168903.	0.00
45.3135	-0.01371	1973087.	-40926.	-4.68E-05	0.00	5.95E+11	372.6044	173802.	0.00
45.8466	-0.01395	1718899.	-38483.	-2.69E-05	0.00	5.95E+11	391.1770	179437.	0.00

46.3797	-0.01406	1480720.	-35926.	-9.73E-06	0.00	5.95E+11	408.2207	185748.	0.00
46.9128	-0.01407	1259247.	-33265.	5.00E-06	0.00	5.95E+11	423.8261	192694.	0.00
47.4459	-0.01400	1055118.	-30508.	1.75E-05	0.00	5.95E+11	438.0816	200247.	0.00
47.9790	-0.01385	868918.	-27678.	2.78E-05	0.00	5.95E+11	446.6591	206349.	0.00
48.5121	-0.01364	700997.	-24817.	3.62E-05	0.00	5.95E+11	447.8642	210057.	0.00
49.0452	-0.01338	551404.	-21954.	4.30E-05	0.00	5.95E+11	447.2168	213764.	0.00
49.5783	-0.01309	420113.	-19100.	4.82E-05	0.00	5.95E+11	444.9830	217472.	0.00
50.1114	-0.01277	307033.	-16265.	5.21E-05	0.00	5.95E+11	441.4092	221180.	0.00
50.6445	-0.01242	212017.	-13456.	5.49E-05	0.00	5.95E+11	436.7186	224888.	0.00
51.1776	-0.01206	134873.	-10680.	5.68E-05	0.00	5.95E+11	431.1080	228595.	0.00
51.7107	-0.01170	75372.	-7942.	5.79E-05	0.00	5.95E+11	424.7449	232303.	0.00
52.2438	-0.01132	33254.	-5248.	5.85E-05	0.00	5.95E+11	417.7641	236011.	0.00
52.7769	-0.01095	8232.	-2599.	5.87E-05	0.00	5.95E+11	410.2653	239719.	0.00
53.3100	-0.01057	0.00	0.00	5.87E-05	0.00	5.95E+11	402.3099	121713.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

Pile-head deflection	=	1.64591519	inches
Computed slope at pile head	=	-0.0054622	radians
Maximum bending moment	=	10086697.	inch-lbs
Maximum shear force	=	62108.	lbs
Depth of maximum bending moment	=	28.78740000	feet below pile head
Depth of maximum shear force	=	18.65850000	feet below pile head
Number of iterations	=	18	
Number of zero deflection points	=	1	
Pile deflection at ground	=	0.58061733	inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear	=	0.	lbs
Moment	=	0.	in-lbs
Axial Load	=	0.	lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
53.31000	1.64591519	10086697.	62108.
50.64450	1.67178023	10046617.	62086.
47.97900	1.78940512	9945048.	-66209.
45.31350	2.09404606	9749699.	-73968.
42.64800	2.88959114	9462086.	-82579.
39.98250	4.70980747	9050614.	-91559.

37.31700 10.77787440 8853712. -106750.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

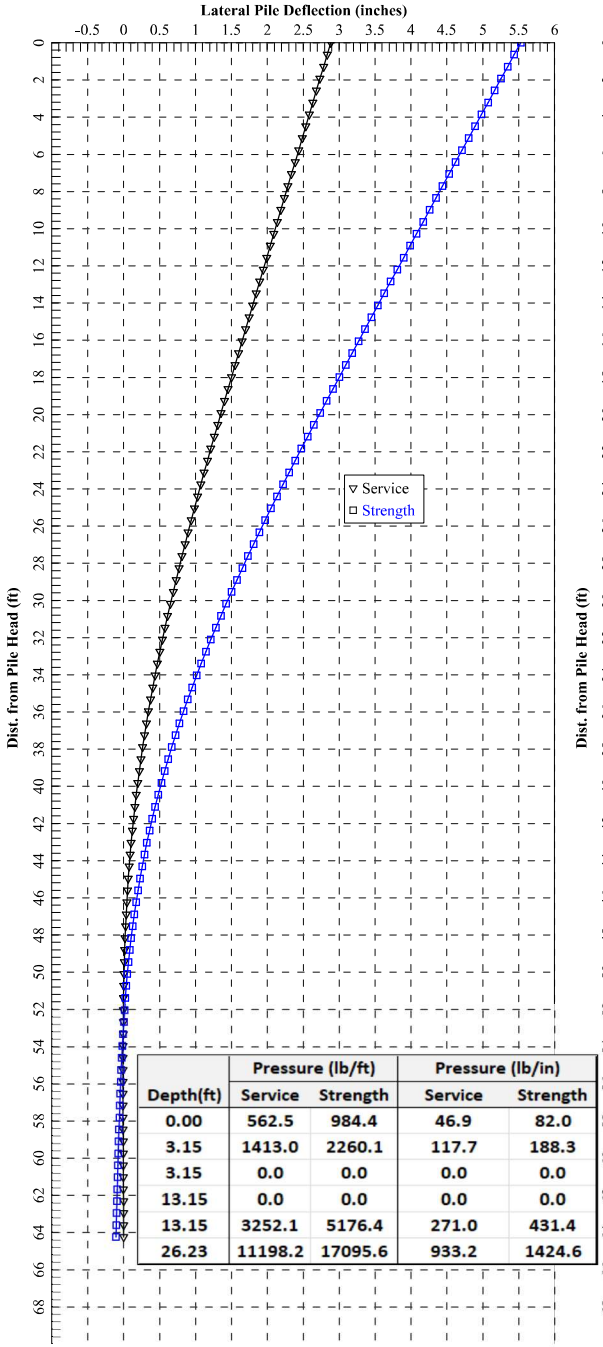
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.2908	-0.00427	53393.	8337352.
2	V, lb	0.00	M, in-lb	0.00	0.00	1.6459	-0.00546	62108.	1.01E+07

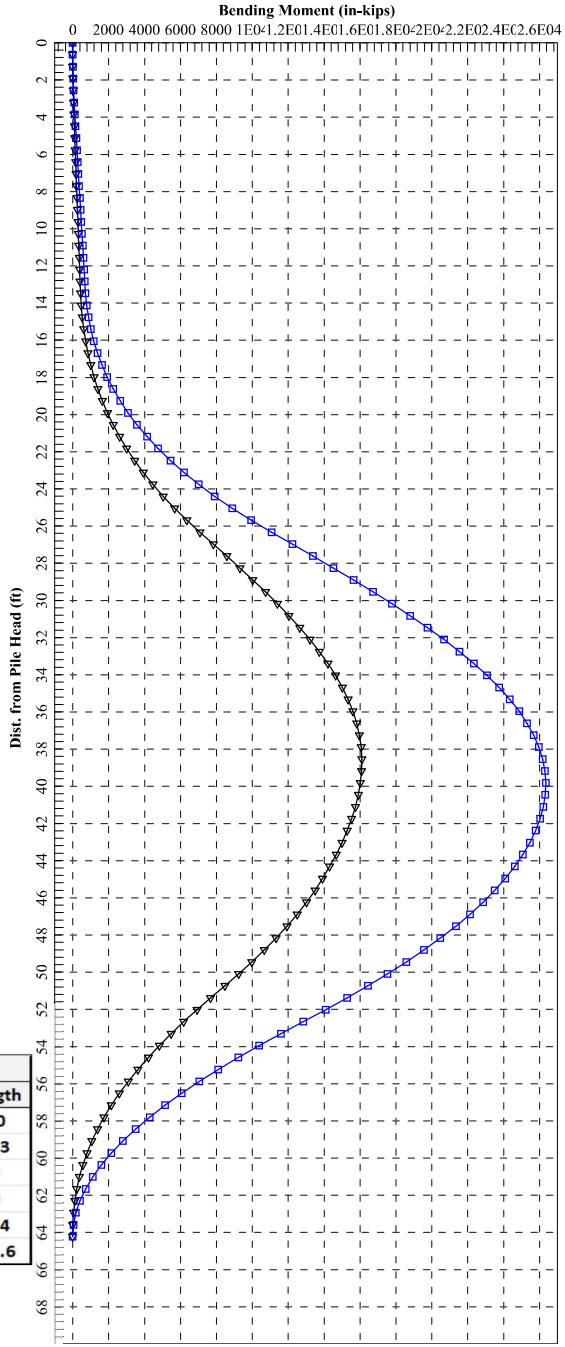
Maximum pile-head deflection = 1.6459151880 inches
Maximum pile-head rotation   = -0.0054621553 radians = -0.312958 deg.

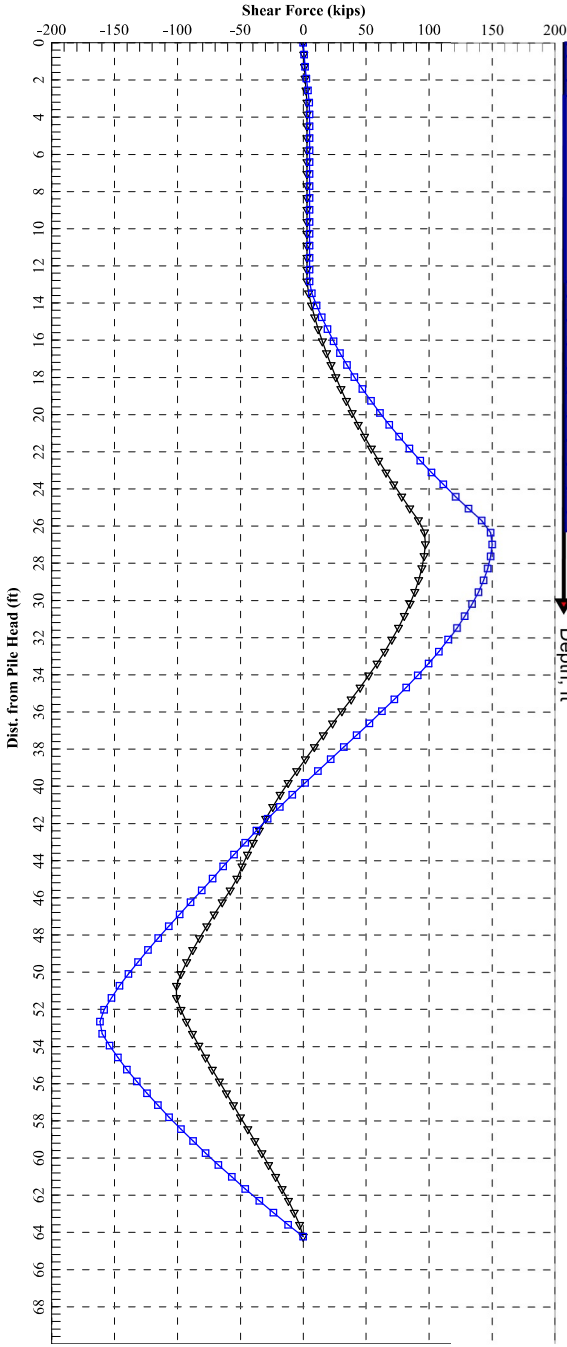
The analysis ended normally.

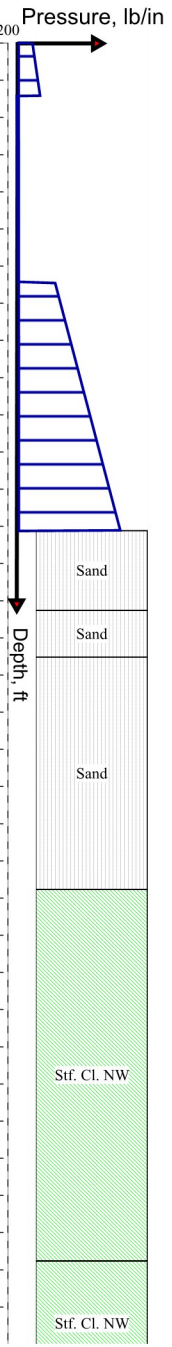
Wall 7 (26.23ft)



Depth(ft)	Pressure (lb/ft)		Pressure (lb/in)	
	Service	Strength	Service	Strength
0.00	562.5	984.4	46.9	82.0
3.15	1413.0	2260.1	117.7	188.3
3.15	0.0	0.0	0.0	0.0
13.15	0.0	0.0	0.0	0.0
13.15	3252.1	5176.4	271.0	431.4
26.23	11198.2	17095.6	933.2	1424.6







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                     LPile for Windows, Version 2022-12.005

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App E LPile March 2026\Wall 7\

Name of input data file:
Wall_7-26.23ft- EPS W36x256_B-071.lp12d

Name of output report file:
Wall_7-26.23ft- EPS W36x256_B-071.lp12o

Name of plot output file:
Wall_7-26.23ft- EPS W36x256_B-071.lp12p

Name of runtime message file:
Wall_7-26.23ft- EPS W36x256_B-071.lp12r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 26, 2026             Time:  17:37:46
```

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77

Job Number: CUY-77-11.21 (TRC# 301525)

Client: ODOT

Engineer: Izzaldin Almohd, Ph.D, P.E

Description: LPILE FOR SOLDIER PILE WALL 7 (H=26.43FT) Boring B-071-0-20

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - Analysis includes loading by multiple distributed lateral loads acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1

 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 3
Total length of pile = 64.230 ft
Depth of ground surface below top of pile = 26.2300 ft

Pile diameters used for p-y curve computations are defined using 6 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	39.0000
2	3.250	39.0000
3	3.250	12.2000
4	26.230	12.2000
5	26.230	48.0000
6	64.230	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a rectangular concrete pile
Length of section = 3.250000 ft

Pile Section No. 2:

Section 2 is a AISC strong axis steel pile
Length of section = 22.980000 ft
AISC Section Type = W

AISC Section Name = W36X256

Pile width = 12.200000 in

Pile Section No. 3:

```
   Section 3 is a drilled shaft with casing and AISC section core/insert
   Length of section                                =    38.000000 ft
   Section Diameter                                 =    48.000000 in
   Core/Insert AISC Section Type                    = W


   Core/Insert AISC Section Name                    = W36X256




--------------------------------------------------------------------------------
                     Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 5 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    26.230000 ft
   Distance from top of pile to bottom of layer       =    30.530000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    34.000000 deg.
   Friction angle at bottom of layer                  =    34.000000 deg.
   Subgrade k at top of layer                         =   120.000000 pci
   Subgrade k at bottom of layer                      =   120.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    30.530000 ft
   Distance from top of pile to bottom of layer       =    33.030000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    32.000000 deg.
   Friction angle at bottom of layer                  =    32.000000 deg.
   Subgrade k at top of layer                         =    90.000000 pci
   Subgrade k at bottom of layer                      =    90.000000 pci


Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    33.030000 ft
   Distance from top of pile to bottom of layer       =    45.530000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Friction angle at top of layer                     =    33.000000 deg.
   Friction angle at bottom of layer                  =    33.000000 deg.
   Subgrade k at top of layer                         =    90.000000 pci
   Subgrade k at bottom of layer                      =    90.000000 pci
```

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	45.530000 ft
Distance from top of pile to bottom of layer	=	65.530000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.006000
Epsilon-50 at bottom of layer	=	0.006000

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	65.530000 ft
Distance from top of pile to bottom of layer	=	85.000000 ft
Effective unit weight at top of layer	=	57.600000 pcf
Effective unit weight at bottom of layer	=	57.600000 pcf
Undrained cohesion at top of layer	=	2000. psf
Undrained cohesion at bottom of layer	=	2000. psf
Epsilon-50 at top of layer	=	0.007000
Epsilon-50 at bottom of layer	=	0.007000

(Depth of the lowest soil layer extends 20.770 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Sand	26.2300	62.6000	--	34.0000	--	120.0000
	(Reese, et al.)	30.5300	62.6000	--	34.0000	--	120.0000
2	Sand	30.5300	62.6000	--	32.0000	--	90.0000
	(Reese, et al.)	33.0300	62.6000	--	32.0000	--	90.0000
3	Sand	33.0300	62.6000	--	33.0000	--	90.0000
	(Reese, et al.)	45.5300	62.6000	--	33.0000	--	90.0000
4	Stiff Clay	45.5300	62.6000	2500.	--	0.00600	--
	w/o Free Water	65.5300	62.6000	2500.	--	0.00600	--
5	Stiff Clay	65.5300	57.6000	2000.	--	0.00700	--
	w/o Free Water	85.0000	57.6000	2000.	--	0.00700	--

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	26.230	0.7650	1.0000
2	65.000	0.7650	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 6 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	46.900
2	3.150	117.700
3	3.150	0.000
4	13.150	0.000
5	13.150	271.000
6	26.230	933.200

Distributed lateral load intensity for Load Case 2 defined using 6 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	82.000
2	3.150	188.300
3	3.150	0.000
4	13.150	0.000
5	13.150	431.400
6	26.230	1424.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 3

Pile Section No. 1:

Dimensions and Properties of Rectangular Concrete Pile:

Length of Section	=	3.250000 ft
Depth of Section	=	16.800000 in
Width of Section	=	39.000000 in
Concrete Cover Thickness (to edge of long. rebar)	=	3.000000 in
Number of Reinforcing Bars	=	8 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Compressive Strength of Concrete	=	4000. psi
Modulus of Rupture of Concrete	=	-474.34165 psi
Gross Area of Pile	=	655.200000 sq. in.
Total Area of Reinforcing Steel	=	6.320000 sq. in.
Area Ratio of Steel Reinforcement	=	0.964591 percent

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	2585.392 kips

Tensile Load for Cracking of Concrete = -291.020 kips
Nominal Axial Tensile Capacity = -379.200 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.000000	0.790000	-16.00000	-4.90000
2	1.000000	0.790000	-5.33333	-4.90000
3	1.000000	0.790000	5.333333	-4.90000
4	1.000000	0.790000	16.000000	-4.90000
5	1.000000	0.790000	-16.00000	4.900000
6	1.000000	0.790000	-5.33333	4.900000
7	1.000000	0.790000	5.333333	4.900000
8	1.000000	0.790000	16.000000	4.900000

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 8.800 inches
between bars 1 and 5.

Ratio of bar spacing to maximum aggregate size = 11.73

Concrete Properties:

Compressive Strength of Concrete = 4000. psi
Modulus of Elasticity of Concrete = 3604997. psi
Modulus of Rupture of Concrete = -474.34165 psi
Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in

concrete more than 0.003. See ACI 318-14, Section 21.2.3.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
6.25000E-07	43.1559235	69049478.	8.4000778	0.00000525	-0.00000525	0.0220133	0.0989639	
0.00000125	86.2272526	68981802.	8.4000779	0.00001050	-0.00001050	0.0439659	0.1979278	
0.00000188	129.2139873	68914127.	8.4000780	0.00001575	-0.00001575	0.0658578	0.2968917	
0.00000250	172.1161276	68846451.	8.4000782	0.00002100	-0.00002100	0.0876889	0.3958557	
0.00000313	214.9336735	68778776.	8.4000783	0.00002625	-0.00002625	0.1094592	0.4948196	
0.00000375	257.6666250	68711100.	8.4000784	0.00003150	-0.00003150	0.1311689	0.5937835	
0.00000438	300.3149820	68643424.	8.4000785	0.00003675	-0.00003675	0.1528178	0.6927475	
0.00000500	342.8787447	68575749.	8.4000787	0.00004200	-0.00004200	0.1744059	0.7917114	
0.00000563	385.3579130	68508073.	8.4000788	0.00004725	-0.00004725	0.1959333	0.8906754	
0.00000625	427.7524869	68440398.	8.4000789	0.00005250	-0.00005250	0.2174000	0.9896393	
0.00000688	470.0624663	68372722.	8.4000790	0.00005775	-0.00005775	0.2388059	1.0886033	
0.00000750	512.2878514	68305047.	8.4000792	0.00006300	-0.00006300	0.2601511	1.1875672	
0.00000813	554.4286420	68237371.	8.4000793	0.00006825	-0.00006825	0.2814356	1.2865312	
0.00000875	596.4848383	68169696.	8.4000794	0.00007350	-0.00007350	0.3026593	1.3854952	
0.00000938	638.4564402	68102020.	8.4000796	0.00007875	-0.00007875	0.3238223	1.4844592	
0.00001000	680.3434476	68034345.	8.4000797	0.00008400	-0.00008400	0.3449245	1.5834231	
0.00001063	722.1458606	67966669.	8.4000798	0.00008925	-0.00008925	0.3659660	1.6823871	
0.00001125	763.8636793	67898994.	8.4000799	0.00009450	-0.00009450	0.3869467	1.7813511	
0.00001188	805.4969035	67831318.	8.4000801	0.00009975	-0.00009975	0.4078667	1.8803151	
0.00001250	847.0455334	67763643.	8.4000802	0.0001050	-0.000105	0.4287260	1.9792791	
0.00001313	888.5095688	67695967.	8.4000803	0.0001103	-0.000110	0.4495245	2.0782431	
0.00001375	888.5095688	64618878.	3.3580934	0.00004617	-0.000185	0.1886540	-4.187635	C
0.00001438	888.5095688	61809361.	3.3585684	0.00004828	-0.000193	0.1971491	-4.377784	C
0.00001500	888.5095688	59233971.	3.3590439	0.00005039	-0.000202	0.2056373	-4.567916	C
0.00001563	888.5095688	56864612.	3.3595198	0.00005249	-0.000210	0.2141184	-4.758030	C
0.00001625	888.5095688	54677512.	3.3599961	0.00005460	-0.000218	0.2225925	-4.948127	C
0.00001688	888.5095688	52652419.	3.3604728	0.00005671	-0.000227	0.2310597	-5.138206	C
0.00001750	888.5095688	50771975.	3.3609499	0.00005882	-0.000235	0.2395198	-5.328268	C
0.00001813	888.5095688	49021218.	3.3614274	0.00006093	-0.000244	0.2479728	-5.518312	C
0.00001875	888.5095688	47387177.	3.3619053	0.00006304	-0.000252	0.2564189	-5.708339	C
0.00001938	888.5095688	45858558.	3.3623836	0.00006515	-0.000260	0.2648579	-5.898348	C
0.00002000	888.5095688	44425478.	3.3628623	0.00006726	-0.000269	0.2732898	-6.088340	C
0.00002063	888.5095688	43079252.	3.3633415	0.00006937	-0.000277	0.2817148	-6.278314	C
0.00002125	888.5095688	41812215.	3.3638210	0.00007148	-0.000286	0.2901326	-6.468270	C
0.00002188	888.5095688	40617580.	3.3643010	0.00007359	-0.000294	0.2985434	-6.658209	C
0.00002250	888.5095688	39489314.	3.3647814	0.00007571	-0.000302	0.3069472	-6.848130	C
0.00002313	888.5095688	38422035.	3.3652622	0.00007782	-0.000311	0.3153438	-7.038034	C

0.00002375	888.5095688	37410929.	3.3657434	0.00007994	-0.000319	0.3237335	-7.227919 C
0.00002438	888.5095688	36451675.	3.3662250	0.00008205	-0.000327	0.3321160	-7.417787 C
0.00002563	888.5095688	34673544.	3.3671895	0.00008628	-0.000344	0.3488598	-7.797470 C
0.00002688	888.5095688	33060821.	3.3681557	0.00009052	-0.000361	0.3655752	-8.177081 C
0.00002813	888.5095688	31591451.	3.3691235	0.00009476	-0.000378	0.3822622	-8.556621 C
0.00002938	888.5095688	30247134.	3.3700930	0.00009900	-0.000395	0.3989207	-8.936089 C
0.00003063	888.5095688	29012557.	3.3710642	0.0001032	-0.000411	0.4155508	-9.315486 C
0.00003188	888.5095688	27874810.	3.3720372	0.0001075	-0.000428	0.4321523	-9.694811 C
0.00003313	888.5095688	26822930.	3.3730118	0.0001117	-0.000445	0.4487252	-10.074063 C
0.00003438	888.5095688	25847551.	3.3739881	0.0001160	-0.000462	0.4652695	-10.453243 C
0.00003563	888.5095688	24940619.	3.3749661	0.0001202	-0.000478	0.4817850	-10.832351 C
0.00003688	888.5095688	24095175.	3.3759458	0.0001245	-0.000495	0.4982719	-11.211385 C
0.00003813	888.5095688	23305169.	3.3769273	0.0001287	-0.000512	0.5147300	-11.590347 C
0.00003938	888.5095688	22565322.	3.3779105	0.0001330	-0.000528	0.5311593	-11.969236 C
0.00004063	888.5095688	21871005.	3.3788954	0.0001373	-0.000545	0.5475598	-12.348051 C
0.00004188	888.5095688	21218139.	3.3798821	0.0001415	-0.000562	0.5639313	-12.726793 C
0.00004313	888.5095688	20603120.	3.3808705	0.0001458	-0.000579	0.5802739	-13.105461 C
0.00004438	888.5095688	20022751.	3.3818607	0.0001501	-0.000595	0.5965876	-13.484055 C
0.00004563	888.5095688	19474182.	3.3828526	0.0001543	-0.000612	0.6128722	-13.862576 C
0.00004688	888.5095688	18954871.	3.3838463	0.0001586	-0.000629	0.6291277	-14.241021 C
0.00004813	888.5095688	18462536.	3.3848418	0.0001629	-0.000646	0.6453541	-14.619393 C
0.00004938	888.5095688	17995131.	3.3858390	0.0001672	-0.000662	0.6615513	-14.997689 C
0.00005063	888.5095688	17550806.	3.3868381	0.0001715	-0.000679	0.6777194	-15.375911 C
0.00005188	888.5095688	17127895.	3.3878389	0.0001757	-0.000696	0.6938581	-15.754057 C
0.00005313	888.5095688	16724886.	3.3888415	0.0001800	-0.000712	0.7099676	-16.132128 C
0.00005438	888.5095688	16340406.	3.3898459	0.0001843	-0.000729	0.7260477	-16.510124 C
0.00005563	888.5095688	15973206.	3.3908522	0.0001886	-0.000746	0.7420984	-16.888044 C
0.00005688	888.5095688	15622146.	3.3918602	0.0001929	-0.000763	0.7581197	-17.265888 C
0.00005813	888.5095688	15286186.	3.3928701	0.0001972	-0.000779	0.7741115	-17.643656 C
0.00005938	888.5095688	14964372.	3.3938818	0.0002015	-0.000796	0.7900737	-18.021347 C
0.00006063	888.5095688	14655828.	3.3948954	0.0002058	-0.000813	0.8060064	-18.398962 C
0.00006188	888.5095688	14359751.	3.3959108	0.0002101	-0.000829	0.8219095	-18.776500 C
0.00006313	888.5095688	14075399.	3.3969280	0.0002144	-0.000846	0.8377828	-19.153961 C
0.00006438	888.5095688	13802090.	3.3979471	0.0002187	-0.000863	0.8536265	-19.531345 C
0.00006563	888.5095688	13539193.	3.3989681	0.0002231	-0.000879	0.8694403	-19.908651 C
0.00006688	888.5095688	13286124.	3.3999909	0.0002274	-0.000896	0.8852244	-20.285880 C
0.00006813	888.5095688	13042342.	3.4010157	0.0002317	-0.000913	0.9009786	-20.663031 C
0.00006938	888.5095688	12807345.	3.4020423	0.0002360	-0.000929	0.9167028	-21.040104 C
0.00007063	888.5095688	12580666.	3.4030708	0.0002403	-0.000946	0.9323971	-21.417098 C
0.00007188	888.5095688	12361872.	3.4041012	0.0002447	-0.000963	0.9480614	-21.794014 C
0.00007313	888.5095688	12150558.	3.4051335	0.0002490	-0.000979	0.9636956	-22.170851 C
0.00007438	888.5095688	11946347.	3.4061677	0.0002533	-0.000996	0.9792998	-22.547609 C
0.00007938	888.5095688	11193821.	3.4103238	0.0002707	-0.001063	1.0414141	-24.053848 C
0.00008438	931.2415391	11036937.	3.4145111	0.0002881	-0.001129	1.1030427	-25.558805 C
0.00008938	985.7404915	11029264.	3.4187301	0.0003055	-0.001196	1.1641823	-27.062466 C
0.00009438	1040.	11021540.	3.4229812	0.0003230	-0.001262	1.2248295	-28.564816 C
0.00009938	1094.	11013763.	3.4272650	0.0003406	-0.001329	1.2849811	-30.065838 C
0.0001044	1149.	11005932.	3.4315819	0.0003582	-0.001395	1.3446336	-31.565518 C
0.0001094	1203.	10998047.	3.4359324	0.0003758	-0.001462	1.4037836	-33.063839 C
0.0001144	1257.	10990107.	3.4403171	0.0003935	-0.001528	1.4624275	-34.560785 C
0.0001194	1311.	10982114.	3.4447102	0.0004112	-0.001594	1.5205513	-36.056431 C
0.0001244	1365.	10974074.	3.4490049	0.0004290	-0.001661	1.5781062	-37.551158 C
0.0001294	1419.	10965979.	3.4533328	0.0004468	-0.001727	1.6351394	-39.044514 C

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0.0001344       1472.     10957827.     3.4576946     0.0004646     -0.001793     1.6916470     -40.536483 C
0.0001394       1526.     10949619.     3.4620908     0.0004825     -0.001859     1.7476255     -42.027049 C
0.0001444       1580.     10941353.     3.4665220     0.0005005     -0.001925     1.8030709     -43.516193 C
0.0001494       1633.     10933028.     3.4709886     0.0005185     -0.001991     1.8579793     -45.003898 C
0.0001544       1686.     10924643.     3.4754914     0.0005365     -0.002057     1.9123468     -46.490147 C
0.0001594       1740.     10916198.     3.4800308     0.0005546     -0.002123     1.9661692     -47.974920 C
0.0001644       1793.     10907691.     3.4846075     0.0005728     -0.002189     2.0194425     -49.458199 C
0.0001694       1846.     10899122.     3.4892221     0.0005910     -0.002255     2.0721625     -50.939964 C
0.0001744       1899.     10890490.     3.4938753     0.0006092     -0.002320     2.1243249     -52.420196 C
0.0001794       1952.     10881792.     3.4985677     0.0006276     -0.002386     2.1759253     -53.898875 C
0.0001844       2005.     10873030.     3.5033000     0.0006459     -0.002452     2.2269593     -55.375980 C
0.0001894       2057.     10864200.     3.5080729     0.0006643     -0.002517     2.2774223     -56.851489 C
0.0001944       2110.     10855303.     3.5128871     0.0006828     -0.002583     2.3273096     -58.325382 C
0.0001994       2162.     10846337.     3.5177432     0.0007014     -0.002648     2.3766167     -59.797635 C
0.0002044       2213.     10830265.     3.5215578     0.0007197     -0.002714     2.4247488     -60.000000 CY
0.0002094       2255.     10769499.     3.5184106     0.0007367     -0.002781     2.4684336     -60.000000 CY
0.0002144       2282.     10645724.     3.5050936     0.0007514     -0.002850     2.5057767     -60.000000 CY
0.0002194       2295.     10460214.     3.4814593     0.0007637     -0.002922     2.5365175     -60.000000 CY
0.0002244       2299.     10246580.     3.4528628     0.0007747     -0.002995     2.5635102     -60.000000 CY
0.0002294       2302.     10036956.     3.4238891     0.0007854     -0.003068     2.5893137     -60.000000 CY
0.0002344       2305.      9835953.     3.3958156     0.0007959     -0.003142     2.6146868     -60.000000 CY
0.0002394       2308.      9643307.     3.3689802     0.0008064     -0.003215     2.6398683     -60.000000 CY
0.0002444       2311.      9458504.     3.3433071     0.0008170     -0.003288     2.6648573     -60.000000 CY
0.0002494       2314.      9281073.     3.3187267     0.0008276     -0.003362     2.6896528     -60.000000 CY
0.0002544       2318.      9110579.     3.2951747     0.0008382     -0.003435     2.7142539     -60.000000 CY
0.0002594       2321.      8946516.     3.2724185     0.0008488     -0.003509     2.7385525     -60.000000 CY
0.0002644       2323.      8788060.     3.2496432     0.0008591     -0.003582     2.7620706     -60.000000 CY
0.0002694       2326.      8635452.     3.2277694     0.0008695     -0.003656     2.7854027     -60.000000 CY
0.0002744       2329.      8488372.     3.2067480     0.0008799     -0.003730     2.8085478     -60.000000 CY
0.0003044       2346.      7706388.     3.0955138     0.0009422     -0.004171     2.9430021     -60.000000 CY
0.0003344       2361.      7061481.     3.0013516     0.0010036     -0.004614     3.0674327     -60.000000 CY
0.0003644       2376.      6521448.     2.9231719     0.0010651     -0.005056     3.1844066     -60.000000 CY
0.0003944       2390.      6061425.     2.8549390     0.0011259     -0.005500     3.2921752     -60.000000 CY
0.0004244       2404.      5665668.     2.7976668     0.0011873     -0.005942     3.3932317     -60.000000 CY
0.0004544       2418.      5320942.     2.7475808     0.0012484     -0.006385     3.4862482     -60.000000 CY
0.0004844       2430.      5017766.     2.7033085     0.0013094     -0.006828     3.5712673     -60.000000 CY
0.0005144       2443.      4749295.     2.6653783     0.0013710     -0.007270     3.6493624     -60.000000 CY
0.0005444       2455.      4509765.     2.6327867     0.0014332     -0.007712     3.7203199     -60.000000 CY
0.0005744       2467.      4294615.     2.6047437     0.0014961     -0.008153     3.7839124     -60.000000 CY
0.0006044       2478.      4099850.     2.5786573     0.0015585     -0.008595     3.8388885     -60.000000 CY
0.0006344       2489.      3922906.     2.5561300     0.0016215     -0.009036     3.8863047     -60.000000 CY
0.0006644       2499.      3761349.     2.5367897     0.0016854     -0.009476     3.9259202     -60.000000 CY
0.0006944       2509.      3613159.     2.5202837     0.0017500     -0.009915     3.9574370     -60.000000 CY
0.0007244       2518.      3476642.     2.5063242     0.0018155     -0.010354     3.9805302     -60.000000 CY
0.0007544       2527.      3350374.     2.4946759     0.0018819     -0.010792     3.9948448     -60.000000 CY
0.0007844       2536.      3233145.     2.4851477     0.0019493     -0.011228     3.9999907     -60.000000 CY
0.0008144       2544.      3123647.     2.4780124     0.0020180     -0.011663     3.9939330     -60.000000 CY
0.0008444       2551.      3021427.     2.4724657     0.0020877     -0.012098     3.9998548     -60.000000 CY
0.0008744       2558.      2925512.     2.4687484     0.0021586     -0.012531     3.9898760     -60.000000 CY
0.0009044       2564.      2835523.     2.4662783     0.0022304     -0.012963     3.9985698     -60.000000 CY
0.0009344       2570.      2750826.     2.4650852     0.0023033     -0.013394     3.9922855     -60.000000 CY
0.0009644       2576.      2670932.     2.4650575     0.0023772     -0.013824     3.9934922     -60.000000 CY
0.0009944       2581.      2595560.     2.4658228     0.0024520     -0.014254     3.9995937     -60.000000 CY
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0.0010244	2586.	2524163.	2.4676346	0.0025278	-0.014682	3.9877161	-60.000000 CY
0.0010544	2590.	2456524.	2.4701719	0.0026045	-0.015109	3.9930031	-60.000000 CY
0.0010844	2594.	2392392.	2.4732586	0.0026819	-0.015536	3.9993460	-60.000000 CY
0.0011144	2598.	2331376.	2.4771176	0.0027604	-0.015961	3.9900614	-60.000000 CY
0.0011444	2601.	2273293.	2.4815578	0.0028398	-0.016386	3.9878777	-60.000000 CY
0.0011744	2605.	2217994.	2.4863705	0.0029199	-0.016810	3.9970227	-60.000000 CY
0.0012044	2608.	2165258.	2.4915768	0.0030008	-0.017233	3.9994734	-60.000000 CYT

Warning: 150 values were calculated for moment-curvature for axial thrust 1.

This usually indicates that the pile is too weak or is under-reinforced,
where all reinforcing steel has yielded.
The input data should be examined and the amount of steel reinforcement
should be increased if necessary.

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens. Strain
1	0.000	2607.753	0.00300000	-0.01722856

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.75).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318,
or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor	Nominal Ax. Thrust kips	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	0.0000	2608.	0.0000	1695.	10923288.
1	0.75	0.0000	2608.	0.0000	1956.	10881146.
1	0.90	0.0000	2608.	0.0000	2347.	7650586.

Pile Section No. 2:

Dimensions and Properties of Steel AISC Strong Axis:

Length of Section	=	22.980000 ft
Flange Width	=	12.200000 in
Section Depth	=	37.400000 in
Flange Thickness	=	1.730000 in
Web Thickness	=	0.960000 in
Yield Stress of Pipe	=	50.000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	75.300000 sq. in.
Moment of Inertia	=	16800. in^4
Elastic Bending Stiffness	=	487200000. kip-in^2
Plastic Modulus, Z	=	1040.in^3
Plastic Moment Capacity = Fy Z	=	52000.in-kip

Axial Structural Capacities:

Nom. Axial Structural Capacity = Fy As	=	3765.000 kips
Nominal Axial Tensile Capacity	=	-3765.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress ksi	Run Msg
0.00000601	2883.	480006160.	18.7000000	3.2246004	
0.00001201	5766.	480006160.	18.7000000	6.4492009	
0.00001802	8649.	480006160.	18.7000000	9.6738013	
0.00002402	11532.	480006160.	18.7000000	12.8984017	
0.00003003	14415.	480006160.	18.7000000	16.1230021	
0.00003604	17298.	480006160.	18.7000000	19.3476026	

0.00004204	20181.	480006160.	18.7000000	22.5722030	
0.00004805	23064.	480006160.	18.7000000	25.7968034	
0.00005406	25947.	480006160.	18.7000000	29.0214038	
0.00006006	28830.	480006160.	18.7000000	32.2460043	
0.00006607	31713.	480006160.	18.7000000	35.4706047	
0.00007207	34596.	480006160.	18.7000000	38.6952051	
0.00007808	37479.	480006160.	18.7000000	41.9198056	
0.00008409	40362.	480006160.	18.7000000	45.1444060	
0.00009009	43245.	480006160.	18.7000000	48.3690064	
0.00009610	45768.	476254989.	18.7000000	50.0000000	Y
0.0001021	46884.	459172815.	18.7000000	50.0000000	Y
0.0001081	47378.	438228174.	18.7000000	50.0000000	Y
0.0001141	47795.	418820022.	18.7000000	50.0000000	Y
0.0001201	48151.	400842510.	18.7000000	50.0000000	Y
0.0001261	48458.	384187517.	18.7000000	50.0000000	Y
0.0001321	48722.	368724884.	18.7000000	50.0000000	Y
0.0001381	48955.	354376948.	18.7000000	50.0000000	Y
0.0001441	49157.	341015611.	18.7000000	50.0000000	Y
0.0001502	49337.	328574040.	18.7000000	50.0000000	Y
0.0001562	49497.	316961793.	18.7000000	50.0000000	Y
0.0001622	49639.	306094927.	18.7000000	50.0000000	Y
0.0001682	49766.	295916894.	18.7000000	50.0000000	Y
0.0001742	49880.	286369075.	18.7000000	50.0000000	Y
0.0001802	49982.	277392071.	18.7000000	50.0000000	Y
0.0001862	50075.	268939208.	18.7000000	50.0000000	Y
0.0001922	50159.	260972045.	18.7000000	50.0000000	Y
0.0001982	50236.	253453843.	18.7000000	50.0000000	Y
0.0002042	50307.	246346608.	18.7000000	50.0000000	Y
0.0002102	50370.	239608120.	18.7000000	50.0000000	Y
0.0002162	50429.	233228130.	18.7000000	50.0000000	Y
0.0002222	50483.	227167553.	18.7000000	50.0000000	Y
0.0002282	50533.	221407941.	18.7000000	50.0000000	Y
0.0002342	50580.	215929857.	18.7000000	50.0000000	Y
0.0002463	50662.	205731080.	18.7000000	50.0000000	Y
0.0002583	50733.	196436688.	18.7000000	50.0000000	Y
0.0002703	50795.	187935028.	18.7000000	50.0000000	Y
0.0002823	50850.	180132463.	18.7000000	50.0000000	Y
0.0002943	50898.	172942285.	18.7000000	50.0000000	Y
0.0003063	50939.	166295713.	18.7000000	50.0000000	Y
0.0003183	50978.	160143156.	18.7000000	50.0000000	Y
0.0003303	51010.	154416527.	18.7000000	50.0000000	Y
0.0003424	51042.	149090413.	18.7000000	50.0000000	Y
0.0003544	51067.	144108704.	18.7000000	50.0000000	Y
0.0003664	51093.	139453665.	18.7000000	50.0000000	Y
0.0003784	51114.	135082646.	18.7000000	50.0000000	Y
0.0003904	51134.	130977791.	18.7000000	50.0000000	Y
0.0004024	51154.	127116521.	18.7000000	50.0000000	Y
0.0004144	51169.	123469366.	18.7000000	50.0000000	Y
0.0004264	51185.	120027684.	18.7000000	50.0000000	Y
0.0004385	51200.	116774587.	18.7000000	50.0000000	Y
0.0004505	51212.	113686848.	18.7000000	50.0000000	Y
0.0004625	51224.	110759099.	18.7000000	50.0000000	Y

Summary of Results for Nominal Moment Capacity for Section 2

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	51224.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile) with Casing and AISC Strong Axis Core/Insert:

Length of Section	=	38.000000 ft
Outside Diameter of Casing	=	48.000000 in
Casing Wall Thickness	=	0.0000 in
Moment of Inertia of Steel Casing	=	0.0000 in^4
Width Flange of Core/Insert	=	12.200000 in
Depth of Core/Insert	=	37.400000 in
Flange Thickness of Core/Insert	=	1.730000 in
Web Thickness of Core/Insert	=	0.960000 in
Moment of Inertia of Steel Core/Insert	=	16800. in^4
Yield Stress of Casing	=	50000. psi
Elastic Modulus of Casing	=	29000000. psi
Yield Stress of Core/Insert	=	50000. psi
Elastic Modulus of Core/Insert	=	29000000. psi
Number of Reinforcing Bars	=	0 bars
Gross Area of Pile	=	1810. sq. in.
Area of Concrete	=	1735. sq. in.
Cross-sectional Area of Steel Casing	=	0.0000 sq. in.
Cross-sectional Area of Steel Core/Insert	=	75.300000 sq. in.
Area of All Steel (Casing, Core/Insert, and Bars)	=	74.794400 sq. in.
Area Ratio of All Steel to Gross Area	=	4.13 percent

Note that the core is assumed to be void of concrete.

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 11135.594 kips
Tensile Load for Cracking of Concrete = -1054.751 kips
Nominal Axial Tensile Capacity = -3765.000 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	0.000

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Max Core Stress ksi	Run Msg
0.00000601	4560.	759183196.	16.4692674	0.00009892	-0.000189	0.4515297	0.00000	0.00000	-4.530558	C
0.00001201	9089.	756616928.	16.5194733	0.0001984	-0.000378	0.8842905	0.00000	0.00000	-9.043626	C
0.00001802	13586.	754003712.	16.5705177	0.0002986	-0.000566	1.2979449	0.00000	0.00000	-13.538766	C
0.00002402	18051.	751342794.	16.6217445	0.0003993	-0.000754	1.6920788	0.00000	0.00000	-18.015998	C
0.00003003	22482.	748631949.	16.6740969	0.0005007	-0.000941	2.0663935	0.00000	0.00000	-22.474403	C
0.00003604	26879.	745869062.	16.7276268	0.0006028	-0.001127	2.4205265	0.00000	0.00000	-26.913341	C
0.00004204	31241.	743051873.	16.7823897	0.0007056	-0.001312	2.7540971	0.00000	0.00000	-31.332127	C
0.00004805	35565.	740177961.	16.8384453	0.0008091	-0.001497	3.0667042	0.00000	0.00000	-35.730035	C
0.00005406	39852.	737244729.	16.8958575	0.0009133	-0.001681	3.3579250	0.00000	0.00000	-40.106289	C
0.00006006	44101.	734249389.	16.9546953	0.0010183	-0.001865	3.6273127	0.00000	0.00000	-44.460059	C
0.00006607	48308.	731188911.	17.0150330	0.0011242	-0.002047	3.8743944	0.00000	0.00000	-48.790461	C
0.00007207	51435.	713640973.	16.9316549	0.0012203	-0.002239	4.0774628	0.00000	0.00000	-50.000000	CY
0.00007808	52943.	678049923.	16.6569658	0.0013006	-0.002447	4.2309924	0.00000	0.00000	-50.000000	CY
0.00008409	54216.	644759896.	16.3913011	0.0013783	-0.002658	4.3662763	0.00000	0.00000	-50.000000	CY
0.00009009	55309.	613911690.	16.1387406	0.0014540	-0.002870	4.4854285	0.00000	0.00000	-50.000000	CY
0.00009610	56253.	585357485.	15.8960406	0.0015276	-0.003085	4.5893533	0.00000	0.00000	-50.000000	CY
0.0001021	57077.	558998302.	15.6670853	0.0015997	-0.003301	4.6797558	0.00000	0.00000	-50.000000	CY
0.0001081	57803.	534661062.	15.4484957	0.0016702	-0.003519	4.7572337	0.00000	0.00000	-50.000000	CY
0.0001141	58447.	512158230.	15.2418646	0.0017394	-0.003738	4.8228751	0.00000	0.00000	-50.000000	CY
0.0001201	59022.	491338882.	15.0463716	0.0018074	-0.003959	4.8773429	0.00000	0.00000	-50.000000	CY
0.0001261	59536.	472022384.	14.8594540	0.0018742	-0.004180	4.9210785	0.00000	0.00000	-50.000000	CY
0.0001321	60002.	454086725.	14.6842895	0.0019403	-0.004402	4.9548994	0.00000	0.00000	-50.000000	CY
0.0001381	60421.	437376487.	14.5156317	0.0020052	-0.004626	4.9789499	0.00000	0.00000	-50.000000	CY
0.0001441	60801.	421792463.	14.3557517	0.0020694	-0.004850	4.9938204	0.00000	0.00000	-50.000000	CY

0.0001502	61152.	407258653.	14.2060505	0.0021331	-0.005074	4.9998425	0.00000	0.00000	-50.000000 CY
0.0001562	61467.	393612598.	14.0610209	0.0021958	-0.005300	4.9992656	0.00000	0.00000	-50.000000 CY
0.0001622	61755.	380810726.	13.9229703	0.0022579	-0.005526	4.9976564	0.00000	0.00000	-50.000000 CY
0.0001682	62022.	368794956.	13.7931403	0.0023196	-0.005753	4.9960417	0.00000	0.00000	-50.000000 CY
0.0001742	62268.	357492287.	13.6705624	0.0023811	-0.005980	4.9995324	0.00000	0.00000	-50.000000 CY
0.0001802	62491.	346810652.	13.5498912	0.0024415	-0.006207	4.9963972	0.00000	0.00000	-50.000000 CY
0.0001862	62698.	336738394.	13.4357722	0.0025016	-0.006436	4.9998997	0.00000	0.00000	-50.000000 CY
0.0001922	62892.	327225206.	13.3280248	0.0025616	-0.006664	4.9966378	0.00000	0.00000	-50.000000 CY
0.0001982	63073.	318221022.	13.2253781	0.0026213	-0.006893	4.9998679	0.00000	0.00000	-50.000000 CY
0.0002042	63238.	309667770.	13.1243877	0.0026801	-0.007122	4.9951170	0.00000	0.00000	-50.000000 CY
0.0002102	63392.	301555487.	13.0272070	0.0027385	-0.007352	4.9992256	0.00000	0.00000	-50.000000 CY
0.0002162	63539.	293856699.	12.9348029	0.0027968	-0.007582	4.9941105	0.00000	0.00000	-50.000000 CY
0.0002222	63675.	286525456.	12.8462455	0.0028548	-0.007812	4.9967070	0.00000	0.00000	-50.000000 CY
0.0002282	63806.	279560836.	12.7620423	0.0029128	-0.008043	4.9996436	0.00000	0.00000	-50.000000 CY
0.0002342	63927.	272908127.	12.6792608	0.0029700	-0.008274	4.9920906	0.00000	0.00000	-50.000000 CY
0.0002463	64146.	260486378.	12.5198612	0.0030831	-0.008737	4.9989503	0.00000	0.00000	-50.000000 CY

Summary of Results for Nominal Moment Capacity for Section 3

Load No.	Axial Thrust kips	Nominal Moment Capacity in-kips
1	0.00000000	64146.

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs

1	26.2300	0.00	N.A.	No	0.00	27217.
2	30.5300	4.5658	Yes	No	27217.	40326.
3	33.0300	6.8383	Yes	No	67544.	478973.
4	45.5300	13.5952	No	No	546517.	1204786.
5	65.5300	39.3000	No	No	1751303.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.8852	1.03E-06	-3.35E-08	-0.00645	0.00	6.90E+10	0.00	0.00	50.5091
0.6423	2.8355	1500.	431.0305	-0.00645	0.00	6.90E+10	0.00	0.00	61.3365
1.2846	2.7858	6644.	959.4226	-0.00645	0.00	6.90E+10	0.00	0.00	75.7729
1.9269	2.7361	16290.	1599.	-0.00645	0.00	6.90E+10	0.00	0.00	90.2094
2.5692	2.6864	31295.	2350.	-0.00645	0.00	6.90E+10	0.00	0.00	104.6458
3.2115	2.6367	52516.	2932.	-0.00644	0.00	6.90E+10	0.00	0.00	46.4007
3.8538	2.5871	76494.	3111.	-0.00644	27.7746	4.80E+11	0.00	0.00	0.00
4.4961	2.5375	100472.	3111.	-0.00644	36.4808	4.80E+11	0.00	0.00	0.00
5.1384	2.4879	124450.	3111.	-0.00643	45.1871	4.80E+11	0.00	0.00	0.00
5.7807	2.4383	148428.	3111.	-0.00643	53.8933	4.80E+11	0.00	0.00	0.00
6.4230	2.3887	172405.	3111.	-0.00643	62.5996	4.80E+11	0.00	0.00	0.00
7.0653	2.3392	196383.	3111.	-0.00643	71.3058	4.80E+11	0.00	0.00	0.00
7.7076	2.2896	220361.	3111.	-0.00642	80.0121	4.80E+11	0.00	0.00	0.00
8.3499	2.2402	244339.	3111.	-0.00642	88.7183	4.80E+11	0.00	0.00	0.00
8.9922	2.1907	268317.	3111.	-0.00642	97.4246	4.80E+11	0.00	0.00	0.00
9.6345	2.1413	292295.	3111.	-0.00641	106.1309	4.80E+11	0.00	0.00	0.00
10.2768	2.0919	316273.	3111.	-0.00641	114.8371	4.80E+11	0.00	0.00	0.00
10.9191	2.0425	340251.	3111.	-0.00640	123.5434	4.80E+11	0.00	0.00	0.00
11.5614	1.9932	364228.	3111.	-0.00640	132.2496	4.80E+11	0.00	0.00	0.00
12.2037	1.9439	388206.	3111.	-0.00639	140.9559	4.80E+11	0.00	0.00	0.00
12.8460	1.8947	412184.	3139.	-0.00638	149.6621	4.80E+11	0.00	0.00	7.2475
13.4883	1.8455	436593.	4277.	-0.00638	158.5247	4.80E+11	0.00	0.00	288.1271
14.1306	1.7964	478118.	6623.	-0.00637	173.6023	4.80E+11	0.00	0.00	320.6447

14.7729	1.7473	538692.	9220.	-0.00636	195.5964	4.80E+11	0.00	0.00	353.1624
15.4152	1.6983	620246.	12067.	-0.00635	225.2083	4.80E+11	0.00	0.00	385.6801
16.0575	1.6494	724712.	15165.	-0.00634	263.1395	4.80E+11	0.00	0.00	418.1977
16.6998	1.6006	854022.	18514.	-0.00633	310.0914	4.80E+11	0.00	0.00	450.7154
17.3421	1.5519	1010108.	22113.	-0.00631	366.7655	4.80E+11	0.00	0.00	483.2331
17.9844	1.5033	1194902.	25963.	-0.00630	433.8631	4.80E+11	0.00	0.00	515.7507
18.6267	1.4548	1410334.	30064.	-0.00627	512.0856	4.80E+11	0.00	0.00	548.2684
19.2690	1.4066	1658338.	34415.	-0.00625	602.1346	4.80E+11	0.00	0.00	580.7861
19.9113	1.3585	1940844.	39017.	-0.00622	704.7114	4.80E+11	0.00	0.00	613.3037
20.5536	1.3107	2259785.	43869.	-0.00619	820.5173	4.80E+11	0.00	0.00	645.8214
21.1959	1.2631	2617093.	48972.	-0.00615	950.2540	4.80E+11	0.00	0.00	678.3391
21.8382	1.2159	3014699.	54326.	-0.00610	1095.	4.80E+11	0.00	0.00	710.8567
22.4805	1.1690	3454534.	59930.	-0.00605	1254.	4.80E+11	0.00	0.00	743.3744
23.1228	1.1226	3938531.	65785.	-0.00599	1430.	4.80E+11	0.00	0.00	775.8921
23.7651	1.0767	4468622.	71891.	-0.00592	1623.	4.80E+11	0.00	0.00	808.4097
24.4074	1.0313	5046738.	78247.	-0.00585	1832.	4.80E+11	0.00	0.00	840.9274
25.0497	0.9865	5674811.	84854.	-0.00576	2060.	4.80E+11	0.00	0.00	873.4451
25.6920	0.9425	6354773.	91711.	-0.00566	2307.	4.80E+11	0.00	0.00	905.9627
26.3343	0.8992	7088556.	96363.	-0.00558	0.00	7.57E+11	-12.137	104.0278	313.2089
26.9766	0.8565	7840224.	97167.	-0.00550	0.00	7.57E+11	-92.474	832.1652	0.00
27.6189	0.8144	8586399.	96116.	-0.00542	0.00	7.57E+11	-180.073	1704.	0.00
28.2612	0.7730	9321876.	94375.	-0.00533	0.00	7.56E+11	-271.726	2709.	0.00
28.9035	0.7323	1.00E+07	91919.	-0.00523	0.00	7.56E+11	-365.607	3848.	0.00
29.5458	0.6924	1.07E+07	88744.	-0.00512	0.00	7.55E+11	-458.309	5102.	0.00
30.1881	0.6533	1.14E+07	84869.	-0.00501	0.00	7.55E+11	-547.095	6454.	0.00
30.8304	0.6152	1.20E+07	80508.	-0.00489	0.00	7.55E+11	-584.509	7323.	0.00
31.4727	0.5780	1.27E+07	75759.	-0.00476	0.00	7.54E+11	-647.944	8641.	0.00
32.1150	0.5417	1.32E+07	70548.	-0.00463	0.00	7.54E+11	-704.047	10017.	0.00
32.7573	0.5066	1.37E+07	64916.	-0.00449	0.00	7.54E+11	-757.516	11526.	0.00
33.3996	0.4725	1.42E+07	58763.	-0.00435	0.00	7.54E+11	-839.021	13687.	0.00
34.0419	0.4395	1.46E+07	52146.	-0.00420	0.00	7.53E+11	-878.078	15399.	0.00
34.6842	0.4077	1.50E+07	45245.	-0.00405	0.00	7.53E+11	-912.430	17250.	0.00
35.3265	0.3771	1.53E+07	38116.	-0.00390	0.00	7.53E+11	-937.465	19163.	0.00
35.9688	0.3476	1.56E+07	30842.	-0.00374	0.00	7.53E+11	-950.096	21065.	0.00
36.6111	0.3194	1.58E+07	23499.	-0.00358	0.00	7.52E+11	-955.286	23049.	0.00
37.2534	0.2925	1.60E+07	16157.	-0.00341	0.00	7.52E+11	-949.923	25031.	0.00
37.8957	0.2668	1.61E+07	8910.	-0.00325	0.00	7.52E+11	-930.404	26876.	0.00
38.5380	0.2424	1.61E+07	1818.	-0.00308	0.00	7.52E+11	-910.042	28935.	0.00
39.1803	0.2193	1.61E+07	-5114.	-0.00292	0.00	7.52E+11	-888.632	31236.	0.00
39.8226	0.1974	1.60E+07	-11834.	-0.00276	0.00	7.52E+11	-855.001	33383.	0.00
40.4649	0.1768	1.59E+07	-18248.	-0.00259	0.00	7.52E+11	-809.421	35286.	0.00
41.1072	0.1575	1.57E+07	-24268.	-0.00243	0.00	7.53E+11	-752.559	36838.	0.00
41.7495	0.1394	1.55E+07	-29810.	-0.00227	0.00	7.53E+11	-685.537	37916.	0.00
42.3918	0.1225	1.53E+07	-34876.	-0.00211	0.00	7.53E+11	-629.128	39591.	0.00
43.0341	0.1068	1.50E+07	-39648.	-0.00196	0.00	7.53E+11	-609.012	43949.	0.00
43.6764	0.09232	1.47E+07	-44244.	-0.00180	0.00	7.53E+11	-583.732	48734.	0.00
44.3187	0.07899	1.43E+07	-48627.	-0.00166	0.00	7.53E+11	-553.495	54008.	0.00
44.9610	0.06679	1.39E+07	-52759.	-0.00151	0.00	7.54E+11	-518.584	59845.	0.00
45.6033	0.05569	1.35E+07	-58029.	-0.00137	0.00	7.54E+11	-849.057	117519.	0.00
46.2456	0.04565	1.30E+07	-64474.	-0.00124	0.00	7.54E+11	-823.313	139018.	0.00
46.8879	0.03663	1.25E+07	-70707.	-0.00111	0.00	7.54E+11	-793.862	167024.	0.00
47.5302	0.02861	1.19E+07	-76695.	-9.81E-04	0.00	7.55E+11	-759.986	204769.	0.00
48.1725	0.02152	1.13E+07	-82400.	-8.62E-04	0.00	7.55E+11	-720.563	258095.	0.00

48.8148	0.01532	1.07E+07	-87774.	-7.50E-04	0.00	7.55E+11	-673.668	338885.	0.00
49.4571	0.00996	9974947.	-92742.	-6.44E-04	0.00	7.56E+11	-615.551	476130.	0.00
50.0994	0.00539	9241846.	-97184.	-5.46E-04	0.00	7.56E+11	-537.054	767817.	0.00
50.7417	0.00154	8476839.	-100794.	-4.56E-04	0.00	7.57E+11	-399.839	1996667.	0.00
51.3840	-0.00164	7688079.	-100749.	-3.74E-04	0.00	7.57E+11	411.5319	1935539.	0.00
52.0263	-0.00422	6923767.	-97120.	-2.99E-04	0.00	7.57E+11	530.1412	968788.	0.00
52.6686	-0.00625	6190949.	-92786.	-2.33E-04	0.00	7.58E+11	594.4687	732676.	0.00
53.3109	-0.00780	5493447.	-88036.	-1.73E-04	0.00	7.58E+11	638.2695	630361.	0.00
53.9532	-0.00892	4833863.	-82993.	-1.21E-04	0.00	7.59E+11	670.3082	578906.	0.00
54.5955	-0.00967	4214099.	-77734.	-7.49E-05	0.00	7.59E+11	694.2944	553604.	0.00
55.2378	-0.01008	3635582.	-72314.	-3.50E-05	0.00	7.59E+11	712.1542	544627.	0.00
55.8801	-0.01021	3099372.	-66775.	-8.21E-07	0.00	7.59E+11	725.0036	547522.	0.00
56.5224	-0.01009	2606232.	-61154.	2.81E-05	0.00	7.59E+11	733.5277	560269.	0.00
57.1647	-0.00977	2156668.	-55483.	5.23E-05	0.00	7.59E+11	738.1510	582197.	0.00
57.8070	-0.00928	1750957.	-49789.	7.22E-05	0.00	7.59E+11	739.1188	613579.	0.00
58.4493	-0.00866	1389154.	-44103.	8.81E-05	0.00	7.59E+11	736.5350	655537.	0.00
59.0916	-0.00793	1071106.	-38449.	1.01E-04	0.00	7.59E+11	730.3720	710194.	0.00
59.7339	-0.00711	796448.	-32858.	1.10E-04	0.00	7.59E+11	720.4572	781077.	0.00
60.3762	-0.00623	564590.	-27359.	1.17E-04	0.00	7.59E+11	706.4298	873989.	0.00
61.0185	-0.00531	374699.	-21987.	1.22E-04	0.00	7.59E+11	687.6501	998850.	0.00
61.6608	-0.00435	225659.	-16782.	1.25E-04	0.00	7.59E+11	663.0132	1173894.	0.00
62.3031	-0.00338	116007.	-11797.	1.27E-04	0.00	7.59E+11	630.5325	1436741.	0.00
62.9454	-0.00240	43813.	-7107.	1.27E-04	0.00	7.59E+11	586.2518	1880516.	0.00
63.5877	-0.00142	6447.	-2842.	1.28E-04	0.00	7.59E+11	520.4676	2825665.	0.00
64.2300	-4.36E-04	0.00	0.00	1.28E-04	0.00	7.59E+11	217.0420	1918349.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     2.88524782 inches
Computed slope at pile head      =     -0.0064507 radians
Maximum bending moment           =      16106622. inch-lbs
Maximum shear force              =       -100794. lbs
Depth of maximum bending moment  =    38.53800000 feet below pile head
Depth of maximum shear force     =    50.74170000 feet below pile head
Number of iterations             =             23
Number of zero deflection points =              2
Pile deflection at ground        =     0.90624618 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
64.23000	2.88524782	16106622.	-100794.
61.01850	2.96872165	15996160.	-107579.
57.80700	3.43105085	15619069.	-116771.
54.59550	4.71821944	14947938.	-122367.
51.38400	8.37401194	14241181.	-129325.
48.17250	50.08242515	14210527.	-181389.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	5.5301	-3.10E-06	0.00	-0.01178	0.00	6.90E+10	0.00	0.00	87.4188
0.6423	5.4393	2597.	736.4375	-0.01178	0.00	6.90E+10	0.00	0.00	103.6751
1.2846	5.3485	11352.	1619.	-0.01178	0.00	6.90E+10	0.00	0.00	125.3502
1.9269	5.2577	27555.	2669.	-0.01178	0.00	6.90E+10	0.00	0.00	147.0252
2.5692	5.1669	52491.	3885.	-0.01177	0.00	6.90E+10	0.00	0.00	168.7003
3.2115	5.0762	87450.	4822.	-0.01177	0.00	6.90E+10	0.00	0.00	74.3493
3.8538	4.9856	126826.	5109.	-0.01176	46.0498	4.80E+11	0.00	0.00	0.00
4.4961	4.8949	166201.	5109.	-0.01176	60.3469	4.80E+11	0.00	0.00	0.00
5.1384	4.8043	205577.	5109.	-0.01175	74.6440	4.80E+11	0.00	0.00	0.00
5.7807	4.7137	244952.	5109.	-0.01175	88.9411	4.80E+11	0.00	0.00	0.00
6.4230	4.6232	284328.	5109.	-0.01175	103.2382	4.80E+11	0.00	0.00	0.00
7.0653	4.5326	323704.	5109.	-0.01174	117.5352	4.80E+11	0.00	0.00	0.00
7.7076	4.4422	363079.	5109.	-0.01174	131.8323	4.80E+11	0.00	0.00	0.00
8.3499	4.3517	402455.	5109.	-0.01173	146.1294	4.80E+11	0.00	0.00	0.00
8.9922	4.2613	441830.	5109.	-0.01172	160.4265	4.80E+11	0.00	0.00	0.00
9.6345	4.1710	481206.	5109.	-0.01172	174.7236	4.80E+11	0.00	0.00	0.00
10.2768	4.0807	520582.	5109.	-0.01171	189.0207	4.80E+11	0.00	0.00	0.00
10.9191	3.9905	559957.	5109.	-0.01170	203.3178	4.80E+11	0.00	0.00	0.00
11.5614	3.9004	599333.	5109.	-0.01169	217.6149	4.80E+11	0.00	0.00	0.00
12.2037	3.8103	638708.	5109.	-0.01168	231.9119	4.80E+11	0.00	0.00	0.00

12.8460	3.7203	678084.	5153.	-0.01167	246.2090	4.80E+11	0.00	0.00	11.5362
13.4883	3.6304	718145.	6959.	-0.01166	260.7550	4.80E+11	0.00	0.00	457.0880
14.1306	3.5406	785360.	10670.	-0.01165	285.1605	4.80E+11	0.00	0.00	505.8596
14.7729	3.4509	882627.	14757.	-0.01163	320.4776	4.80E+11	0.00	0.00	554.6312
15.4152	3.3613	1012843.	19220.	-0.01162	367.7584	4.80E+11	0.00	0.00	603.4028
16.0575	3.2718	1178905.	24059.	-0.01160	428.0548	4.80E+11	0.00	0.00	652.1744
16.6998	3.1825	1383711.	29273.	-0.01158	502.4189	4.80E+11	0.00	0.00	700.9460
17.3421	3.0933	1630158.	34864.	-0.01156	591.9027	4.80E+11	0.00	0.00	749.7176
17.9844	3.0043	1921144.	40830.	-0.01153	697.5583	4.80E+11	0.00	0.00	798.4891
18.6267	2.9156	2259566.	47173.	-0.01149	820.4376	4.80E+11	0.00	0.00	847.2607
19.2690	2.8272	2648321.	53891.	-0.01145	961.5927	4.80E+11	0.00	0.00	896.0323
19.9113	2.7390	3090306.	60985.	-0.01141	1122.	4.80E+11	0.00	0.00	944.8039
20.5536	2.6513	3588420.	68455.	-0.01135	1303.	4.80E+11	0.00	0.00	993.5755
21.1959	2.5640	4145559.	76301.	-0.01129	1505.	4.80E+11	0.00	0.00	1042.
21.8382	2.4772	4764621.	84523.	-0.01122	1730.	4.80E+11	0.00	0.00	1091.
22.4805	2.3910	5448504.	93121.	-0.01114	1978.	4.80E+11	0.00	0.00	1140.
23.1228	2.3055	6200103.	102095.	-0.01105	2251.	4.80E+11	0.00	0.00	1189.
23.7651	2.2208	7022318.	111445.	-0.01094	2550.	4.80E+11	0.00	0.00	1237.
24.4074	2.1369	7918045.	121170.	-0.01082	2875.	4.80E+11	0.00	0.00	1286.
25.0497	2.0540	8890182.	131272.	-0.01068	3228.	4.80E+11	0.00	0.00	1335.
25.6920	1.9722	9941626.	141749.	-0.01053	3610.	4.80E+11	0.00	0.00	1384.
26.3343	1.8916	1.11E+07	148865.	-0.01040	0.00	7.55E+11	-15.567	63.4297	478.1865
26.9766	1.8119	1.22E+07	150181.	-0.01028	0.00	7.55E+11	-121.032	514.8419	0.00
27.6189	1.7332	1.34E+07	148802.	-0.01015	0.00	7.54E+11	-236.717	1053.	0.00
28.2612	1.6555	1.45E+07	146511.	-0.01000	0.00	7.53E+11	-357.820	1666.	0.00
28.9035	1.5790	1.56E+07	143282.	-0.00985	0.00	7.53E+11	-480.103	2344.	0.00
29.5458	1.5037	1.67E+07	139117.	-0.00968	0.00	7.52E+11	-600.610	3079.	0.00
30.1881	1.4297	1.78E+07	134043.	-0.00951	0.00	7.51E+11	-716.126	3861.	0.00
30.8304	1.3572	1.88E+07	128334.	-0.00932	0.00	7.51E+11	-765.191	4346.	0.00
31.4727	1.2861	1.98E+07	122117.	-0.00912	0.00	7.50E+11	-848.152	5083.	0.00
32.1150	1.2166	2.07E+07	115292.	-0.00891	0.00	7.50E+11	-922.614	5845.	0.00
32.7573	1.1487	2.15E+07	107902.	-0.00870	0.00	7.49E+11	-995.174	6677.	0.00
33.3996	1.0825	2.24E+07	99810.	-0.00847	0.00	7.49E+11	-1105.	7864.	0.00
34.0419	1.0181	2.31E+07	91074.	-0.00824	0.00	7.48E+11	-1162.	8798.	0.00
34.6842	0.9556	2.38E+07	81916.	-0.00799	0.00	7.48E+11	-1214.	9792.	0.00
35.3265	0.8949	2.44E+07	72400.	-0.00775	0.00	7.47E+11	-1255.	10812.	0.00
35.9688	0.8362	2.49E+07	62618.	-0.00749	0.00	7.47E+11	-1283.	11826.	0.00
36.6111	0.7794	2.53E+07	52628.	-0.00723	0.00	7.47E+11	-1309.	12945.	0.00
37.2534	0.7247	2.57E+07	42470.	-0.00697	0.00	7.47E+11	-1327.	14113.	0.00
37.8957	0.6720	2.60E+07	32237.	-0.00670	0.00	7.46E+11	-1328.	15238.	0.00
38.5380	0.6213	2.62E+07	21981.	-0.00643	0.00	7.46E+11	-1333.	16531.	0.00
39.1803	0.5728	2.63E+07	11687.	-0.00616	0.00	7.46E+11	-1339.	18012.	0.00
39.8226	0.5263	2.64E+07	1405.	-0.00589	0.00	7.46E+11	-1329.	19467.	0.00
40.4649	0.4820	2.63E+07	-8744.	-0.00562	0.00	7.46E+11	-1304.	20857.	0.00
41.1072	0.4397	2.62E+07	-18636.	-0.00535	0.00	7.46E+11	-1263.	22132.	0.00
41.7495	0.3995	2.60E+07	-28144.	-0.00508	0.00	7.46E+11	-1204.	23235.	0.00
42.3918	0.3614	2.58E+07	-37234.	-0.00481	0.00	7.46E+11	-1154.	24615.	0.00
43.0341	0.3254	2.55E+07	-46104.	-0.00455	0.00	7.47E+11	-1147.	27173.	0.00
43.6764	0.2914	2.51E+07	-54887.	-0.00428	0.00	7.47E+11	-1132.	29942.	0.00
44.3187	0.2594	2.46E+07	-63521.	-0.00403	0.00	7.47E+11	-1108.	32939.	0.00
44.9610	0.2293	2.41E+07	-71941.	-0.00378	0.00	7.47E+11	-1076.	36186.	0.00
45.6033	0.2011	2.35E+07	-80600.	-0.00353	0.00	7.48E+11	-1170.	44851.	0.00
46.2456	0.1749	2.29E+07	-89550.	-0.00329	0.00	7.48E+11	-1152.	50769.	0.00

46.8879	0.1504	2.21E+07	-98343.	-0.00306	0.00	7.49E+11	-1130.	57910.	0.00
47.5302	0.1277	2.13E+07	-106954.	-0.00284	0.00	7.49E+11	-1105.	66680.	0.00
48.1725	0.1067	2.05E+07	-115354.	-0.00262	0.00	7.50E+11	-1075.	77689.	0.00
48.8148	0.08726	1.96E+07	-123507.	-0.00242	0.00	7.50E+11	-1041.	91913.	0.00
49.4571	0.06941	1.86E+07	-131370.	-0.00222	0.00	7.51E+11	-999.784	111024.	0.00
50.0994	0.05303	1.75E+07	-138886.	-0.00204	0.00	7.52E+11	-950.726	138184.	0.00
50.7417	0.03804	1.64E+07	-145979.	-0.00186	0.00	7.52E+11	-889.667	180277.	0.00
51.3840	0.02434	1.53E+07	-152525.	-0.00170	0.00	7.53E+11	-808.912	256116.	0.00
52.0263	0.01186	1.41E+07	-158289.	-0.00155	0.00	7.54E+11	-686.763	446450.	0.00
52.6686	4.80E-04	1.28E+07	-161653.	-0.00141	0.00	7.54E+11	-186.090	2988397.	0.00
53.3109	-0.00988	1.16E+07	-159760.	-0.00129	0.00	7.55E+11	677.2762	528114.	0.00
53.9532	-0.01934	1.04E+07	-154015.	-0.00117	0.00	7.56E+11	813.4096	324229.	0.00
54.5955	-0.02797	9223107.	-147390.	-0.00107	0.00	7.57E+11	905.6991	249565.	0.00
55.2378	-0.03588	8113987.	-140129.	-9.85E-04	0.00	7.57E+11	978.3996	210159.	0.00
55.8801	-0.04316	7062991.	-132351.	-9.08E-04	0.00	7.57E+11	1040.	185704.	0.00
56.5224	-0.04988	6073766.	-124128.	-8.41E-04	0.00	7.58E+11	1094.	169038.	0.00
57.1647	-0.05612	5149526.	-115509.	-7.84E-04	0.00	7.59E+11	1143.	156956.	0.00
57.8070	-0.06196	4293179.	-106525.	-7.36E-04	0.00	7.59E+11	1188.	147793.	0.00
58.4493	-0.06747	3507415.	-97204.	-6.96E-04	0.00	7.59E+11	1231.	140595.	0.00
59.0916	-0.07270	2794761.	-87562.	-6.64E-04	0.00	7.59E+11	1271.	134774.	0.00
59.7339	-0.07771	2157624.	-77614.	-6.39E-04	0.00	7.59E+11	1310.	129947.	0.00
60.3762	-0.08255	1598319.	-67371.	-6.20E-04	0.00	7.59E+11	1348.	125856.	0.00
61.0185	-0.08727	1119094.	-56838.	-6.06E-04	0.00	7.59E+11	1385.	122318.	0.00
61.6608	-0.09190	722145.	-46023.	-5.97E-04	0.00	7.59E+11	1421.	119206.	0.00
62.3031	-0.09647	409633.	-34930.	-5.91E-04	0.00	7.59E+11	1457.	116427.	0.00
62.9454	-0.101	183695.	-23560.	-5.88E-04	0.00	7.59E+11	1493.	113913.	0.00
63.5877	-0.106	46448.	-11916.	-5.87E-04	0.00	7.59E+11	1528.	111616.	0.00
64.2300	-0.110	0.00	0.00	-5.87E-04	0.00	7.59E+11	1564.	54752.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     5.53011471 inches
Computed slope at pile head      =     -0.0117814 radians
Maximum bending moment           =      26359373. inch-lbs
Maximum shear force              =       -161653. lbs
Depth of maximum bending moment  =    39.82260000 feet below pile head
Depth of maximum shear force     =    52.66860000 feet below pile head
Number of iterations             =             34
Number of zero deflection points =              1
Pile deflection at ground        =     1.90472869 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear   =   0. lbs
Moment   =   0. in-lbs
Axial Load =   0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
64.23000	5.53011471	26359373.	-161653.
61.01850	6.26952161	25638186.	-172816.
57.80700	8.48681503	24915038.	-185337.
54.59550	20.75348613	24817845.	-218121.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	2.8852	-0.00645	-100794.	1.61E+07
2	V, lb	0.00	M, in-lb	0.00	0.00	5.5301	-0.01178	-161653.	2.64E+07

Maximum pile-head deflection = 5.5301147104 inches
Maximum pile-head rotation   = -0.0117814154 radians = -0.675025 deg.

No error or warning messages were generated by this analysis.

The analysis ended normally.

TEMPORARY WOOD LAGGING:

MAXIMUM LOAD (MOMENT & SHEAR) CASE

Project: **CUY-77-11.41: Reconstruction of I-77**
Subject: **Design of Temp. Wood Lagging for Soldier Pile Walls**
Designer: DA Date 6/20/26
Checker: CEJ Date 6/22/26

Lateral earth poressures are based on soil having unit weight of 120 pcf and friction angle of 30 deg for all wall, accoringly, design of temporary timber lagging is performed based on maximum retained height, and max. pile spacing of all soldier pile Walls

Design calculations are in accordance with ODOT BDM 307.6.3, FHWA-RD-75-128 and requirements of AASHTO LRFD.

Design is performed considering two cases:

1) lateral pressure reduction due to soil srching (Armento, 1972, also in FHWA-RD-75-128): soil pressure reduction=50%, and

2) ignoring soil arching

Worst Case:	Wall #	1A	Worst case (Max. height and spacing)		
Geometry Input:	Soldier pile spacing, S (ft)	7.5	AASHTO soil-structure geometry		
	Clear distance between solider piles, Lc(ft)	6.8	L = S-b_{flange}; flange width = 0.96 ft, however, L was taken as = S-0.7 ft (to account for other walls/sections with smaller flanges).		
	Width of Tember Laggding, L (ft)	7.05	=Lc+Lb/12	Min. bearing length on SP flange, Lb (in)=	3
	Retained height, H (ft)	21.56			
Soil Input:	Soil unit weight, γ (pcf)	120			
	Soil friction angle, ϕ (deg)	30			

Lagging:	Material	**Souther Pine G-1**		AASHTO LRFD 8.4.4	
	Reference Design Bending, Fbo (ksi)	1.5		Format Conversion Factor Bend, C_{KFb}	2.94
	Reference Design Shear, Fvo (ksi)	0.175		Format Conversion Factor Shear, C_{KFv}	3.33
	Reference Elastic Modulus, Eo (ksi)	1600		Wet Service Factor, CM	1.00
	Adjusted Design Bending, Fb (ksi)	**3.528**	AASHTO Eq. 8.4.4.1-1	Size Factor, CF	1.00
	Adjusted Design Shear, Fv (ksi)	**0.466**	AASHTO Eq. 8.4.4.1-2	Flat-Use Factor, Cfu	1.00
	Flexure Resistance factor ϕ	0.85	AASHTO 8.5.2.2	Incising Factor Force Effects, Ci	0.80
	Shear Resistance factor ϕ	0.75	AASHTO 8.5.2.2	Deck Factor, Cd	1.00
Design:	Lagging thickness, t (in)	4	Nominal	Time Effect Factor, Cλ	1.00
	Lagging thickness, t (in)	**3.5**	Net thickness	Beam Stability Factor, CL	1.00
	Lagging tributary width, b (in)	**3.5**	Net width		
	Section Modulus, S (in3/ft)	7.15	b* t^2/6 (in3 per foot of height)		
	Factored moment resistance, fbMn = $\phi_b F_b S C_L$ (k.in)	21.43			
	Max. moment capacity, Mm (k.ft)	1.79	Unit coversion (/12)		

Project: **CUY-77-11.41: Reconstruction of I-77**
Subject: **Design of Temp. Wood Lagging for Soldier Pile Walls**
Designer: DA Date 6/20/26
Checker: CEJ Date 6/22/26

CALCULATIONS **Considering Pressure reduction due to soil arching:** **Reduce lateral earth pressure by** **50%**

Moment/Section modlus

Active earth pressure Ka=	0.333	AASHTO 3.11.5.3
Max lateral pressure, Pm (psf)=	862.40	σh = Ka γ H
Load factor for EH, ϕ_{EH}=	1.50	
Reduction factor for Soil Arching, ϕsa=	0.50	[Armento (1972) & FHWA-RD-75-128]
Service Uniform load, w (lb/ft)=	125.77	= Pm*b* ϕ_{sa}
Factored Uniform load, ϕ_{EH} w (lb/ft)=	188.65	
Factored Max. Moment, Mu (lb-ft)	937.64	Mu= 0.8 ϕ_{EH}w L^2/8 (Simply suppoerted)
Factored Max. Moment, Mu (k-in)	11.25	Unit conversion (x 12 /1000)
Required Min. section modulus Sreq (in^3)	3.19	
Min. Required thickness, inch=	2.34	= SQRT(6 S/b) **< design thickness of 3.5 inches (Safe)**
Assumed lagging S (3.5in), (in^3)=	7.15	

Shear Resistance

Factored Max. Shear force, ϕV (k)=	1.00	= ϕ Wu L/2
Nominal Shear resistance, Vn (lb)	4.08	= $F_v$bd/1.4
Factored Shear resistance, ϕ Vn (lb)	3.06	= $\phi_v F_v$bd/1.4
Shear OK?	**OK, Safe**	
Shear Capacity/ Demand Ratio (CDR)	3.07	

Max. deflection, δm:

Uniform load, w (lb/in)=	10.481	= 125.767 / 12
L (in)=	84.6	= 7.05 *12
E (psi)=	1600000	
I, in4=	12.50520833	= b t^3/12
δm=	**0.35**	**inch**

$$\delta_m = \frac{5\ w\ L^4}{384\ E\ I}$$

Project: **CUY-77-11.41: Reconstruction of I-77**
Subject: **Design of Temp. Wood Lagging for Soldier Pile Walls**
Designer: DA Date 6/20/26
Checker: CEJ Date 6/22/26

CALCULATIONS **Ignoring soil arching effects (Full Soil Pressure)**

Moment/Section modlus

Active earth pressure Ka=	0.333	AASHTO 3.11.5.3	
Max lateral pressure, Pm (psf)=	862.40	σh = Ka γ H	
Load factor for EH, ϕ_{EH}=	1.50		
Reduction factor for Soil Arching, ϕsa=	1.00	Ignoring soil arching	
Service Uniform load, w (lb/ft)=	251.5	= Pm*b* ϕ_{sa}	
Factored Uniform load, ϕ_{EH} w (lb/ft)=	377.3		
Factored Max. Moment, Mu (lb-ft)	1875.27	Mu= 0.8 ϕ_{EH}w L^2/8	(Simply suppoerted)
Factored Max. Moment, Mu (k-in)	22.50	Unit conversion (x 12 /1000)	
Required Min. section modulus Sreq (in^3)	6.38		
Min. Required thickness, inch=	3.31	= SQRT(6 S/b)	**< design thickness of 3.5 inches (Safe)**
Lagging S (84.6in), (in^3)=	7.15		

Shear Resistance

Factored Max. Shear force, ϕV (k)=	1.99	= ϕ Wu L/2
Nominal Shear resistance, Vn (lb)	4.08	= $F_v$bd/1.4
Factored Shear resistance, ϕ Vn (lb)	3.06	= $\phi_v F_v$bd/1.4
Shear OK?	**OK, Safe**	
Shear Capacity/ Demand Ratio (CDR)	1.53	

Max. deflection, δm:

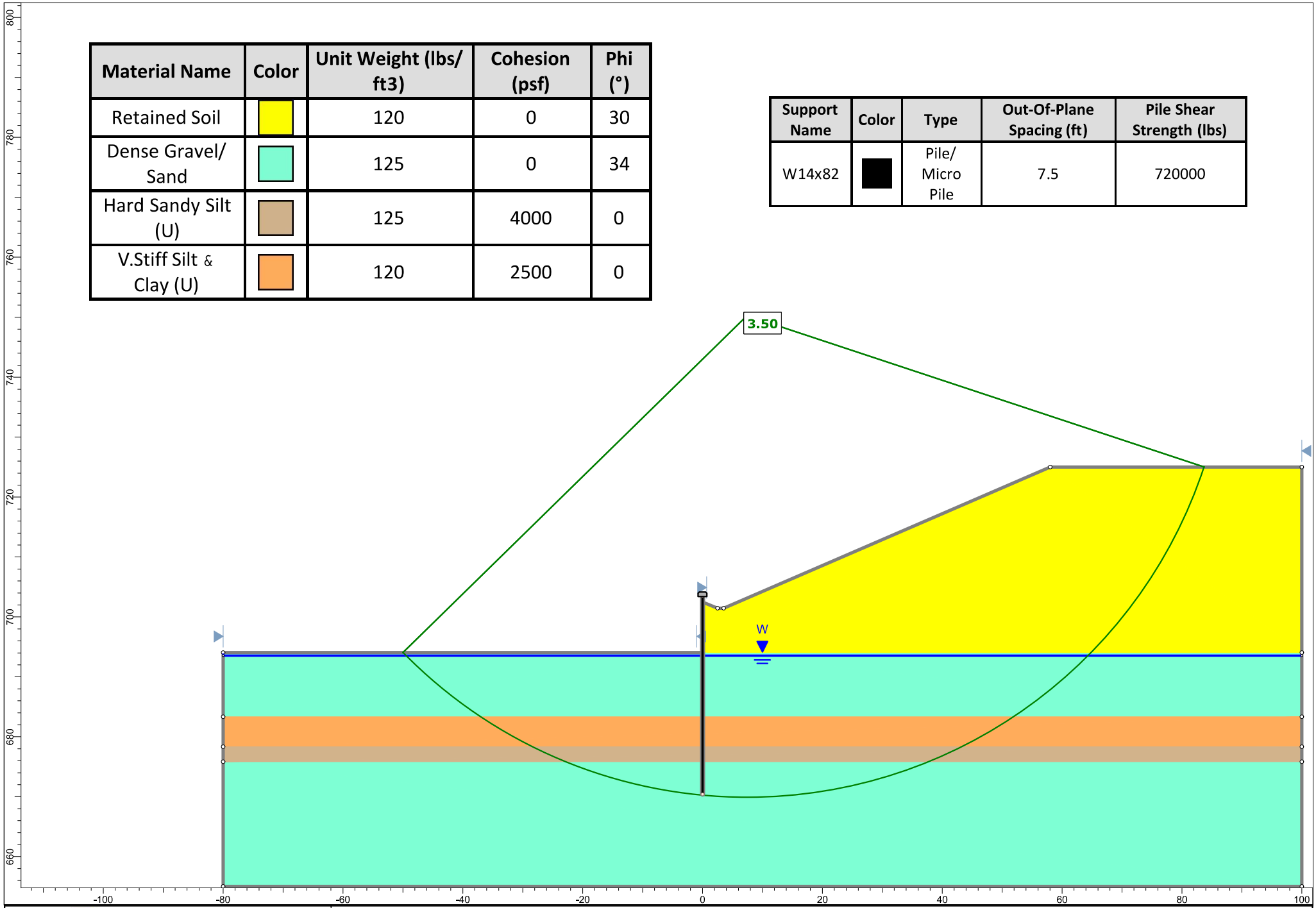
Uniform load, w (lb/in)=	20.961	= 251.533 / 12
L (in)=	84.6	= 11.2516817715 *12
E (psi)=	1600000	
I, in4=	12.50521	= b t^3/12
δm=	**0.70**	**inch**

$$\delta_m = \frac{5\,w\,L^4}{384\,E\,I}$$

APPENDIX G
GLOBAL STABILITY OF SOLDIER PILE WALLS

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Gravel/ Sand		125	0	34
Hard Sandy Silt (U)		125	4000	0
V.Stiff Silt & Clay (U)		120	2500	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W14x82		Pile/ Micro Pile	7.5	720000



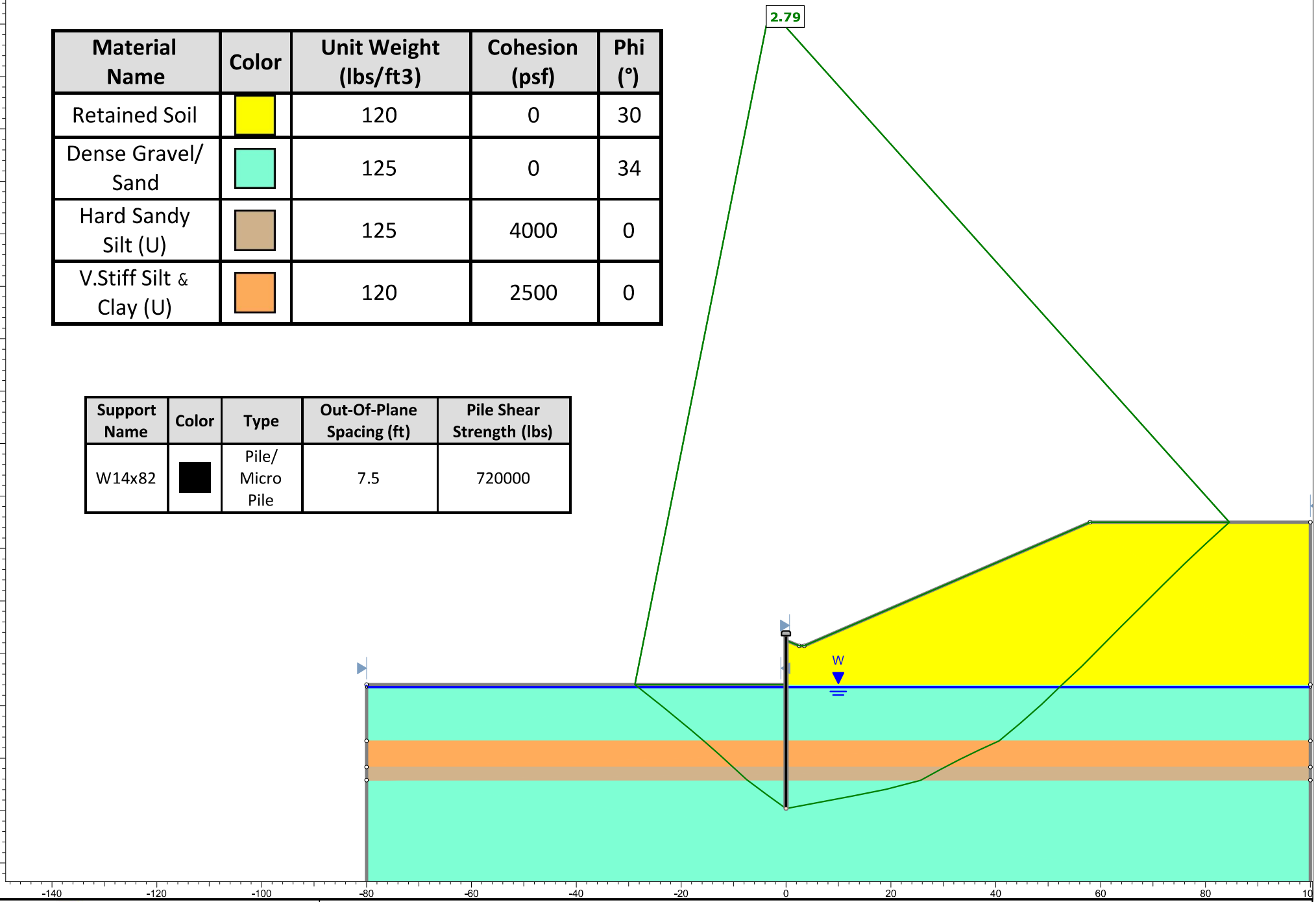
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 12.92 (B-041-0-20)- Total Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Gravel/ Sand		125	0	34
Hard Sandy Silt (U)		125	4000	0
V.Stiff Silt & Clay (U)		120	2500	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W14x82		Pile/ Micro Pile	7.5	720000



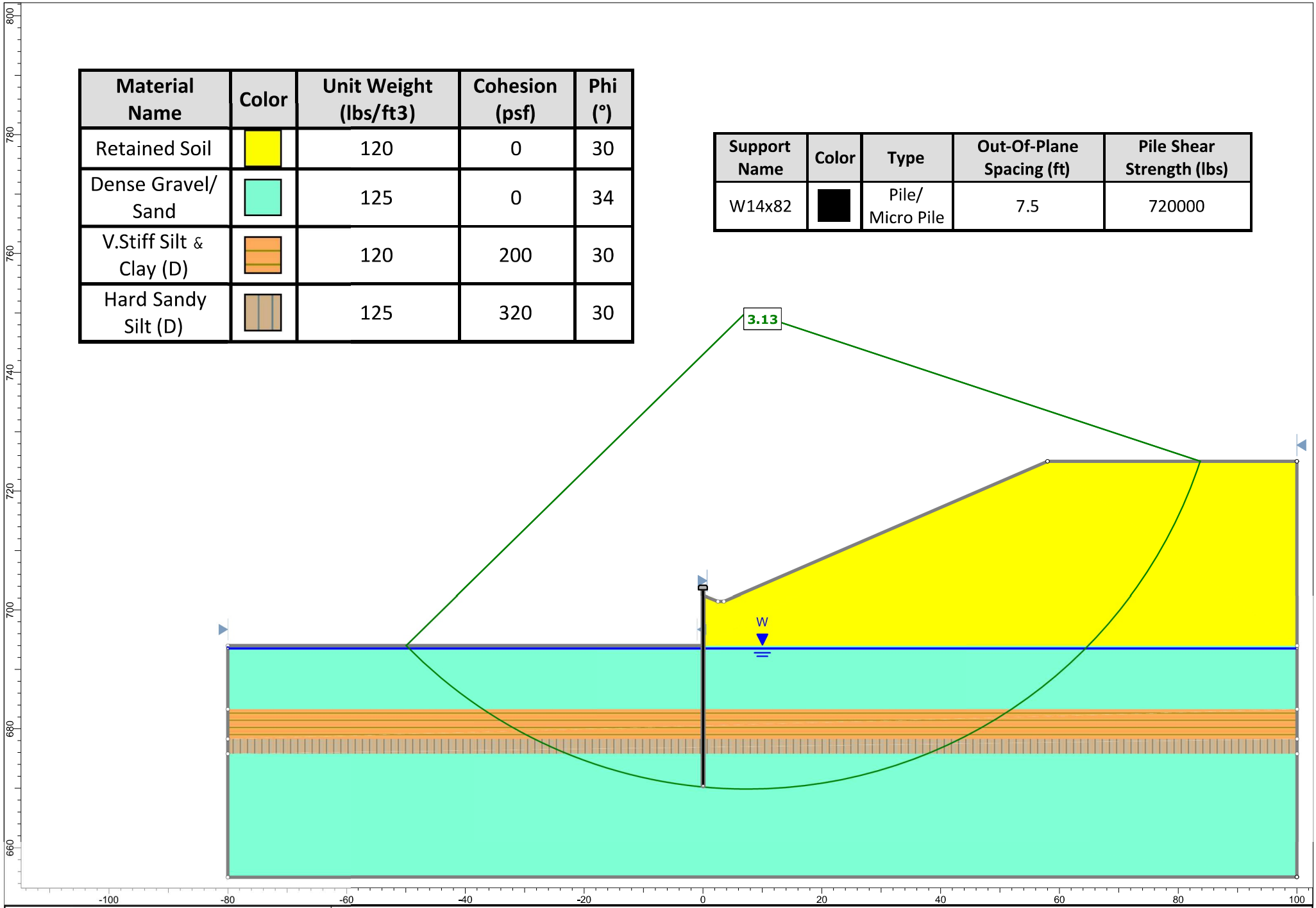
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 12.92 (B-041-0-20)- Total Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Gravel/ Sand		125	0	34
V.Stiff Silt & Clay (D)		120	200	30
Hard Sandy Silt (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W14x82		Pile/ Micro Pile	7.5	720000



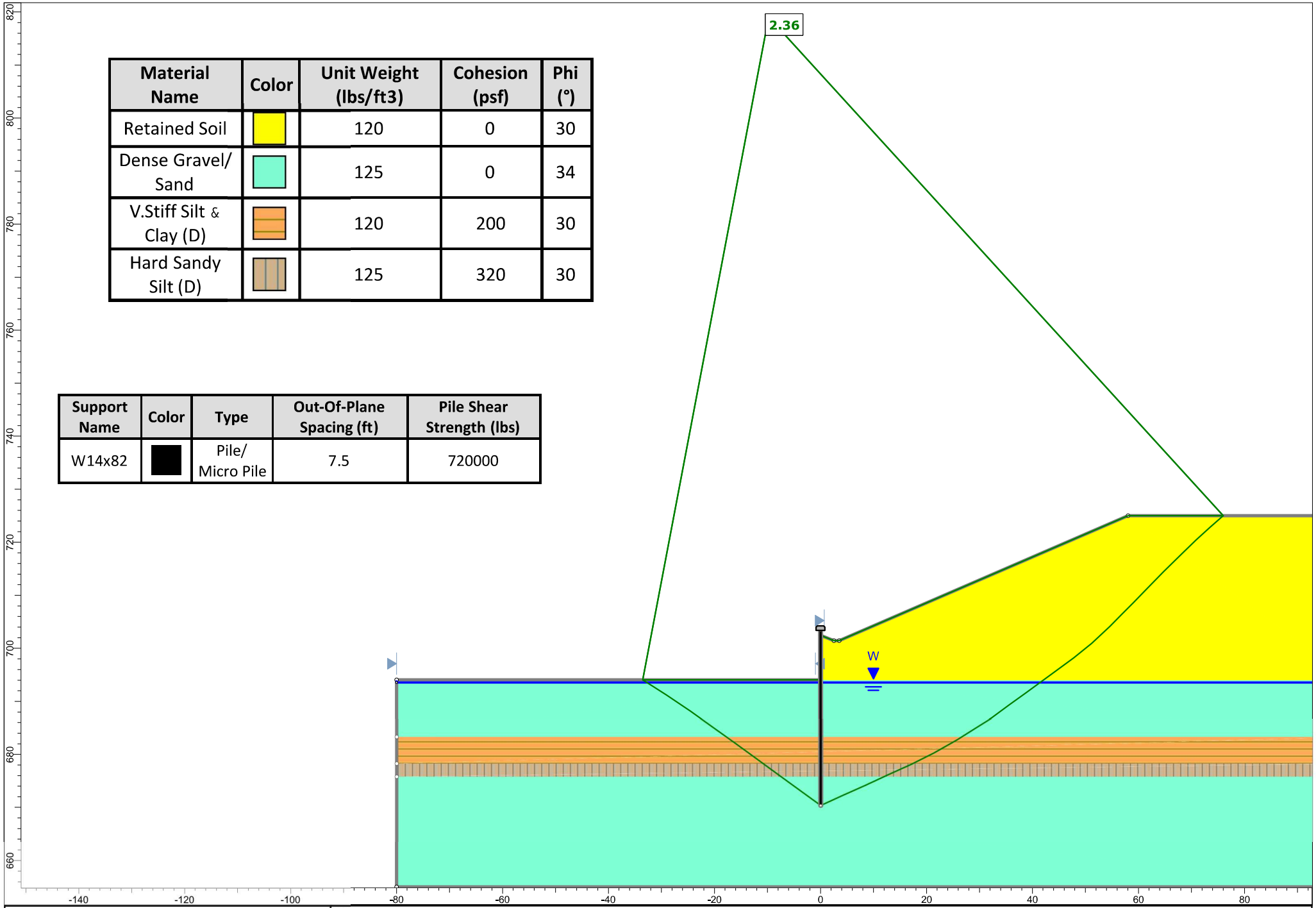
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 12.92 (B-041-0-20)- Effective Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Gravel/ Sand		125	0	34
V.Stiff Silt & Clay (D)		120	200	30
Hard Sandy Silt (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W14x82		Pile/ Micro Pile	7.5	720000



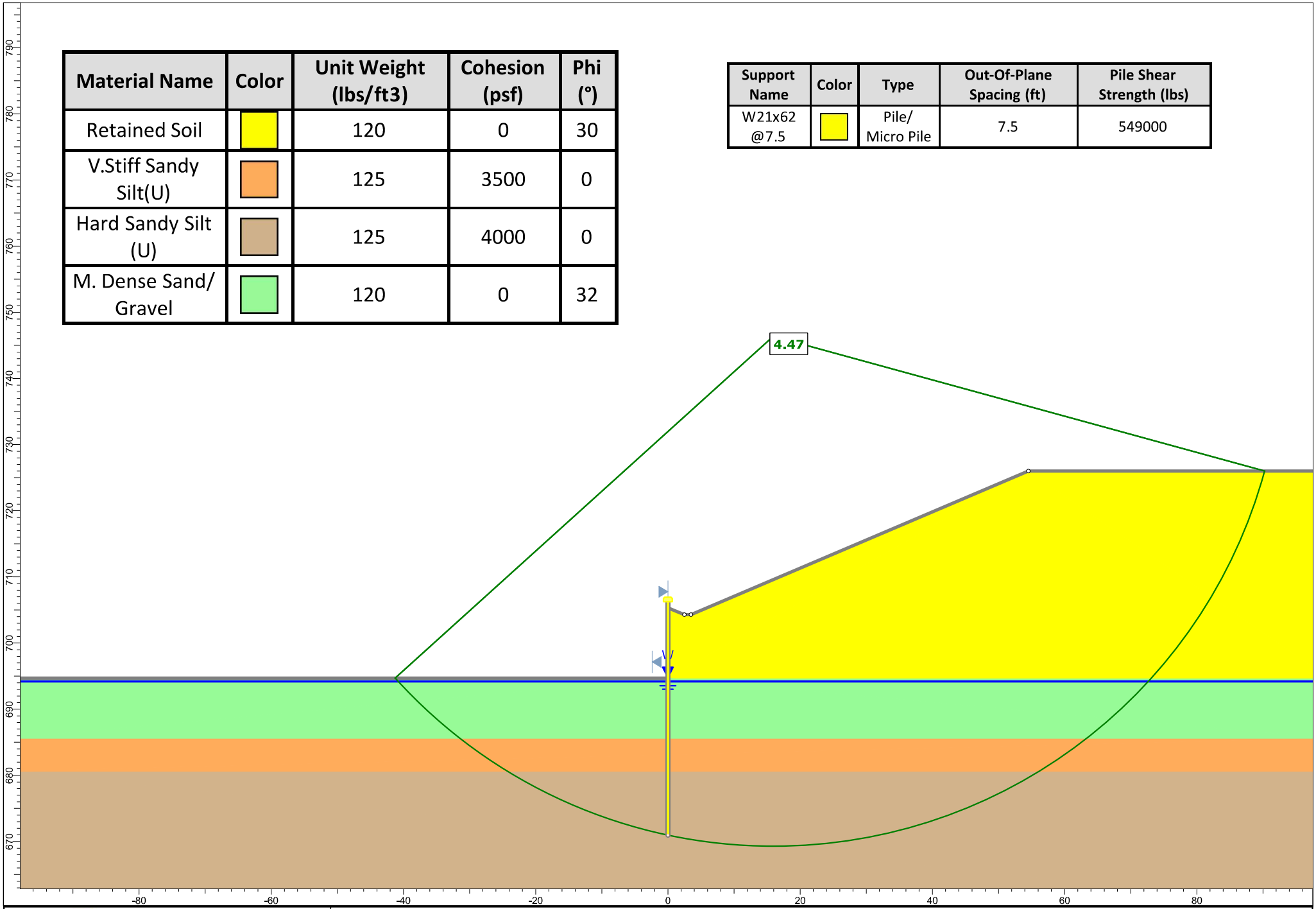
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 12.92 (B-041-0-20)- Effective Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
V.Stiff Sandy Silt(U)		125	3500	0
Hard Sandy Silt (U)		125	4000	0
M. Dense Sand/ Gravel		120	0	32

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W21x62 @7.5		Pile/ Micro Pile	7.5	549000



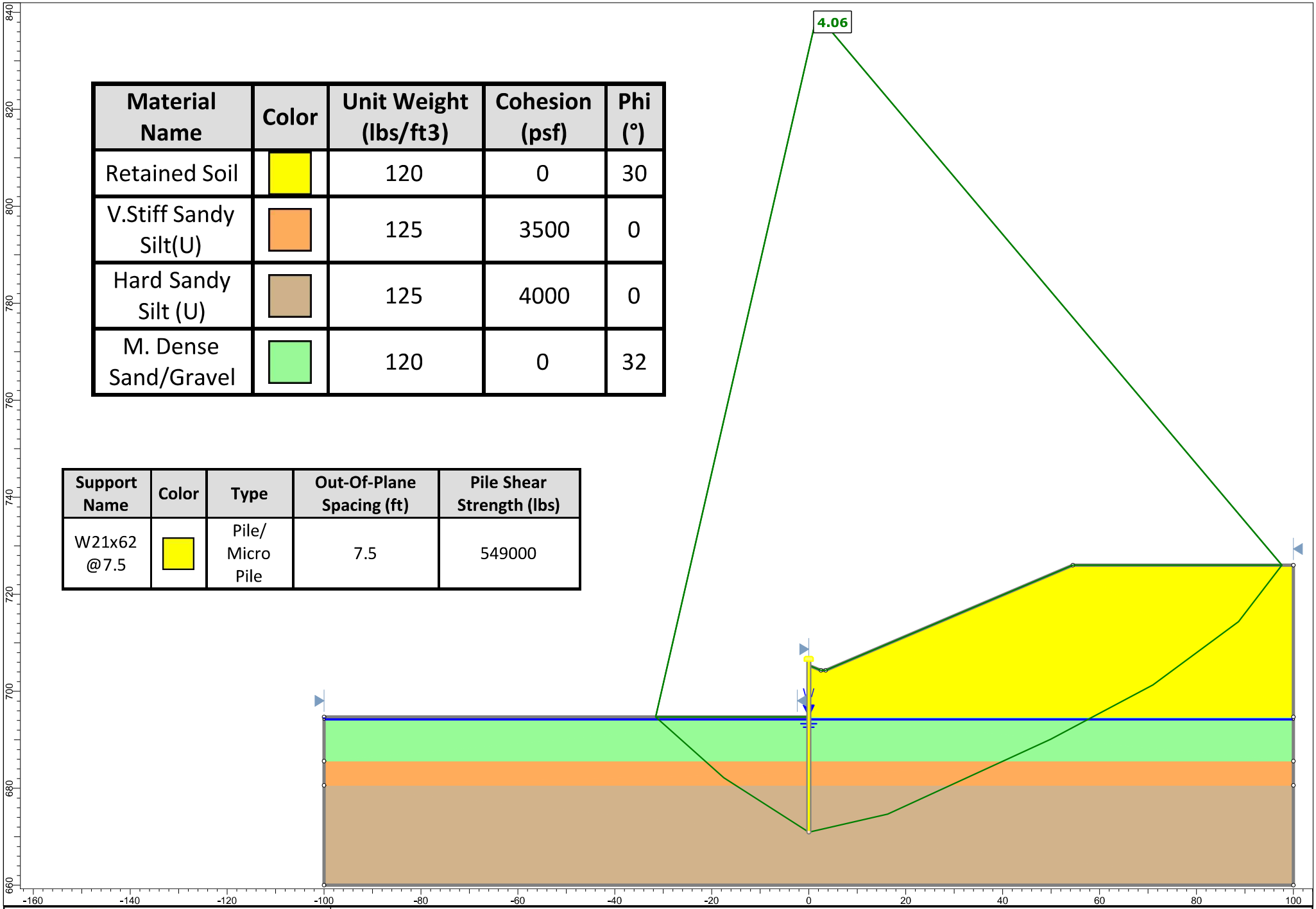
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 15.11 (B-042-0-20)- Total Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
V.Stiff Sandy Silt(U)		125	3500	0
Hard Sandy Silt (U)		125	4000	0
M. Dense Sand/Gravel		120	0	32

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W21x62 @7.5		Pile/ Micro Pile	7.5	549000



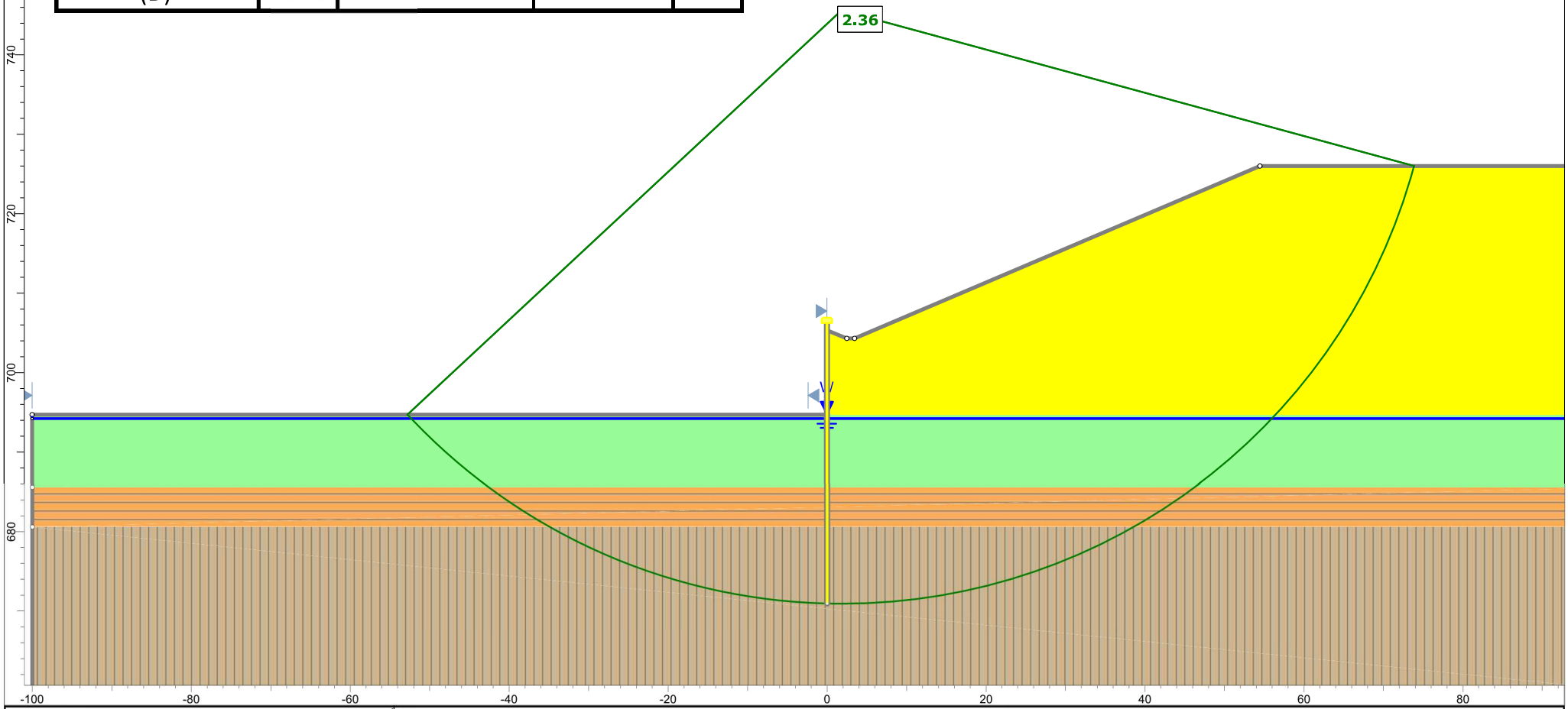
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 15.11 (B-042-0-20)- Total Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
V.Stiff Sandy Silt(D)		120	280	30
M. Dense Sand/ Gravel		120	0	32
Hard Sandy Silt (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W21x62 @7.5		Pile/ Micro Pile	7.5	549000



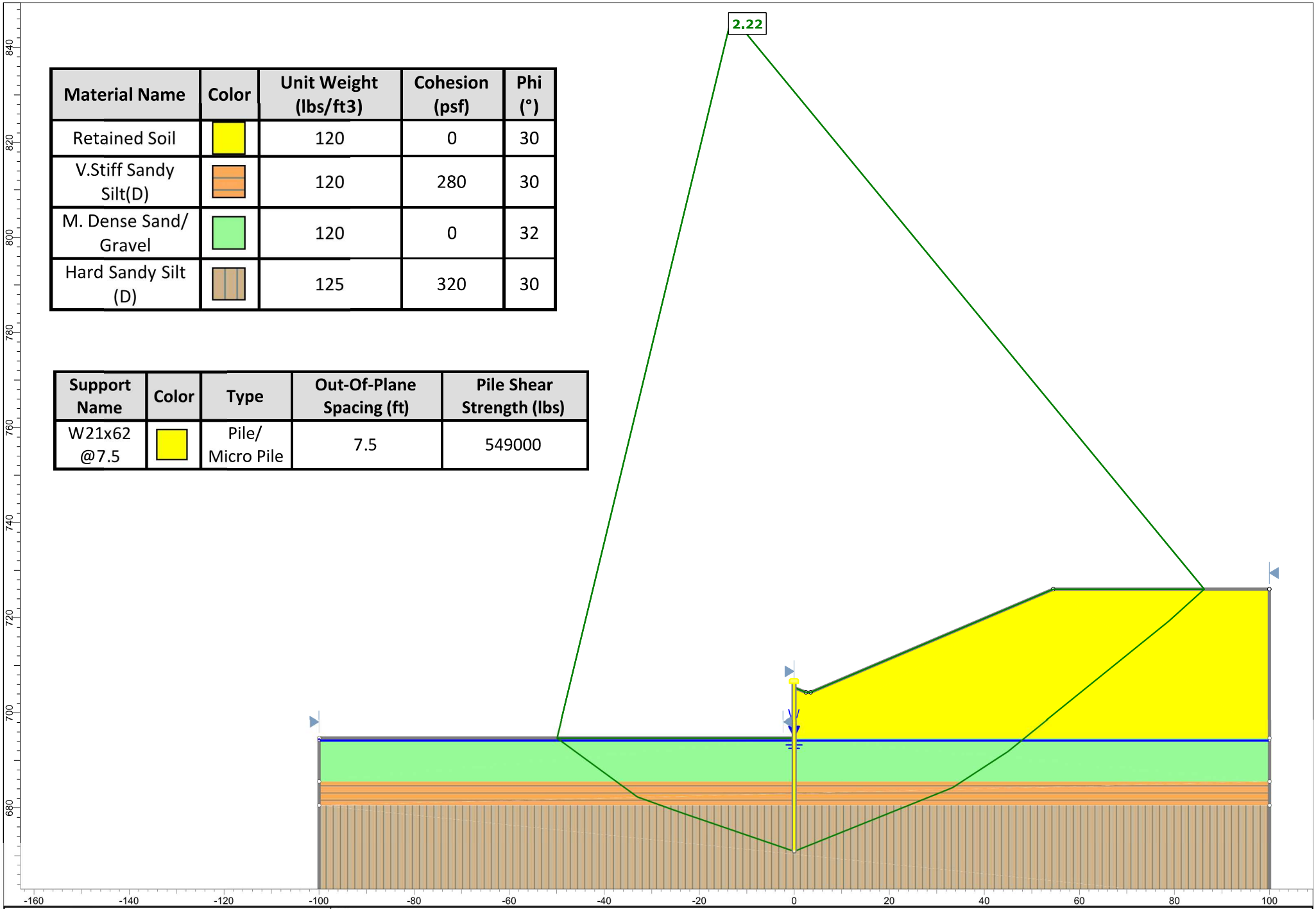
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 15.11 (B-042-0-20)- Effective Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
V.Stiff Sandy Silt(D)		120	280	30
M. Dense Sand/ Gravel		120	0	32
Hard Sandy Silt (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W21x62 @7.5		Pile/ Micro Pile	7.5	549000



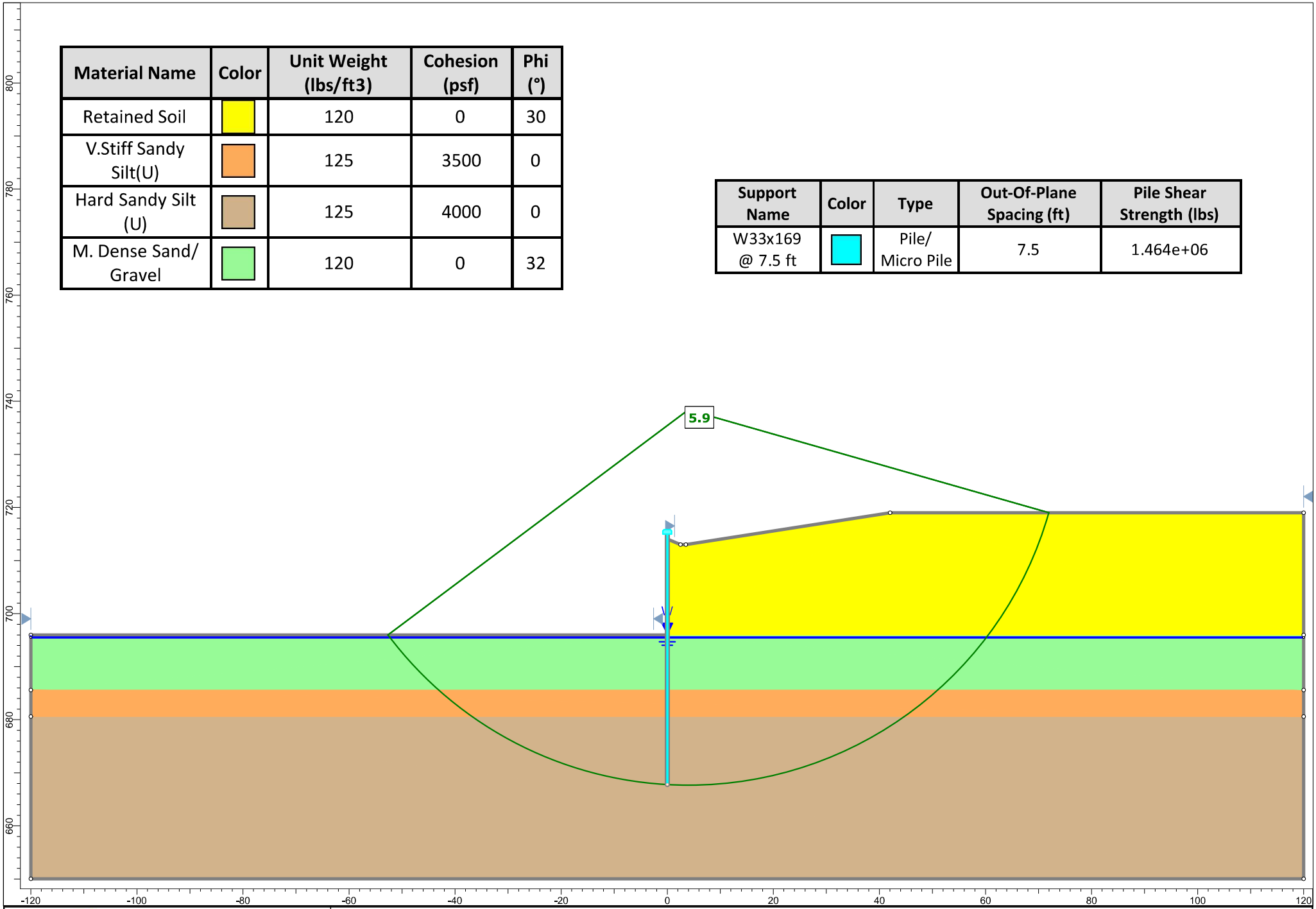
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A H= 15.11 (B-042-0-20)- Effective Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
V.Stiff Sandy Silt(U)		125	3500	0
Hard Sandy Silt (U)		125	4000	0
M. Dense Sand/ Gravel		120	0	32

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7.5 ft		Pile/ Micro Pile	7.5	1.464e+06



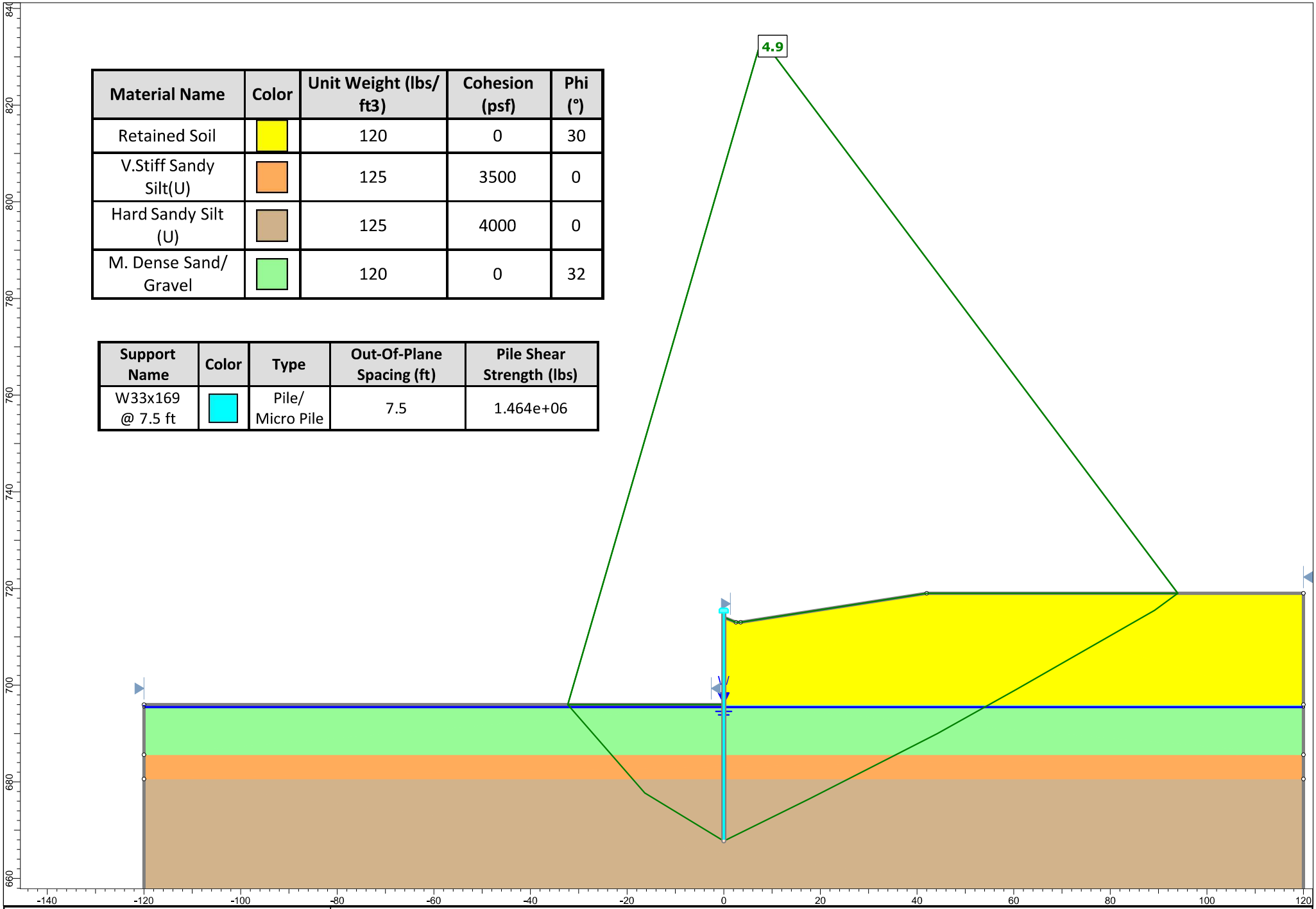
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A_H=22.56 ft (B-042-0-20)- Total Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
V.Stiff Sandy Silt(U)		125	3500	0
Hard Sandy Silt (U)		125	4000	0
M. Dense Sand/ Gravel		120	0	32

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7.5 ft		Pile/ Micro Pile	7.5	1.464e+06



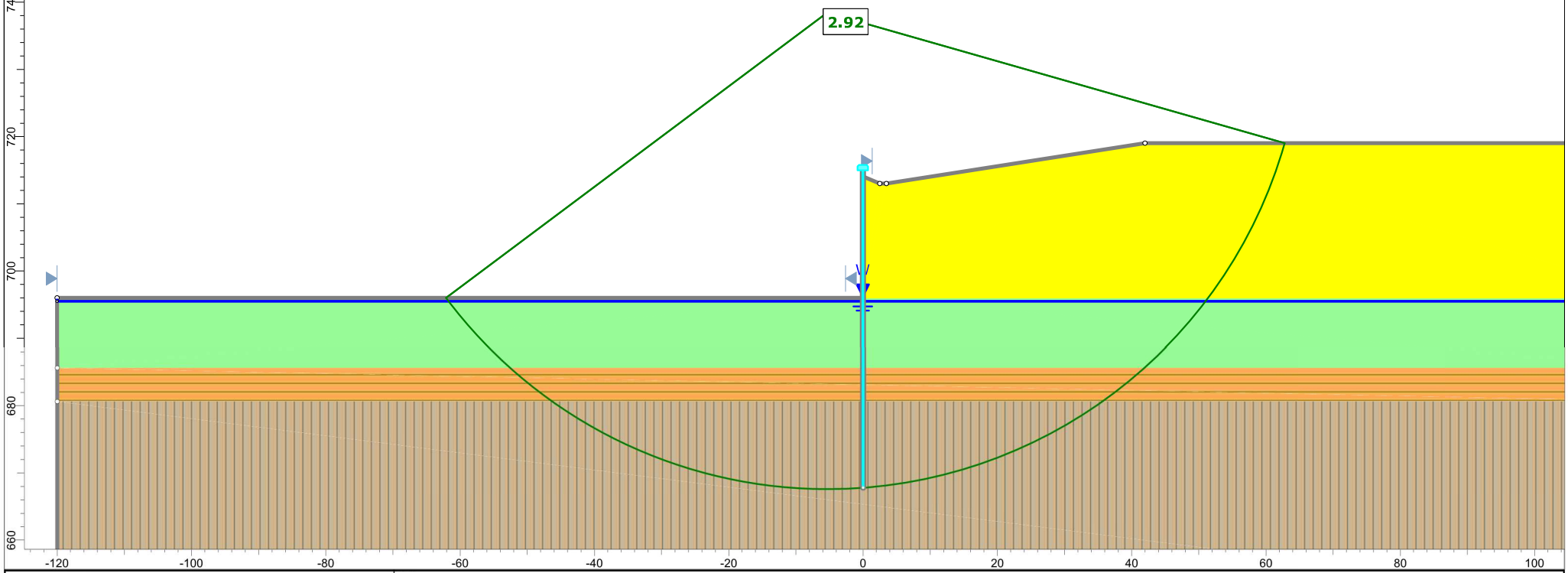
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A_H=22.56 ft (B-042-0-20)- Total Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense Sand/ Gravel		120	0	32
V.Stiff Silt & Clay (D)		120	200	30
Hard Sandy Silt (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7.5 ft		Pile/Micro Pile	7.5	1.464e+06



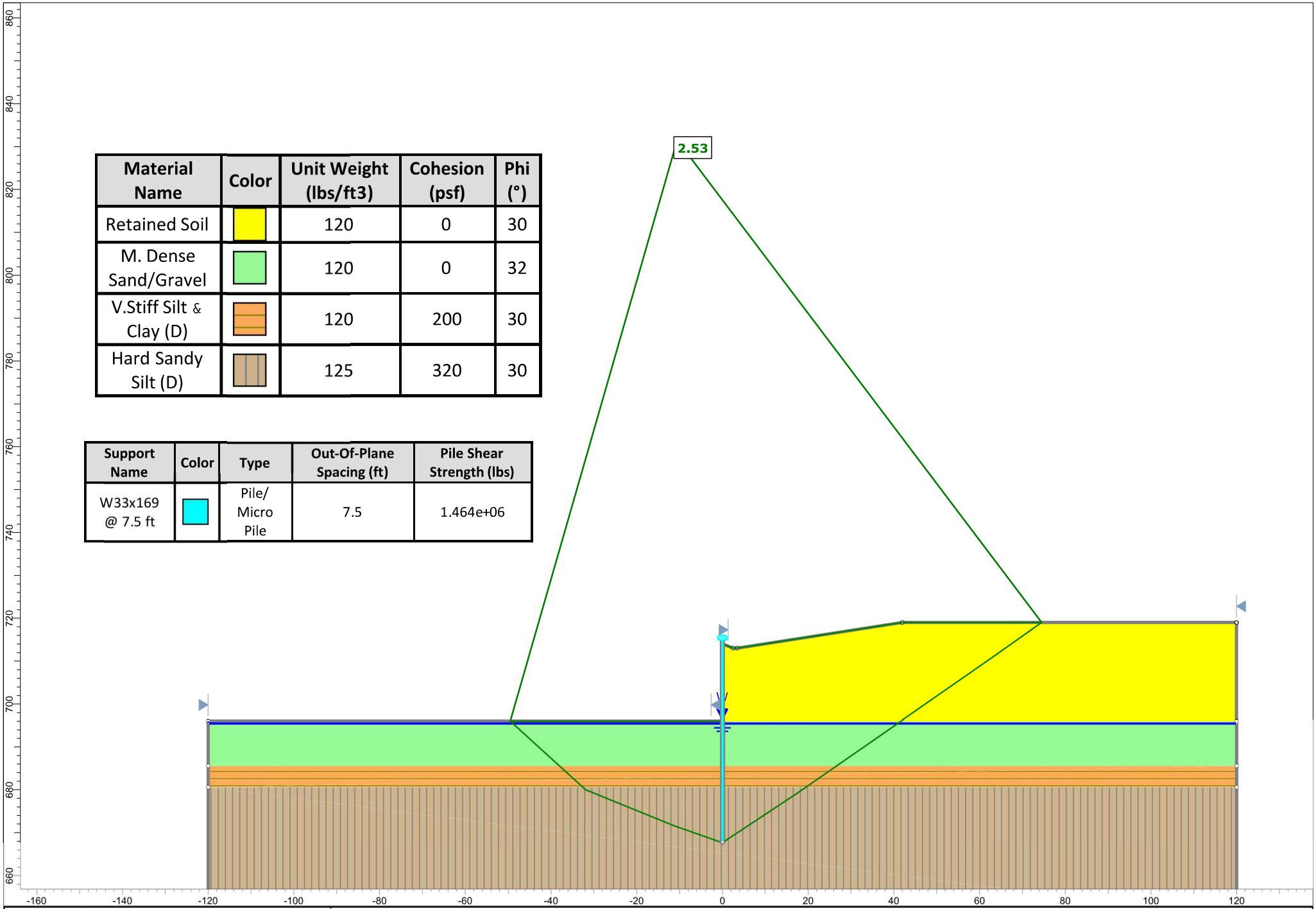
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A_H=22.56 ft (B-042-0-20)- Effective Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense Sand/Gravel		120	0	32
V.Stiff Silt & Clay (D)		120	200	30
Hard Sandy Silt (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7.5 ft		Pile/ Micro Pile	7.5	1.464e+06



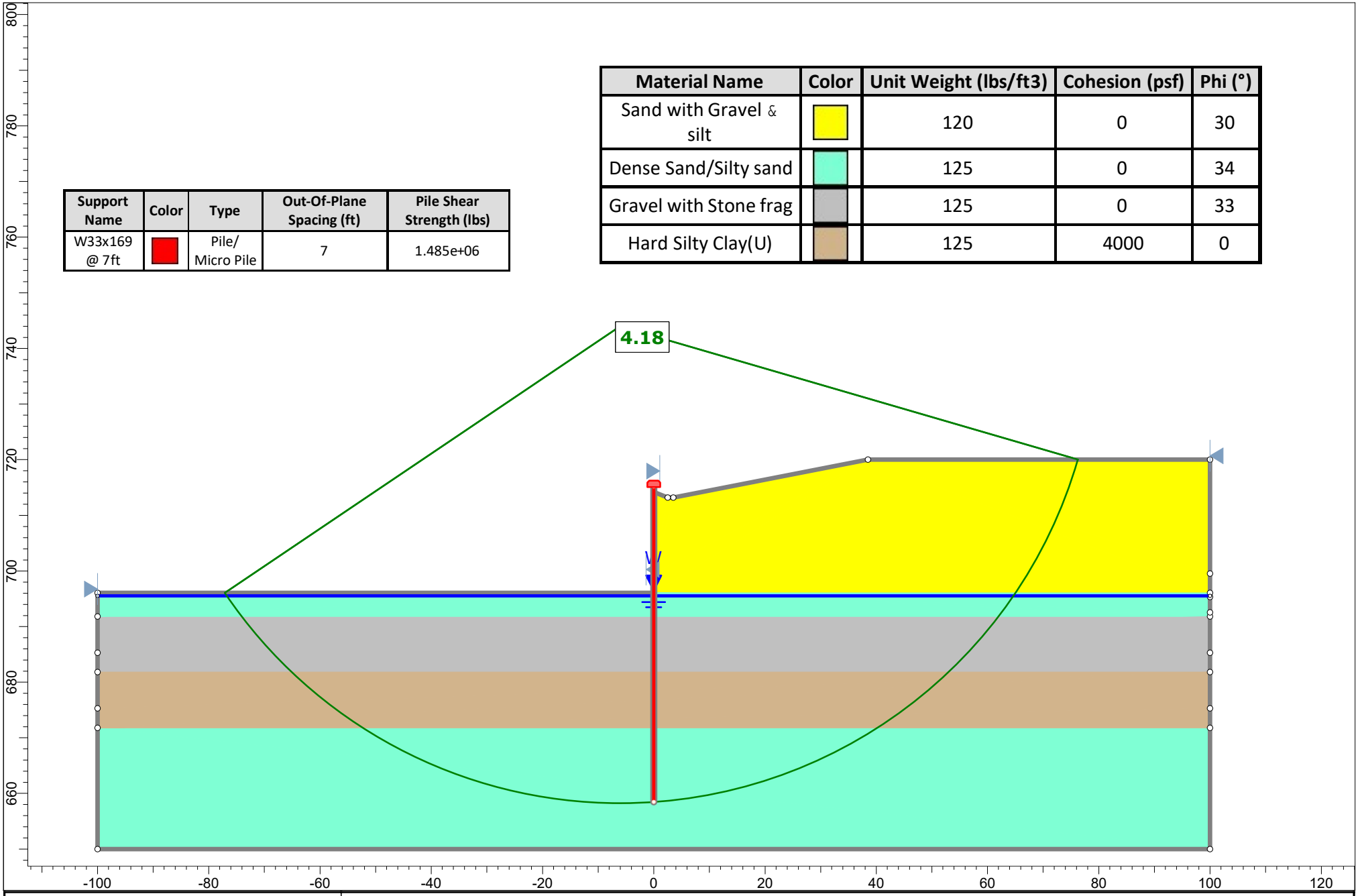
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1A_H=22.56 ft (B-042-0-20)- Effective Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03/29/2026	File Name	SP Wall 1A.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7ft		Pile/ Micro Pile	7	1.485e+06

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Sand with Gravel & silt		120	0	30
Dense Sand/Silty sand		125	0	34
Gravel with Stone frag		125	0	33
Hard Silty Clay(U)		125	4000	0



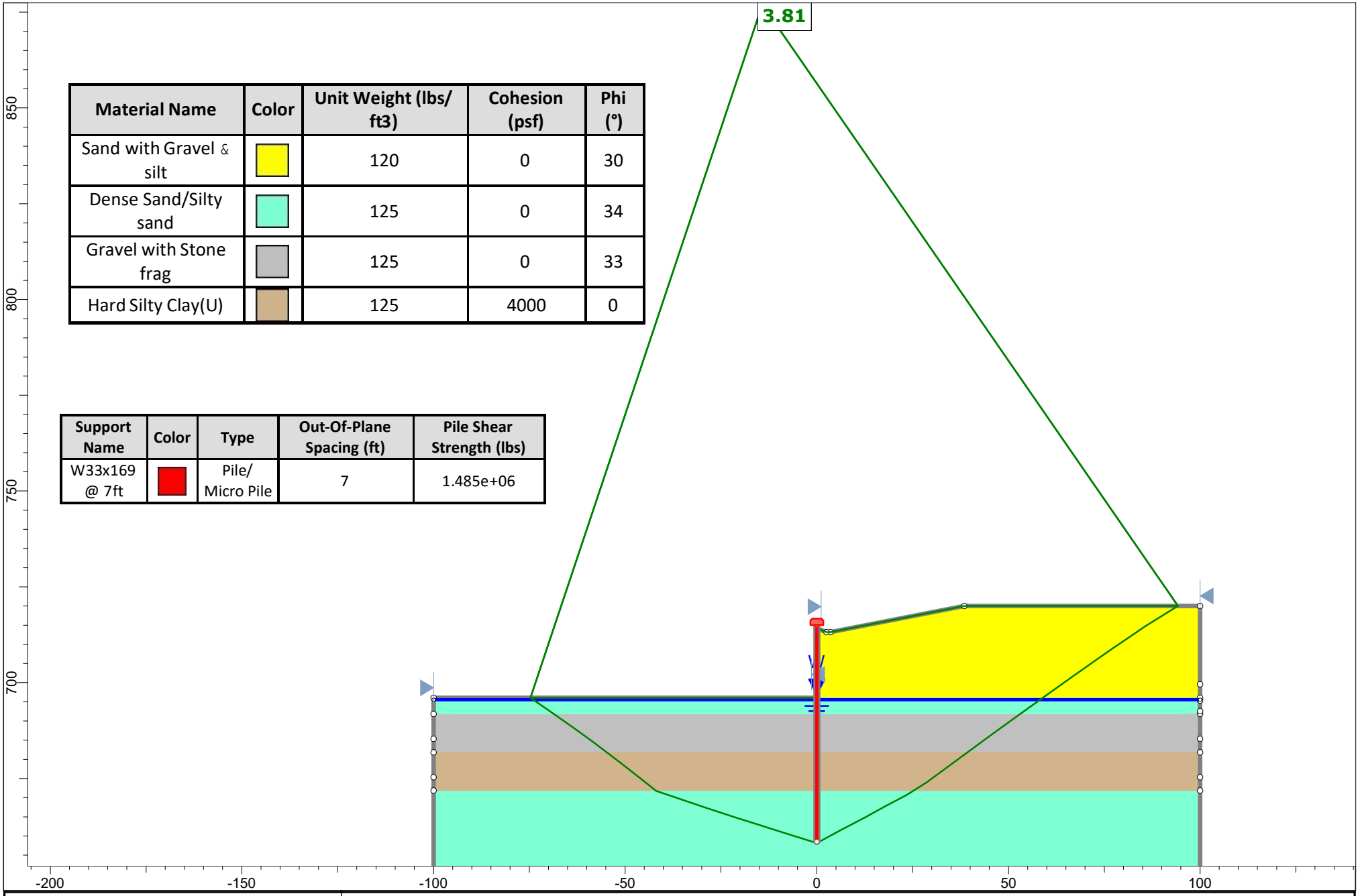
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1B_H=22.65 (Total Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1B.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Sand with Gravel & silt		120	0	30
Dense Sand/Silty sand		125	0	34
Gravel with Stone frag		125	0	33
Hard Silty Clay(U)		125	4000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7ft		Pile/ Micro Pile	7	1.485e+06



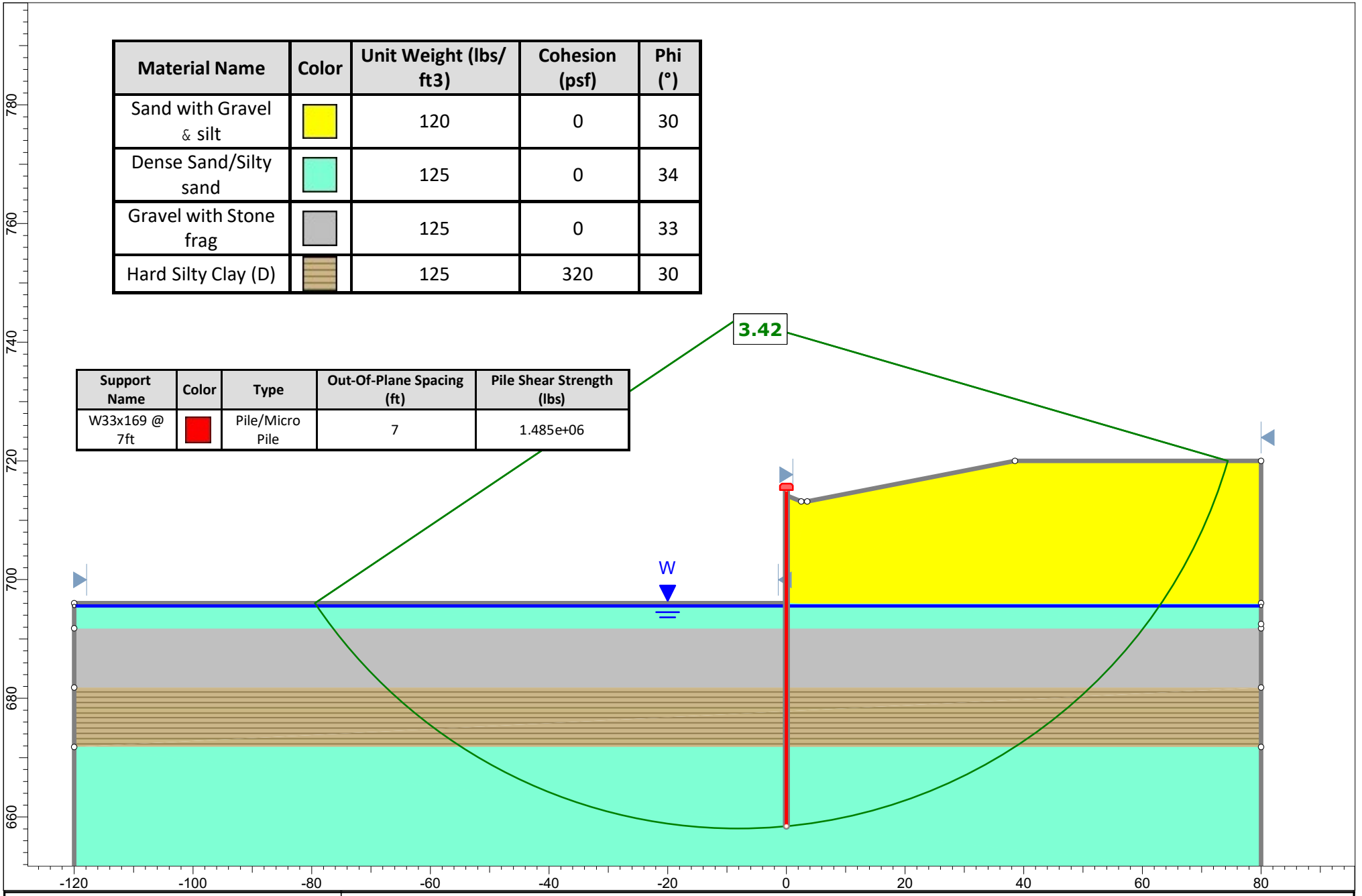
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1B_H=22.65 (Total Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1B.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Sand with Gravel & silt		120	0	30
Dense Sand/Silty sand		125	0	34
Gravel with Stone frag		125	0	33
Hard Silty Clay (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7ft		Pile/Micro Pile	7	1.485e+06

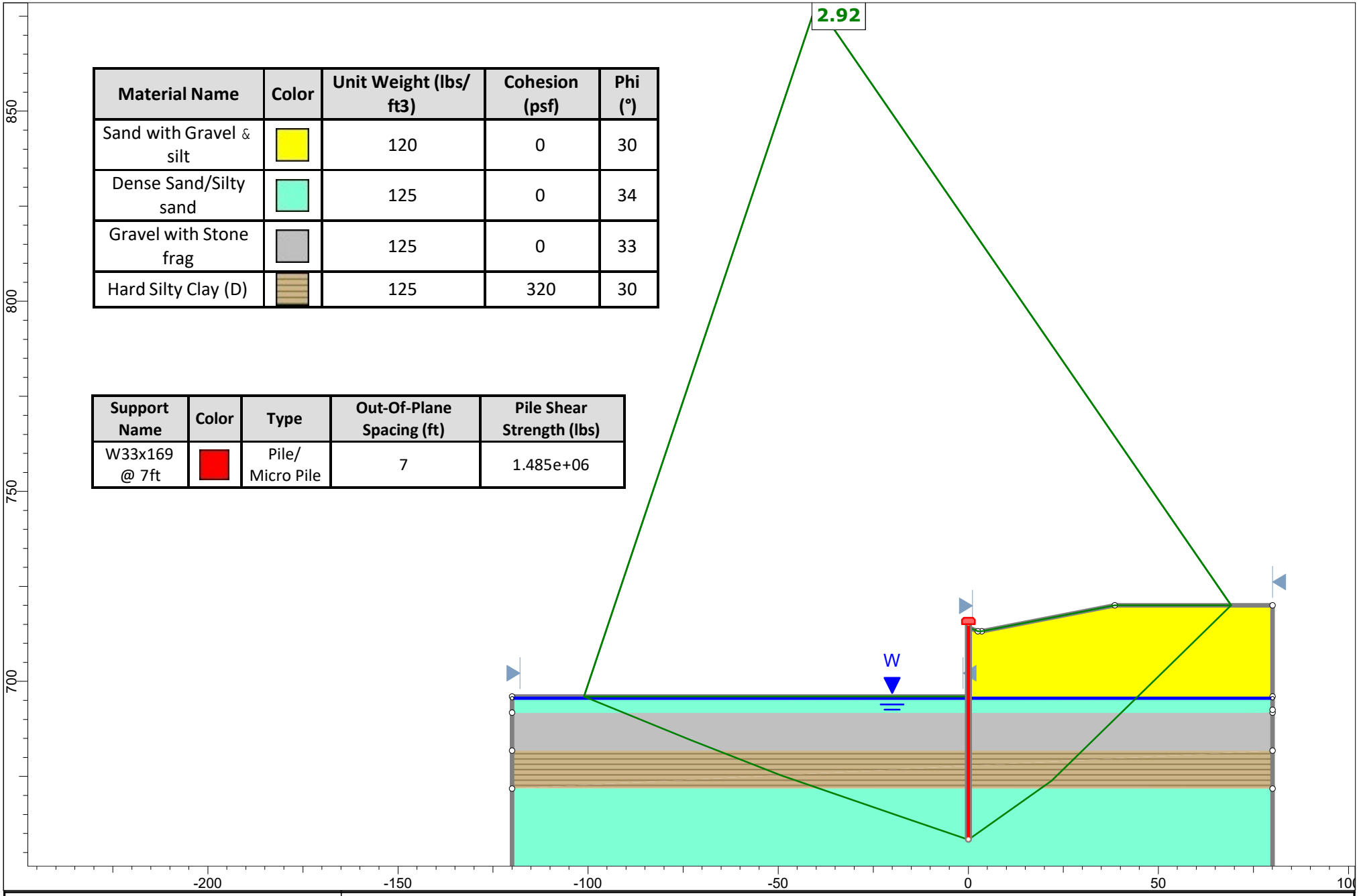


Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1B_H=22.65 (Effective Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1B.slmd

SLIDEINTERPRET 9.041

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Sand with Gravel & silt		120	0	30
Dense Sand/Silty sand		125	0	34
Gravel with Stone frag		125	0	33
Hard Silty Clay (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W33x169 @ 7ft		Pile/ Micro Pile	7	1.485e+06



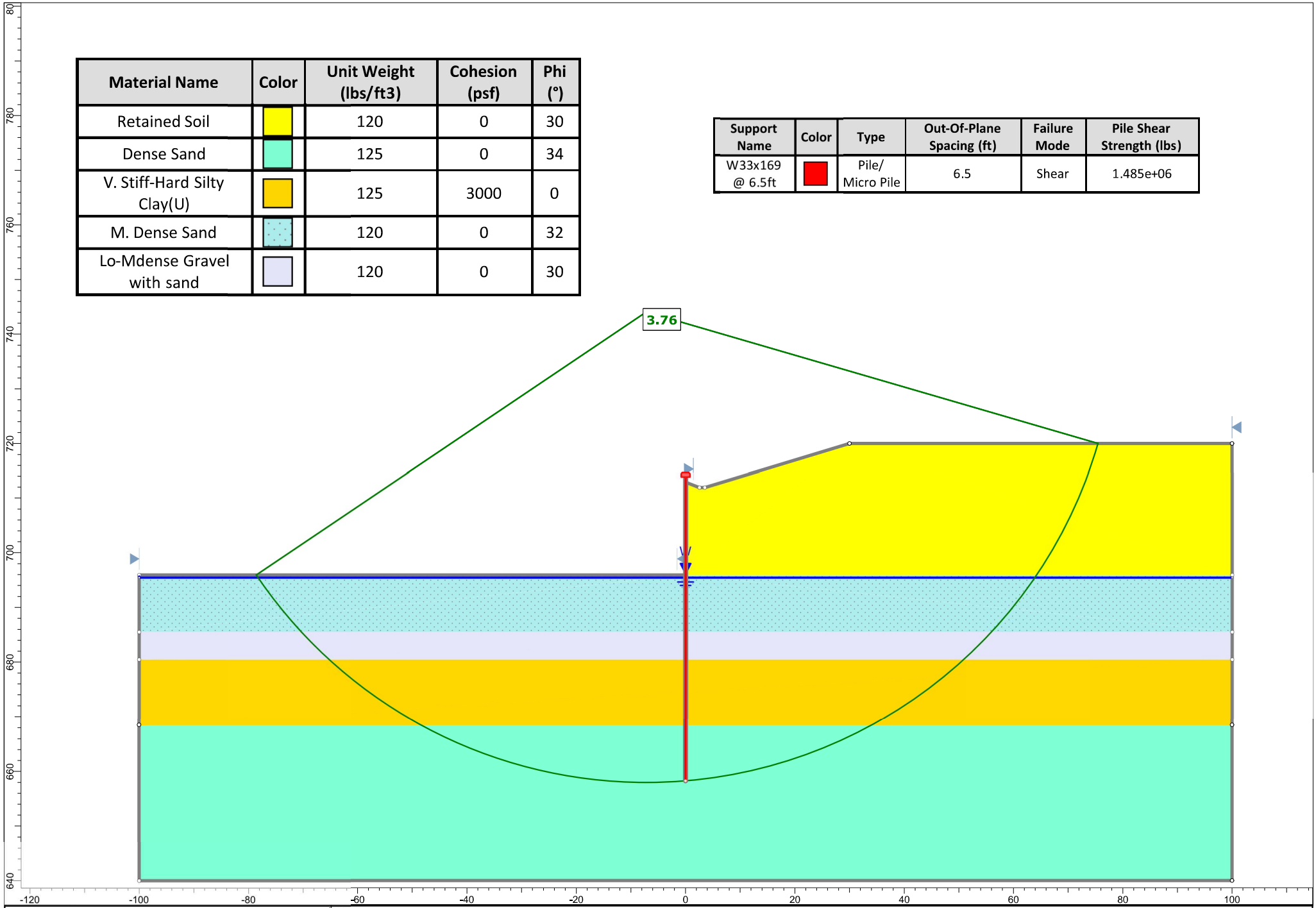
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1B_H=22.65 (Effective Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1B.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Sand		125	0	34
V. Stiff-Hard Silty Clay(U)		125	3000	0
M. Dense Sand		120	0	32
Lo-Mdense Gravel with sand		120	0	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W33x169 @ 6.5ft		Pile/ Micro Pile	6.5	Shear	1.485e+06



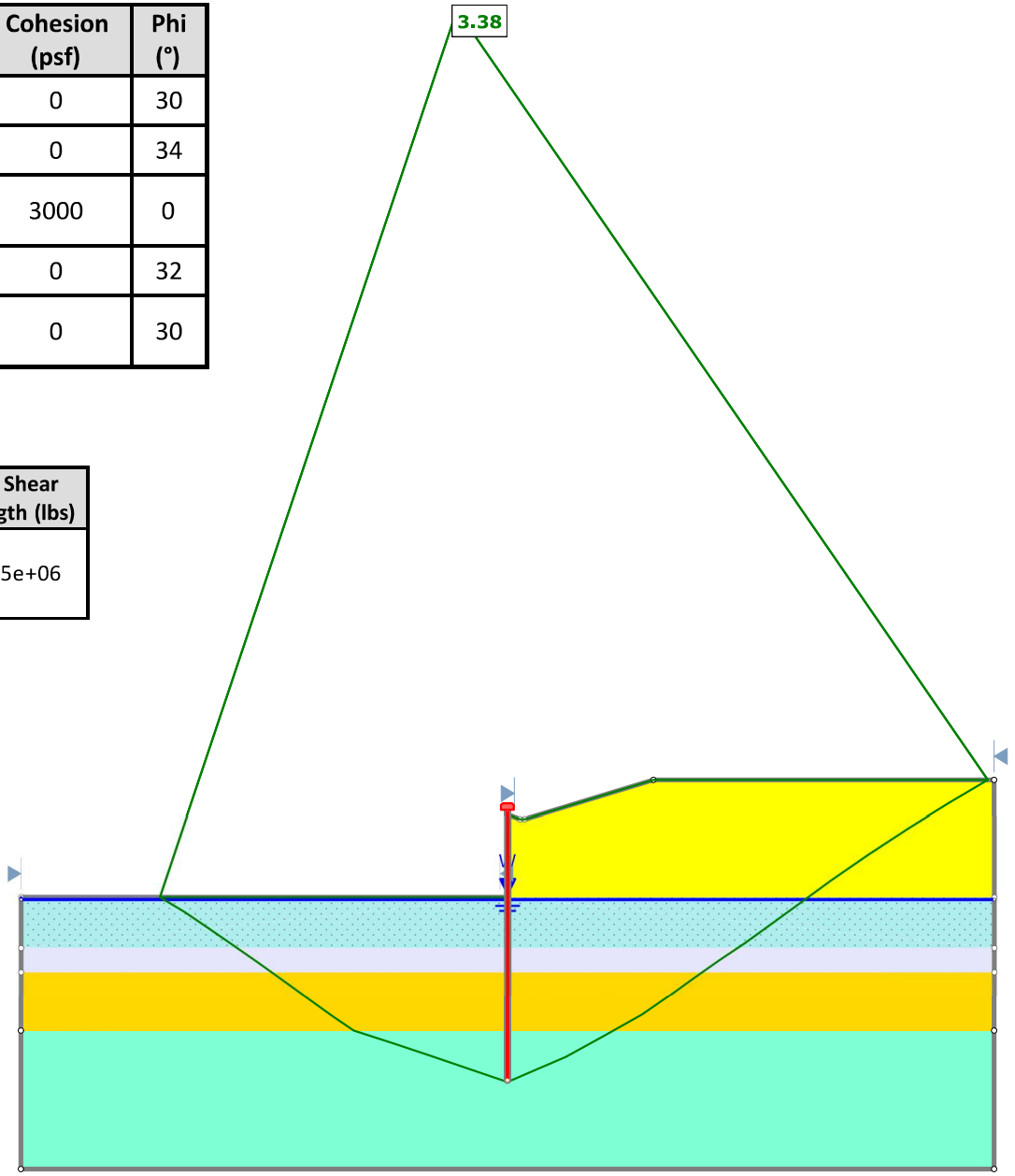
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1C_H=21.48 (Total Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1C.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Sand		125	0	34
V. Stiff-Hard Silty Clay(U)		125	3000	0
M. Dense Sand		120	0	32
Lo-Mdense Gravel with sand		120	0	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W33x169 @ 6.5ft		Pile/ Micro Pile	6.5	Shear	1.485e+06



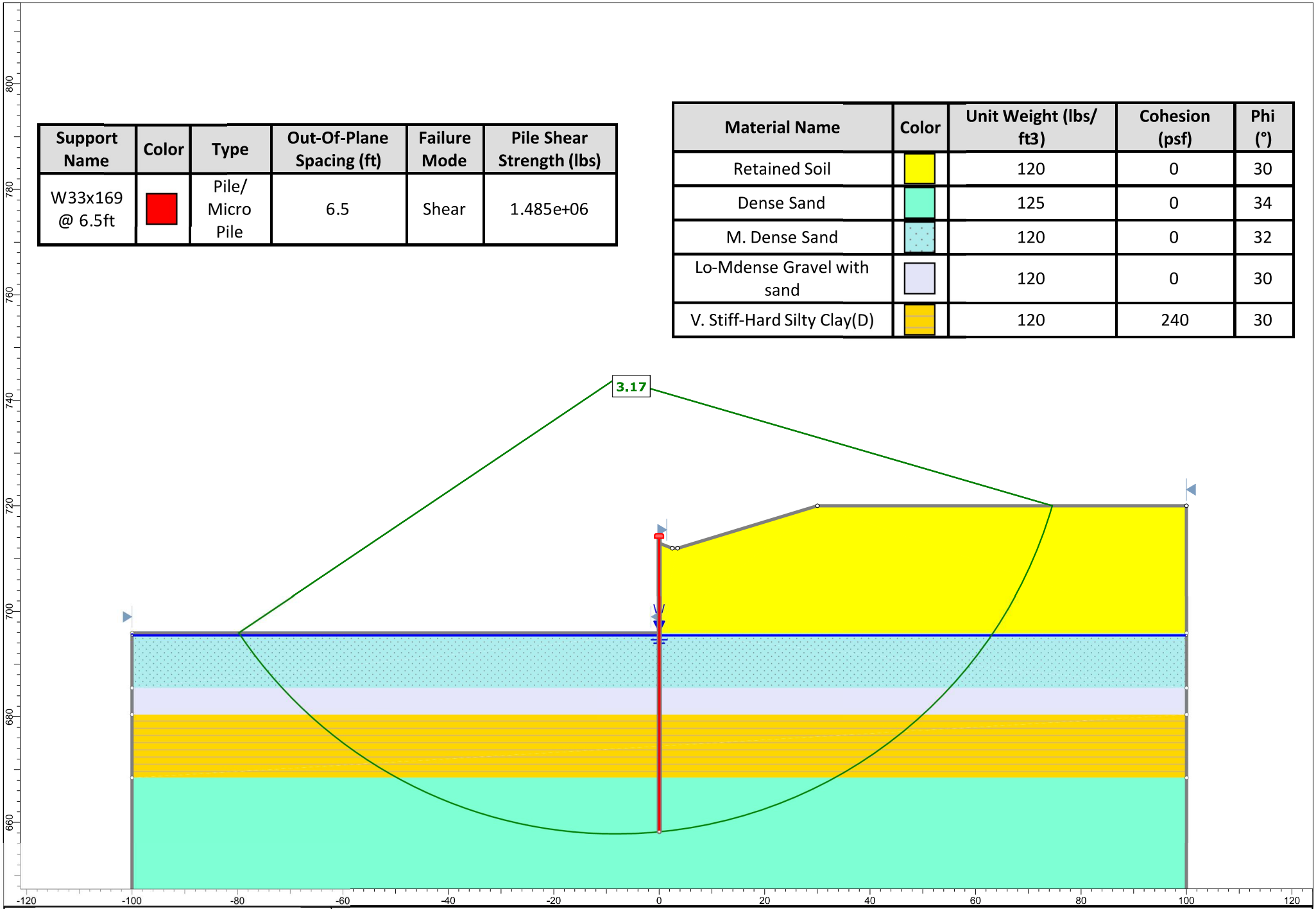
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1C_H=21.48 (Total Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1C.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W33x169 @ 6.5ft		Pile/ Micro Pile	6.5	Shear	1.485e+06

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Sand		125	0	34
M. Dense Sand		120	0	32
Lo-Mdense Gravel with sand		120	0	30
V. Stiff-Hard Silty Clay(D)		120	240	30



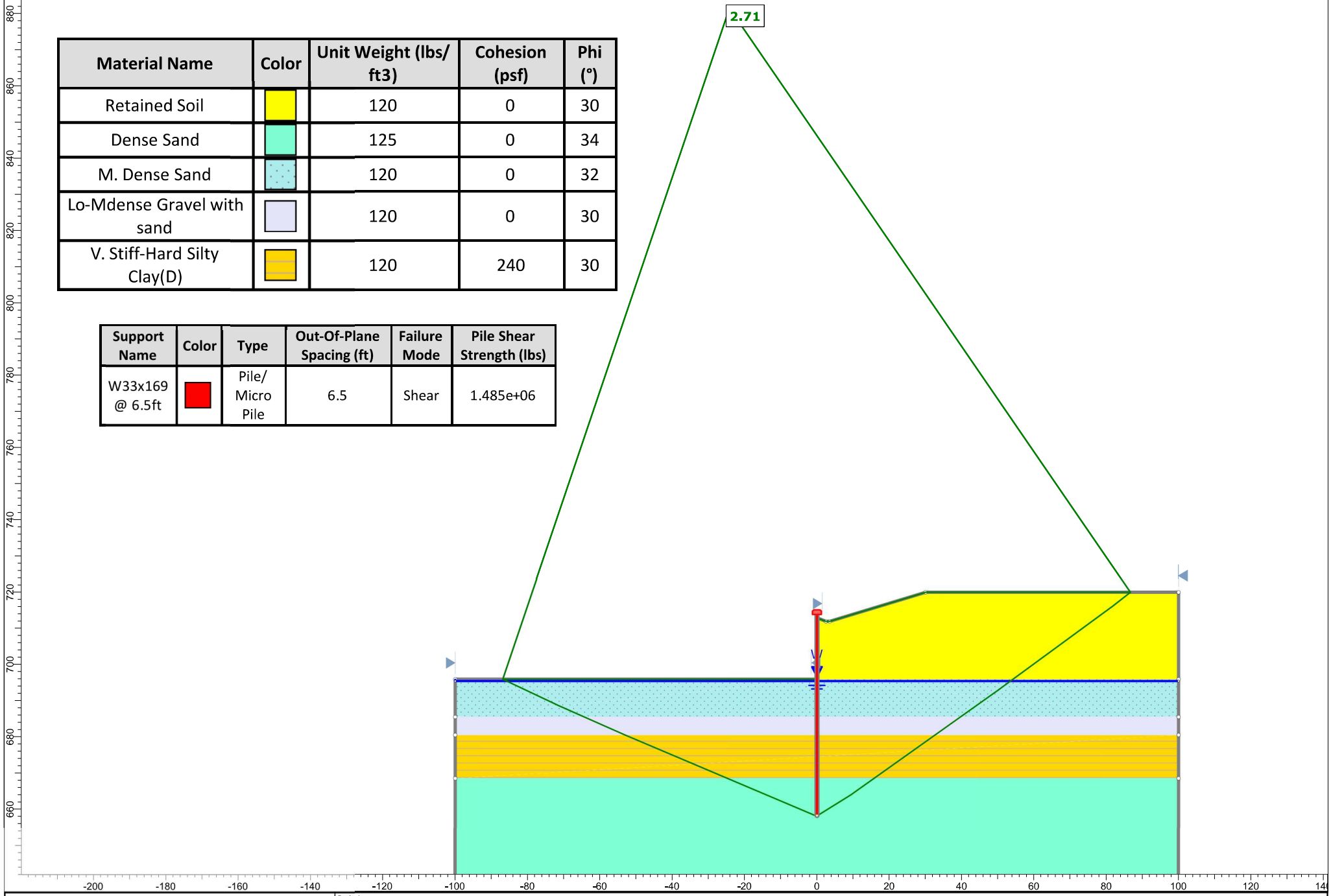
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1C_H=21.48 (Effective Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1C.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Dense Sand		125	0	34
M. Dense Sand		120	0	32
Lo-Mdense Gravel with sand		120	0	30
V. Stiff-Hard Silty Clay(D)		120	240	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W33x169 @ 6.5ft		Pile/ Micro Pile	6.5	Shear	1.485e+06



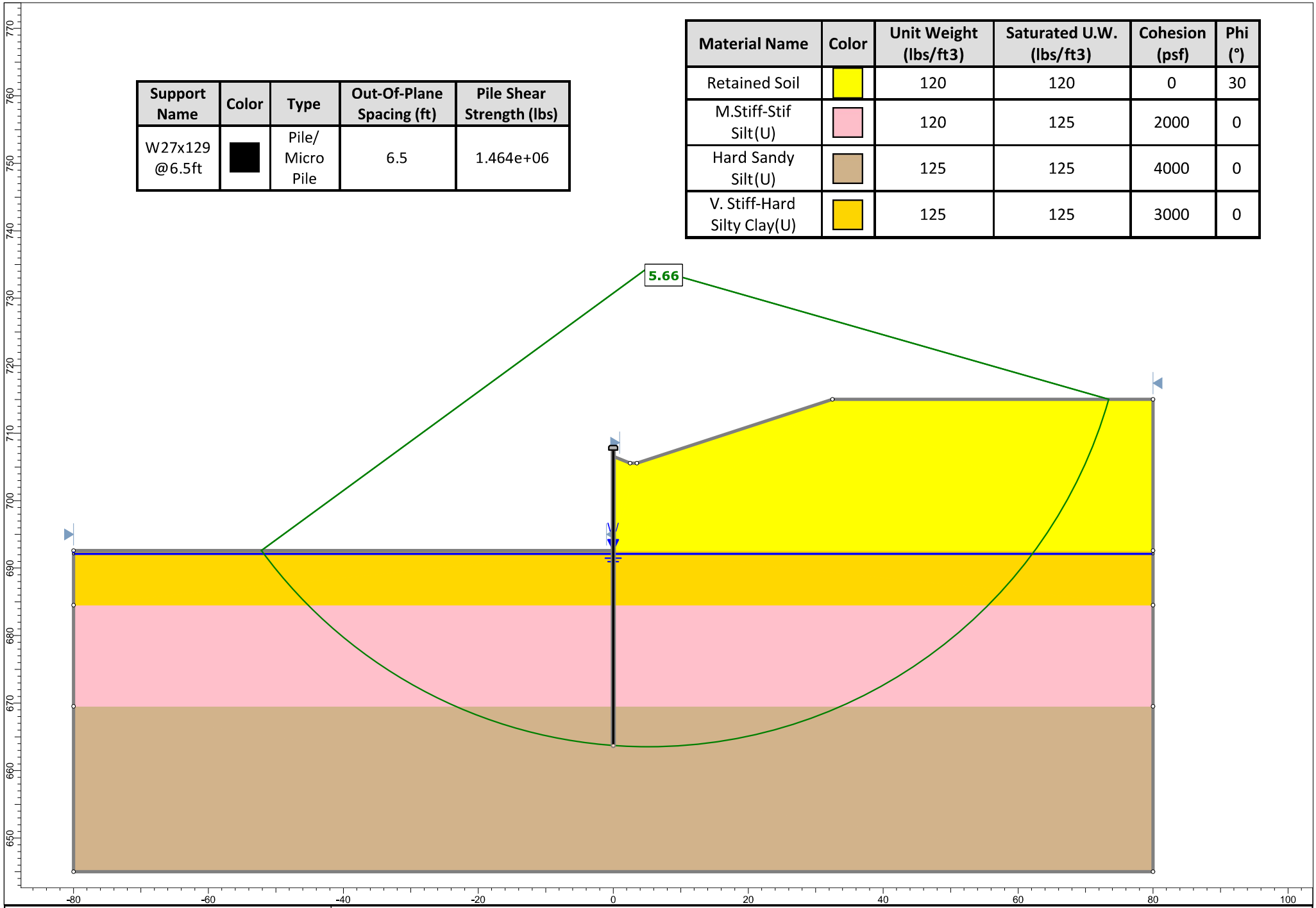
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1C_H=21.48 (Effective Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1C.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x129 @6.5ft		Pile/ Micro Pile	6.5	1.464e+06

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
M.Stiff-Stif Silt(U)		120	125	2000	0
Hard Sandy Silt(U)		125	125	4000	0
V. Stiff-Hard Silty Clay(U)		125	125	3000	0



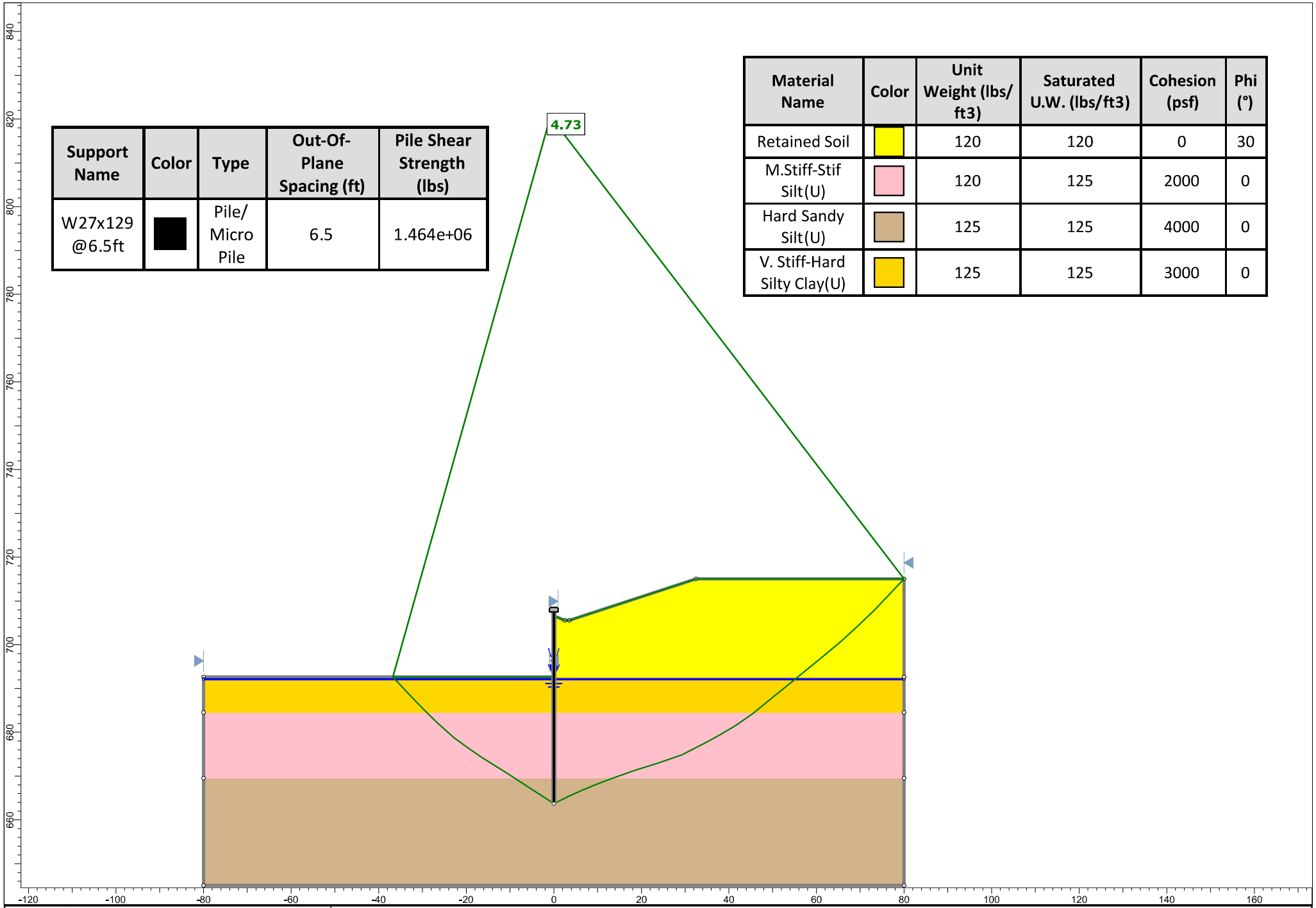
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=18.46 (B-048-0-20)- Total Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x129 @6.5ft		Pile/ Micro Pile	6.5	1.464e+06

Material Name	Color	Unit Weight (lbs/ ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
M.Stiff-Stif Silt(U)		120	125	2000	0
Hard Sandy Silt(U)		125	125	4000	0
V. Stiff-Hard Silty Clay(U)		125	125	3000	0



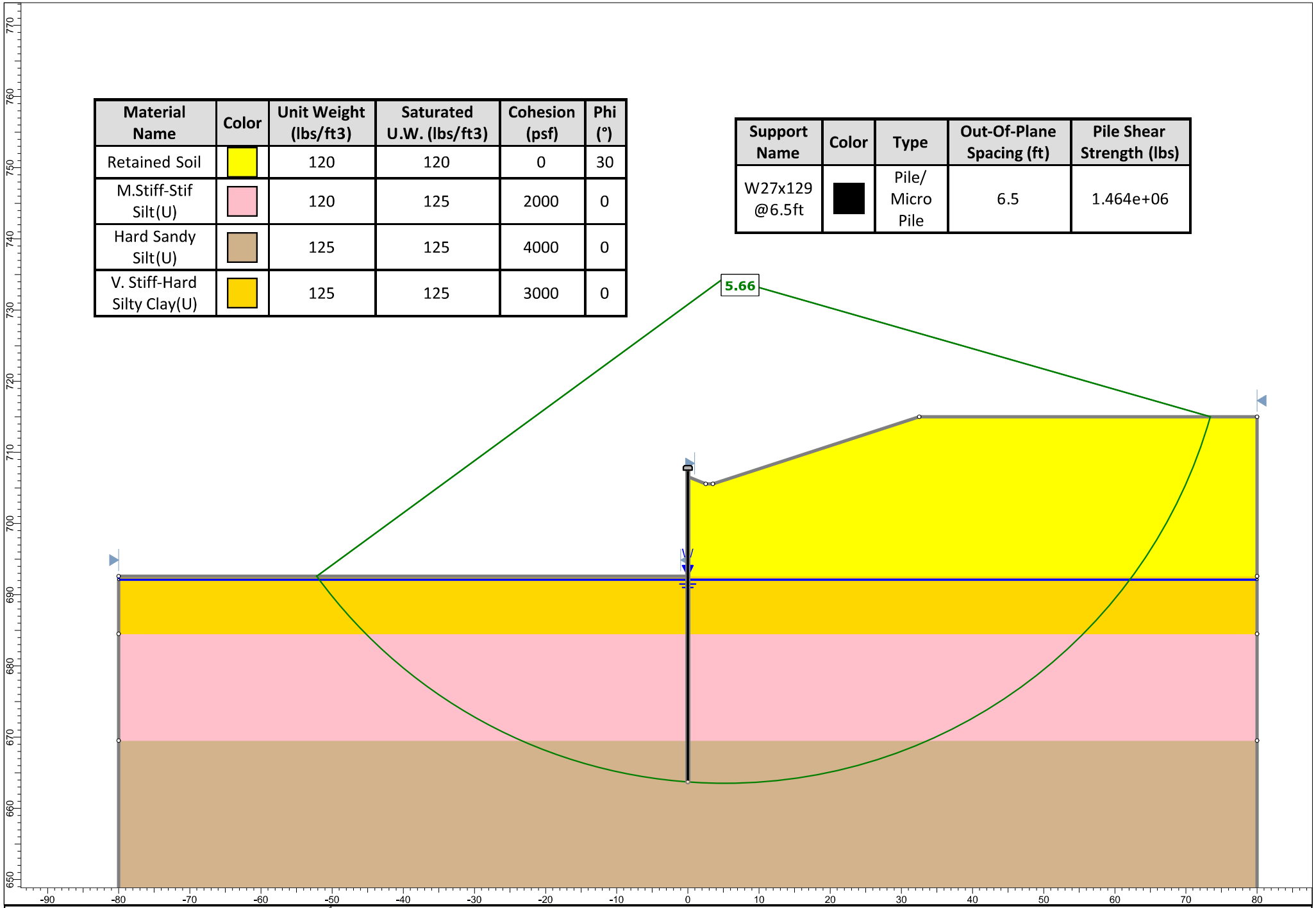
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=18.46 (B-048-0-20)- Total Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
M.Stiff-Stif Silt(U)		120	125	2000	0
Hard Sandy Silt(U)		125	125	4000	0
V. Stiff-Hard Silty Clay(U)		125	125	3000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x129 @6.5ft		Pile/ Micro Pile	6.5	1.464e+06



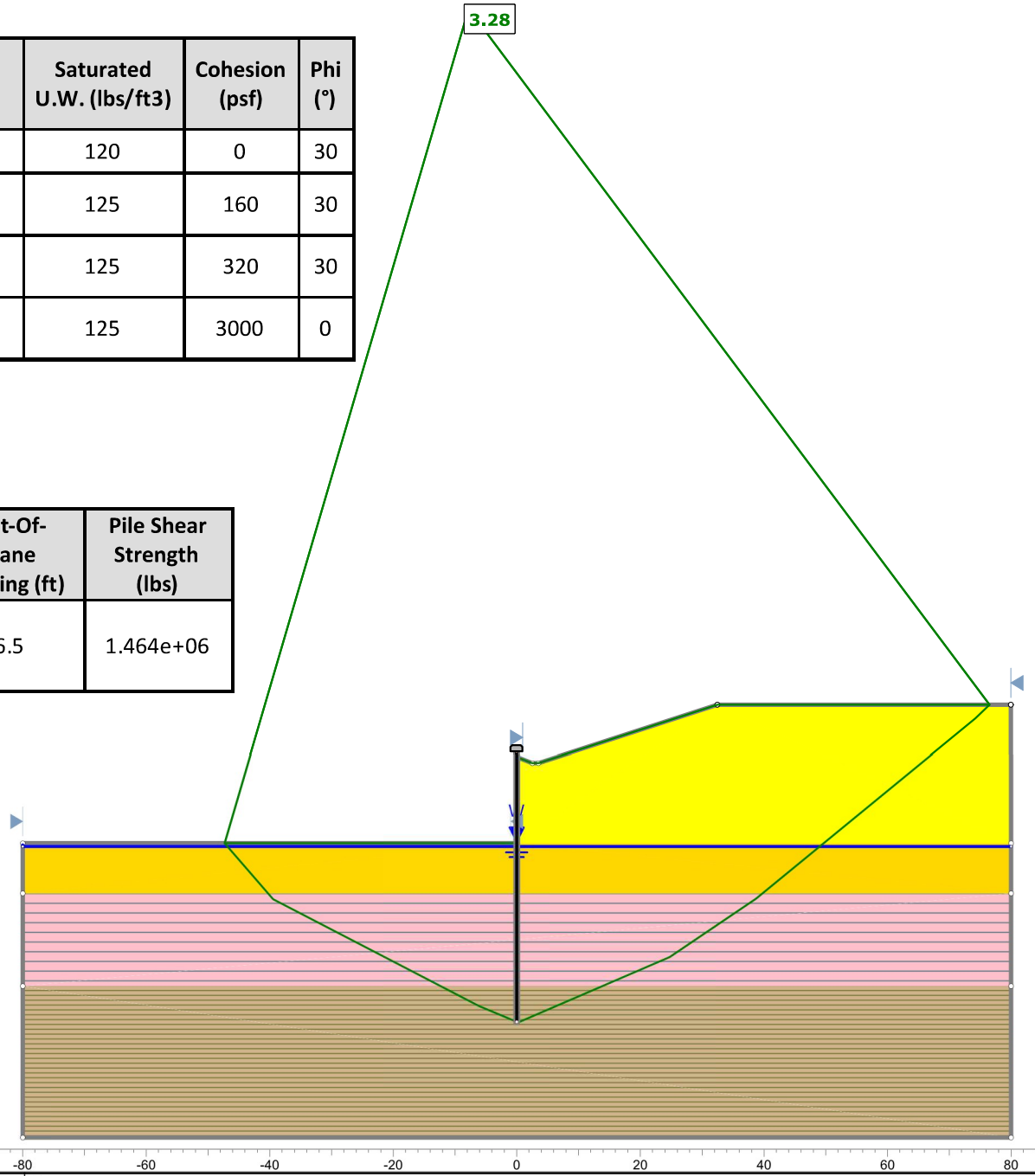
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=18.46 (B-048-0-20)- Effective Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
M.Stiff-Stif Silt(D)		120	125	160	30
Hard Sandy Silt (D)		125	125	320	30
V. Stiff-Hard Silty Clay(U)		125	125	3000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x129 @6.5ft		Pile/ Micro Pile	6.5	1.464e+06



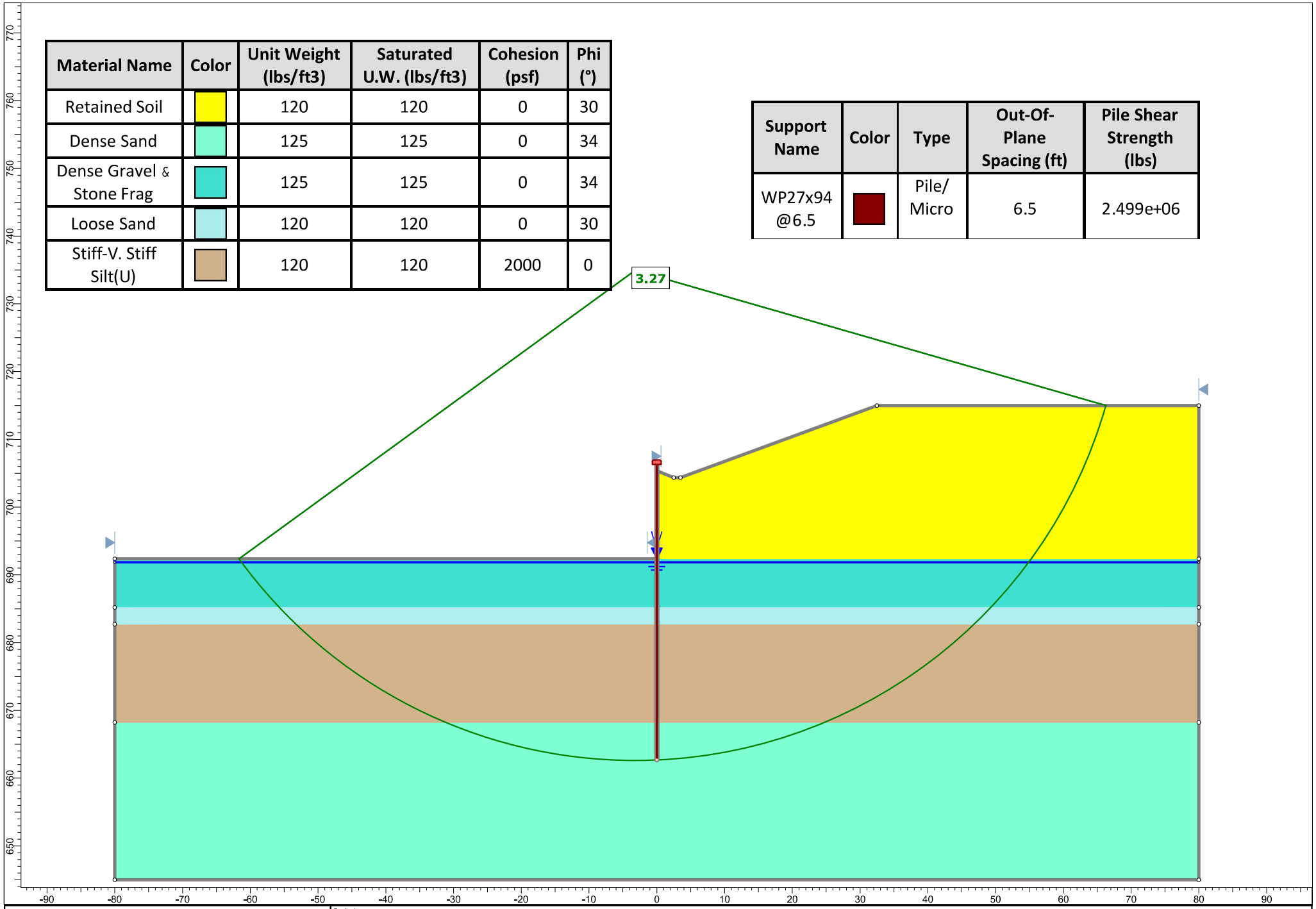
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=18.46 (B-048-0-20)- Effective Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

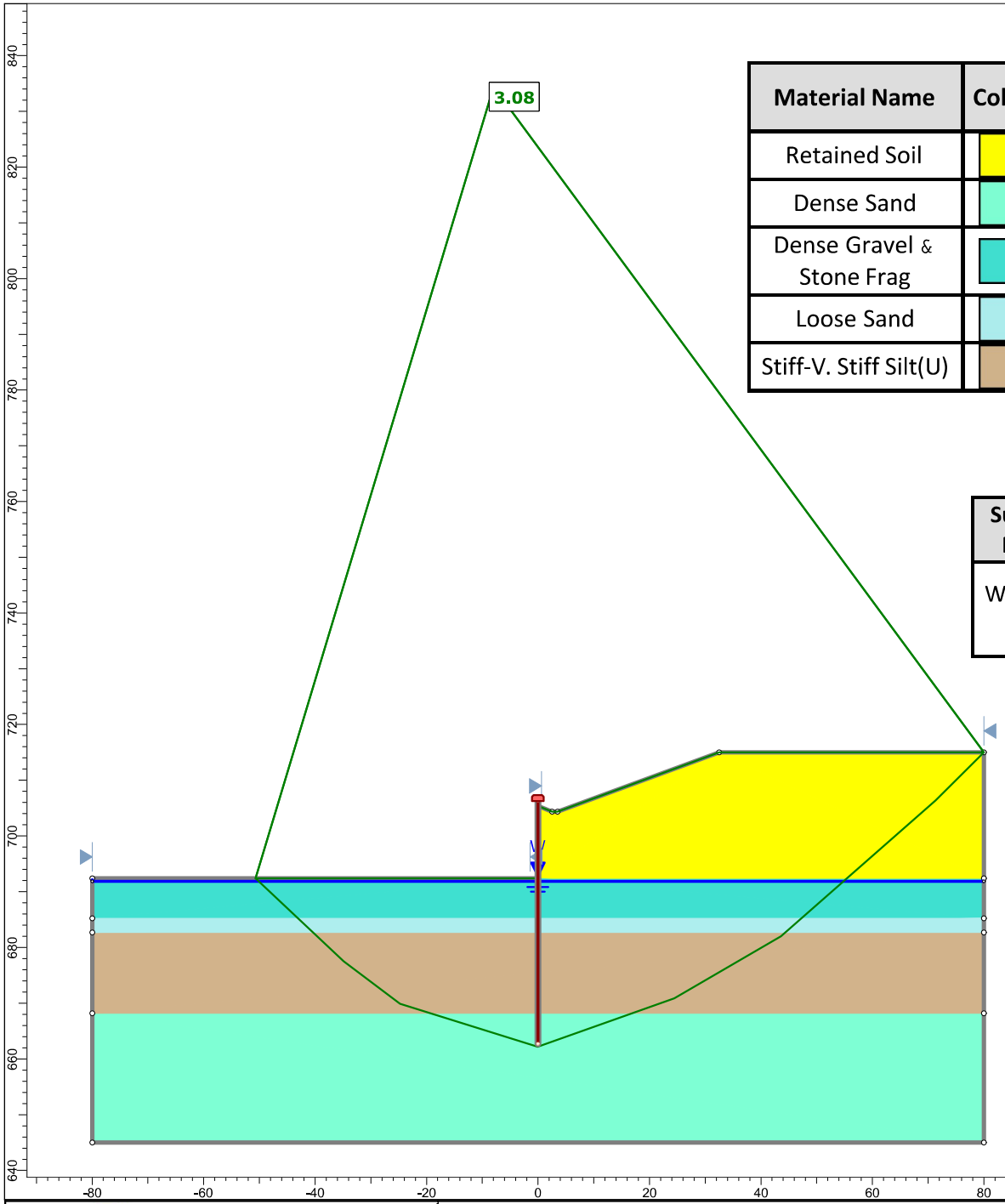
Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Sand		125	125	0	34
Dense Gravel & Stone Frag		125	125	0	34
Loose Sand		120	120	0	30
Stiff-V. Stiff Silt(U)		120	120	2000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
WP27x94 @6.5		Pile/ Micro	6.5	2.499e+06



SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=17.49 (B-049-0-20)- Total Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Sand		125	125	0	34
Dense Gravel & Stone Frag		125	125	0	34
Loose Sand		120	120	0	30
Stiff-V. Stiff Silt(U)		120	120	2000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
WP27x94 @6.5		Pile/ Micro Pile	6.5	2.499e+06

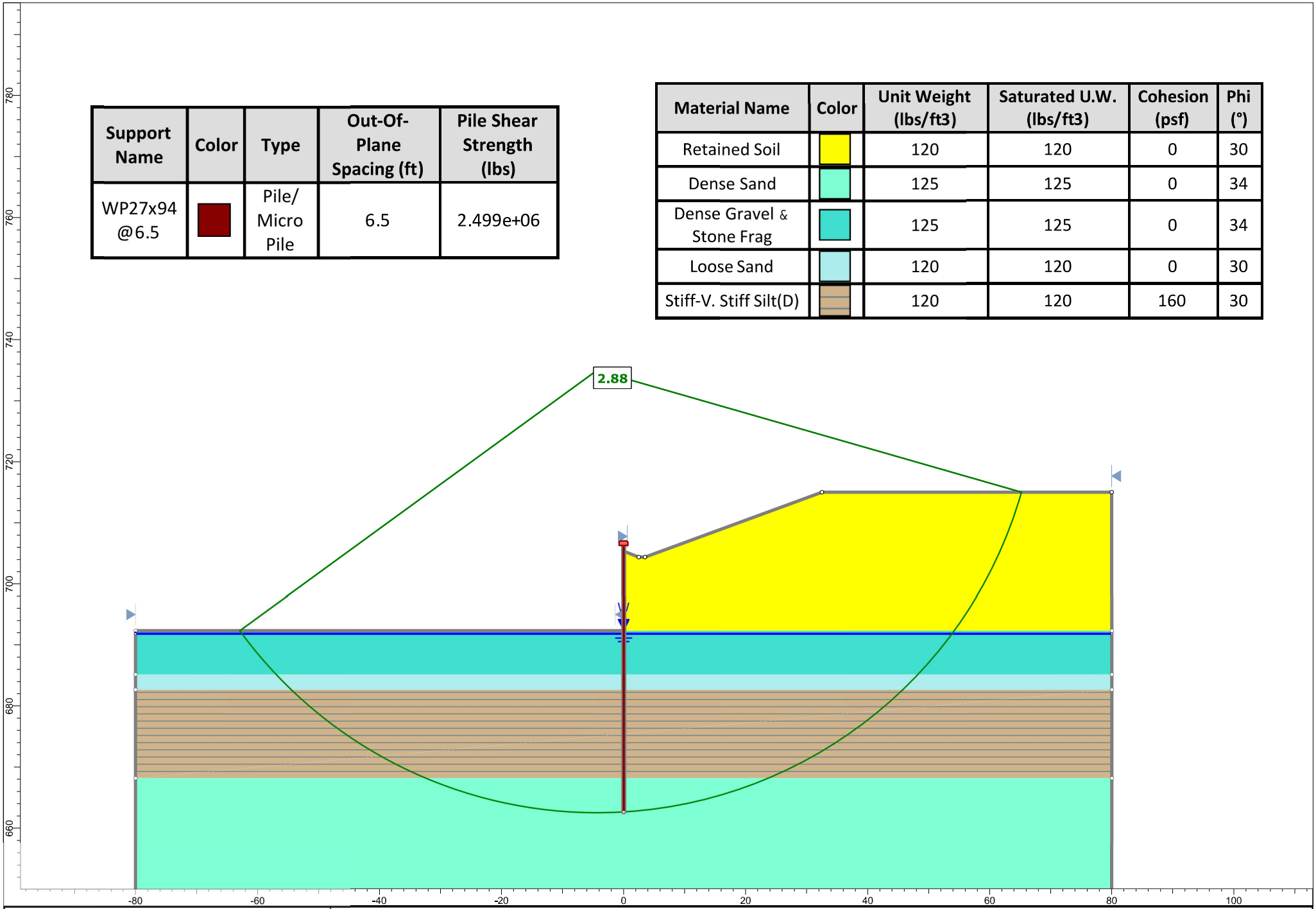
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=17.49 (B-049-0-20)- Total Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
WP27x94 @6.5		Pile/ Micro Pile	6.5	2.499e+06

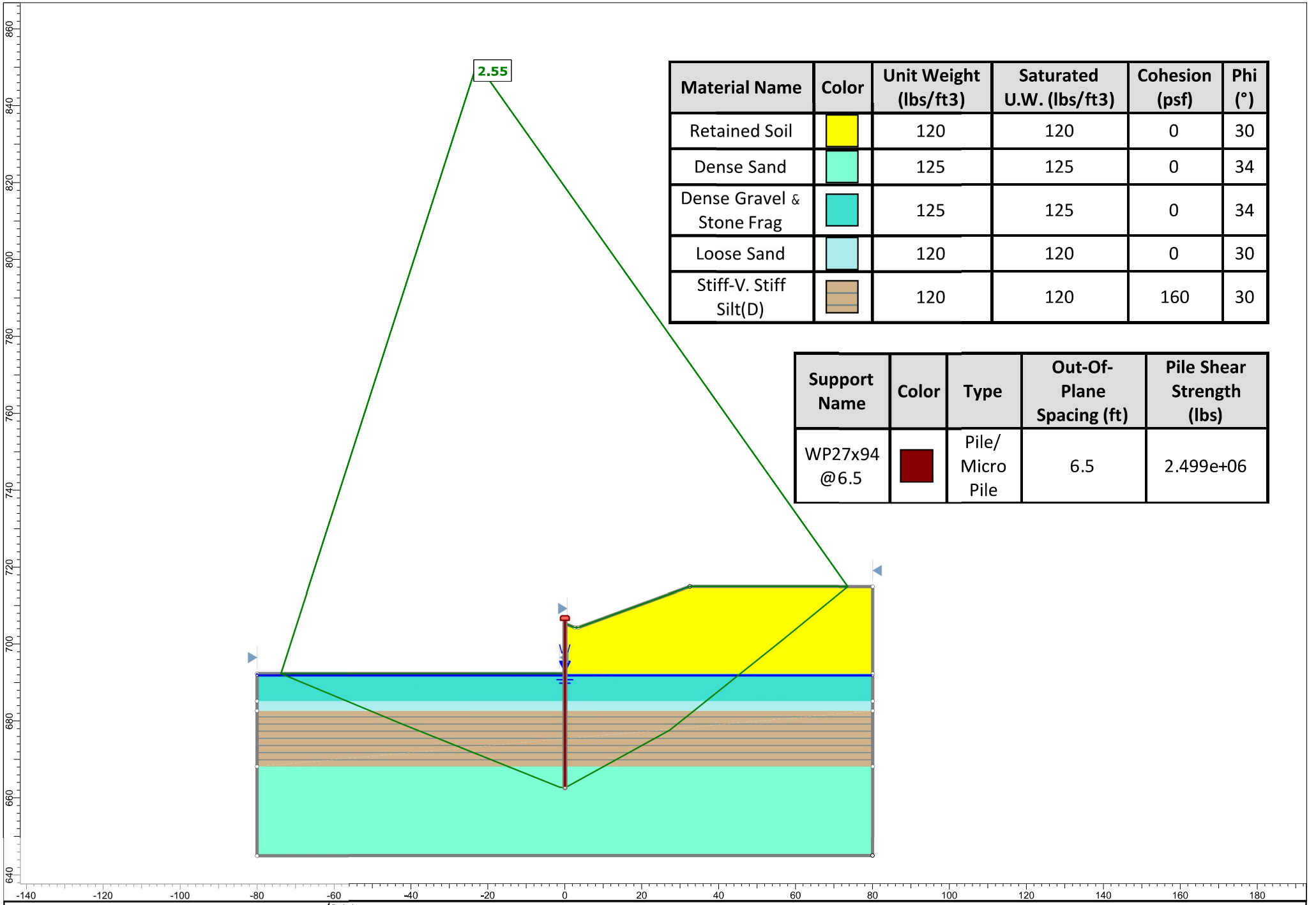
Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Sand		125	125	0	34
Dense Gravel & Stone Frag		125	125	0	34
Loose Sand		120	120	0	30
Stiff-V. Stiff Silt(D)		120	120	160	30



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=17.49 (B-049-0-20)- Effective Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Sand		125	125	0	34
Dense Gravel & Stone Frag		125	125	0	34
Loose Sand		120	120	0	30
Stiff-V. Stiff Silt(D)		120	120	160	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
WP27x94 @6.5		Pile/ Micro Pile	6.5	2.499e+06

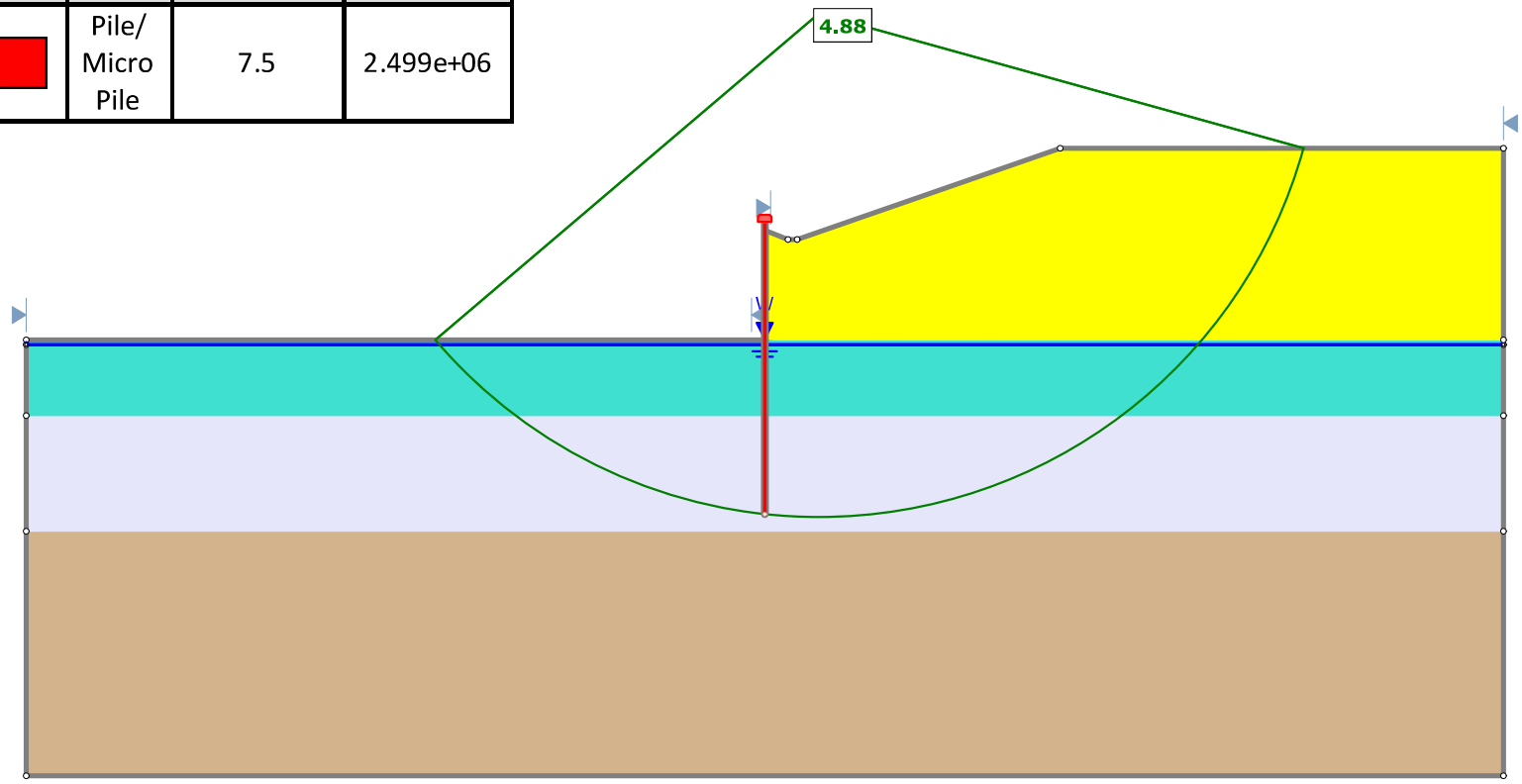
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=17.49 (B-049-0-20)- Effective Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Gravel & Stone Frag		125	125	0	34
V. Stiff Sandy Silt (U)		125	125	3000	0
Hard Sandy Silt(U)		125	125	4000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x84@ 7.5ft		Pile/ Micro Pile	7.5	2.499e+06



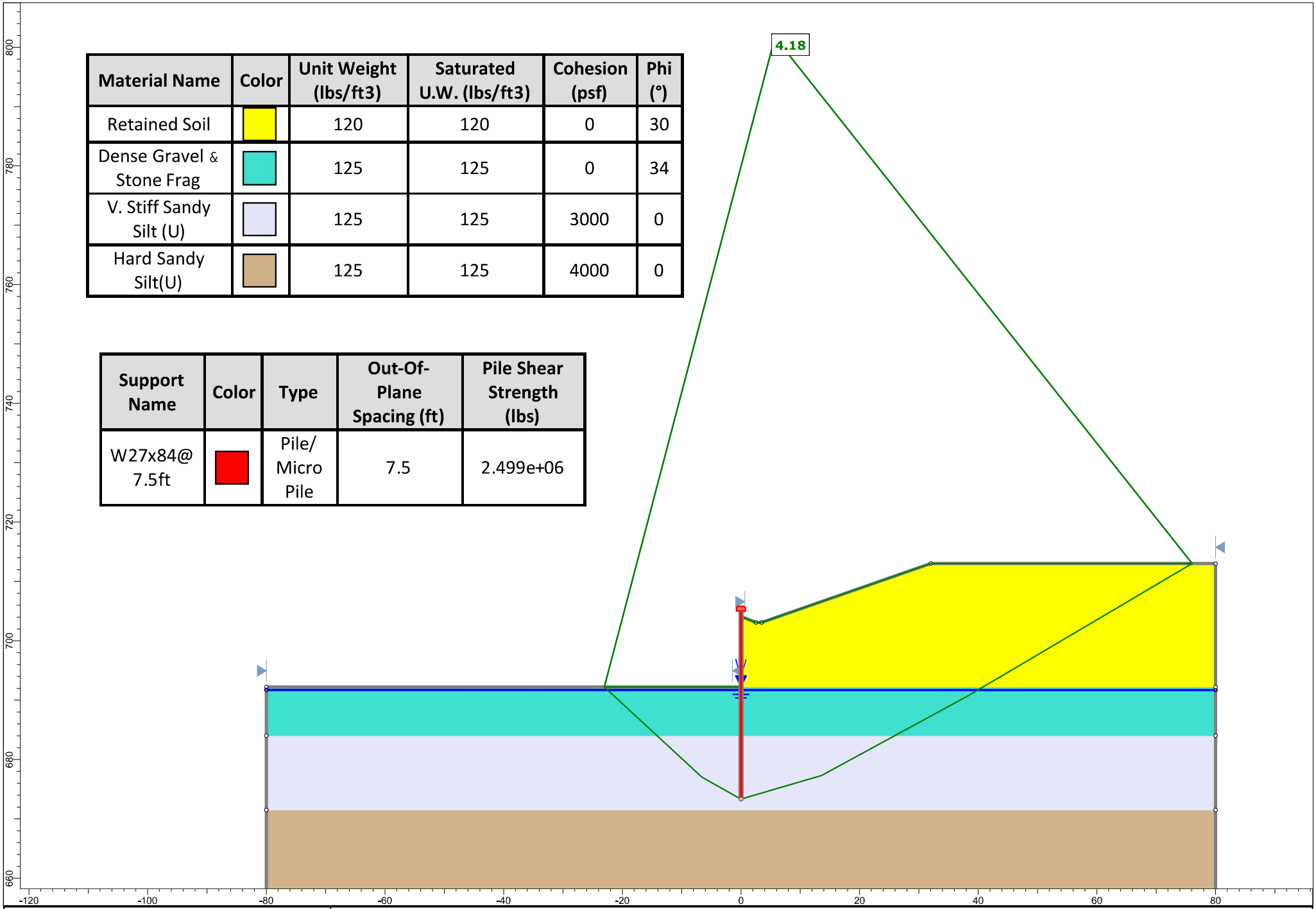
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=16.38 (B-050-0-20)- Total Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Gravel & Stone Frag		125	125	0	34
V. Stiff Sandy Silt (U)		125	125	3000	0
Hard Sandy Silt(U)		125	125	4000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x84@ 7.5ft		Pile/ Micro Pile	7.5	2.499e+06



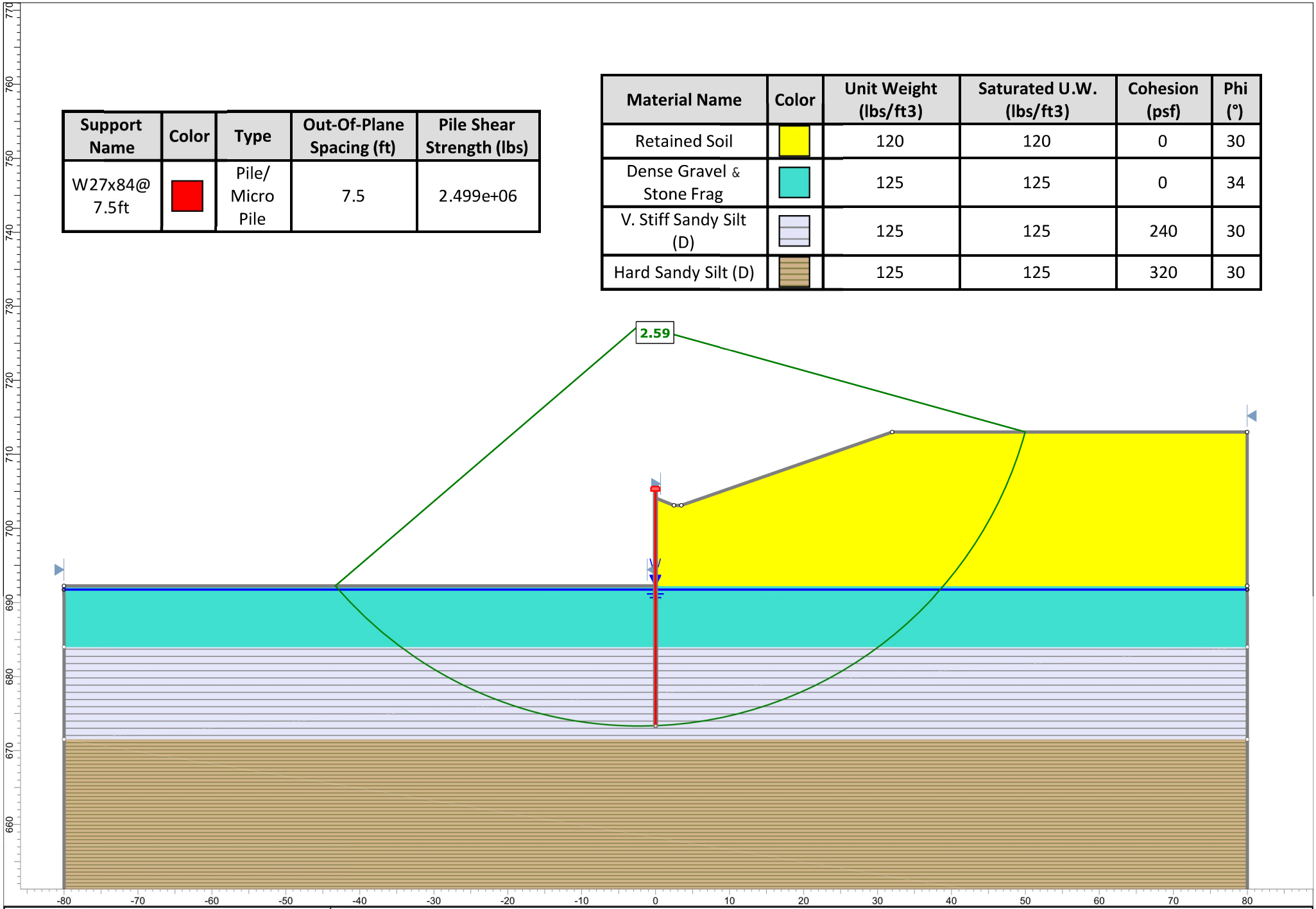
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=16.38 (B-050-0-20)- Total Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x84@ 7.5ft		Pile/ Micro Pile	7.5	2.499e+06

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Gravel & Stone Frag		125	125	0	34
V. Stiff Sandy Silt (D)		125	125	240	30
Hard Sandy Silt (D)		125	125	320	30



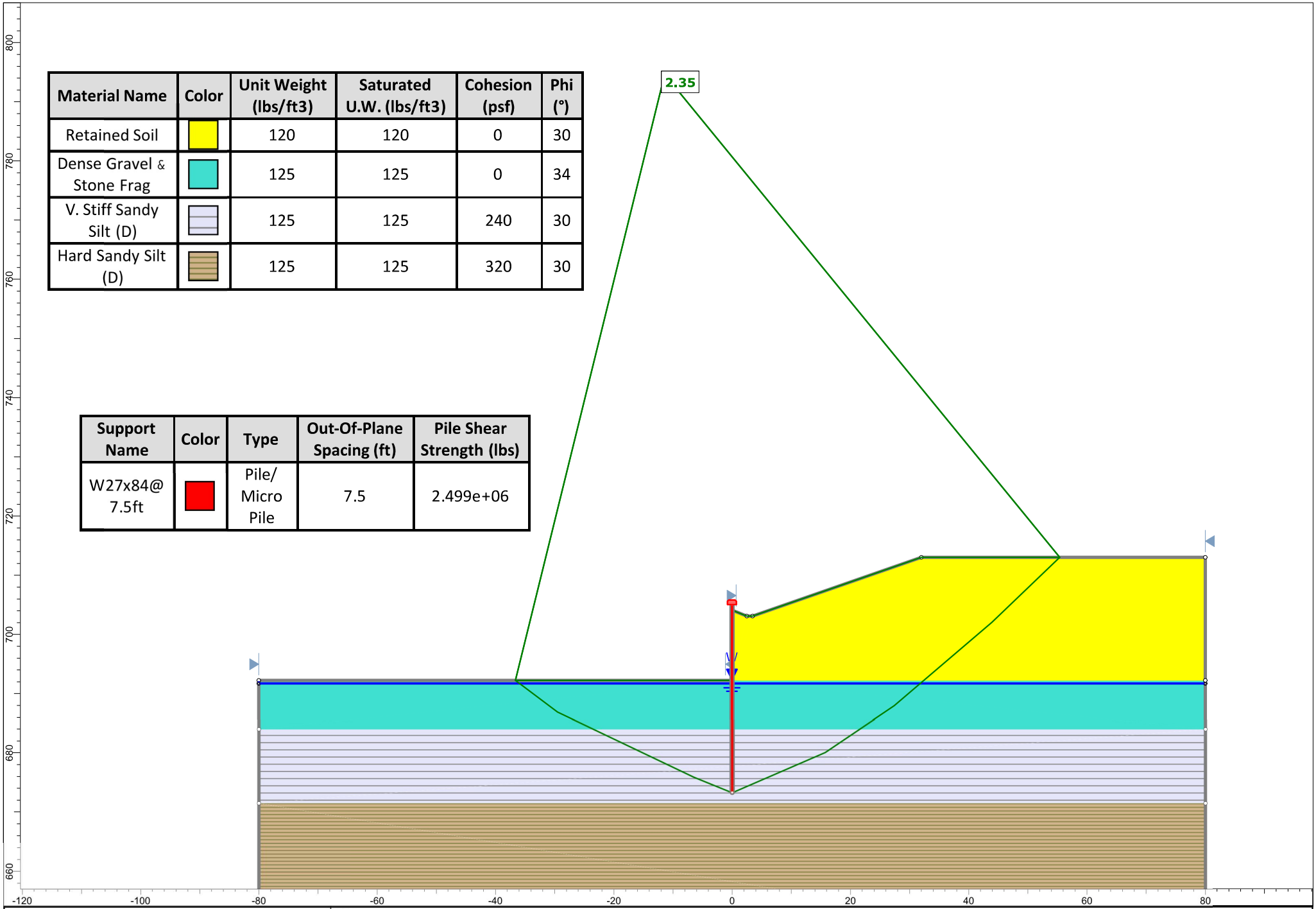
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=16.38 (B-050-0-20)- Effective Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
Dense Gravel & Stone Frag		125	125	0	34
V. Stiff Sandy Silt (D)		125	125	240	30
Hard Sandy Silt (D)		125	125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W27x84@ 7.5ft		Pile/ Micro Pile	7.5	2.499e+06



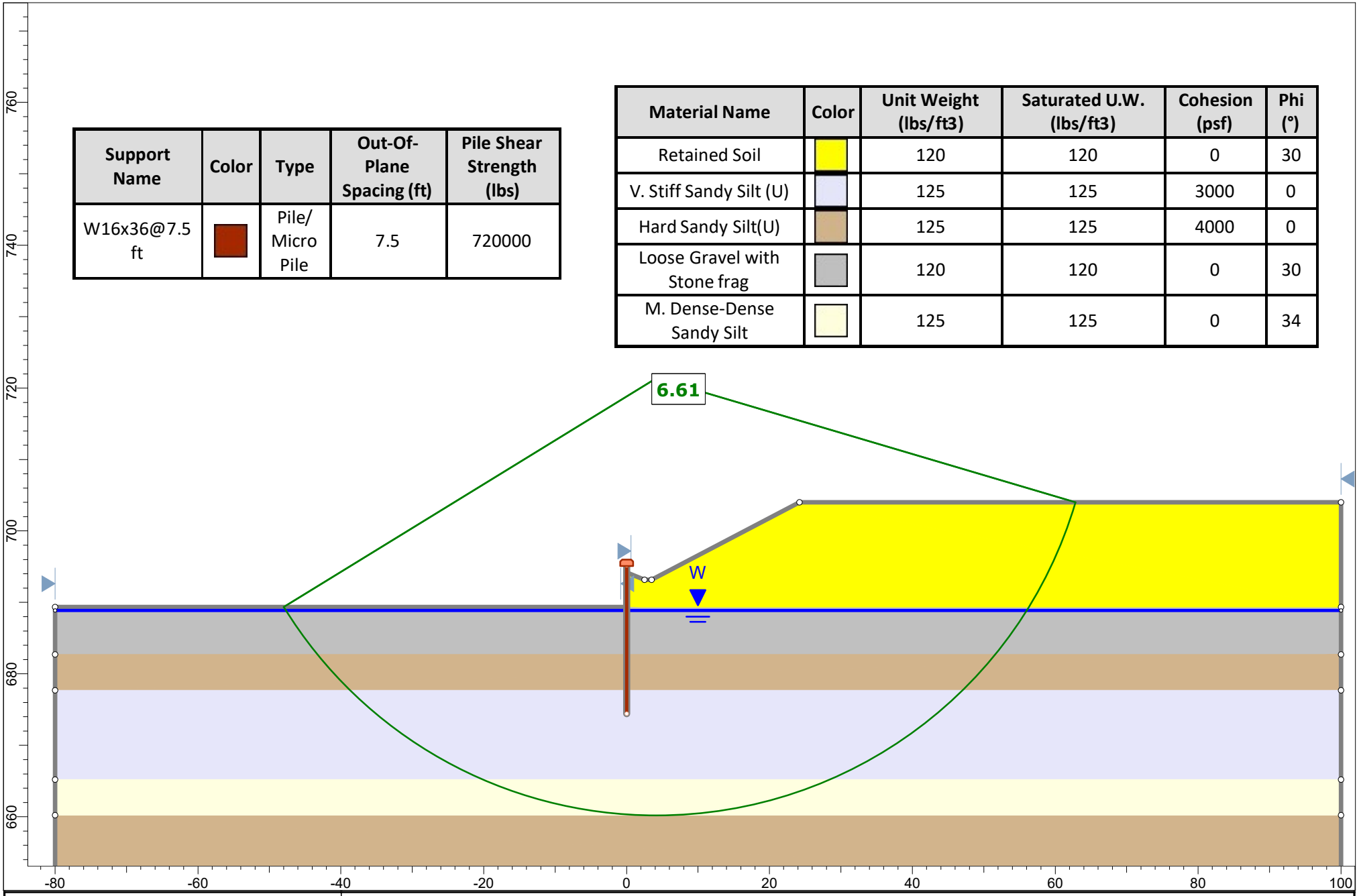
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=16.38 (B-050-0-20)- Effective Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W16x36@7.5 ft		Pile/ Micro Pile	7.5	720000

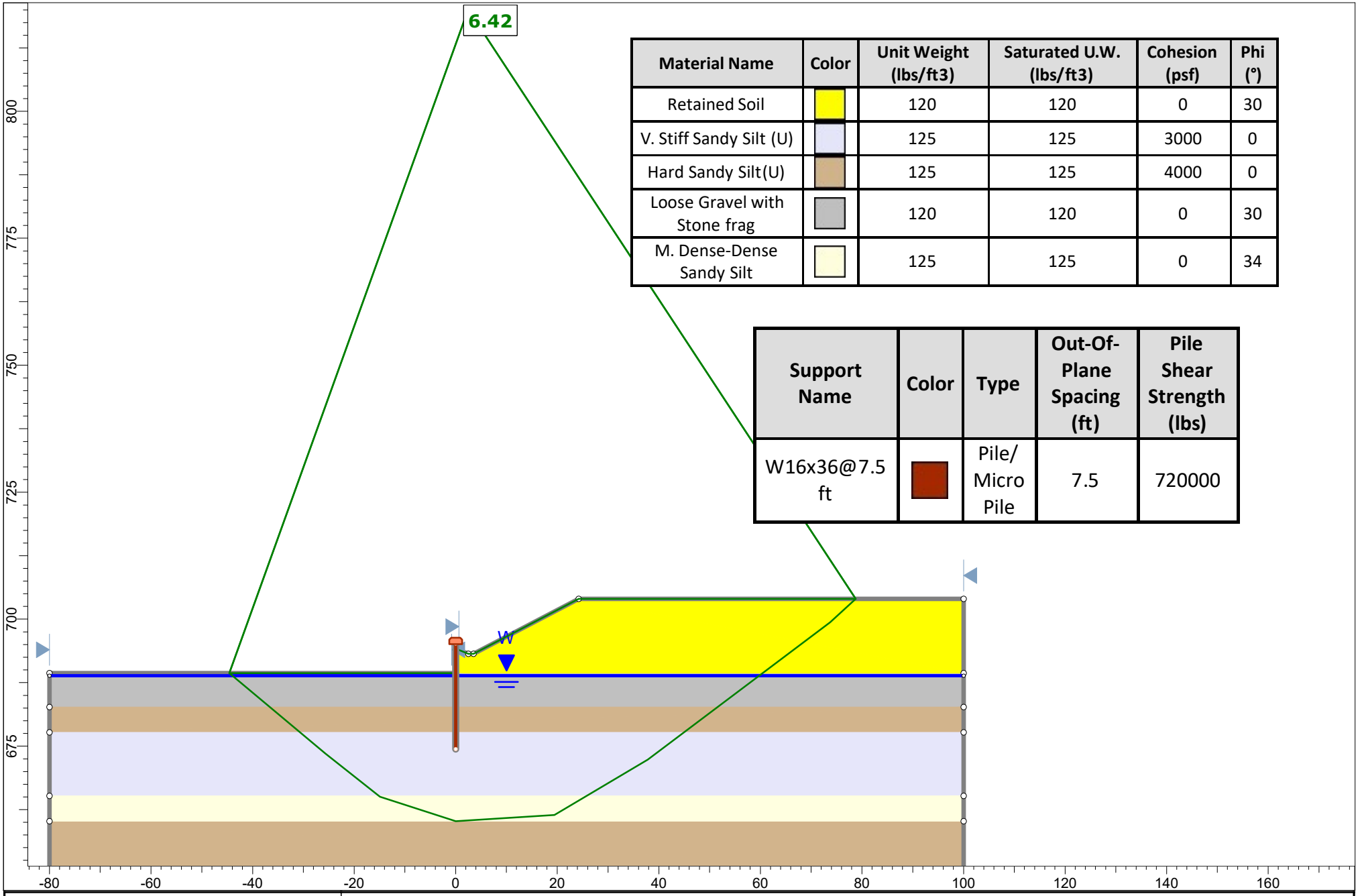
Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
V. Stiff Sandy Silt (U)		125	125	3000	0
Hard Sandy Silt(U)		125	125	4000	0
Loose Gravel with Stone frag		120	120	0	30
M. Dense-Dense Sandy Silt		125	125	0	34



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=9.90 (B-051-0-20)- Total Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
V. Stiff Sandy Silt (U)		125	125	3000	0
Hard Sandy Silt(U)		125	125	4000	0
Loose Gravel with Stone frag		120	120	0	30
M. Dense-Dense Sandy Silt		125	125	0	34

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W16x36@7.5 ft		Pile/ Micro Pile	7.5	720000

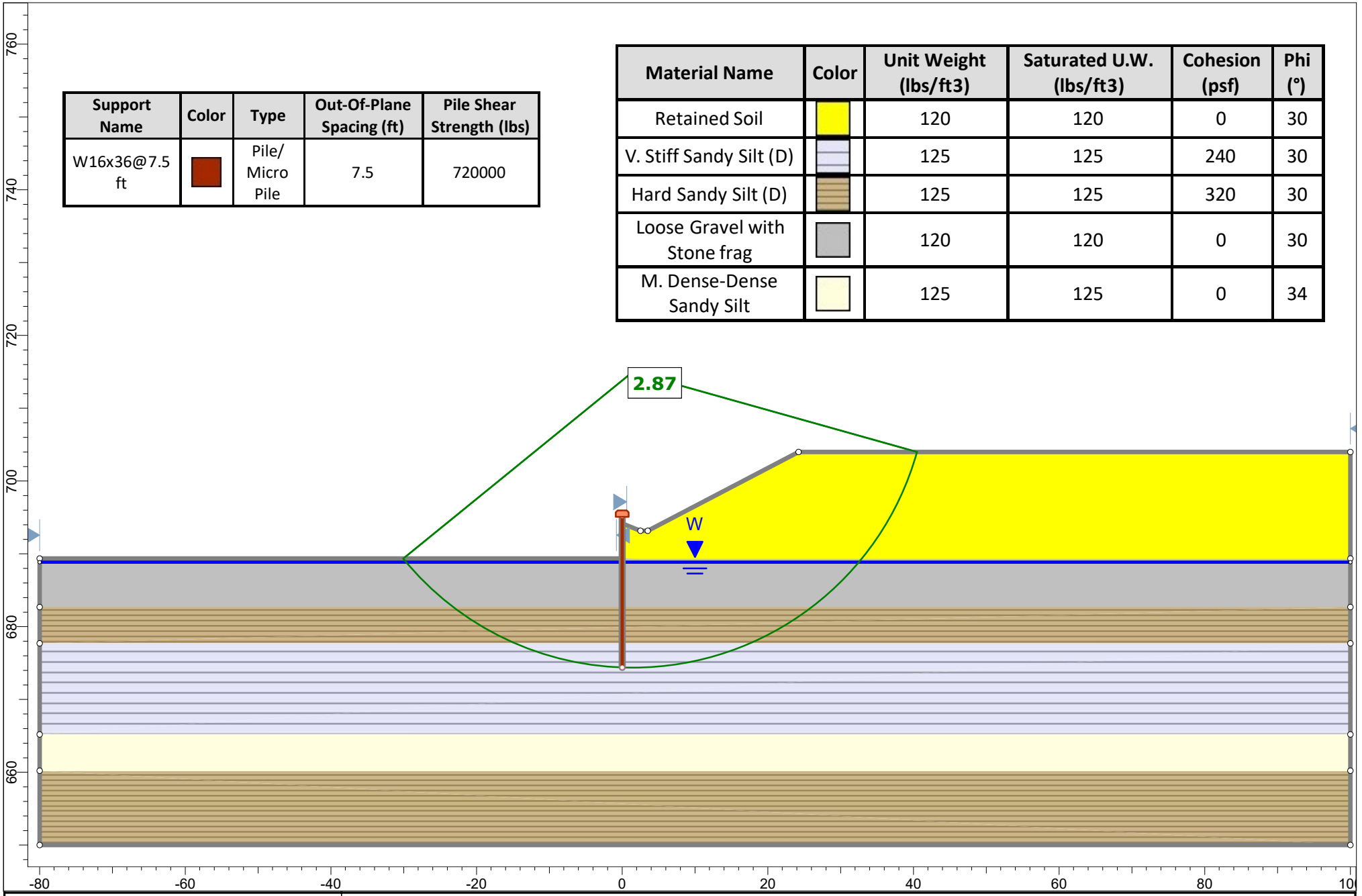
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=9.90 (B-051-0-20)- Total Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W16x36@7.5 ft		Pile/ Micro Pile	7.5	720000

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
V. Stiff Sandy Silt (D)		125	125	240	30
Hard Sandy Silt (D)		125	125	320	30
Loose Gravel with Stone frag		120	120	0	30
M. Dense-Dense Sandy Silt		125	125	0	34



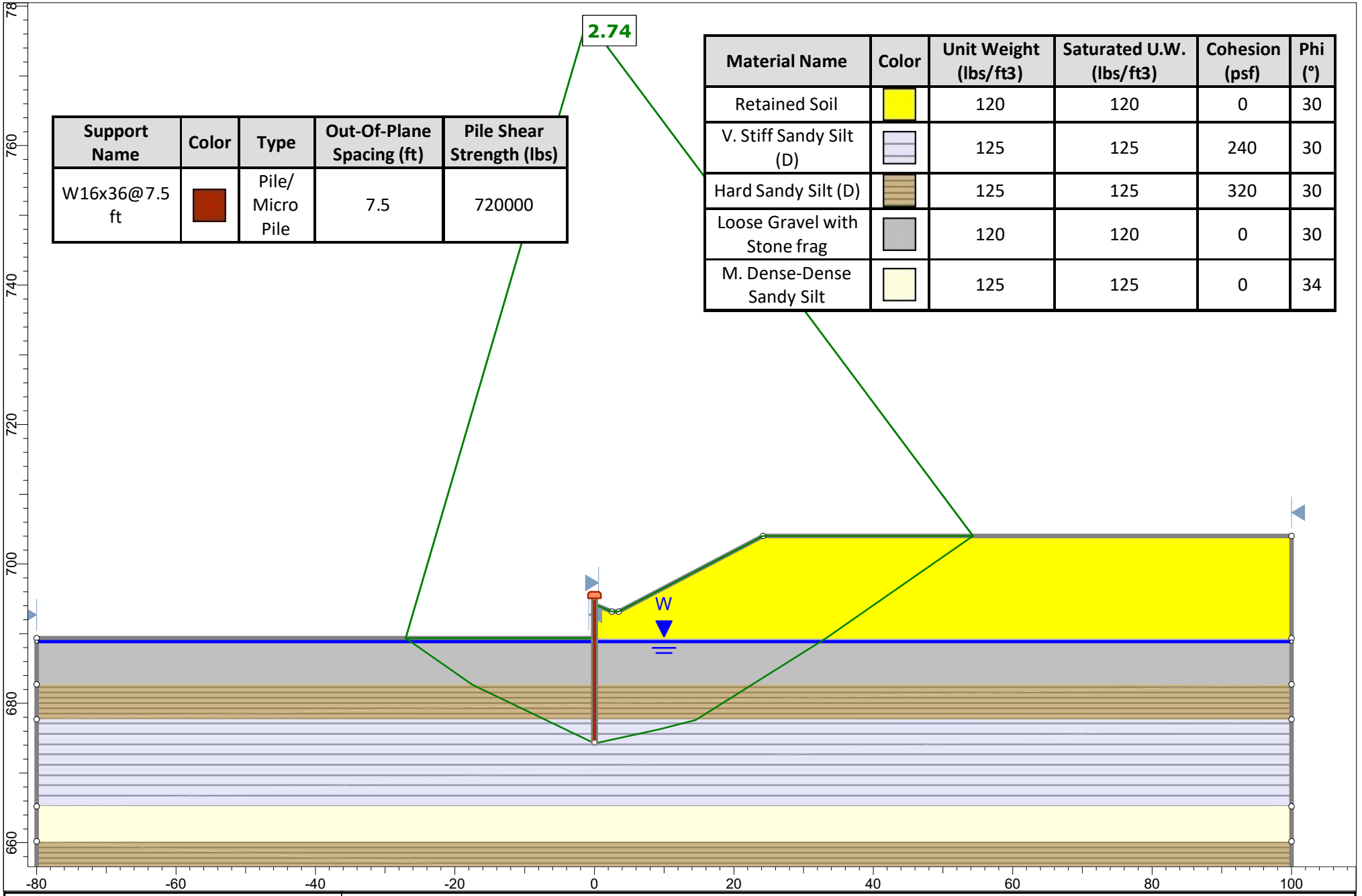
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=9.90 (B-051-0-20)- Effective Stress	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
W16x36@7.5 ft		Pile/ Micro Pile	7.5	720000

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	120	0	30
V. Stiff Sandy Silt (D)		125	125	240	30
Hard Sandy Silt (D)		125	125	320	30
Loose Gravel with Stone frag		120	120	0	30
M. Dense-Dense Sandy Silt		125	125	0	34



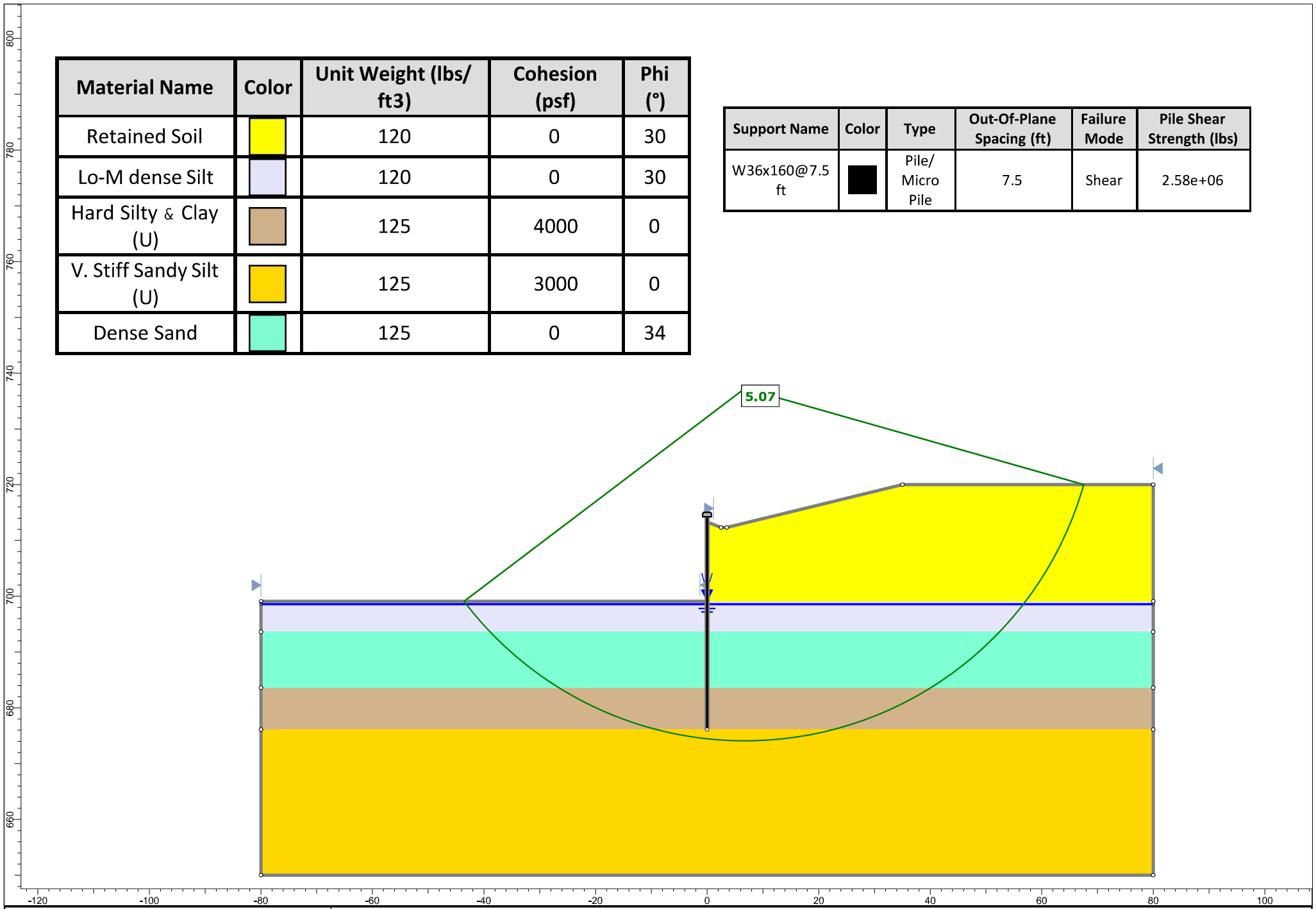
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 1D_H=9.90 (B-051-0-20)- Effective Stress	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 1D.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Lo-M dense Silt		120	0	30
Hard Silty & Clay (U)		125	4000	0
V. Stiff Sandy Silt (U)		125	3000	0
Dense Sand		125	0	34

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x160@7.5 ft		Pile/ Micro Pile	7.5	Shear	2.58e+06



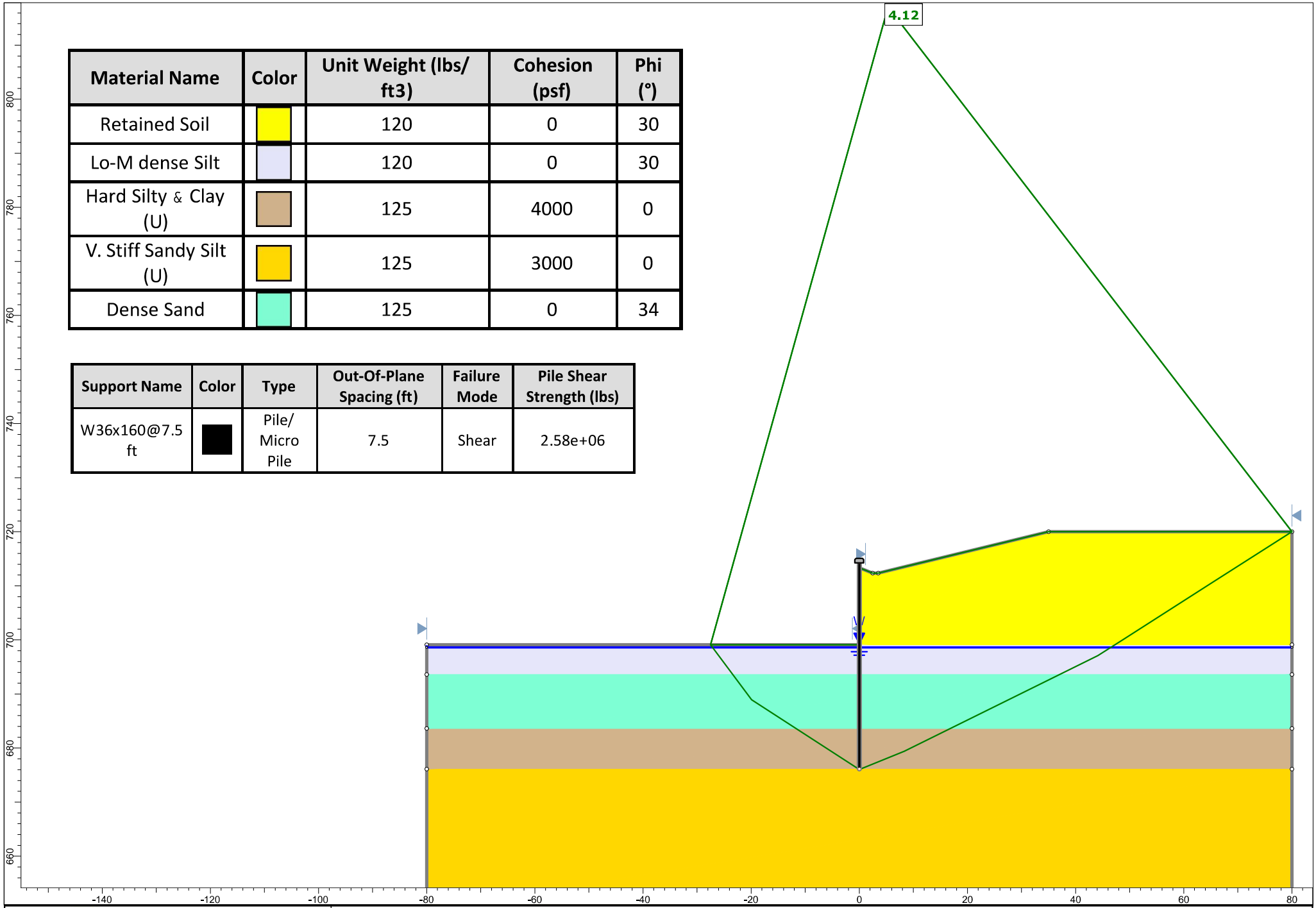
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2_H=18.74 (Total Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 2.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Lo-M dense Silt		120	0	30
Hard Silty & Clay (U)		125	4000	0
V. Stiff Sandy Silt (U)		125	3000	0
Dense Sand		125	0	34

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x160@7.5 ft		Pile/ Micro Pile	7.5	Shear	2.58e+06



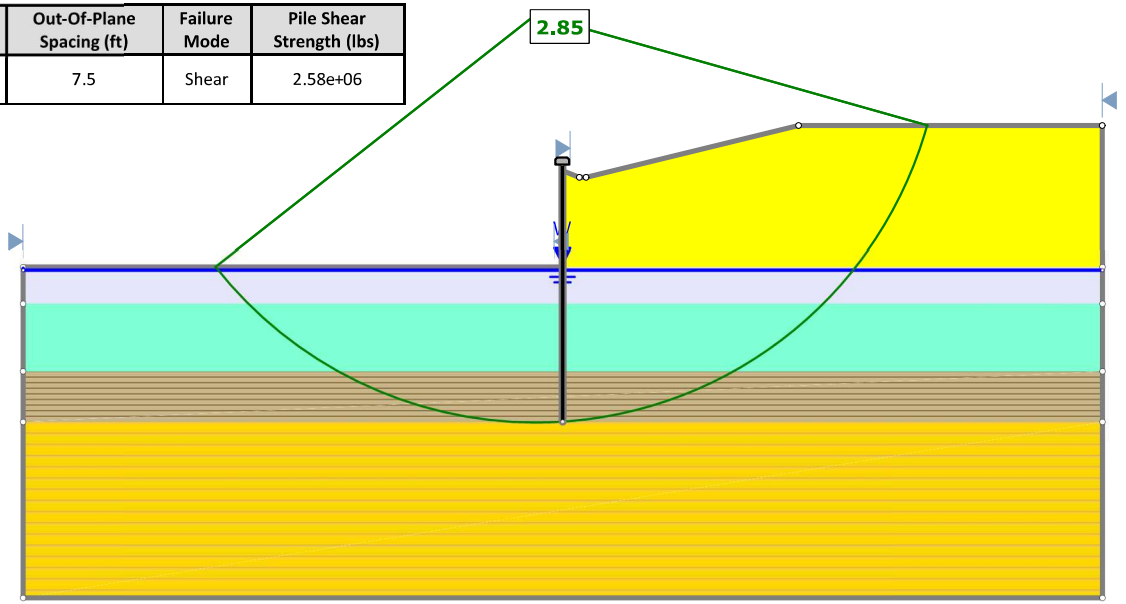
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2_H=18.74 (Total Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 2.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Lo-M dense Silt		120	0	30
Hard Silt & Clay (D)		125	320	30
V. Stiff Sandy Silt (D)		120	240	30
Dense Sand		125	0	34

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x160@7.5 ft		Pile/ Micro Pile	7.5	Shear	2.58e+06



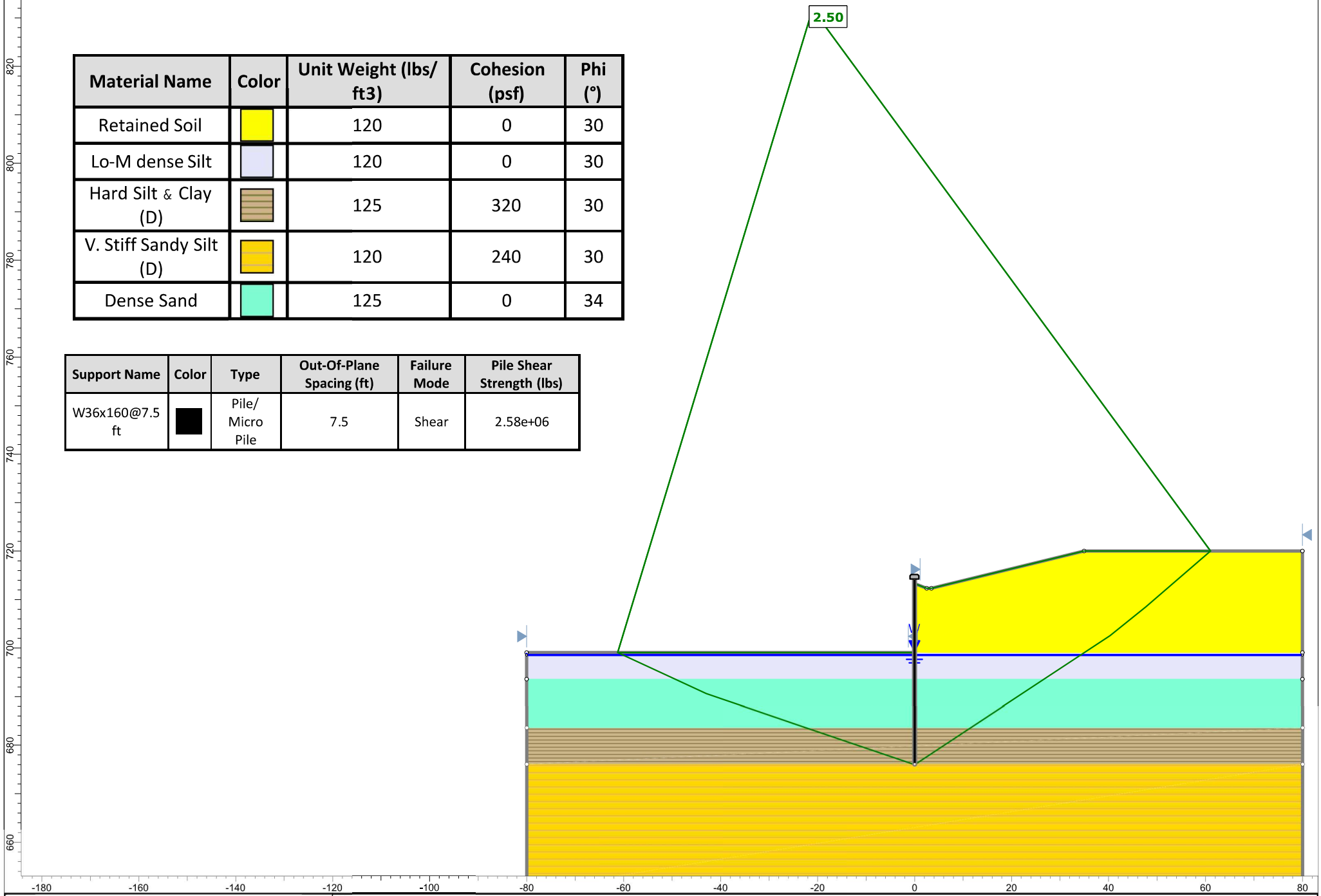
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2_H=18.74 (Effective Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 2.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
Lo-M dense Silt		120	0	30
Hard Silt & Clay (D)		125	320	30
V. Stiff Sandy Silt (D)		120	240	30
Dense Sand		125	0	34

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x160@7.5 ft		Pile/ Micro Pile	7.5	Shear	2.58e+06



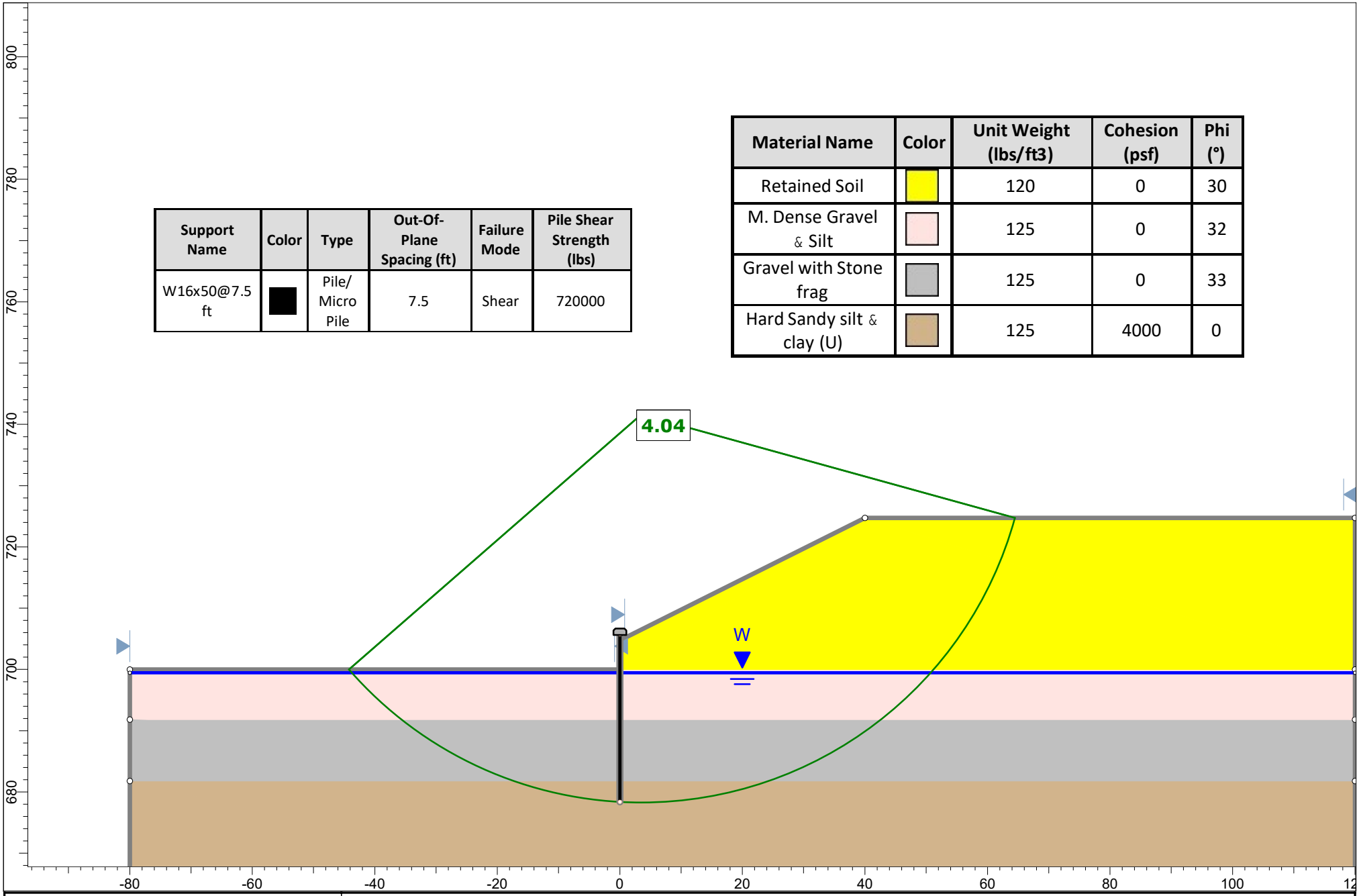
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2_H=18.74 (Effective Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/29/2026	File Name	SP Wall 2.slmd

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W16x50@7.5 ft		Pile/ Micro Pile	7.5	Shear	720000

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense Gravel & Silt		125	0	32
Gravel with Stone frag		125	0	33
Hard Sandy silt & clay (U)		125	4000	0



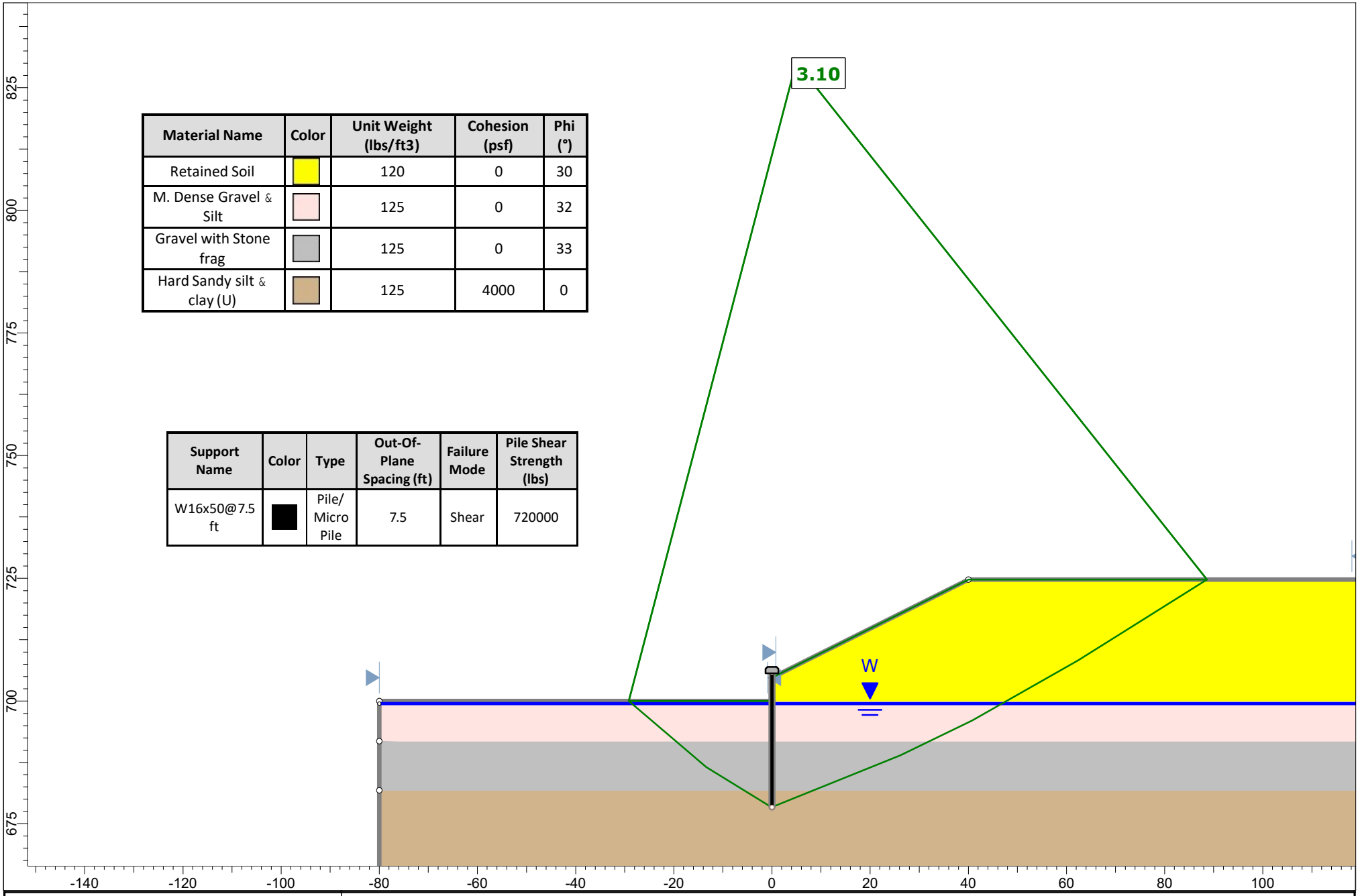
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2A_H=9.27 (Total Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 2A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense Gravel & Silt		125	0	32
Gravel with Stone frag		125	0	33
Hard Sandy silt & clay (U)		125	4000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W16x50@7.5 ft		Pile/ Micro Pile	7.5	Shear	720000



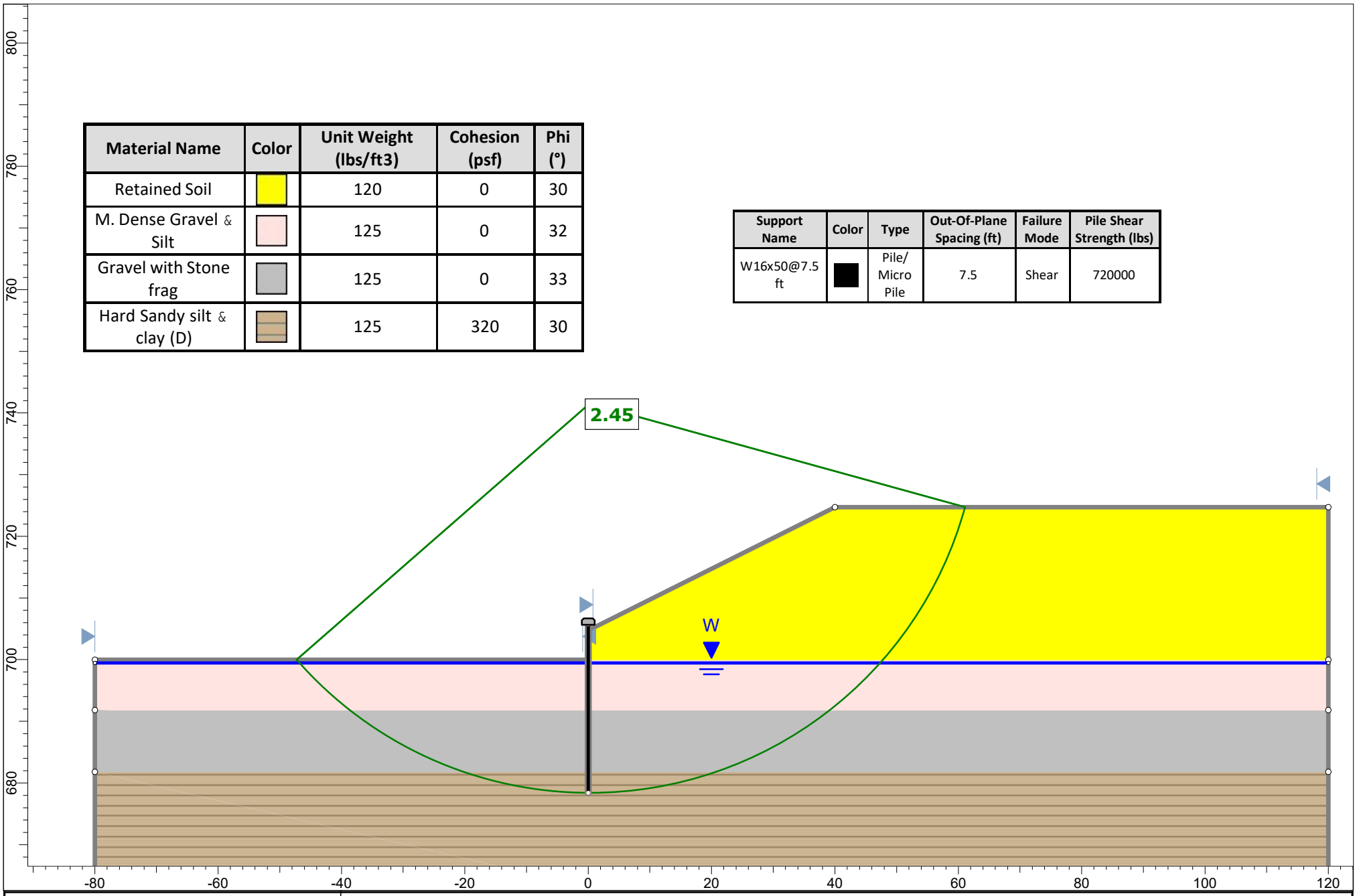
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2A_H=9.27 (Total Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 2A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense Gravel & Silt		125	0	32
Gravel with Stone frag		125	0	33
Hard Sandy silt & clay (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W16x50@7.5 ft		Pile/ Micro Pile	7.5	Shear	720000



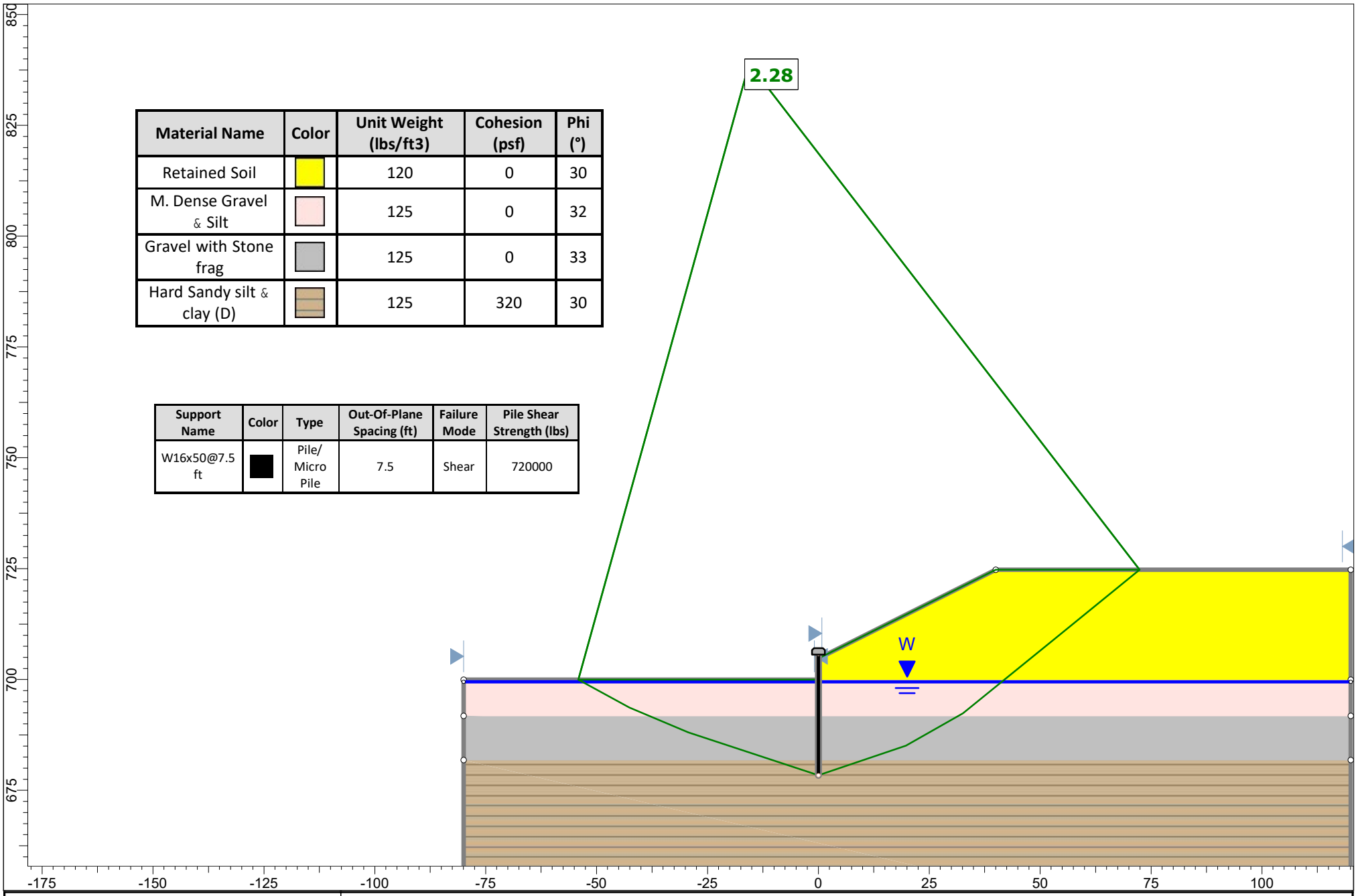
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2A_H=9.27 (Effective Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 2A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense Gravel & Silt		125	0	32
Gravel with Stone frag		125	0	33
Hard Sandy silt & clay (D)		125	320	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W16x50@7.5 ft		Pile/ Micro Pile	7.5	Shear	720000



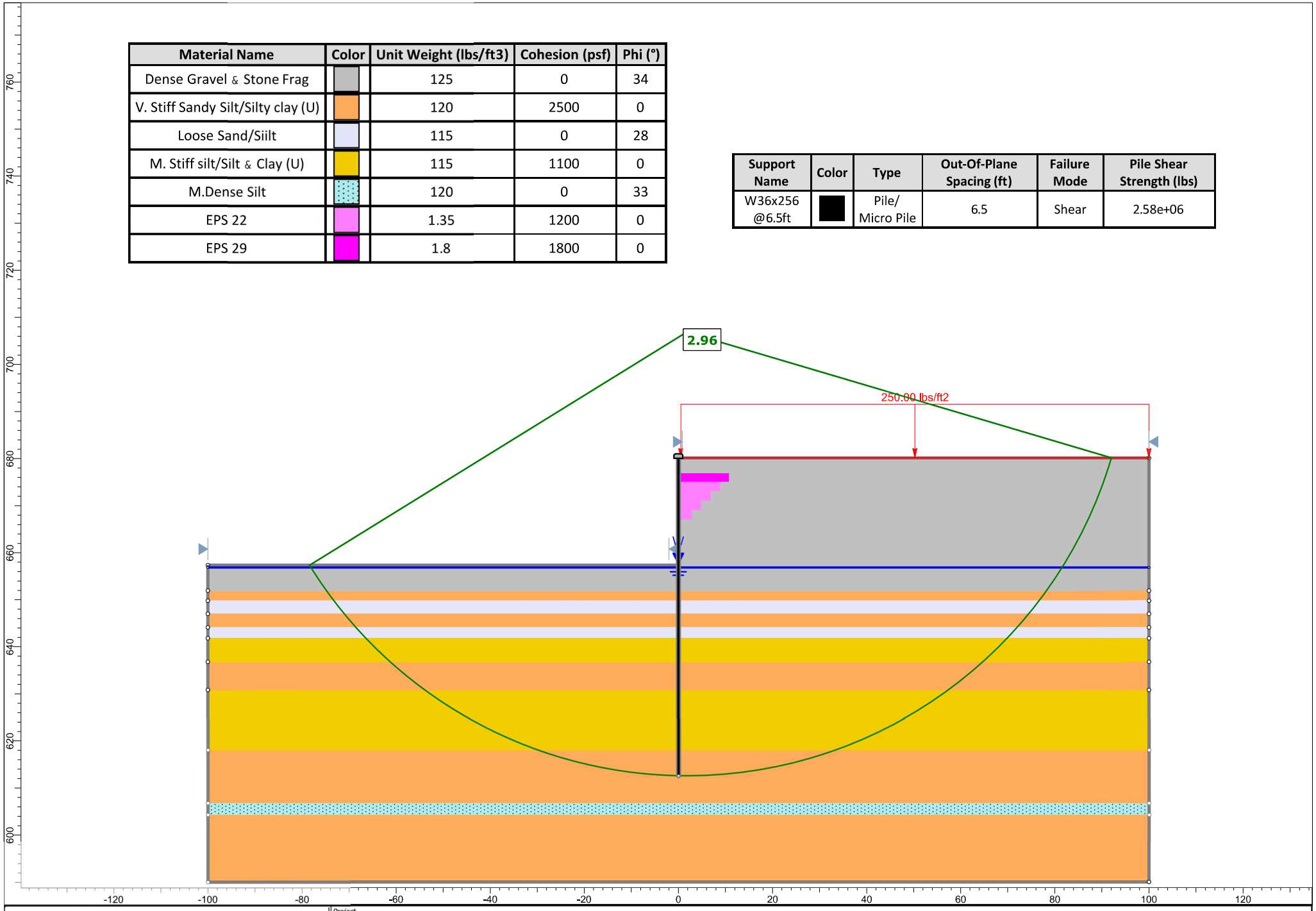
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 2A_H=9.27 (Effective Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 2A.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Dense Gravel & Stone Frag		125	0	34
V. Stiff Sandy Silt/Silty clay (U)		120	2500	0
Loose Sand/Siilt		115	0	28
M. Stiff silt/Silt & Clay (U)		115	1100	0
M.Dense Silt		120	0	33
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.5ft		Pile/ Micro Pile	6.5	Shear	2.58e+06



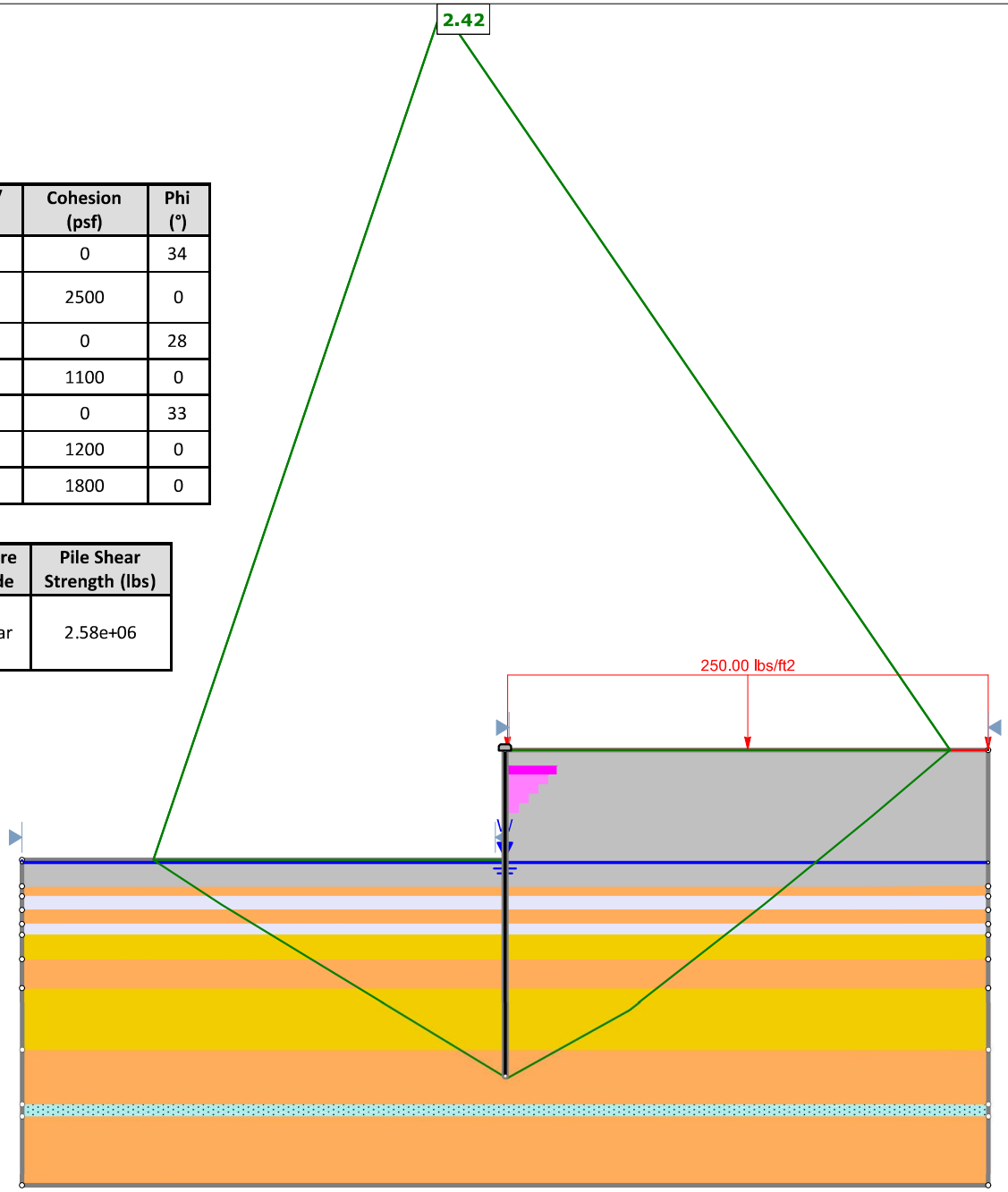
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5B_H=27.46 (Total Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Walls 5B 3-31-26.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Dense Gravel & Stone Frag		125	0	34
V. Stiff Sandy Silt/Silty clay (U)		120	2500	0
Loose Sand/Siilt		115	0	28
M. Stiff silt/Silt & Clay (U)		115	1100	0
M.Dense Silt		120	0	33
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.5ft		Pile/ Micro Pile	6.5	Shear	2.58e+06



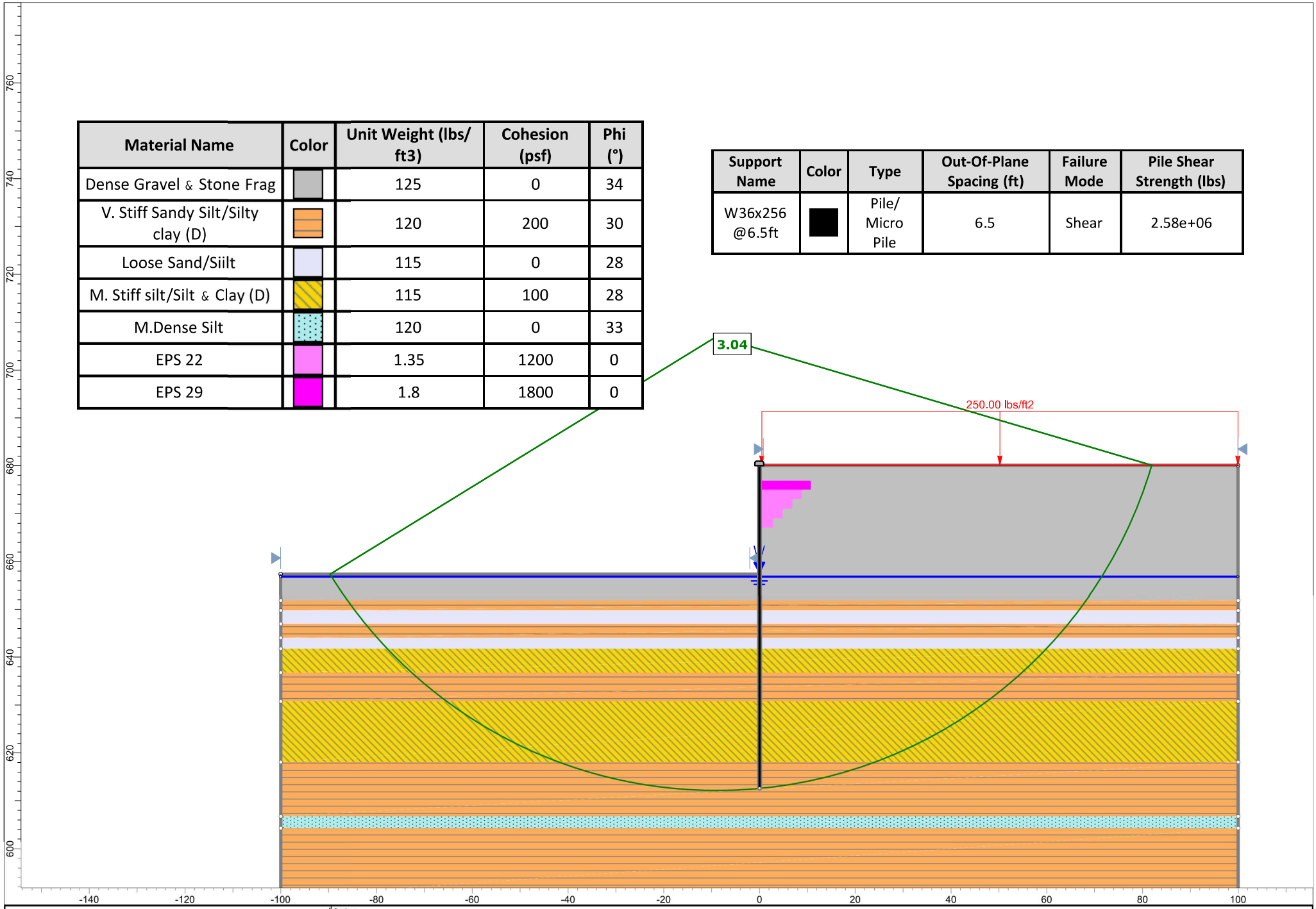
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5B_H=27.46 (Total Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Walls 5B 3-31-26.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Dense Gravel & Stone Frag		125	0	34
V. Stiff Sandy Silt/Silty clay (D)		120	200	30
Loose Sand/Siilt		115	0	28
M. Stiff silt/Silt & Clay (D)		115	100	28
M.Dense Silt		120	0	33
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.5ft		Pile/ Micro Pile	6.5	Shear	2.58e+06

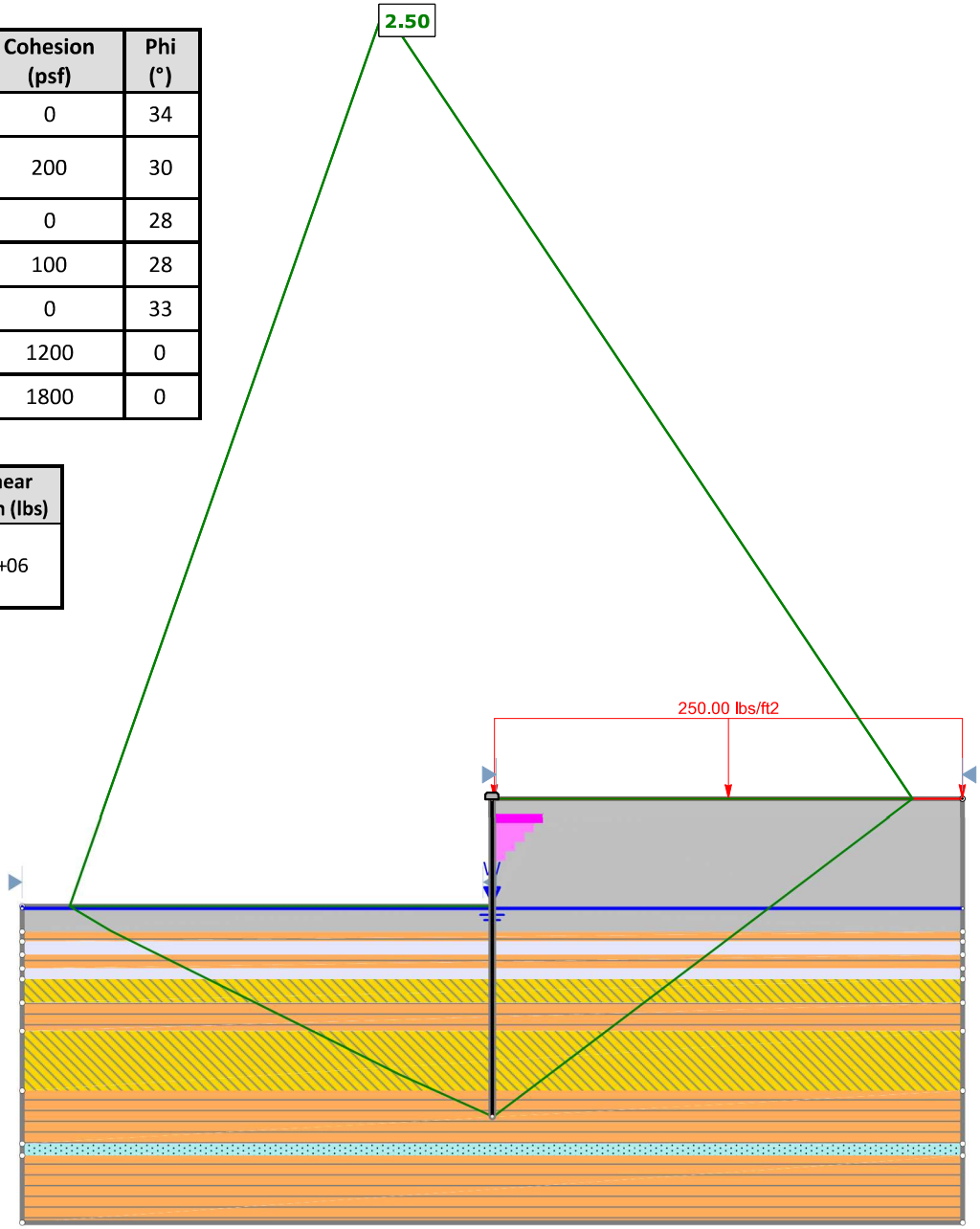


SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5B_H=27.46 (Effective Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Walls 5B 3-31-26.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Dense Gravel & Stone Frag		125	0	34
V. Stiff Sandy Silt/Silty clay (D)		120	200	30
Loose Sand/Siilt		115	0	28
M. Stiff silt/Silt & Clay (D)		115	100	28
M.Dense Silt		120	0	33
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.5ft		Pile/ Micro Pile	6.5	Shear	2.58e+06



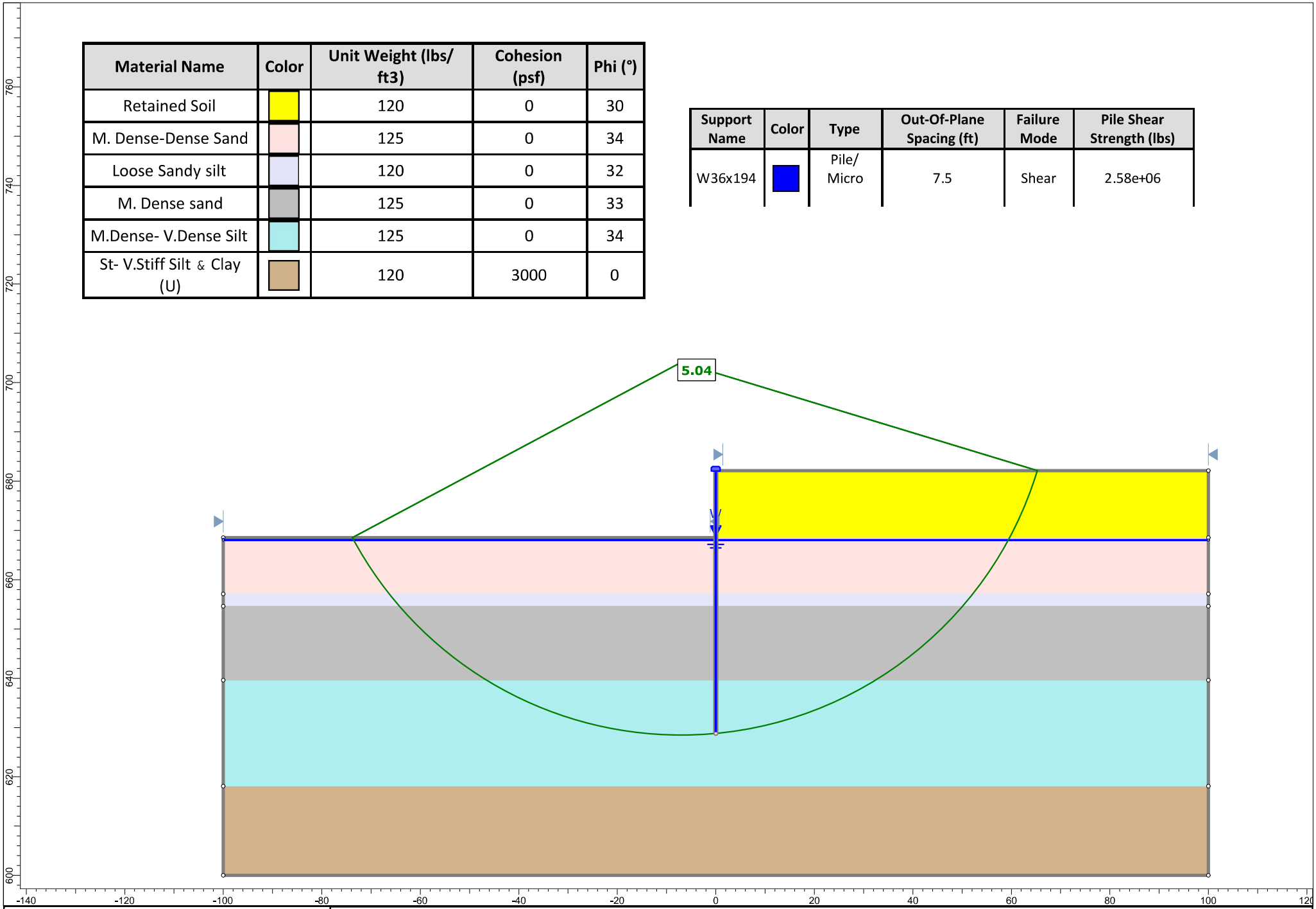
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5B_H=27.46 (Effective Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Walls 5B 3-31-26.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense-Dense Sand		125	0	34
Loose Sandy silt		120	0	32
M. Dense sand		125	0	33
M.Dense- V.Dense Silt		125	0	34
St- V.Stiff Silt & Clay (U)		120	3000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x194		Pile/ Micro	7.5	Shear	2.58e+06



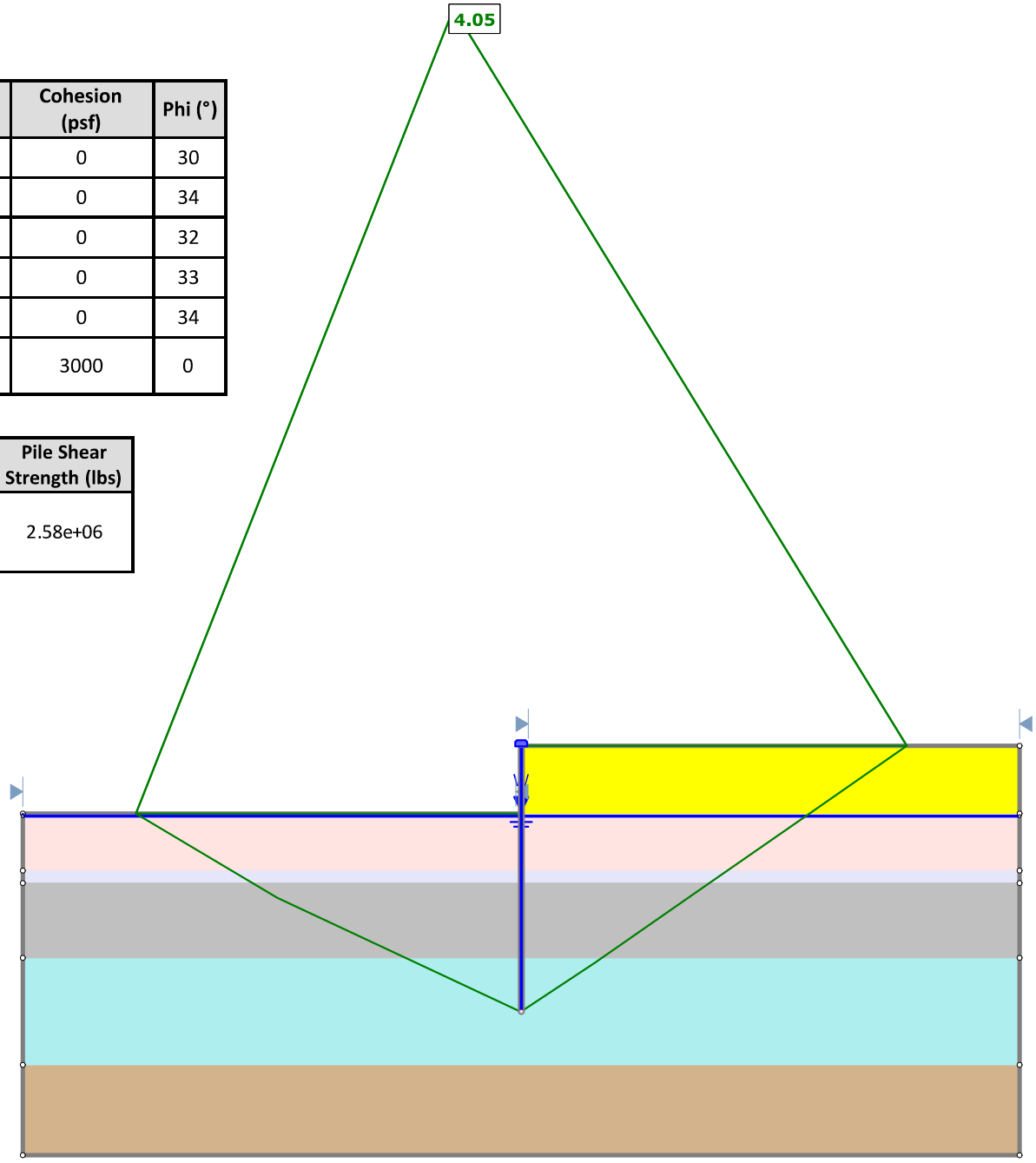
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5C_H=18.31 (Total Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 5C.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense-Dense Sand		125	0	34
Loose Sandy silt		120	0	32
M. Dense sand		125	0	33
M.Dense- V.Dense Silt		125	0	34
St- V.Stiff Silt & Clay (U)		120	3000	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x194		Pile/ Micro Pile	7.5	Shear	2.58e+06

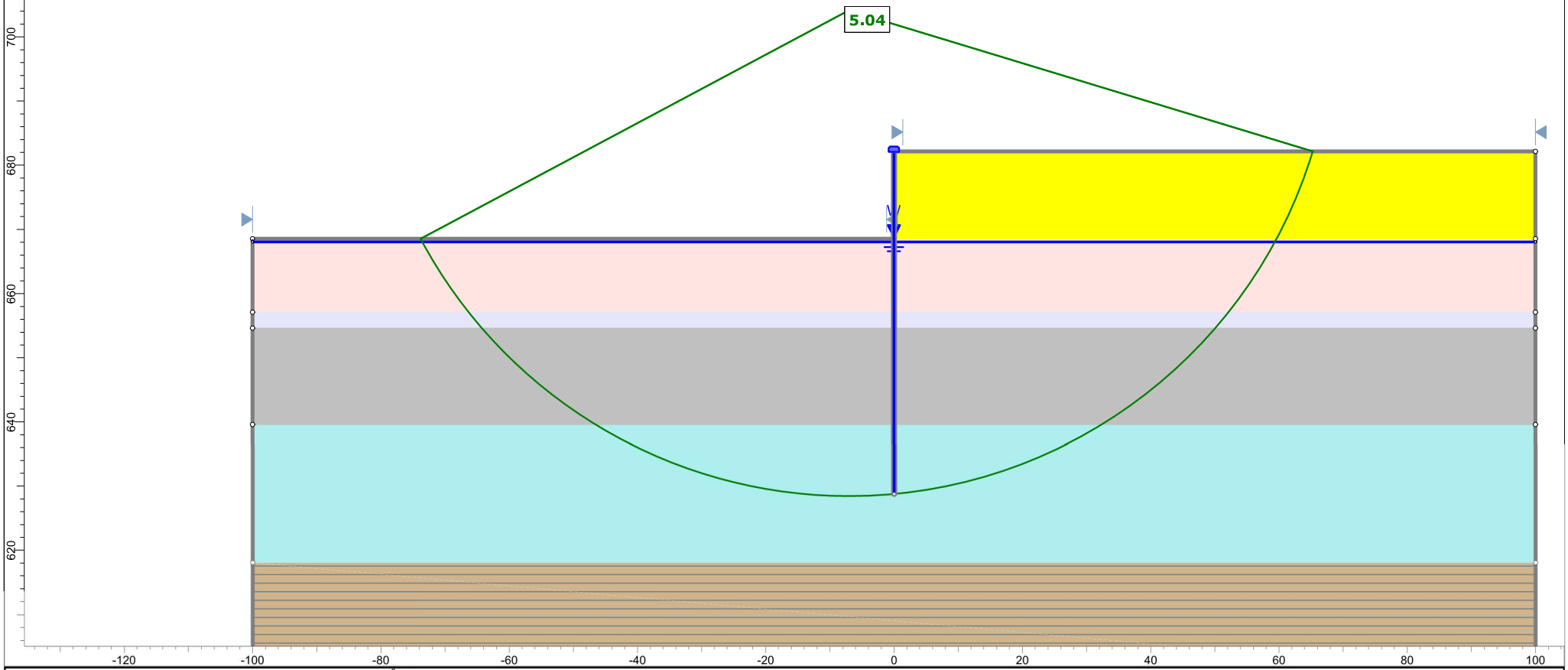


SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5C_H=18.31 (Total Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 5C.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense-Dense Sand		125	0	34
Loose Sandy silt		120	0	32
M. Dense sand		125	0	33
M.Dense- V.Dense Silt		125	0	34
St- V.Stiff Silt & Clay (D)		120	240	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x194		Pile/ Micro Pile	7.5	Shear	2.58e+06



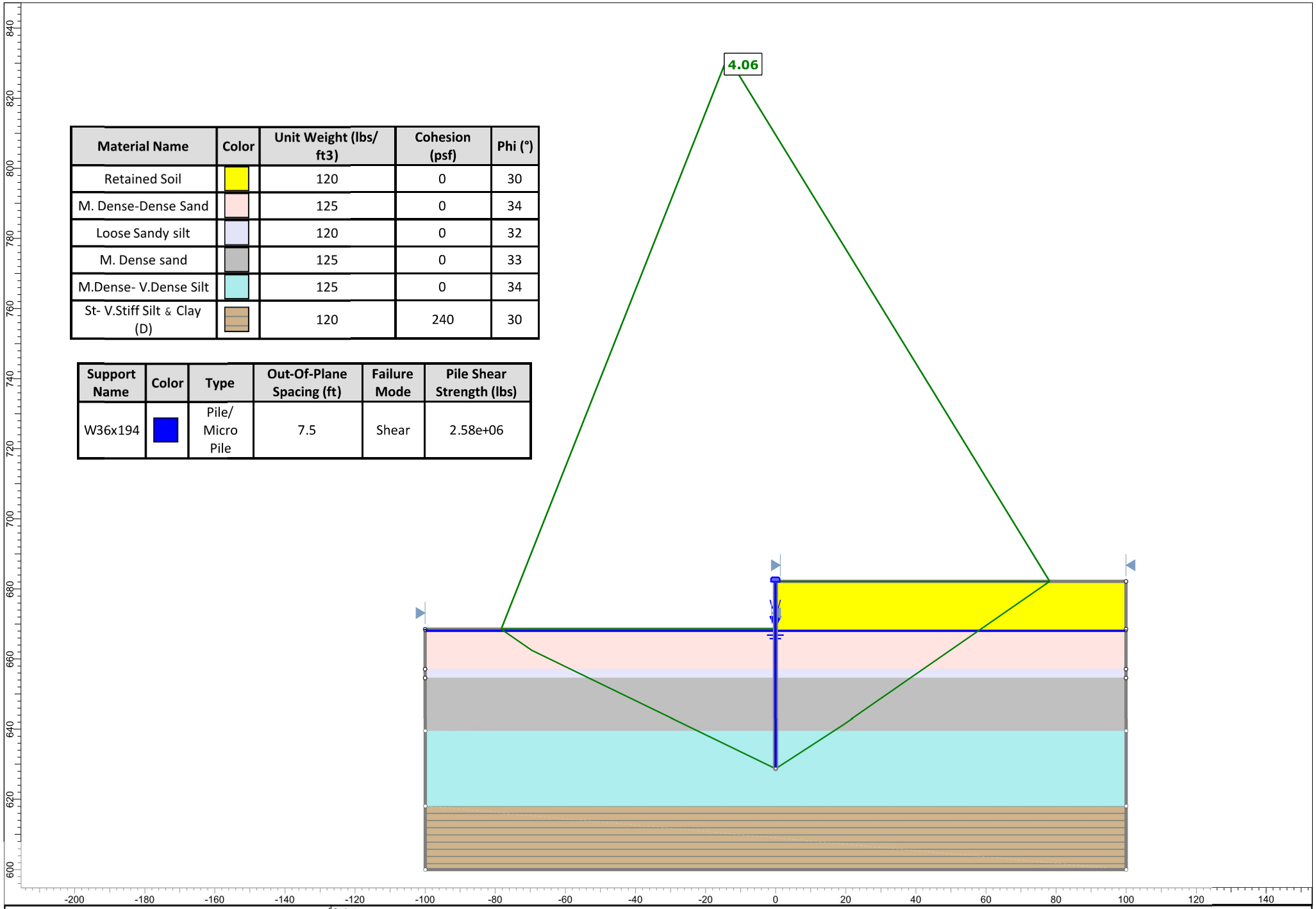
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5C_H=18.31 (Effective Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 5C.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense-Dense Sand		125	0	34
Loose Sandy silt		120	0	32
M. Dense sand		125	0	33
M.Dense- V.Dense Silt		125	0	34
St- V.Stiff Silt & Clay (D)		120	240	30

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x194		Pile/ Micro Pile	7.5	Shear	2.58e+06



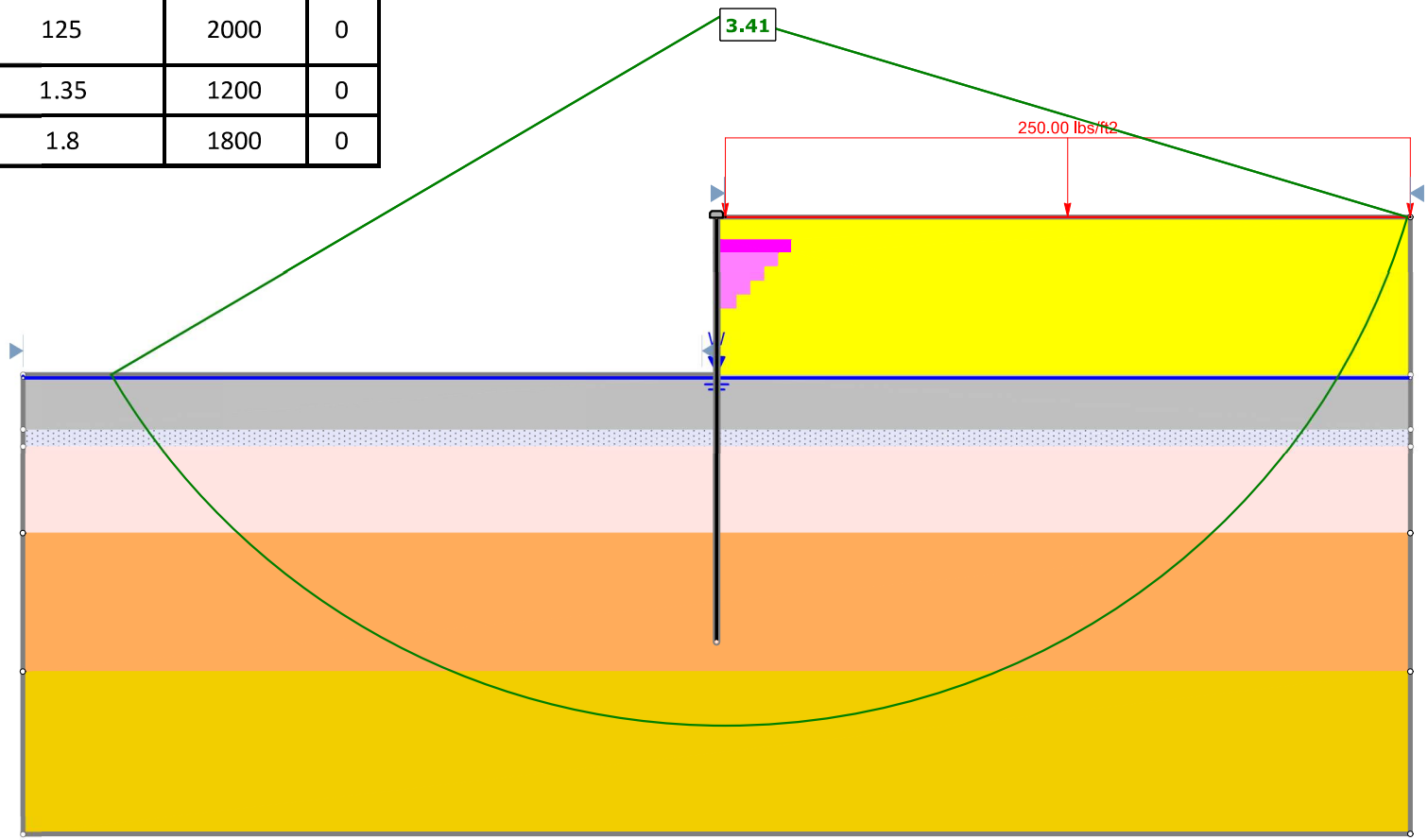
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5C_H=18.31 (Effective Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 5C.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense sand		125	0	34
M. Dense Gravel & Stone Frag		125	0	32
Loose-Dense Silt		125	0	33
V. Stiff Sandy Silt/Silty clay (U)		120	2500	0
Stiff-V. Stiff Silt & Clay (U)		125	2000	0
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.75ft		Pile/ Micro Pile	6.75	Shear	2.58e+06



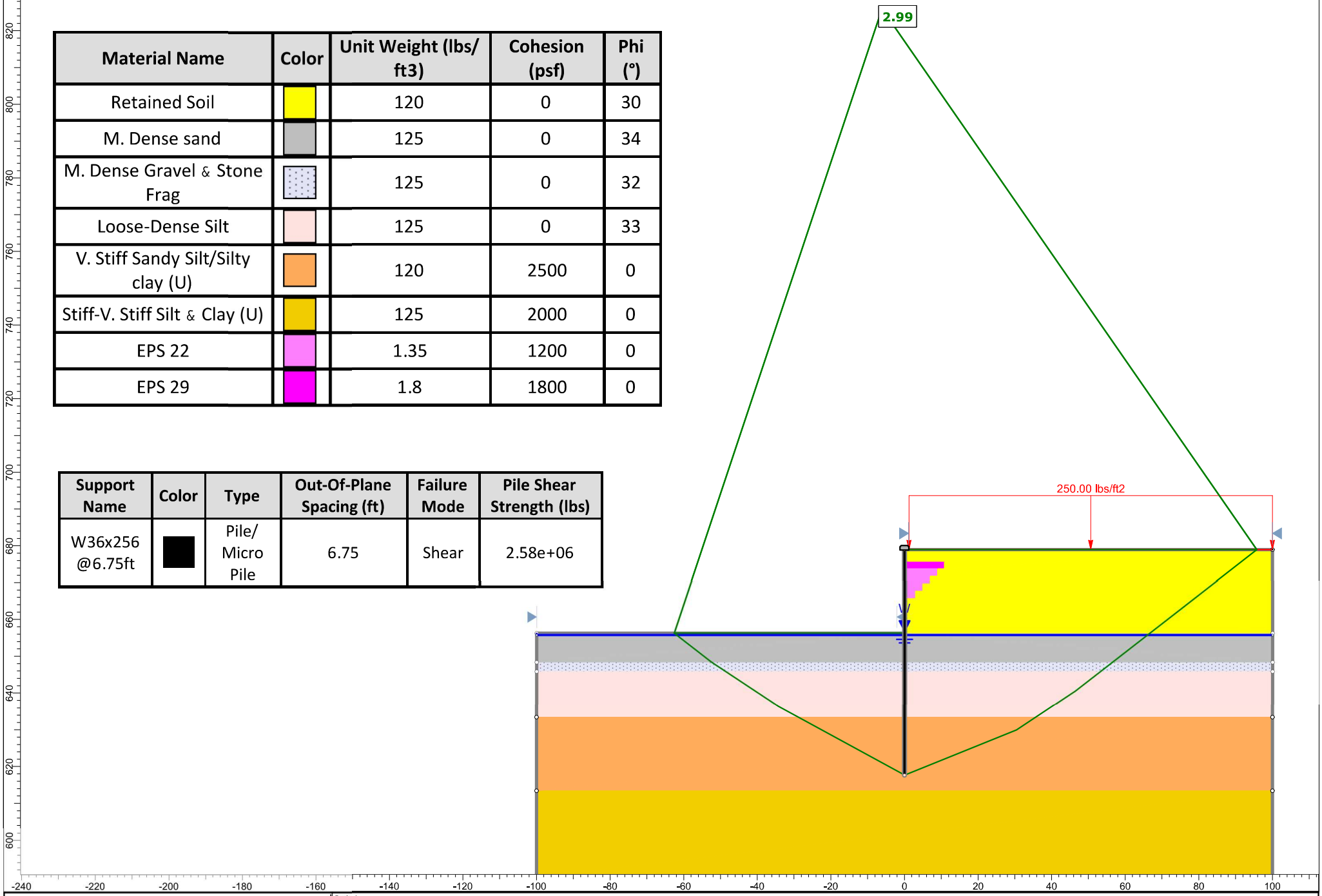
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 7_H=26.23 (Total Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 7.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense sand		125	0	34
M. Dense Gravel & Stone Frag		125	0	32
Loose-Dense Silt		125	0	33
V. Stiff Sandy Silt/Silty clay (U)		120	2500	0
Stiff-V. Stiff Silt & Clay (U)		125	2000	0
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.75ft		Pile/ Micro Pile	6.75	Shear	2.58e+06



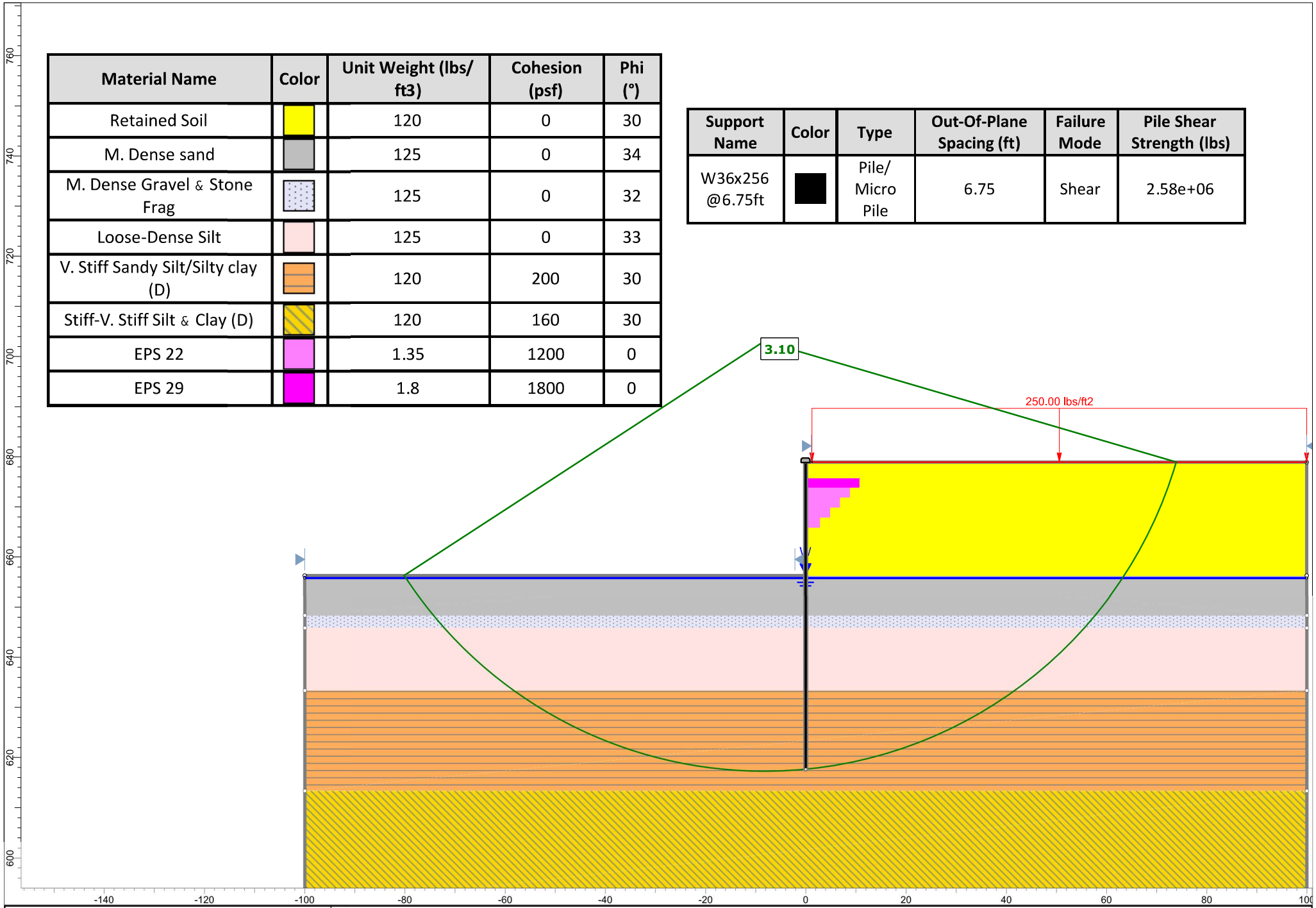
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 7_H=26.23 (Total Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 7.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense sand		125	0	34
M. Dense Gravel & Stone Frag		125	0	32
Loose-Dense Silt		125	0	33
V. Stiff Sandy Silt/Silty clay (D)		120	200	30
Stiff-V. Stiff Silt & Clay (D)		120	160	30
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.75ft		Pile/ Micro Pile	6.75	Shear	2.58e+06

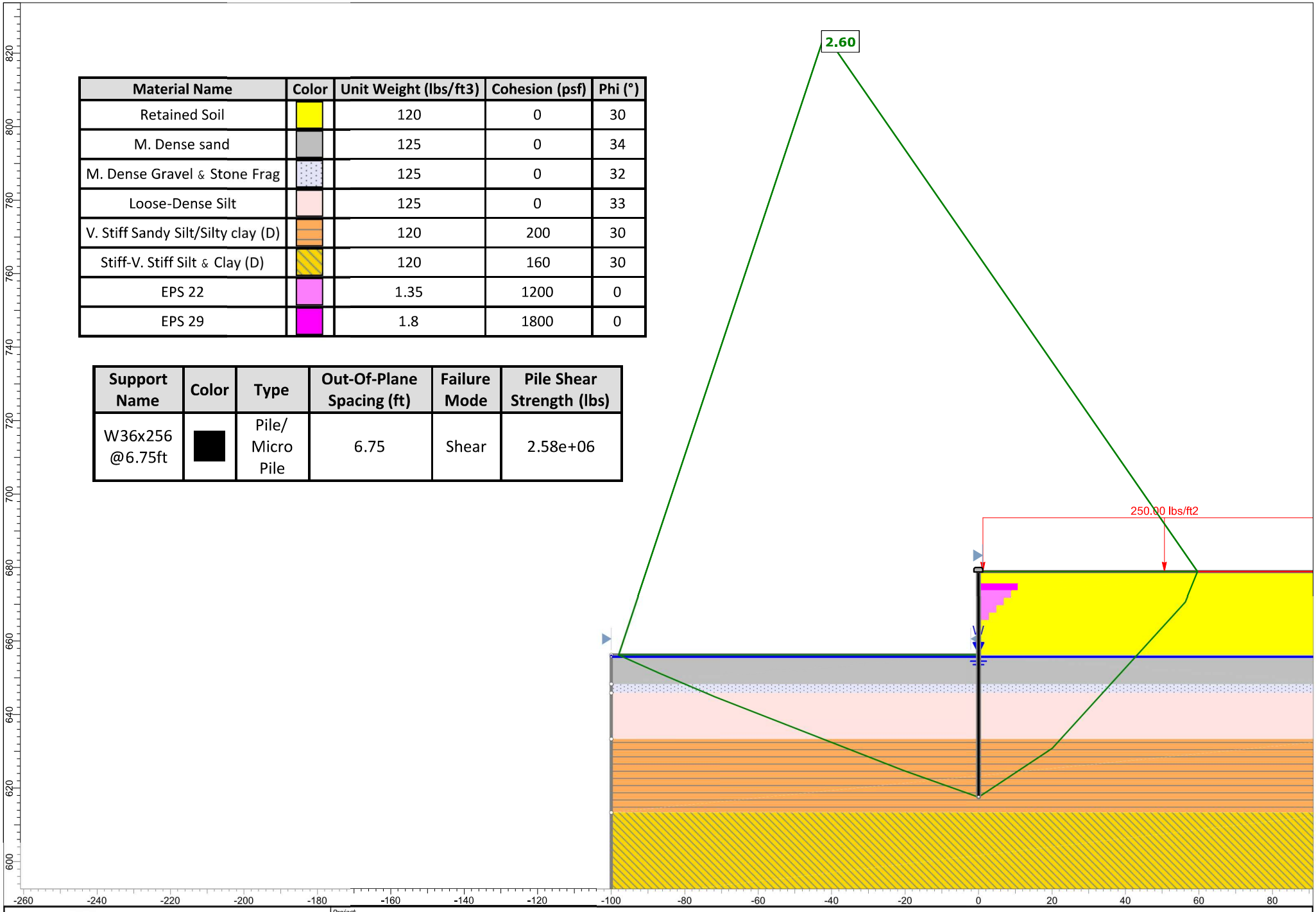


SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 7_H=26.23 (Effective Stress)	Scenario	Circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 7.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Retained Soil		120	0	30
M. Dense sand		125	0	34
M. Dense Gravel & Stone Frag		125	0	32
Loose-Dense Silt		125	0	33
V. Stiff Sandy Silt/Silty clay (D)		120	200	30
Stiff-V. Stiff Silt & Clay (D)		120	160	30
EPS 22		1.35	1200	0
EPS 29		1.8	1800	0

Support Name	Color	Type	Out-Of-Plane Spacing (ft)	Failure Mode	Pile Shear Strength (lbs)
W36x256 @6.75ft		Pile/ Micro Pile	6.75	Shear	2.58e+06



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 7_H=26.23 (Effective Stress)	Scenario	Non-circular Slip
Drawn By	Izzaldin Almohd, PhD, PE	Company	TRC Engineers Inc
Date	3/31/2026	File Name	SP Wall 7.slmd

APPENDIX H
CIP WALLS ON SPREAD FOOTINGS: SOIL PROFILES & PROPERTIES AND DESIGN

Project: **CUY-77-11.41: Reconstruction of I-77**
Subject: **Summary for CIP Walls 3, 4, 5A and 6**

Designer: DA Date 4/13/26
Checker: RLT Date 4/17/26

Wall	Wall Sta.		Boring	Max. Wall Height, Ht (ft)	Max. Design Height, H (ft)	Foundation Width, B (ft)	Vertical Bearing Pressure (ksf)		Factored Bearing Resistance (ksf)	Eccentrcity, e/B (-)	Sliding CDR	Settl. (in)
	From	To					Service	Strength				
3	30+00	32+20	B-053-0-20	11.19	10.19	9.0	1.52	1.99	5.40	0.0118	2.58	0.67
	32+20	34+00	B-054-0-20	12.12	11.12	9.0	1.7	2.19	7.10	0.0365	2.32	0.66
	34+00	35+10	B-055-0-20	11.52	10.52	9.0	1.6	2.06	5.10	0.0279	2.48	0.55
4	41+11.91	43+21.91	B-060-0-20	9.52	8.52	7.5	1.3	1.77	7.10	0.0171	2.18	0.40
			B-061-0-20						4.20	0.0321	2.33	0.32
5A	7+66.28	8+60	B-064-0-20	13.29	9.79	8.50	1.49	2.02	4.50	0.0573	2.41	0.52
	8+60	10+80	B-065-0-20	20.18	16.68	11.00	2.54	3.51	4.80	0.0511	1.81	1.20
	10+80	12+60	B-066-0-20	27.41	23.91	15.00	3.56	4.93	5.50	0.0612	1.81	1.41
	12+60	14+86.25	B-067-0-20	31.97	28.47	18.00	3.78	5.21	8.80	0.0424	1.61	3.73
6	6+00	11+50	B-022-0-18	8.5	6.9	7.00	1.06	1.37	2.80	0.0056	2.04	0.77

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Wall 3 Borings

Completed by: DA Date: 4/13/26

Checked by: RLT Date: 4/17/26

Generalized Soil Stratigraphy and Material Properties

Wall 3		B-053-0-20	%ER=	89
CIP Wall		104+25, 68 RT		
water=	668.50	668.5		
Use=	676.95			
GS=	684.20			
from	to	Description		N60
687.14		Top of Retained fill		
684.2	683.7	Topsoil		
683.7	676.95	V. stiff silt and clay		15
676.95	668.2	V. stiff silt and clay		16
668.2	659.2	V. stiff to hard sandy silt		28

Wall 3	Boring B-053-0-20			App. Sta: 104+25, 68 RT
CIP:				Wall Sta: 31+35
Design Height, H=	10.19	Wall Height, H=	11.19	
Top of Wall=	688.14			
Top of Retained Fill=	687.14	Copping or Parapet=	1 ft	(not supporting fill)
Lower grade=	681.31	Embedment=	4.36	> 3.5' -- OK
Bottom of wall El=	676.95			

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of Wall
Foundation	0	8.75	120	57.6	2000	200	30	
Foundation	8.75	17.75	125	62.6	3500	250	30	

* C' = 0.08 Cu

Wall 3		B-054-0-20		
		106+00, 82 10		
water=	666.50	666.5		
Use=	674.95			
GS=	681.20			
from	to	Description		Nf
686.07		Top of Wall		
681.2	680.7	Topsoil		
680.7	674.95	Gravel with sand & stone frag.		31
674.95	666.7	V.stiff to Hard silt, some clay		17
666.7	662.7	Med. Dense sandy silt		25
662.7	656.2	Dense f-c sand		33

Wall 3	Boring B-054-0-20			App. Sta 106+00, 82 10
CIP:				Wall Sta: 33+09
Design Height, H=	11.12	Wall Height, H=	12.12	
Top of Wall=	687.07			
Top of Retained Fill=	686.07	Copping or Parapet=	1 ft	(not supporting fill)
Lower grade=	679.57	Embedment=	4.62	> 3.5' -- OK
Bottom of wall El=	674.95			

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of Wall
Foundation	0	8.25	120	57.6	3000	240	30	
Foundation	8.25	12.25	125	62.6	0	0	34	
Foundation	12.25	18.75	130	67.6	0	0	36	

* C' = 0.08 Cu

Project **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Wall 3 Borings

Completed by: DA Date: 4/13/26

Checked by: RLT Date: 4/17/26

Generalized Soil Stratigraphy and Material Properties

Wall 3		B-055-0-20	107+50, 103 RT	
water=	674.4	664.4		
Use=	674.95			
GS=	680.4			
from	to	Description		Nf
685.47		Top of Wall		
680.4	679.9	Topsoil		
679.9	677.4	Hard sandy silt		12
677.4	674.95	Stiff to v. stiff silt, some clay		15
674.95	664.4	Stiff to v. stiff silt, some clay		15
664.4	655.4	Sand, dense		40

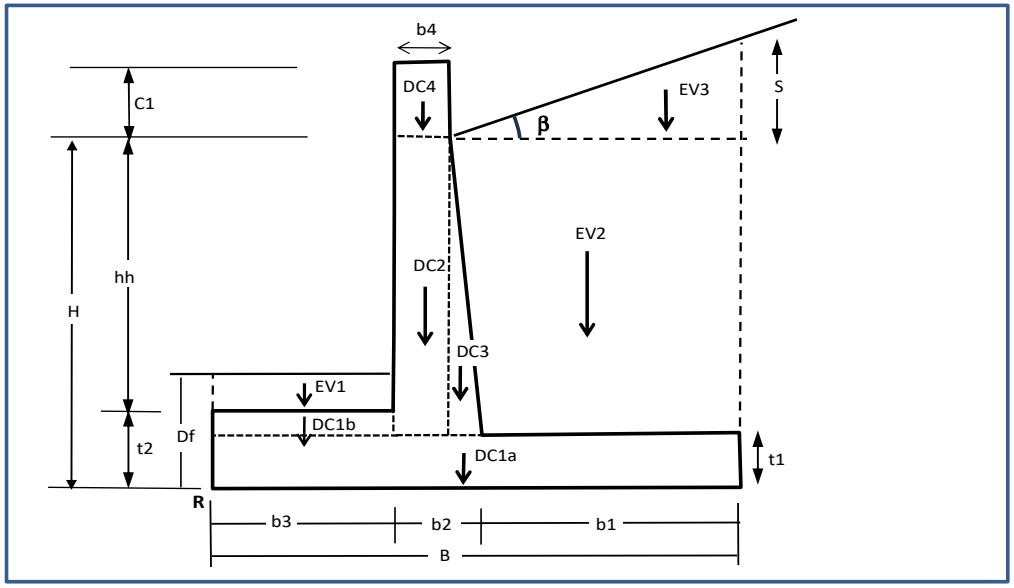
Wall 3 CIP:		Boring B-055-0-20						App. Sta: 107+50, 103 RT
Design Height, H=	10.52	Wall Height, H=	11.52					Wall Sta: 34+53.5
Top of Wall=	686.5							
Top of Retained Fill=	685.47	Copping or Parapet=	1	ft	(not supporting fill)			
Lower grade=	679.14	Embedment=	4.19	> 3.5' -- OK				
Bottom of wall El=	674.95							

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
Retained(new fill)	0	10.52	120	120	0	0	30	Bottom of Wall
Foundation	0	10.55	125	62.6	2500	150	30	
Foundation	10.55	19.55	125	62.6	0	0	36	

* C' = 0.08 Cu

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 30+00 to 32+20**
Boring:	**B-053-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 11.19 (all units are in feet)

H, ft	10.19	b1, ft =	6.0	t1, ft=	3.0	wall angle, θ=	90
he, ft =	7.19	b2, ft =	1.5	t2, ft=	3.25	Backfill angle, β =	18.4
B, ft=	9.0	b3, ft =	1.5	c1, ft=	1.0	Traffic Surcharge (LL), psf=	0.0
Df, ft =	4.0	b4, ft=	1.5 ft				

S, ft = 2

MATERIAL PROPERTIES

Retained Fill

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Unit Wt, γf =	120	pcf
Friction Angle-ϕ=	30	DEG
δ = 2/3 (ϕ)=	20	DEG

Γ = 2.002391

Active Earth Press. Coeff., Ka =	**0.399**
Passive Earth Press. Coeff., Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 30+00 to 32+20**

Boring: **B-053-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-053-0-20

Soil	Depth (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
V. stiff silt and clay	0	8.75	120	57.6	2000	200	30	5
V. stiff to hard sandy silt	8.75	17.75	125	62.6	3500	250	30	1.9
	Used in Analyses:		**120**	**57.6**	**2000**	**200**	**30**	

Weighted Average Es (within depth =2 B) = **3.41**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	4050	4.5		18225.0
Wc-DC1b	731.25	0.75		548.4
Wc-DC2	1617.75	2.25		3639.9
Wc-DC3	0	3.00		0.0
Wc-DC4	225	2.25		506.3
ΣDCi =	**6624.0**		**ΣM$_{DCi}$ =**	**22919.6**
Soil EV1	0	0.75		0.0
Soil EV2	5176.8	6.0		31060.8
Soil EV3	720.0	7.0		5040.0
ΣEVi =	**5896.8**		**ΣMEVi**	**36100.8**

Ignored on passive side.
Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 3.46 ft from R =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 6.12 ft from R =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 30+00 to 32+20**

Boring: **B-053-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR Resistance Reduction factors

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 0 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv
UNFACTORED	6624.0	5896.8	2483.3	2333.5	849.3	0.0	0.0	0.0
Arm to (R)	3.46	6.12	3.40	3.40	9.00	5.09	9.00	6.00
Factored Loads (lb/ft)								
Strgth-1a	5961.6	5896.8	3724.9	3500.3	1274.0	0.0	0.0	0.0
Strgth-1b	8280.0	7960.7	3724.9	3500.3	1274.0	0.0	0.0	0.0
Service I	6624.0	5896.8	2483.3	2333.5	849.3	0.0	0.0	0.0

Sliding & Eccentricity
Bearing capacity
Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-20627.663	-36100.8	11889.3	-11466.0	0.0	0.0	0.0	**-56305.2**	13132.4	4.28750	0.2125004	**0.0236**
Strgth-1b	-28649.531	-48736.08	11889.3	-11466.0	0.0	0.0	0.0	**-76962.3**	17514.7	4.39416	0.1058398	**0.0118**
Service I	-22919.625	-36100.8	7926.2	-7644.0	0.0	0.0	0.0	**-58738.2**	13370.1	4.39324	0.1067586	**0.0119**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 30+00 to 32+20**

Boring: **B-053-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 5961.6+5896.8+0+0+1273.999 = **13132.4** lb and Extreme Limit States

Factored Horizontal Loads, HH = 3500.28+0 **3500.3** lb **angle, α =** 0.260 rads = 14.92

Net Moments (Strength-1b) = -56305.2 lb

eccentricity , e = 0.21 ft

e/B = 0.0236 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta$ (10.6.3.4-2) Deg

Factored Horizontal Loads, γΣQ = 3500.3 lb

Sum of Normal Forces, N = 13132.4 lb tan δ = tan ϕ Cast in place

Factored Friction Resistance to Sliding, ϕτ Rτ = 7582.0 lb ϕτ = 1 (AASHTO LRFD Table 11.5.7-1)

Factored Passive Resistance to Sliding, ϕep Rep= 1440.0 lb ϕep = 0.5 (AASHTO Table 10.5.5.2.2-1)

Factored Sliding Resistance, RR= 9022.0 lb

Ignoring passive resistance **RR= 7582.0 lb**

γΣQ = 3500.3 ≤ RR

Capacity Demand Ratio, CDR= 9021.99/3500.28 = **2.58** **OK, CDR > 1.0 …Safe**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 30+00 to 32+20**

Boring: **B-053-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b)

Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 8280+7960.68+1273.999+0+0= **17514.7** lb

Factored Horizontal Loads = 0+3500.28+0 = **3500.3** lb

angle, α = ATAN(3500.3/17514.7) = 0.197 rads = 11.30 Deg.

Net Moments (Strength-1b) = -76962.3 lb Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service	
from Table C	eccentricity , e (ft)=	0.2125	0.1058	0.1068	
	e/B =	0.0236	0.0118	0.0119	**OK, e/B<0.33**
	B' =B-2e (ft)=	8.57	8.79	8.79	
	N, k/ft=	13.13	17.51	13.37	
	Vertical Bearing Pressure, σv (ksf)=	1.53	1.99	1.52	

$$\sigma_v = \frac{\sum V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	120	pcf
γ'_{soil}=	57.6	
Su=	2000	psf
ϕu=	0	
c'=	200	psf
ϕ'=	30	deg

The footing is essentially very long (L/B > 10) --> Strip

Short- Term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.000	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$
Nc	5.140	$N_c = 5.14$	
		for $\phi_f > 0$	
Ny	0.000	$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q + 1)\tan\phi_f$

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 30+00 to 32+20**
Boring:	**B-053-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1 + \left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$

$for\ \phi_f > 0$

$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1 - 0.4\left(\frac{B}{L}\right),\ s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n =	**11 ksf**

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R =	**5.4 ksf**

Capacity Demand Ratio, CDR= 5.4/1.99 = **2.71** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 30+00 to 32+20**

Boring: **B-053-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Long-term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	11.90	
Nc	22.30	
Ny	12.50	

$for\ \phi_f = 0$

$N_c = 5.14$

$for\ \phi_f > 0$

$N_c = (N_q - 1)\cot\phi_f$

$N_q = e^{(\pi\tan(\phi_f))}\tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right)$

$N_\gamma = 2(N_q + 1)\tan\phi_f$

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1+\left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$

$for\ \phi_f > 0$

$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1-0.4\left(\frac{B}{L}\right),\ s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**
(Assumed at Df)

Nominal Bearing Capacity

AASHTO 10.6.3.1.2a-1

$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$

q_n = 13 ksf

Factored Bearing Resistance

$q_R = \phi_b\, q_n$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 6.7 ksf

Capacity Demand Ratio, CDR= 6.7/1.99 = **3.37** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 30+00 to 32+20**
Boring:	**B-053-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **13370.1** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.012** **e =** **0.107** **ft** **(Table C, above, for Service Loads)**

B' = 8.8 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 88.0 **ft**

$$S_e = \frac{q_o\left(1-\upsilon^2\right)\sqrt{A}}{144\ E_s\ \beta_z}$$

qo: Contact pressure= 13370.1/8.8= **1519** **psf**

qo: Contact pressure= **1.519** **ksf**

υ: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(8.8*88) = **27.8** **ft**

E: Young's modulus (ksi)= **3.41**

βz: Shape factor = **1.41**

AASHTO LRFD

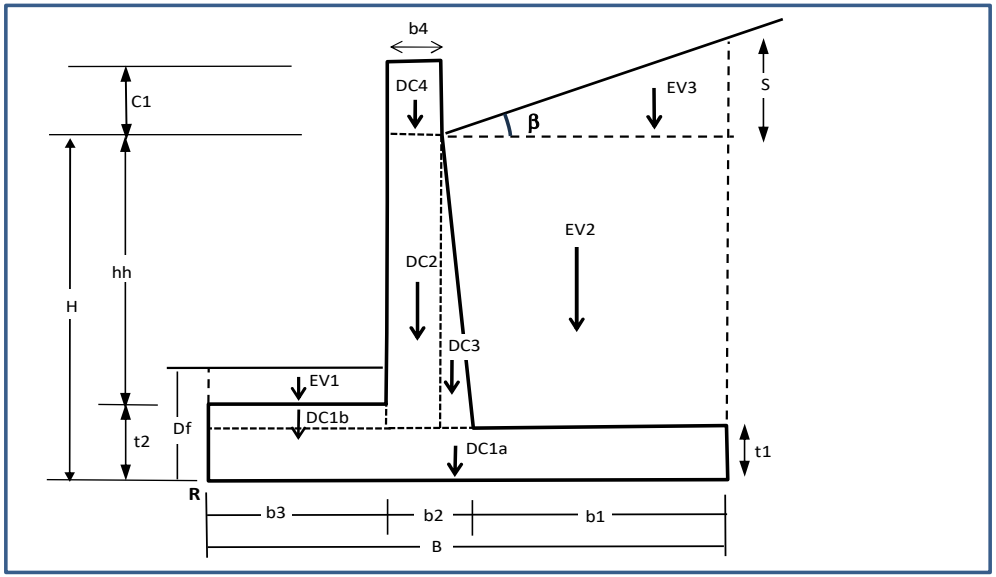
Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*1.519*(1-0.3^2)*27.8/(144*3.41*1.41)= **0.67** inch

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 32+20 to 34+00**
Boring:	**B-054-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 12.12 (all units are in feet)

H, ft	11.12	b1, ft =	6.0	t1, ft=	3.0	wall angle, θ=	90
he, ft =	8.12	b2, ft =	1.5	t2, ft=	3.25	Backfill angle, β =	18.4
B, ft=	9.0	b3, ft =	1.5	c1, ft=	1.0	Traffic Surcharge (LL), psf=	0.0
Df, ft =	4.0	b4, ft=	1.5 ft				

S, ft = 2

MATERIAL PROPERTIES

Retained Fill

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma\,[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Unit Wt, γf =	120	pcf	Γ = 2.002391
Friction Angle-ϕ=	30	DEG	
δ = 2/3 (ϕ)=	20	DEG	

Active Earth Press. Coeff., Ka =	**0.399**
Passive Earth Press. Coeff., Kp =	**3.000**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 32+20 to 34+00**
Boring:	**B-054-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-054-0-20

Soil	Depth (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
V.stiff to Hard silt, some clay	0	8.25	120	57.6	3000	240	30	3
Med. Dense sandy silt	8.25	12.25	125	62.6	0	0	34	1.9
Dense f-c sand	12.25	18.75	130	67.6	0	0	36	6
	Used in Analyses:		**120**	**57.6**	**3000**	**240**	**30**	

Weighted Average Es (within depth =2 B) = **3.71**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	4050	4.5		18225.0
Wc-DC1b	731.25	0.75		548.4
Wc-DC2	1827	2.25		4110.8
Wc-DC3	0	3.00		0.0
Wc-DC4	225	2.25		506.3
ΣDCi =	**6833.3**		**ΣM$_{DCi}$ =**	**23390.4**
Soil EV1	0	0.75		0.0
Soil EV2	5846.4	6.0		35078.4
Soil EV3	720.0	7.0		5040.0
ΣEVi =	**6566.4**		**ΣMEVi**	**40118.4**

Ignored on passive side.
Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 3.42 ft from R =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 6.11 ft from R =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 32+20 to 34+00**

Boring: **B-054-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR Resistance Reduction factors

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 0 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	6833.3	6566.4	2957.2	2778.9	1011.4	0.0	0.0	0.0	
Arm to (R)	3.42	6.11	3.71	3.71	9.00	5.56	9.00	6.00	
Factored Loads (lb/ft)									
Strgth-1a	6149.9	6566.4	4435.9	4168.4	1517.2	0.0	0.0	0.0	Sliding & Eccentricity
Strgth-1b	8541.6	8864.6	4435.9	4168.4	1517.2	0.0	0.0	0.0	Bearing capacity
Service I	6833.3	6566.4	2957.2	2778.9	1011.4	0.0	0.0	0.0	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-21051.394	-40118.4	15450.7	-13654.4	0.0	0.0	0.0	**-59373.5**	14233.5	4.17140	0.3286027	**0.0365**
Strgth-1b	-29238.047	-54159.84	15450.7	-13654.4	0.0	0.0	0.0	**-81601.6**	18923.4	4.31222	0.1877846	**0.0209**
Service I	-23390.438	-40118.4	10300.5	-9102.9	0.0	0.0	0.0	**-62311.3**	14411.1	4.32385	0.1761548	**0.0196**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a) *** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 32+20 to 34+00**

Boring: B-054-0-20

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 6149.925+6566.4+0+0+1517.157 = **14233.5** lb and Extreme Limit States

Factored Horizontal Loads, HH = 4168.35+0 **4168.4** lb **angle, α =** 0.285 rads = 16.32 Deg

Net Moments (Strength-1b) = -59373.5 lb

eccentricity , e = 0.33 ft

e/B = 0.0365 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta$ (10.6.3.4-2)

Factored Horizontal Loads, $\gamma \Sigma Q$ = 4168.4 lb

Sum of Normal Forces, N = 14233.5 lb $\tan \delta = \tan \phi$ Cast in place

Factored Friction Resistance to Sliding, $\phi\tau$ $R\tau$ = 8217.7 lb $\phi\tau$ = 1 (AASHTO LRFD Table 11.5.7-1)

Factored Passive Resistance to Sliding, ϕep Rep= 1440.0 lb ϕep = 0.5 (AASHTO Table 10.5.5.2.2-1)

Factored Sliding Resistance, RR= 9657.7 lb

Ignoring passive resistance **RR= 8217.7 lb**

$\gamma \Sigma Q$ = 4168.4 ≤ RR

Capacity Demand Ratio, CDR= 9657.7/4168.35 = **2.32** **OK, CDR > 1.0 …Safe**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 32+20 to 34+00**
Boring:	**B-054-0-20**
Designer:	DA — Date 4/13/26
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CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b) — Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 8541.563+8864.64+1517.157+0+0= **18923.4** lb

Factored Horizontal Loads = 0+4168.35+0 = **4168.4** lb

angle, α = ATAN(4168.4/18923.4) = 0.217 rads = 12.42 Deg.

Net Moments (Strength-1b) = -81601.6 lb — Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service
from Table C	eccentricity , e (ft)=	0.329	0.188	0.176
	e/B=	0.037	0.021	0.020
	B'=B-2e (ft) =	8.343	8.624	8.648
	N, k/ft=	14.2	18.9	14.4
	Vertical Bearing pressure, σv (ksf)=	1.71	2.19	1.67

0.021 **OK, e/B <0.33**

$$\sigma_v = \frac{\sum V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	120	pcf
γ'_{soil}=	57.6	
Su=	3000	psf
ϕu=	0	
c'=	240	psf
ϕ'=	30	deg

The footing is essentially very long (L/B > 10) --> Strip

Short- Term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.000	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$
Nc	5.140	$N_c = 5.14$	
		for $\phi_f > 0$	
Ny	0.000	$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q + 1)\tan\phi_f$

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 32+20 to 34+00**
Boring:	**B-054-0-20**
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CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000	$for\ \phi_f = 0$
sq	1.000	$s_c = 1+\left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$
sy	1.000	$for\ \phi_f > 0$
		$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1-0.4\left(\frac{B}{L}\right),\ s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

q_n =	**16 ksf**

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R =	**8.0 ksf**

Capacity Demand Ratio, CDR= 8/2.19 = **3.65** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 32+20 to 34+00**
Boring:	**B-054-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Long-term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	11.90	$for\ \phi_f = 0$
Nc	22.30	$N_c = 5.14$
		$for\ \phi_f > 0$
		$N_c = (N_q - 1)\cot\phi_f$
Ny	12.50	

Shape Factors (AASHTO 10.6.6.1.2a-3):

		$for\ \phi_f = 0$
sc	1.000	$s_c = 1 + \left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$
sq	1.000	$for\ \phi_f > 0$
sy	1.000	$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right), s_\gamma = 1 - 0.4\left(\frac{B}{L}\right), s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq} 1

$C_{w\gamma}$ 0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 14 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\ q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 7.1 ksf

Capacity Demand Ratio, CDR= 7.1/2.19 = **3.24** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 32+20 to 34+00**
Boring:	**B-054-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **14411.1** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.020** **e =** **0.176** **ft** **(Table C, above, for Service Loads)**

B' = 8.6 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 86.0 **ft**

$$S_e = \frac{q_o(1-\upsilon^2)\sqrt{A}}{144\,E_s\,\beta_z}$$

qo: Contact pressure= 14411.1/8.6= **1676** **psf**

qo: Contact pressure= **1.676** **ksf**

v: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(8.6*86) = **27.2** **ft**

E: Young's modulus (ksi)= **3.71**

βz: Shape factor = **1.41**

AASHTO LRFD

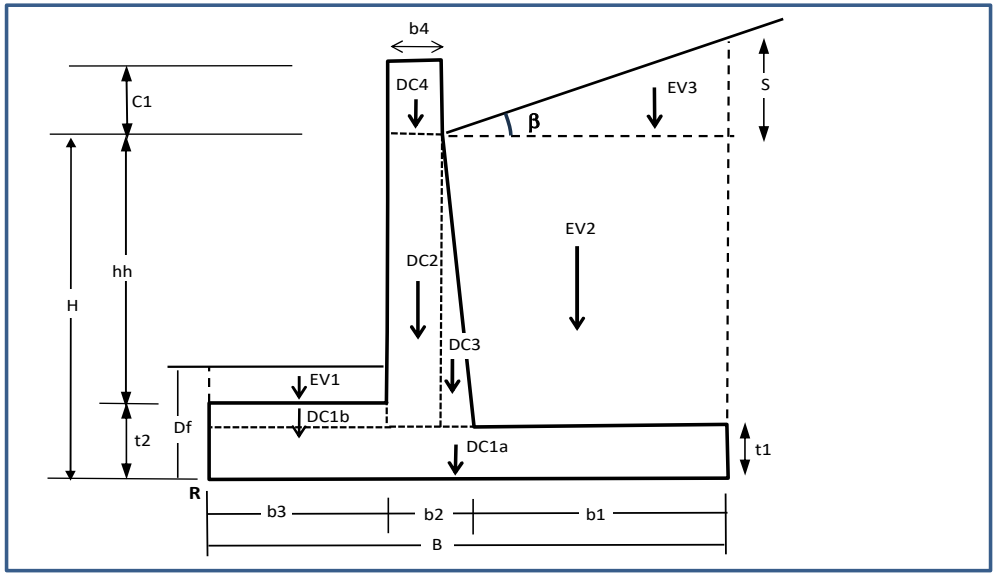
Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*1.676*(1-0.3^2)*27.2/(144*3.71*1.41)= **0.66** inch

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 34+00 to 35+10**
Boring:	**B-055-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 11.52 (all units are in feet)

H, ft	10.52	b1, ft =	6.0	t1, ft=	3.0	wall angle, θ=	90
he, ft =	7.52	b2, ft =	1.5	t2, ft=	3.25	Backfill angle, β =	18.4
B, ft=	9.0	b3, ft =	1.5	c1, ft=	1.0	Traffic Surcharge (LL), psf=	0.0
Df, ft =	4.0	b4, ft=	1.5 ft				

S, ft = 2

MATERIAL PROPERTIES

Retained Fill

Unit Wt, γf =	120	pcf
Friction Angle-ϕ=	30	DEG
δ = 2/3 (ϕ)=	20	DEG

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Γ = 2.002391

Active Earth Press. Coeff., Ka =	**0.399**
Passive Earth Press. Coeff., Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 34+00 to 35+10**

Boring: **B-055-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-055-0-20

Soil	Depth (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
Stiff to v. stiff silt, some clay	0	10.55	125	62.6	2500	150	30	3
Sand, dense	10.55	19.55	125	62.6	0	0	36	6
Used in Analyses:			**125**	**62.6**	**2500**	**150**	**30**	

Weighted Average Es (within depth =2 B) = **4.24**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	4050	4.5		18225.0
Wc-DC1b	731.25	0.75		548.4
Wc-DC2	1692	2.25		3807.0
Wc-DC3	0	3.00		0.0
Wc-DC4	225	2.25		506.3
ΣDCi =	**6698.3**		**ΣM$_{DCi}$ =**	**23086.7**
Soil EV1	0	0.75		0.0
Soil EV2	5414.4	6.0		32486.4
Soil EV3	720.0	7.0		5040.0
ΣEVi =	**6134.4**		**ΣMEVi**	**37526.4**

Ignored on passive side.
Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 3.45 ft **from R** =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 6.12 ft **from R** =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 34+00 to 35+10**

Boring: **B-055-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR — Resistance Reduction factors

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 0 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	6698.3	6134.4	2646.7	2487.1	905.2	0.0	0.0	0.0	
Arm to (R)	3.45	6.12	3.51	3.51	9.00	5.26	9.00	6.00	
Factored Loads (lb/ft)									
Strgth-1a	6028.4	6134.4	3970.1	3730.7	1357.9	0.0	0.0	0.0	Sliding & Eccentricity
Strgth-1b	8372.8	8281.4	3970.1	3730.7	1357.9	0.0	0.0	0.0	Bearing capacity
Service I	6698.3	6134.4	2646.7	2487.1	905.2	0.0	0.0	0.0	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-20778.019	-37526.4	13082.2	-12220.7	0.0	0.0	0.0	**-57442.9**	13520.7	4.24852	0.251479	**0.0279**
Strgth-1b	-28858.359	-50660.64	13082.2	-12220.7	0.0	0.0	0.0	**-78657.5**	18012.1	4.36692	0.1330777	**0.0148**
Service I	-23086.688	-37526.4	8721.5	-8147.1	0.0	0.0	0.0	**-60038.7**	13737.9	4.37030	0.1296962	**0.0144**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 34+00 to 35+10**
Boring:	**B-055-0-20**
Designer:	DA Date 4/13/26
Checker:	RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 6028.425+6134.4+0+0+1357.852 = **13520.7** lb and Extreme Limit States

Factored Horizontal Loads, HH = 3730.67+0 **3730.7** lb **angle, α =** 0.269 rads = 15.43 Deg

Net Moments (Strength-1b) = -57442.9 lb

eccentricity , e = 0.25 ft

e/B = 0.0279 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta \qquad (10.6.3.4\text{-}2)$

Factored Horizontal Loads, γΣQ =	3730.7	lb		
Sum of Normal Forces, N =	13520.7	lb	tan δ = tan ϕ	Cast in place
Factored Friction Resistance to Sliding, ϕτ Rτ =	7806.2	lb	ϕτ =	1 (AASHTO LRFD Table 11.5.7-1)
Factored Passive Resistance to Sliding, ϕep Rep=	1440.0	lb	ϕep =	0.5 (AASHTO Table 10.5.5.2.2-1)
Factored Sliding Resistance, RR=	9246.2	lb		
Ignoring passive resistance **RR=**	**7806.2**	**lb**		

γΣQ = 3730.7 ≤ RR

Capacity Demand Ratio, CDR= 9246.17/3730.67 = **2.48** **OK, CDR > 1.0 …Safe**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 3: Sta 34+00 to 35+10**

Boring: **B-055-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b)

Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 8372.813+8281.44+1357.852+0+0= **18012.1** lb

Factored Horizontal Loads = 0+3730.67+0 = **3730.7** lb

angle, α = ATAN(3730.7/18012.1) = 0.204 rads = 11.70 Deg.

Net Moments (Strength-1b) = -78657.5 lb

Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service
from Table C	eccentricity , e (ft)=	0.251	0.133	0.130
	e/B=	0.028	0.015	0.014
	B'=B-2e (ft) =	8.497	8.734	8.741
	N, k/ft=	13.5	18.0	13.7
	Vertical Bearing pressure, σv (ksf)=	1.59	2.06	1.57

0.015 **OK, e/B <0.33**

$$\sigma_v = \frac{\sum V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	125	pcf
γ'_{soil}=	62.6	
Su=	2500	psf
ϕu=	0	
c'=	150	psf
ϕ'=	30	deg

The footing is essentially very long (L/B > 10) --> Strip

Short- Term:

Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.000	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$
Nc	5.140	$N_c = 5.14$	
		for $\phi_f > 0$	
Ny	0.000	$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q + 1)\tan\phi_f$

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 34+00 to 35+10**
Boring:	**B-055-0-20**
Designer:	DA — Date 4/13/26
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CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000	$for\ \phi_f = 0$
sq	1.000	$s_c = 1+\left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$
sy	1.000	$for\ \phi_f > 0$
		$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1-0.4\left(\frac{B}{L}\right),\ s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 13 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 6.7 ksf

Capacity Demand Ratio, CDR= 6.7/2.06 = **3.25** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 34+00 to 35+10**
Boring:	**B-055-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Long-term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	9.60	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right)$
Nc	19.30	$N_c = 5.14$	
		for $\phi_f > 0$	
Ny	9.40	$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q+1)\tan\phi_f$

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000	*for* $\phi_f = 0$
sq	1.000	$s_c = 1+\left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$
sy	1.000	*for* $\phi_f > 0$
		$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right), s_\gamma = 1-0.4\left(\frac{B}{L}\right), s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity AASHTO 10.6.3.1.2a-1

q_n = 10 ksf

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 5.1 ksf

Capacity Demand Ratio, CDR= 5.1/2.06 = **2.48** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 3: Sta 34+00 to 35+10**
Boring:	**B-055-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **13737.9** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.014** **e =** **0.130** **ft** **(Table C, above, for Service Loads)**

B' = 8.7 **ft**

Long (strip footing, L = 10B); L = 87.0 **ft**

settlement calculations as follow:

$$S_e = \frac{q_o\left(1-\upsilon^2\right)\sqrt{A}}{144\,E_s\,\beta_z}$$

qo: Contact pressure= 13737.9/8.7= **1579** **psf**

qo: Contact pressure= **1.579** **ksf**

υ: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(8.7*87) = **27.5** **ft**

E: Young's modulus (ksi)= **4.24**

βz: Shape factor = **1.41**

AASHTO LRFD

Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*1.579*(1-0.3^2)*27.5/(144*4.24*1.41)= **0.55** inch

Project: **CUY-77-11.41: Reconstruction of I-77**
PID: **PID 105743**
Wall 4 Borings
Completed by: DA Date: 4/13/26
Checked by: RLT Date: 4/17/26

Generalized Soil Stratigraphy and Material Properties

Wall 4 B-060-0-20 129+30, 55 LT
Boring B-060-0-20 shows better soil conditions, will not be used
water= NA
Use = 646.98
GS= 651.4

from	to	Description	N60
655.5		Top of Wall	
651.4	651.2	Topsoil	
651.2	646.98	V. stiff Silt- Fill	14
646.98	642.9	V. stiff Silt- Fill	14
642.9	637.9	V. stiff sandy silt- Fill	17
637.9	633.5	V. dense Gravel with sand- Fill	53
633.5	632.9	V. stiff silt	17
632.9	630.0	Med. Stiff silt and clay	7
630	621.4	Hard silt and clay	40

Wall 4 Boring B-060-0-20 App. Sta: 129+30, 55 LT
CIP: Design Height, H= 8.52 Wall Height, H= 9.52 Wall Sta: Just Before (South of) Wall 4
Top of Wall= 656.5 (max within Wall length)
Top of retained fill= 655.5 (max within Wall length)
Lower grade= 652.53
Bottom of wall El= 646.98

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of wall
Foundation/clay	0	4.08	125	62.6	3500	280	30	
Foundation/clay	4.08	9.08	125	62.6	3000	240	30	
Foundation/ sand	9.08	13.48	125	62.6	0	0	36	
Foundation/clay	13.48	14.08	125	62.6	3000	240	30	
Foundation/clay	14.08	16.98	120	57.6	1000	80	28	
Foundation/clay	16.98	25.58	120	57.6	4000	320	30	

* C' = 0.08 Cu

Representative Boring (worst case)
Wall 4 B-061-0-20 131+25, 53 LT
Boring is within wall limits. Weaker soil conditions encountered --> Use soil profile from this boring.
water= 648.4 643.4
use= 646.98
GS= 650.6

from	to	Description	N60
655.5		Top of Wall	
650.6	650.3	Topsoil	
650.3	646.98	M. dense Gravel with stone fragme	24
646.98	644.6	M. De Gravel with stone frag.- Fill	24
644.6	637.1	Loose Gravel with sand and silt	5
637.1	632.1	Medium dense fine sand	13
632.1	627.1	Loose to M. dense C-F sand	10
627.1	620.6	Stiff-V. Stiff sandy silt and clay	17

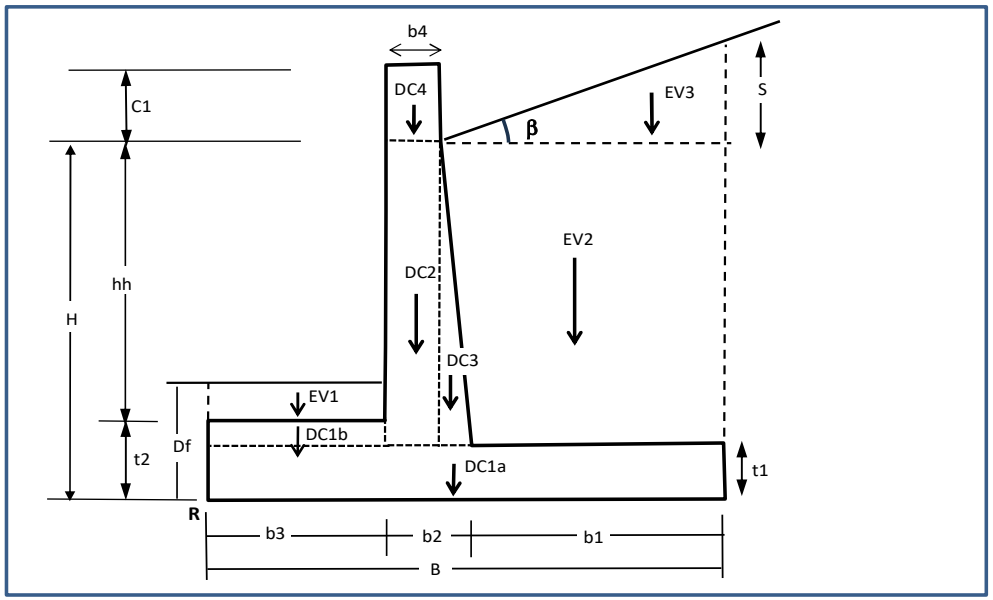
Wall 4 Boring B-061-0-20 App. Sta: 131+25, 53 LT
CIP: Design Height, H= 8.52 Wall Height, H= 9.52 Wall Sta: 41+80 to 43+21.91
Top of Wall= 656.5 (max within Wall length)
Top of retained fill= 655.5 (max within Wall length)
Lower grade= 652.53
Bottom of wall El= 646.98

zone	Depth below from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of Wall
Foundation/ sand	0	2.38	120	57.6	0	0	34	
Foundation/ sand	2.38	9.88	120	57.6	0	0	30	
Foundation/ sand	9.88	14.88	120	57.6	0	0	32	
Foundation/ sand	14.88	19.88	120	57.6	0	0	30	
Foundation/ clay	19.88	26.38	120	57.6	2000	160	30	

* C' = 0.08 Cu

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 4: Sta 41+11.91 to 43+21.91**
Boring:	**B-060-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 9.52

(all units are in feet)

H, ft	8.52	b1, ft =	5.0	t1, ft=	2.0	wall angle, θ=	90
he, ft =	6.52	b2, ft =	1.5	t2, ft=	2.25	Backfill angle, β =	26.6
B, ft=	7.5	b3, ft =	1.0	c1, ft=	1.0	Traffic Surcharge (LL), psf=	0.0
Df, ft =	4.0	b4, ft=	1.5 ft				

S, ft = 2.5

MATERIAL PROPERTIES

Retained Fill

Unit Wt, γf =	120	pcf
Friction Angle-ϕ=	30	DEG
δ = 2/3 (ϕ)=	20	DEG

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Γ = 1.521978

Active Earth Press. Coeff., Ka =	**0.524**
Passive Earth Press. Coeff., Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 4: Sta 41+11.91 to 43+21.91**

Boring: **B-060-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-060-0-20

Soil	Depth (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
V. stiff Silt- Fill	0	4.08	125	62.6	3500	280	30	2.3
V. stiff sandy silt- Fill	4.08	9.08	125	62.6	3000	240	30	3.0
V. dense Gravel with sand- Fill	9.08	13.48	125	62.6	0	0	36	7.0
V. stiff silt	13.48	14.08	125	62.6	3000	240	30	2.2
Med. Stiff silt and clay	14.08	16.98	120	57.6	1000	80	28	6.0
	Used in Analyses:		**120**	**57.6**	**3250**	**260**	**30**	

Weighted Average Es (within depth =2 B) = **4.13**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	2250	3.75		8437.5
Wc-DC1b	337.5	0.5		168.8
Wc-DC2	1467	1.75		2567.2
Wc-DC3	0	2.50		0.0
Wc-DC4	225	1.75		393.8
ΣDCi =	**4279.5**		**ΣM$_{DCi}$ =**	**11567.3**
Soil EV1	0	0.5		0.0
Soil EV2	3912.0	5.0		19560.0
Soil EV3	750.0	5.8		4375.0
ΣEVi =	**4662.0**		**ΣMEVi**	**23935.0**

Ignored on passive side.
Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 2.70 ft **from R** =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 5.13 ft **from R** =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 4: Sta 41+11.91 to 43+21.91**

Boring: B-060-0-20

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR Resistance Reduction factors

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 0 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	4279.5	4662.0	2284.0	2146.3	781.2	0.0	0.0	0.0	
Arm to (R)	2.70	5.13	2.84	2.84	7.50	4.26	7.50	5.00	
Factored Loads (lb/ft)									
Strgth-1a	3851.6	4662.0	3426.0	3219.4	1171.8	0.0	0.0	0.0	Sliding & Eccentricity
Strgth-1b	5349.4	6293.7	3426.0	3219.4	1171.8	0.0	0.0	0.0	Bearing capacity
Service I	4279.5	4662.0	2284.0	2146.3	781.2	0.0	0.0	0.0	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-10410.525	-23935	9143.1	-8788.2	0.0	0.0	0.0	**-33990.7**	9685.3	3.50951	0.2404938	**0.0321**
Strgth-1b	-14459.063	-32312.25	9143.1	-8788.2	0.0	0.0	0.0	**-46416.5**	12814.8	3.62209	0.1279134	**0.0171**
Service I	-11567.25	-23935	6095.4	-5858.8	0.0	0.0	0.0	**-35265.7**	9722.7	3.62716	0.1228422	**0.0164**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 4: Sta 41+11.91 to 43+21.91**

Boring: **B-060-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 3851.55+4662+0+0+1171.765 = **9685.3** lb and Extreme Limit States

Factored Horizontal Loads, HH = 3219.4+0 **3219.4** lb **angle, α =** 0.321 rads = 18.39 Deg

Net Moments (Strength-1b) = -33990.7 lb

eccentricity , e = 0.24 ft

e/B = 0.0321 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta \qquad (10.6.3.4\text{-}2)$

Factored Horizontal Loads, γ ΣQ =	3219.4	lb		
Sum of Normal Forces, N =	9685.3	lb	tan δ = tan ϕ	Cast in place
Factored Friction Resistance to Sliding, ϕτ Rτ =	5591.8	lb	ϕτ =	1 (AASHTO LRFD Table 11.5.7-1)
Factored Passive Resistance to Sliding, ϕep Rep=	1440.0	lb	ϕep =	0.5 (AASHTO Table 10.5.5.2.2-1)
Factored Sliding Resistance, RR=	7031.8	lb		
Ignoring passive resistance **RR=**	**5591.8**	**lb**		

γ ΣQ = 3219.4 ≤ RR

Capacity Demand Ratio, CDR= 7031.82/3219.4 = **2.18** **OK, CDR > 1.0 …Safe**

Project: **CUY-77-11.41: Reconstruction of I-77**

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Boring: **B-060-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b)

Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 5349.375+6293.7+1171.765+0+0= **12814.8** lb

Factored Horizontal Loads = 0+3219.4+0 = **3219.4** lb

angle, α = ATAN(3219.4/12814.8) = 0.246 rads = 14.10 Deg.

Net Moments (Strength-1b) = -46416.5 lb Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service	0.017	**OK, e/B <0.33**
from Table C	eccentricity , e (ft)=	0.240	0.128	0.123		
	e/B=	0.032	0.017	0.016		
	B'=B-2e (ft) =	7.019	7.244	7.254		
	N, k/ft=	9.7	12.8	9.7		
	Vertical Bearing pressure, σv (ksf)=	1.38	1.77	1.34		

$$\sigma_v = \frac{\sum V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	120	pcf
γ'_{soil}=	57.6	
Su=	3250	psf
ϕu=	0	
c'=	260	psf
ϕ'=	30	deg

The footing is essentially very long (L/B > 10) --> Strip

Short- Term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.000	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$
Nc	5.140	$N_c = 5.14$	
		for $\phi_f > 0$	
Ny	0.000	$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q + 1)\tan\phi_f$

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 4: Sta 41+11.91 to 43+21.91**

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CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

		$for\ \phi_f = 0$
sc	1.000	$s_c = 1 + \left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$
sq	1.000	$for\ \phi_f > 0$
sy	1.000	$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1 - 0.4\left(\frac{B}{L}\right),\ s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq} 1

$C_{w\gamma}$ 0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 17 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 8.6 ksf

Capacity Demand Ratio, CDR= 8.6/1.77 = **4.9** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

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CIP Retaining Wall- Geotechnical Design

Long-term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	11.90	$for\ \phi_f = 0$
Nc	22.30	$N_c = 5.14$
		$for\ \phi_f > 0$
Ny	12.50	$N_c = (N_q - 1)\cot\phi_f$

$$N_q = e^{(\pi\tan(\phi_f))}\tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right) \qquad N_\gamma = 2(N_q+1)\tan\phi_f$$

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000	$for\ \phi_f = 0$
sq	1.000	$s_c = 1+\left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$
sy	1.000	$for\ \phi_f > 0$

$$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1-0.4\left(\frac{B}{L}\right),\ s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

AASHTO 10.6.3.1.2a-1

q_n = 14 ksf

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 7.1 ksf

Capacity Demand Ratio, CDR= 7.1/1.77 = **4.01** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

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CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **9722.7** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.016** **e =** **0.123** **ft** **(Table C, above, for Service Loads)**

B' = 7.3 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 73.0 **ft**

$$S_e = \frac{q_o(1-\upsilon^2)\sqrt{A}}{144\,E_s\,\beta_z}$$

qo: Contact pressure= 9722.7/7.3= **1332** **psf**

qo: Contact pressure= **1.332** **ksf**

υ: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(7.3*73) = **23.1** **ft**

E: Young's modulus (ksi)= **4.13**

βz: Shape factor = **1.41**

AASHTO LRFD

Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*1.332*(1-0.3^2)*23.1/(144*4.13*1.41)= **0.40** inch

Project:	**CUY-77-11.41: Reconstruction of I-77**
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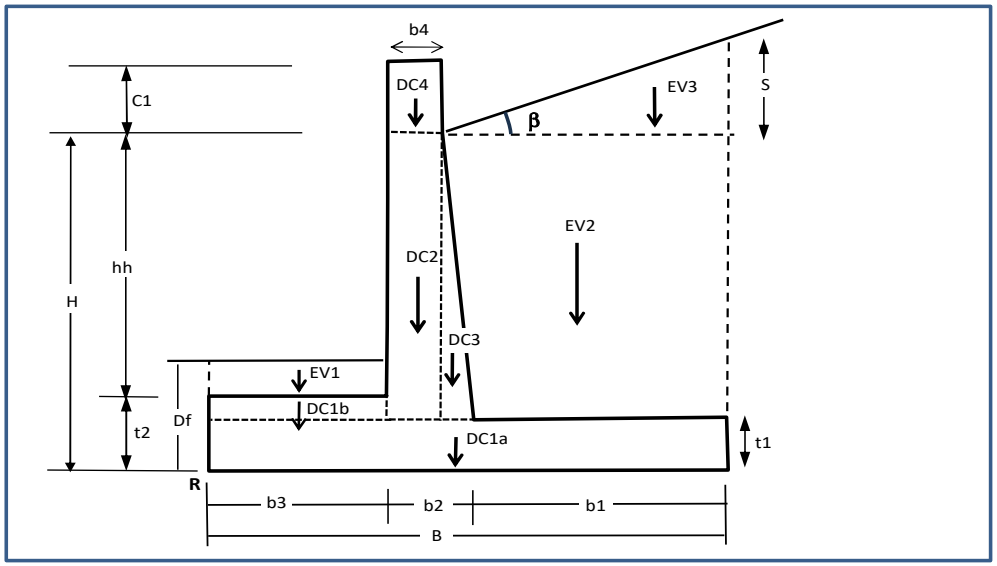
CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL								
Total Height =	9.52					(all units are in feet)		
H, ft	8.52	b1, ft =	5.0	t1, ft=	2.0	wall angle, θ=	90	
he, ft =	6.52	b2, ft =	1.5	t2, ft=	2.25	Backfill angle, β =	26.6	S, ft = 2.5
B, ft=	7.5	b3, ft =	1.0	c1, ft=	1.0	Traffic Surcharge (LL), psf=	0.0	
Df, ft =	4.0	b4, ft=	1.5 ft					

MATERIAL PROPERTIES

Retained Fill

$$k_a = \frac{\sin^2(\theta+\phi'_f)}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi'_f+\delta)\sin(\phi'_f-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Unit Wt, γf =	120	pcf	Γ =	1.521978
Friction Angle-ϕ=	30	DEG	Active Earth Press. Coeff., Ka =	**0.524**
δ = 2/3 (ϕ)=	20	DEG	Passive Earth Press. Coeff., Kp =	**3.000**

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CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-061-0-20

Soil	Depth (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
M. De Gravel with stone frag.- Fill	0	2.38	120	57.6	0	0	34	11.5
Loose Gravel with sand and silt	2.38	9.88	120	57.6	0	0	30	5.0
Medium dense fine sand	9.88	14.88	120	57.6	0	0	32	2.5
Loose to M. dense C-F sand	14.88	19.88	120	57.6	0	0	30	4.0
Stiff-V. Stiff sandy silt and clay	19.88	26.38	120	57.6	2000	160	30	3.0
Used in Analyses:			**120**	**57.6**	**0**	**0**	**32**	

Weighted Average Es (within depth =2 B) = **5.19**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	2250	3.75		8437.5
Wc-DC1b	337.5	0.5		168.8
Wc-DC2	1467	1.75		2567.2
Wc-DC3	0	2.50		0.0
Wc-DC4	225	1.75		393.8
ΣDCi =	**4279.5**		**ΣM$_{DCi}$ =**	**11567.3**
Soil EV1	0	0.5		0.0
Soil EV2	3912.0	5.0		19560.0
Soil EV3	750.0	5.8		4375.0
ΣEVi =	**4662.0**		**ΣMEVi**	**23935.0**

Ignored on passive side.
Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 2.70 ft **from R** =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 5.13 ft **from R** =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

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CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR — Resistance Reduction factors

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 0 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	4279.5	4662.0	2284.0	2146.3	781.2	0.0	0.0	0.0	
Arm to (R)	2.70	5.13	2.84	2.84	7.50	4.26	7.50	5.00	
Factored Loads (lb/ft)									
Strgth-1a	3851.6	4662.0	3426.0	3219.4	1171.8	0.0	0.0	0.0	Sliding & Eccentricity
Strgth-1b	5349.4	6293.7	3426.0	3219.4	1171.8	0.0	0.0	0.0	Bearing capacity
Service I	4279.5	4662.0	2284.0	2146.3	781.2	0.0	0.0	0.0	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-10410.525	-23935	9143.1	-8788.2	0.0	0.0	0.0	**-33990.7**	9685.3	3.50951	0.2404938	**0.0321**
Strgth-1b	-14459.063	-32312.25	9143.1	-8788.2	0.0	0.0	0.0	**-46416.5**	12814.8	3.62209	0.1279134	**0.0171**
Service I	-11567.25	-23935	6095.4	-5858.8	0.0	0.0	0.0	**-35265.7**	9722.7	3.62716	0.1228422	**0.0164**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

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CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 3851.55+4662+0+0+1171.765 = **9685.3** lb and Extreme Limit States

Factored Horizontal Loads, HH = 3219.4+0 **3219.4** lb **angle, α =** 0.321 rads = 18.39 Deg

Net Moments (Strength-1b) = -33990.7 lb

eccentricity , e = 0.24 ft

e/B = 0.0321 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for conesionles soil, $R_\tau = V \tan \delta$ (10.6.3.4-2)

Factored Horizontal Loads, γΣQ = 3219.4 lb

Sum of Normal Forces, N = 9685.3 lb tan δ = tan ϕ Cast in place

Factored Friction Resistance to Sliding, ϕτ Rτ = 6052.1 lb ϕτ = 1 (AASHTO LRFD Table 11.5.7-1)

Factored Passive Resistance to Sliding, ϕep Rep= 1440.0 lb ϕep = 0.5 (AASHTO Table 10.5.5.2.2-1)

Factored Sliding Resistance, RR= 7492.1 lb

Ignoring passive resistance **RR= 6052.1 lb**

γΣQ = 3219.4 ≤ RR

Capacity Demand Ratio, CDR= 7492.06/3219.4 = **2.33** **OK, CDR > 1.0 …Safe**

Project: **CUY-77-11.41: Reconstruction of I-77**

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CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b)

Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 5349.375+6293.7+1171.765+0+0= **12814.8** lb

Factored Horizontal Loads = 0+3219.4+0 = **3219.4** lb

angle, α = ATAN(3219.4/12814.8) = 0.246 rads = 14.10 Deg.

Net Moments (Strength-1b) = -46416.5 lb

Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service
from Table C	eccentricity , e =	0.240493791	0.128	0.123
	e/B=	0.032	0.017	0.016
	B'=B-2e (ft) =	7.019	7.244	7.254
	N, k/ft=	9.7	12.8	9.7
	Vertical Bearing pressure, σv (ksf)=	1.38	1.77	1.34

e/B = 0.016 **OK, e/B <0.33**

$$\sigma_v = \frac{\sum V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	120	pcf
γ'_{soil}=	57.6	
Su=	0	psf
ϕu=	0	
c'=	0	psf
ϕ'=	32	deg

Undrained Analyses is not applicable

The footing is essentially very long (L/B > 10) --> Strip

Long-term:

Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

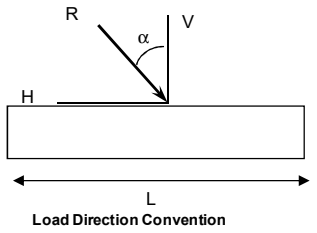
Nq	11.90
Nc	22.30
Ny	12.50

$$for\ \phi_f = 0 \qquad N_c = 5.14$$

$$for\ \phi_f > 0 \qquad N_c = (N_q - 1)\cot\phi_f$$

$$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$$

$$N_\gamma = 2(N_q + 1)\tan\phi_f$$



AASHTO Table 10.6.3.1.2a-1

Project: **CUY-77-11.41: Reconstruction of I-77**

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Shape Factors (AASHTO 10.6.6.1.2a-3):

		$for\ \phi_f = 0$
sc	1.000	$s_c = 1+\left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$
sq	1.000	$for\ \phi_f > 0$
sy	1.000	$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right), s_\gamma = 1-0.4\left(\frac{B}{L}\right), s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq} 1

$C_{w\gamma}$ 0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 8 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Bearing Resistance

$$q_R = \phi_b\ q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 4.2 ksf

Capacity Demand Ratio, CDR= 4.2/1.77 = **2.37** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
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Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **9722.7** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.016** **e =** **0.123** **ft** **(Table C, above, for Service Loads)**

B' = 7.3 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 73.0 **ft**

$$S_e = \frac{q_o\left(1-\upsilon^2\right)\sqrt{A}}{144\ E_s\ \beta_z}$$

qo: Contact pressure= 9722.7/7.3= **1332** **psf**

qo: Contact pressure= **1.332** **ksf**

υ: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(7.3*73) = **23.1** **ft**

E: Young's modulus (ksi)= **5.19**

βz: Shape factor = **1.41**

AASHTO LRFD

Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*1.332*(1-0.3^2)*23.1/(144*5.19*1.41)= **0.32** inch

Project: **CUY-77-11.41: Reconstruction of I-77**
PID: **PID 105743**
Wall 5A Borings
Completed by: DA Date: 4/13/2026
Checked by: RLT Date: 4/17/2026

Generalized Soil Stratigraphy and Material Properties

Wall 5A B-064-0-20
163+00, 52 LT

water= 654.1 656.1
Use= 666

GS= 672.1

from	to	Description	N60
679.29			
672.1	668.6	Gravel & Gravel with stone frag.- Fill	27
668.6	666	Med. Dense Sandy silt- Fill	22
666	658.6	Med. Dense Sandy silt -Fill	12
658.6	651.1	V. loose to m.dense Sand, some gravel - Fill	9
651.1	637.1	M. dene to V, dense Gravel with sand- slag Fill	30

B-064-0-20 App. Sta: 163+00, 52 LT
CIP: Design Height, H= 9.79 Wall Height, H= 13.29 Wall Sta: 7+66.28
Top of Wall= 679.29 (Top of Barrier) (Boring is just before wall starts)
Top of retained fill= 675.79 Represent wall sta: 7+66.28 to 8+60
Lower grade= 673.18
Bottom of wall El= 666

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of Wall
Foundation / sand	0	7.4	125	62.6	0	0	32	
Foundation/ sand	7.4	14.9	120	57.6	0	0	30	
Foundation / sand	14.9	28.9	125	62.6	0	0	36	

* C' = 0.08 Cu

Wall 5A B-065-0-20
165+00, 50 LT

water= 646.1 646.5
Use= 660

GS= 667.1

from	to	Description	N60
676.68	Top of retained fill		
667.1	660	Gravel and stone fragments- fill	52
660	656.1	Stiff sandy silt- fill	11
656.1	651.1	M. dense Gravel and stone frag.- fill	17
651.1	632.1	Stiff sandy silt, some clay- fill	15

B-065-0-20 App. Sta: 165+00, 50 LT
CIP: Design Height, H= 16.68 Wall Height, H= 20.18 Wall Sta: 9+40
Top of Wall= 680.18 (Top of Barrier) Represent wall sta: 8+60 to 10+80
Top of retained fill= 676.68
Lower grade= 666.14
Bottom of wall El= 660

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of Wall
Foundation/ sand	0.0	3.9	120	57.6	2500	200	30	
Foundation/ sand	3.9	8.9	125	62.6	0	0	33	
Foundation/ sand	8.9	27.9	125	62.6	2500	200	32	

* C' = 0.08 Cu

Project: **CUY-77-11.41: Reconstruction of I-77**
PID: **PID 105743**
Wall 5A Borings
Completed by: DA Date: 4/13/2026
Checked by: RLT Date: 4/17/2026

Generalized Soil Stratigraphy and Material Properties

Wall 5A B-066-0-20
167+00, 48 LT

water= 636.1 636.8
Use= 654

GS= 662.1

from	to	Description	N60
677.91	Top of retainde fill		
662.1	661.1	Gravel- fill	
661.1	654	M.dense- dense gravel and sand	25
654	651.1	M.dense- dense gravel and sand	18
651.1	637.1	Lo-M.desne C-f sand	9
637.1	631.1	M. dense f-c sand	17
631.1	622.1	V. stiff to hard Sandy silt	15

B-066-0-20 App. Sta: 167+00, 48 LT
CIP: Design Height, H= 23.91 Wall Height, H= 27.41 Wall Sta: 11+40
Top of Wall= 681.41 (Top of Barrier) Represent wall sta: 10+80 to 12+60
Top of retained fill= 677.91
Lower grade= 659.72
Bottom of wall El= 654.0

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of Wall
Foundation / sand	0	2.9	125	62.6	0	0	34	
Foundation / sand	2.9	16.9	125	62.6	0	0	32	
Foundation / sand	16.9	22.9	125	62.6	0	0	33	
Foundation	22.9	31.9	125	62.6	3500	280	30	

* C' = 0.08 Cu

Wall 5A B-067-0-20
169+00, 48 LT

water= NA
Use = 651

GS= 657.2

from	to	Description	N60
679.47	Top of retainde fill		
657.2	651.00	Dense Gravel & stone frag- fill	41
651.0	651.2	Hard silt	18
651.2	643.3	Loose C-F sand, some silt	9
643.3	628.7	Stiff-V. stiff silt, some clay	15
628.7	618.7	M. dense silt, little clay, little sand	15
618.7	607.2	Stiff-V. stiff silt, some clay	18

B-067-0-20 App. Sta: 169+00, 48 LT
CIP Design Height, H= 28.47 Wall Height, H= 31.97 Wall Sta: 13+35
Top of Wall= 682.97 (Top of Barrier) Represent wall sta: 12+60 to 14+86.25
Top of retained fill= 679.47
Lower grade= 655.42
Bottom of wall El= 651.00

zone	Depth below footing (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	
New Fill								Bottom of Wall
Foundation	0.0	-0.2	125	62.6	4000	320	30	
Foundation	-0.2	7.7	120	57.6	0	0	31	
Foundation	7.7	22.3	125	62.6	3000	240	30	
Foundation	22.3	32.3	125	62.6	0	0	32	
Foundation	32.3	43.8	125	62.6	3000	240	30	

* C' = 0.08 Cu

Project: **CUY-77-11.41: Reconstruction of I-77**

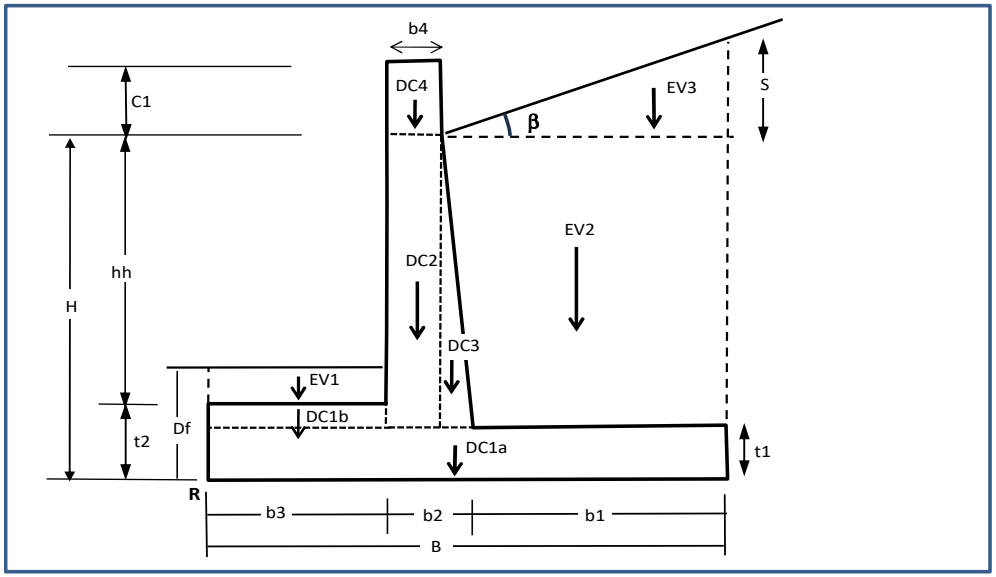
Subject: **Wall 5A: Sta 7+66.28 to 8+60**

Boring: **B-064-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL				Total Height =	13.29			(all units are in feet)			
H, ft	9.79	=13.29-3.5	b1, ft =	4.8		t1, ft=	2.0	wall angle, θ=	90		
he, ft =	7.79		b2, ft =	1.83		t2, ft=	2.25	Backfill angle, β =	0.0	S, ft =	0
B, ft=	8.5		b3, ft =	1.83		c1, ft*=	2.23	Traffic Surcharge (LL), psf=	250.0		
Df, ft =	4.0		b4, ft =	1.83		C1 is 1.0ft less than per plans, to compensate for thickness difference					

MATERIAL PROPERTIES

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Retained Fill

Unit Wt, γf =	120	pcf	Γ =	2.684481
Friction Angle-ϕ=	30	DEG	Active Earth Press. Coeff., Ka =	**0.297**
δ = 2/3 (ϕ)=	20	DEG	Passive Earth Press. Coeff., Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 7+66.28 to 8+60**

Boring: **B-064-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-064-0-20	Soil	Depth (ft) from	to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
	Med. Dense Sandy silt -Fill	0	7.4	125	62.6	0	0	32	2.2
	V. loose to m.dense Sand, some gravel - Fill	7.4	14.9	120	57.6	0	0	30	4.0
	M. dene to V, dense Gravel with sand- slag Fill	14.9	28.9	125	62.6	0	0	36	11.0
	Used in Analyses:			**123.00**	**57.6**	**0**	**0**	**33.0**	

Weighted Average Es (within depth =2 B) = **4.08**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	2550	4.2500		10837.5
Wc-DC1b	618.75	0.9167		567.2
Wc-DC2	2142.25	2.75		5891.2
Wc-DC3	0	3.67		0.0
Wc-DC4	612.5	2.75		1684.4
ΣDCi =	**5923.5**		**ΣM_{DCi} =**	**18980.3**
Soil EV1	0	0.9167		0.0
Soil EV2	4518.2	6.1		27485.7
Soil EV3	0.0	6.9		0.0
ΣEVi =	**4518.2**		**ΣMEVi**	**27485.7**

Ignored on passive side.

Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 3.20 ft **from R** $=\Sigma M_{DCi} / \Sigma DCi$

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 6.08 ft **from R** $=\Sigma M_{EVi} / \Sigma EVi$

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 7+66.28 to 8+60**

Boring: **B-064-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Resistance Reduction factors Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 250 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	5923.5	4518.2	1709.7	1606.6	584.8	683.8	248.9	1208.3	
Arm to (R)	3.20	6.08	3.26	3.26	8.50	4.89	8.50	6.08	
Factored Loads (lb/ft)									
Strgth-1a	5331.1	4518.2	2564.6	2410.0	877.2	1196.6	435.5	0.0	Sliding & Eccentricity
Strgth-1b	7404.4	6099.6	2564.6	2410.0	877.2	1196.6	435.5	2114.6	Bearing capacity
Service I	5923.5	4518.2	1709.7	1606.6	584.8	683.8	248.9	1208.3	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-17082.225	-27485.7167	7864.5	-7455.8	5857.5	-3702.1	0.0	**-42003.8**	11162.0	3.76309	0.4869066	**0.0573**
Strgth-1b	-23725.313	-37105.7175	7864.5	-7455.8	5857.5	-3702.1	-12863.7	**-71130.6**	16931.2	4.20115	0.0488492	**0.0057**
Service I	-18980.25	-27485.7167	5243.0	-4970.5	3347.2	-2115.5	-7350.7	**-52312.5**	12483.7	4.19047	0.0595279	**0.0070**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 7+66.28 to 8+60**

Boring: **B-064-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 5331.15+4518.2+0+435.54+877.152 = **11162.0** lb and Extreme Limit States

Factored Horizontal Loads, HH = 2409.95+1196.63504310969 = **3606.6** lb **angle, α =** 0.313 rads = 17.91 Deg

Net Moments (Strength-1b) = -42003.8 lb

eccentricity , e = 0.49 ft

e/B = 0.0573 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta$ (10.6.3.4-2)

Factored Horizontal Loads, $\gamma \Sigma Q$ = 3606.6 lb

Sum of Normal Forces, N = 11162.0 lb $\tan \delta = \tan \phi$ Cast in place

Factored Friction Resistance to Sliding, $\phi\tau$ Rτ = 7248.7 lb $\phi\tau$ = 1 (AASHTO LRFD Table 11.5.7-1)

Factored Passive Resistance to Sliding, ϕep Rep= 1440.0 lb ϕep = 0.5 (AASHTO Table 10.5.5.2.2-1)

Factored Sliding Resistance, RR= 8688.7 lb

Ignoring passive resistance **RR= 7248.7 lb**

$\gamma \Sigma Q$ = 3606.6 ≤ RR

Capacity Demand Ratio, CDR= 8688.71/3606.59 = **2.41** **OK, CDR > 1.0 …Safe**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 5A: Sta 7+66.28 to 8+60**
Boring:	**B-064-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b)

Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 7404.375+6099.57+877.152+435.54+2114.583= **16931.2** lb

Factored Horizontal Loads = 0+2409.95+1196.63504310969 = **3606.6** lb

angle, α = ATAN(3606.6/16931.2) = 0.210 rads = 12.03 Deg.

Net Moments (Strength-1b) = -71130.6 lb Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service	0.006	**OK, e/B <0.33**
from Table C	eccentricity , e (ft)=	0.487	0.049	**0.060**		
	e/B =	0.057	0.006	0.007	= B-2e	
	B'=B-2e (ft) =	7.53	8.40	8.38		
	N (k/ft)=	11.2	16.9	12.5		
	Vertical Bearing pressure, σv (ksf)=	1.48	2.02	1.49		

$$\sigma_v = \frac{\Sigma V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	123	pcf
γ'_{soil}=	57.6	
Su=	0	psf
ϕu=	0	
c'=	0	psf
ϕ'=	33	deg

Undrained Analyses is not applicable

The footing is essentially very long (L/B > 10) --> Strip

Long-term:

Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	11.90	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$
Nc	22.30	$N_c = 5.14$	
		for $\phi_f > 0$	
		$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q + 1)\tan\phi_f$
Ny	12.50		

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 7+66.28 to 8+60**

Boring: **B-064-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1 + \left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$

$for\ \phi_f > 0$

$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1 - 0.4\left(\frac{B}{L}\right),\ s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 9 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 4.5 ksf

Capacity Demand Ratio, CDR= 4.5/2.02 = **2.23** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 7+66.28 to 8+60**

Boring: **B-064-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **12483.7** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.007** **e =** **0.060** **ft** **(Table C, above, for Service Loads)**

B' = 8.4 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 84.0 **ft**

$$S_e = \frac{q_o(1-\upsilon^2)\sqrt{A}}{144\,E_s\,\beta_z}$$

qo: Contact pressure= 12483.7/8.4= **1486** **psf**

qo: Contact pressure= **1.486** **ksf**

υ: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(8.4*84) = **26.6** **ft**

E: Young's modulus (ksi)= **4.08**

βz: Shape factor = **1.41**

AASHTO LRFD

Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*1.486*(1-0.3^2)*26.6/(144*4.08*1.41)= **0.52** inch

Project: **CUY-77-11.41: Reconstruction of I-77**

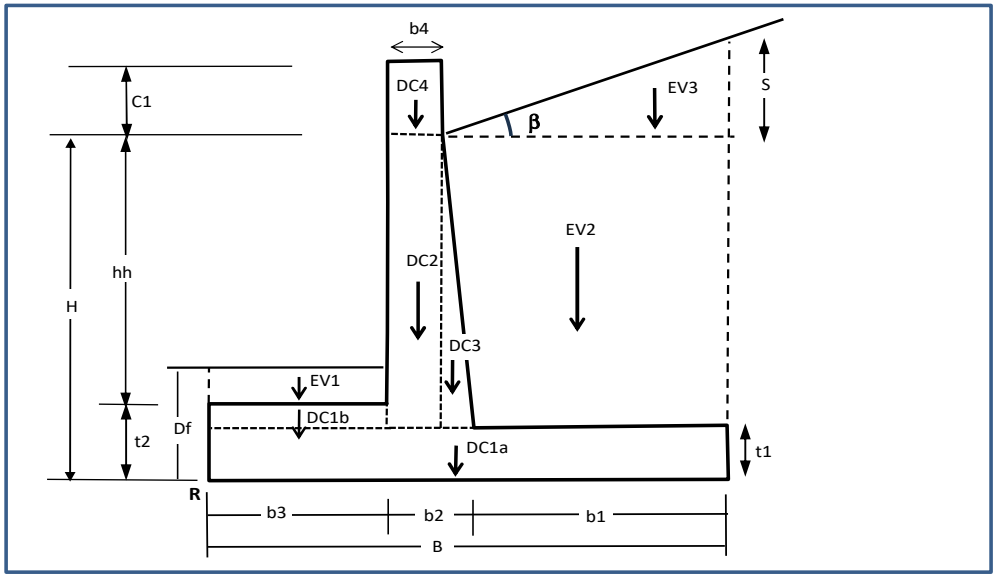
Subject: **Wall 5A: Sta 8+60 to 10+80**

Boring: **B-065-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 20.18 (all units are in feet)

H, ft	16.68	=20.18-3.5	b1, ft =	7.33	t1, ft=	2.0	wall angle, θ= 90
he, ft =	14.68		b2, ft =	1.83	t2, ft=	2.25	Backfill angle, β = 0.0 S, ft = 0
B, ft=	11.0		b3, ft =	1.83	c1, ft*=	2.23	Traffic Surcharge (LL), psf= 250.0
Df, ft =	4.0		b4, ft =	1.83			

C1 is 1.0ft less than per plans, to compensate for thickness difference

MATERIAL PROPERTIES

Retained Fill

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Unit Wt, γf = 120 pcf

Friction Angle-ϕ= 30 DEG

δ = 2/3 (ϕ)= 20 DEG

Γ = 2.684481

Active Earth Press. Coeff., Ka =	**0.297**
Passive Earth Press. Coeff., Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 8+60 to 10+80**

Boring: **B-065-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-065-0-20

Soil	Depth (ft) from	Depth (ft) to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
Stiff sandy silt- fill	0	3.9	120	57.6	2500	200	30	1.7
M. dense Gravel and stone frag.- fill	3.9	8.9	125	62.6	0	0	33	10.0
Stiff sandy silt, some clay- fill	8.9	27.9	125	62.6	2500	200	32	1.7
Used in Analyses:			**123.00**	**57.6**	**2500**	**0**	**32.0**	

Weighted Average Es (within depth =2 B) = **3.59**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft	
Wc-DC1a	3300	5.50		18150.0	
Wc-DC1b	618.75	0.9167		567.2	
Wc-DC2	4037	2.75		11101.8	
Wc-DC3	0	3.67		0.0	
Wc-DC4	612.5	2.75		1684.4	
ΣDCi =	**8568.2**		**ΣM$_{DCi}$ =**	**31503.3**	
Soil EV1	0	0.9167		0.0	*Ignored on passive side.*
Soil EV2	12918.4	7.3		94734.9	Wall face slope safely ignored
Soil EV3	0.0	8.6		0.0	
ΣEVi =	**12918.4**		**ΣMEVi**	**94734.9**	

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 3.68 ft from R =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 7.33 ft from R =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 8+60 to 10+80**

Boring: **B-065-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR — Resistance Reduction factors

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 250 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	8568.2	12918.4	4963.2	4663.8	1697.5	1165.0	424.0	1833.3	
Arm to (R)	3.68	7.33	5.56	5.56	11.00	8.34	11.00	7.33	
Factored Loads (lb/ft)									
Strgth-1a	7711.4	12918.4	7444.7	6995.8	2546.3	2038.8	742.1	0.0	Sliding & Eccentricity
Strgth-1b	10710.3	17439.8	7444.7	6995.8	2546.3	2038.8	742.1	3208.3	Bearing capacity
Service I	8568.2	12918.4	4963.2	4663.8	1697.5	1165.0	424.0	1833.3	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-28352.981	-94734.9333	38896.5	-28008.8	17003.6	-8162.7	0.0	**-103359.3**	23918.1	4.32138	1.1786235	**0.1071**
Strgth-1b	-39379.141	-127892.16	38896.5	-28008.8	17003.6	-8162.7	-23527.8	**-171070.5**	34646.8	4.93755	0.5624459	**0.0511**
Service I	-31503.313	-94734.9333	25931.0	-18672.5	9716.3	-4664.4	-13444.4	**-127372.3**	25441.5	5.00647	0.4935279	**0.0449**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 8+60 to 10+80**

Boring: **B-065-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 7711.425+12918.4+0+742.063+2546.252 = **23918.1** lb and Extreme Limit States

Factored Horizontal Loads, HH = 6995.77+2038.80209592132 **9034.6** lb **angle, α =** 0.361 rads = 20.69 Deg

Net Moments (Strength-1b) = -103359.3 lb

eccentricity , e = 1.18 ft

e/B = 0.1071 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta \qquad (10.6.3.4\text{-}2)$

Factored Horizontal Loads, $\gamma \Sigma Q$ =	9034.6	lb		
Sum of Normal Forces, N =	23918.1	lb	$\tan \delta = \tan \phi$	Cast in place
Factored Friction Resistance to Sliding, $\phi\tau$ Rτ =	14945.7	lb	$\phi\tau$ =	1 (AASHTO LRFD Table 11.5.7-1)
Factored Passive Resistance to Sliding, ϕep Rep=	1440.0	lb	ϕep =	0.5 (AASHTO Table 10.5.5.2.2-1)
Factored Sliding Resistance, RR=	16385.7	lb		
Ignoring passive resistance **RR=**	**14945.7**	**lb**		

$\gamma \Sigma Q$ = 9034.6 ≤ RR

Capacity Demand Ratio, CDR= 16385.71/9034.57 = **1.81** **OK, CDR > 1.0 …Safe**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 5A: Sta 8+60 to 10+80**
Boring:	**B-065-0-20**
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CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b) Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 10710.313+17439.84+2546.252+742.063+3208.33 **34646.8** lb

Factored Horizontal Loads = 0+6995.77+2038.80209592132 = **9034.6** lb

angle, α = ATAN(9034.6/34646.8) = 0.255 rads = 14.62 Deg.

Net Moments (Strength-1b) = -171070.5 lb Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service	0.051	**OK, e/B <0.33**
from Table C	eccentricity , e (ft)=	1.179	0.562	**0.494**		
	e/B =	0.107	0.051	0.045	= B-2e	
	B'=B-2e (ft) =	8.64	9.88	10.01		
	N (k/ft)=	23.9	34.6	25.4		
	Vertical Bearing pressure, σv (ksf)=	2.77	3.51	2.54	$\sigma_v = \frac{\sum V}{B-2e}$	(11.6.3.2-1)

Calculation of Nominal bearing resistance

γ_{soil}=	123	pcf
γ'_{soil}=	57.6	
Su=	2500	psf
ϕu=	0	
c'=	0	psf
ϕ'=	32	deg

The footing is essentially very long (L/B > 10) --> Strip

Short- Term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.000	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right)$
Nc	5.140	$N_c = 5.14$	
		for $\phi_f > 0$	
Ny	0.000	$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q+1)\tan\phi_f$

Project: **CUY-77-11.41: Reconstruction of I-77**

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CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1 + \left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$

$for\ \phi_f > 0$

$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1 - 0.4\left(\frac{B}{L}\right),\ s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 13 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 6.7 ksf

Capacity Demand Ratio, CDR= 6.7/3.51 = **1.9** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 8+60 to 10+80**

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CIP Retaining Wall- Geotechnical Design

Long-term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq 11.90

Nc 22.30

Ny 12.50

$$N_q = e^{\left(\pi \tan(\phi_f)\right)} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$$

for $\phi_f = 0$

$N_c = 5.14$

for $\phi_f > 0$

$$N_c = \left(N_q - 1\right)\cot\phi_f$$

$$N_\gamma = 2\left(N_q + 1\right)\tan\phi_f$$

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc 1.000

sq 1.000

sy 1.000

for $\phi_f = 0$

$$s_c = 1 + \left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$$

for $\phi_f > 0$

$$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1 - 0.4\left(\frac{B}{L}\right),\ s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq} 1

$C_{w\gamma}$ 0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity AASHTO 10.6.3.1.2a-1

q_n = 10 ksf

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 4.8 ksf

Capacity Demand Ratio, CDR= 4.8/3.51 = **1.37** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 5A: Sta 8+60 to 10+80**
Boring:	**B-065-0-20**
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CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **25441.5** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.045** **e =** **0.494** **ft** **(Table C, above, for Service Loads)**

B' = 10.0 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 100.0 **ft**

$$S_e = \frac{q_o\left(1-\upsilon^2\right)\sqrt{A}}{144\ E_s\ \beta_z}$$

qo: Contact pressure= 25441.5/10= **2544** **psf**

qo: Contact pressure= **2.544** **ksf**

v: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(10*100) = **31.6** **ft**

E: Young's modulus (ksi)= **3.59**

βz: Shape factor = **1.41**

AASHTO LRFD

Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*2.544*(1-0.3^2)*31.6/(144*3.59*1.41)= **1.20** inch

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 5A: Sta 10+80 to 12+60**
Boring:	**B-066-0-20**
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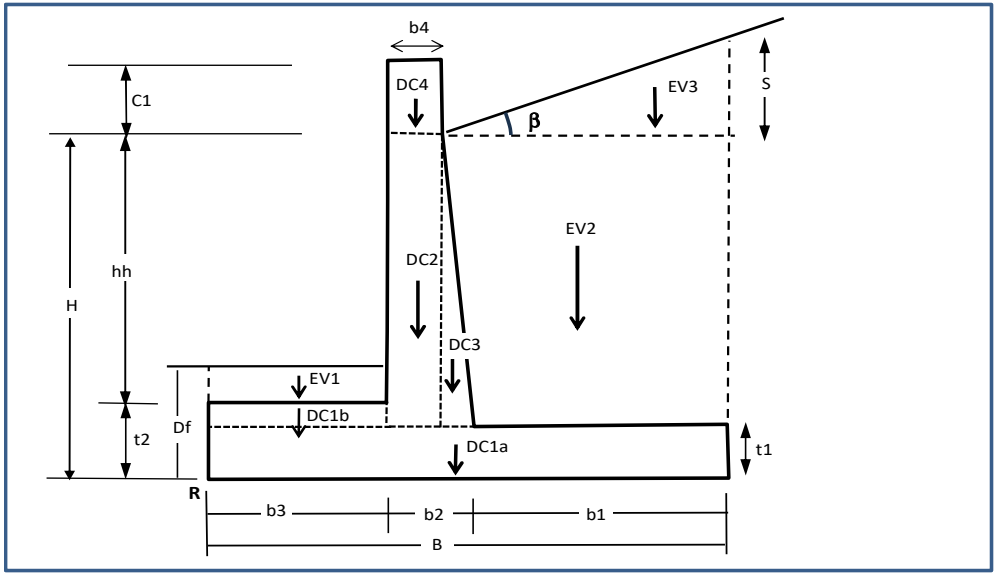
CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 27.41 (all units are in feet)

H, ft	23.91	=27.41-3.5	b1, ft =	10.67	t1, ft=	2.0	wall angle, θ=	90	
he, ft =	21.91		b2, ft =	2.50	t2, ft=	2.25	Backfill angle, β =	0.0	S, ft = 0
B, ft=	15.0		b3, ft =	1.83	c1, ft*=	2.23	Traffic Surcharge (LL), psf=	250.0	
Df, ft =	4.0		b4, ft =	1.83					

C1 is 1.0ft less than per plans, to compensate for thickness difference

MATERIAL PROPERTIES

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Retained Fill

Unit Wt, γf =	120	pcf	Γ = 2.684481
Friction Angle-ϕ=	30	DEG	
δ = 2/3 (ϕ)=	20	DEG	

Active Earth Press. Coeff., Ka =	**0.297**
Passive Earth Press. Coeff., Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 10+80 to 12+60**

Boring: **B-066-0-20**

Designer: DA Date 4/13/26

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CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-066-0-20

Soil	Depth (ft) from	Depth (ft) to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
M.dense- dense gravel and sand	0	2.9	125	62.6	0	0	34	13
Lo-M.desne C-f sand	2.9	16.9	125	62.6	0	0	32	4.5
M. dense f-c sand	16.9	22.9	125	62.6	0	0	33	5.5
V. stiff to hard Sandy silt	22.9	31.9	125	62.6	3500	280	30	3.0
Used in Analyses:			**125**	**62.6**	**0**	**0**	**33.0**	

Weighted Average Es (within depth =2 B) = **5.76**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft	
Wc-DC1a	4500	7.5000		33750.0	
Wc-DC1b	618.75	0.9167		567.2	
Wc-DC2	6025.25	2.75		16569.4	
Wc-DC3	1095.5	3.89		4260.3	
Wc-DC4	612.5	2.75		1684.4	
ΣDCi =	**12852.0**		**ΣM$_{DCi}$ =**	**56831.3**	
Soil EV1	0	0.9167		0.0	*Ignored on passive side.*
Soil EV2	28044.8	9.7		271099.7	Wall face slope safely ignored
Soil EV3	0.0	11.4		0.0	
ΣEVi =	**28044.8**		**ΣMEVi**	**271099.7**	

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 4.42 ft **from R** =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 9.67 ft **from R** =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 10+80 to 12+60**

Boring: **B-066-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Resistance Reduction factors Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 250 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	12852.0	28044.8	10198.2	9583.2	3488.0	1670.0	607.8	2666.7	
Arm to (R)	4.42	9.67	7.97	7.97	15.00	11.96	15.00	9.67	
Factored Loads (lb/ft)									
Strgth-1a	11566.8	28044.8	15297.4	14374.8	5232.0	2922.5	1063.7	0.0	Sliding & Eccentricity
Strgth-1b	16065.0	37860.5	15297.4	14374.8	5232.0	2922.5	1063.7	4666.7	Bearing capacity
Service I	12852.0	28044.8	10198.2	9583.2	3488.0	1670.0	607.8	2666.7	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-51148.15	-271099.73	114567.4	-78480.1	34938.8	-15955.7	0.0	**-267177.5**	45907.3	5.81993	1.6800672	**0.1120**
Strgth-1b	-71039.097	-365984.64	114567.4	-78480.1	34938.8	-15955.7	-45111.1	**-427064.5**	64887.9	6.58158	0.9184232	**0.0612**
Service I	-56831.278	-271099.73	76378.2	-52320.1	19965.0	-9117.5	-25777.8	**-318803.1**	47659.3	6.68921	0.8107898	**0.0541**

*** e = B/2 - Xd**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 10+80 to 12+60**

Boring: **B-066-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 11566.8+28044.8+0+1063.713+5232.009 = **45907.3** lb and Extreme Limit States

Factored Horizontal Loads, HH = 14374.83+2922.52746483686 **17297.4** lb **angle, α =** 0.360 rads = 20.65 Deg

Net Moments (Strength-1b) = -267177.5 lb

eccentricity , e = 1.68 ft

e/B = 0.1120 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta$ (10.6.3.4-2)

Factored Horizontal Loads, $\gamma \Sigma Q$ = 17297.4 lb

Sum of Normal Forces, N = 45907.3 lb $\tan \delta = \tan \phi$ Cast in place

Factored Friction Resistance to Sliding, $\phi\tau$ $R\tau$ = 29812.6 lb $\phi\tau$ = 1 (AASHTO LRFD Table 11.5.7-1)

Factored Passive Resistance to Sliding, ϕep Rep= 1440.0 lb ϕep = 0.5 (AASHTO Table 10.5.5.2.2-1)

Factored Sliding Resistance, RR= 31252.6 lb

Ignoring passive resistance **RR= 29812.6 lb**

$\gamma \Sigma Q$ = 17297.4 ≤ RR

Capacity Demand Ratio, CDR= 31252.56/17297.35 = **1.81** **OK, CDR > 1.0 …Safe**

Project: **CUY-77-11.41: Reconstruction of I-77**
Subject: **Wall 5A: Sta 10+80 to 12+60**
Boring: **B-066-0-20**
Designer: DA Date 4/13/26
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CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b)

Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 16065+37860.48+5232.009+1063.713+4666.667= **64887.9** lb

Factored Horizontal Loads = 0+14374.83+2922.52746483686 = **17297.4** lb

angle, α = ATAN(17297.4/64887.9) = 0.261 rads = 14.93 Deg.

Net Moments (Strength-1b) = -427064.5 lb Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service	0.061	**OK, e/B <0.33**
from Table C	eccentricity , e (ft)=	1.680	0.918	**0.811**		
	e/B =	0.112	0.061	0.054		= B-2e
	B'=B-2e (ft) =	11.64	13.16	13.38		
	N (k/ft)=	45.9	64.9	47.7		
	Vertical Bearing pressure, σv (ksf)=	3.94	4.93	3.56	$\sigma_v = \frac{\sum V}{B-2e}$	(11.6.3.2-1)

Calculation of Nominal bearing resistance

γ_{soil}=	125	pcf
γ'_{soil}=	62.6	
Su=	0	psf
ϕu=	0	
c'=	0	psf
ϕ'=	33	deg

Undrained Analyses is not applicable

The footing is essentially very long (L/B > 10) --> Strip

Long-term:

Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	11.90	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right)$
Nc	22.30	$N_c = 5.14$	
		for $\phi_f > 0$	
Ny	12.50	$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q+1)\tan\phi_f$

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 5A: Sta 10+80 to 12+60**
Boring:	**B-066-0-20**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000	$for\ \phi_f = 0$
sq	1.000	$s_c = 1+\left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$
sy	1.000	$for\ \phi_f > 0$
		$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right), s_\gamma = 1-0.4\left(\frac{B}{L}\right), s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq} 1

$C_{w\gamma}$ 0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 11 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 5.5 ksf

Capacity Demand Ratio, CDR= 5.5/4.93 = **1.12** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 10+80 to 12+60**

Boring: **B-066-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **47659.3** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.054** **e =** **0.811** **ft** **(Table C, above, for Service Loads)**

B' = 13.4 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 134.0 **ft**

$$S_e = \frac{q_o\left(1-\upsilon^2\right)\sqrt{A}}{144\ E_s\ \beta_z}$$

qo: Contact pressure= 47659.3/13.4= **3557** **psf**

qo: Contact pressure= **3.557** **ksf**

v: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(13.4*134) **42.4** **ft**

E: Young's modulus (ksi)= **5.76**

βz: Shape factor = **1.41**

AASHTO LRFD

Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/*B*	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*3.557*(1-0.3^2)*42.4/(144*5.76*1.41)= **1.41** inch

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 5A: Sta 12+60 to 14+86.25**
Boring:	**B-067-0-20**
Designer:	DA Date 4/13/26
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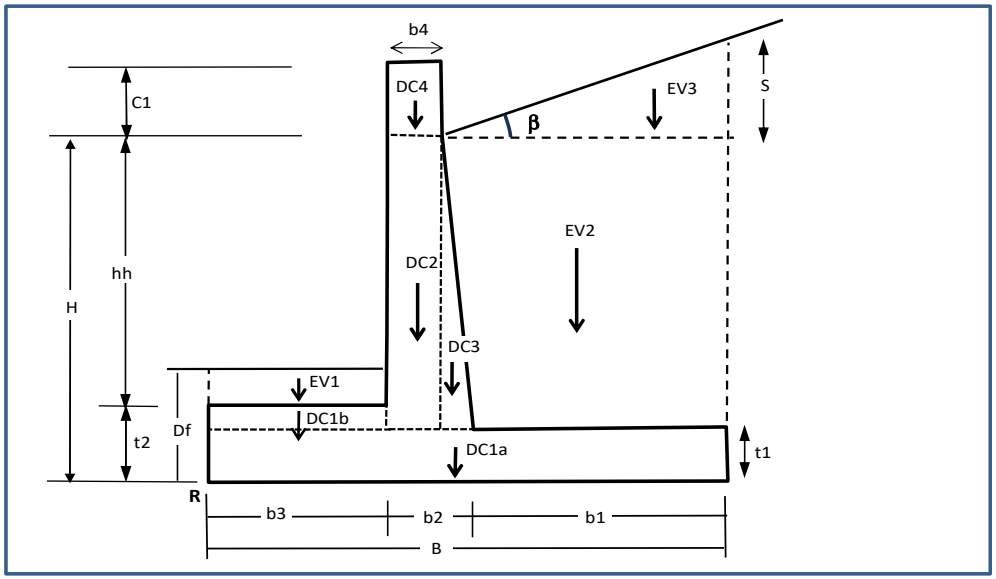
CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 31.97

(all units are in feet)

H, ft	28.47	=31.97-3.5	b1, ft =	11.58	t1, ft=	2.5	wall angle, θ=	90	
he, ft =	25.97		b2, ft =	3.33	t2, ft=	2.75	Backfill angle, β =	0.0	S, ft = 0
B, ft=	18.0		b3, ft =	3.08	c1, ft*=	2.23	Traffic Surcharge (LL), psf=	250.0	
Df, ft =	4.0		b4, ft =	1.83					

C1 is 1.0ft less than per plans, to compensate for thickness difference

MATERIAL PROPERTIES

Retained Fill

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Unit Wt, γf =	120	pcf	Γ =	2.684481
Friction Angle-ϕ=	30	DEG		
δ = 2/3 (ϕ)=	20	DEG		

Active Earth Press. Coeff., Ka =	**0.297**
Passive Earth Press. Coeff., Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 12+60 to 14+86.25**

Boring: **B-067-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-067-0-20

Soil	Depth (ft) from	Depth (ft) to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
Hard silt	0	-0.2	125	62.6	4000	320	30	5.0
Loose C-F sand, some silt	-0.2	7.7	120	57.6	0	0	31	2.5
Stiff-V. stiff silt, some clay	7.7	22.3	125	62.6	3000	240	30	3.5
M. dense silt, little clay, little sand	22.3	32.3	125	62.6	0	0	32	2.5
Stiff-V. stiff silt, some clay	32.3	43.8	125	62.6	3000	240	30	2.5
	Used in Analyses:		**124**	**57.6**	**4000**	**240**	**31.0**	

Weighted Average Es (within depth =2 B) = **2.89**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	6750	9.0000		60750.0
Wc-DC1b	1271.875	1.5417		1960.8
Wc-DC2	7141.75	4		28567.0
Wc-DC3	2921.625	5.42		15825.5
Wc-DC4	612.5	4		2450.0
ΣDCi =	**18697.8**		**ΣM$_{DCi}$ =**	**109553.3**
Soil EV1	0	1.5417		0.0
Soil EV2	36098.3	12.2		440700.1
Soil EV3	0.0	14.1		0.0
ΣEVi =	**36098.3**		**ΣMEVi**	**440700.1**

Ignored on passive side.

Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 5.86 ft **from R** =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 12.21 ft **from R** =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 12+60 to 14+86.25**

Boring: **B-067-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR — Resistance Reduction factors

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 250 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	18697.8	36098.3	14459.1	13587.1	4945.3	1988.5	723.8	2895.8	
Arm to (R)	5.86	12.21	9.49	9.49	18.00	14.24	18.00	12.21	
Factored Loads (lb/ft)									
Strgth-1a	16828.0	36098.3	21688.7	20380.7	7418.0	3479.9	1266.6	0.0	Sliding & Eccentricity
Strgth-1b	23372.2	48732.7	21688.7	20380.7	7418.0	3479.9	1266.6	5067.7	Bearing capacity
Service I	18697.8	36098.3	14459.1	13587.1	4945.3	1988.5	723.8	2895.8	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-98597.948	-440700.079	193412.5	-133523.2	49536.3	-22798.4	0.0	**-452670.8**	61610.8	7.34726	1.6527377	**0.0918**
Strgth-1b	-136941.6	-594945.107	193412.5	-133523.2	49536.3	-22798.4	-61868.3	**-707127.7**	85857.1	8.23610	0.7639027	**0.0424**
Service I	-109553.28	-440700.079	128941.7	-89015.5	28306.5	-13027.7	-35353.3	**-530401.6**	63360.9	8.37111	0.6288873	**0.0349**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 12+60 to 14+86.25**

Boring: **B-067-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 16827.975+36098.3+0+1266.579+7417.956 = **61610.8** lb and Extreme Limit States

Factored Horizontal Loads, HH = 20380.67+3479.89782199522 **23860.6** lb **angle, α =** 0.369 rads = 21.17 Deg

Net Moments (Strength-1b) = -452670.8 lb

eccentricity , e = 1.65 ft

e/B = 0.0918 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta$ (10.6.3.4-2)

Factored Horizontal Loads, γΣQ = 23860.6 lb

Sum of Normal Forces, N = 61610.8 lb tan δ = tan ϕ Cast in place

Factored Friction Resistance to Sliding, ϕτ Rτ = 37019.5 lb ϕτ = 1 (AASHTO LRFD Table 11.5.7-1)

Factored Passive Resistance to Sliding, ϕep Rep= 1440.0 lb ϕep = 0.5 (AASHTO Table 10.5.5.2.2-1)

Factored Sliding Resistance, RR= 38459.5 lb

Ignoring passive resistance **RR= 37019.5 lb**

γΣQ = 23860.6 ≤ RR

Capacity Demand Ratio, CDR= 38459.51/23860.57 = **1.61** **OK, CDR > 1.0 …Safe**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 12+60 to 14+86.25**

Boring: **B-067-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b) Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 23372.188+48732.705+7417.956+1266.579+5067. **85857.1** lb

Factored Horizontal Loads = 0+20380.67+3479.89782199522 = **23860.6** lb

angle, α = ATAN(23860.6/85857.1) = 0.271 rads = 15.53 Deg.

Net Moments (Strength-1b) = -707127.7 lb Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service	0.042	**OK, e/B <0.33**
from Table C	eccentricity , e (ft)=	1.653	0.764	**0.629**		
	e/B =	0.092	0.042	0.035		= B-2e
	B'=B-2e (ft) =	14.69	16.47	16.74		
	N (k/ft)=	61.6	85.9	63.4		
	Vertical Bearing pressure, σv (ksf)=	4.19	5.21	3.78		

$$\sigma_v = \frac{\sum V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	124	pcf
γ'_{soil}=	57.6	
Su=	4000	psf
ϕu=	0	
c'=	240	psf
ϕ'=	31	deg

Undrained Analyses is not applicable

The footing is essentially very long (L/B > 10) --> Strip

Short- Term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.000
Nc	5.140
Ny	0.000

for $\phi_f = 0$

$N_c = 5.14$

for $\phi_f > 0$

$N_c = (N_q - 1)\cot\phi_f$

$N_q = e^{(\pi\tan(\phi_f))}\tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$

$N_\gamma = 2(N_q + 1)\tan\phi_f$

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 12+60 to 14+86.25**

Boring: **B-067-0-20**

Designer: DA Date 4/13/26

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CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1 + \left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$

$for\ \phi_f > 0$

$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1 - 0.4\left(\frac{B}{L}\right),\ s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 21 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\ q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 10.5 ksf

Capacity Demand Ratio, CDR= 10.5/5.21 = **2.0** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 12+60 to 14+86.25**

Boring: **B-067-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Long-term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	11.90	$for\ \phi_f = 0$
Nc	22.30	$N_c = 5.14$
		$for\ \phi_f > 0$
		$N_c = (N_q - 1)\cot\phi_f$
Ny	12.50	

$N_q = e^{(\pi\tan(\phi_f))}\tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right)$

$N_\gamma = 2(N_q+1)\tan\phi_f$

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1+\left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$

$for\ \phi_f > 0$

$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right), s_\gamma = 1-0.4\left(\frac{B}{L}\right), s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity AASHTO 10.6.3.1.2a-1

q_n = 18 ksf

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\ q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 8.8 ksf

Capacity Demand Ratio, CDR= 8.8/5.21 = **1.69** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 5A: Sta 12+60 to 14+86.25**

Boring: **B-067-0-20**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **63360.9** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.035** **e =** **0.629** **ft** **(Table C, above, for Service Loads)**

B' = 16.7 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 167.0 **ft**

$$S_e = \frac{q_o(1-\upsilon^2)\sqrt{A}}{144\,E_s\,\beta_z}$$

qo: Contact pressure= 63360.9/16.7= **3794** **psf**

qo: Contact pressure= **3.794** **ksf**

υ: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(16.7*167) **52.8** **ft**

E: Young's modulus (ksi)= **2.89**

βz: Shape factor = **1.41**

AASHTO LRFD

Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*3.794*(1-0.3^2)*52.8/(144*2.89*1.41)= **3.73** inch

Project: **CUY-77-11.41: Reconstruction of I-77**

PID: **PID 105743**

Wall 6 Boring Data

Completed by: DA Date: 3/17/2026

Checked by: RLT Date:

Generalized Soil Stratigraphy and Material Properties

Wall 6		B-022-0-18	%ER=	84.5
		159+05, 40' Lt		
Boring B-060-0-20 shows better soil conditions, will not be used				
water=	NA			
Use =	674.9			
GS=	678.7			
from	to	Description		N60
680.06		Top of Wall		
678.7	677.3	Asphalt/Concrete		
677.3	676.2	V. dense stone frag. With sand		100
676.2	675.4	M. dense sandy silt		
675.4	674.2	Stiff silt and clay		15
674.2	674.9	M. stiff silty clay		13
674.9	672.7	M. stiff silty clay		13
672.7	671.2	M. dense sandy silt		25
		Assume continuity of M. dense sandy silt		
		to a min. Elev =	654.9	

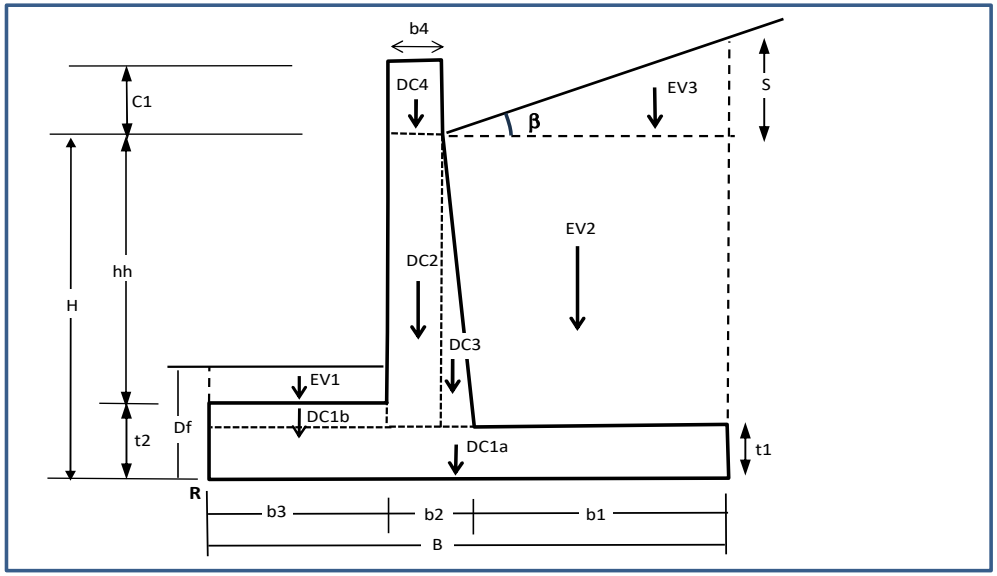
Wall 6			Boring	B-022-0-18				App. Sta:	159+05, 40' Lt
CIP:	Design Height, H=	5.16	Wall Height, H=	8.66				Wall Sta:	8+70
	Top of Wall=	680.06							
	Top of retained fill=	680.06							
	Lower grade=	680.05							
	Bottom of wall El=	674.9							
			Depth below footing (ft)						
	zone		from	to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg
	New Fill								Bottom of wall
	Foundation/clay		0	2.2	117	54.6	1000	100	28
	Foundation/ sand		2.2	3.7	120	57.6	0	0	32
	Assume conintuity- Sand		3.7	25	120	57.6	0	0	32

* Equivalent Secant friction angle (ϕ_s': zero cohesion friction angle:

$\phi s' = \tan^{-1}(\sigma_{v\text{-average}} \times \tan(\phi')/\sigma_{v\text{-average}})$

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 6: Sta 6+00 to 11+50**
Boring:	**B-022-0-18**
Designer:	DA — Date 4/13/26
Checker:	RLT — Date 4/17/26

CIP Retaining Wall- Geotechnical Design



GEOMETRY OF WALL

Total Height = 8.50 (all units are in feet)

H, ft	6.90	b1, ft =	4.33	t1, ft=	2.0	wall angle, θ=	90
he, ft =	4.90	b2, ft =	1.67	t2, ft=	2.25	Backfill angle, β =	18.4
B, ft=	7.0	b3, ft =	1.00	c1, ft*=	1.60	Traffic Surcharge (LL), psf=	0.0
Df, ft =	4.0	b4, ft =	1.83	Average thickness of parapet (c1) =	1.0		

S, ft = 1.44

MATERIAL PROPERTIES

Retained Fill

$$k_a = \frac{\sin^2(\theta+\phi_f')}{\Gamma[\sin^2\theta\sin(\theta-\delta)]} \qquad (3.11.5.3\text{-}1)$$

$$\Gamma = \left[1+\sqrt{\frac{\sin(\phi_f'+\delta)\sin(\phi_f'-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2 \qquad (3.11.5.3\text{-}2)$$

Unit Wt, γf =	120	pcf	Γ = 2.002391
Friction Angle-ϕ=	30	DEG	
δ = 2/3 (ϕ)=	20	DEG	

Active Earth Press. Coeff.,	Ka =	**0.399**
Passive Earth Press. Coeff.,	Kp =	**3.000**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 6: Sta 6+00 to 11+50**

Boring: **B-022-0-18**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Foundation Properties:

Boring: B-022-0-18

Soil	Depth (ft) from	Depth (ft) to	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg	Es, ksi
M. stiff silty clay	0	2.2	117	54.6	1000	100	28	2.2
M. dense sandy silt	2.2	3.7	120	57.6	0	0	32	1.5
Assume conintuity- Sand	3.7	25	120	57.6	0	0	32	1.5
Used in Analyses:			**119.00**	**54.6**	**1000**	**100**	**28.0**	

Weighted Average Es (within depth =2 B) = **1.61**

Concrete

Unit Wt, γc = 150 pcf

Concrete & Soil weights, & center of masses per foot of wall

Item	Unfactored Wt (lb/ft)	Mom. Arm to (R) (ft)		Moment AbouRt lb/ft
Wc-DC1a	2100	3.500		7350.0
Wc-DC1b	337.5	0.500		168.8
Wc-DC2	1347.5	1.917		2582.7
Wc-DC3	-61.25	2.778		-170.1
Wc-DC4	240	1.917		460.0
ΣDCi =	**3963.8**		**ΣM$_{DCi}$ =**	**10391.3**
Soil EV1	0	0.5000		0.0
Soil EV2	2548.0	4.8		12315.3
Soil EV3	375.6	5.6		2086.4
ΣEVi =	**2923.6**		**ΣMEVi**	**14401.8**

Ignored on passive side.
Wall face slope safely ignored

Center of Mass for Concrete elements (distance from Center of mass to point R), Xcon = Σ(Wi ai)/ΣWi

X con= 2.62 ft **from R** =ΣM$_{DCi}$ /ΣDCi

Center of Mass for Vertical Soil Weights (distance from Center of mass to point R), Xs = Σ(Si ai)/ΣSi

X s= 4.93 ft **from R** =ΣM$_{EVi}$ /ΣEVi

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 6: Sta 6+00 to 11+50**

Boring: **B-022-0-18**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

ANALYSES CASES AND LOAD FACTORS

Load & resistance factors for Strength I and Service Limits

Table A FACTOR (γ) FOR

Group	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ*	LSh sin δ	LSv*	Resistance Reduction factors Application
Strgth-1a	0.9	1	1.5	1.5	1.5	1.75	1.75	0	Sliding & Eccentricity
Strgth-1b	1.25	1.35	1.5	1.5	1.5	1.75	1.75	1.75	Bearing capacity
Service I	1	1	1	1	1	1	1	1	Settlement

* LSv: vertical traffic surcharge.LSh: horizontal traffic surcharge

Slding resistance factor= 1.0 AASHTO LRFD Table 11.5.7-1

Calculattion of Loads (Unfactored & Factored Loads)

Table B Unit: (Lb/ft) EH-h EH-v Traffic Surcharge, q= 0 psf

Case	DC	EV	EH	EHcosδ	EHsinδ	LSh cos δ	LSh sin δ	LSv	
UNFACTORED	3963.8	2923.6	1138.6	1069.9	389.4	0.0	0.0	0.0	
Arm to (R)	2.62	4.93	2.30	2.30	7.00	3.45	7.00	4.83	
Factored Loads (lb/ft)									
Strgth-1a	3567.4	2923.6	1707.9	1604.9	584.1	0.0	0.0	0.0	Sliding & Eccentricity
Strgth-1b	4954.7	3946.8	1707.9	1604.9	584.1	0.0	0.0	0.0	Bearing capacity
Service I	3963.8	2923.6	1138.6	1069.9	389.4	0.0	0.0	0.0	Settlement

EH (arm)= (d+h1)/3 LSh (arm)= (d+h1)/2 WS (arm)= d+h1+h5/2

EV: ignores the weight of soil on the passive side.

Calculation of Moments and eccentricity for load cases

Table C

Moments	DC	EV	EHcosδ	EHsinδ	LSh cos δ	LSh sin d	LSv	Net M. lb.ft/ft	Factored Normal Forces(lb)	Distance from (R) Xd (ft)	Eccent. e (ft) *	e/B
Strgth-1a	-9352.1875	-14401.7531	3691.3	-4089.0	0.0	0.0	0.0	**-24151.6**	7075.1	3.41362	0.086378	**0.0123**
Strgth-1b	-12989.149	-19442.3667	3691.3	-4089.0	0.0	0.0	0.0	**-32829.2**	9485.6	3.46094	0.0390595	**0.0056**
Service I	-10391.319	-14401.7531	2460.9	-2726.0	0.0	0.0	0.0	**-25058.2**	7276.7	3.44360	0.0563952	**0.0081**

The force and moments due to the live load surcharge shouldn't be included in the sliding and eccentricity checks(AASHTO LRFD Figure C11.5.5-3a)

*** e = B/2 - Xd**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 6: Sta 6+00 to 11+50**

Boring: **B-022-0-18**

Designer: DA Date 4/13/26

Checker: RLT Date 4/17/26

CIP Retaining Wall- Geotechnical Design

Stability Checks (Strength 1)

1- Eccentricty (Strength-1a State)

Factored Normal Loads, N = 3567.375+2923.556+0+0+584.143 = **7075.1** lb and Extreme Limit States

Factored Horizontal Loads, HH = 1604.92+0 **1604.9** lb **angle, α =** 0.223 rads = 12.78 Deg

Net Moments (Strength-1b) = -24151.6 lb

eccentricity , e = 0.09 ft

e/B = 0.0123 **OK, e < B/3**

2- Sliding Stability (Strength-1a State):

According to AASHTO (Sec. 10.6.3.4), unfactored Resistance to sliding (Rt) is calculated as:

$$R_R = \varphi R_n = \varphi_\tau R_\tau + \varphi_{ep} R_{ep} \qquad (10.6.3.4\text{-}1)$$

(Second term is passive resistance and is igored)

for cohesionles soil, $R_\tau = V \tan \delta$ (10.6.3.4-2)

Factored Horizontal Loads, $\gamma \Sigma Q$ = 1604.9 lb

Sum of Normal Forces, N = 7075.1 lb $\tan \delta = \tan \phi$ Cast in place

Factored Friction Resistance to Sliding, $\phi\tau$ Rτ = 3761.9 lb $\phi\tau$ = 1 (AASHTO LRFD Table 11.5.7-1)

Factored Passive Resistance to Sliding, ϕep Rep= 1440.0 lb ϕep = 0.5 (AASHTO Table 10.5.5.2.2-1)

Factored Sliding Resistance, RR= 5201.9 lb

Ignoring passive resistance **RR= 3761.9 lb**

$\gamma \Sigma Q$ = 1604.9 ≤ RR

Capacity Demand Ratio, CDR= 5201.88/1604.92 = **3.24** **OK, CDR > 1.0 …Safe**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 6: Sta 6+00 to 11+50**
Boring:	**B-022-0-18**
Designer:	DA Date 4/13/26
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CIP Retaining Wall- Geotechnical Design

3 Bearing Capacity Check (Strength -1b)

Calculate Nominal Bearing Resistance at the Strength

Calculation of Contact Pressures

Factored Normal Loads = 4954.688+3946.8+584.143+0+0= **9485.6** lb

Factored Horizontal Loads = 0+1604.92+0 = **1604.9** lb

angle, α = ATAN(1604.9/9485.6) = 0.168 rads = 9.60 Deg.

Net Moments (Strength-1b) = -32829.2 lb Net Moment (Strength-1b)= EH.H/3 +Es.H/2

		Strength 1a	Strength 1b	Service	0.006	**OK, e/B <0.33**
from Table C	eccentricity , e (ft)=	0.086	0.039	**0.056**		
	e/B =	0.012	0.006	0.008	= B-2e	
	B'=B-2e (ft) =	6.83	6.92	6.89		
	N (k/ft)=	7.1	9.5	7.3		
	Vertical Bearing pressure, σv (ksf)=	1.04	1.37	1.06		

$$\sigma_v = \frac{\sum V}{B - 2e} \qquad (11.6.3.2\text{-}1)$$

Calculation of Nominal bearing resistance

γ_{soil}=	119	pcf
γ'_{soil}=	54.6	
Su=	1000	psf
ϕu=	0	
c'=	100	psf
ϕ'=	28	deg

The footing is essentially very long (L/B > 10) --> Strip

Short- Term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.000	*for* $\phi_f = 0$	$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$
Nc	5.140	$N_c = 5.14$	
		for $\phi_f > 0$	
		$N_c = (N_q - 1)\cot\phi_f$	$N_\gamma = 2(N_q + 1)\tan\phi_f$
Ny	0.000		

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 6: Sta 6+00 to 11+50**

Boring: **B-022-0-18**

Designer: DA Date 4/13/26

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CIP Retaining Wall- Geotechnical Design

Shape Factors (AASHTO 10.6.6.1.2a-3):

$for\ \phi_f = 0$

$s_c = 1 + \left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$

$for\ \phi_f > 0$

$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right), s_\gamma = 1 - 0.4\left(\frac{B}{L}\right), s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

sc	1.000	
sq	1.000	
sy	1.000	

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq} 1

$C_{w\gamma}$ 0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 6 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 2.8 ksf

Capacity Demand Ratio, CDR= 2.8/1.37 = **2.04** **OK… CDR > 1.0**

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Wall 6: Sta 6+00 to 11+50**

Boring: **B-022-0-18**

Designer: DA Date 4/13/26

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CIP Retaining Wall- Geotechnical Design

Long-term: Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	11.90	$for\ \phi_f = 0$
Nc	22.30	$N_c = 5.14$
		$for\ \phi_f > 0$
		$N_c = (N_q - 1)\cot\phi_f$
Ny	12.50	

$$N_q = e^{(\pi\tan(\phi_f))}\tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right)$$

$$N_\gamma = 2(N_q+1)\tan\phi_f$$

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000	$for\ \phi_f = 0$
sq	1.000	$s_c = 1+\left(\frac{B}{5L}\right), s_\gamma = 1, s_q = 1$
sy	1.000	$for\ \phi_f > 0$
		$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right), s_\gamma = 1-0.4\left(\frac{B}{L}\right), s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity AASHTO 10.6.3.1.2a-1

q_n = 10 ksf

$$q_n = CNcSc + \gamma DfNqSq\ d_qCwq + 0.5\gamma B'N_\gamma S_\gamma Cw\gamma$$

Factored Bearing Resistance

$$q_R = \phi_b\, q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 5.2 ksf

Capacity Demand Ratio, CDR= 5.2/1.37 = **3.8** **OK… CDR > 1.0**

Project:	**CUY-77-11.41: Reconstruction of I-77**
Subject:	**Wall 6: Sta 6+00 to 11+50**
Boring:	**B-022-0-18**
Designer:	DA Date 4/13/26
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CIP Retaining Wall- Geotechnical Design

Caclulation of Settlement

Service Normal Loads = **7276.7** lb **(Table B, above, for Service Loads)**

eccentricity , e /B= **0.008** **e =** **0.056** **ft** **(Table C, above, for Service Loads)**

B' = 6.9 **ft**

settlement calculations as follow: **Long (strip footing, L = 10B); L =** 69.0 **ft**

$$S_e = \frac{q_o\left(1-\upsilon^2\right)\sqrt{A}}{144\ E_s\ \beta_z}$$

qo: Contact pressure= 7276.7/6.9= **1055** **psf**

qo: Contact pressure= **1.055** **ksf**

υ: Poisson's ratio = 0.3

√A': Influence Depth = SQRT(6.9*69) = **21.8** **ft**

E: Young's modulus (ksi)= **1.61**

βz: Shape factor = **1.41**

AASHTO LRFD

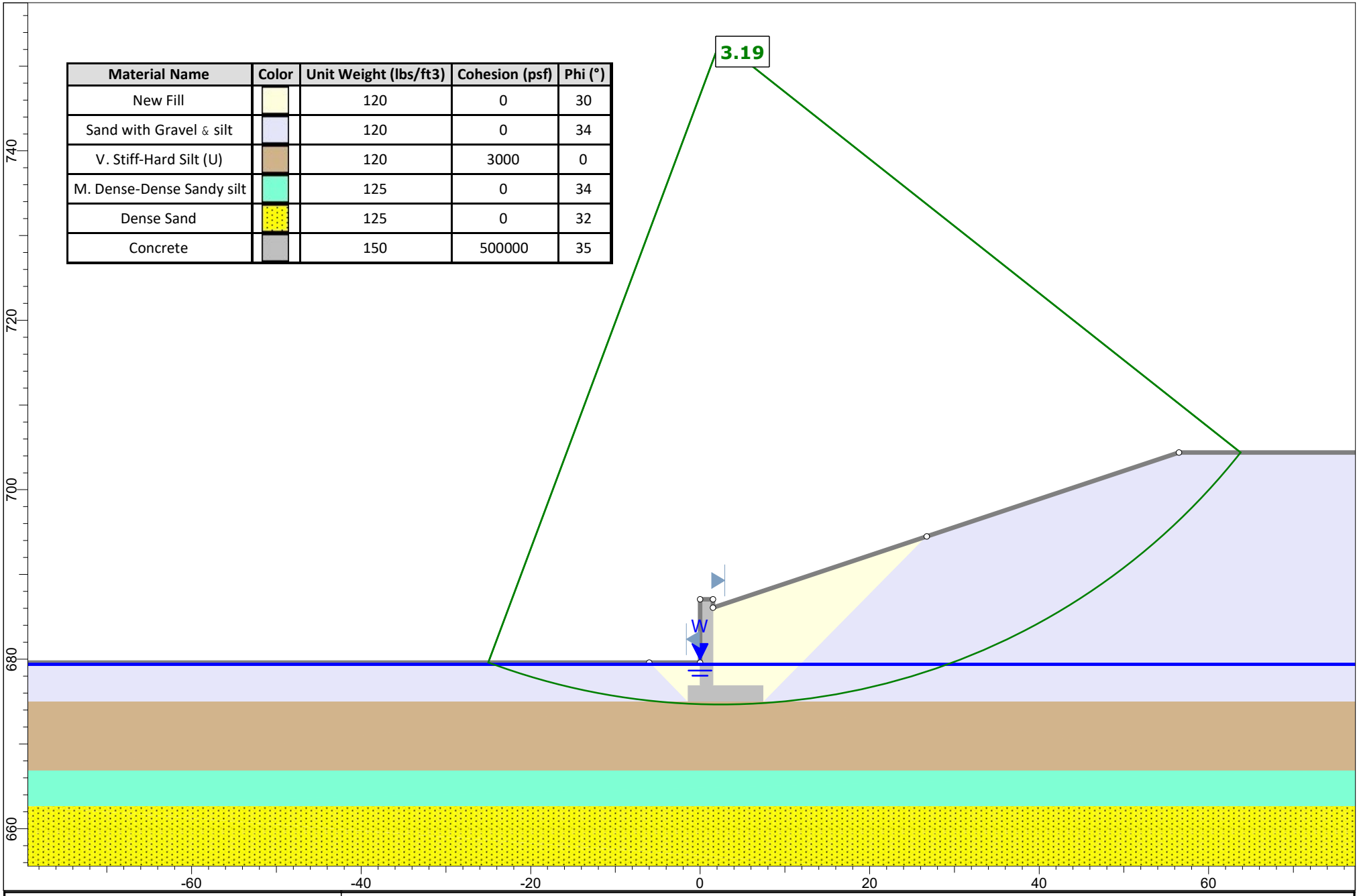
Table 10.6.2.4.2-1—Elastic Shape and Rigidity Factors, EPRI (1983)

L/B	Flexible, β_z (average)	β_z Rigid
Circular	1.04	1.13
1	1.06	1.08
2	1.09	1.10
3	1.13	1.15
5	1.22	1.24
10	1.41	1.41

Calculated Settlement, Se= 12*1.055*(1-0.3^2)*21.8/(144*1.61*1.41)= **0.77** inch

APPENDIX I
GLOBAL STABILITY ANALYSIS OF CIP WALLS

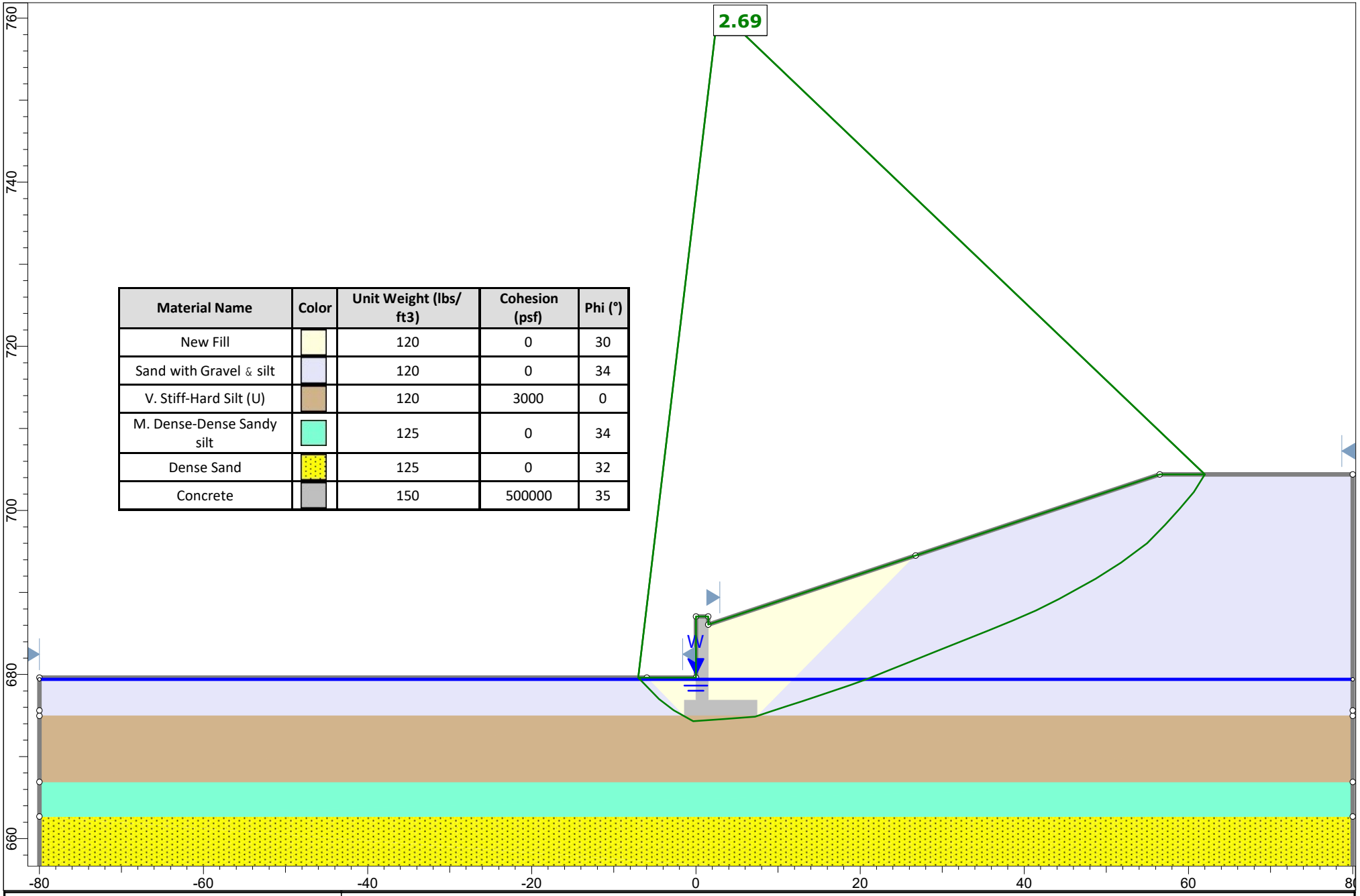
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
Sand with Gravel & silt		120	0	34
V. Stiff-Hard Silt (U)		120	3000	0
M. Dense-Dense Sandy silt		125	0	34
Dense Sand		125	0	32
Concrete		150	500000	35



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 3 H=12.12 ft- Total Stress	*Scenario*	Curcular
Drawn By	Dean Almohd, PhD, PE	*Company*	TRC Engineers, Inc.
Date	11/18/2025, 10:01:53 PM	*File Name*	CIP Wall 3 _12.12ft.slmd



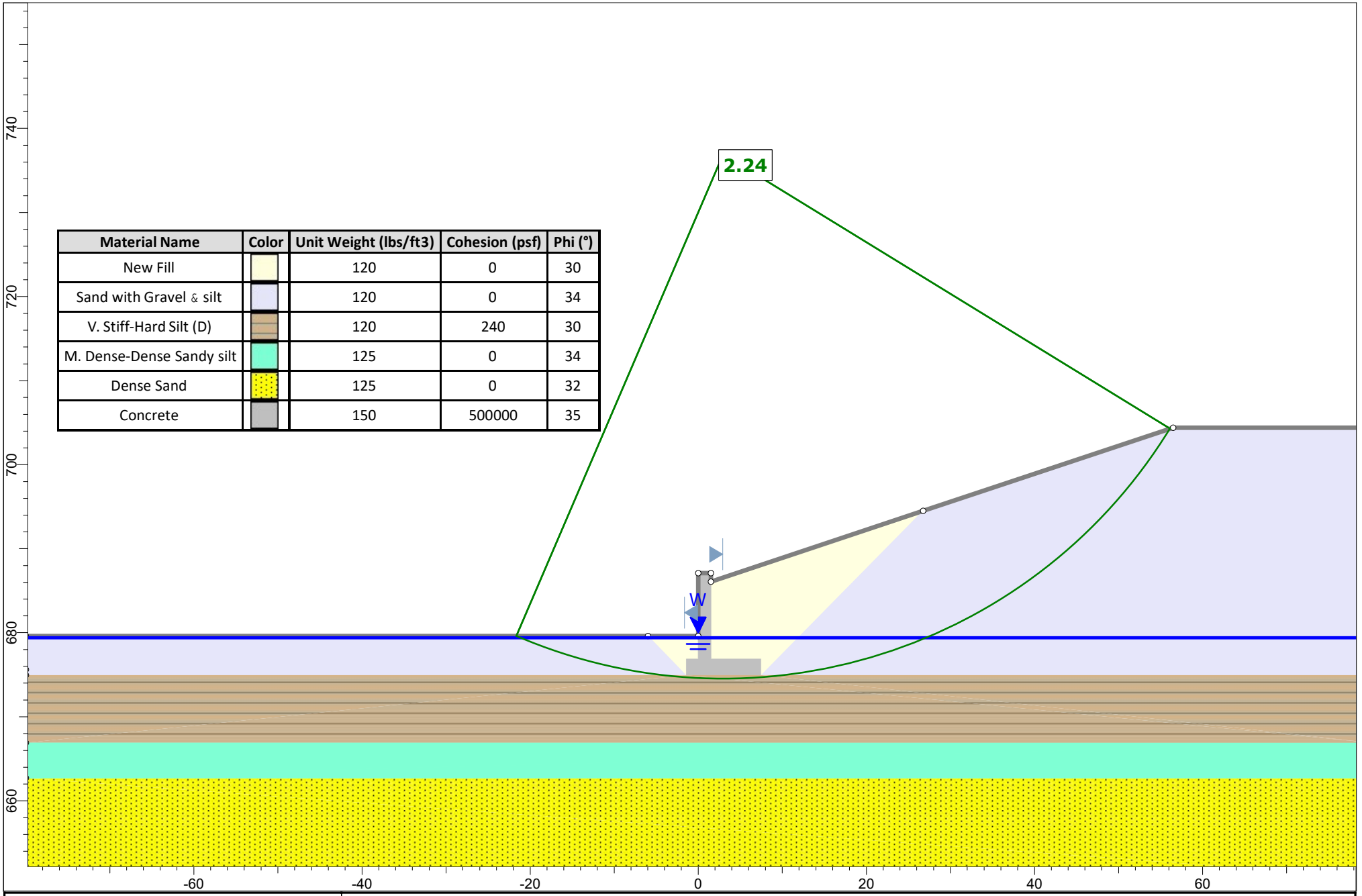
Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
Sand with Gravel & silt		120	0	34
V. Stiff-Hard Silt (U)		120	3000	0
M. Dense-Dense Sandy silt		125	0	34
Dense Sand		125	0	32
Concrete		150	500000	35

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 3 H=12.12 ft- Total Stress	*Scenario*	Non-Curcular
Drawn By	Dean Almohd, PhD, PE	*Company*	TRC Engineers, Inc.
Date	11/18/2025, 10:01:53 PM	*File Name*	CIP Wall 3 _12.12ft.slmd

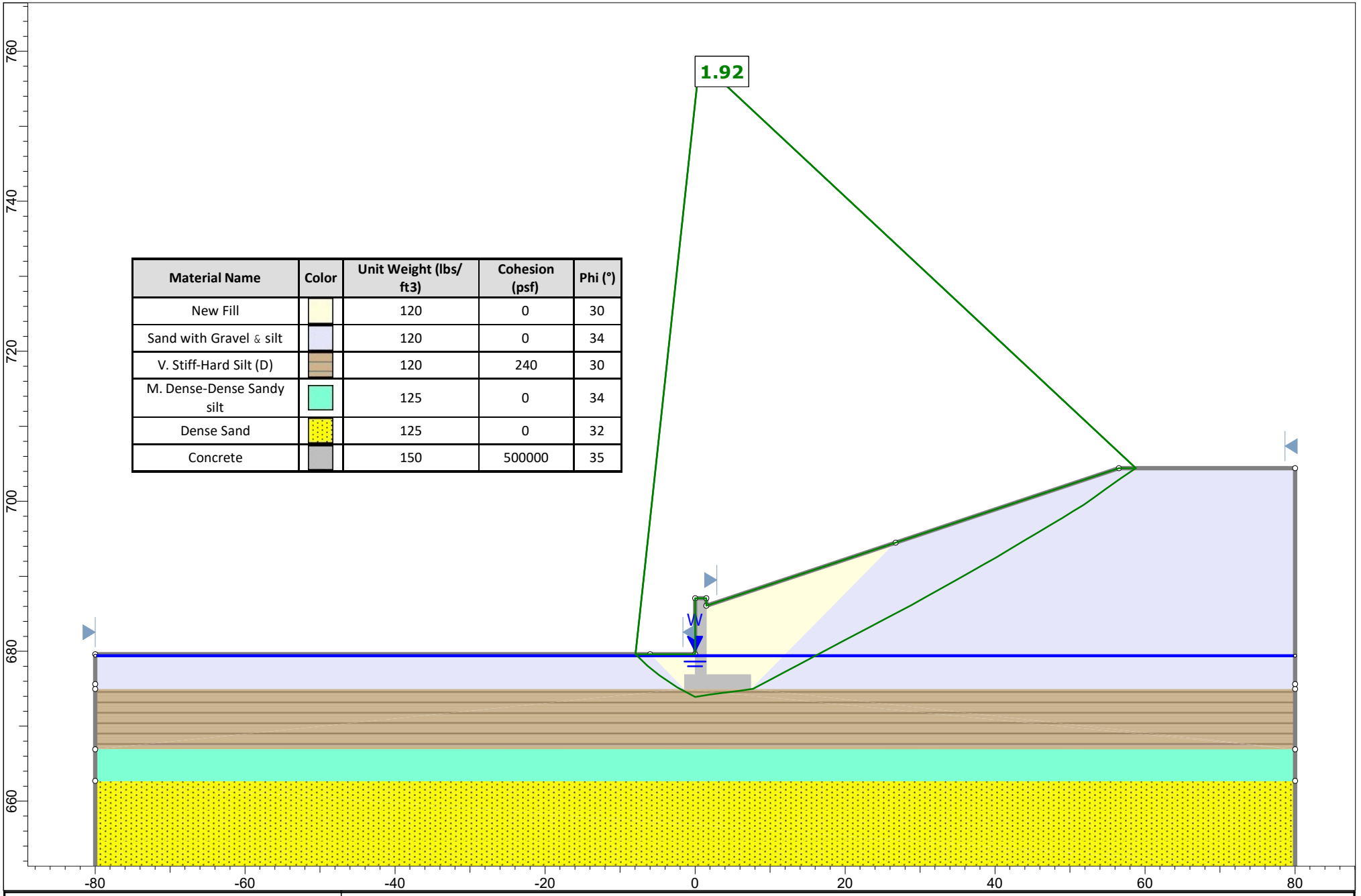
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
Sand with Gravel & silt		120	0	34
V. Stiff-Hard Silt (D)		120	240	30
M. Dense-Dense Sandy silt		125	0	34
Dense Sand		125	0	32
Concrete		150	500000	35



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 3 H=12.12 ft- Effective Stress	Scenario	Curcular
Drawn By	Dean Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	11/18/2025, 10:01:53 PM	File Name	CIP Wall 3 _12.12ft.slmd



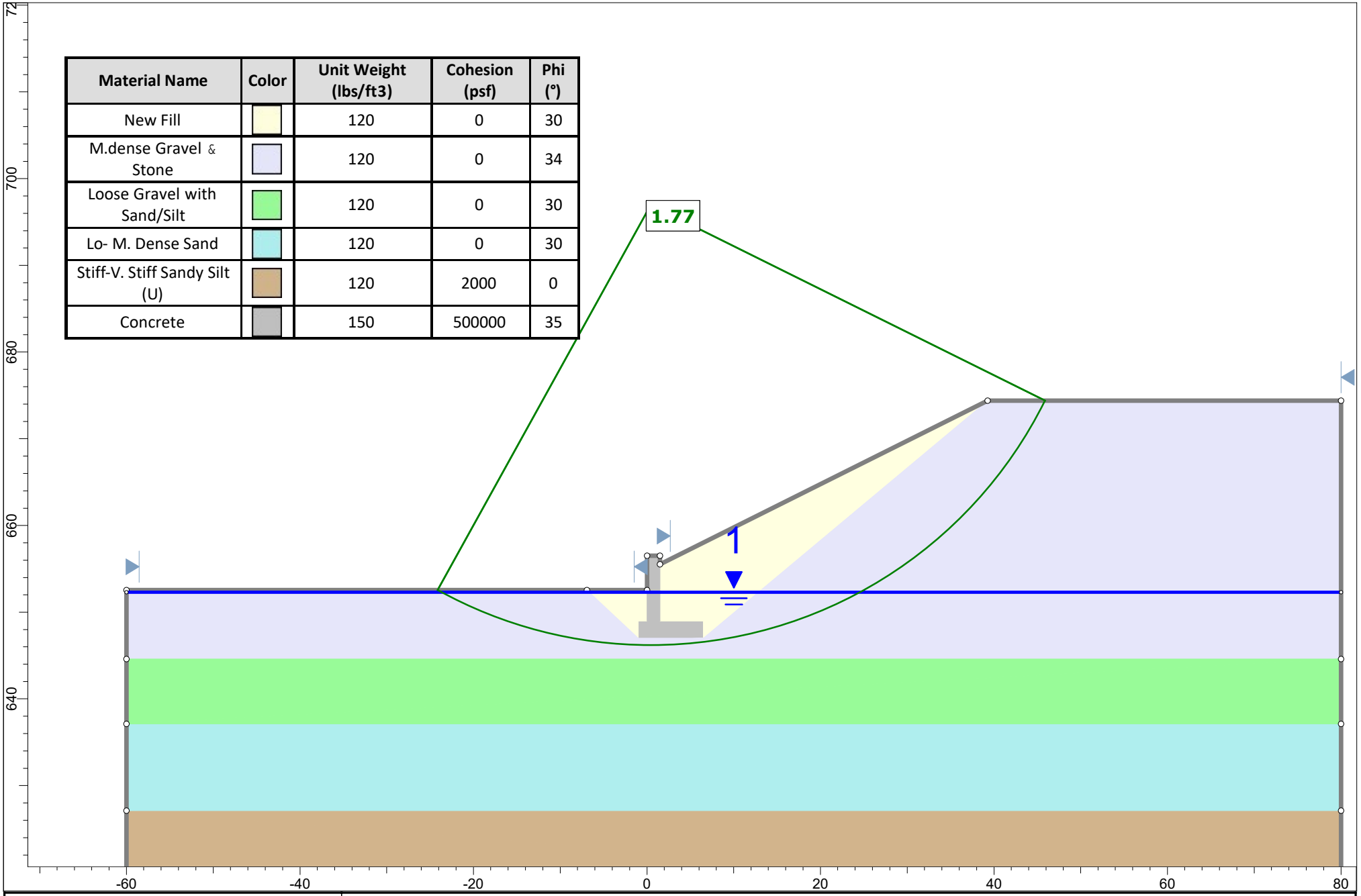
Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
Sand with Gravel & silt		120	0	34
V. Stiff-Hard Silt (D)		120	240	30
M. Dense-Dense Sandy silt		125	0	34
Dense Sand		125	0	32
Concrete		150	500000	35

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 3 H=12.12 ft- Effective Stress	*Scenario*	Non-Curcular
Drawn By	Dean Almohd, PhD, PE	*Company*	TRC Engineers, Inc.
Date	11/18/2025, 10:01:53 PM	*File Name*	CIP Wall 3 _12.12ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
M.dense Gravel & Stone		120	0	34
Loose Gravel with Sand/Silt		120	0	30
Lo- M. Dense Sand		120	0	30
Stiff-V. Stiff Sandy Silt (U)		120	2000	0
Concrete		150	500000	35

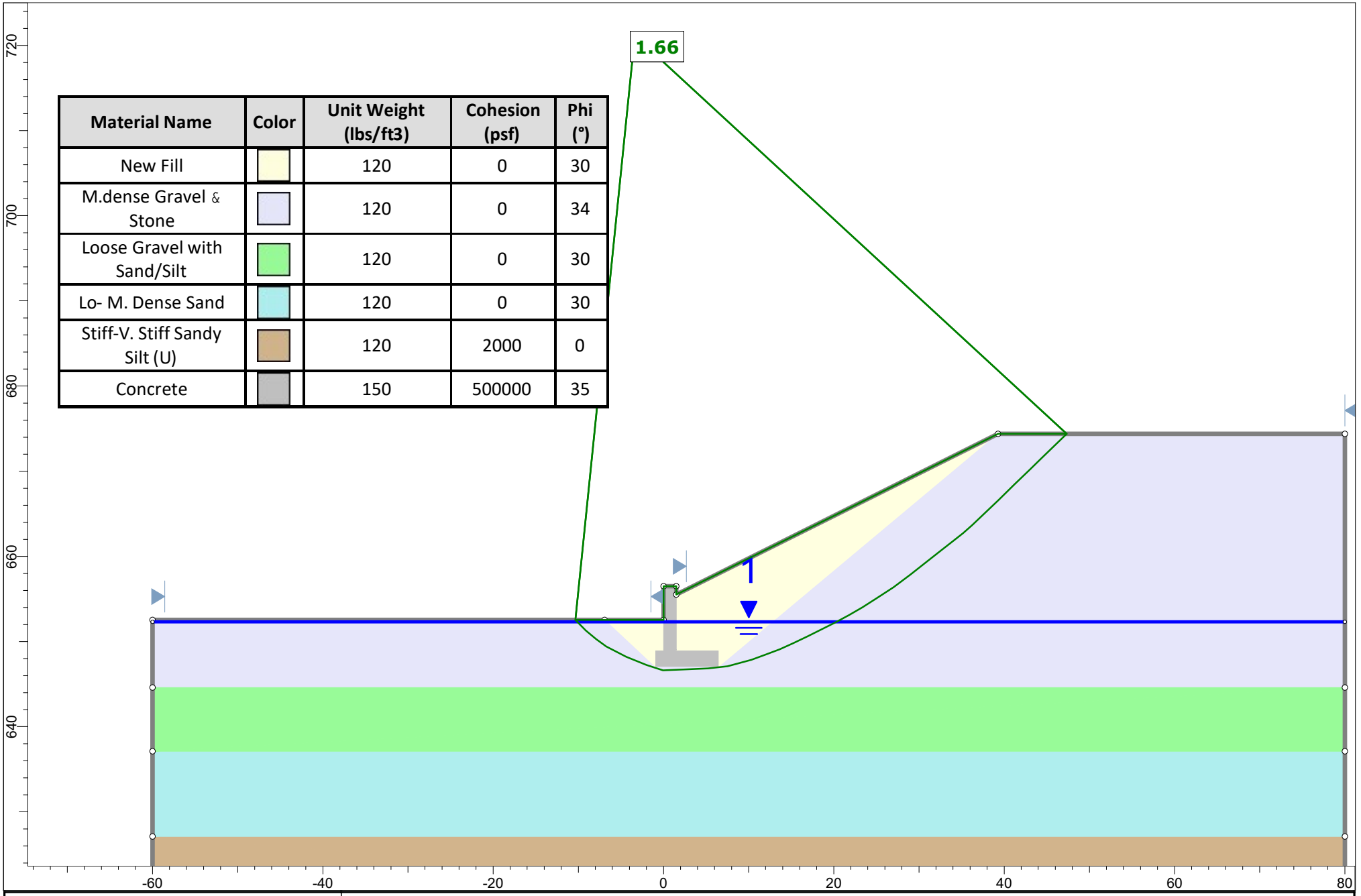


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 4 _ H=9.52 (Total Stress)	Scenario	Circular Slip
Drawn By	Dean Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 4_9.52ft_3-31-2026.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
M.dense Gravel & Stone		120	0	34
Loose Gravel with Sand/Silt		120	0	30
Lo- M. Dense Sand		120	0	30
Stiff-V. Stiff Sandy Silt (U)		120	2000	0
Concrete		150	500000	35

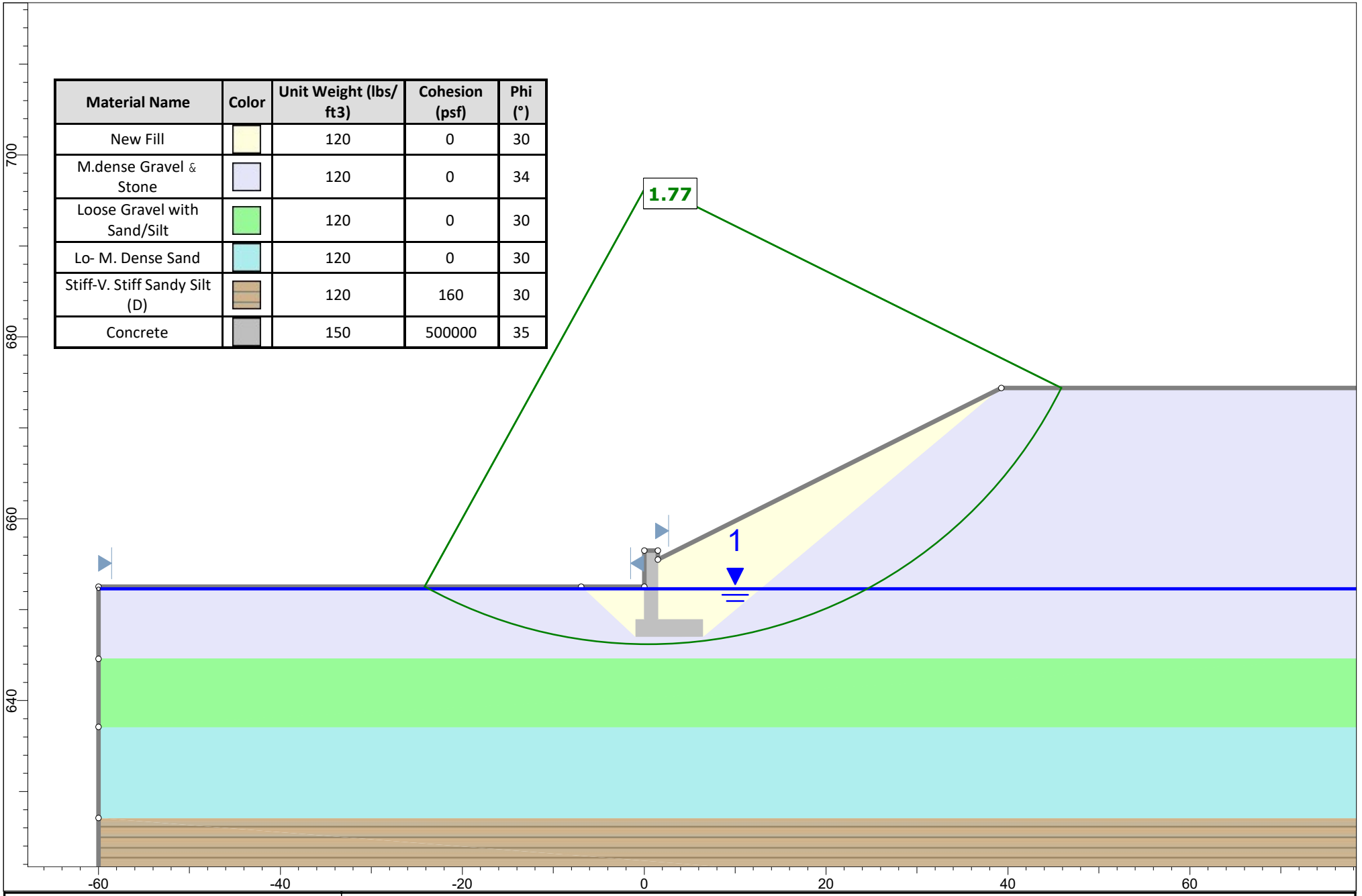


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 4 _ H=9.52 (Total Stress)	Scenario	Nocircular Slip
Drawn By	Dean Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 4_9.52ft_3-31-2026.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
M.dense Gravel & Stone		120	0	34
Loose Gravel with Sand/Silt		120	0	30
Lo- M. Dense Sand		120	0	30
Stiff-V. Stiff Sandy Silt (D)		120	160	30
Concrete		150	500000	35

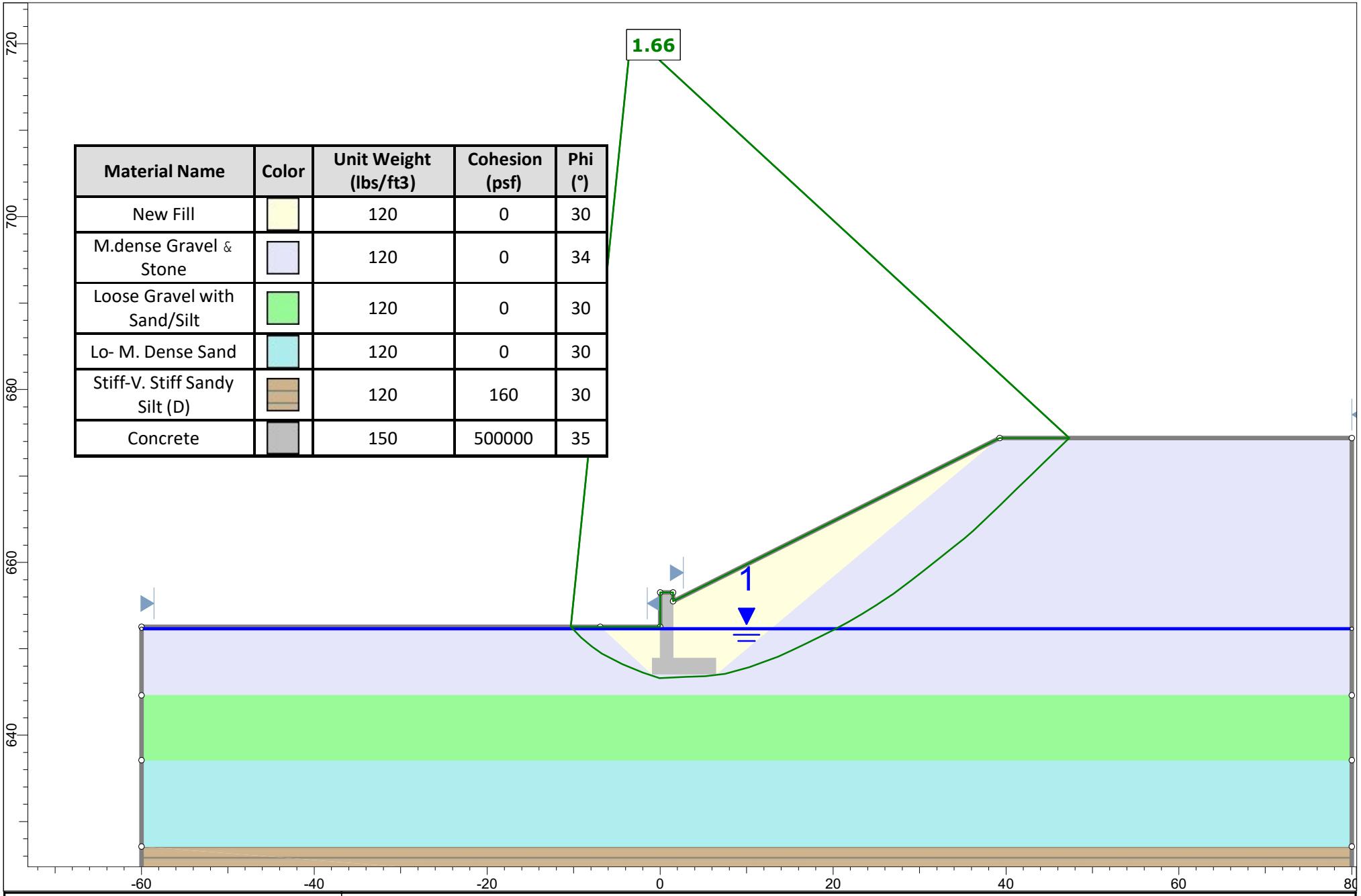


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 4 _ H=9.52 (Effective Stress)	Scenario	Circular Slip
Drawn By	Dean Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 4_9.52ft_3-31-2026.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
New Fill		120	0	30
M.dense Gravel & Stone		120	0	34
Loose Gravel with Sand/Silt		120	0	30
Lo- M. Dense Sand		120	0	30
Stiff-V. Stiff Sandy Silt (D)		120	160	30
Concrete		150	500000	35

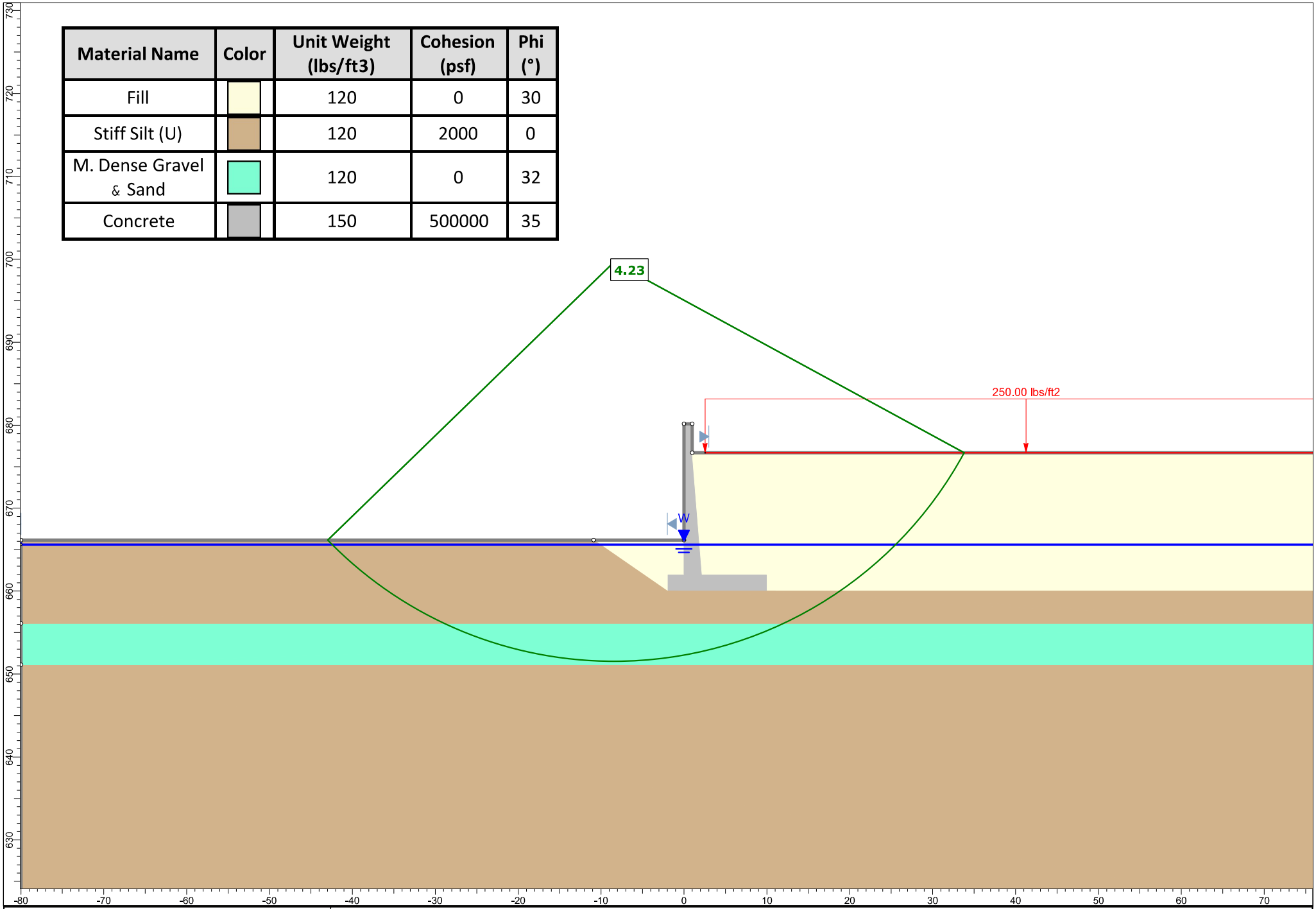


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 4 _ H=9.52 (Effective Stress)	Scenario	Nocircular Slip
Drawn By	Dean Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 4_9.52ft_3-31-2026.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Stiff Silt (U)		120	2000	0
M. Dense Gravel & Sand		120	0	32
Concrete		150	500000	35

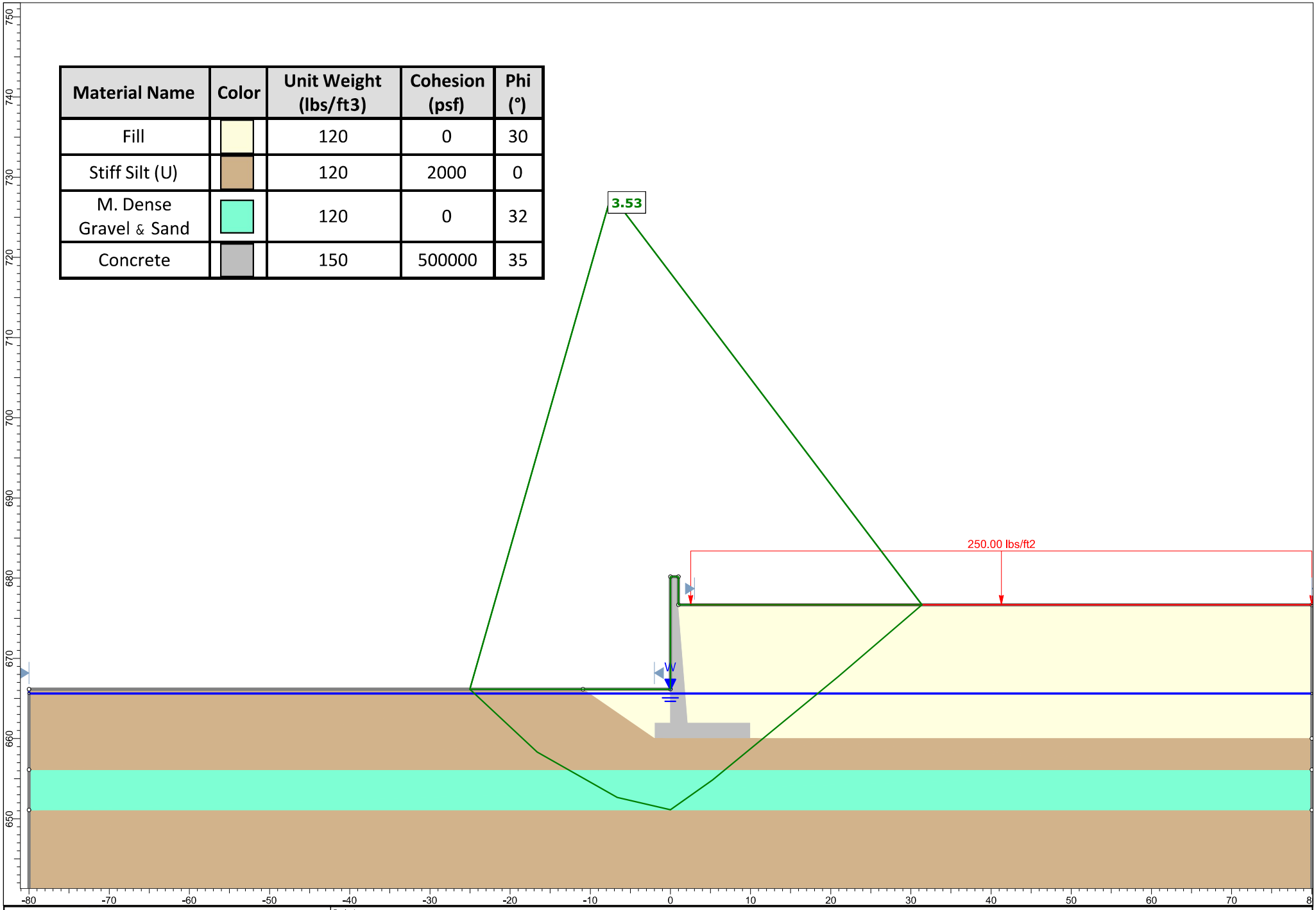


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=16.68 ft (B-065-0-20, Total Stress)	Scenario	Circular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_16.68 ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Stiff Silt (U)		120	2000	0
M. Dense Gravel & Sand		120	0	32
Concrete		150	500000	35

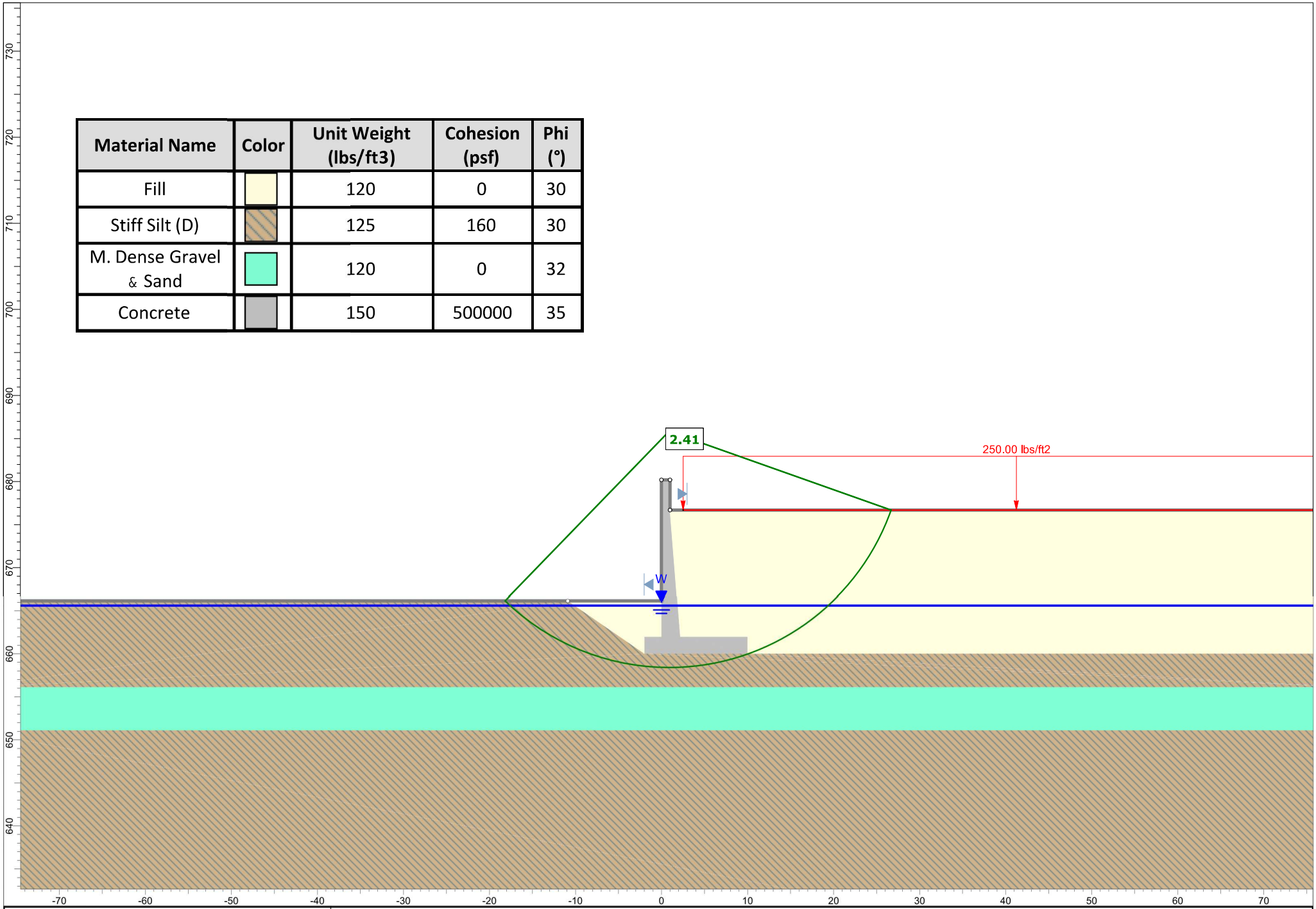


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=16.68 ft (B-065-0-20, Total Stress)	Scenario	Noncircular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_16.68 ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Stiff Silt (D)		125	160	30
M. Dense Gravel & Sand		120	0	32
Concrete		150	500000	35

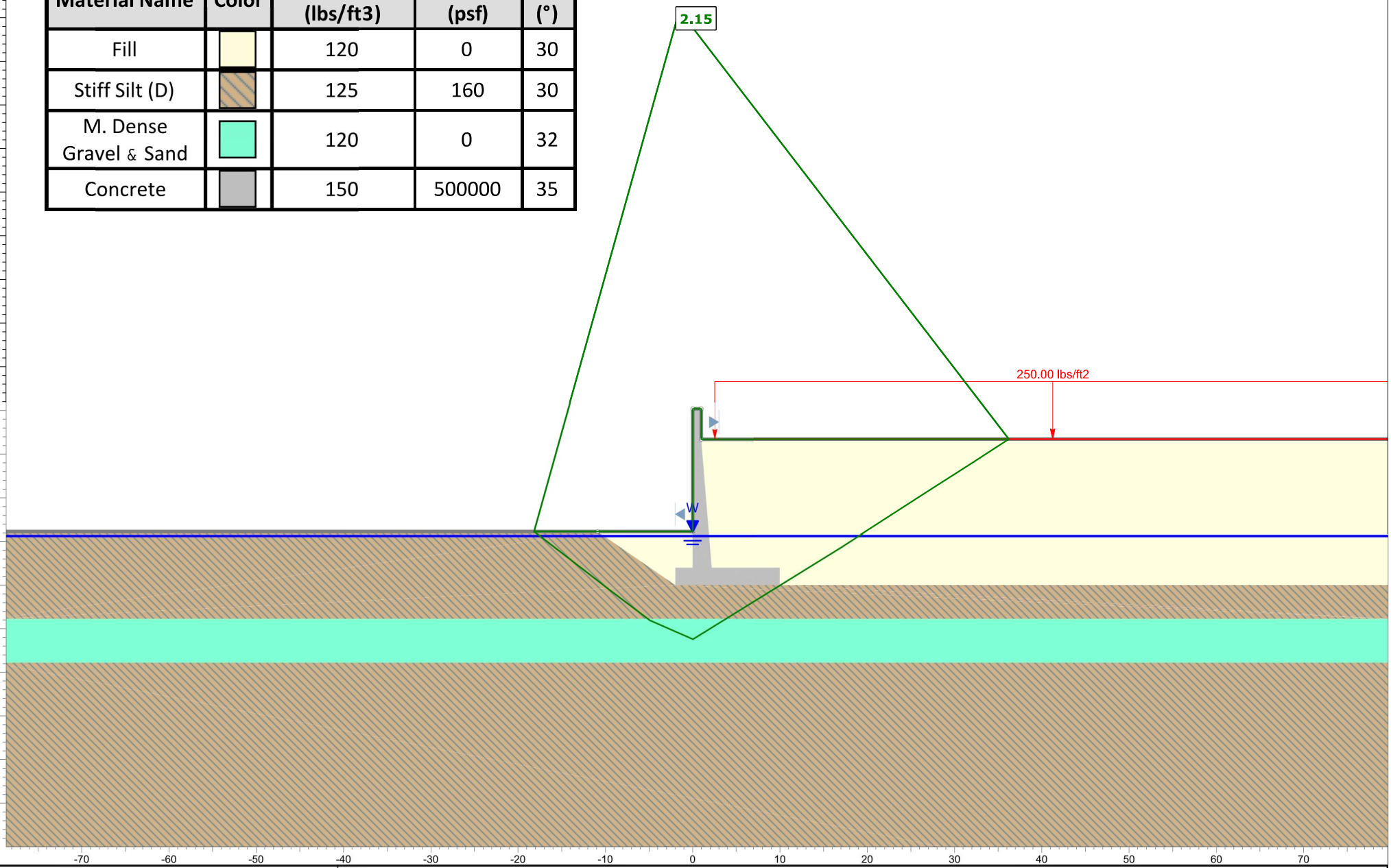


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=16.68 ft (B-065-0-20, Effective Stress)	Scenario	Circular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_16.68 ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Stiff Silt (D)		125	160	30
M. Dense Gravel & Sand		120	0	32
Concrete		150	500000	35

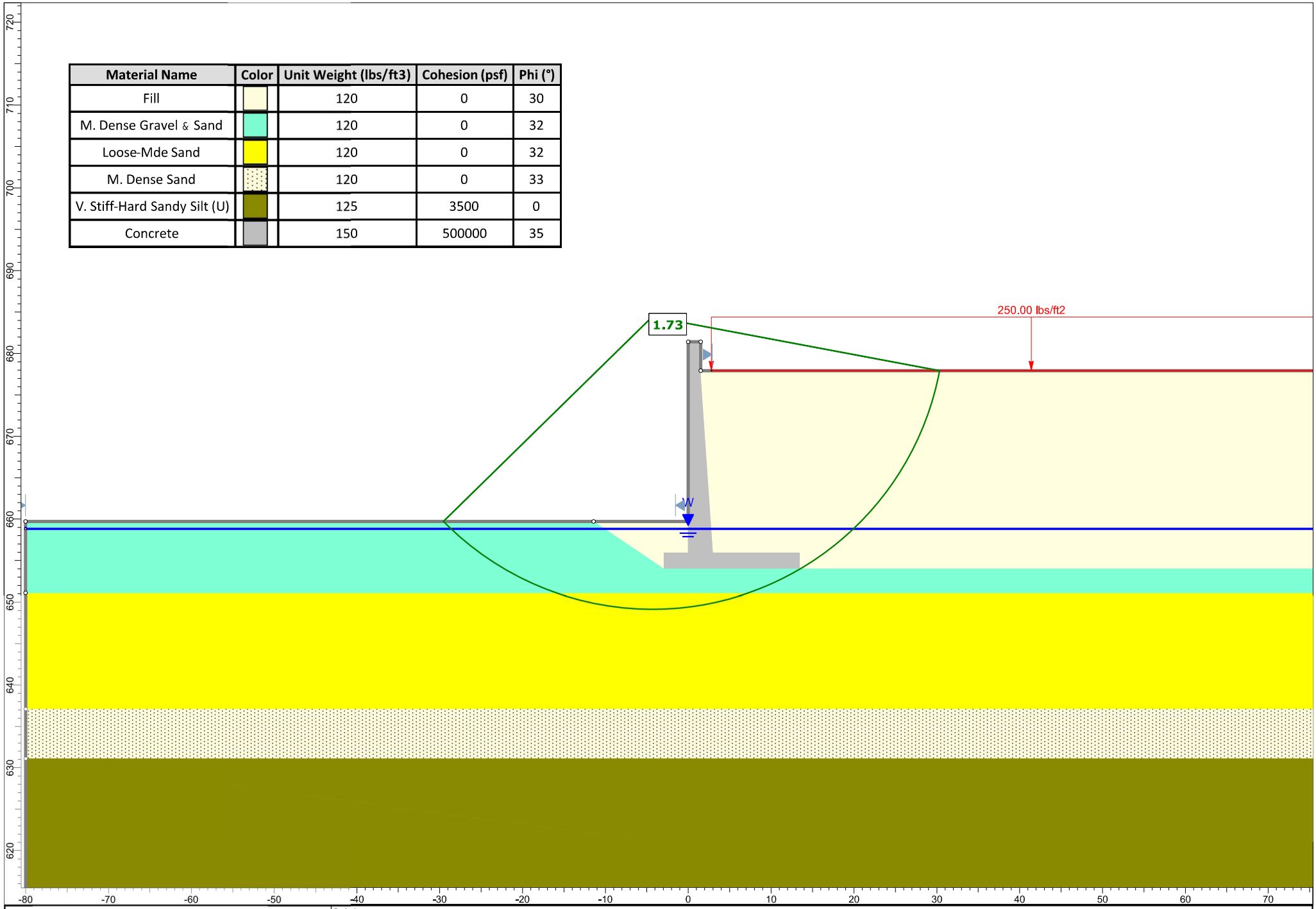


TRC

SSLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=16.68 ft (B-065-0-20, Effective Stress)	Scenario	Noncircular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_16.68 ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
M. Dense Gravel & Sand		120	0	32
Loose-Mde Sand		120	0	32
M. Dense Sand		120	0	33
V. Stiff-Hard Sandy Silt (U)		125	3500	0
Concrete		150	500000	35

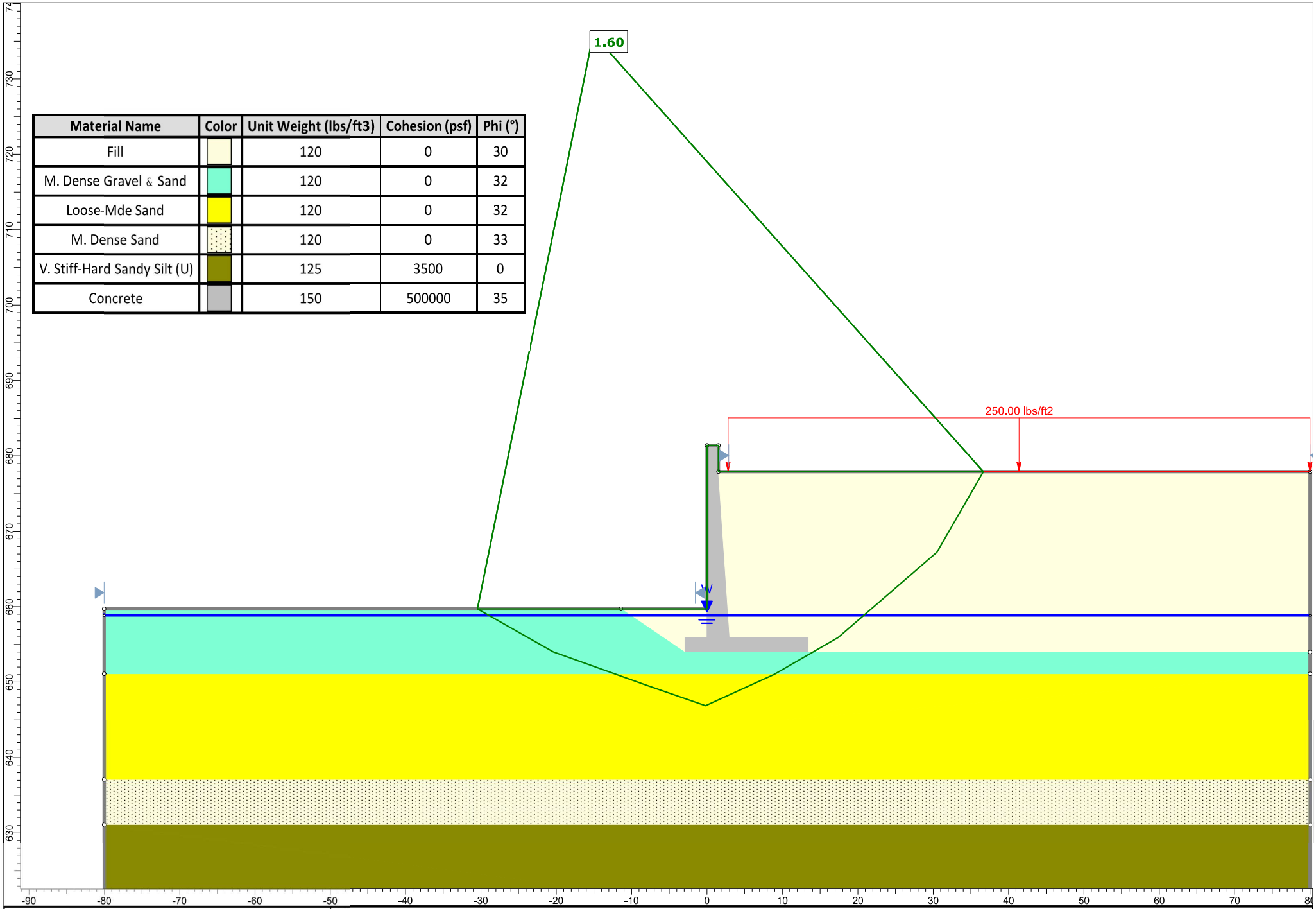


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=23.91 ft (B-066-0-20, Total Stress)	Scenario	Circular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_23.91 ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
M. Dense Gravel & Sand		120	0	32
Loose-Mde Sand		120	0	32
M. Dense Sand		120	0	33
V. Stiff-Hard Sandy Silt (U)		125	3500	0
Concrete		150	500000	35

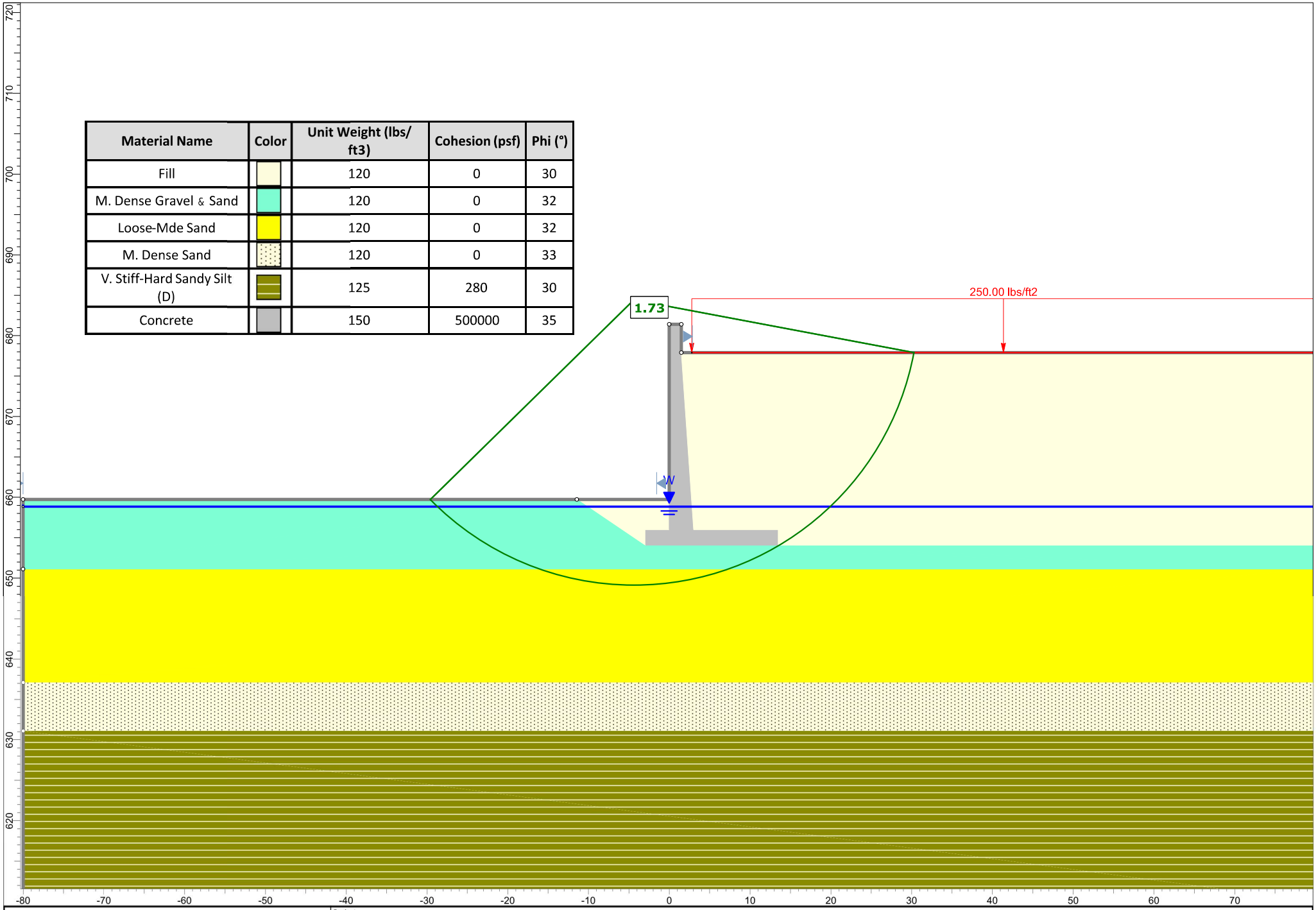


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=23.91 ft (B-066-0-20, Total Stress)	Scenario	Noncircular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_23.91 ft.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
M. Dense Gravel & Sand		120	0	32
Loose-Mde Sand		120	0	32
M. Dense Sand		120	0	33
V. Stiff-Hard Sandy Silt (D)		125	280	30
Concrete		150	500000	35

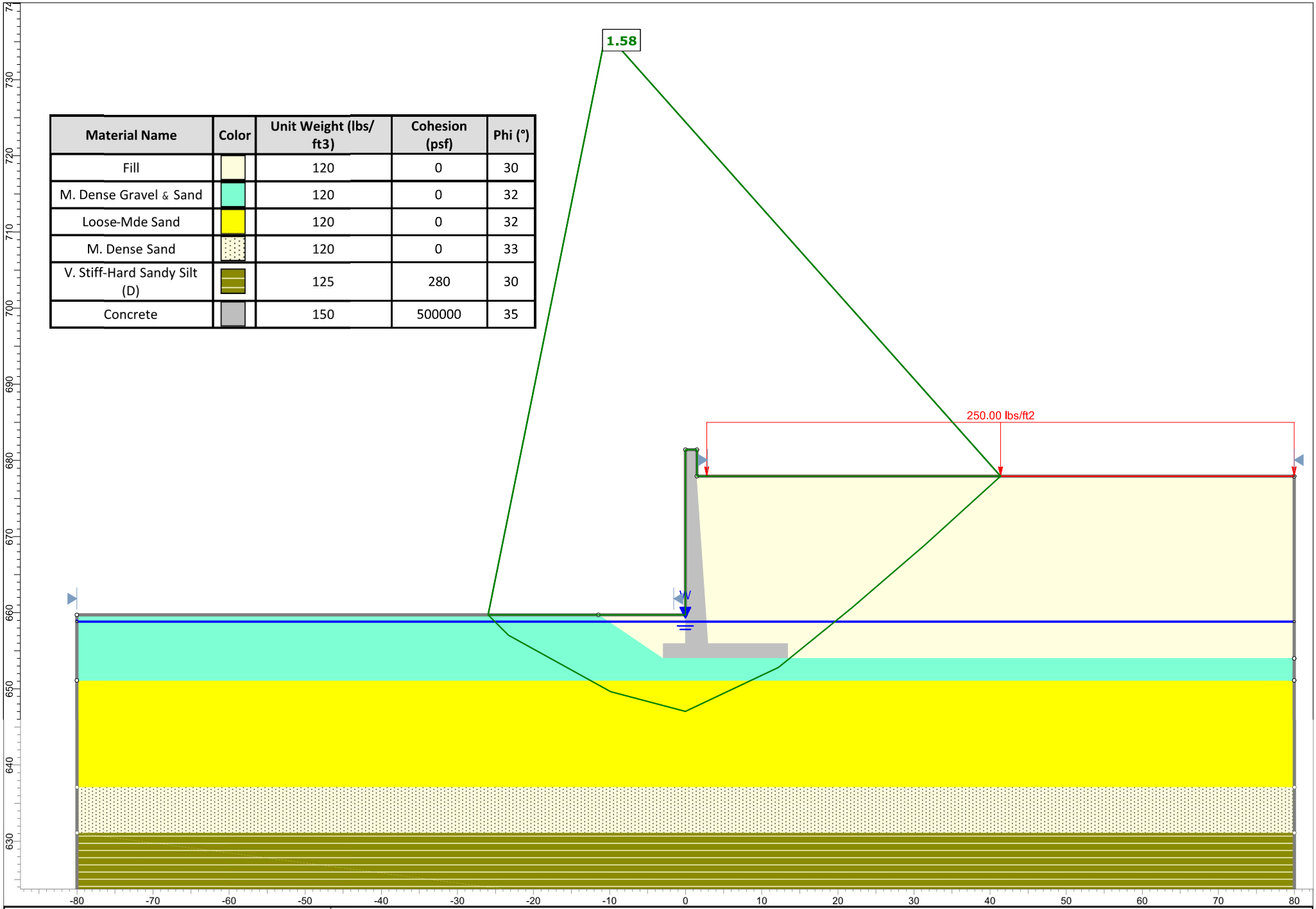


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=23.91 ft (B-066-0-20, Effective Stress)	Scenario	Circular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_23.91 ft.slmd

Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
M. Dense Gravel & Sand		120	0	32
Loose-Mde Sand		120	0	32
M. Dense Sand		120	0	33
V. Stiff-Hard Sandy Silt (D)		125	280	30
Concrete		150	500000	35

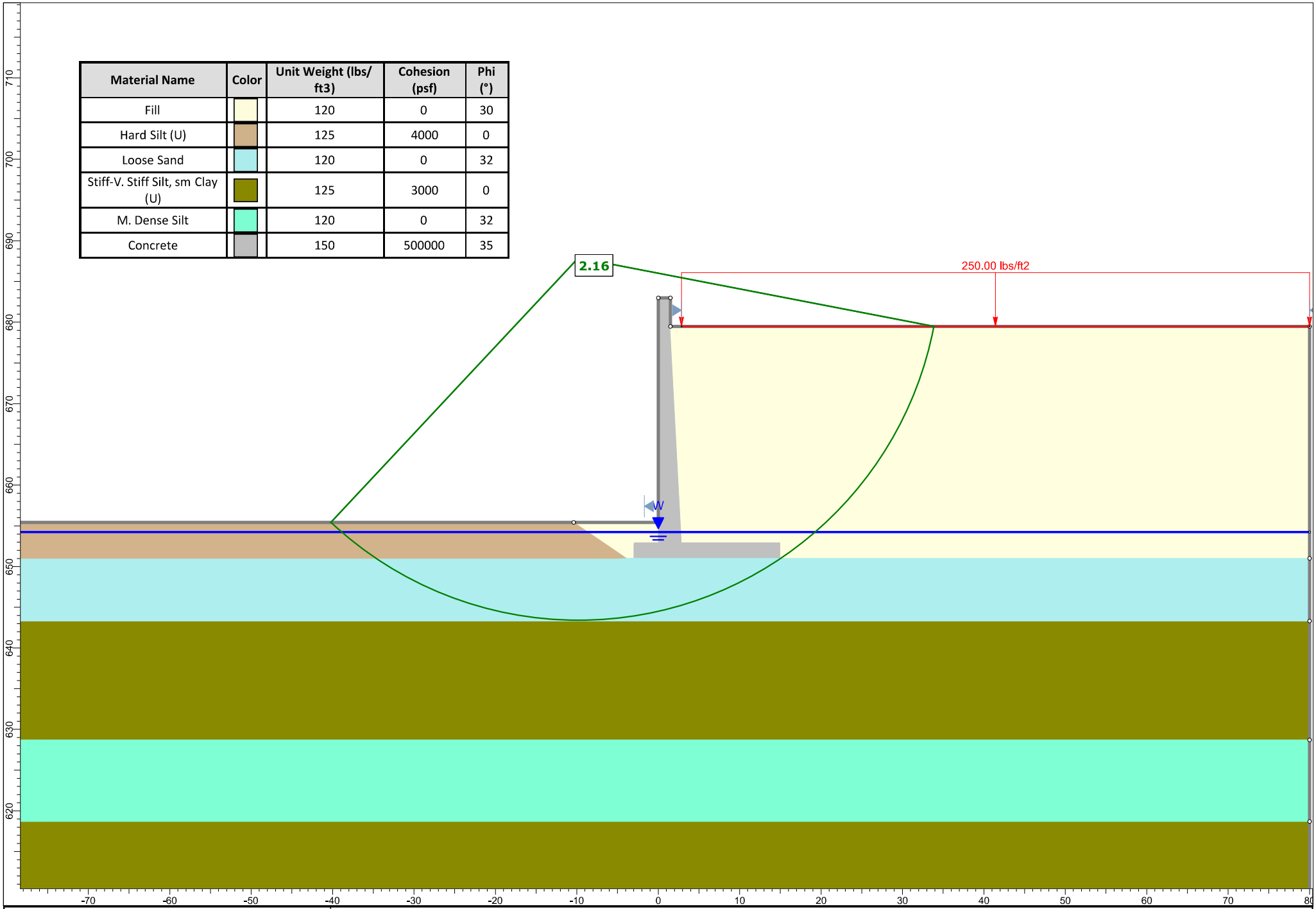


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=23.91 ft (B-066-0-20, Effective Stress)	Scenario	Noncircular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_23.91 ft.slmd

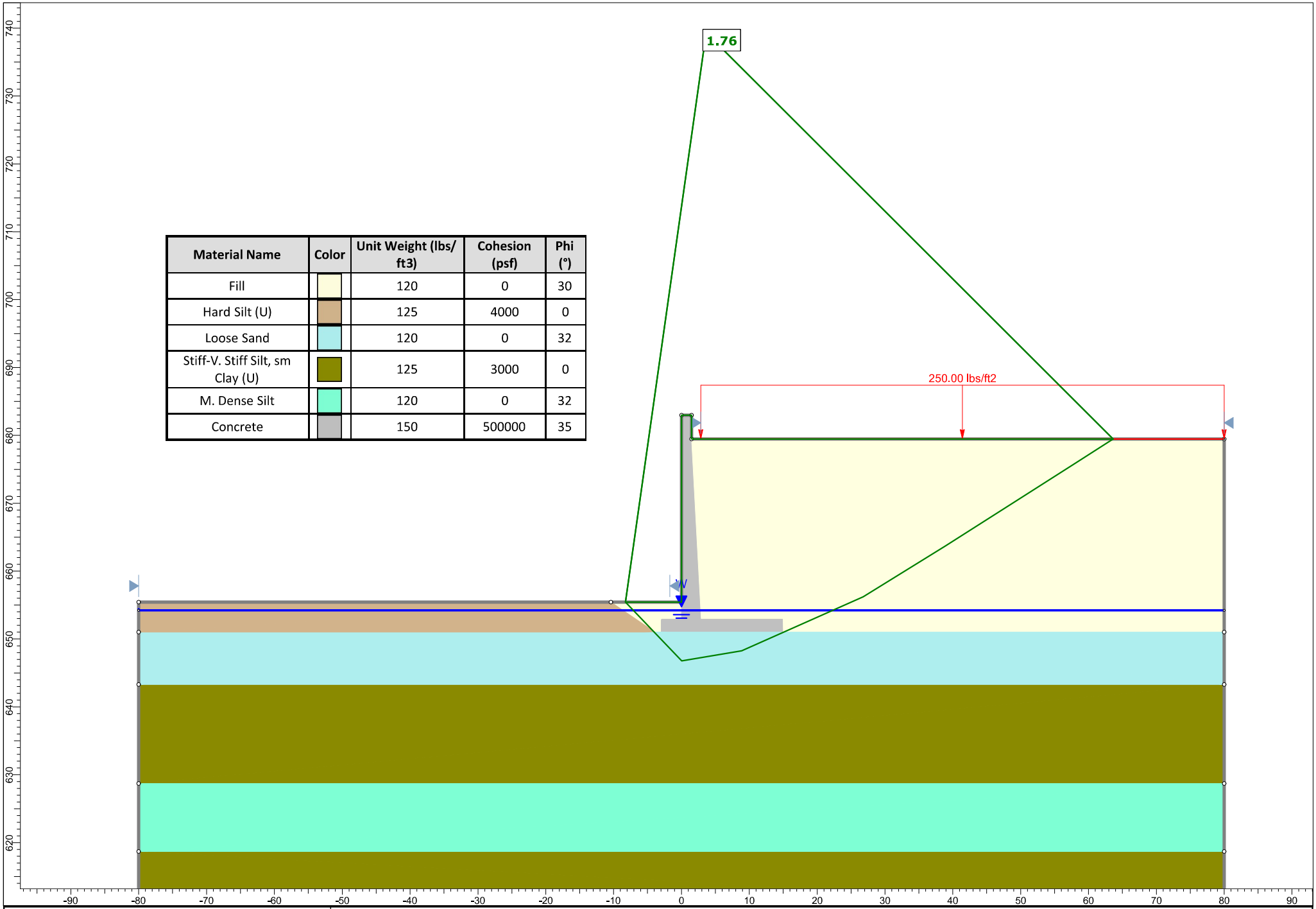
Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Hard Silt (U)		125	4000	0
Loose Sand		120	0	32
Stiff-V. Stiff Silt, sm Clay (U)		125	3000	0
M. Dense Silt		120	0	32
Concrete		150	500000	35



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=28.47 ft (B-067-0-20, Total Stress)	Scenario	Circular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_28.47 ft.slmd



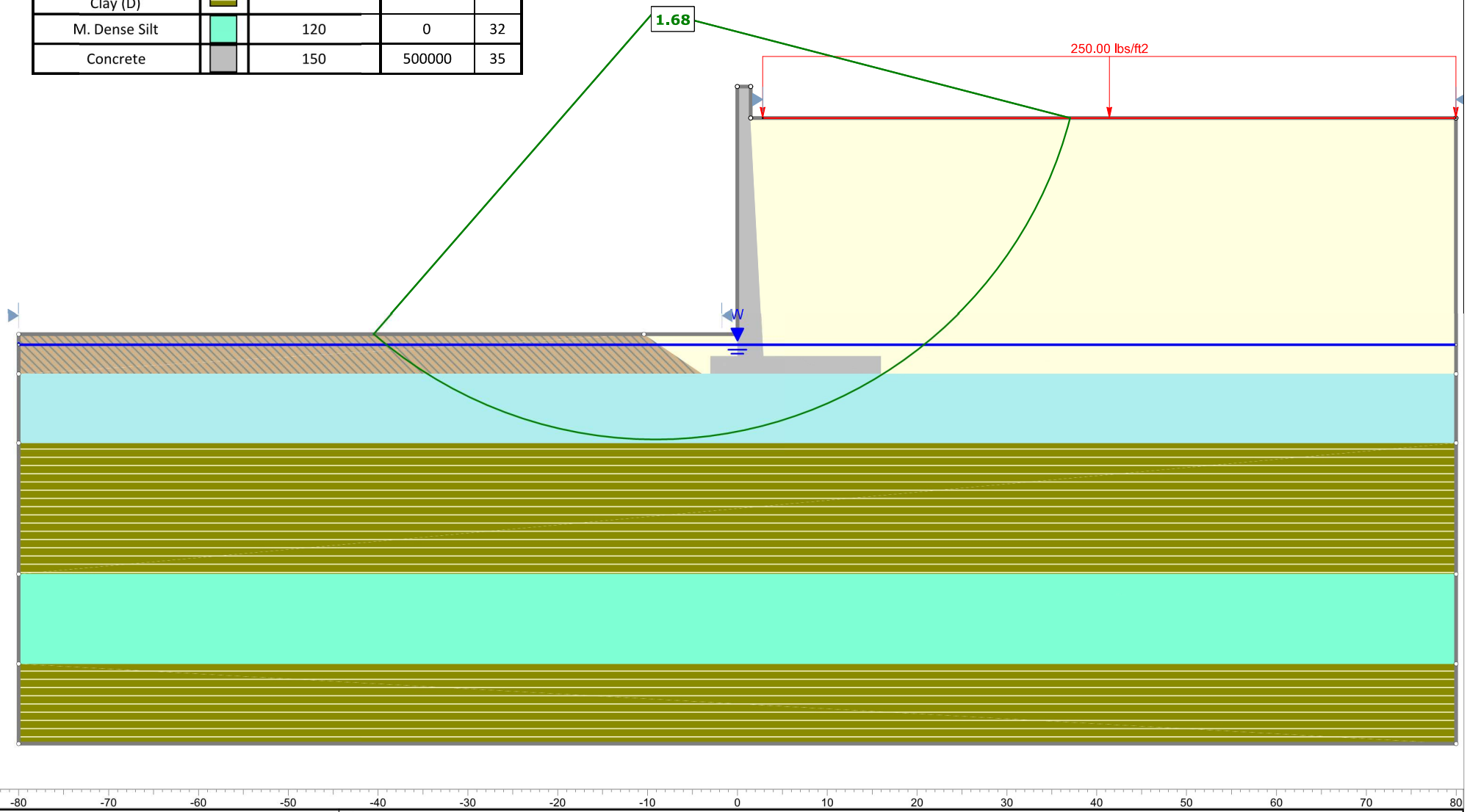
Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Hard Silt (U)		125	4000	0
Loose Sand		120	0	32
Stiff-V. Stiff Silt, sm Clay (U)		125	3000	0
M. Dense Silt		120	0	32
Concrete		150	500000	35

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=28.47 ft (B-067-0-20, Total Stress)	Scenario	Noncircular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_28.47 ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Hard Silt (D)		125	320	30
Loose Sand		120	0	32
Stiff-V. Stiff Silt, sm Clay (D)		125	240	30
M. Dense Silt		120	0	32
Concrete		150	500000	35

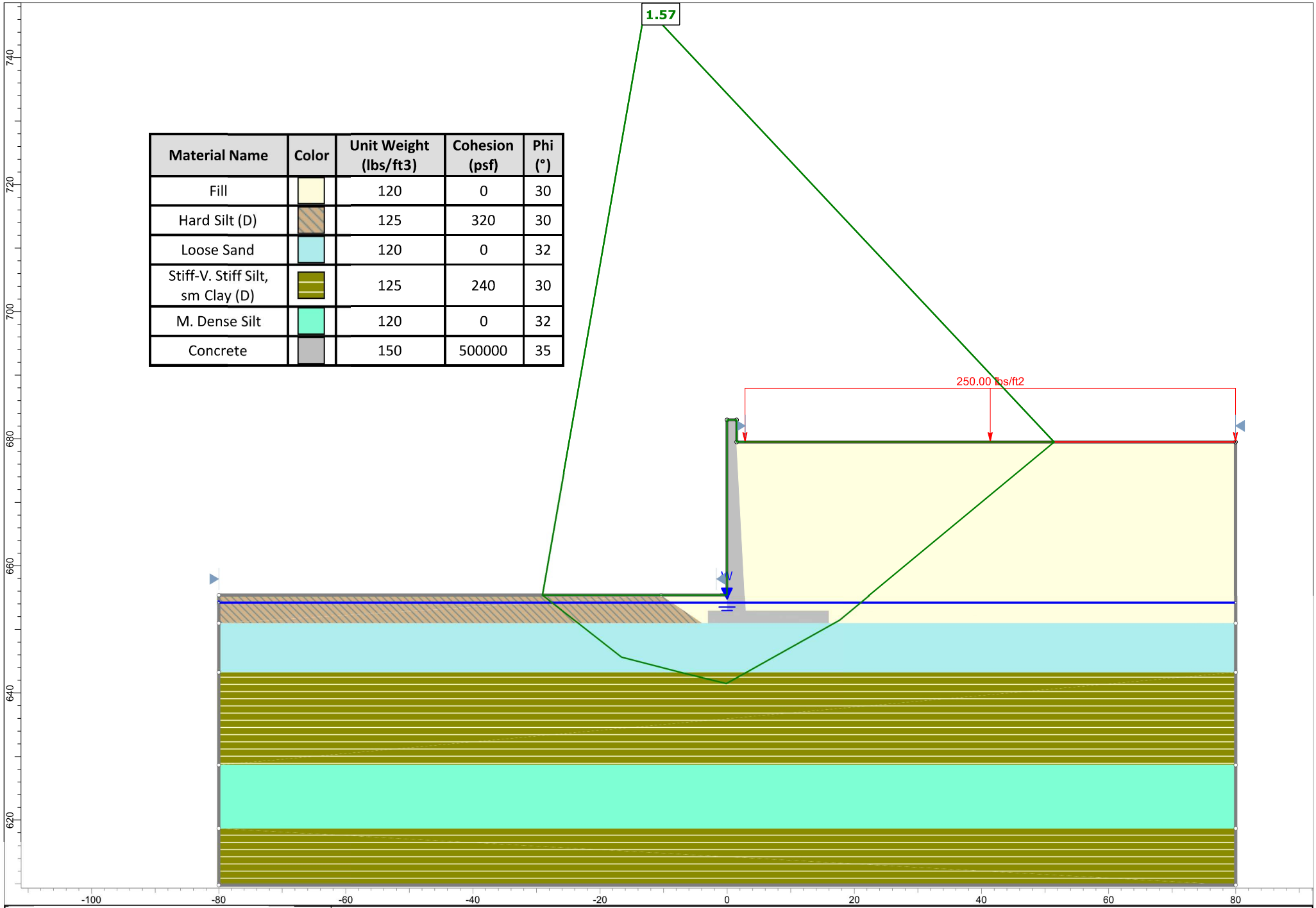


TRC

sSLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=28.47 ft (B-067-0-20, Effective Stress)	Scenario	Circular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_28.47 ft.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (°)
Fill		120	0	30
Hard Silt (D)		125	320	30
Loose Sand		120	0	32
Stiff-V. Stiff Silt, sm Clay (D)		125	240	30
M. Dense Silt		120	0	32
Concrete		150	500000	35



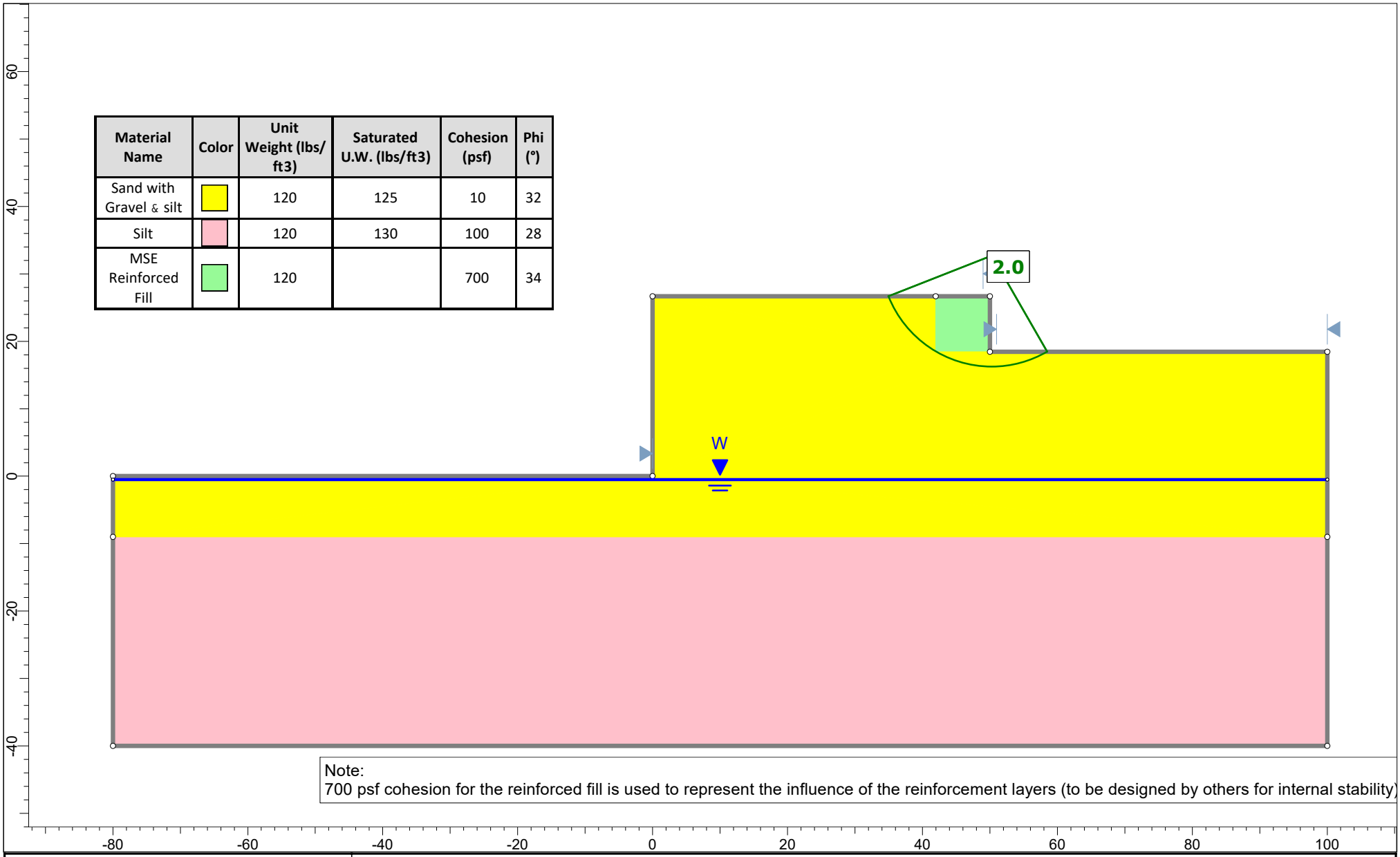
TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	Wall 5A_ H=28.47 ft (B-067-0-20, Effective Stress)	Scenario	Noncircular Slip
Drawn By	Shawn McGee, P.E.	Company	TRC Engineers, Inc.
Date	11/18/2025	File Name	CIP Wall 5A_28.47 ft.slmd

APPENDIX J
EXTERNAL STABILITY ANALYSIS OF TEMPORARY WIRE FACED WALL

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Sand with Gravel & silt		120	125	10	32
Silt		120	130	100	28
MSE Reinforced Fill		120		700	34

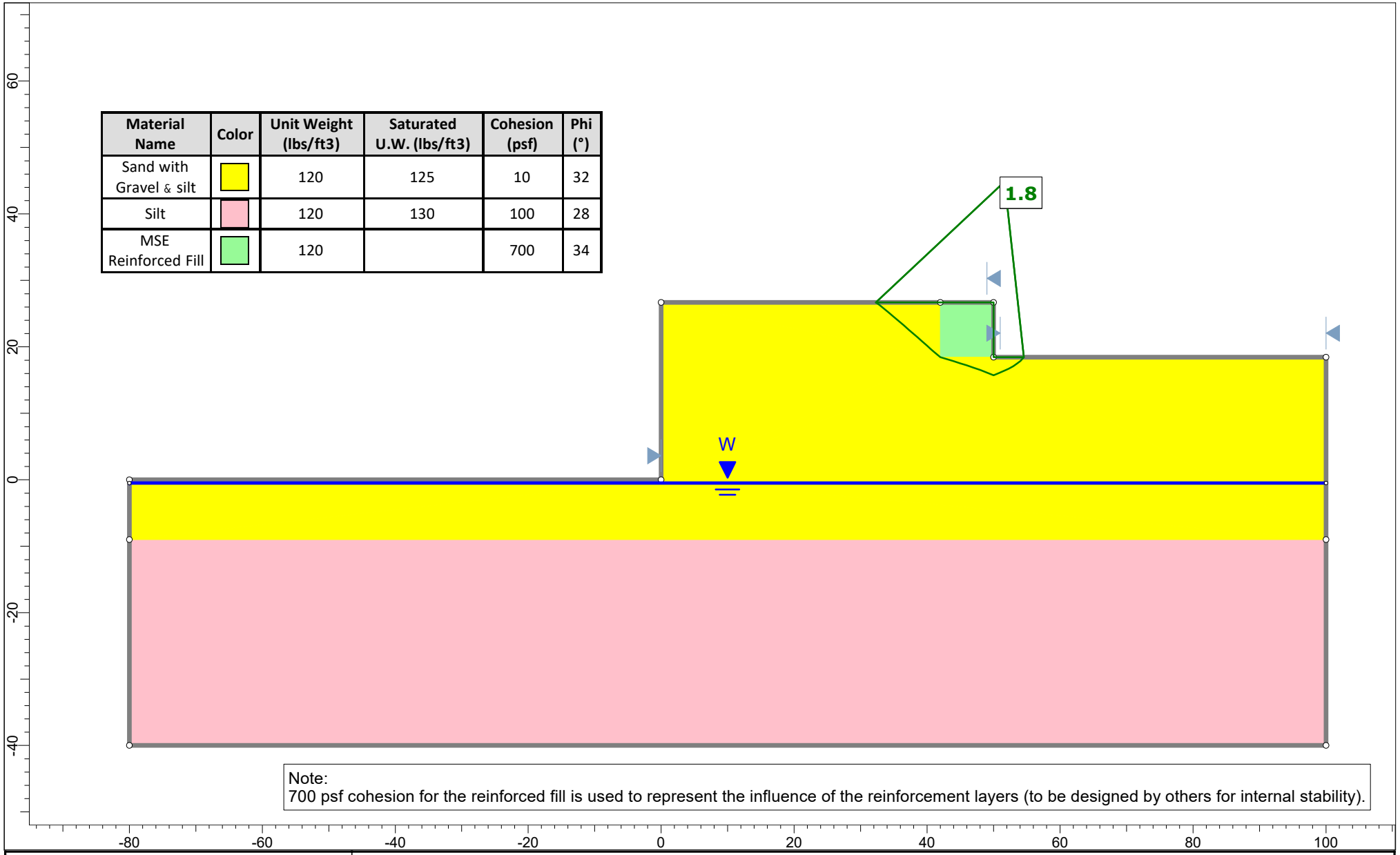


Note:
700 psf cohesion for the reinforced fill is used to represent the influence of the reinforcement layers (to be designed by others for internal stability)

SLIDEINTERPRET 9.040

Project	CUY-77-11.41 (PID 105743)		
Group	Temporary Wall	*Scenario*	Circular Failure Surface
Drawn By	Rakam Tamang, PE	*Company*	TRC Engineers Inc
Date	11/18/2025	*File Name*	Morgana Trail Temporary Wall.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Saturated U.W. (lbs/ft3)	Cohesion (psf)	Phi (°)
Sand with Gravel & silt		120	125	10	32
Silt		120	130	100	28
MSE Reinforced Fill		120		700	34



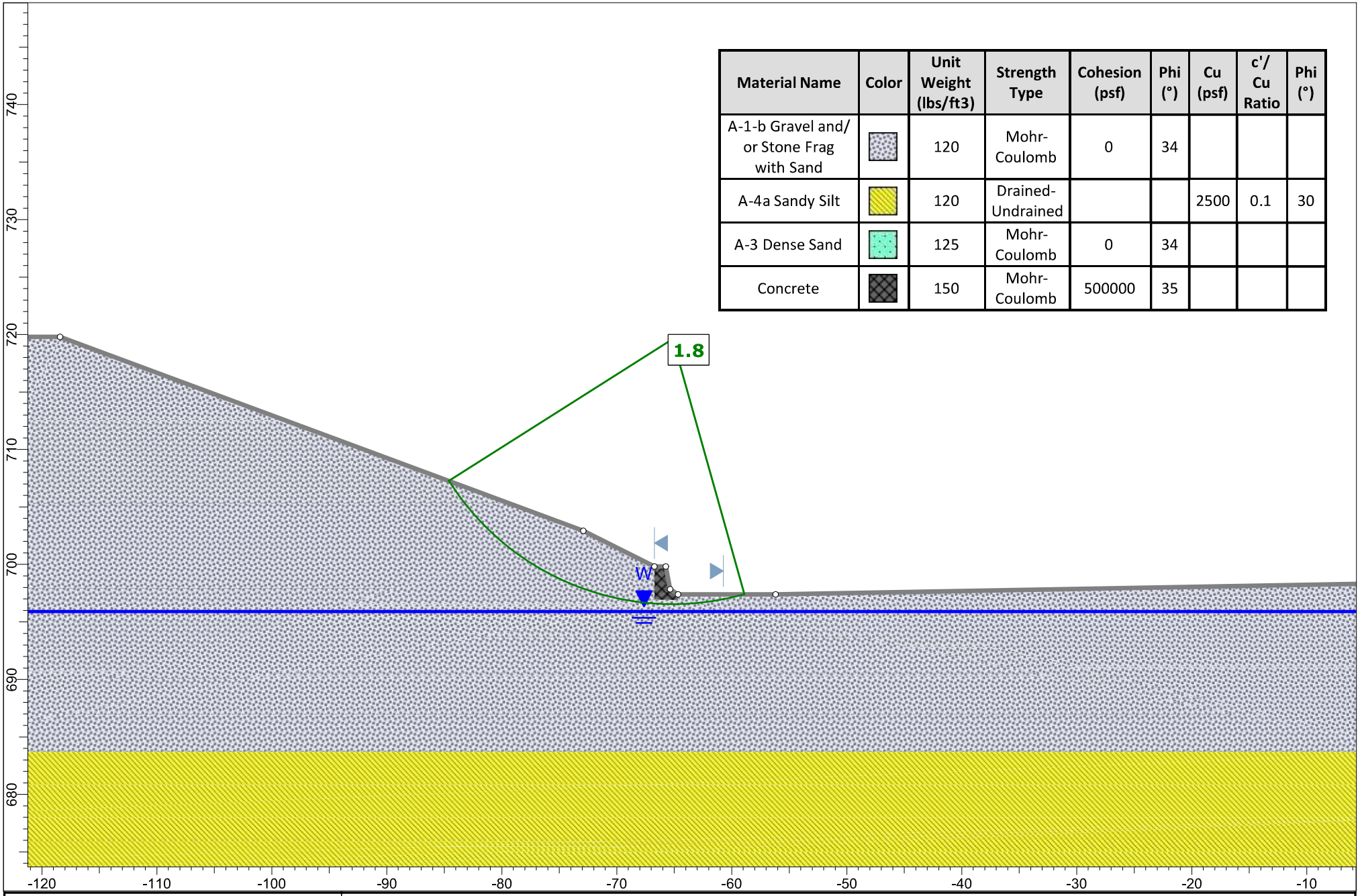
Note:
700 psf cohesion for the reinforced fill is used to represent the influence of the reinforcement layers (to be designed by others for internal stability).

SLIDEINTERPRET 9.040

Project	CUY-77-11.41 (PID 105743)		
Group	Temporary Wall	Scenario	Non-circular Failure Surface
Drawn By	Rakam Tamang, PE	Company	TRC Engineers Inc
Date	11/18/2025	File Name	Morgana Trail Temporary Wall.slmd

APPENDIX K
GLOBAL SLOPE STABILITY RESULTS FOR PROPOSED EMBANKMENTS

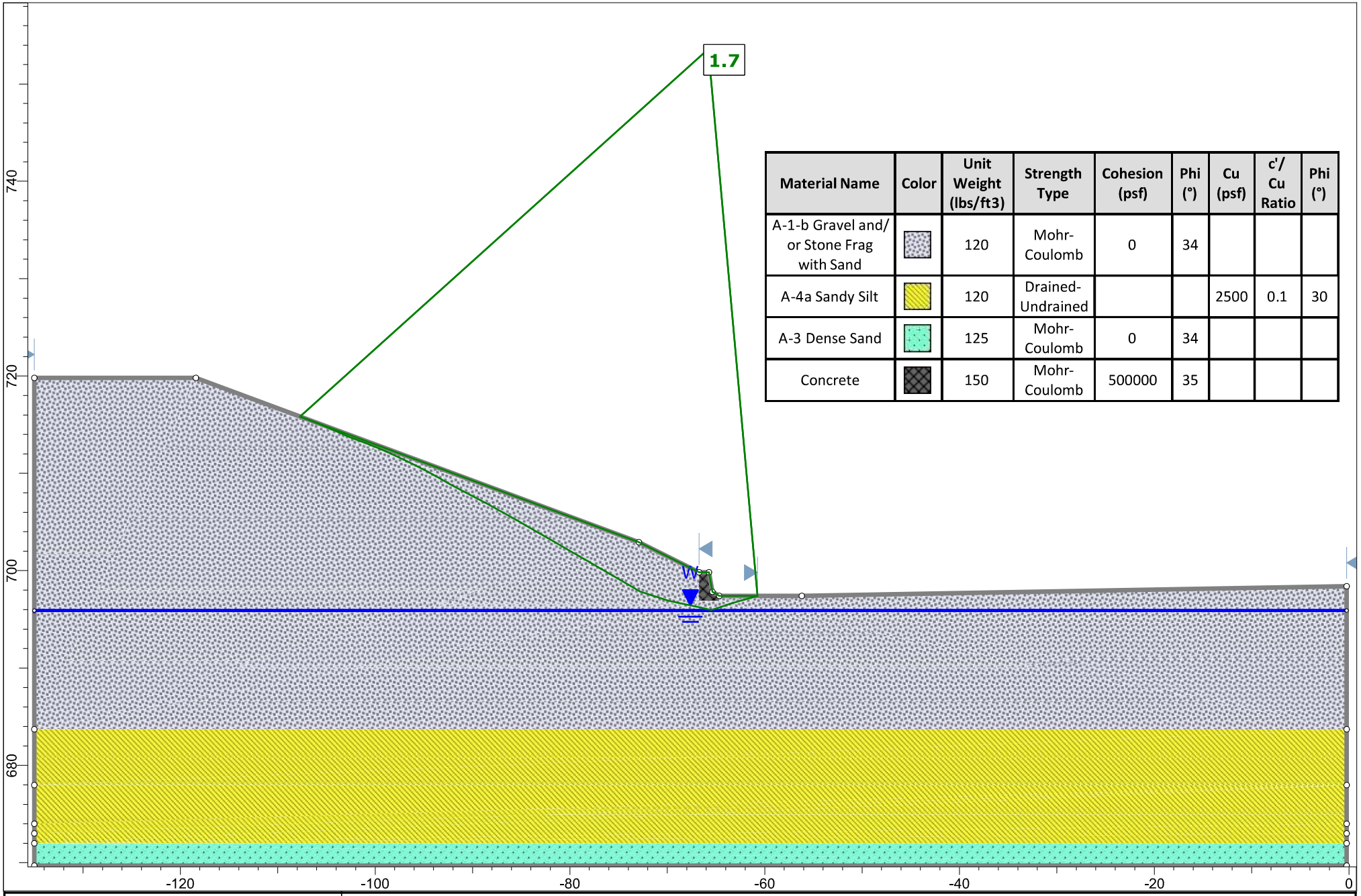
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-1-b Gravel and/ or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
A-3 Dense Sand		125	Mohr-Coulomb	0	34			
Concrete		150	Mohr-Coulomb	500000	35			



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 77+25 with Barrier	Scenario	Circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd



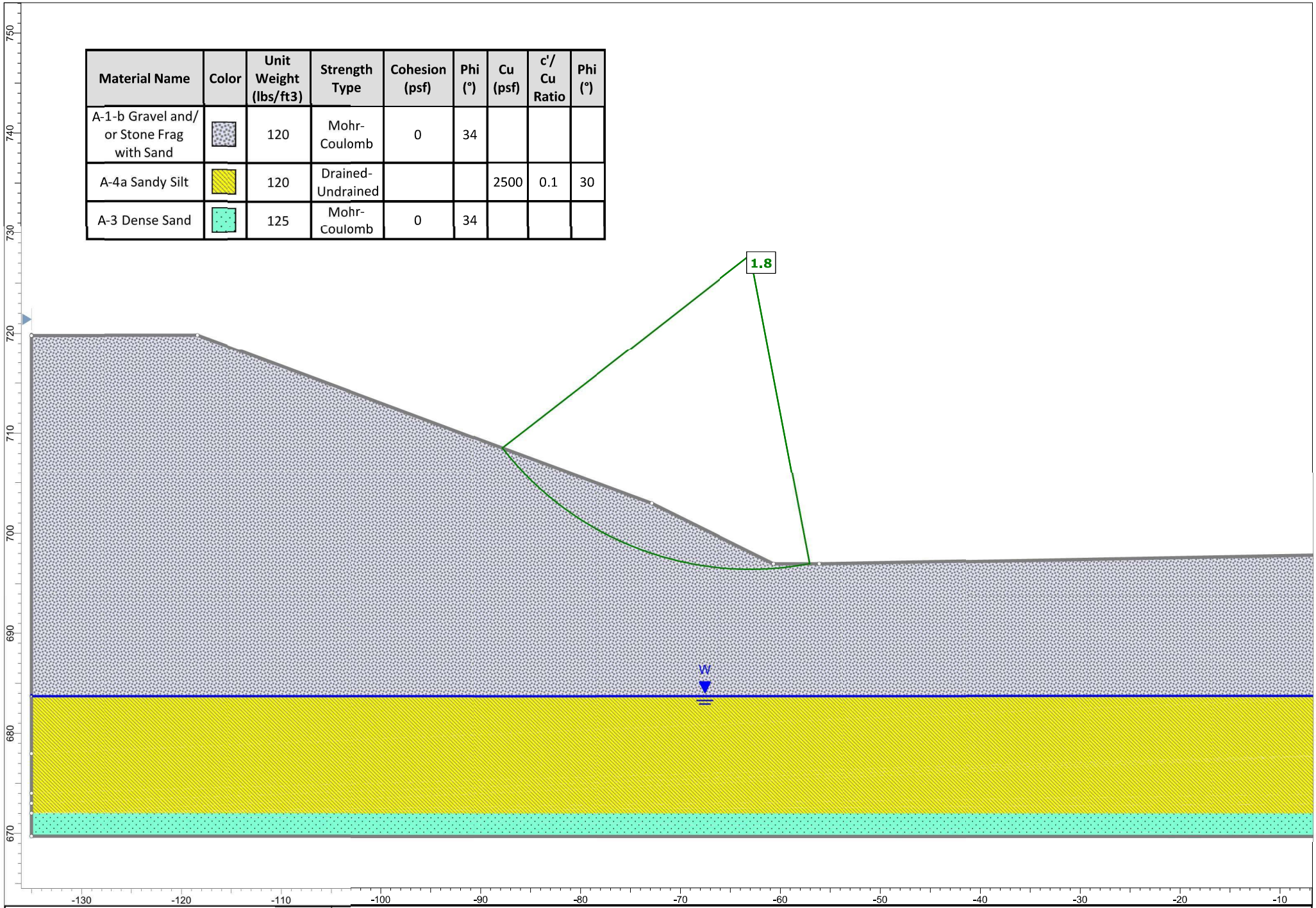
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-1-b Gravel and/ or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
A-3 Dense Sand		125	Mohr-Coulomb	0	34			
Concrete		150	Mohr-Coulomb	500000	35			

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 77+25 with Barrier	Scenario	Non-circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

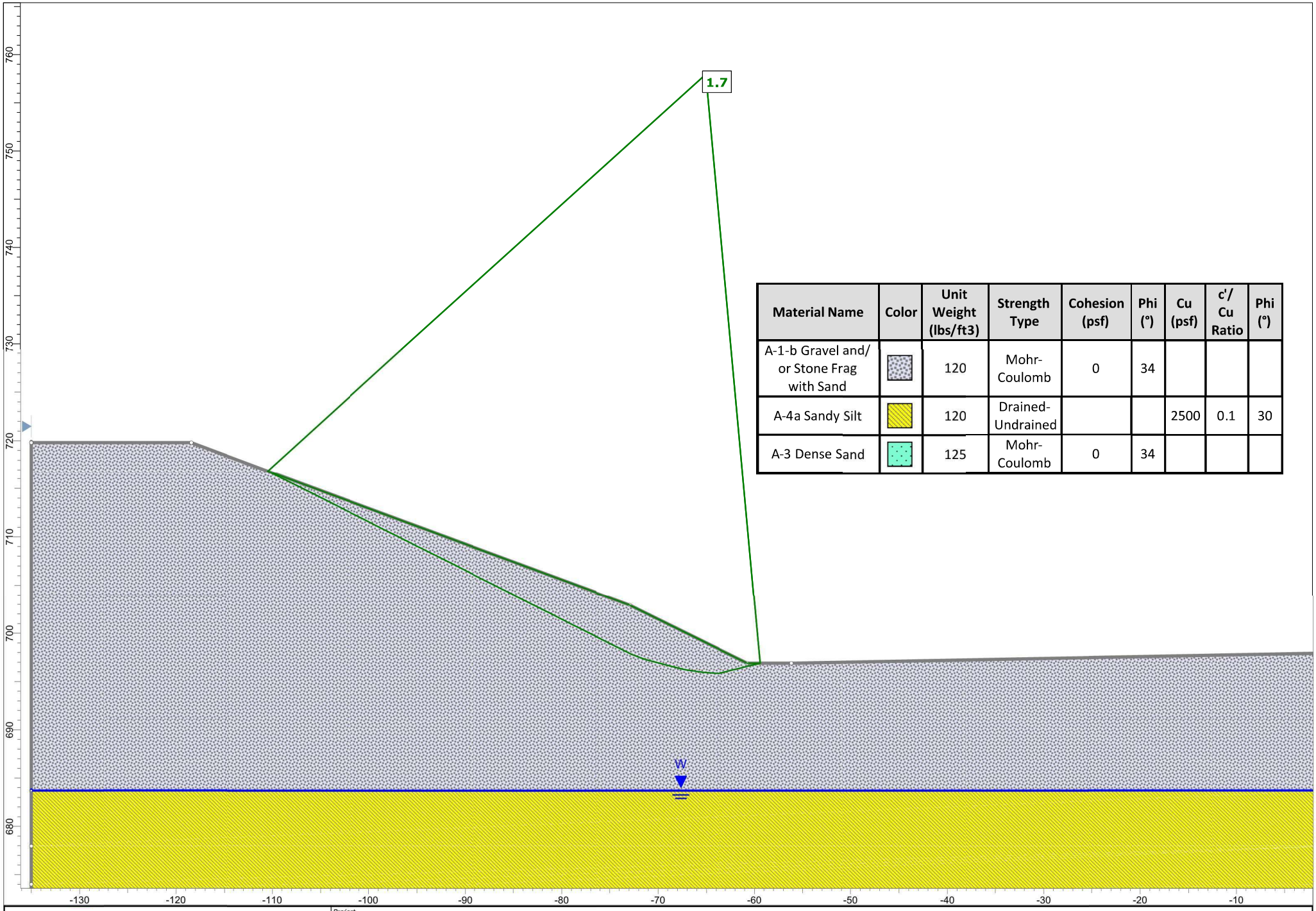
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-1-b Gravel and/ or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
A-3 Dense Sand		125	Mohr-Coulomb	0	34			



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 78+00	Scenario	Circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

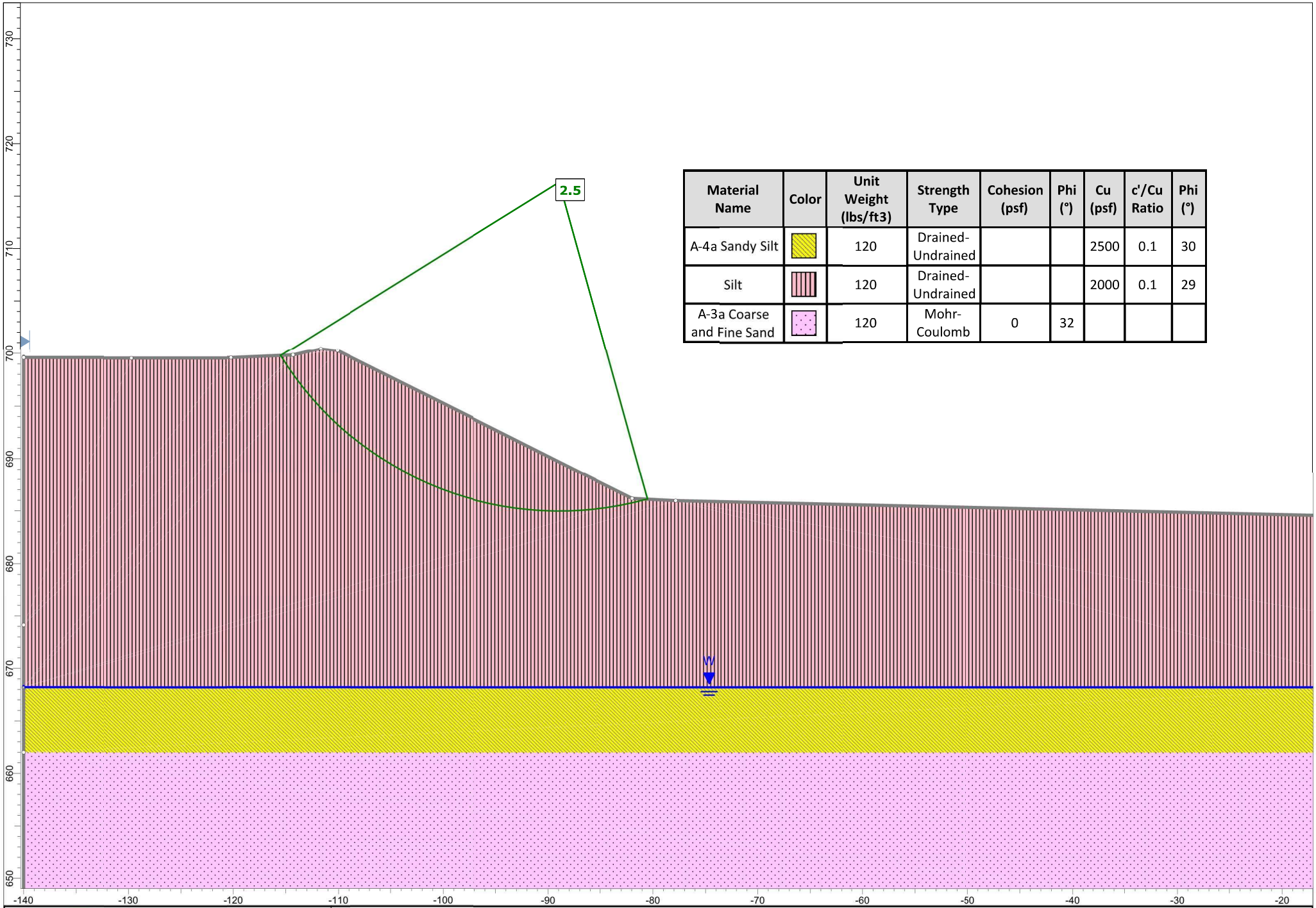


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-1-b Gravel and/ or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
A-3 Dense Sand		125	Mohr-Coulomb	0	34			

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 78+00	Scenario	Non-circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

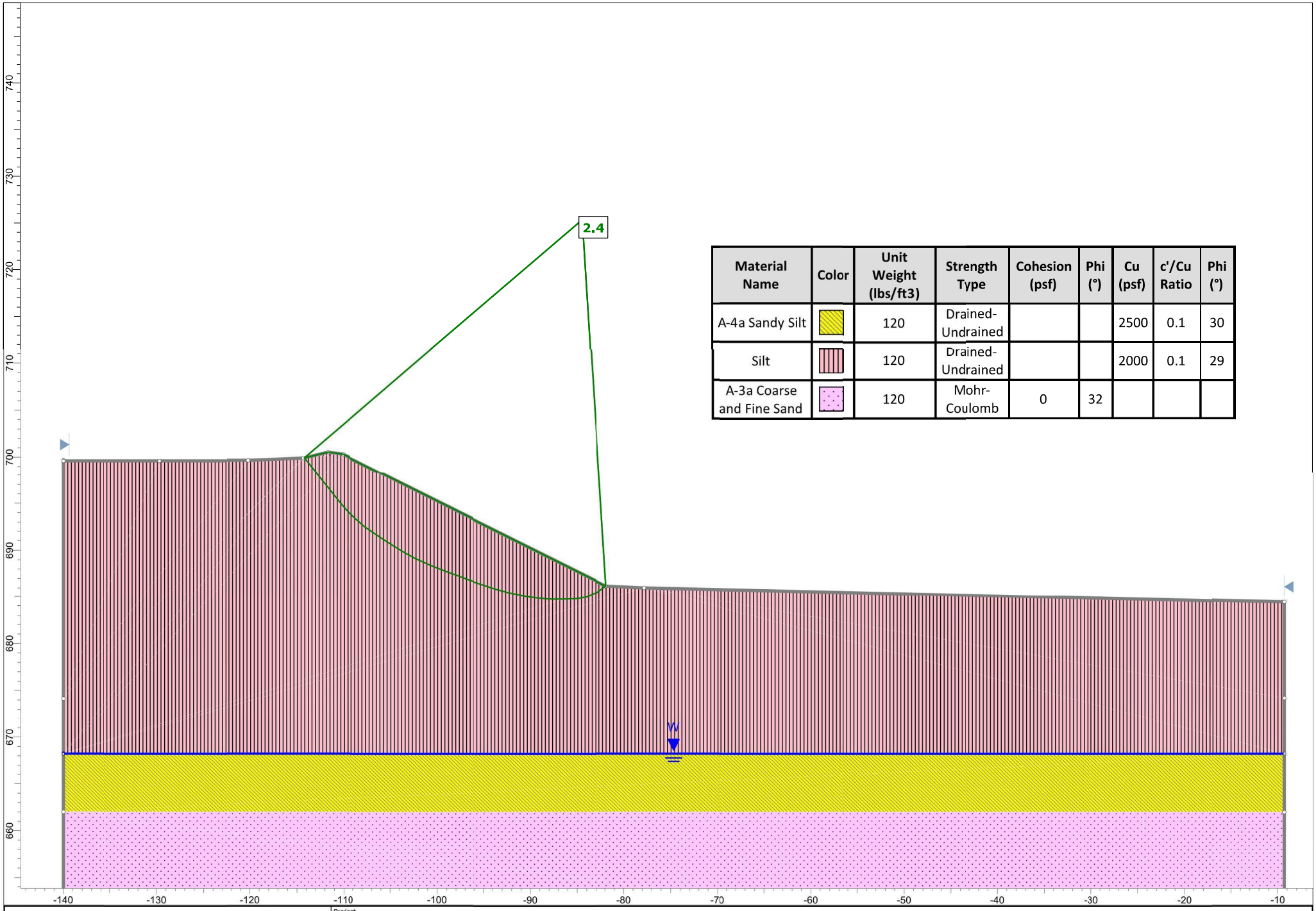


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/Cu Ratio	Phi (°)
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
Silt		120	Drained-Undrained			2000	0.1	29
A-3a Coarse and Fine Sand		120	Mohr-Coulomb	0	32			

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 105+00	Scenario	Circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd



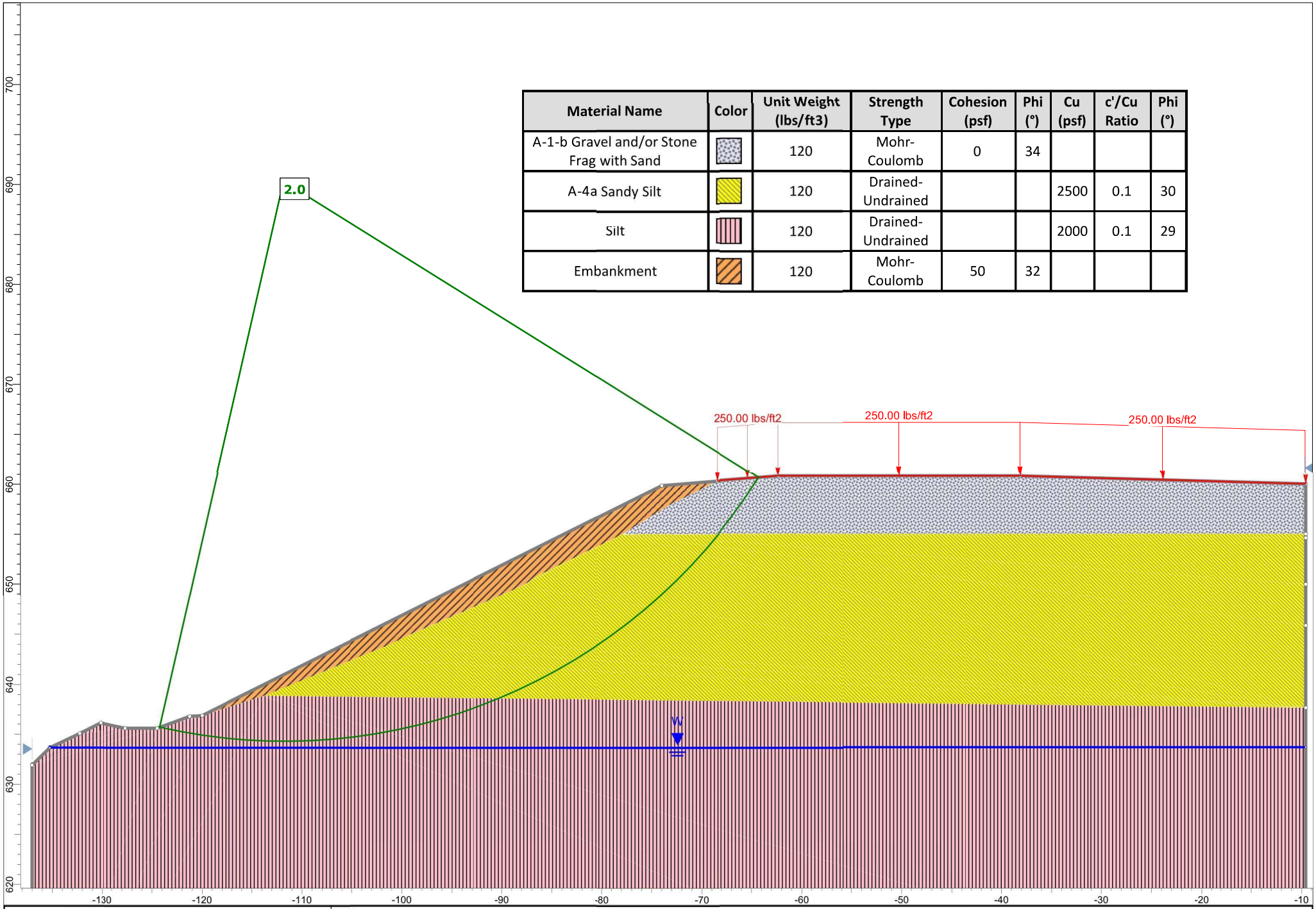
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/Cu Ratio	Phi (°)
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
Silt		120	Drained-Undrained			2000	0.1	29
A-3a Coarse and Fine Sand		120	Mohr-Coulomb	0	32			

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 105+00	Scenario	Non-circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

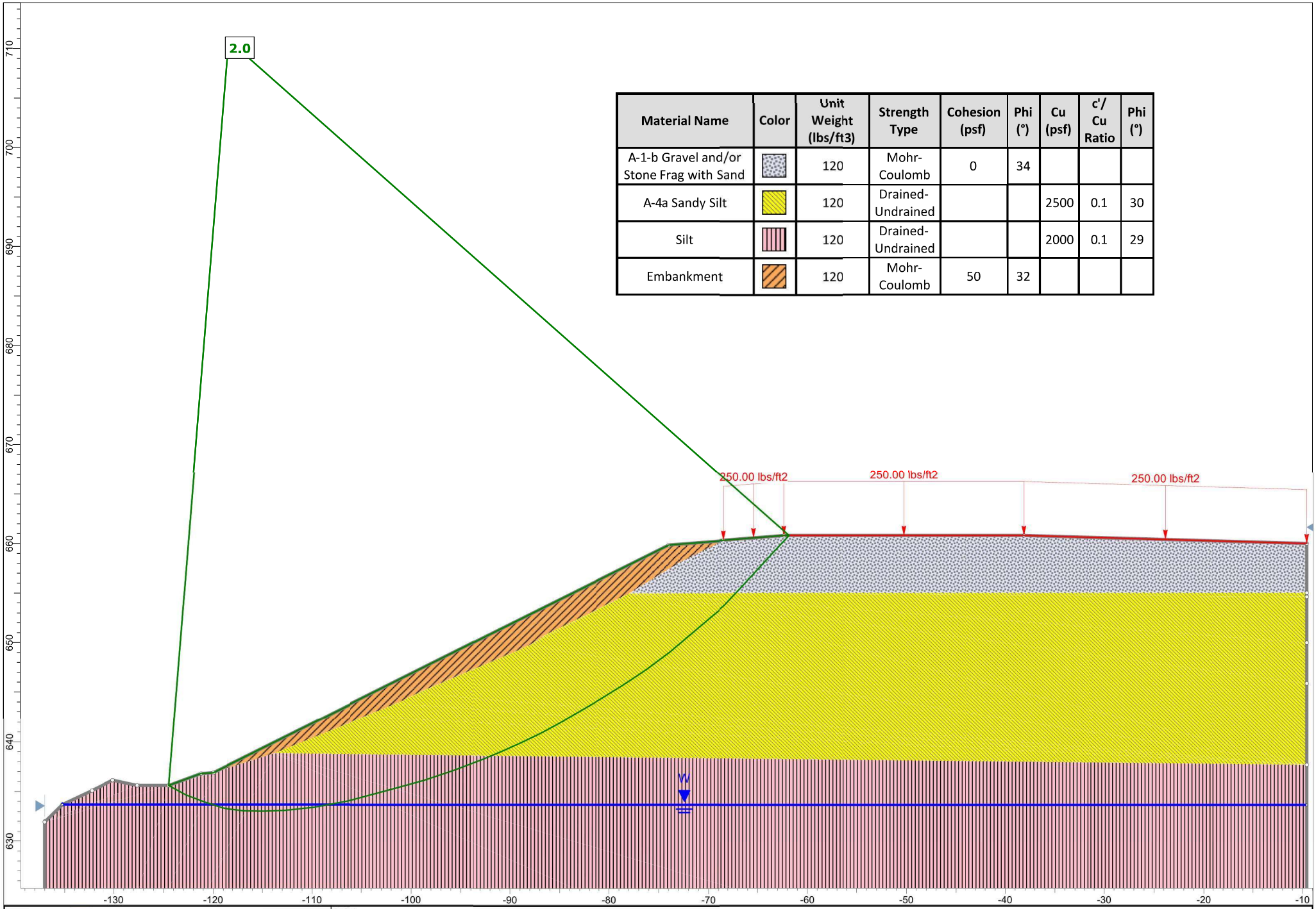
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/Cu Ratio	Phi (°)
A-1-b Gravel and/or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
Silt		120	Drained-Undrained			2000	0.1	29
Embankment		120	Mohr-Coulomb	50	32			



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 122+00	Scenario	Circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd



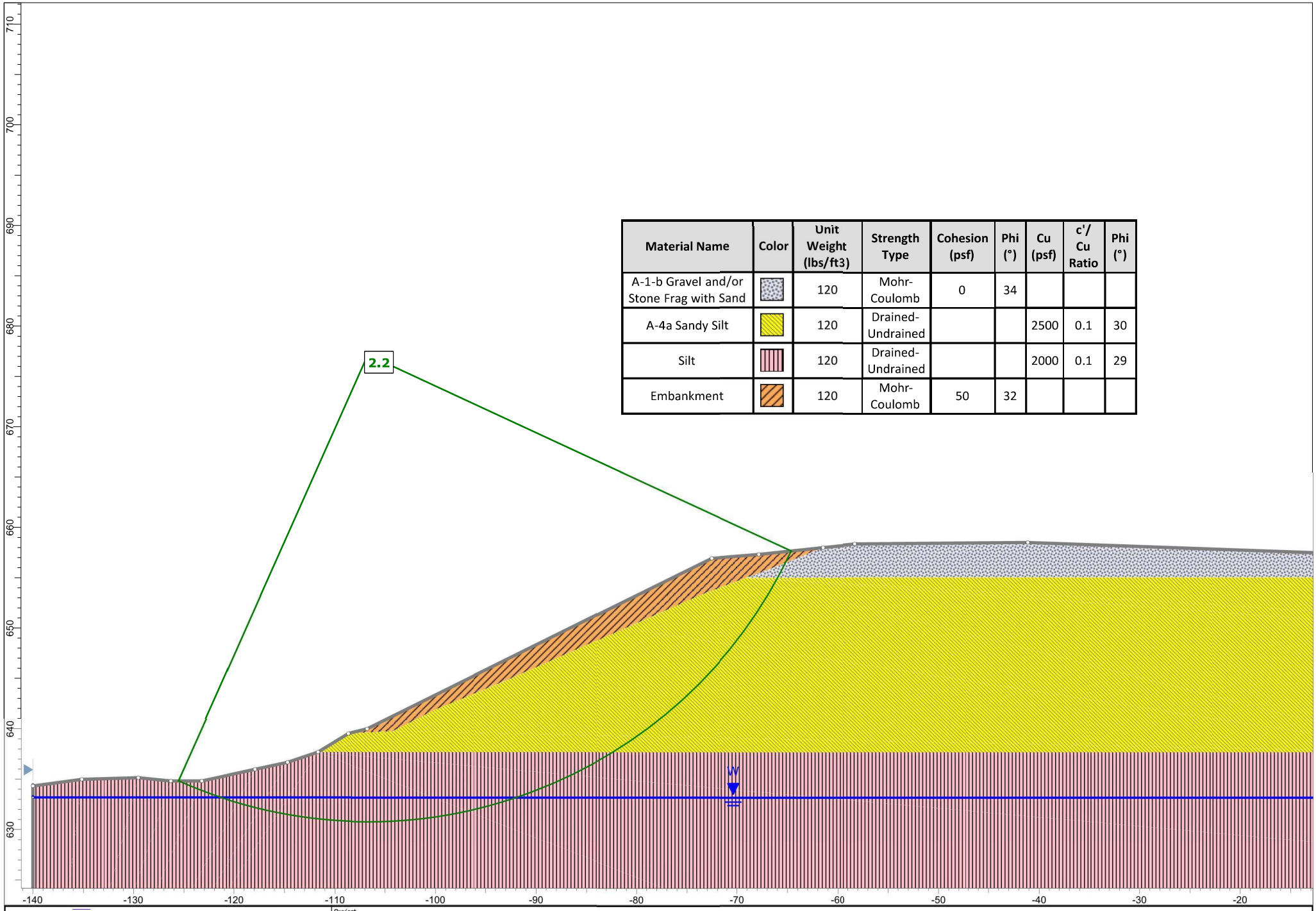
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-1-b Gravel and/or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
Silt		120	Drained-Undrained			2000	0.1	29
Embankment		120	Mohr-Coulomb	50	32			

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 122+00	Scenario	Non-circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

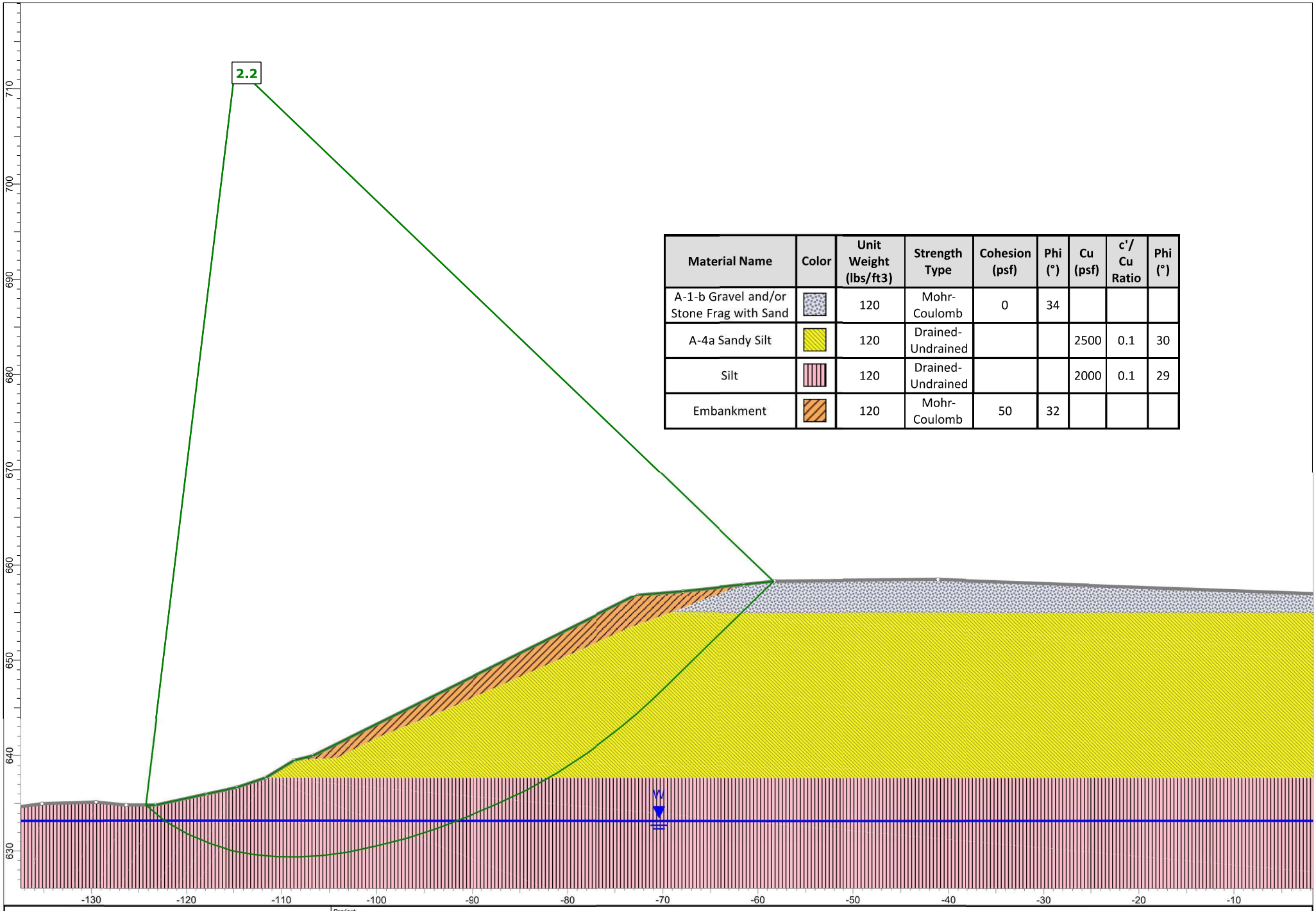
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-1-b Gravel and/or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
Silt		120	Drained-Undrained			2000	0.1	29
Embankment		120	Mohr-Coulomb	50	32			



TRC

Project	CUY-77-11.41 (PID 105743)		
Group	STA 124+00	Scenario	Cicular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

SLIDEINTERPRET 9.041

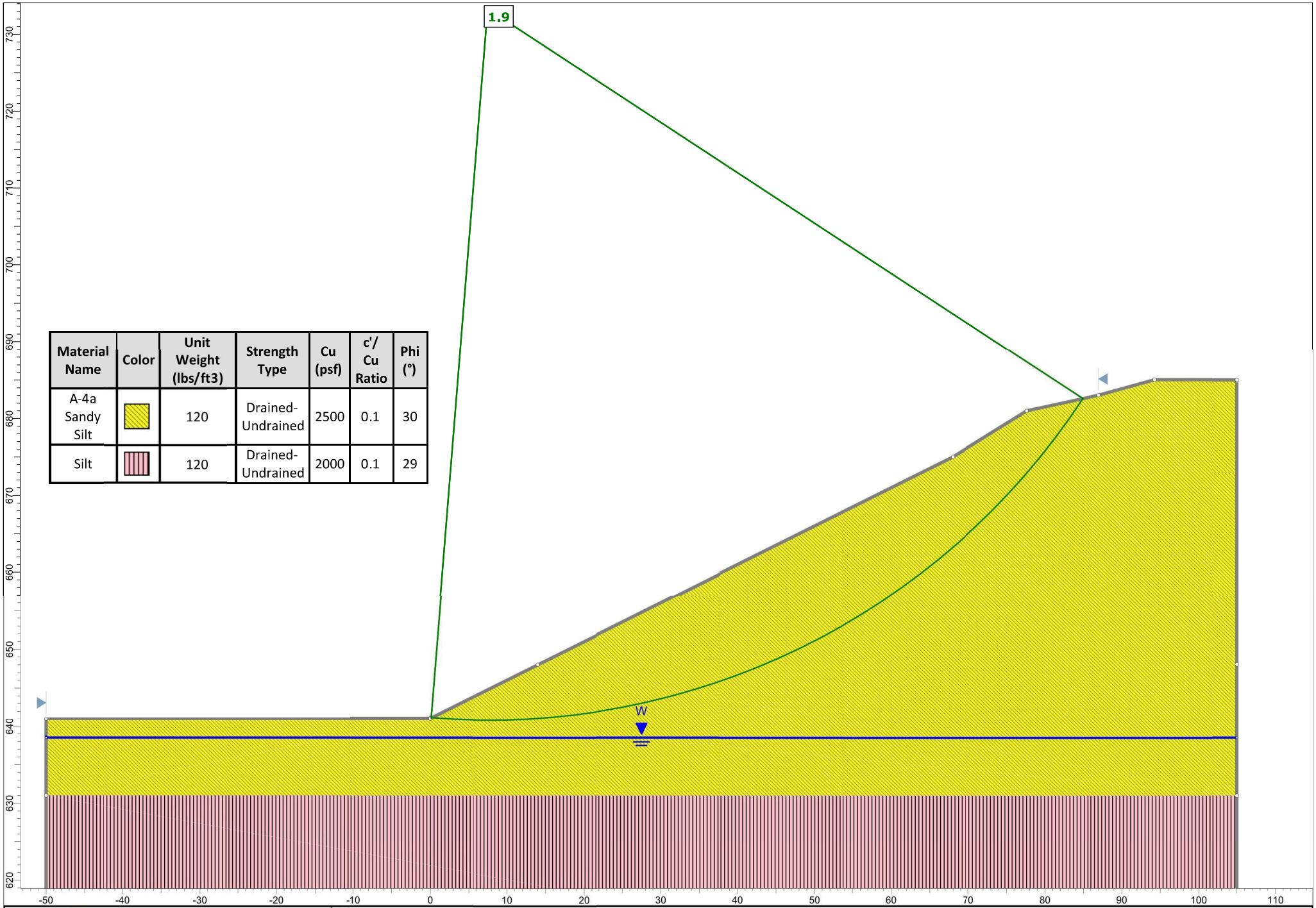


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-1-b Gravel and/or Stone Frag with Sand		120	Mohr-Coulomb	0	34			
A-4a Sandy Silt		120	Drained-Undrained			2500	0.1	30
Silt		120	Drained-Undrained			2000	0.1	29
Embankment		120	Mohr-Coulomb	50	32			

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 124+00	Scenario	Non-Circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

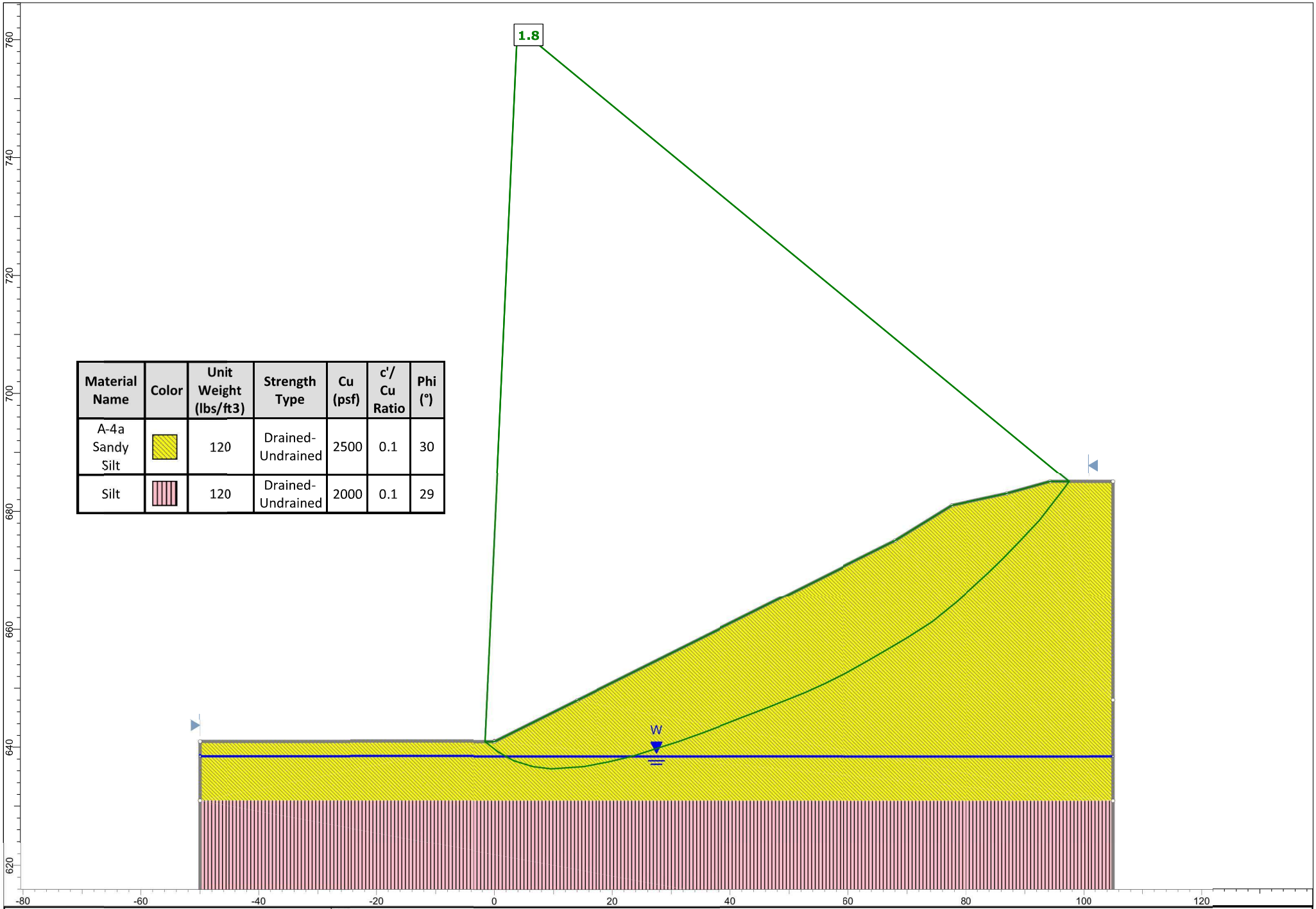


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-4a Sandy Silt		120	Drained-Undrained	2500	0.1	30
Silt		120	Drained-Undrained	2000	0.1	29

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 140+00	Scenario	Circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd



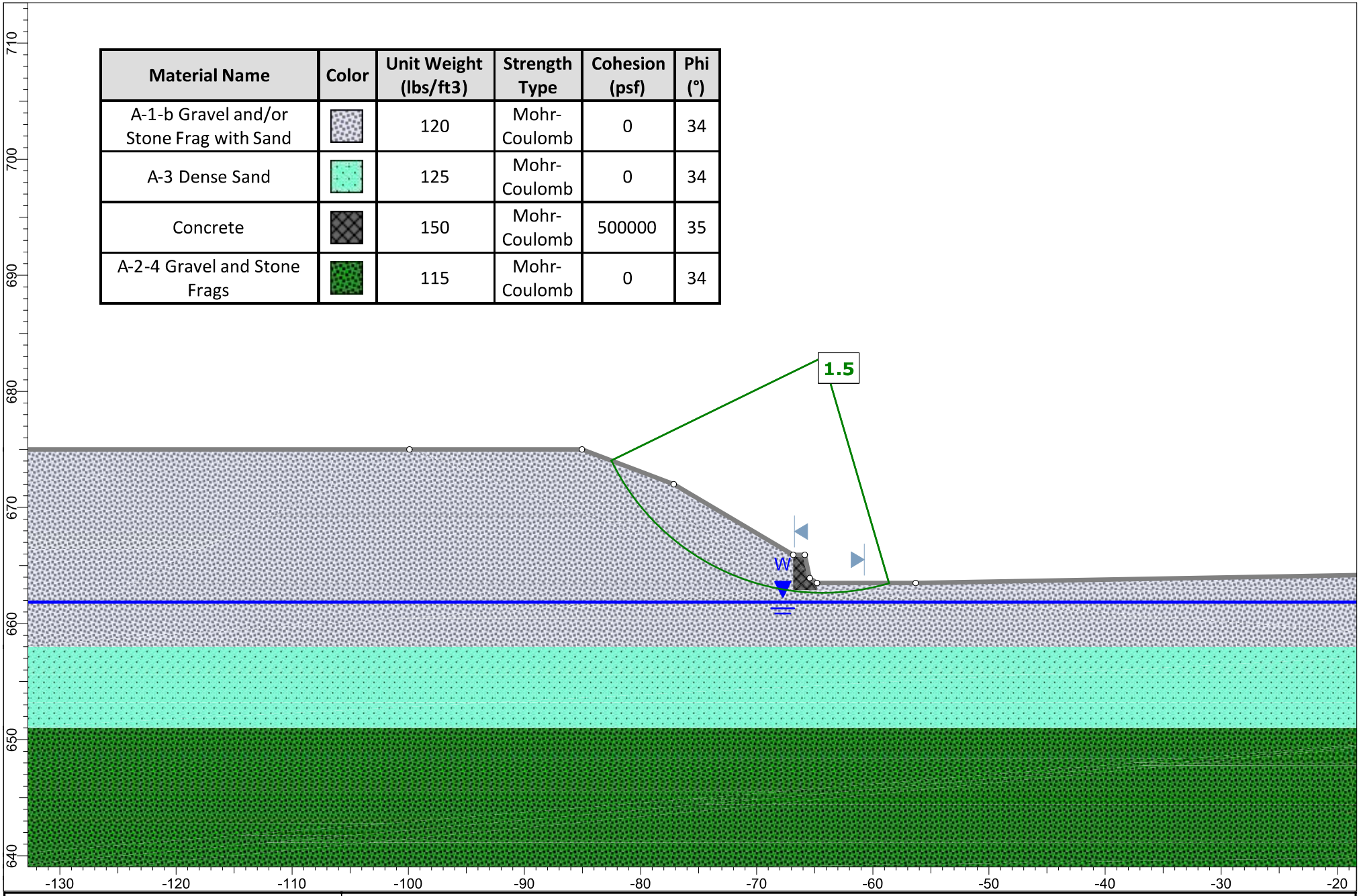
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cu (psf)	c'/ Cu Ratio	Phi (°)
A-4a Sandy Silt		120	Drained-Undrained	2500	0.1	30
Silt		120	Drained-Undrained	2000	0.1	29

TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 140+00	Scenario	Non-circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
A-1-b Gravel and/or Stone Frag with Sand		120	Mohr-Coulomb	0	34
A-3 Dense Sand		125	Mohr-Coulomb	0	34
Concrete		150	Mohr-Coulomb	500000	35
A-2-4 Gravel and Stone Frags		115	Mohr-Coulomb	0	34

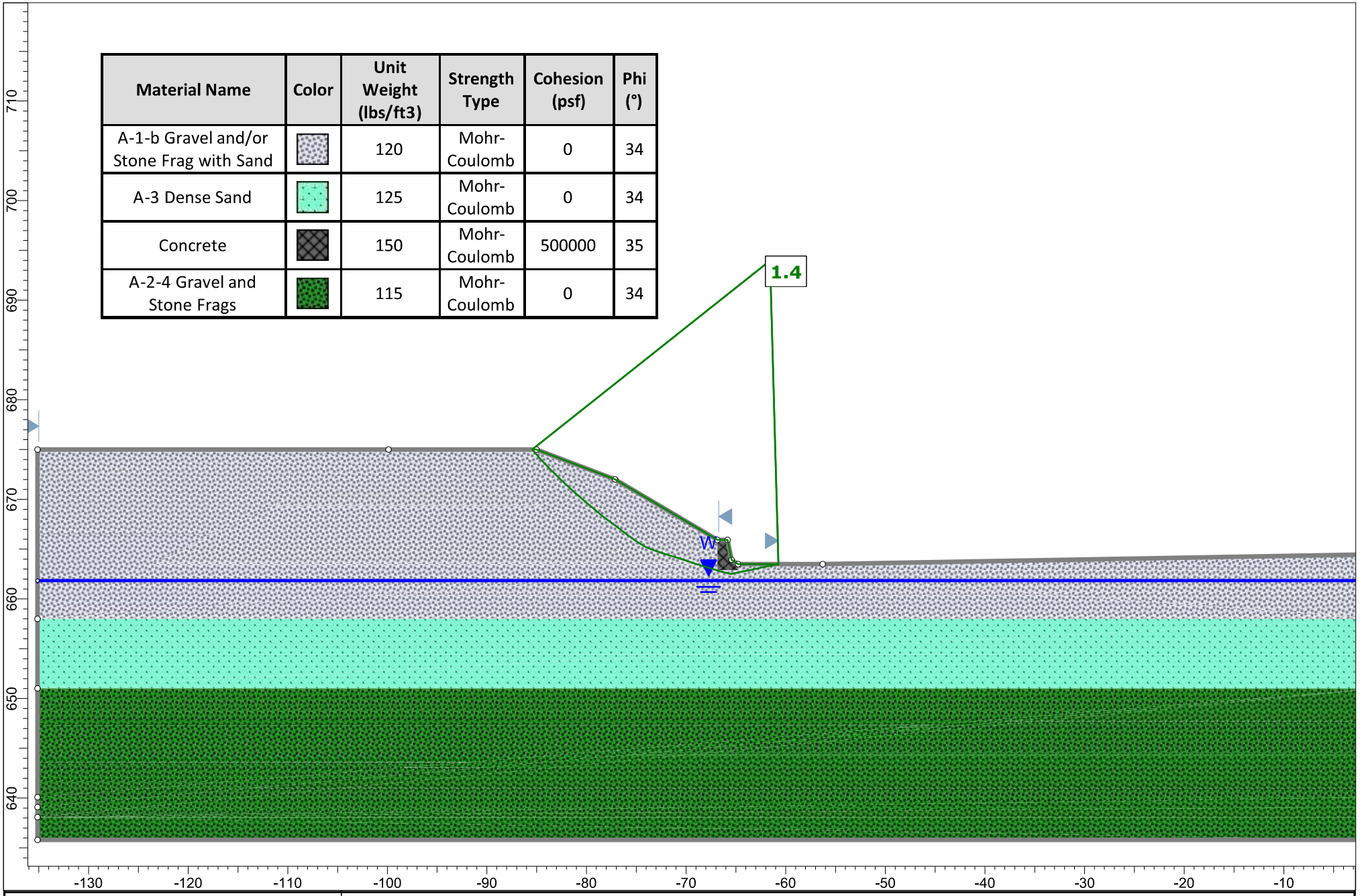


TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 141+75 with Barrier	Scenario	Circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
A-1-b Gravel and/or Stone Frag with Sand		120	Mohr-Coulomb	0	34
A-3 Dense Sand		125	Mohr-Coulomb	0	34
Concrete		150	Mohr-Coulomb	500000	35
A-2-4 Gravel and Stone Frags		115	Mohr-Coulomb	0	34



TRC

SLIDEINTERPRET 9.041

Project	CUY-77-11.41 (PID 105743)		
Group	STA 141+75 with Barrier	Scenario	Non-circular Slip
Drawn By	Izzaldin (Dean) Almohd, PhD, PE	Company	TRC Engineers, Inc.
Date	03-30-2026	File Name	CUY-77-11.41 Embankment Slopes and Stub Walls.slmd

APPENDIX L
L-PILE ANALYSES FOR CCTV POLE

- Metal Pole On 30-In Diameter Drilled Shaft:
    1. 20.0 feet embedment (Not Recommended)
    2. 25.0 feet embedment (Recommended)
- Concrete Pole Embedded in Grouted Hole:
    3. 20.0 feet embedment (Not Recommended)
    4. 25.0 feet embedment (Recommended)
- Fixity Conditions Evaluations
    1. Metal Pole on 20-Imch Diameter Drilled shaft (20 ft & 25 ft embedment)
    2. Concrete Pole Embedded in Grouted Hole (20 ft & 25 ft embedment)

TRC Member of WSP

Project: **CUY-77-11.41: Reconstruction of I-77**
PID: **PID 105743**

Completed by: DA Date: 6/11/2026
Checked by: RLT Date: 6/11/2026

Generalized Soil Stratigraphy and Material Properties

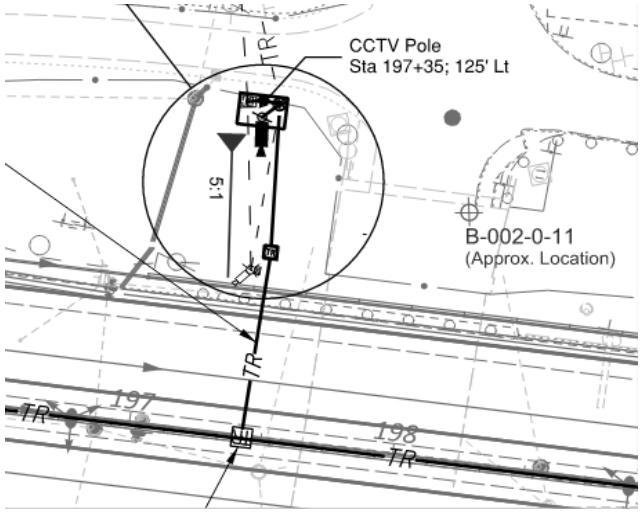
CCTV Pole

Boring B-002-0-11
Sta: 9+07, 23' Lt of Pershing Ave.
App. Sta.: 198+15, 107' Lt of IR 77
water= 657.3
Use = 678.0
GS= 679.8 (Top of Boring El.)

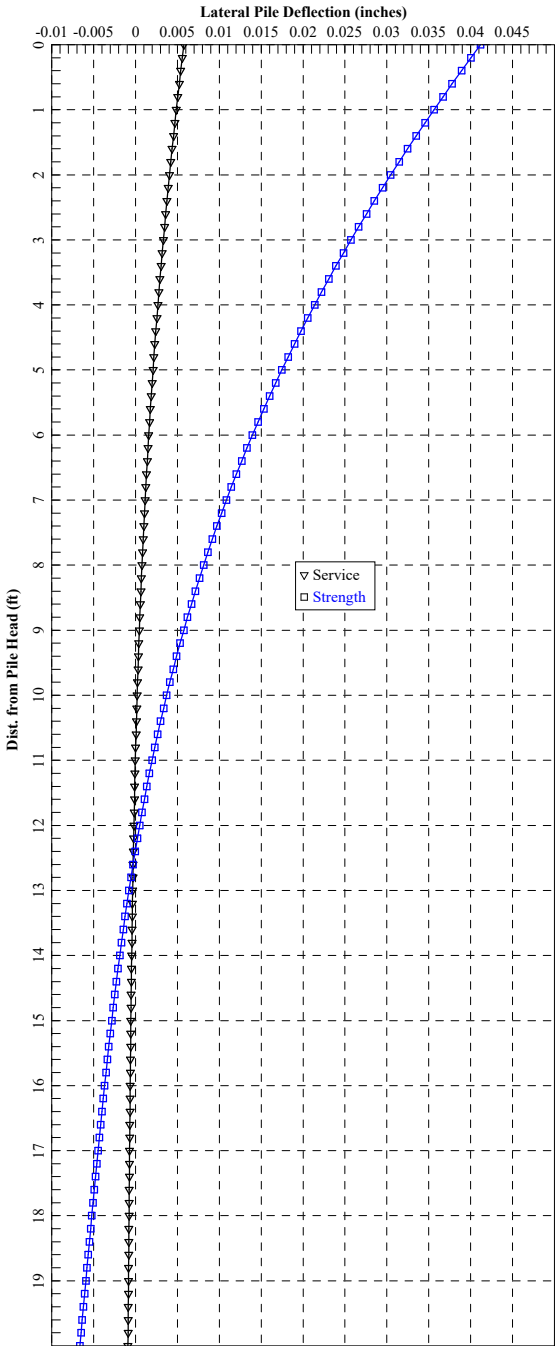
Design Height, H= 678.00 Wall Height, H= 678.00
Existing Ground El= 678 (Approximate)
Top of shaft El= 678
Bottom of frost El= 674.50 = 678-3.5

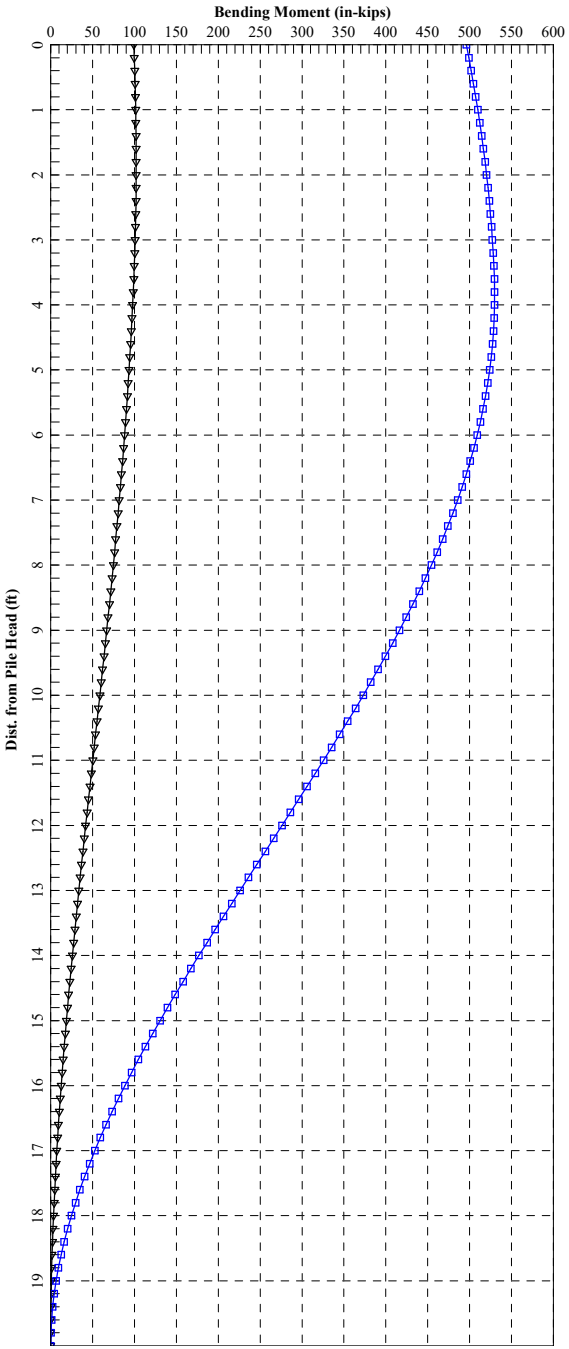
from	to	Description	N	Profile zone	Profile from	Profile to	γ, pcf	γ', pcf	Cu, psf	c', psf	ϕ', deg	Equiv. * ϕ_s'	Lpile K, pci	Lpile E50	
678.00															Top of shaft El
670.30	666.3	Sand/slag (fill)	11	Foundation/Clay*	0	3.5	110	47.6	250	-	-	-	-	0.02	
				Foundation/ sand	3.50	11.70	125	62.6	0	0	30	30	60	NA	
666.3	660.8	Loose-V.loose sand	5	Foundation/ sand	11.70	17.20	125	62.6	0	0	28	28	60	NA	
660.8	649.3	Loose Silt	8	Foundation/ sand	17.20	28.70	125	62.6	0	0	30	30	60	NA	
649.3	643.8	V. stiff to hard silt and clay	18	Foundation/ clay	28.70	34.20	125	62.6	2500	200	29	31	NA	0.005	
643.8	627.8	Stiff to very stiff silt and clay	18	Foundation/ clay	34.20	50.20	125	62.6	2500	200	29	31	NA	0.005	
627.8	602.0	V. dense silt/ sand	>50	Foundation/ sand	50.20	76.00	130	67.6	0	0	34	34	120	NA	

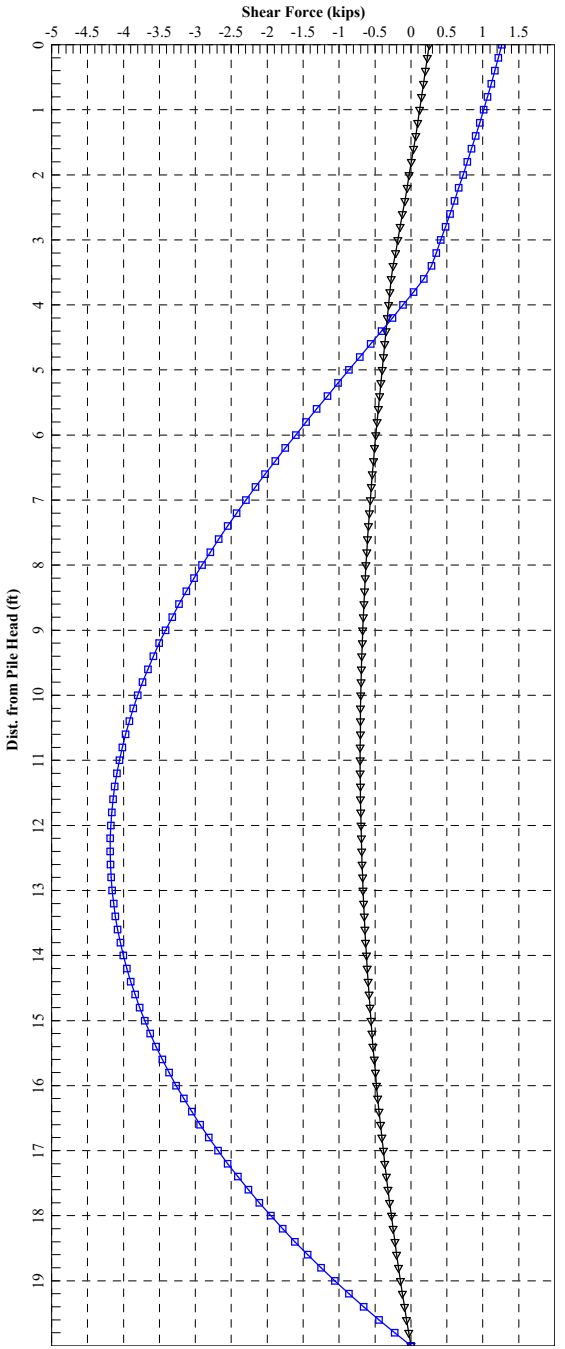
* Frost depth (3.5 ft) modeled as very soft clay (As requested by ODOT)
Remaining depth of boring is beyond depth of influence

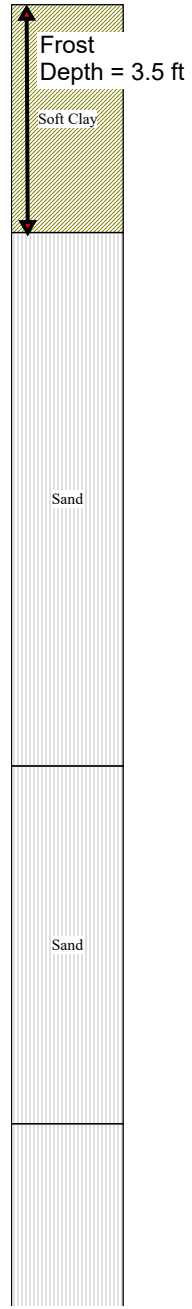


CCTV Foundation: 20-ft long drilled shaft (30-inch Diameter)









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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App L CCTV Profile & LPile\CCTV Pole LPile\

Name of input data file:
CCTV Drilled Shaft 20ft.lp12d

Name of output report file:
CCTV Drilled Shaft 20ft.lp12o

Name of plot output file:
CCTV Drilled Shaft 20ft.lp12p

Name of runtime message file:
CCTV Drilled Shaft 20ft.lp12r

Date and Time of Analysis

Date: June 12, 2026 Time: 11:19:03

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Rakam Tamang, P.E.
Description: CCTV Pole at Sta 197+35, 125 ft Lt (Drilled Shaft)

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	1
Total length of pile	=	20.000 ft
Depth of ground surface below top of pile	=	0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	30.0000
2	20.000	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile

Length of section	=	20.000000 ft
Shaft Diameter	=	30.000000 in

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	11.300 degrees
	=	0.197 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 6 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	100.000000 pcf
Effective unit weight at bottom of layer	=	100.000000 pcf
Undrained cohesion at top of layer	=	250.000000 psf
Undrained cohesion at bottom of layer	=	250.000000 psf
Epsilon-50 at top of layer	=	0.020000
Epsilon-50 at bottom of layer	=	0.020000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	11.700000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	30.000000 deg.
Friction angle at bottom of layer	=	30.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	11.700000 ft
Distance from top of pile to bottom of layer	=	17.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	28.000000 deg.
Friction angle at bottom of layer	=	28.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.200000 ft
Distance from top of pile to bottom of layer	=	28.700000 ft
Effective unit weight at top of layer	=	65.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	30.000000 deg.
Friction angle at bottom of layer	=	30.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	28.700000 ft
Distance from top of pile to bottom of layer	=	34.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 6 is stiff clay without free water

Distance from top of pile to top of layer	=	34.200000 ft
Distance from top of pile to bottom of layer	=	50.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf

Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

(Depth of the lowest soil layer extends 30.200 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft	0.00	100.0000	250.0000	--	0.02000	--
	Clay	3.5000	100.0000	250.0000	--	0.02000	--
2	Sand	3.5000	62.6000	--	30.0000	--	60.0000
	(Reese, et al.)	11.7000	62.6000	--	30.0000	--	60.0000
3	Sand	11.7000	62.6000	--	28.0000	--	60.0000
	(Reese, et al.)	17.2000	62.6000	--	28.0000	--	60.0000
4	Sand	17.2000	65.6000	--	30.0000	--	60.0000
	(Reese, et al.)	28.7000	62.6000	--	30.0000	--	60.0000
5	Stiff Clay	28.7000	62.6000	2500.	--	0.00500	--
	w/o Free Water	34.2000	62.6000	2500.	--	0.00500	--
6	Stiff Clay	34.2000	62.6000	2500.	--	0.00500	--
	w/o Free Water	50.2000	62.6000	2500.	--	0.00500	--

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 253.000000 lbs	M = 99208. in-lbs	11061.	Yes	Yes
2	1	V = 1264. lbs	M = 496038. in-lbs	11061.	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	20.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of long. rebar)	=	3.000000 in
Number of Reinforcing Bars	=	12 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	9.480000 sq. in.
Area Ratio of Steel Reinforcement	=	1.34 percent
Edge-to-Edge Bar Spacing	=	4.952838 in
Maximum Concrete Aggregate Size	=	0.750000 in
Ratio of Bar Spacing to Aggregate Size	=	6.60
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	2939.886 kips
Tensile Load for Cracking of Concrete	=	-321.764 kips
Nominal Axial Tensile Capacity	=	-568.800 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.000000	0.790000	11.500000	0.00000
2	1.000000	0.790000	9.959292	5.750000
3	1.000000	0.790000	5.750000	9.959292
4	1.000000	0.790000	0.00000	11.500000
5	1.000000	0.790000	-5.75000	9.959292
6	1.000000	0.790000	-9.95929	5.750000
7	1.000000	0.790000	-11.50000	0.00000
8	1.000000	0.790000	-9.95929	-5.75000
9	1.000000	0.790000	-5.75000	-9.95929
10	1.000000	0.790000	0.00000	-11.50000
11	1.000000	0.790000	5.750000	-9.95929
12	1.000000	0.790000	9.959292	-5.75000

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 4.953 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 6.60

Concrete Properties:

Compressive Strength of Concrete = 4000. psi
Modulus of Elasticity of Concrete = 3604997. psi
Modulus of Rupture of Concrete = -474.34165 psi
Compression Strain at Peak Stress = 0.001886
Tensile Strain at Fracture of Concrete = -0.0001154
Maximum Coarse Aggregate Size = 0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	11.061

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-14, Section 21.2.3.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 11.061 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	229.4723749	183577900.	17.7482147	0.00002219	-0.00001531	0.0927523	0.5291853	
0.00000250	457.6017855	183040714.	16.3794516	0.00004095	-0.00003405	0.1702290	0.9591352	
0.00000375	684.3298991	182487973.	15.9232451	0.00005971	-0.00005279	0.2469306	1.3890904	
0.00000500	909.6564592	181931292.	15.6951668	0.00007848	-0.00007152	0.3228569	1.8190492	
0.00000625	1134.	181373029.	15.5583381	0.00009724	-0.00009026	0.3980077	2.2490113	
0.00000750	1356.	180813975.	15.4671341	0.0001160	-0.000109	0.4723831	2.6789767	

0.00000875	1356.	154983407.	9.1815291	0.00008034	-0.000182	0.3281415	-4.559499 C
0.00001000	1356.	135610481.	9.0304255	0.00009030	-0.000210	0.3677683	-5.254677 C
0.00001125	1356.	120542650.	8.9128051	0.0001003	-0.000237	0.4071758	-5.949885 C
0.00001250	1356.	108488385.	8.8182820	0.0001102	-0.000265	0.4463471	-6.645248 C
0.00001375	1356.	98625805.	8.7397597	0.0001202	-0.000292	0.4852388	-7.341083 C
0.00001500	1356.	90406988.	8.6748666	0.0001301	-0.000320	0.5239487	-8.036683 C
0.00001625	1356.	83452604.	8.6204595	0.0001401	-0.000347	0.5624764	-8.732046 C
0.00001750	1356.	77491704.	8.5742934	0.0001501	-0.000375	0.6008214	-9.427171 C
0.00001875	1356.	72325590.	8.5341545	0.0001600	-0.000402	0.6389420	-10.122366 C
0.00002000	1356.	67805241.	8.4986692	0.0001700	-0.000430	0.6768195	-10.817772 C
0.00002125	1356.	63816697.	8.4677599	0.0001799	-0.000458	0.7145151	-11.512930 C
0.00002250	1356.	60271325.	8.4406655	0.0001899	-0.000485	0.7520285	-12.207841 C
0.00002375	1356.	57099150.	8.4167854	0.0001999	-0.000513	0.7893591	-12.902501 C
0.00002500	1356.	54244193.	8.3956389	0.0002099	-0.000540	0.8265066	-13.596912 C
0.00002625	1356.	51661136.	8.3768370	0.0002199	-0.000568	0.8634706	-14.291070 C
0.00002750	1356.	49312902.	8.3600613	0.0002299	-0.000595	0.9002505	-14.984976 C
0.00002875	1356.	47168863.	8.3450489	0.0002399	-0.000623	0.9368461	-15.678628 C
0.00003000	1356.	45203494.	8.3315808	0.0002499	-0.000650	0.9732568	-16.372025 C
0.00003125	1356.	43395354.	8.3194728	0.0002600	-0.000678	1.0094821	-17.065165 C
0.00003250	1406.	43255437.	8.3085694	0.0002700	-0.000705	1.0455218	-17.758048 C
0.00003375	1456.	43148288.	8.2987378	0.0002801	-0.000732	1.0813753	-18.450673 C
0.00003500	1507.	43047525.	8.2898643	0.0002901	-0.000760	1.1170421	-19.143038 C
0.00003625	1557.	42952482.	8.2818511	0.0003002	-0.000787	1.1525219	-19.835141 C
0.00003750	1607.	42862583.	8.2746131	0.0003103	-0.000815	1.1878141	-20.526983 C
0.00003875	1658.	42777325.	8.2680765	0.0003204	-0.000842	1.2229184	-21.218561 C
0.00004000	1708.	42696269.	8.2621765	0.0003305	-0.000870	1.2578342	-21.909875 C
0.00004125	1758.	42619028.	8.2568563	0.0003406	-0.000897	1.2925611	-22.600923 C
0.00004250	1808.	42545262.	8.2520658	0.0003507	-0.000924	1.3270987	-23.291704 C
0.00004375	1858.	42474656.	8.2476723	0.0003608	-0.000952	1.3614331	-23.982328 C
0.00004500	1908.	42406948.	8.2436605	0.0003710	-0.000979	1.3955668	-24.672773 C
0.00004625	1958.	42341907.	8.2400749	0.0003811	-0.001006	1.4295112	-25.362937 C
0.00004750	2008.	42279321.	8.2368830	0.0003913	-0.001034	1.4632658	-26.052819 C
0.00004875	2058.	42218995.	8.2340554	0.0004014	-0.001061	1.4968301	-26.742417 C
0.00005125	2158.	42104448.	8.2293904	0.0004218	-0.001116	1.5633859	-28.120756 C
0.00005375	2257.	41997069.	8.2258984	0.0004421	-0.001170	1.6291747	-29.497943 C
0.00005625	2357.	41895874.	8.2234301	0.0004626	-0.001225	1.6941923	-30.873967 C
0.00005875	2456.	41800045.	8.2218618	0.0004830	-0.001279	1.7584347	-32.248815 C
0.00006125	2555.	41708897.	8.2210901	0.0005035	-0.001334	1.8218975	-33.622476 C
0.00006375	2653.	41621852.	8.2210280	0.0005241	-0.001388	1.8845767	-34.994937 C
0.00006625	2752.	41538420.	8.2216017	0.0005447	-0.001443	1.9464679	-36.366185 C
0.00006875	2850.	41458180.	8.2227483	0.0005653	-0.001497	2.0075667	-37.736208 C
0.00007125	2948.	41380771.	8.2244137	0.0005860	-0.001552	2.0678687	-39.104992 C
0.00007375	3046.	41305880.	8.2265516	0.0006067	-0.001606	2.1273693	-40.472525 C
0.00007625	3144.	41233234.	8.2291215	0.0006275	-0.001660	2.1860639	-41.838792 C
0.00007875	3242.	41162596.	8.2320883	0.0006483	-0.001714	2.2439480	-43.203781 C
0.00008125	3339.	41093755.	8.2354214	0.0006691	-0.001768	2.3010167	-44.567476 C
0.00008375	3436.	41026528.	8.2390940	0.0006900	-0.001822	2.3572653	-45.929863 C
0.00008625	3533.	40960751.	8.2430824	0.0007110	-0.001877	2.4126889	-47.290928 C
0.00008875	3630.	40896277.	8.2473656	0.0007320	-0.001931	2.4672825	-48.650655 C
0.00009125	3726.	40832988.	8.2518476	0.0007530	-0.001985	2.5210227	-50.009235 C
0.00009375	3822.	40770776.	8.2564718	0.0007740	-0.002038	2.5738945	-51.366780 C
0.00009625	3918.	40709524.	8.2613301	0.0007952	-0.002092	2.6259174	-52.723000 C
0.00009875	4014.	40649137.	8.2664099	0.0008163	-0.002146	2.6770863	-54.077881 C
0.0001013	4110.	40589530.	8.2717001	0.0008375	-0.002200	2.7273960	-55.431408 C

0.0001038	4205.	40530625.	8.2771906	0.0008588	-0.002254	2.7768413	-56.783565 C
0.0001063	4300.	40472351.	8.2828724	0.0008801	-0.002307	2.8254166	-58.134337 C
0.0001088	4395.	40414644.	8.2887374	0.0009014	-0.002361	2.8731167	-59.483707 C
0.0001113	4490.	40357416.	8.2947766	0.0009228	-0.002415	2.9199353	-60.000000 CY
0.0001138	4579.	40252154.	8.2977175	0.0009439	-0.002469	2.9650655	-60.000000 CY
0.0001163	4659.	40073391.	8.2956984	0.0009644	-0.002523	3.0080462	-60.000000 CY
0.0001188	4734.	39865459.	8.2916731	0.0009846	-0.002578	3.0496021	-60.000000 CY
0.0001213	4809.	39661678.	8.2879579	0.0010049	-0.002633	3.0903042	-60.000000 CY
0.0001238	4875.	39392078.	8.2793233	0.0010246	-0.002688	3.1288743	-60.000000 CY
0.0001263	4926.	39019647.	8.2627799	0.0010432	-0.002744	3.1645912	-60.000000 CY
0.0001288	4968.	38586252.	8.2409589	0.0010610	-0.002801	3.1981137	-60.000000 CY
0.0001313	5008.	38154972.	8.2185190	0.0010787	-0.002859	3.2305958	-60.000000 CY
0.0001338	5048.	37739069.	8.1971444	0.0010964	-0.002916	3.2624615	-60.000000 CY
0.0001363	5087.	37337692.	8.1767784	0.0011141	-0.002973	3.2937077	-60.000000 CY
0.0001388	5127.	36950048.	8.1573683	0.0011318	-0.003031	3.3243314	-60.000000 CY
0.0001413	5166.	36575405.	8.1388653	0.0011496	-0.003088	3.3543293	-60.000000 CY
0.0001438	5206.	36213077.	8.1212238	0.0011674	-0.003145	3.3836982	-60.000000 CY
0.0001463	5245.	35862427.	8.1044017	0.0011853	-0.003202	3.4124350	-60.000000 CY
0.0001488	5284.	35522862.	8.0883595	0.0012031	-0.003259	3.4405363	-60.000000 CY
0.0001588	5438.	34253857.	8.0301163	0.0012748	-0.003488	3.5462539	-60.000000 CY
0.0001688	5536.	32806087.	7.9465388	0.0013410	-0.003722	3.6339647	-60.000000 CY
0.0001788	5598.	31317772.	7.8477481	0.0014028	-0.003960	3.7072477	-60.000000 CY
0.0001888	5659.	29982490.	7.7614374	0.0014650	-0.004198	3.7727375	-60.000000 CY
0.0001988	5719.	28777012.	7.6857755	0.0015275	-0.004435	3.8302877	-60.000000 CY
0.0002088	5778.	27681105.	7.6173631	0.0015901	-0.004672	3.8794506	-60.000000 CY
0.0002188	5836.	26679664.	7.5550980	0.0016527	-0.004910	3.9202118	-60.000000 CY
0.0002288	5893.	25761681.	7.5001504	0.0017157	-0.005147	3.9527896	-60.000000 CY
0.0002388	5949.	24916542.	7.4516607	0.0017791	-0.005383	3.9770110	-60.000000 CY
0.0002488	6004.	24135337.	7.4089116	0.0018430	-0.005620	3.9926936	-60.000000 CY
0.0002588	6056.	23405526.	7.3701966	0.0019070	-0.005855	3.9996339	-60.000000 CY
0.0002688	6098.	22691969.	7.3271640	0.0019692	-0.006093	3.9983738	-60.000000 CY
0.0002788	6125.	21973571.	7.2744036	0.0020277	-0.006335	3.9949737	-60.000000 CY
0.0002888	6141.	21268629.	7.2178317	0.0020841	-0.006578	3.9996075	-60.000000 CY
0.0002988	6155.	20601014.	7.1642046	0.0021403	-0.006822	3.9959996	-60.000000 CY
0.0003088	6167.	19975114.	7.1151821	0.0021968	-0.007066	3.9997907	-60.000000 CY
0.0003188	6180.	19386796.	7.0704559	0.0022537	-0.007309	3.9955556	-60.000000 CY
0.0003288	6191.	18832071.	7.0275880	0.0023103	-0.007552	3.9995609	-60.000000 CY
0.0003388	6202.	18307943.	6.9866031	0.0023667	-0.007796	3.9930729	-60.000000 CY
0.0003488	6212.	17812818.	6.9488942	0.0024234	-0.008039	3.9983525	-60.000000 CY
0.0003588	6222.	17344516.	6.9140363	0.0024804	-0.008282	3.9993096	-60.000000 CY
0.0003688	6232.	16900408.	6.8821140	0.0025378	-0.008525	3.9948696	-60.000000 CY
0.0003788	6241.	16479162.	6.8524915	0.0025954	-0.008767	3.9990248	-60.000000 CY
0.0003888	6251.	16078880.	6.8250958	0.0026533	-0.009009	3.9972025	-60.000000 CY
0.0003988	6259.	15697783.	6.7999155	0.0027115	-0.009251	3.9941733	-60.000000 CY
0.0004088	6268.	15334880.	6.7764776	0.0027699	-0.009493	3.9985371	-60.000000 CY
0.0004188	6277.	14988852.	6.7546693	0.0028285	-0.009734	3.9999815	-60.000000 CY
0.0004288	6284.	14657661.	6.7330839	0.0028868	-0.009976	3.9903239	-60.000000 CY
0.0004388	6292.	14341120.	6.7124308	0.0029451	-0.010217	3.9959522	-60.000000 CY
0.0004488	6300.	14038378.	6.6931187	0.0030035	-0.010459	3.9991776	-60.000000 CYT
0.0004588	6307.	13748456.	6.6751406	0.0030622	-0.010700	3.9980758	-60.000000 CYT
0.0004688	6314.	13470346.	6.6586086	0.0031212	-0.010941	3.9885351	-60.000000 CYT
0.0004788	6321.	13203627.	6.6431055	0.0031804	-0.011182	3.9944406	-60.000000 CYT
0.0004888	6328.	12947598.	6.6285754	0.0032397	-0.011423	3.9982466	-60.000000 CYT
0.0004988	6335.	12701607.	6.6149674	0.0032992	-0.011663	3.9999189	-60.000000 CYT

0.0005088	6341.	12464846.	6.6024784	0.0033590	-0.011903	3.9928509	-60.000000 CYT
0.0005188	6348.	12236965.	6.5908379	0.0034190	-0.012144	3.9884553	-60.000000 CYT
0.0005288	6354.	12017542.	6.5799050	0.0034791	-0.012383	3.9940568	-60.000000 CYT
0.0005388	6361.	11806103.	6.5696460	0.0035394	-0.012623	3.9978298	-60.000000 CYT
0.0005488	6367.	11602208.	6.5600296	0.0035998	-0.012863	3.9997465	-60.000000 CYT
0.0006088	6377.	10475977.	6.5408541	0.0039817	-0.014281	3.9999750	-60.000000 CYT

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens. Strain
1	11.061	6299.265	0.00300000	-0.01044435

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.75).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318,
or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor	Nominal Ax. Thrust kips	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	11.061000	6299.	7.189650	4095.	40598988.
1	0.75	11.061000	6299.	8.295750	4724.	39891831.
1	0.90	11.061000	6299.	9.954900	5669.	29779496.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	8859.
2	3.5000	2.7813	No	No	8859.	102420.
3	11.7000	12.2774	Yes	No	111280.	157975.
4	17.2000	16.9227	Yes	No	269254.	131645.
5	28.7000	28.7000	No	No	400899.	0.00
6	34.2000	34.2000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 253.0 lbs
Applied moment at pile head = 99208.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.00577	99208.	253.0000	-7.78E-05	0.00	1.84E+11	-10.206	2123.	0.00
0.2000	0.00558	99788.	228.1527	-7.65E-05	0.00	1.84E+11	-10.500	4514.	0.00
0.4000	0.00540	100307.	202.6122	-7.52E-05	0.00	1.84E+11	-10.784	4792.	0.00
0.6000	0.00522	100764.	176.4012	-7.39E-05	0.00	1.84E+11	-11.059	5082.	0.00
0.8000	0.00505	101158.	149.5424	-7.25E-05	0.00	1.84E+11	-11.324	5385.	0.00
1.0000	0.00487	101486.	122.0588	-7.12E-05	0.00	1.84E+11	-11.579	5702.	0.00
1.2000	0.00470	101748.	93.9735	-6.99E-05	0.00	1.84E+11	-11.825	6032.	0.00
1.4000	0.00454	101941.	65.3097	-6.86E-05	0.00	1.84E+11	-12.061	6378.	0.00
1.6000	0.00438	102065.	36.0909	-6.72E-05	0.00	1.84E+11	-12.288	6740.	0.00
1.8000	0.00422	102118.	6.3407	-6.59E-05	0.00	1.84E+11	-12.504	7118.	0.00
2.0000	0.00406	102099.	-23.917	-6.46E-05	0.00	1.84E+11	-12.711	7515.	0.00
2.2000	0.00391	102006.	-54.659	-6.32E-05	0.00	1.84E+11	-12.907	7931.	0.00
2.4000	0.00376	101840.	-85.860	-6.19E-05	0.00	1.84E+11	-13.094	8367.	0.00

2.6000	0.00361	101597.	-117.497	-6.06E-05	0.00	1.84E+11	-13.270	8825.	0.00
2.8000	0.00347	101279.	-149.545	-5.92E-05	0.00	1.84E+11	-13.436	9306.	0.00
3.0000	0.00332	100883.	-181.979	-5.79E-05	0.00	1.84E+11	-13.592	9812.	0.00
3.2000	0.00319	100408.	-214.774	-5.66E-05	0.00	1.84E+11	-13.737	10344.	0.00
3.4000	0.00305	99855.	-247.906	-5.53E-05	0.00	1.84E+11	-13.872	10905.	0.00
3.6000	0.00292	99221.	-273.641	-5.40E-05	0.00	1.84E+11	-7.574	6221.	0.00
3.8000	0.00279	98544.	-291.902	-5.27E-05	0.00	1.84E+11	-7.644	6566.	0.00
4.0000	0.00267	97823.	-310.300	-5.14E-05	0.00	1.84E+11	-7.687	6912.	0.00
4.2000	0.00255	97058.	-328.768	-5.01E-05	0.00	1.84E+11	-7.703	7258.	0.00
4.4000	0.00243	96248.	-347.243	-4.89E-05	0.00	1.84E+11	-7.693	7603.	0.00
4.6000	0.00231	95393.	-365.666	-4.76E-05	0.00	1.84E+11	-7.660	7949.	0.00
4.8000	0.00220	94495.	-383.981	-4.64E-05	0.00	1.84E+11	-7.603	8294.	0.00
5.0000	0.00209	93553.	-402.133	-4.51E-05	0.00	1.84E+11	-7.524	8640.	0.00
5.2000	0.00198	92567.	-420.073	-4.39E-05	0.00	1.84E+11	-7.425	8986.	0.00
5.4000	0.00188	91539.	-437.750	-4.27E-05	0.00	1.84E+11	-7.306	9331.	0.00
5.6000	0.00178	90468.	-455.121	-4.15E-05	0.00	1.84E+11	-7.169	9677.	0.00
5.8000	0.00168	89356.	-472.142	-4.04E-05	0.00	1.84E+11	-7.015	10022.	0.00
6.0000	0.00158	88204.	-488.773	-3.92E-05	0.00	1.84E+11	-6.844	10368.	0.00
6.2000	0.00149	87012.	-504.977	-3.81E-05	0.00	1.84E+11	-6.659	10714.	0.00
6.4000	0.00140	85782.	-520.719	-3.69E-05	0.00	1.84E+11	-6.459	11059.	0.00
6.6000	0.00131	84515.	-535.965	-3.58E-05	0.00	1.84E+11	-6.246	11405.	0.00
6.8000	0.00123	83211.	-550.686	-3.47E-05	0.00	1.84E+11	-6.021	11750.	0.00
7.0000	0.00115	81873.	-564.853	-3.36E-05	0.00	1.84E+11	-5.785	12096.	0.00
7.2000	0.00107	80502.	-578.441	-3.26E-05	0.00	1.84E+11	-5.538	12442.	0.00
7.4000	9.91E-04	79099.	-591.426	-3.15E-05	0.00	1.84E+11	-5.282	12787.	0.00
7.6000	9.17E-04	77665.	-603.787	-3.05E-05	0.00	1.84E+11	-5.018	13133.	0.00
7.8000	8.45E-04	76202.	-615.503	-2.95E-05	0.00	1.84E+11	-4.746	13478.	0.00
8.0000	7.75E-04	74712.	-626.557	-2.85E-05	0.00	1.84E+11	-4.466	13824.	0.00
8.2000	7.08E-04	73196.	-636.934	-2.75E-05	0.00	1.84E+11	-4.181	14170.	0.00
8.4000	6.43E-04	71656.	-646.619	-2.66E-05	0.00	1.84E+11	-3.890	14515.	0.00
8.6000	5.80E-04	70094.	-655.600	-2.57E-05	0.00	1.84E+11	-3.594	14861.	0.00
8.8000	5.20E-04	68511.	-663.866	-2.48E-05	0.00	1.84E+11	-3.294	15206.	0.00
9.0000	4.62E-04	66908.	-671.409	-2.39E-05	0.00	1.84E+11	-2.991	15552.	0.00
9.2000	4.05E-04	65289.	-678.220	-2.30E-05	0.00	1.84E+11	-2.685	15898.	0.00
9.4000	3.51E-04	63654.	-684.293	-2.22E-05	0.00	1.84E+11	-2.376	16243.	0.00
9.6000	2.99E-04	62006.	-689.623	-2.14E-05	0.00	1.84E+11	-2.066	16589.	0.00
9.8000	2.49E-04	60345.	-694.207	-2.06E-05	0.00	1.84E+11	-1.754	16934.	0.00
10.0000	2.00E-04	58675.	-698.042	-1.98E-05	0.00	1.84E+11	-1.441	17280.	0.00
10.2000	1.54E-04	56996.	-701.126	-1.90E-05	0.00	1.84E+11	-1.128	17626.	0.00
10.4000	1.09E-04	55310.	-703.458	-1.83E-05	0.00	1.84E+11	-0.815	17971.	0.00
10.6000	6.59E-05	53620.	-705.040	-1.76E-05	0.00	1.84E+11	-0.503	18317.	0.00
10.8000	2.45E-05	51927.	-705.873	-1.69E-05	0.00	1.84E+11	-0.191	18662.	0.00
11.0000	-1.52E-05	50233.	-705.958	-1.62E-05	0.00	1.84E+11	0.1201	19008.	0.00
11.2000	-5.33E-05	48539.	-705.298	-1.56E-05	0.00	1.84E+11	0.4297	19354.	0.00
11.4000	-8.99E-05	46848.	-703.897	-1.49E-05	0.00	1.84E+11	0.7379	19699.	0.00
11.6000	-1.25E-04	45161.	-701.758	-1.43E-05	0.00	1.84E+11	1.0443	20045.	0.00
11.8000	-1.59E-04	43480.	-698.886	-1.38E-05	0.00	1.84E+11	1.3488	20390.	0.00
12.0000	-1.91E-04	41807.	-695.286	-1.32E-05	0.00	1.84E+11	1.6513	20736.	0.00
12.2000	-2.22E-04	40144.	-690.963	-1.27E-05	0.00	1.84E+11	1.9515	21082.	0.00
12.4000	-2.52E-04	38491.	-685.922	-1.22E-05	0.00	1.84E+11	2.2494	21427.	0.00
12.6000	-2.81E-04	36852.	-680.168	-1.17E-05	0.00	1.84E+11	2.5450	21773.	0.00
12.8000	-3.08E-04	35227.	-673.709	-1.12E-05	0.00	1.84E+11	2.8381	22118.	0.00
13.0000	-3.34E-04	33619.	-666.548	-1.07E-05	0.00	1.84E+11	3.1288	22464.	0.00
13.2000	-3.60E-04	32028.	-658.693	-1.03E-05	0.00	1.84E+11	3.4170	22810.	0.00

13.4000	-3.84E-04	30458.	-650.150	-9.91E-06	0.00	1.84E+11	3.7028	23155.	0.00
13.6000	-4.07E-04	28908.	-640.923	-9.52E-06	0.00	1.84E+11	3.9862	23501.	0.00
13.8000	-4.29E-04	27382.	-631.019	-9.15E-06	0.00	1.84E+11	4.2674	23846.	0.00
14.0000	-4.51E-04	25880.	-620.442	-8.80E-06	0.00	1.84E+11	4.5463	24192.	0.00
14.2000	-4.72E-04	24404.	-609.199	-8.48E-06	0.00	1.84E+11	4.8231	24538.	0.00
14.4000	-4.92E-04	22956.	-597.294	-8.17E-06	0.00	1.84E+11	5.0980	24883.	0.00
14.6000	-5.11E-04	21537.	-584.731	-7.87E-06	0.00	1.84E+11	5.3710	25229.	0.00
14.8000	-5.30E-04	20150.	-571.515	-7.60E-06	0.00	1.84E+11	5.6424	25574.	0.00
15.0000	-5.47E-04	18795.	-557.649	-7.35E-06	0.00	1.84E+11	5.9123	25920.	0.00
15.2000	-5.65E-04	17473.	-543.137	-7.11E-06	0.00	1.84E+11	6.1809	26266.	0.00
15.4000	-5.82E-04	16188.	-527.982	-6.89E-06	0.00	1.84E+11	6.4484	26611.	0.00
15.6000	-5.98E-04	14939.	-512.186	-6.69E-06	0.00	1.84E+11	6.7150	26957.	0.00
15.8000	-6.14E-04	13730.	-495.751	-6.50E-06	0.00	1.84E+11	6.9810	27302.	0.00
16.0000	-6.29E-04	12560.	-478.678	-6.33E-06	0.00	1.84E+11	7.2466	27648.	0.00
16.2000	-6.44E-04	11432.	-460.968	-6.17E-06	0.00	1.84E+11	7.5120	27994.	0.00
16.4000	-6.59E-04	10348.	-442.620	-6.03E-06	0.00	1.84E+11	7.7775	28339.	0.00
16.6000	-6.73E-04	9308.	-423.635	-5.90E-06	0.00	1.84E+11	8.0434	28685.	0.00
16.8000	-6.87E-04	8315.	-404.011	-5.79E-06	0.00	1.84E+11	8.3098	29030.	0.00
17.0000	-7.01E-04	7369.	-383.747	-5.68E-06	0.00	1.84E+11	8.5771	29376.	0.00
17.2000	-7.14E-04	6473.	-362.840	-5.59E-06	0.00	1.84E+11	8.8454	29722.	0.00
17.4000	-7.28E-04	5628.	-341.287	-5.51E-06	0.00	1.84E+11	9.1152	30067.	0.00
17.6000	-7.41E-04	4835.	-319.085	-5.44E-06	0.00	1.84E+11	9.3865	30413.	0.00
17.8000	-7.54E-04	4097.	-296.230	-5.39E-06	0.00	1.84E+11	9.6596	30758.	0.00
18.0000	-7.67E-04	3414.	-272.716	-5.34E-06	0.00	1.84E+11	9.9349	31104.	0.00
18.2000	-7.79E-04	2788.	-248.540	-5.30E-06	0.00	1.84E+11	10.2124	31450.	0.00
18.4000	-7.92E-04	2221.	-223.694	-5.26E-06	0.00	1.84E+11	10.4925	31795.	0.00
18.6000	-8.05E-04	1714.	-198.173	-5.24E-06	0.00	1.84E+11	10.7752	32141.	0.00
18.8000	-8.17E-04	1270.	-171.969	-5.22E-06	0.00	1.84E+11	11.0609	32486.	0.00
19.0000	-8.30E-04	889.1318	-145.077	-5.20E-06	0.00	1.84E+11	11.3496	32832.	0.00
19.2000	-8.42E-04	573.7730	-117.487	-5.19E-06	0.00	1.84E+11	11.6416	33178.	0.00
19.4000	-8.55E-04	325.4696	-89.193	-5.19E-06	0.00	1.84E+11	11.9369	33523.	0.00
19.6000	-8.67E-04	145.9224	-60.186	-5.19E-06	0.00	1.84E+11	12.2356	33869.	0.00
19.8000	-8.79E-04	36.8522	-30.458	-5.18E-06	0.00	1.84E+11	12.5379	34214.	0.00
20.0000	-8.92E-04	0.00	0.00	-5.18E-06	0.00	1.84E+11	12.8437	17280.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.00576823 inches
Computed slope at pile head      =     -0.0000778 radians
Maximum bending moment           =        102118. inch-lbs
Maximum shear force              =   -705.9576778 lbs
Depth of maximum bending moment  =     1.80000000 feet below pile head
Depth of maximum shear force     =    11.00000000 feet below pile head
Number of iterations             =              9
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 253. lbs
Moment = 99208. in-lbs
Axial Load = 11061. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.00000	0.00576823	102118.	-705.9576778
19.00000	0.00600953	102076.	-744.2669468
18.00000	0.00637505	102027.	-791.0604728
17.00000	0.00691150	101954.	-846.5550992
16.00000	0.00768559	101861.	-910.9521412
15.00000	0.00873867	101763.	-983.5984637
14.00000	0.01033952	101635.	-1069.
13.00000	0.01263409	101492.	-1169.
12.00000	0.01612732	101331.	-1288.
11.00000	0.02155338	101158.	-1433.
10.00000	0.03049620	100976.	-1614.
9.00000	0.04646334	100788.	-1852.
8.00000	0.07797469	100606.	-2174.
7.00000	0.14880934	100463.	-2637.
6.00000	0.38356765	100479.	-3378.
5.00000	1.94778433	102306.	-4900.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 1264.0 lbs
Applied moment at pile head = 496038.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.04118	496038.	1264.	-4.80E-04	0.00	1.83E+11	-19.645	572.4659	0.00
0.2000	0.04004	499028.	1216.	-4.73E-04	0.00	1.83E+11	-20.240	1213.	0.00
0.4000	0.03891	501901.	1167.	-4.67E-04	0.00	1.83E+11	-20.820	1284.	0.00
0.6000	0.03780	504653.	1116.	-4.60E-04	0.00	1.83E+11	-21.383	1358.	0.00

0.8000	0.03670	507283.	1064.	-4.53E-04	0.00	1.83E+11	-21.931	1434.	0.00
1.0000	0.03562	509786.	1011.	-4.47E-04	0.00	1.83E+11	-22.462	1513.	0.00
1.2000	0.03456	512159.	956.4478	-4.40E-04	0.00	1.83E+11	-22.977	1596.	0.00
1.4000	0.03351	514400.	900.7034	-4.33E-04	0.00	1.83E+11	-23.476	1681.	0.00
1.6000	0.03248	516506.	843.7809	-4.26E-04	0.00	1.83E+11	-23.959	1771.	0.00
1.8000	0.03146	518473.	785.7201	-4.20E-04	0.00	1.83E+11	-24.425	1863.	0.00
2.0000	0.03046	520299.	726.5607	-4.13E-04	0.00	1.83E+11	-24.874	1960.	0.00
2.2000	0.02948	521982.	666.3429	-4.06E-04	0.00	1.83E+11	-25.307	2060.	0.00
2.4000	0.02851	523519.	605.1071	-3.99E-04	0.00	1.83E+11	-25.723	2165.	0.00
2.6000	0.02756	524908.	542.8942	-3.92E-04	0.00	1.83E+11	-26.121	2274.	0.00
2.8000	0.02663	526146.	479.7453	-3.85E-04	0.00	1.83E+11	-26.503	2388.	0.00
3.0000	0.02571	527231.	415.7017	-3.78E-04	0.00	1.83E+11	-26.867	2508.	0.00
3.2000	0.02481	528162.	350.8054	-3.72E-04	0.00	1.83E+11	-27.213	2632.	0.00
3.4000	0.02393	528935.	285.0984	-3.65E-04	0.00	1.83E+11	-27.542	2762.	0.00
3.6000	0.02306	529549.	180.3089	-3.58E-04	0.00	1.83E+11	-59.782	6221.	0.00
3.8000	0.02221	529819.	35.6370	-3.51E-04	0.00	1.83E+11	-60.778	6566.	0.00
4.0000	0.02138	529739.	-111.188	-3.44E-04	0.00	1.83E+11	-61.576	6912.	0.00
4.2000	0.02056	529304.	-259.702	-3.37E-04	0.00	1.83E+11	-62.186	7258.	0.00
4.4000	0.01976	528510.	-409.460	-3.30E-04	0.00	1.83E+11	-62.613	7603.	0.00
4.6000	0.01898	527356.	-560.032	-3.23E-04	0.00	1.83E+11	-62.864	7949.	0.00
4.8000	0.01821	525839.	-711.006	-3.16E-04	0.00	1.83E+11	-62.948	8294.	0.00
5.0000	0.01746	523960.	-861.987	-3.09E-04	0.00	1.83E+11	-62.870	8640.	0.00
5.2000	0.01673	521718.	-1013.	-3.02E-04	0.00	1.83E+11	-62.638	8986.	0.00
5.4000	0.01601	519116.	-1162.	-2.95E-04	0.00	1.83E+11	-62.258	9331.	0.00
5.6000	0.01531	516154.	-1311.	-2.89E-04	0.00	1.83E+11	-61.738	9677.	0.00
5.8000	0.01463	512837.	-1459.	-2.82E-04	0.00	1.83E+11	-61.084	10022.	0.00
6.0000	0.01396	509168.	-1604.	-2.75E-04	0.00	1.83E+11	-60.303	10368.	0.00
6.2000	0.01331	505151.	-1748.	-2.69E-04	0.00	1.83E+11	-59.401	10714.	0.00
6.4000	0.01267	500792.	-1889.	-2.62E-04	0.00	1.83E+11	-58.384	11059.	0.00
6.6000	0.01205	496096.	-2028.	-2.55E-04	0.00	1.83E+11	-57.259	11405.	0.00
6.8000	0.01144	491070.	-2164.	-2.49E-04	0.00	1.83E+11	-56.031	11750.	0.00
7.0000	0.01085	485722.	-2297.	-2.42E-04	0.00	1.83E+11	-54.708	12096.	0.00
7.2000	0.01028	480058.	-2427.	-2.36E-04	0.00	1.83E+11	-53.293	12442.	0.00
7.4000	0.00972	474087.	-2553.	-2.30E-04	0.00	1.83E+11	-51.794	12787.	0.00
7.6000	0.00918	467818.	-2675.	-2.24E-04	0.00	1.83E+11	-50.215	13133.	0.00
7.8000	0.00865	461259.	-2794.	-2.18E-04	0.00	1.83E+11	-48.563	13478.	0.00
8.0000	0.00813	454420.	-2908.	-2.12E-04	0.00	1.83E+11	-46.841	13824.	0.00
8.2000	0.00763	447311.	-3018.	-2.06E-04	0.00	1.83E+11	-45.056	14170.	0.00
8.4000	0.00714	439943.	-3124.	-2.00E-04	0.00	1.83E+11	-43.211	14515.	0.00
8.6000	0.00667	432326.	-3226.	-1.94E-04	0.00	1.83E+11	-41.312	14861.	0.00
8.8000	0.00621	424470.	-3322.	-1.89E-04	0.00	1.83E+11	-39.363	15206.	0.00
9.0000	0.00577	416388.	-3415.	-1.83E-04	0.00	1.83E+11	-37.368	15552.	0.00
9.2000	0.00533	408090.	-3502.	-1.78E-04	0.00	1.83E+11	-35.331	15898.	0.00
9.4000	0.00491	399589.	-3584.	-1.72E-04	0.00	1.83E+11	-33.257	16243.	0.00
9.6000	0.00451	390895.	-3661.	-1.67E-04	0.00	1.83E+11	-31.149	16589.	0.00
9.8000	0.00411	382023.	-3734.	-1.62E-04	0.00	1.83E+11	-29.010	16934.	0.00
10.0000	0.00373	372983.	-3801.	-1.57E-04	0.00	1.83E+11	-26.844	17280.	0.00
10.2000	0.00336	363788.	-3862.	-1.52E-04	0.00	1.83E+11	-24.654	17626.	0.00
10.4000	0.00300	354451.	-3919.	-1.48E-04	0.00	1.83E+11	-22.442	17971.	0.00
10.6000	0.00265	344985.	-3970.	-1.43E-04	0.00	1.83E+11	-20.212	18317.	0.00
10.8000	0.00231	335402.	-4016.	-1.39E-04	0.00	1.83E+11	-17.965	18662.	0.00
11.0000	0.00198	325716.	-4056.	-1.34E-04	0.00	1.83E+11	-15.705	19008.	0.00
11.2000	0.00167	315939.	-4091.	-1.30E-04	0.00	1.83E+11	-13.433	19354.	0.00
11.4000	0.00136	306085.	-4121.	-1.26E-04	0.00	1.83E+11	-11.152	19699.	0.00

11.6000	0.00106	296166.	-4145.	-1.22E-04	0.00	1.83E+11	-8.862	20045.	0.00
11.8000	7.73E-04	286196.	-4163.	-1.18E-04	0.00	1.83E+11	-6.565	20390.	0.00
12.0000	4.93E-04	276188.	-4176.	-1.15E-04	0.00	1.83E+11	-4.263	20736.	0.00
12.2000	2.23E-04	266156.	-4184.	-1.11E-04	0.00	1.83E+11	-1.957	21082.	0.00
12.4000	-3.95E-05	256112.	-4186.	-1.08E-04	0.00	1.83E+11	0.3523	21427.	0.00
12.6000	-2.94E-04	246070.	-4182.	-1.04E-04	0.00	1.84E+11	2.6643	21773.	0.00
12.8000	-5.40E-04	236044.	-4173.	-1.01E-04	0.00	1.84E+11	4.9784	22118.	0.00
13.0000	-7.79E-04	226046.	-4158.	-9.81E-05	0.00	1.84E+11	7.2941	22464.	0.00
13.2000	-0.00101	216090.	-4138.	-9.53E-05	0.00	1.84E+11	9.6113	22810.	0.00
13.4000	-0.00124	206189.	-4112.	-9.25E-05	0.00	1.84E+11	11.9299	23155.	0.00
13.6000	-0.00146	196357.	-4081.	-8.99E-05	0.00	1.84E+11	14.2500	23501.	0.00
13.8000	-0.00167	186607.	-4044.	-8.74E-05	0.00	1.84E+11	16.5719	23846.	0.00
14.0000	-0.00187	176952.	-4001.	-8.50E-05	0.00	1.84E+11	18.8960	24192.	0.00
14.2000	-0.00208	167406.	-3953.	-8.27E-05	0.00	1.84E+11	21.2228	24538.	0.00
14.4000	-0.00227	157982.	-3899.	-8.06E-05	0.00	1.84E+11	23.5532	24883.	0.00
14.6000	-0.00246	148694.	-3840.	-7.86E-05	0.00	1.84E+11	25.8879	25229.	0.00
14.8000	-0.00265	139555.	-3775.	-7.67E-05	0.00	1.84E+11	28.2278	25574.	0.00
15.0000	-0.00283	130578.	-3704.	-7.50E-05	0.00	1.84E+11	30.5742	25920.	0.00
15.2000	-0.00301	121778.	-3628.	-7.33E-05	0.00	1.84E+11	32.9281	26266.	0.00
15.4000	-0.00318	113167.	-3546.	-7.18E-05	0.00	1.84E+11	35.2908	26611.	0.00
15.6000	-0.00335	104759.	-3459.	-7.03E-05	0.00	1.84E+11	37.6638	26957.	0.00
15.8000	-0.00352	96569.	-3366.	-6.90E-05	0.00	1.84E+11	40.0485	27302.	0.00
16.0000	-0.00368	88609.	-3267.	-6.78E-05	0.00	1.84E+11	42.4464	27648.	0.00
16.2000	-0.00385	80893.	-3162.	-6.67E-05	0.00	1.84E+11	44.8591	27994.	0.00
16.4000	-0.00400	73436.	-3051.	-6.57E-05	0.00	1.84E+11	47.2884	28339.	0.00
16.6000	-0.00416	66251.	-2935.	-6.48E-05	0.00	1.84E+11	49.7359	28685.	0.00
16.8000	-0.00432	59352.	-2812.	-6.40E-05	0.00	1.84E+11	52.2033	29030.	0.00
17.0000	-0.00447	52755.	-2684.	-6.32E-05	0.00	1.84E+11	54.6924	29376.	0.00
17.2000	-0.00462	46472.	-2550.	-6.26E-05	0.00	1.84E+11	57.2049	29722.	0.00
17.4000	-0.00477	40518.	-2410.	-6.20E-05	0.00	1.84E+11	59.7427	30067.	0.00
17.6000	-0.00492	34909.	-2263.	-6.15E-05	0.00	1.84E+11	62.3073	30413.	0.00
17.8000	-0.00506	29659.	-2110.	-6.11E-05	0.00	1.84E+11	64.9007	30758.	0.00
18.0000	-0.00521	24783.	-1952.	-6.07E-05	0.00	1.84E+11	67.5243	31104.	0.00
18.2000	-0.00536	20295.	-1786.	-6.04E-05	0.00	1.84E+11	70.1798	31450.	0.00
18.4000	-0.00550	16212.	-1615.	-6.02E-05	0.00	1.84E+11	72.8688	31795.	0.00
18.6000	-0.00564	12548.	-1436.	-6.00E-05	0.00	1.84E+11	75.5926	32141.	0.00
18.8000	-0.00579	9320.	-1252.	-5.99E-05	0.00	1.84E+11	78.3527	32486.	0.00
19.0000	-0.00593	6543.	-1060.	-5.98E-05	0.00	1.84E+11	81.1502	32832.	0.00
19.2000	-0.00608	4233.	-862.155	-5.97E-05	0.00	1.84E+11	83.9862	33178.	0.00
19.4000	-0.00622	2408.	-657.137	-5.97E-05	0.00	1.84E+11	86.8617	33523.	0.00
19.6000	-0.00636	1082.	-445.171	-5.96E-05	0.00	1.84E+11	89.7773	33869.	0.00
19.8000	-0.00650	274.1226	-226.158	-5.96E-05	0.00	1.84E+11	92.7336	34214.	0.00
20.0000	-0.00665	0.00	0.00	-5.96E-05	0.00	1.84E+11	95.7311	17280.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

```
Output Summary for Load Case No. 2:
Pile-head deflection             =     0.04118045 inches
Computed slope at pile head      =     -0.0004797 radians
Maximum bending moment           =        529819. inch-lbs
Maximum shear force              =         -4186. lbs
Depth of maximum bending moment  =     3.80000000 feet below pile head
Depth of maximum shear force     =    12.40000000 feet below pile head
Number of iterations             =              7
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment
Shear = 1264. lbs
Moment = 496038. in-lbs
Axial Load = 11061. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.00000	0.04118045	529819.	-4186.
19.00000	0.04337397	529381.	-4456.
18.00000	0.04646790	528771.	-4764.
17.00000	0.05079144	527974.	-5110.
16.00000	0.05680554	526994.	-5495.
15.00000	0.06622424	525881.	-5969.
14.00000	0.07820249	524535.	-6464.
13.00000	0.09700102	522874.	-7085.
12.00000	0.13175187	520706.	-7958.
11.00000	0.19934904	518122.	-9053.
10.00000	0.35270698	515172.	-10467.
9.00000	0.73376155	512510.	-12277.
8.00000	1.83876300	511372.	-14752.

Summary of Pile-head Responses for Conventional Analyses

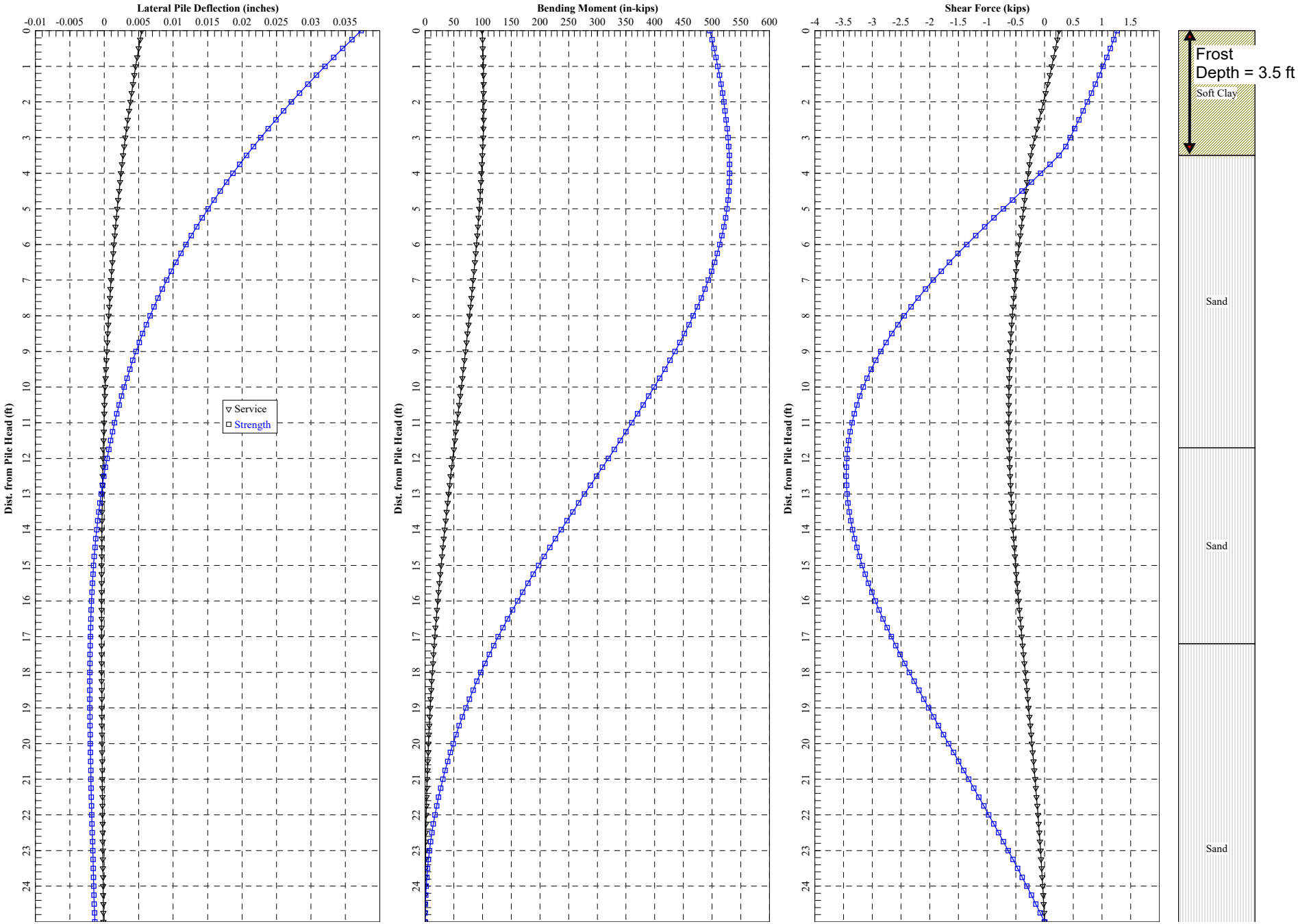
Definitions of Pile-head Loading Conditions:
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	253.0000	M, in-lb	99208.	11061.	0.00577	-7.78E-05	-705.958	102118.
2	V, lb	1264.	M, in-lb	496038.	11061.	0.04118	-4.80E-04	-4186.	529819.

Maximum pile-head deflection = 0.0411804524 inches
Maximum pile-head rotation = -0.0004797068 radians = -0.027485 deg.

The analysis ended normally.

CCTV Foundation: 25-ft long drilled shaft (30-inch Diameter)



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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App L CCTV Profile & LPile\CCTV Pole LPile\

Name of input data file:
CCTV Drilled Shaft 25ft.lp12d

Name of output report file:
CCTV Drilled Shaft 25ft.lp12o

Name of plot output file:
CCTV Drilled Shaft 25ft.lp12p

Name of runtime message file:
CCTV Drilled Shaft 25ft.lp12r

Date and Time of Analysis

Date: June 12, 2026 Time: 11:37:29

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Rakam Tamang, P.E.
Description: CCTV Pole at Sta 197+35, 125 ft Lt (Drilled Shaft)

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	1
Total length of pile	=	25.000 ft
Depth of ground surface below top of pile	=	0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	30.0000
2	25.000	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 25.000000 ft
Shaft Diameter = 30.000000 in

Ground Slope and Pile Batter Angles

Ground Slope Angle = 11.300 degrees
= 0.197 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 6 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 0.0000 ft
Distance from top of pile to bottom of layer = 3.500000 ft
Effective unit weight at top of layer = 100.000000 pcf
Effective unit weight at bottom of layer = 100.000000 pcf
Undrained cohesion at top of layer = 250.000000 psf
Undrained cohesion at bottom of layer = 250.000000 psf
Epsilon-50 at top of layer = 0.020000
Epsilon-50 at bottom of layer = 0.020000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 3.500000 ft
Distance from top of pile to bottom of layer = 11.700000 ft
Effective unit weight at top of layer = 62.600000 pcf
Effective unit weight at bottom of layer = 62.600000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 60.000000 pci
Subgrade k at bottom of layer = 60.000000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	11.700000 ft
Distance from top of pile to bottom of layer	=	17.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	28.000000 deg.
Friction angle at bottom of layer	=	28.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.200000 ft
Distance from top of pile to bottom of layer	=	28.700000 ft
Effective unit weight at top of layer	=	65.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	30.000000 deg.
Friction angle at bottom of layer	=	30.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	28.700000 ft
Distance from top of pile to bottom of layer	=	34.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 6 is stiff clay without free water

Distance from top of pile to top of layer	=	34.200000 ft
Distance from top of pile to bottom of layer	=	50.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

(Depth of the lowest soil layer extends 25.200 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft Clay	0.00 3.5000	100.0000 100.0000	250.0000 250.0000	-- --	0.02000 0.02000	-- --
2	Sand (Reese, et al.)	3.5000 11.7000	62.6000 62.6000	-- --	30.0000 30.0000	-- --	60.0000 60.0000
3	Sand (Reese, et al.)	11.7000 17.2000	62.6000 62.6000	-- --	28.0000 28.0000	-- --	60.0000 60.0000
4	Sand (Reese, et al.)	17.2000 28.7000	65.6000 62.6000	-- --	30.0000 30.0000	-- --	60.0000 60.0000
5	Stiff Clay w/o Free Water	28.7000 34.2000	62.6000 62.6000	2500. 2500.	-- --	0.00500 0.00500	-- --
6	Stiff Clay w/o Free Water	34.2000 50.2000	62.6000 62.6000	2500. 2500.	-- --	0.00500 0.00500	-- --

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 253.000000 lbs	M = 99208. in-lbs	11061.	Yes	Yes
2	1	V = 1264. lbs	M = 496038. in-lbs	11061.	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	25.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of long. rebar)	=	3.000000 in
Number of Reinforcing Bars	=	12 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	9.480000 sq. in.
Area Ratio of Steel Reinforcement	=	1.34 percent
Edge-to-Edge Bar Spacing	=	4.952838 in
Maximum Concrete Aggregate Size	=	0.750000 in
Ratio of Bar Spacing to Aggregate Size	=	6.60
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	2939.886 kips
Tensile Load for Cracking of Concrete	=	-321.764 kips
Nominal Axial Tensile Capacity	=	-568.800 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.000000	0.790000	11.500000	0.00000
2	1.000000	0.790000	9.959292	5.750000
3	1.000000	0.790000	5.750000	9.959292
4	1.000000	0.790000	0.00000	11.500000
5	1.000000	0.790000	-5.75000	9.959292
6	1.000000	0.790000	-9.95929	5.750000
7	1.000000	0.790000	-11.50000	0.00000
8	1.000000	0.790000	-9.95929	-5.75000
9	1.000000	0.790000	-5.75000	-9.95929
10	1.000000	0.790000	0.00000	-11.50000
11	1.000000	0.790000	5.750000	-9.95929
12	1.000000	0.790000	9.959292	-5.75000

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 4.953 inches
between bars 7 and 8.
Ratio of bar spacing to maximum aggregate size = 6.60

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.34165 psi
Compression Strain at Peak Stress	=	0.001886
Tensile Strain at Fracture of Concrete	=	-0.0001154
Maximum Coarse Aggregate Size	=	0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	11.061

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-14, Section 21.2.3.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 11.061 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	229.4723749	183577900.	17.7482147	0.00002219	-0.00001531	0.0927523	0.5291853	
0.00000250	457.6017855	183040714.	16.3794516	0.00004095	-0.00003405	0.1702290	0.9591352	
0.00000375	684.3298991	182487973.	15.9232451	0.00005971	-0.00005279	0.2469306	1.3890904	
0.00000500	909.6564592	181931292.	15.6951668	0.00007848	-0.00007152	0.3228569	1.8190492	
0.00000625	1134.	181373029.	15.5583381	0.00009724	-0.00009026	0.3980077	2.2490113	
0.00000750	1356.	180813975.	15.4671341	0.0001160	-0.000109	0.4723831	2.6789767	
0.00000875	1356.	154983407.	9.1815291	0.00008034	-0.000182	0.3281415	-4.559499	C
0.00001000	1356.	135610481.	9.0304255	0.00009030	-0.000210	0.3677683	-5.254677	C
0.00001125	1356.	120542650.	8.9128051	0.0001003	-0.000237	0.4071758	-5.949885	C
0.00001250	1356.	108488385.	8.8182820	0.0001102	-0.000265	0.4463471	-6.645248	C
0.00001375	1356.	98625805.	8.7397597	0.0001202	-0.000292	0.4852388	-7.341083	C
0.00001500	1356.	90406988.	8.6748666	0.0001301	-0.000320	0.5239487	-8.036683	C

0.00001625	1356.	83452604.	8.6204595	0.0001401	-0.000347	0.5624764	-8.732046 C
0.00001750	1356.	77491704.	8.5742934	0.0001501	-0.000375	0.6008214	-9.427171 C
0.00001875	1356.	72325590.	8.5341545	0.0001600	-0.000402	0.6389420	-10.122366 C
0.00002000	1356.	67805241.	8.4986692	0.0001700	-0.000430	0.6768195	-10.817772 C
0.00002125	1356.	63816697.	8.4677599	0.0001799	-0.000458	0.7145151	-11.512930 C
0.00002250	1356.	60271325.	8.4406655	0.0001899	-0.000485	0.7520285	-12.207841 C
0.00002375	1356.	57099150.	8.4167854	0.0001999	-0.000513	0.7893591	-12.902501 C
0.00002500	1356.	54244193.	8.3956389	0.0002099	-0.000540	0.8265066	-13.596912 C
0.00002625	1356.	51661136.	8.3768370	0.0002199	-0.000568	0.8634706	-14.291070 C
0.00002750	1356.	49312902.	8.3600613	0.0002299	-0.000595	0.9002505	-14.984976 C
0.00002875	1356.	47168863.	8.3450489	0.0002399	-0.000623	0.9368461	-15.678628 C
0.00003000	1356.	45203494.	8.3315808	0.0002499	-0.000650	0.9732568	-16.372025 C
0.00003125	1356.	43395354.	8.3194728	0.0002600	-0.000678	1.0094821	-17.065165 C
0.00003250	1406.	43255437.	8.3085694	0.0002700	-0.000705	1.0455218	-17.758048 C
0.00003375	1456.	43148288.	8.2987378	0.0002801	-0.000732	1.0813753	-18.450673 C
0.00003500	1507.	43047525.	8.2898643	0.0002901	-0.000760	1.1170421	-19.143038 C
0.00003625	1557.	42952482.	8.2818511	0.0003002	-0.000787	1.1525219	-19.835141 C
0.00003750	1607.	42862583.	8.2746131	0.0003103	-0.000815	1.1878141	-20.526983 C
0.00003875	1658.	42777325.	8.2680765	0.0003204	-0.000842	1.2229184	-21.218561 C
0.00004000	1708.	42696269.	8.2621765	0.0003305	-0.000870	1.2578342	-21.909875 C
0.00004125	1758.	42619028.	8.2568563	0.0003406	-0.000897	1.2925611	-22.600923 C
0.00004250	1808.	42545262.	8.2520658	0.0003507	-0.000924	1.3270987	-23.291704 C
0.00004375	1858.	42474656.	8.2476723	0.0003608	-0.000952	1.3614331	-23.982328 C
0.00004500	1908.	42406948.	8.2436605	0.0003710	-0.000979	1.3955668	-24.672773 C
0.00004625	1958.	42341907.	8.2400749	0.0003811	-0.001006	1.4295112	-25.362937 C
0.00004750	2008.	42279321.	8.2368830	0.0003913	-0.001034	1.4632658	-26.052819 C
0.00004875	2058.	42218995.	8.2340554	0.0004014	-0.001061	1.4968301	-26.742417 C
0.00005125	2158.	42104448.	8.2293904	0.0004218	-0.001116	1.5633859	-28.120756 C
0.00005375	2257.	41997069.	8.2258984	0.0004421	-0.001170	1.6291747	-29.497943 C
0.00005625	2357.	41895874.	8.2234301	0.0004626	-0.001225	1.6941923	-30.873967 C
0.00005875	2456.	41800045.	8.2218618	0.0004830	-0.001279	1.7584347	-32.248815 C
0.00006125	2555.	41708897.	8.2210901	0.0005035	-0.001334	1.8218975	-33.622476 C
0.00006375	2653.	41621852.	8.2210280	0.0005241	-0.001388	1.8845767	-34.994937 C
0.00006625	2752.	41538420.	8.2216017	0.0005447	-0.001443	1.9464679	-36.366185 C
0.00006875	2850.	41458180.	8.2227483	0.0005653	-0.001497	2.0075667	-37.736208 C
0.00007125	2948.	41380771.	8.2244137	0.0005860	-0.001552	2.0678687	-39.104992 C
0.00007375	3046.	41305880.	8.2265516	0.0006067	-0.001606	2.1273693	-40.472525 C
0.00007625	3144.	41233234.	8.2291215	0.0006275	-0.001660	2.1860639	-41.838792 C
0.00007875	3242.	41162596.	8.2320883	0.0006483	-0.001714	2.2439480	-43.203781 C
0.00008125	3339.	41093755.	8.2354214	0.0006691	-0.001768	2.3010167	-44.567476 C
0.00008375	3436.	41026528.	8.2390940	0.0006900	-0.001822	2.3572653	-45.929863 C
0.00008625	3533.	40960751.	8.2430824	0.0007110	-0.001877	2.4126889	-47.290928 C
0.00008875	3630.	40896277.	8.2473656	0.0007320	-0.001931	2.4672825	-48.650655 C
0.00009125	3726.	40832988.	8.2518476	0.0007530	-0.001985	2.5210227	-50.009235 C
0.00009375	3822.	40770776.	8.2564718	0.0007740	-0.002038	2.5738945	-51.366780 C
0.00009625	3918.	40709524.	8.2613301	0.0007952	-0.002092	2.6259174	-52.723000 C
0.00009875	4014.	40649137.	8.2664099	0.0008163	-0.002146	2.6770863	-54.077881 C
0.0001013	4110.	40589530.	8.2717001	0.0008375	-0.002200	2.7273960	-55.431408 C
0.0001038	4205.	40530625.	8.2771906	0.0008588	-0.002254	2.7768413	-56.783565 C
0.0001063	4300.	40472351.	8.2828724	0.0008801	-0.002307	2.8254166	-58.134337 C
0.0001088	4395.	40414644.	8.2887374	0.0009014	-0.002361	2.8731167	-59.483707 C
0.0001113	4490.	40357416.	8.2947766	0.0009228	-0.002415	2.9199353	-60.000000 CY
0.0001138	4579.	40252154.	8.2977175	0.0009439	-0.002469	2.9650655	-60.000000 CY
0.0001163	4659.	40073391.	8.2956984	0.0009644	-0.002523	3.0080462	-60.000000 CY
0.0001188	4734.	39865459.	8.2916731	0.0009846	-0.002578	3.0496021	-60.000000 CY

0.0001213	4809.	39661678.	8.2879579	0.0010049	-0.002633	3.0903042	-60.000000 CY
0.0001238	4875.	39392078.	8.2793233	0.0010246	-0.002688	3.1288743	-60.000000 CY
0.0001263	4926.	39019647.	8.2627799	0.0010432	-0.002744	3.1645912	-60.000000 CY
0.0001288	4968.	38586252.	8.2409589	0.0010610	-0.002801	3.1981137	-60.000000 CY
0.0001313	5008.	38154972.	8.2185190	0.0010787	-0.002859	3.2305958	-60.000000 CY
0.0001338	5048.	37739069.	8.1971444	0.0010964	-0.002916	3.2624615	-60.000000 CY
0.0001363	5087.	37337692.	8.1767784	0.0011141	-0.002973	3.2937077	-60.000000 CY
0.0001388	5127.	36950048.	8.1573683	0.0011318	-0.003031	3.3243314	-60.000000 CY
0.0001413	5166.	36575405.	8.1388653	0.0011496	-0.003088	3.3543293	-60.000000 CY
0.0001438	5206.	36213077.	8.1212238	0.0011674	-0.003145	3.3836982	-60.000000 CY
0.0001463	5245.	35862427.	8.1044017	0.0011853	-0.003202	3.4124350	-60.000000 CY
0.0001488	5284.	35522862.	8.0883595	0.0012031	-0.003259	3.4405363	-60.000000 CY
0.0001588	5438.	34253857.	8.0301163	0.0012748	-0.003488	3.5462539	-60.000000 CY
0.0001688	5536.	32806087.	7.9465388	0.0013410	-0.003722	3.6339647	-60.000000 CY
0.0001788	5598.	31317772.	7.8477481	0.0014028	-0.003960	3.7072477	-60.000000 CY
0.0001888	5659.	29982490.	7.7614374	0.0014650	-0.004198	3.7727375	-60.000000 CY
0.0001988	5719.	28777012.	7.6857755	0.0015275	-0.004435	3.8302877	-60.000000 CY
0.0002088	5778.	27681105.	7.6173631	0.0015901	-0.004672	3.8794506	-60.000000 CY
0.0002188	5836.	26679664.	7.5550980	0.0016527	-0.004910	3.9202118	-60.000000 CY
0.0002288	5893.	25761681.	7.5001504	0.0017157	-0.005147	3.9527896	-60.000000 CY
0.0002388	5949.	24916542.	7.4516607	0.0017791	-0.005383	3.9770110	-60.000000 CY
0.0002488	6004.	24135337.	7.4089116	0.0018430	-0.005620	3.9926936	-60.000000 CY
0.0002588	6056.	23405526.	7.3701966	0.0019070	-0.005855	3.9996339	-60.000000 CY
0.0002688	6098.	22691969.	7.3271640	0.0019692	-0.006093	3.9983738	-60.000000 CY
0.0002788	6125.	21973571.	7.2744036	0.0020277	-0.006335	3.9949737	-60.000000 CY
0.0002888	6141.	21268629.	7.2178317	0.0020841	-0.006578	3.9996075	-60.000000 CY
0.0002988	6155.	20601014.	7.1642046	0.0021403	-0.006822	3.9959996	-60.000000 CY
0.0003088	6167.	19975114.	7.1151821	0.0021968	-0.007066	3.9997907	-60.000000 CY
0.0003188	6180.	19386796.	7.0704559	0.0022537	-0.007309	3.9955556	-60.000000 CY
0.0003288	6191.	18832071.	7.0275880	0.0023103	-0.007552	3.9995609	-60.000000 CY
0.0003388	6202.	18307943.	6.9866031	0.0023667	-0.007796	3.9930729	-60.000000 CY
0.0003488	6212.	17812818.	6.9488942	0.0024234	-0.008039	3.9983525	-60.000000 CY
0.0003588	6222.	17344516.	6.9140363	0.0024804	-0.008282	3.9993096	-60.000000 CY
0.0003688	6232.	16900408.	6.8821140	0.0025378	-0.008525	3.9948696	-60.000000 CY
0.0003788	6241.	16479162.	6.8524915	0.0025954	-0.008767	3.9990248	-60.000000 CY
0.0003888	6251.	16078880.	6.8250958	0.0026533	-0.009009	3.9972025	-60.000000 CY
0.0003988	6259.	15697783.	6.7999155	0.0027115	-0.009251	3.9941733	-60.000000 CY
0.0004088	6268.	15334880.	6.7764776	0.0027699	-0.009493	3.9985371	-60.000000 CY
0.0004188	6277.	14988852.	6.7546693	0.0028285	-0.009734	3.9999815	-60.000000 CY
0.0004288	6284.	14657661.	6.7330839	0.0028868	-0.009976	3.9903239	-60.000000 CY
0.0004388	6292.	14341120.	6.7124308	0.0029451	-0.010217	3.9959522	-60.000000 CY
0.0004488	6300.	14038378.	6.6931187	0.0030035	-0.010459	3.9991776	-60.000000 CYT
0.0004588	6307.	13748456.	6.6751406	0.0030622	-0.010700	3.9980758	-60.000000 CYT
0.0004688	6314.	13470346.	6.6586086	0.0031212	-0.010941	3.9885351	-60.000000 CYT
0.0004788	6321.	13203627.	6.6431055	0.0031804	-0.011182	3.9944406	-60.000000 CYT
0.0004888	6328.	12947598.	6.6285754	0.0032397	-0.011423	3.9982466	-60.000000 CYT
0.0004988	6335.	12701607.	6.6149674	0.0032992	-0.011663	3.9999189	-60.000000 CYT
0.0005088	6341.	12464846.	6.6024784	0.0033590	-0.011903	3.9928509	-60.000000 CYT
0.0005188	6348.	12236965.	6.5908379	0.0034190	-0.012144	3.9884553	-60.000000 CYT
0.0005288	6354.	12017542.	6.5799050	0.0034791	-0.012383	3.9940568	-60.000000 CYT
0.0005388	6361.	11806103.	6.5696460	0.0035394	-0.012623	3.9978298	-60.000000 CYT
0.0005488	6367.	11602208.	6.5600296	0.0035998	-0.012863	3.9997465	-60.000000 CYT
0.0006088	6377.	10475977.	6.5408541	0.0039817	-0.014281	3.9999750	-60.000000 CYT

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens. Strain
1	11.061	6299.265	0.00300000	-0.01044435

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.75).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318,
or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor	Nominal Ax. Thrust kips	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	11.061000	6299.	7.189650	4095.	40598988.
1	0.75	11.061000	6299.	8.295750	4724.	39891831.
1	0.90	11.061000	6299.	9.954900	5669.	29779496.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	8859.
2	3.5000	2.7813	No	No	8859.	102420.
3	11.7000	12.2774	Yes	No	111280.	157975.
4	17.2000	16.9227	Yes	No	269254.	464078.
5	28.7000	28.7000	No	No	733332.	0.00
6	34.2000	34.2000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals
for Layer n. Layering correction equivalent depths are computed only
for soil types with both shallow-depth and deep-depth expressions for
peak lateral load transfer. These soil types are soft and stiff clays,
non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 253.0 lbs
Applied moment at pile head = 99208.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.00542	99208.	253.0000	-7.57E-05	0.00	1.84E+11	-10.003	2766.	0.00
0.2500	0.00520	99924.	222.4619	-7.40E-05	0.00	1.84E+11	-10.356	5974.	0.00
0.5000	0.00498	100548.	190.8862	-7.24E-05	0.00	1.84E+11	-10.694	6442.	0.00
0.7500	0.00477	101075.	158.3180	-7.07E-05	0.00	1.84E+11	-11.018	6935.	0.00
1.0000	0.00456	101502.	124.8029	-6.91E-05	0.00	1.84E+11	-11.326	7457.	0.00
1.2500	0.00435	101828.	90.3867	-6.74E-05	0.00	1.84E+11	-11.618	8010.	0.00
1.5000	0.00415	102049.	55.1158	-6.58E-05	0.00	1.84E+11	-11.896	8596.	0.00
1.7500	0.00396	102163.	19.0369	-6.41E-05	0.00	1.84E+11	-12.157	9217.	0.00
2.0000	0.00377	102168.	-17.803	-6.24E-05	0.00	1.84E+11	-12.403	9877.	0.00
2.2500	0.00358	102060.	-55.355	-6.08E-05	0.00	1.84E+11	-12.632	10579.	0.00
2.5000	0.00340	101839.	-93.573	-5.91E-05	0.00	1.84E+11	-12.846	11326.	0.00
2.7500	0.00323	101503.	-132.406	-5.74E-05	0.00	1.84E+11	-13.043	12123.	0.00
3.0000	0.00306	101049.	-171.807	-5.58E-05	0.00	1.84E+11	-13.224	12973.	0.00
3.2500	0.00289	100476.	-211.725	-5.41E-05	0.00	1.84E+11	-13.388	13882.	0.00
3.5000	0.00273	99782.	-242.138	-5.25E-05	0.00	1.84E+11	-6.888	7560.	0.00
3.7500	0.00258	99026.	-262.911	-5.09E-05	0.00	1.84E+11	-6.961	8100.	0.00
4.0000	0.00243	98208.	-283.842	-4.93E-05	0.00	1.84E+11	-6.993	8640.	0.00
4.2500	0.00228	97327.	-304.809	-4.77E-05	0.00	1.84E+11	-6.985	9180.	0.00
4.5000	0.00214	96382.	-325.698	-4.61E-05	0.00	1.84E+11	-6.941	9720.	0.00
4.7500	0.00201	95375.	-346.401	-4.45E-05	0.00	1.84E+11	-6.862	10260.	0.00
5.0000	0.00188	94307.	-366.819	-4.30E-05	0.00	1.84E+11	-6.750	10800.	0.00
5.2500	0.00175	93177.	-386.859	-4.14E-05	0.00	1.84E+11	-6.610	11340.	0.00
5.5000	0.00163	91988.	-406.435	-3.99E-05	0.00	1.84E+11	-6.441	11880.	0.00
5.7500	0.00151	90741.	-425.468	-3.84E-05	0.00	1.84E+11	-6.248	12420.	0.00
6.0000	0.00140	89438.	-443.887	-3.69E-05	0.00	1.84E+11	-6.031	12960.	0.00
6.2500	0.00129	88081.	-461.624	-3.55E-05	0.00	1.84E+11	-5.794	13500.	0.00
6.5000	0.00118	86671.	-478.619	-3.41E-05	0.00	1.84E+11	-5.537	14040.	0.00
6.7500	0.00108	85211.	-494.821	-3.27E-05	0.00	1.84E+11	-5.264	14580.	0.00
7.0000	9.87E-04	83704.	-510.179	-3.13E-05	0.00	1.84E+11	-4.975	15120.	0.00
7.2500	8.95E-04	82152.	-524.653	-2.99E-05	0.00	1.84E+11	-4.674	15660.	0.00
7.5000	8.08E-04	80558.	-538.205	-2.86E-05	0.00	1.84E+11	-4.361	16200.	0.00
7.7500	7.24E-04	78925.	-550.805	-2.73E-05	0.00	1.84E+11	-4.039	16740.	0.00
8.0000	6.44E-04	77255.	-562.426	-2.60E-05	0.00	1.84E+11	-3.709	17280.	0.00
8.2500	5.68E-04	75552.	-573.048	-2.48E-05	0.00	1.84E+11	-3.372	17820.	0.00
8.5000	4.95E-04	73818.	-582.652	-2.35E-05	0.00	1.84E+11	-3.031	18360.	0.00
8.7500	4.26E-04	72058.	-591.228	-2.24E-05	0.00	1.84E+11	-2.686	18900.	0.00
9.0000	3.61E-04	70273.	-598.768	-2.12E-05	0.00	1.84E+11	-2.340	19440.	0.00
9.2500	2.99E-04	68466.	-605.268	-2.01E-05	0.00	1.84E+11	-1.993	19980.	0.00
9.5000	2.41E-04	66642.	-610.728	-1.90E-05	0.00	1.84E+11	-1.647	20520.	0.00
9.7500	1.86E-04	64803.	-615.152	-1.79E-05	0.00	1.84E+11	-1.302	21060.	0.00
10.0000	1.33E-04	62953.	-618.547	-1.68E-05	0.00	1.84E+11	-0.961	21600.	0.00

10.2500	8.45E-05	61093.	-620.924	-1.58E-05	0.00	1.84E+11	-0.624	22140.	0.00
10.5000	3.85E-05	59228.	-622.297	-1.48E-05	0.00	1.84E+11	-0.291	22680.	0.00
10.7500	-4.53E-06	57360.	-622.681	-1.39E-05	0.00	1.84E+11	0.03507	23220.	0.00
11.0000	-4.48E-05	55493.	-622.096	-1.30E-05	0.00	1.84E+11	0.3547	23760.	0.00
11.2500	-8.23E-05	53629.	-620.564	-1.21E-05	0.00	1.84E+11	0.6668	24300.	0.00
11.5000	-1.17E-04	51770.	-618.108	-1.12E-05	0.00	1.84E+11	0.9707	24840.	0.00
11.7500	-1.50E-04	49921.	-614.753	-1.04E-05	0.00	1.84E+11	1.2656	25380.	0.00
12.0000	-1.80E-04	48082.	-610.528	-9.58E-06	0.00	1.84E+11	1.5511	25920.	0.00
12.2500	-2.07E-04	46258.	-605.462	-8.81E-06	0.00	1.84E+11	1.8265	26460.	0.00
12.5000	-2.32E-04	44450.	-599.585	-8.07E-06	0.00	1.84E+11	2.0915	27000.	0.00
12.7500	-2.56E-04	42661.	-592.929	-7.36E-06	0.00	1.84E+11	2.3455	27540.	0.00
13.0000	-2.77E-04	40893.	-585.529	-6.67E-06	0.00	1.84E+11	2.5883	28080.	0.00
13.2500	-2.96E-04	39148.	-577.417	-6.02E-06	0.00	1.84E+11	2.8195	28620.	0.00
13.5000	-3.13E-04	37429.	-568.629	-5.39E-06	0.00	1.84E+11	3.0390	29160.	0.00
13.7500	-3.28E-04	35737.	-559.201	-4.80E-06	0.00	1.84E+11	3.2464	29700.	0.00
14.0000	-3.41E-04	34074.	-549.169	-4.23E-06	0.00	1.84E+11	3.4417	30240.	0.00
14.2500	-3.53E-04	32442.	-538.570	-3.68E-06	0.00	1.84E+11	3.6246	30780.	0.00
14.5000	-3.64E-04	30843.	-527.440	-3.17E-06	0.00	1.84E+11	3.7953	31320.	0.00
14.7500	-3.72E-04	29278.	-515.816	-2.67E-06	0.00	1.84E+11	3.9536	31860.	0.00
15.0000	-3.80E-04	27748.	-503.737	-2.21E-06	0.00	1.84E+11	4.0995	32400.	0.00
15.2500	-3.86E-04	26256.	-491.238	-1.77E-06	0.00	1.84E+11	4.2331	32940.	0.00
15.5000	-3.90E-04	24801.	-478.357	-1.35E-06	0.00	1.84E+11	4.3545	33480.	0.00
15.7500	-3.94E-04	23386.	-465.129	-9.57E-07	0.00	1.84E+11	4.4638	34020.	0.00
16.0000	-3.96E-04	22010.	-451.592	-5.86E-07	0.00	1.84E+11	4.5611	34560.	0.00
16.2500	-3.97E-04	20676.	-437.781	-2.37E-07	0.00	1.84E+11	4.6466	35100.	0.00
16.5000	-3.97E-04	19384.	-423.730	9.04E-08	0.00	1.84E+11	4.7205	35640.	0.00
16.7500	-3.97E-04	18134.	-409.475	3.97E-07	0.00	1.84E+11	4.7830	36180.	0.00
17.0000	-3.95E-04	16927.	-395.049	6.83E-07	0.00	1.84E+11	4.8344	36720.	0.00
17.2500	-3.93E-04	15763.	-380.485	9.51E-07	0.00	1.84E+11	4.8749	37260.	0.00
17.5000	-3.89E-04	14644.	-365.816	1.20E-06	0.00	1.84E+11	4.9047	37800.	0.00
17.7500	-3.85E-04	13568.	-351.072	1.43E-06	0.00	1.84E+11	4.9242	38340.	0.00
18.0000	-3.81E-04	12537.	-336.285	1.64E-06	0.00	1.84E+11	4.9337	38880.	0.00
18.2500	-3.75E-04	11551.	-321.485	1.84E-06	0.00	1.84E+11	4.9334	39420.	0.00
18.5000	-3.70E-04	10608.	-306.699	2.02E-06	0.00	1.84E+11	4.9237	39960.	0.00
18.7500	-3.63E-04	9710.	-291.956	2.19E-06	0.00	1.84E+11	4.9049	40500.	0.00
19.0000	-3.57E-04	8856.	-277.283	2.34E-06	0.00	1.84E+11	4.8773	41040.	0.00
19.2500	-3.49E-04	8046.	-262.705	2.48E-06	0.00	1.84E+11	4.8412	41580.	0.00
19.5000	-3.42E-04	7280.	-248.248	2.60E-06	0.00	1.84E+11	4.7970	42120.	0.00
19.7500	-3.34E-04	6557.	-233.935	2.71E-06	0.00	1.84E+11	4.7450	42660.	0.00
20.0000	-3.25E-04	5876.	-219.789	2.82E-06	0.00	1.84E+11	4.6855	43200.	0.00
20.2500	-3.17E-04	5238.	-205.833	2.91E-06	0.00	1.84E+11	4.6187	43740.	0.00
20.5000	-3.08E-04	4641.	-192.087	2.99E-06	0.00	1.84E+11	4.5451	44280.	0.00
20.7500	-2.99E-04	4085.	-178.572	3.06E-06	0.00	1.84E+11	4.4649	44820.	0.00
21.0000	-2.90E-04	3569.	-165.307	3.12E-06	0.00	1.84E+11	4.3785	45360.	0.00
21.2500	-2.80E-04	3093.	-152.310	3.18E-06	0.00	1.84E+11	4.2859	45900.	0.00
21.5000	-2.71E-04	2655.	-139.600	3.22E-06	0.00	1.84E+11	4.1877	46440.	0.00
21.7500	-2.61E-04	2255.	-127.192	3.26E-06	0.00	1.84E+11	4.0839	46980.	0.00
22.0000	-2.51E-04	1892.	-115.104	3.30E-06	0.00	1.84E+11	3.9749	47520.	0.00
22.2500	-2.41E-04	1564.	-103.350	3.33E-06	0.00	1.84E+11	3.8609	48060.	0.00
22.5000	-2.31E-04	1272.	-91.946	3.35E-06	0.00	1.84E+11	3.7420	48600.	0.00
22.7500	-2.21E-04	1012.	-80.905	3.37E-06	0.00	1.84E+11	3.6186	49140.	0.00
23.0000	-2.11E-04	785.9311	-70.241	3.38E-06	0.00	1.84E+11	3.4906	49680.	0.00
23.2500	-2.01E-04	590.8033	-59.967	3.39E-06	0.00	1.84E+11	3.3584	50220.	0.00
23.5000	-1.90E-04	425.9009	-50.097	3.40E-06	0.00	1.84E+11	3.2220	50760.	0.00
23.7500	-1.80E-04	289.9965	-40.641	3.41E-06	0.00	1.84E+11	3.0816	51300.	0.00

24.0000	-1.70E-04	181.8266	-31.613	3.41E-06	0.00	1.84E+11	2.9373	51840.	0.00
24.2500	-1.60E-04	100.0924	-23.023	3.41E-06	0.00	1.84E+11	2.7891	52380.	0.00
24.5000	-1.50E-04	43.4604	-14.884	3.41E-06	0.00	1.84E+11	2.6372	52920.	0.00
24.7500	-1.39E-04	10.5632	-7.206	3.42E-06	0.00	1.84E+11	2.4816	53460.	0.00
25.0000	-1.29E-04	0.00	0.00	3.42E-06	0.00	1.84E+11	2.3222	27000.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:
Pile-head deflection = 0.00542474 inches
Computed slope at pile head = -0.0000757 radians
Maximum bending moment = 102168. inch-lbs
Maximum shear force = -622.6809831 lbs
Depth of maximum bending moment = 2.00000000 feet below pile head
Depth of maximum shear force = 10.75000000 feet below pile head
Number of iterations = 8
Number of zero deflection points = 1

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 253. lbs
Moment = 99208. in-lbs
Axial Load = 11061. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.00000	0.00542474	102168.	-622.6809831
23.75000	0.00542498	102178.	-630.3777680
22.50000	0.00546805	102166.	-645.1777317
21.25000	0.00557102	102152.	-669.5620717
20.00000	0.00576823	102118.	-705.9576778
18.75000	0.00610648	102063.	-755.7092189
17.50000	0.00665476	101989.	-818.8512200
16.25000	0.00744796	101886.	-893.4024205
15.00000	0.00873867	101763.	-983.5984637
13.75000	0.01081044	101602.	-1092.
12.50000	0.01418379	101414.	-1225.
11.25000	0.02000376	101201.	-1394.
10.00000	0.03078582	100971.	-1617.
8.75000	0.05223196	100742.	-1922.
7.50000	0.10601784	100525.	-2383.
6.25000	0.28452807	100439.	-3154.
5.00000	2.03347740	102416.	-4916.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 1264.0 lbs
Applied moment at pile head = 496038.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.03731	496038.	1264.	-4.55E-04	0.00	1.83E+11	-19.009	764.2118	0.00
0.2500	0.03596	499759.	1206.	-4.47E-04	0.00	1.83E+11	-19.715	1645.	0.00
0.5000	0.03463	503303.	1146.	-4.39E-04	0.00	1.83E+11	-20.396	1767.	0.00
0.7500	0.03332	506663.	1084.	-4.30E-04	0.00	1.83E+11	-21.052	1895.	0.00
1.0000	0.03205	509833.	1019.	-4.22E-04	0.00	1.83E+11	-21.683	2030.	0.00
1.2500	0.03079	512808.	953.5175	-4.14E-04	0.00	1.83E+11	-22.288	2171.	0.00
1.5000	0.02956	515582.	885.7854	-4.05E-04	0.00	1.83E+11	-22.867	2320.	0.00
1.7500	0.02836	518149.	816.3553	-3.97E-04	0.00	1.83E+11	-23.420	2477.	0.00
2.0000	0.02718	520506.	745.3061	-3.88E-04	0.00	1.83E+11	-23.946	2643.	0.00
2.2500	0.02603	522647.	672.7174	-3.80E-04	0.00	1.83E+11	-24.446	2817.	0.00
2.5000	0.02490	524568.	598.6697	-3.71E-04	0.00	1.83E+11	-24.919	3002.	0.00
2.7500	0.02380	526264.	523.2441	-3.63E-04	0.00	1.83E+11	-25.365	3197.	0.00
3.0000	0.02273	527731.	446.5227	-3.54E-04	0.00	1.83E+11	-25.783	3403.	0.00
3.2500	0.02168	528966.	368.5885	-3.45E-04	0.00	1.83E+11	-26.173	3622.	0.00
3.5000	0.02066	529966.	251.2399	-3.37E-04	0.00	1.83E+11	-52.059	7560.	0.00
3.7500	0.01966	530496.	93.5204	-3.28E-04	0.00	1.83E+11	-53.087	8100.	0.00
4.0000	0.01869	530549.	-66.858	-3.19E-04	0.00	1.83E+11	-53.832	8640.	0.00
4.2500	0.01775	530116.	-229.066	-3.10E-04	0.00	1.83E+11	-54.307	9180.	0.00
4.5000	0.01683	529195.	-392.317	-3.02E-04	0.00	1.83E+11	-54.527	9720.	0.00
4.7500	0.01594	527782.	-555.865	-2.93E-04	0.00	1.83E+11	-54.505	10260.	0.00
5.0000	0.01507	525879.	-719.006	-2.84E-04	0.00	1.83E+11	-54.256	10800.	0.00
5.2500	0.01423	523487.	-881.079	-2.76E-04	0.00	1.83E+11	-53.793	11340.	0.00
5.5000	0.01342	520611.	-1041.	-2.67E-04	0.00	1.83E+11	-53.129	11880.	0.00
5.7500	0.01263	517256.	-1200.	-2.59E-04	0.00	1.83E+11	-52.279	12420.	0.00
6.0000	0.01186	513431.	-1355.	-2.50E-04	0.00	1.83E+11	-51.254	12960.	0.00
6.2500	0.01113	509143.	-1507.	-2.42E-04	0.00	1.83E+11	-50.068	13500.	0.00
6.5000	0.01041	504405.	-1655.	-2.34E-04	0.00	1.83E+11	-48.734	14040.	0.00
6.7500	0.00973	499229.	-1799.	-2.25E-04	0.00	1.83E+11	-47.264	14580.	0.00
7.0000	0.00906	493626.	-1938.	-2.17E-04	0.00	1.83E+11	-45.670	15120.	0.00
7.2500	0.00842	487612.	-2073.	-2.09E-04	0.00	1.83E+11	-43.963	15660.	0.00
7.5000	0.00781	481203.	-2202.	-2.01E-04	0.00	1.83E+11	-42.156	16200.	0.00
7.7500	0.00722	474413.	-2326.	-1.93E-04	0.00	1.83E+11	-40.260	16740.	0.00
8.0000	0.00665	467261.	-2444.	-1.86E-04	0.00	1.83E+11	-38.285	17280.	0.00
8.2500	0.00610	459764.	-2555.	-1.78E-04	0.00	1.83E+11	-36.242	17820.	0.00
8.5000	0.00558	451941.	-2661.	-1.71E-04	0.00	1.83E+11	-34.141	18360.	0.00
8.7500	0.00508	443810.	-2760.	-1.63E-04	0.00	1.83E+11	-31.992	18900.	0.00
9.0000	0.00460	435391.	-2853.	-1.56E-04	0.00	1.83E+11	-29.804	19440.	0.00
9.2500	0.00414	426704.	-2939.	-1.49E-04	0.00	1.83E+11	-27.586	19980.	0.00
9.5000	0.00371	417768.	-3018.	-1.42E-04	0.00	1.83E+11	-25.347	20520.	0.00

9.7500	0.00329	408604.	-3091.	-1.35E-04	0.00	1.83E+11	-23.095	21060.	0.00
10.0000	0.00289	399231.	-3157.	-1.29E-04	0.00	1.83E+11	-20.838	21600.	0.00
10.2500	0.00252	389671.	-3216.	-1.22E-04	0.00	1.83E+11	-18.583	22140.	0.00
10.5000	0.00216	379944.	-3268.	-1.16E-04	0.00	1.83E+11	-16.338	22680.	0.00
10.7500	0.00182	370069.	-3314.	-1.10E-04	0.00	1.83E+11	-14.109	23220.	0.00
11.0000	0.00150	360067.	-3353.	-1.04E-04	0.00	1.83E+11	-11.902	23760.	0.00
11.2500	0.00120	349958.	-3385.	-9.79E-05	0.00	1.83E+11	-9.723	24300.	0.00
11.5000	9.15E-04	339761.	-3411.	-9.23E-05	0.00	1.83E+11	-7.577	24840.	0.00
11.7500	6.47E-04	329495.	-3431.	-8.68E-05	0.00	1.83E+11	-5.470	25380.	0.00
12.0000	3.94E-04	319181.	-3444.	-8.15E-05	0.00	1.83E+11	-3.406	25920.	0.00
12.2500	1.58E-04	308835.	-3451.	-7.64E-05	0.00	1.83E+11	-1.390	26460.	0.00
12.5000	-6.39E-05	298477.	-3453.	-7.14E-05	0.00	1.83E+11	0.5751	27000.	0.00
12.7500	-2.71E-04	288123.	-3448.	-6.66E-05	0.00	1.83E+11	2.4854	27540.	0.00
13.0000	-4.63E-04	277792.	-3438.	-6.20E-05	0.00	1.83E+11	4.3379	28080.	0.00
13.2500	-6.43E-04	267500.	-3422.	-5.75E-05	0.00	1.83E+11	6.1297	28620.	0.00
13.5000	-8.08E-04	257263.	-3401.	-5.32E-05	0.00	1.83E+11	7.8584	29160.	0.00
13.7500	-9.62E-04	247096.	-3375.	-4.91E-05	0.00	1.84E+11	9.5218	29700.	0.00
14.0000	-0.00110	237015.	-3344.	-4.51E-05	0.00	1.84E+11	11.1184	30240.	0.00
14.2500	-0.00123	227034.	-3309.	-4.13E-05	0.00	1.84E+11	12.6465	30780.	0.00
14.5000	-0.00135	217167.	-3268.	-3.77E-05	0.00	1.84E+11	14.1050	31320.	0.00
14.7500	-0.00146	207426.	-3224.	-3.42E-05	0.00	1.84E+11	15.4931	31860.	0.00
15.0000	-0.00156	197825.	-3176.	-3.09E-05	0.00	1.84E+11	16.8102	32400.	0.00
15.2500	-0.00164	188375.	-3123.	-2.78E-05	0.00	1.84E+11	18.0560	32940.	0.00
15.5000	-0.00172	179088.	-3067.	-2.48E-05	0.00	1.84E+11	19.2304	33480.	0.00
15.7500	-0.00179	169973.	-3008.	-2.19E-05	0.00	1.84E+11	20.3335	34020.	0.00
16.0000	-0.00185	161041.	-2945.	-1.92E-05	0.00	1.84E+11	21.3658	34560.	0.00
16.2500	-0.00191	152302.	-2880.	-1.67E-05	0.00	1.84E+11	22.3280	35100.	0.00
16.5000	-0.00195	143763.	-2812.	-1.42E-05	0.00	1.84E+11	23.2207	35640.	0.00
16.7500	-0.00199	135433.	-2741.	-1.20E-05	0.00	1.84E+11	24.0451	36180.	0.00
17.0000	-0.00203	127320.	-2667.	-9.81E-06	0.00	1.84E+11	24.8023	36720.	0.00
17.2500	-0.00205	119430.	-2592.	-7.79E-06	0.00	1.84E+11	25.4937	37260.	0.00
17.5000	-0.00207	111769.	-2515.	-5.90E-06	0.00	1.84E+11	26.1208	37800.	0.00
17.7500	-0.00209	104343.	-2435.	-4.14E-06	0.00	1.84E+11	26.6853	38340.	0.00
18.0000	-0.00210	97157.	-2355.	-2.49E-06	0.00	1.84E+11	27.1888	38880.	0.00
18.2500	-0.00210	90216.	-2272.	-9.59E-07	0.00	1.84E+11	27.6333	39420.	0.00
18.5000	-0.00210	83523.	-2189.	4.60E-07	0.00	1.84E+11	28.0207	39960.	0.00
18.7500	-0.00210	77083.	-2104.	1.77E-06	0.00	1.84E+11	28.3531	40500.	0.00
19.0000	-0.00209	70898.	-2019.	2.98E-06	0.00	1.84E+11	28.6325	41040.	0.00
19.2500	-0.00208	64970.	-1933.	4.09E-06	0.00	1.84E+11	28.8612	41580.	0.00
19.5000	-0.00207	59303.	-1846.	5.11E-06	0.00	1.84E+11	29.0413	42120.	0.00
19.7500	-0.00205	53896.	-1758.	6.03E-06	0.00	1.84E+11	29.1751	42660.	0.00
20.0000	-0.00203	48752.	-1671.	6.87E-06	0.00	1.84E+11	29.2648	43200.	0.00
20.2500	-0.00201	43872.	-1583.	7.63E-06	0.00	1.84E+11	29.3126	43740.	0.00
20.5000	-0.00199	39255.	-1495.	8.31E-06	0.00	1.84E+11	29.3209	44280.	0.00
20.7500	-0.00196	34902.	-1407.	8.91E-06	0.00	1.84E+11	29.2917	44820.	0.00
21.0000	-0.00193	30813.	-1319.	9.45E-06	0.00	1.84E+11	29.2274	45360.	0.00
21.2500	-0.00190	26986.	-1232.	9.92E-06	0.00	1.84E+11	29.1301	45900.	0.00
21.5000	-0.00187	23422.	-1144.	1.03E-05	0.00	1.84E+11	29.0017	46440.	0.00
21.7500	-0.00184	20119.	-1058.	1.07E-05	0.00	1.84E+11	28.8445	46980.	0.00
22.0000	-0.00181	17075.	-971.401	1.10E-05	0.00	1.84E+11	28.6602	47520.	0.00
22.2500	-0.00178	14290.	-885.734	1.13E-05	0.00	1.84E+11	28.4508	48060.	0.00
22.5000	-0.00174	11760.	-800.731	1.15E-05	0.00	1.84E+11	28.2181	48600.	0.00
22.7500	-0.00171	9485.	-716.458	1.16E-05	0.00	1.84E+11	27.9636	49140.	0.00
23.0000	-0.00167	7461.	-632.979	1.18E-05	0.00	1.84E+11	27.6889	49680.	0.00
23.2500	-0.00164	5686.	-550.353	1.19E-05	0.00	1.84E+11	27.3955	50220.	0.00

23.5000	-0.00160	4158.	-468.633	1.20E-05	0.00	1.84E+11	27.0846	50760.	0.00
23.7500	-0.00156	2873.	-387.870	1.20E-05	0.00	1.84E+11	26.7573	51300.	0.00
24.0000	-0.00153	1830.	-308.112	1.21E-05	0.00	1.84E+11	26.4146	51840.	0.00
24.2500	-0.00149	1024.	-229.404	1.21E-05	0.00	1.84E+11	26.0573	52380.	0.00
24.5000	-0.00146	452.6491	-151.789	1.21E-05	0.00	1.84E+11	25.6861	52920.	0.00
24.7500	-0.00142	112.4680	-75.308	1.21E-05	0.00	1.84E+11	25.3015	53460.	0.00
25.0000	-0.00138	0.00	0.00	1.21E-05	0.00	1.84E+11	24.9037	27000.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.03731031 inches
Computed slope at pile head      =     -0.0004551 radians
Maximum bending moment           =        530549. inch-lbs
Maximum shear force              =         -3453. lbs
Depth of maximum bending moment  =     4.00000000 feet below pile head
Depth of maximum shear force     =    12.50000000 feet below pile head
Number of iterations             =              7
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           1264. lbs
Moment     =         496038. in-lbs
Axial Load =          11061. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.00000	0.03731031	530549.	-3453.
23.75000	0.03771038	530545.	-3546.
22.50000	0.03836222	530460.	-3695.
21.25000	0.03943843	530230.	-3908.
20.00000	0.04118045	529819.	-4186.
18.75000	0.04392403	529194.	-4523.
17.50000	0.04814566	528329.	-4918.
16.25000	0.05530798	527275.	-5404.
15.00000	0.06622424	525881.	-5969.
13.75000	0.08303967	524054.	-6635.
12.50000	0.10993848	521973.	-7447.
11.25000	0.18052831	518702.	-8796.
10.00000	0.36602130	514997.	-10554.
8.75000	0.90097801	512019.	-12803.
7.50000	3.34111717	512696.	-16651.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

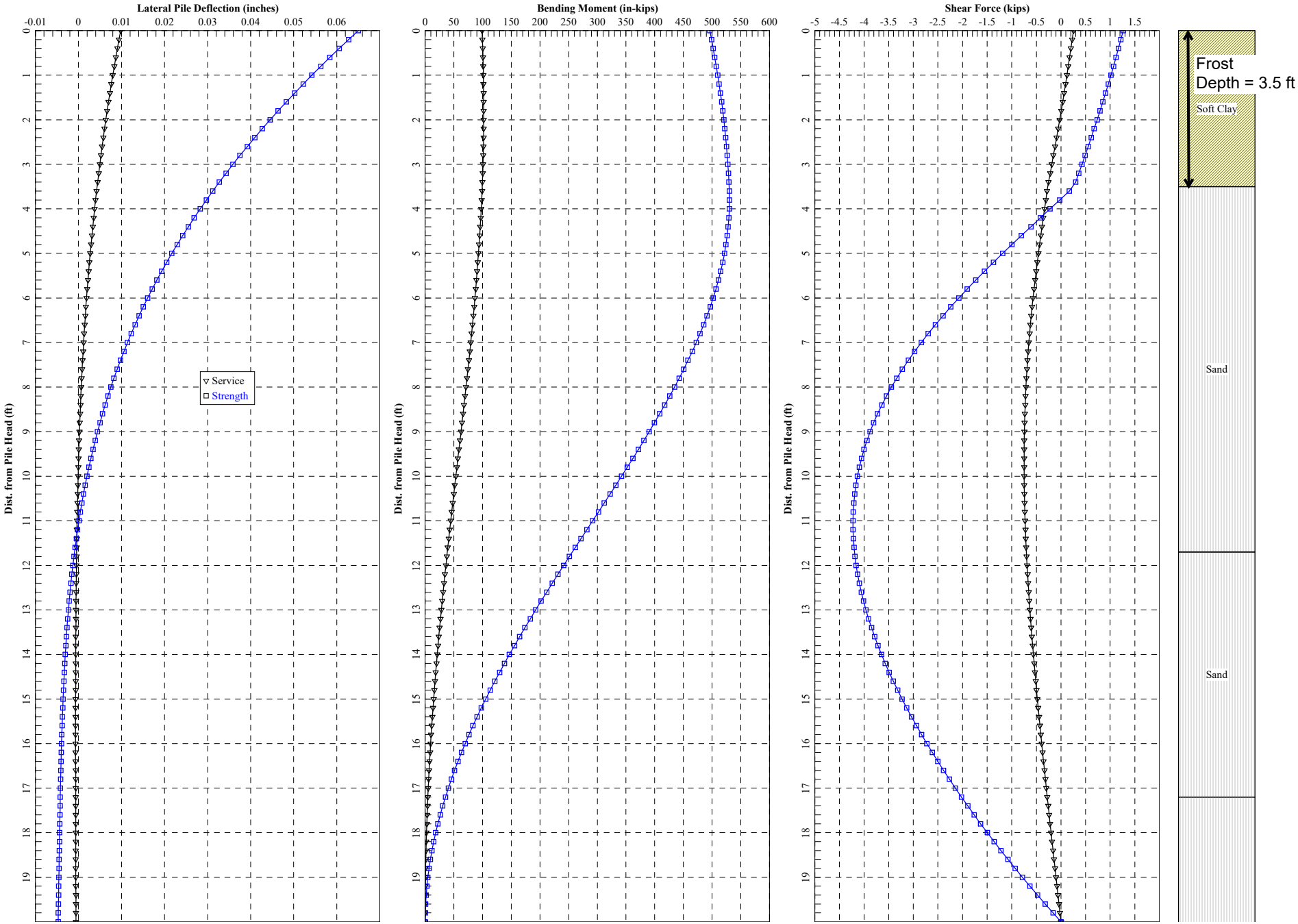
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	253.0000	M, in-lb	99208.	11061.	0.00542	-7.57E-05	-622.681	102168.
2	V, lb	1264.	M, in-lb	496038.	11061.	0.03731	-4.55E-04	-3453.	530549.

Maximum pile-head deflection = 0.0373103129 inches
Maximum pile-head rotation = -0.0004551176 radians = -0.026076 deg.

The analysis ended normally.

CCTV Foundation: 20-ft long Embedded Concrete Pole



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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App L CCTV Profile & LPile\CCTV Pole LPile\

Name of input data file:
CCTV Concrete Pole 20ft.lp12d

Name of output report file:
CCTV Concrete Pole 20ft.lp12o

Name of plot output file:
CCTV Concrete Pole 20ft.lp12p

Name of runtime message file:
CCTV Concrete Pole 20ft.lp12r

Date and Time of Analysis

Date: June 12, 2026 Time: 10:02:01

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Rakam Tamang, P.E.
Description: CCTV Pole at Sta 197+35, 125 ft Lt (Fiber Reinforced Conc)

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 20.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	23.1000
2	20.000	26.7000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional Shape = Circular Pipe
Length of section = 20.000000 ft
Width of top of section = 23.100000 in
Width of bottom of section = 26.700000 in
Wall Thickness at Top = 3.550000 in
Wall Thickness at Bottom = 3.550000 in
Top Area = 218.034384 sq. in
Bottom Area = 258.183938 sq. in
Moment of Inertia at Top = 10760. in^4
Moment of Inertia at Bottom = 17703. in^4
Elastic Modulus = 6244000. psi

Ground Slope and Pile Batter Angles

Ground Slope Angle = 11.310 degrees
= 0.197 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 6 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	100.000000 pcf
Effective unit weight at bottom of layer	=	100.000000 pcf
Undrained cohesion at top of layer	=	250.000000 psf
Undrained cohesion at bottom of layer	=	250.000000 psf
Epsilon-50 at top of layer	=	0.020000
Epsilon-50 at bottom of layer	=	0.020000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	11.700000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	30.000000 deg.
Friction angle at bottom of layer	=	30.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	11.700000 ft
Distance from top of pile to bottom of layer	=	17.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	28.000000 deg.
Friction angle at bottom of layer	=	28.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.200000 ft
Distance from top of pile to bottom of layer	=	28.700000 ft
Effective unit weight at top of layer	=	65.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	30.000000 deg.
Friction angle at bottom of layer	=	30.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	28.700000 ft
Distance from top of pile to bottom of layer	=	34.200000 ft

```
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000


Layer 6 is stiff clay without free water

   Distance from top of pile to top of layer          =    34.200000 ft
   Distance from top of pile to bottom of layer       =    50.200000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        2500. psf
   Undrained cohesion at bottom of layer              =        2500. psf
   Epsilon-50 at top of layer                         =     0.005000
   Epsilon-50 at bottom of layer                      =     0.005000


 (Depth of the lowest soil layer extends 30.200 ft below the pile tip)
```

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft Clay	0.00 3.5000	100.0000 100.0000	250.0000 250.0000	-- --	0.02000 0.02000	-- --
2	Sand (Reese, et al.)	3.5000 11.7000	62.6000 62.6000	-- --	30.0000 30.0000	-- --	60.0000 60.0000
3	Sand (Reese, et al.)	11.7000 17.2000	62.6000 62.6000	-- --	28.0000 28.0000	-- --	60.0000 60.0000
4	Sand (Reese, et al.)	17.2000 28.7000	65.6000 62.6000	-- --	30.0000 30.0000	-- --	60.0000 60.0000
5	Stiff Clay w/o Free Water	28.7000 34.2000	62.6000 62.6000	2500. 2500.	-- --	0.00500 0.00500	-- --
6	Stiff Clay w/o Free Water	34.2000 50.2000	62.6000 62.6000	2500. 2500.	-- --	0.00500 0.00500	-- --

---

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 253.000000 lbs	M = 99208. in-lbs	11061.	Yes	Yes
2	1	V = 1264. lbs	M = 496038. in-lbs	11061.	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	7088.
2	3.5000	2.7718	No	No	7088.	87531.
3	11.7000	12.0326	Yes	No	94619.	149012.
4	17.2000	16.6263	Yes	No	243631.	125317.
5	28.7000	28.7000	No	No	368948.	0.00
6	34.2000	34.2000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 253.0 lbs
Applied moment at pile head = 99208.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.00980	99208.	253.0000	-1.61E-04	157.2211	6.72E+10	-10.227	1252.	0.00
0.2000	0.00942	99790.	228.0705	-1.57E-04	157.3211	6.72E+10	-10.547	2688.	0.00
0.4000	0.00904	100311.	202.3878	-1.54E-04	157.3545	6.79E+10	-10.855	2880.	0.00
0.6000	0.00868	100770.	175.9817	-1.50E-04	157.3204	6.83E+10	-11.150	3083.	0.00
0.8000	0.00832	101164.	148.8822	-1.47E-04	157.2176	6.87E+10	-11.433	3296.	0.00
1.0000	0.00798	101492.	121.1195	-1.43E-04	157.0452	6.91E+10	-11.703	3522.	0.00
1.2000	0.00764	101753.	92.7242	-1.40E-04	156.8025	6.94E+10	-11.960	3759.	0.00
1.4000	0.00731	101945.	63.7268	-1.36E-04	156.4888	6.98E+10	-12.204	4010.	0.00
1.6000	0.00698	102066.	34.1582	-1.33E-04	156.1034	7.02E+10	-12.436	4274.	0.00
1.8000	0.00667	102116.	4.0496	-1.29E-04	155.6457	7.06E+10	-12.655	4554.	0.00
2.0000	0.00636	102092.	-26.568	-1.26E-04	155.1154	7.10E+10	-12.860	4851.	0.00
2.2000	0.00606	101995.	-57.662	-1.22E-04	154.5120	7.13E+10	-13.052	5165.	0.00
2.4000	0.00578	101822.	-89.202	-1.19E-04	153.8354	7.17E+10	-13.231	5498.	0.00
2.6000	0.00549	101573.	-121.154	-1.15E-04	153.0852	7.21E+10	-13.396	5852.	0.00
2.8000	0.00522	101246.	-153.488	-1.12E-04	152.2614	7.25E+10	-13.548	6227.	0.00
3.0000	0.00496	100842.	-186.169	-1.09E-04	151.3640	7.29E+10	-13.686	6627.	0.00
3.2000	0.00470	100359.	-219.166	-1.05E-04	150.3930	7.33E+10	-13.811	7053.	0.00
3.4000	0.00445	99796.	-252.444	-1.02E-04	149.3486	7.37E+10	-13.921	7508.	0.00
3.6000	0.00421	99152.	-282.240	-9.90E-05	148.2310	7.41E+10	-10.909	6221.	0.00
3.8000	0.00398	98446.	-308.382	-9.58E-05	147.0583	7.45E+10	-10.876	6566.	0.00
4.0000	0.00375	97677.	-334.390	-9.26E-05	145.8314	7.49E+10	-10.797	6912.	0.00
4.2000	0.00353	96846.	-360.159	-8.95E-05	144.5514	7.53E+10	-10.676	7258.	0.00
4.4000	0.00332	95953.	-385.590	-8.64E-05	143.2196	7.57E+10	-10.516	7603.	0.00
4.6000	0.00312	95000.	-410.593	-8.34E-05	141.8374	7.61E+10	-10.319	7949.	0.00
4.8000	0.00292	93987.	-435.081	-8.04E-05	140.4067	7.65E+10	-10.088	8294.	0.00
5.0000	0.00273	92916.	-458.979	-7.75E-05	138.9292	7.69E+10	-9.826	8640.	0.00
5.2000	0.00255	91788.	-482.214	-7.46E-05	137.4071	7.73E+10	-9.536	8986.	0.00
5.4000	0.00237	90605.	-504.720	-7.18E-05	135.8423	7.77E+10	-9.219	9331.	0.00
5.6000	0.00220	89369.	-526.439	-6.90E-05	134.2373	7.81E+10	-8.880	9677.	0.00
5.8000	0.00204	88082.	-547.317	-6.63E-05	132.5943	7.85E+10	-8.518	10022.	0.00
6.0000	0.00188	86745.	-567.305	-6.37E-05	130.9158	7.89E+10	-8.139	10368.	0.00
6.2000	0.00173	85362.	-586.362	-6.10E-05	129.2043	7.93E+10	-7.742	10714.	0.00
6.4000	0.00159	83934.	-604.450	-5.85E-05	127.4623	7.97E+10	-7.331	11059.	0.00
6.6000	0.00145	82464.	-621.536	-5.60E-05	125.6926	8.01E+10	-6.907	11405.	0.00
6.8000	0.00132	80954.	-637.593	-5.35E-05	123.8976	8.05E+10	-6.473	11750.	0.00
7.0000	0.00120	79406.	-652.598	-5.12E-05	122.0801	8.09E+10	-6.031	12096.	0.00
7.2000	0.00108	77824.	-666.532	-4.88E-05	120.2428	8.14E+10	-5.581	12442.	0.00

7.4000	9.62E-04	76209.	-679.381	-4.66E-05	118.3882	8.18E+10	-5.126	12787.	0.00
7.6000	8.53E-04	74565.	-691.134	-4.44E-05	116.5191	8.22E+10	-4.668	13133.	0.00
7.8000	7.49E-04	72894.	-701.784	-4.22E-05	114.6381	8.26E+10	-4.207	13478.	0.00
8.0000	6.50E-04	71199.	-711.329	-4.01E-05	112.7477	8.30E+10	-3.746	13824.	0.00
8.2000	5.57E-04	69482.	-719.768	-3.81E-05	110.8506	8.35E+10	-3.286	14170.	0.00
8.4000	4.68E-04	67746.	-727.104	-3.61E-05	108.9493	8.39E+10	-2.828	14515.	0.00
8.6000	3.83E-04	65994.	-733.344	-3.42E-05	107.0463	8.43E+10	-2.372	14861.	0.00
8.8000	3.03E-04	64228.	-738.496	-3.24E-05	105.1440	8.47E+10	-1.921	15206.	0.00
9.0000	2.28E-04	62451.	-742.573	-3.06E-05	103.2448	8.52E+10	-1.476	15552.	0.00
9.2000	1.56E-04	60665.	-745.587	-2.89E-05	101.3510	8.56E+10	-1.036	15898.	0.00
9.4000	8.92E-05	58874.	-747.555	-2.72E-05	99.4648	8.60E+10	-0.604	16243.	0.00
9.6000	2.60E-05	57078.	-748.495	-2.56E-05	97.5885	8.64E+10	-0.179	16589.	0.00
9.8000	-3.35E-05	55282.	-748.426	-2.40E-05	95.7241	8.69E+10	0.2365	16934.	0.00
10.0000	-8.93E-05	53487.	-747.371	-2.25E-05	93.8736	8.73E+10	0.6431	17280.	0.00
10.2000	-1.42E-04	51696.	-745.351	-2.11E-05	92.0392	8.77E+10	1.0398	17626.	0.00
10.4000	-1.90E-04	49911.	-742.392	-1.97E-05	90.2225	8.82E+10	1.4262	17971.	0.00
10.6000	-2.36E-04	48133.	-738.519	-1.84E-05	88.4254	8.86E+10	1.8018	18317.	0.00
10.8000	-2.79E-04	46367.	-733.757	-1.71E-05	86.6497	8.91E+10	2.1662	18662.	0.00
11.0000	-3.18E-04	44612.	-728.135	-1.59E-05	84.8970	8.95E+10	2.5191	19008.	0.00
11.2000	-3.55E-04	42872.	-721.680	-1.47E-05	83.1687	8.99E+10	2.8602	19354.	0.00
11.4000	-3.89E-04	41149.	-714.420	-1.36E-05	81.4665	9.04E+10	3.1893	19699.	0.00
11.6000	-4.20E-04	39444.	-706.386	-1.25E-05	79.7917	9.08E+10	3.5063	20045.	0.00
11.8000	-4.49E-04	37759.	-697.605	-1.15E-05	78.1456	9.13E+10	3.8110	20390.	0.00
12.0000	-4.75E-04	36096.	-688.108	-1.05E-05	76.5294	9.17E+10	4.1034	20736.	0.00
12.2000	-4.99E-04	34457.	-677.923	-9.59E-06	74.9444	9.22E+10	4.3835	21082.	0.00
12.4000	-5.21E-04	32843.	-667.082	-8.72E-06	73.3915	9.26E+10	4.6513	21427.	0.00
12.6000	-5.41E-04	31255.	-655.612	-7.89E-06	71.8718	9.31E+10	4.9068	21773.	0.00
12.8000	-5.59E-04	29696.	-643.544	-7.11E-06	70.3863	9.35E+10	5.1503	22118.	0.00
13.0000	-5.75E-04	28167.	-630.905	-6.37E-06	68.9357	9.40E+10	5.3819	22464.	0.00
13.2000	-5.89E-04	26668.	-617.725	-5.67E-06	67.5209	9.44E+10	5.6017	22810.	0.00
13.4000	-6.02E-04	25202.	-604.031	-5.01E-06	66.1425	9.49E+10	5.8099	23155.	0.00
13.6000	-6.13E-04	23769.	-589.851	-4.39E-06	64.8013	9.53E+10	6.0068	23501.	0.00
13.8000	-6.23E-04	22371.	-575.211	-3.81E-06	63.4978	9.58E+10	6.1927	23846.	0.00
14.0000	-6.32E-04	21008.	-560.139	-3.27E-06	62.2325	9.62E+10	6.3679	24192.	0.00
14.2000	-6.39E-04	19682.	-544.658	-2.76E-06	61.0060	9.67E+10	6.5327	24538.	0.00
14.4000	-6.45E-04	18394.	-528.794	-2.29E-06	59.8186	9.72E+10	6.6873	24883.	0.00
14.6000	-6.50E-04	17144.	-512.570	-1.85E-06	58.6706	9.76E+10	6.8323	25229.	0.00
14.8000	-6.54E-04	15934.	-496.010	-1.45E-06	57.5624	9.81E+10	6.9679	25574.	0.00
15.0000	-6.57E-04	14763.	-479.135	-1.07E-06	56.4943	9.85E+10	7.0945	25920.	0.00
15.2000	-6.59E-04	13634.	-461.967	-7.28E-07	55.4664	9.90E+10	7.2126	26266.	0.00
15.4000	-6.60E-04	12546.	-444.525	-4.12E-07	54.4789	9.95E+10	7.3225	26611.	0.00
15.6000	-6.61E-04	11500.	-426.828	-1.22E-07	53.5320	9.99E+10	7.4246	26957.	0.00
15.8000	-6.61E-04	10497.	-408.895	1.41E-07	52.6256	1.00E+11	7.5193	27302.	0.00
16.0000	-6.60E-04	9538.	-390.744	3.80E-07	51.7600	1.01E+11	7.6071	27648.	0.00
16.2000	-6.59E-04	8622.	-372.389	5.96E-07	50.9350	1.01E+11	7.6884	27994.	0.00
16.4000	-6.57E-04	7750.	-353.846	7.89E-07	50.1507	1.02E+11	7.7636	28339.	0.00
16.6000	-6.55E-04	6923.	-335.131	9.62E-07	49.4070	1.02E+11	7.8330	28685.	0.00
16.8000	-6.53E-04	6141.	-316.255	1.11E-06	48.7039	1.03E+11	7.8971	29030.	0.00
17.0000	-6.50E-04	5405.	-297.231	1.25E-06	48.0412	1.03E+11	7.9562	29376.	0.00
17.2000	-6.47E-04	4715.	-278.070	1.37E-06	47.4189	1.04E+11	8.0108	29722.	0.00
17.4000	-6.43E-04	4070.	-258.784	1.47E-06	46.8368	1.04E+11	8.0613	30067.	0.00
17.6000	-6.40E-04	3472.	-239.381	1.55E-06	46.2947	1.05E+11	8.1079	30413.	0.00
17.8000	-6.36E-04	2921.	-219.870	1.63E-06	45.7926	1.05E+11	8.1509	30758.	0.00
18.0000	-6.32E-04	2417.	-200.260	1.69E-06	45.3301	1.06E+11	8.1909	31104.	0.00

18.2000	-6.28E-04	1960.	-180.557	1.74E-06	44.9071	1.06E+11	8.2279	31450.	0.00
18.4000	-6.24E-04	1550.	-160.769	1.78E-06	44.5235	1.07E+11	8.2624	31795.	0.00
18.6000	-6.19E-04	1188.	-140.901	1.81E-06	44.1789	1.07E+11	8.2945	32141.	0.00
18.8000	-6.15E-04	873.6771	-120.958	1.83E-06	43.8732	1.08E+11	8.3245	32486.	0.00
19.0000	-6.11E-04	607.3031	-100.946	1.85E-06	43.6061	1.08E+11	8.3526	32832.	0.00
19.2000	-6.06E-04	389.0395	-80.868	1.86E-06	43.3774	1.09E+11	8.3790	33178.	0.00
19.4000	-6.02E-04	219.0385	-60.729	1.87E-06	43.1868	1.09E+11	8.4038	33523.	0.00
19.6000	-5.97E-04	97.4432	-40.532	1.87E-06	43.0342	1.10E+11	8.4271	33869.	0.00
19.8000	-5.93E-04	24.3881	-20.280	1.87E-06	42.9192	1.10E+11	8.4491	34214.	0.00
20.0000	-5.88E-04	0.00	0.00	1.87E-06	42.8415	1.11E+11	8.4698	17280.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.00980021 inches
Computed slope at pile head      =     -0.0001609 radians
Maximum bending moment           =        102116. inch-lbs
Maximum shear force              =   -748.4949547 lbs
Depth of maximum bending moment  =     1.80000000 feet below pile head
Depth of maximum shear force     =     9.60000000 feet below pile head
Number of iterations             =              9
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =            253. lbs
Moment     =          99208. in-lbs
Axial Load =          11061. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.00000	0.00980021	102116.	-748.4949547
19.00000	0.00994241	102098.	-773.2624006
18.00000	0.01019393	102079.	-809.5338763
17.00000	0.01060727	102036.	-858.8921585
16.00000	0.01125736	101989.	-921.8443633
15.00000	0.01224088	101913.	-997.8114259
14.00000	0.01376359	101820.	-1089.
13.00000	0.01609075	101700.	-1195.
12.00000	0.01980430	101550.	-1324.
11.00000	0.02556776	101383.	-1479.
10.00000	0.03529935	101196.	-1673.
9.00000	0.05299561	100999.	-1927.

8.00000	0.08840277	100807.	-2276.
7.00000	0.17325322	100658.	-2789.
6.00000	0.52192642	100772.	-3602.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 1264.0 lbs
Applied moment at pile head = 496038.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.06500	496038.	1264.	-9.41E-04	583.1812	6.72E+10	-19.212	354.6860	0.00
0.2000	0.06276	499041.	1217.	-9.24E-04	584.1883	6.72E+10	-19.844	758.8443	0.00
0.4000	0.06057	501929.	1169.	-9.06E-04	585.0615	6.79E+10	-20.456	810.5922	0.00
0.6000	0.05841	504699.	1119.	-8.88E-04	585.7986	6.83E+10	-21.047	864.7543	0.00
0.8000	0.05630	507347.	1068.	-8.70E-04	586.3976	6.87E+10	-21.617	921.4776	0.00
1.0000	0.05423	509871.	1015.	-8.53E-04	586.8568	6.91E+10	-22.167	980.9206	0.00
1.2000	0.05221	512266.	961.3990	-8.35E-04	587.1744	6.94E+10	-22.695	1043.	0.00
1.4000	0.05023	514530.	906.3229	-8.17E-04	587.3490	6.98E+10	-23.202	1109.	0.00
1.6000	0.04829	516660.	850.0559	-8.00E-04	587.3791	7.02E+10	-23.687	1177.	0.00
1.8000	0.04639	518653.	792.6496	-7.82E-04	587.2636	7.06E+10	-24.151	1250.	0.00
2.0000	0.04453	520506.	734.1560	-7.64E-04	587.0013	7.10E+10	-24.593	1325.	0.00
2.2000	0.04272	522217.	674.6278	-7.47E-04	586.5915	7.13E+10	-25.013	1405.	0.00
2.4000	0.04095	523784.	614.1179	-7.29E-04	586.0334	7.17E+10	-25.411	1489.	0.00
2.6000	0.03922	525204.	552.6797	-7.12E-04	585.3263	7.21E+10	-25.787	1578.	0.00
2.8000	0.03753	526474.	490.3670	-6.94E-04	584.4698	7.25E+10	-26.140	1672.	0.00
3.0000	0.03589	527594.	427.2341	-6.77E-04	583.4636	7.29E+10	-26.471	1770.	0.00
3.2000	0.03428	528561.	363.3356	-6.59E-04	582.3075	7.33E+10	-26.778	1875.	0.00
3.4000	0.03272	529373.	298.7268	-6.42E-04	581.0015	7.37E+10	-27.063	1985.	0.00
3.6000	0.03120	530029.	169.2032	-6.25E-04	579.5456	7.41E+10	-80.874	6221.	0.00
3.8000	0.02972	530219.	-25.428	-6.08E-04	577.6326	7.45E+10	-81.319	6566.	0.00
4.0000	0.02828	529939.	-220.759	-5.91E-04	575.2651	7.49E+10	-81.457	6912.	0.00
4.2000	0.02689	529190.	-416.071	-5.74E-04	572.4475	7.53E+10	-81.303	7258.	0.00
4.4000	0.02553	527973.	-610.685	-5.57E-04	569.1859	7.57E+10	-80.875	7603.	0.00
4.6000	0.02421	526289.	-803.963	-5.40E-04	565.4877	7.61E+10	-80.190	7949.	0.00
4.8000	0.02293	524142.	-995.306	-5.24E-04	561.3617	7.65E+10	-79.263	8294.	0.00
5.0000	0.02170	521539.	-1184.	-5.08E-04	556.8180	7.69E+10	-78.110	8640.	0.00
5.2000	0.02050	518485.	-1370.	-4.91E-04	551.8679	7.73E+10	-76.748	8986.	0.00
5.4000	0.01934	514989.	-1552.	-4.75E-04	546.5235	7.77E+10	-75.190	9331.	0.00
5.6000	0.01822	511059.	-1731.	-4.59E-04	540.7981	7.81E+10	-73.453	9677.	0.00
5.8000	0.01713	506706.	-1905.	-4.44E-04	534.7055	7.85E+10	-71.550	10022.	0.00
6.0000	0.01609	501940.	-2074.	-4.28E-04	528.2604	7.89E+10	-69.495	10368.	0.00
6.2000	0.01508	496774.	-2238.	-4.13E-04	521.4781	7.93E+10	-67.303	10714.	0.00
6.4000	0.01410	491220.	-2397.	-3.98E-04	514.3744	7.97E+10	-64.986	11059.	0.00
6.6000	0.01316	485290.	-2550.	-3.84E-04	506.9657	8.01E+10	-62.557	11405.	0.00
6.8000	0.01226	479000.	-2697.	-3.69E-04	499.2685	8.05E+10	-60.029	11750.	0.00

7.0000	0.01139	472364.	-2838.	-3.55E-04	491.3000	8.09E+10	-57.413	12096.	0.00
7.2000	0.01056	465397.	-2972.	-3.41E-04	483.0771	8.14E+10	-54.721	12442.	0.00
7.4000	0.00975	458115.	-3101.	-3.28E-04	474.6175	8.18E+10	-51.964	12787.	0.00
7.6000	0.00898	450532.	-3222.	-3.14E-04	465.9384	8.22E+10	-49.152	13133.	0.00
7.8000	0.00824	442666.	-3336.	-3.01E-04	457.0575	8.26E+10	-46.296	13478.	0.00
8.0000	0.00754	434534.	-3444.	-2.89E-04	447.9921	8.30E+10	-43.405	13824.	0.00
8.2000	0.00686	426150.	-3545.	-2.76E-04	438.7599	8.35E+10	-40.488	14170.	0.00
8.4000	0.00621	417534.	-3638.	-2.64E-04	429.3781	8.39E+10	-37.553	14515.	0.00
8.6000	0.00559	408700.	-3725.	-2.52E-04	419.8638	8.43E+10	-34.609	14861.	0.00
8.8000	0.00500	399667.	-3804.	-2.41E-04	410.2342	8.47E+10	-31.664	15206.	0.00
9.0000	0.00443	390452.	-3877.	-2.30E-04	400.5058	8.52E+10	-28.724	15552.	0.00
9.2000	0.00389	381070.	-3942.	-2.19E-04	390.6953	8.56E+10	-25.797	15898.	0.00
9.4000	0.00338	371540.	-4001.	-2.08E-04	380.8189	8.60E+10	-22.888	16243.	0.00
9.6000	0.00289	361877.	-4052.	-1.98E-04	370.8922	8.64E+10	-20.003	16589.	0.00
9.8000	0.00243	352100.	-4097.	-1.88E-04	360.9310	8.69E+10	-17.148	16934.	0.00
10.0000	0.00199	342223.	-4135.	-1.79E-04	350.9504	8.73E+10	-14.328	17280.	0.00
10.2000	0.00157	332263.	-4166.	-1.70E-04	340.9651	8.77E+10	-11.547	17626.	0.00
10.4000	0.00118	322237.	-4190.	-1.61E-04	330.9894	8.82E+10	-8.808	17971.	0.00
10.6000	8.01E-04	312159.	-4208.	-1.52E-04	321.0373	8.86E+10	-6.116	18317.	0.00
10.8000	4.47E-04	302046.	-4220.	-1.44E-04	311.1224	8.91E+10	-3.474	18662.	0.00
11.0000	1.12E-04	291913.	-4225.	-1.36E-04	301.2576	8.95E+10	-0.885	19008.	0.00
11.2000	-2.05E-04	281775.	-4224.	-1.28E-04	291.4555	8.99E+10	1.6495	19354.	0.00
11.4000	-5.03E-04	271646.	-4217.	-1.21E-04	281.7285	9.04E+10	4.1268	19699.	0.00
11.6000	-7.84E-04	261540.	-4204.	-1.14E-04	272.0880	9.08E+10	6.5455	20045.	0.00
11.8000	-0.00105	251472.	-4186.	-1.07E-04	262.5454	9.13E+10	8.9041	20390.	0.00
12.0000	-0.00130	241455.	-4161.	-1.00E-04	253.1116	9.17E+10	11.2018	20736.	0.00
12.2000	-0.00153	231503.	-4132.	-9.42E-05	243.7967	9.22E+10	13.4378	21082.	0.00
12.4000	-0.00175	221627.	-4097.	-8.83E-05	234.6107	9.26E+10	15.6118	21427.	0.00
12.6000	-0.00195	211842.	-4057.	-8.27E-05	225.5632	9.31E+10	17.7238	21773.	0.00
12.8000	-0.00215	202158.	-4012.	-7.74E-05	216.6630	9.35E+10	19.7740	22118.	0.00
13.0000	-0.00233	192588.	-3962.	-7.23E-05	207.9187	9.40E+10	21.7629	22464.	0.00
13.2000	-0.00249	183144.	-3908.	-6.75E-05	199.3386	9.44E+10	23.6913	22810.	0.00
13.4000	-0.00265	173836.	-3848.	-6.30E-05	190.9304	9.49E+10	25.5602	23155.	0.00
13.6000	-0.00280	164674.	-3785.	-5.87E-05	182.7014	9.53E+10	27.3708	23501.	0.00
13.8000	-0.00293	155671.	-3717.	-5.47E-05	174.6587	9.58E+10	29.1246	23846.	0.00
14.0000	-0.00306	146835.	-3645.	-5.09E-05	166.8088	9.62E+10	30.8231	24192.	0.00
14.2000	-0.00318	138176.	-3569.	-4.74E-05	159.1580	9.67E+10	32.4683	24538.	0.00
14.4000	-0.00329	129705.	-3489.	-4.41E-05	151.7123	9.72E+10	34.0621	24883.	0.00
14.6000	-0.00339	121429.	-3406.	-4.10E-05	144.4771	9.76E+10	35.6067	25229.	0.00
14.8000	-0.00348	113359.	-3319.	-3.81E-05	137.4578	9.81E+10	37.1042	25574.	0.00
15.0000	-0.00357	105502.	-3228.	-3.54E-05	130.6593	9.85E+10	38.5572	25920.	0.00
15.2000	-0.00365	97867.	-3134.	-3.30E-05	124.0864	9.90E+10	39.9680	26266.	0.00
15.4000	-0.00373	90463.	-3036.	-3.07E-05	117.7434	9.95E+10	41.3393	26611.	0.00
15.6000	-0.00380	83296.	-2935.	-2.86E-05	111.6346	9.99E+10	42.6737	26957.	0.00
15.8000	-0.00387	76375.	-2831.	-2.67E-05	105.7639	1.00E+11	43.9740	27302.	0.00
16.0000	-0.00393	69708.	-2724.	-2.49E-05	100.1350	1.01E+11	45.2429	27648.	0.00
16.2000	-0.00399	63300.	-2614.	-2.34E-05	94.7515	1.01E+11	46.4831	27994.	0.00
16.4000	-0.00404	57161.	-2501.	-2.19E-05	89.6168	1.02E+11	47.6976	28339.	0.00
16.6000	-0.00409	51297.	-2385.	-2.07E-05	84.7340	1.02E+11	48.8890	28685.	0.00
16.8000	-0.00414	45713.	-2266.	-1.95E-05	80.1061	1.03E+11	50.0602	29030.	0.00
17.0000	-0.00418	40419.	-2145.	-1.85E-05	75.7362	1.03E+11	51.2139	29376.	0.00
17.2000	-0.00423	35419.	-2021.	-1.76E-05	71.6268	1.04E+11	52.3527	29722.	0.00
17.4000	-0.00427	30721.	-1894.	-1.69E-05	67.7808	1.04E+11	53.4794	30067.	0.00
17.6000	-0.00431	26330.	-1764.	-1.62E-05	64.2007	1.05E+11	54.5965	30413.	0.00

17.8000	-0.00435	22255.	-1632.	-1.57E-05	60.8890	1.05E+11	55.7065	30758.	0.00
18.0000	-0.00438	18500.	-1497.	-1.52E-05	57.8481	1.06E+11	56.8117	31104.	0.00
18.2000	-0.00442	15072.	-1359.	-1.48E-05	55.0805	1.06E+11	57.9142	31450.	0.00
18.4000	-0.00445	11978.	-1219.	-1.45E-05	52.5883	1.07E+11	59.0164	31795.	0.00
18.6000	-0.00449	9224.	-1076.	-1.43E-05	50.3740	1.07E+11	60.1199	32141.	0.00
18.8000	-0.00452	6816.	-929.974	-1.41E-05	48.4398	1.08E+11	61.2267	32486.	0.00
19.0000	-0.00456	4761.	-781.696	-1.40E-05	46.7879	1.08E+11	62.3383	32832.	0.00
19.2000	-0.00459	3065.	-630.742	-1.39E-05	45.4206	1.09E+11	63.4561	33178.	0.00
19.4000	-0.00462	1734.	-477.098	-1.38E-05	44.3400	1.09E+11	64.5812	33523.	0.00
19.6000	-0.00466	775.2198	-320.743	-1.38E-05	43.5485	1.10E+11	65.7146	33869.	0.00
19.8000	-0.00469	195.0619	-161.657	-1.38E-05	43.0483	1.10E+11	66.8570	34214.	0.00
20.0000	-0.00472	0.00	0.00	-1.38E-05	42.8415	1.11E+11	68.0087	17280.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.06499888 inches
Computed slope at pile head = -0.0009414 radians
Maximum bending moment = 530219. inch-lbs
Maximum shear force = -4225. lbs
Depth of maximum bending moment = 3.80000000 feet below pile head
Depth of maximum shear force = 11.00000000 feet below pile head
Number of iterations = 7
Number of zero deflection points = 1

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 1264. lbs
Moment = 496038. in-lbs
Axial Load = 11061. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.00000	0.06499888	530219.	-4225.
19.00000	0.06637986	530051.	-4437.
18.00000	0.06849785	529754.	-4713.
17.00000	0.07171739	529302.	-5050.
16.00000	0.07654283	528672.	-5446.
15.00000	0.08511770	527961.	-5949.
14.00000	0.09759757	526778.	-6512.
13.00000	0.12733779	524708.	-7273.
12.00000	0.18837136	521769.	-8214.
11.00000	0.29369361	518994.	-9268.
10.00000	0.52415177	516163.	-10634.
9.00000	1.10400771	513906.	-12486.
8.00000	3.06270284	514459.	-15411.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

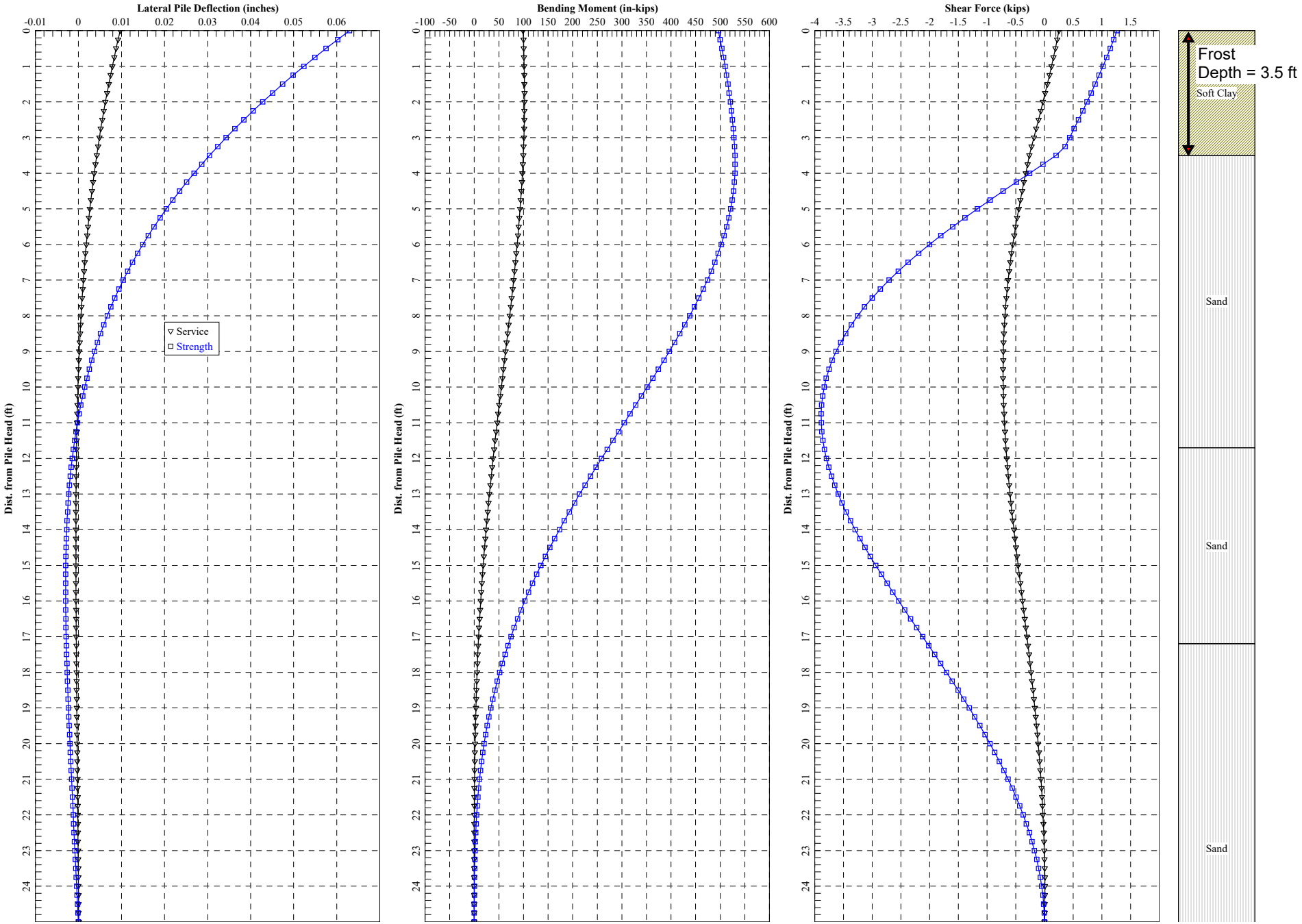
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	253.0000	M, in-lb	99208.	11061.	0.00980	-1.61E-04	-748.495	102116.
2	V, lb	1264.	M, in-lb	496038.	11061.	0.06500	-9.41E-04	-4225.	530219.

Maximum pile-head deflection = 0.0649988796 inches
Maximum pile-head rotation = -0.0009414253 radians = -0.053940 deg.

The analysis ended normally.

CCTV Foundation: 25-ft long Embedded Concrete Pole



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LPile for Windows, Version 2022-12.005

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\\Cleveland-vfp\Sys\Projects\ODOT\301525_CUY-77-11.41_PID_105743\Geotechnical\Geotech Report-Final_April 2026\App L CCTV Profile & LPile\CCTV Pole LPile\

Name of input data file:
CCTV Concrete Pole 25ft.lp12d

Name of output report file:
CCTV Concrete Pole 25ft.lp12o

Name of plot output file:
CCTV Concrete Pole 25ft.lp12p

Name of runtime message file:
CCTV Concrete Pole 25ft.lp12r

Date and Time of Analysis

Date: June 12, 2026 Time: 11:03:43

Problem Title

Project Name: RECONSTRUCTION OF INTERSTATE 77
Job Number: CUY-77-11.21 (TRC# 301525)
Client: ODOT
Engineer: Rakam Tamang, P.E.
Description: CCTV Pole at Sta 197+35, 125 ft Lt (Fiber Reinforced Conc)

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 25.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	23.1000
2	25.000	27.6000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional Shape = Circular Pipe
Length of section = 25.000000 ft
Width of top of section = 23.100000 in
Width of bottom of section = 27.600000 in
Wall Thickness at Top = 3.550000 in
Wall Thickness at Bottom = 3.550000 in
Top Area = 218.034000 sq. in
Bottom Area = 268.221300 sq. in
Moment of Inertia at Top = 10760. in^4
Moment of Inertia at Bottom = 19815. in^4
Elastic Modulus = 6244000. psi

Ground Slope and Pile Batter Angles

Ground Slope Angle = 11.310 degrees
= 0.197 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 6 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	3.500000 ft
Effective unit weight at top of layer	=	100.000000 pcf
Effective unit weight at bottom of layer	=	100.000000 pcf
Undrained cohesion at top of layer	=	250.000000 psf
Undrained cohesion at bottom of layer	=	250.000000 psf
Epsilon-50 at top of layer	=	0.020000
Epsilon-50 at bottom of layer	=	0.020000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	3.500000 ft
Distance from top of pile to bottom of layer	=	11.700000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	30.000000 deg.
Friction angle at bottom of layer	=	30.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	11.700000 ft
Distance from top of pile to bottom of layer	=	17.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	28.000000 deg.
Friction angle at bottom of layer	=	28.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	17.200000 ft
Distance from top of pile to bottom of layer	=	28.700000 ft
Effective unit weight at top of layer	=	65.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Friction angle at top of layer	=	30.000000 deg.
Friction angle at bottom of layer	=	30.000000 deg.
Subgrade k at top of layer	=	60.000000 pci
Subgrade k at bottom of layer	=	60.000000 pci

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	28.700000 ft
Distance from top of pile to bottom of layer	=	34.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

Layer 6 is stiff clay without free water

Distance from top of pile to top of layer	=	34.200000 ft
Distance from top of pile to bottom of layer	=	50.200000 ft
Effective unit weight at top of layer	=	62.600000 pcf
Effective unit weight at bottom of layer	=	62.600000 pcf
Undrained cohesion at top of layer	=	2500. psf
Undrained cohesion at bottom of layer	=	2500. psf
Epsilon-50 at top of layer	=	0.005000
Epsilon-50 at bottom of layer	=	0.005000

(Depth of the lowest soil layer extends 25.200 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft Clay	0.00 3.5000	100.0000 100.0000	250.0000 250.0000	-- --	0.02000 0.02000	-- --
2	Sand (Reese, et al.)	3.5000 11.7000	62.6000 62.6000	-- --	30.0000 30.0000	-- --	60.0000 60.0000
3	Sand (Reese, et al.)	11.7000 17.2000	62.6000 62.6000	-- --	28.0000 28.0000	-- --	60.0000 60.0000
4	Sand (Reese, et al.)	17.2000 28.7000	65.6000 62.6000	-- --	30.0000 30.0000	-- --	60.0000 60.0000
5	Stiff Clay w/o Free Water	28.7000 34.2000	62.6000 62.6000	2500. 2500.	-- --	0.00500 0.00500	-- --
6	Stiff Clay w/o Free Water	34.2000 50.2000	62.6000 62.6000	2500. 2500.	-- --	0.00500 0.00500	-- --

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 253.000000 lbs	M = 99208. in-lbs	11061.	Yes	Yes
2	1	V = 1264. lbs	M = 496038. in-lbs	11061.	Yes	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions
Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	7088.
2	3.5000	2.7718	No	No	7088.	87531.
3	11.7000	12.0326	Yes	No	94619.	149012.
4	17.2000	16.6263	Yes	No	243631.	445375.
5	28.7000	28.7000	No	No	689006.	0.00
6	34.2000	34.2000	No	No	0.00	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 253.0 lbs
Applied moment at pile head = 99208.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.00969	99208.	253.0000	-1.60E-04	157.2212	6.72E+10	-10.193	1578.	0.00
0.2500	0.00922	99926.	221.8290	-1.56E-04	157.3308	6.72E+10	-10.588	3447.	0.00
0.5000	0.00875	100549.	189.5010	-1.51E-04	157.3363	6.81E+10	-10.964	3757.	0.00
0.7500	0.00831	101073.	156.0747	-1.47E-04	157.2358	6.86E+10	-11.320	4088.	0.00
1.0000	0.00787	101496.	121.6092	-1.43E-04	157.0273	6.91E+10	-11.657	4442.	0.00
1.2500	0.00745	101813.	86.1645	-1.38E-04	156.7093	6.95E+10	-11.973	4821.	0.00
1.5000	0.00704	102022.	49.8009	-1.34E-04	156.2805	7.00E+10	-12.269	5226.	0.00
1.7500	0.00665	102120.	12.5794	-1.30E-04	155.7397	7.05E+10	-12.545	5661.	0.00
2.0000	0.00627	102106.	-25.438	-1.25E-04	155.0861	7.10E+10	-12.800	6128.	0.00
2.2500	0.00590	101976.	-64.190	-1.21E-04	154.3189	7.15E+10	-13.034	6631.	0.00
2.5000	0.00554	101729.	-103.614	-1.17E-04	153.4377	7.19E+10	-13.248	7173.	0.00
2.7500	0.00520	101362.	-143.644	-1.12E-04	152.4422	7.24E+10	-13.440	7757.	0.00
3.0000	0.00487	100874.	-184.218	-1.08E-04	151.3323	7.29E+10	-13.610	8390.	0.00
3.2500	0.00455	100264.	-225.271	-1.04E-04	150.1082	7.34E+10	-13.758	9075.	0.00
3.5000	0.00424	99530.	-261.942	-1.00E-04	148.7703	7.39E+10	-10.690	7560.	0.00
3.7500	0.00395	98699.	-293.966	-9.60E-05	147.3476	7.44E+10	-10.659	8100.	0.00
4.0000	0.00367	97772.	-325.792	-9.21E-05	145.8418	7.49E+10	-10.558	8640.	0.00
4.2500	0.00340	96750.	-357.215	-8.82E-05	144.2551	7.54E+10	-10.390	9180.	0.00
4.5000	0.00314	95635.	-388.045	-8.44E-05	142.5900	7.59E+10	-10.163	9720.	0.00
4.7500	0.00289	94428.	-418.113	-8.06E-05	140.8498	7.64E+10	-9.882	10260.	0.00
5.0000	0.00265	93131.	-447.262	-7.70E-05	139.0379	7.69E+10	-9.551	10800.	0.00
5.2500	0.00243	91749.	-475.354	-7.34E-05	137.1585	7.74E+10	-9.177	11340.	0.00
5.5000	0.00221	90284.	-502.264	-6.98E-05	135.2157	7.79E+10	-8.763	11880.	0.00
5.7500	0.00201	88740.	-527.882	-6.64E-05	133.2141	7.84E+10	-8.316	12420.	0.00
6.0000	0.00181	87121.	-552.114	-6.31E-05	131.1583	7.89E+10	-7.839	12960.	0.00
6.2500	0.00163	85432.	-574.877	-5.98E-05	129.0533	7.95E+10	-7.337	13500.	0.00
6.5000	0.00146	83676.	-596.102	-5.66E-05	126.9042	8.00E+10	-6.813	14040.	0.00
6.7500	0.00129	81859.	-615.731	-5.35E-05	124.7160	8.05E+10	-6.273	14580.	0.00
7.0000	0.00113	79985.	-633.720	-5.05E-05	122.4938	8.10E+10	-5.719	15120.	0.00
7.2500	9.88E-04	78060.	-650.033	-4.76E-05	120.2429	8.15E+10	-5.156	15660.	0.00
7.5000	8.49E-04	76088.	-664.646	-4.48E-05	117.9685	8.21E+10	-4.586	16200.	0.00
7.7500	7.19E-04	74075.	-677.545	-4.20E-05	115.6757	8.26E+10	-4.013	16740.	0.00
8.0000	5.97E-04	72026.	-688.724	-3.94E-05	113.3695	8.31E+10	-3.440	17280.	0.00
8.2500	4.83E-04	69945.	-698.187	-3.68E-05	111.0549	8.37E+10	-2.869	17820.	0.00
8.5000	3.76E-04	67839.	-705.944	-3.44E-05	108.7369	8.42E+10	-2.303	18360.	0.00
8.7500	2.77E-04	65712.	-712.014	-3.20E-05	106.4200	8.47E+10	-1.744	18900.	0.00

9.0000	1.84E-04	63569.	-716.421	-2.97E-05	104.1090	8.53E+10	-1.195	19440.	0.00
9.2500	9.86E-05	61415.	-719.198	-2.75E-05	101.8083	8.58E+10	-0.657	19980.	0.00
9.5000	1.93E-05	59256.	-720.380	-2.54E-05	99.5221	8.63E+10	-0.132	20520.	0.00
9.7500	-5.39E-05	57095.	-720.011	-2.34E-05	97.2545	8.69E+10	0.3781	21060.	0.00
10.0000	-1.21E-04	54937.	-718.136	-2.15E-05	95.0094	8.74E+10	0.8718	21600.	0.00
10.2500	-1.83E-04	52787.	-714.806	-1.96E-05	92.7905	8.80E+10	1.3480	22140.	0.00
10.5000	-2.39E-04	50650.	-710.076	-1.79E-05	90.6013	8.85E+10	1.8055	22680.	0.00
10.7500	-2.90E-04	48528.	-704.003	-1.62E-05	88.4451	8.91E+10	2.2433	23220.	0.00
11.0000	-3.36E-04	46427.	-696.647	-1.46E-05	86.3248	8.96E+10	2.6607	23760.	0.00
11.2500	-3.77E-04	44349.	-688.070	-1.31E-05	84.2434	9.02E+10	3.0569	24300.	0.00
11.5000	-4.14E-04	42299.	-678.337	-1.16E-05	82.2035	9.07E+10	3.4314	24840.	0.00
11.7500	-4.47E-04	40280.	-667.515	-1.03E-05	80.2075	9.13E+10	3.7838	25380.	0.00
12.0000	-4.76E-04	38295.	-655.668	-8.99E-06	78.2576	9.19E+10	4.1136	25920.	0.00
12.2500	-5.01E-04	36346.	-642.867	-7.78E-06	76.3558	9.24E+10	4.4208	26460.	0.00
12.5000	-5.23E-04	34438.	-629.178	-6.63E-06	74.5038	9.30E+10	4.7051	27000.	0.00
12.7500	-5.41E-04	32572.	-614.670	-5.56E-06	72.7032	9.36E+10	4.9666	27540.	0.00
13.0000	-5.56E-04	30750.	-599.412	-4.54E-06	70.9554	9.41E+10	5.2054	28080.	0.00
13.2500	-5.68E-04	28976.	-583.472	-3.60E-06	69.2616	9.47E+10	5.4215	28620.	0.00
13.5000	-5.78E-04	27250.	-566.917	-2.71E-06	67.6227	9.53E+10	5.6153	29160.	0.00
13.7500	-5.85E-04	25574.	-549.814	-1.88E-06	66.0394	9.58E+10	5.7869	29700.	0.00
14.0000	-5.89E-04	23951.	-532.228	-1.11E-06	64.5125	9.64E+10	5.9368	30240.	0.00
14.2500	-5.91E-04	22381.	-514.225	-3.86E-07	63.0424	9.70E+10	6.0654	30780.	0.00
14.5000	-5.91E-04	20866.	-495.867	2.80E-07	61.6292	9.76E+10	6.1730	31320.	0.00
14.7500	-5.89E-04	19406.	-477.217	8.98E-07	60.2732	9.82E+10	6.2603	31860.	0.00
15.0000	-5.86E-04	18002.	-458.335	1.47E-06	58.9742	9.88E+10	6.3277	32400.	0.00
15.2500	-5.81E-04	16656.	-439.280	1.99E-06	57.7321	9.93E+10	6.3758	32940.	0.00
15.5000	-5.74E-04	15366.	-420.108	2.47E-06	56.5465	9.99E+10	6.4052	33480.	0.00
15.7500	-5.66E-04	14135.	-400.876	2.92E-06	55.4170	1.01E+11	6.4165	34020.	0.00
16.0000	-5.56E-04	12961.	-381.635	3.32E-06	54.3430	1.01E+11	6.4103	34560.	0.00
16.2500	-5.46E-04	11845.	-362.439	3.69E-06	53.3237	1.02E+11	6.3872	35100.	0.00
16.5000	-5.34E-04	10786.	-343.337	4.02E-06	52.3584	1.02E+11	6.3478	35640.	0.00
16.7500	-5.22E-04	9785.	-324.375	4.32E-06	51.4461	1.03E+11	6.2929	36180.	0.00
17.0000	-5.08E-04	8840.	-305.602	4.59E-06	50.5857	1.04E+11	6.2230	36720.	0.00
17.2500	-4.94E-04	7951.	-287.059	4.83E-06	49.7763	1.04E+11	6.1386	37260.	0.00
17.5000	-4.79E-04	7117.	-268.790	5.05E-06	49.0165	1.05E+11	6.0406	37800.	0.00
17.7500	-4.64E-04	6338.	-250.836	5.24E-06	48.3051	1.05E+11	5.9294	38340.	0.00
18.0000	-4.48E-04	5612.	-233.233	5.41E-06	47.6408	1.06E+11	5.8056	38880.	0.00
18.2500	-4.31E-04	4938.	-216.020	5.56E-06	47.0221	1.07E+11	5.6697	39420.	0.00
18.5000	-4.15E-04	4315.	-199.232	5.69E-06	46.4476	1.07E+11	5.5224	39960.	0.00
18.7500	-3.97E-04	3742.	-182.902	5.80E-06	45.9156	1.08E+11	5.3641	40500.	0.00
19.0000	-3.80E-04	3217.	-167.063	5.90E-06	45.4247	1.08E+11	5.1953	41040.	0.00
19.2500	-3.62E-04	2739.	-151.745	5.98E-06	44.9732	1.09E+11	5.0165	41580.	0.00
19.5000	-3.44E-04	2306.	-136.978	6.05E-06	44.5594	1.10E+11	4.8281	42120.	0.00
19.7500	-3.26E-04	1917.	-122.790	6.11E-06	44.1816	1.10E+11	4.6305	42660.	0.00
20.0000	-3.07E-04	1569.	-109.208	6.16E-06	43.8380	1.11E+11	4.4241	43200.	0.00
20.2500	-2.89E-04	1261.	-96.258	6.19E-06	43.5269	1.11E+11	4.2092	43740.	0.00
20.5000	-2.70E-04	991.2523	-83.965	6.22E-06	43.2464	1.12E+11	3.9862	44280.	0.00
20.7500	-2.51E-04	757.0879	-72.353	6.25E-06	42.9947	1.13E+11	3.7552	44820.	0.00
21.0000	-2.33E-04	556.7196	-61.445	6.27E-06	42.7699	1.13E+11	3.5166	45360.	0.00
21.2500	-2.14E-04	388.0000	-51.265	6.28E-06	42.5701	1.14E+11	3.2705	45900.	0.00
21.5000	-1.95E-04	248.7149	-41.833	6.29E-06	42.3935	1.15E+11	3.0172	46440.	0.00
21.7500	-1.76E-04	136.5845	-33.172	6.29E-06	42.2380	1.15E+11	2.7568	46980.	0.00

22.0000	-1.57E-04	49.2655	-25.303	6.29E-06	42.1017	1.16E+11	2.4895	47520.	0.00
22.2500	-1.38E-04	-15.648	-18.245	6.29E-06	42.0055	1.17E+11	2.2153	48060.	0.00
22.5000	-1.19E-04	-60.625	-12.021	6.29E-06	41.9667	1.17E+11	1.9343	48600.	0.00
22.7500	-1.01E-04	-88.193	-6.650	6.29E-06	41.9157	1.18E+11	1.6466	49140.	0.00
23.0000	-8.17E-05	-100.941	-2.152	6.29E-06	41.8545	1.18E+11	1.3522	49680.	0.00
23.2500	-6.28E-05	-101.521	1.4531	6.29E-06	41.7849	1.19E+11	1.0511	50220.	0.00
23.5000	-4.39E-05	-92.640	4.1448	6.28E-06	41.7091	1.20E+11	0.7434	50760.	0.00
23.7500	-2.51E-05	-77.069	5.9034	6.28E-06	41.6291	1.20E+11	0.4290	51300.	0.00
24.0000	-6.24E-06	-57.637	6.7087	6.28E-06	41.5470	1.21E+11	0.1079	51840.	0.00
24.2500	1.26E-05	-37.233	6.5408	6.28E-06	41.4647	1.22E+11	-0.220	52380.	0.00
24.5000	3.14E-05	-18.809	5.3794	6.28E-06	41.3845	1.22E+11	-0.554	52920.	0.00
24.7500	5.03E-05	-5.374	3.2043	6.28E-06	41.3083	1.23E+11	-0.896	53460.	0.00
25.0000	6.91E-05	0.00	0.00	6.28E-06	41.2383	1.24E+11	-1.244	27000.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.00969041 inches
Computed slope at pile head      =     -0.0001604 radians
Maximum bending moment           =        102120. inch-lbs
Maximum shear force              =   -720.3802409 lbs
Depth of maximum bending moment  =     1.75000000 feet below pile head
Depth of maximum shear force     =     9.50000000 feet below pile head
Number of iterations             =              8
Number of zero deflection points =              2
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =            253. lbs
Moment     =          99208. in-lbs
Axial Load =          11061. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.00000	0.00969041	102120.	-720.3802409
23.75000	0.00967237	102127.	-719.7641109
22.50000	0.00967225	102129.	-721.9873097
21.25000	0.00970254	102122.	-730.3013930
20.00000	0.00979519	102116.	-748.3558032
18.75000	0.00999941	102095.	-781.2735059
17.50000	0.01039006	102059.	-832.9402491

16.25000	0.01105711	102004.	-904.6479871
15.00000	0.01223769	101913.	-997.8238351
13.75000	0.01426181	101792.	-1114.
12.50000	0.01769085	101630.	-1256.
11.25000	0.02396531	101423.	-1439.
10.00000	0.03576175	101189.	-1677.
8.75000	0.05939964	100951.	-2003.
7.50000	0.12026189	100723.	-2504.
6.25000	0.37163144	100673.	-3358.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 1264.0 lbs
Applied moment at pile head = 496038.0 in-lbs
Axial thrust load on pile head = 11061.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.06299	496038.	1264.	-9.29E-04	583.1813	6.72E+10	-19.011	452.7286	0.00
0.2500	0.06023	499775.	1206.	-9.07E-04	584.4024	6.72E+10	-19.785	985.3830	0.00
0.5000	0.05755	503333.	1145.	-8.85E-04	585.4153	6.81E+10	-20.526	1070.	0.00
0.7500	0.05493	506706.	1083.	-8.63E-04	586.2160	6.86E+10	-21.234	1160.	0.00
1.0000	0.05237	509887.	1018.	-8.41E-04	586.8010	6.91E+10	-21.909	1255.	0.00
1.2500	0.04988	512869.	951.2981	-8.18E-04	587.1670	6.95E+10	-22.551	1356.	0.00
1.5000	0.04746	515649.	882.7335	-7.96E-04	587.3113	7.00E+10	-23.159	1464.	0.00
1.7500	0.04510	518219.	812.3960	-7.74E-04	587.2314	7.05E+10	-23.733	1579.	0.00
2.0000	0.04282	520574.	740.3885	-7.52E-04	586.9254	7.10E+10	-24.272	1701.	0.00
2.2500	0.04059	522711.	666.8151	-7.30E-04	586.3916	7.15E+10	-24.777	1831.	0.00
2.5000	0.03843	524624.	591.7808	-7.08E-04	585.6286	7.19E+10	-25.246	1971.	0.00
2.7500	0.03634	526309.	515.3920	-6.86E-04	584.6356	7.24E+10	-25.680	2120.	0.00
3.0000	0.03432	527762.	437.7562	-6.65E-04	583.4119	7.29E+10	-26.077	2280.	0.00
3.2500	0.03235	528979.	358.9820	-6.43E-04	581.9574	7.34E+10	-26.439	2452.	0.00
3.5000	0.03046	529958.	204.1949	-6.21E-04	580.2721	7.39E+10	-76.753	7560.	0.00
3.7500	0.02863	530246.	-26.867	-6.00E-04	577.9077	7.44E+10	-77.289	8100.	0.00
4.0000	0.02686	529837.	-258.824	-5.79E-04	574.8691	7.49E+10	-77.350	8640.	0.00
4.2500	0.02515	528731.	-490.302	-5.58E-04	571.1654	7.54E+10	-76.969	9180.	0.00
4.5000	0.02351	526932.	-720.024	-5.37E-04	566.8097	7.59E+10	-76.179	9720.	0.00
4.7500	0.02193	524447.	-946.812	-5.16E-04	561.8182	7.64E+10	-75.013	10260.	0.00
5.0000	0.02042	521285.	-1170.	-4.95E-04	556.2102	7.69E+10	-73.500	10800.	0.00
5.2500	0.01896	517462.	-1387.	-4.75E-04	550.0078	7.74E+10	-71.672	11340.	0.00
5.5000	0.01757	512993.	-1599.	-4.55E-04	543.2355	7.79E+10	-69.558	11880.	0.00
5.7500	0.01623	507897.	-1804.	-4.36E-04	535.9196	7.84E+10	-67.187	12420.	0.00
6.0000	0.01495	502196.	-2002.	-4.17E-04	528.0883	7.89E+10	-64.587	12960.	0.00
6.2500	0.01373	495913.	-2192.	-3.98E-04	519.7714	7.95E+10	-61.784	13500.	0.00

6.5000	0.01257	489073.	-2372.	-3.79E-04	510.9996	8.00E+10	-58.804	14040.	0.00
6.7500	0.01146	481704.	-2544.	-3.61E-04	501.8049	8.05E+10	-55.673	14580.	0.00
7.0000	0.01040	473833.	-2706.	-3.43E-04	492.2197	8.10E+10	-52.414	15120.	0.00
7.2500	0.00940	465489.	-2858.	-3.26E-04	482.2770	8.15E+10	-49.049	15660.	0.00
7.5000	0.00844	456704.	-3000.	-3.09E-04	472.0104	8.21E+10	-45.601	16200.	0.00
7.7500	0.00754	447507.	-3132.	-2.92E-04	461.4530	8.26E+10	-42.089	16740.	0.00
8.0000	0.00669	437931.	-3253.	-2.76E-04	450.6384	8.31E+10	-38.534	17280.	0.00
8.2500	0.00588	428008.	-3363.	-2.61E-04	439.5997	8.37E+10	-34.954	17820.	0.00
8.5000	0.00512	417770.	-3463.	-2.46E-04	428.3696	8.42E+10	-31.365	18360.	0.00
8.7500	0.00441	407249.	-3551.	-2.31E-04	416.9804	8.47E+10	-27.784	18900.	0.00
9.0000	0.00374	396477.	-3629.	-2.17E-04	405.4636	8.53E+10	-24.226	19440.	0.00
9.2500	0.00311	385487.	-3697.	-2.03E-04	393.8502	8.58E+10	-20.706	19980.	0.00
9.5000	0.00252	374310.	-3754.	-1.90E-04	382.1701	8.63E+10	-17.235	20520.	0.00
9.7500	0.00197	362978.	-3800.	-1.77E-04	370.4524	8.69E+10	-13.826	21060.	0.00
10.0000	0.00146	351521.	-3837.	-1.65E-04	358.7252	8.74E+10	-10.489	21600.	0.00
10.2500	9.80E-04	339969.	-3863.	-1.53E-04	347.0154	8.80E+10	-7.236	22140.	0.00
10.5000	5.39E-04	328351.	-3880.	-1.42E-04	335.3490	8.85E+10	-4.073	22680.	0.00
10.7500	1.30E-04	316697.	-3888.	-1.31E-04	323.7505	8.91E+10	-1.010	23220.	0.00
11.0000	-2.46E-04	305033.	-3886.	-1.20E-04	312.2435	8.96E+10	1.9467	23760.	0.00
11.2500	-5.91E-04	293386.	-3876.	-1.10E-04	300.8501	9.02E+10	4.7907	24300.	0.00
11.5000	-9.08E-04	281782.	-3858.	-1.01E-04	289.5913	9.07E+10	7.5167	24840.	0.00
11.7500	-0.00120	270245.	-3831.	-9.17E-05	278.4867	9.13E+10	10.1201	25380.	0.00
12.0000	-0.00146	258799.	-3797.	-8.30E-05	267.5547	9.19E+10	12.5973	25920.	0.00
12.2500	-0.00169	247466.	-3756.	-7.48E-05	256.8123	9.24E+10	14.9450	26460.	0.00
12.5000	-0.00191	236268.	-3708.	-6.70E-05	246.2753	9.30E+10	17.1610	27000.	0.00
12.7500	-0.00210	225223.	-3653.	-5.95E-05	235.9582	9.36E+10	19.2435	27540.	0.00
13.0000	-0.00226	214352.	-3593.	-5.25E-05	225.8741	9.41E+10	21.1914	28080.	0.00
13.2500	-0.00241	203671.	-3526.	-4.59E-05	216.0350	9.47E+10	23.0042	28620.	0.00
13.5000	-0.00254	193197.	-3455.	-3.96E-05	206.4517	9.53E+10	24.6819	29160.	0.00
13.7500	-0.00265	182944.	-3378.	-3.37E-05	197.1335	9.58E+10	26.2250	29700.	0.00
14.0000	-0.00274	172928.	-3298.	-2.81E-05	188.0889	9.64E+10	27.6344	30240.	0.00
14.2500	-0.00282	163160.	-3213.	-2.29E-05	179.3251	9.70E+10	28.9115	30780.	0.00
14.5000	-0.00288	153653.	-3124.	-1.81E-05	170.8480	9.76E+10	30.0581	31320.	0.00
14.7500	-0.00293	144415.	-3033.	-1.35E-05	162.6628	9.82E+10	31.0762	31860.	0.00
15.0000	-0.00296	135457.	-2938.	-9.22E-06	154.7734	9.88E+10	31.9683	32400.	0.00
15.2500	-0.00298	126787.	-2841.	-5.25E-06	147.1827	9.93E+10	32.7371	32940.	0.00
15.5000	-0.00299	118411.	-2742.	-1.56E-06	139.8927	9.99E+10	33.3853	33480.	0.00
15.7500	-0.00299	110336.	-2641.	1.87E-06	132.9045	1.01E+11	33.9163	34020.	0.00
16.0000	-0.00298	102565.	-2539.	5.04E-06	126.2184	1.01E+11	34.3332	34560.	0.00
16.2500	-0.00296	95104.	-2435.	7.96E-06	119.8336	1.02E+11	34.6395	35100.	0.00
16.5000	-0.00293	87954.	-2331.	1.07E-05	113.7489	1.02E+11	34.8387	35640.	0.00
16.7500	-0.00290	81118.	-2226.	1.31E-05	107.9619	1.03E+11	34.9346	36180.	0.00
17.0000	-0.00285	74596.	-2121.	1.54E-05	102.4699	1.04E+11	34.9306	36720.	0.00
17.2500	-0.00280	68388.	-2017.	1.75E-05	97.2693	1.04E+11	34.8307	37260.	0.00
17.5000	-0.00275	62494.	-1913.	1.93E-05	92.3559	1.05E+11	34.6385	37800.	0.00
17.7500	-0.00269	56912.	-1809.	2.10E-05	87.7250	1.05E+11	34.3578	38340.	0.00
18.0000	-0.00262	51638.	-1707.	2.26E-05	83.3712	1.06E+11	33.9922	38880.	0.00
18.2500	-0.00255	46671.	-1605.	2.40E-05	79.2887	1.07E+11	33.5453	39420.	0.00
18.5000	-0.00248	42005.	-1505.	2.52E-05	75.4712	1.07E+11	33.0207	39960.	0.00
18.7500	-0.00240	37637.	-1407.	2.63E-05	71.9119	1.08E+11	32.4219	40500.	0.00
19.0000	-0.00232	33560.	-1311.	2.73E-05	68.6038	1.08E+11	31.7523	41040.	0.00
19.2500	-0.00224	29769.	-1217.	2.82E-05	65.5392	1.09E+11	31.0150	41580.	0.00

19.5000	-0.00215	26257.	-1125.	2.90E-05	62.7104	1.10E+11	30.2132	42120.	0.00
19.7500	-0.00206	23017.	-1036.	2.96E-05	60.1090	1.10E+11	29.3499	42660.	0.00
20.0000	-0.00197	20041.	-948.979	3.02E-05	57.7265	1.11E+11	28.4278	43200.	0.00
20.2500	-0.00188	17321.	-865.163	3.07E-05	55.5543	1.11E+11	27.4497	43740.	0.00
20.5000	-0.00179	14848.	-784.361	3.12E-05	53.5833	1.12E+11	26.4180	44280.	0.00
20.7500	-0.00170	12613.	-706.732	3.15E-05	51.8042	1.13E+11	25.3351	44820.	0.00
21.0000	-0.00160	10606.	-632.424	3.18E-05	50.2077	1.13E+11	24.2031	45360.	0.00
21.2500	-0.00150	8816.	-561.584	3.21E-05	48.7841	1.14E+11	23.0240	45900.	0.00
21.5000	-0.00141	7234.	-494.348	3.23E-05	47.5236	1.15E+11	21.7996	46440.	0.00
21.7500	-0.00131	5848.	-430.852	3.25E-05	46.4164	1.15E+11	20.5316	46980.	0.00
22.0000	-0.00121	4647.	-371.222	3.26E-05	45.4522	1.16E+11	19.2213	47520.	0.00
22.2500	-0.00112	3618.	-315.585	3.27E-05	44.6210	1.17E+11	17.8701	48060.	0.00
22.5000	-0.00102	2751.	-264.061	3.28E-05	43.9125	1.17E+11	16.4791	48600.	0.00
22.7500	-9.19E-04	2032.	-216.768	3.28E-05	43.3161	1.18E+11	15.0493	49140.	0.00
23.0000	-8.20E-04	1448.	-173.822	3.29E-05	42.8214	1.18E+11	13.5815	49680.	0.00
23.2500	-7.21E-04	986.8287	-135.336	3.29E-05	42.4179	1.19E+11	12.0763	50220.	0.00
23.5000	-6.23E-04	634.0724	-101.420	3.29E-05	42.0948	1.20E+11	10.5343	50760.	0.00
23.7500	-5.24E-04	376.1244	-72.184	3.30E-05	41.8413	1.20E+11	8.9559	51300.	0.00
24.0000	-4.25E-04	198.7796	-47.738	3.30E-05	41.6467	1.21E+11	7.3415	51840.	0.00
24.2500	-3.26E-04	87.5081	-28.189	3.30E-05	41.5001	1.22E+11	5.6912	52380.	0.00
24.5000	-2.27E-04	27.4572	-13.645	3.30E-05	41.3906	1.22E+11	4.0052	52920.	0.00
24.7500	-1.28E-04	3.4528	-4.212	3.30E-05	41.3070	1.23E+11	2.2835	53460.	0.00
25.0000	-2.92E-05	0.00	0.00	3.30E-05	41.2383	1.24E+11	0.5262	27000.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     0.06298875 inches
Computed slope at pile head      =     -0.0009293 radians
Maximum bending moment           =        530246. inch-lbs
Maximum shear force              =         -3888. lbs
Depth of maximum bending moment  =     3.75000000 feet below pile head
Depth of maximum shear force     =    10.75000000 feet below pile head
Number of iterations             =              7
Number of zero deflection points =              2
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           1264. lbs
Moment     =         496038. in-lbs
Axial Load =          11061. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.00000	0.06298875	530246.	-3888.
23.75000	0.06330142	530358.	-3903.
22.50000	0.06362675	530402.	-3950.
21.25000	0.06410446	530367.	-4050.
20.00000	0.06496448	530223.	-4224.
18.75000	0.06655837	529929.	-4492.
17.50000	0.06940475	529437.	-4856.
16.25000	0.07542167	528882.	-5353.
15.00000	0.08509624	527962.	-5949.
13.75000	0.10438177	526331.	-6727.
12.50000	0.15060952	523394.	-7694.
11.25000	0.26536817	519568.	-9021.
10.00000	0.54453552	515989.	-10716.
8.75000	1.34938679	513630.	-13019.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	253.0000	M, in-lb	99208.	11061.	0.00969	-1.60E-04	-720.380	102120.
2	V, lb	1264.	M, in-lb	496038.	11061.	0.06299	-9.29E-04	-3888.	530246.

Maximum pile-head deflection = 0.0629887486 inches
Maximum pile-head rotation = -0.0009292966 radians = -0.053245 deg.

The analysis ended normally.

Fixity Conditions: CCTV on Drilled Shaft Foundation

Driled shaft Embedment (ft):	**20**	**25**
Tip Fixity Condition:	**Rigid Pole**	**Non-fixed**

See Next Pages for Interpretations

Shaft Embedment = 20.0 ft

Lateral Pile Deflection (inches)

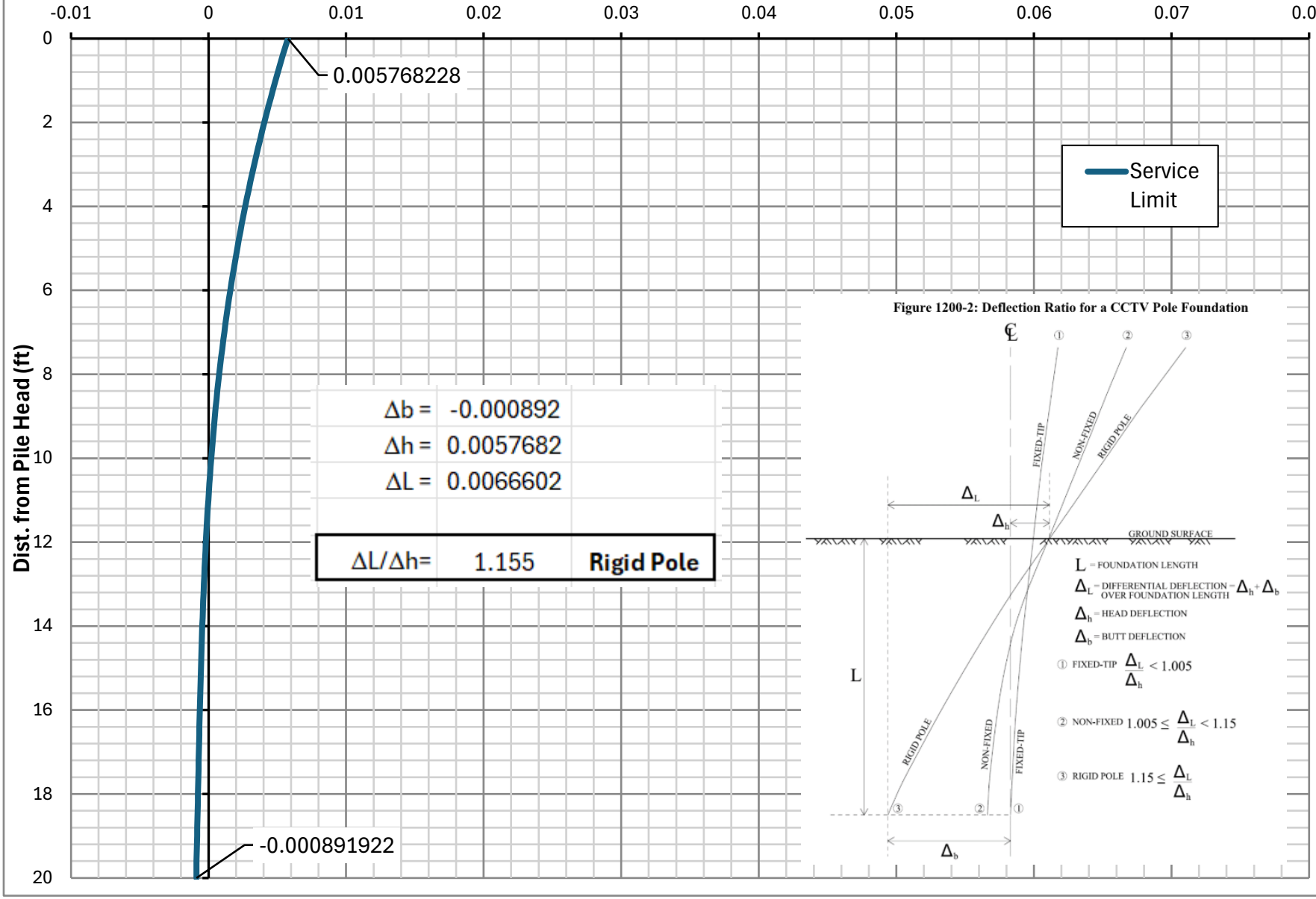


Figure 1200-2: Deflection Ratio for a CCTV Pole Foundation

Shaft Embedment = 25.0 ft

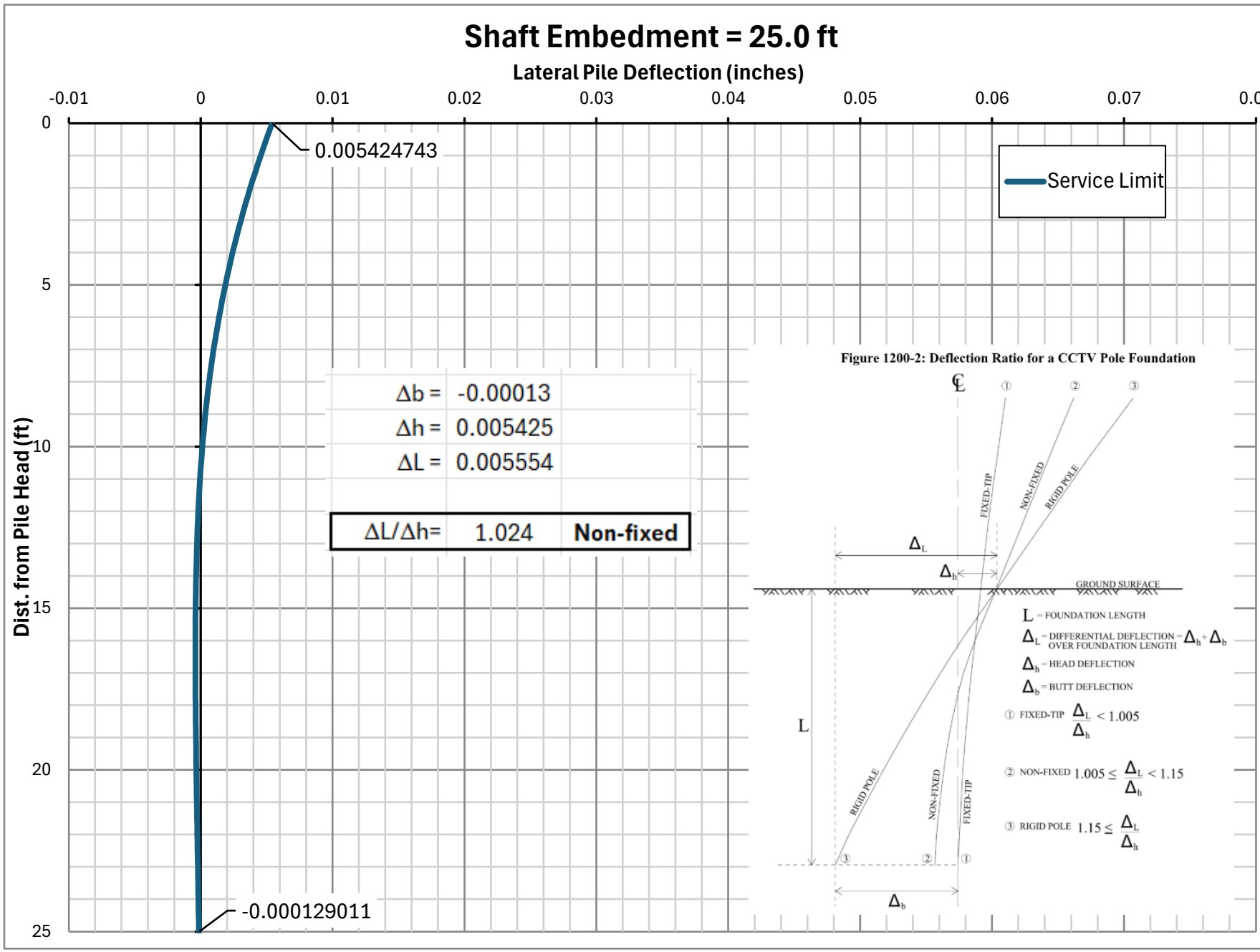


Figure 1200-2: Deflection Ratio for a CCTV Pole Foundation

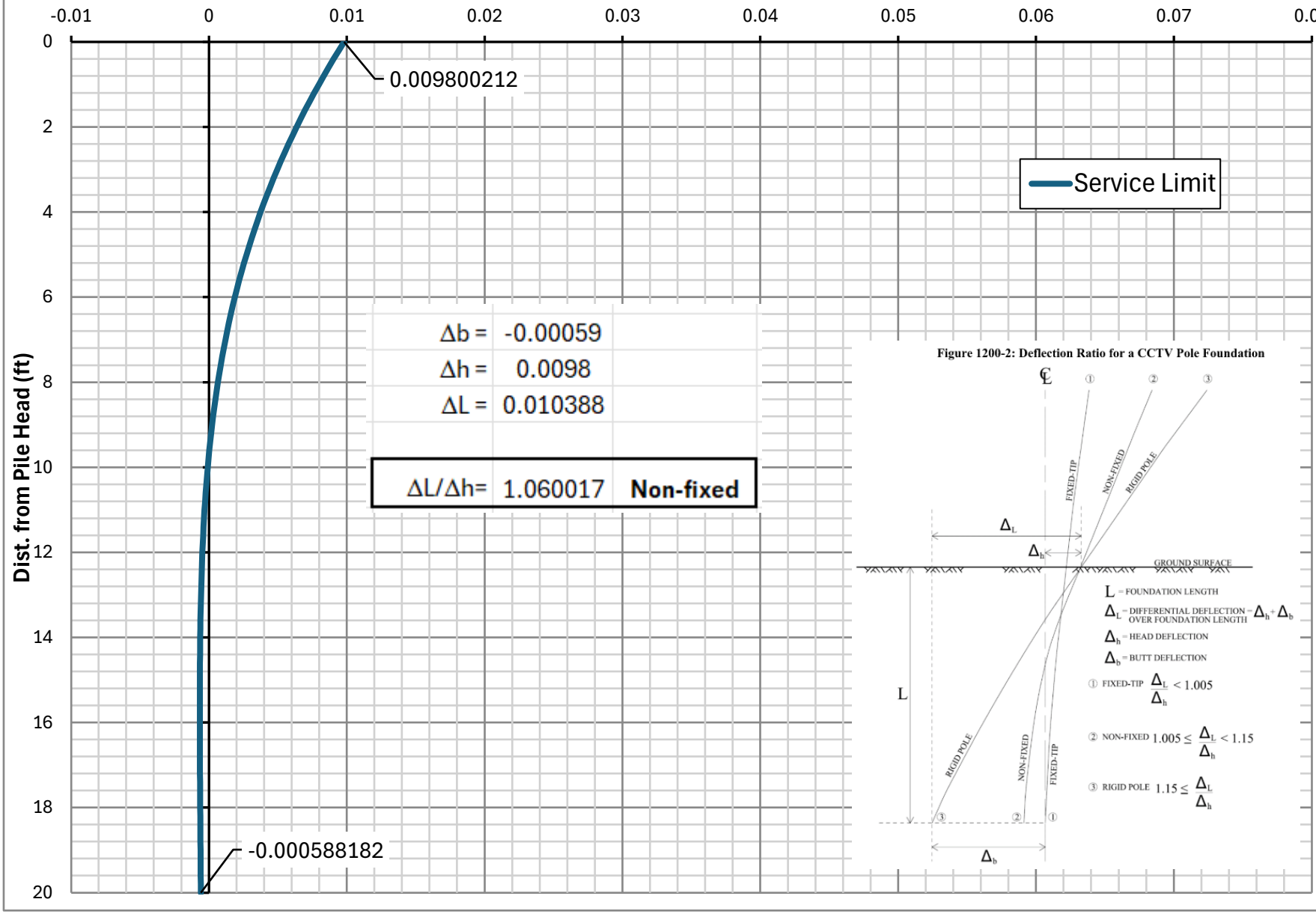
Fixity Conditions: Concrete CCTV Embeded into Subsoils

Driled shaft Embedment (ft):	**20**	**25**
Tip Fixity Condition:	**Non-fixed**	**Fixed End**

See Next Pages for Interpretations

Concrete Pole Embedment = 20.0 ft

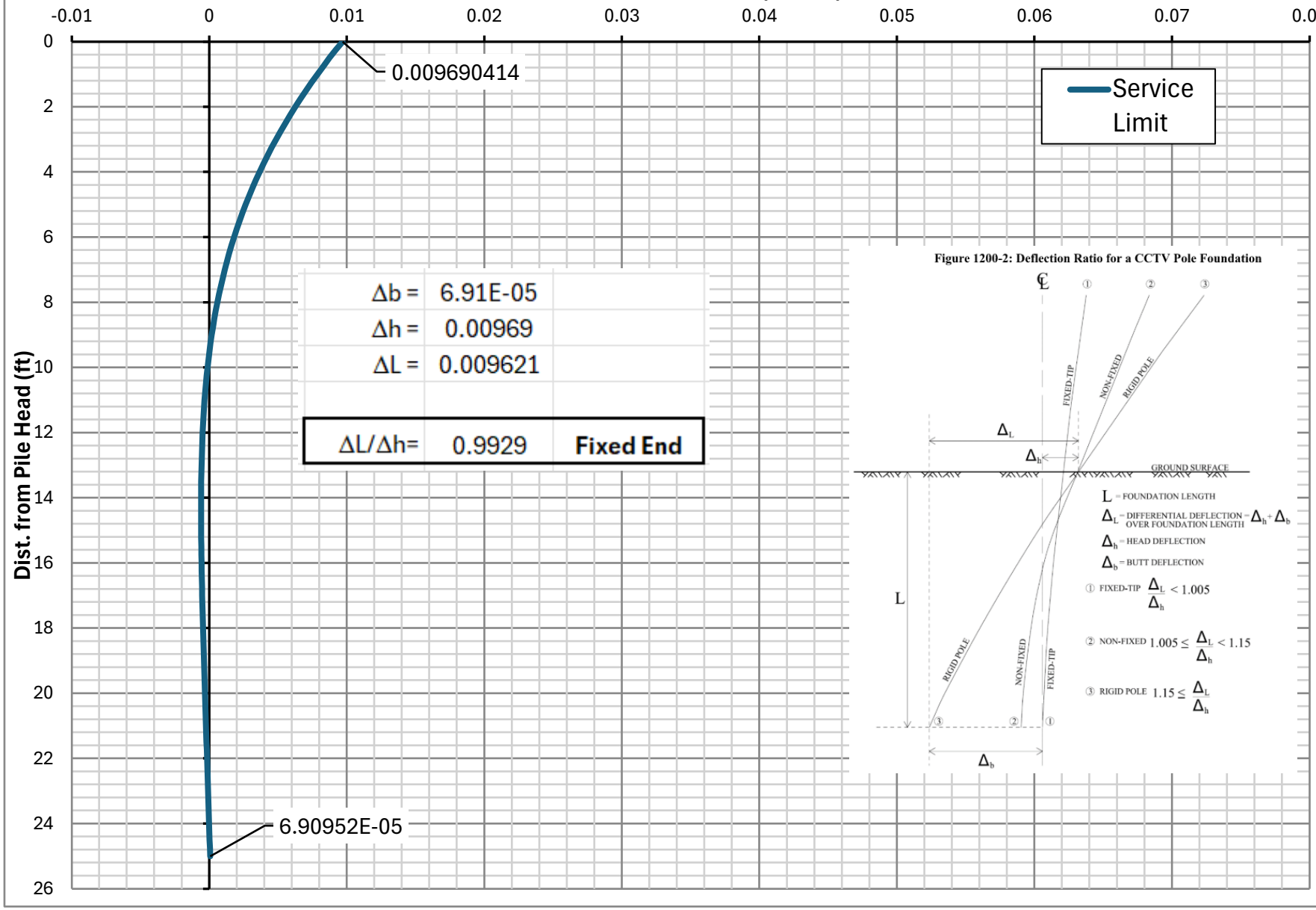
Lateral Pile Deflection (inches)



Δb =	-0.00059
Δh =	0.0098
ΔL =	0.010388
ΔL/Δh=	1.060017 **Non-fixed**

Figure 1200-2: Deflection Ratio for a CCTV Pole Foundation

Concrete Pole Embedment = 25.0 ft



APPENDIX M
GEOTECHNICAL DESIGN FOR MORGANA TRAIL CULVERT ON MAT FOUNDATION

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Morgana Trail Culvert Mat Foundation Bearing**

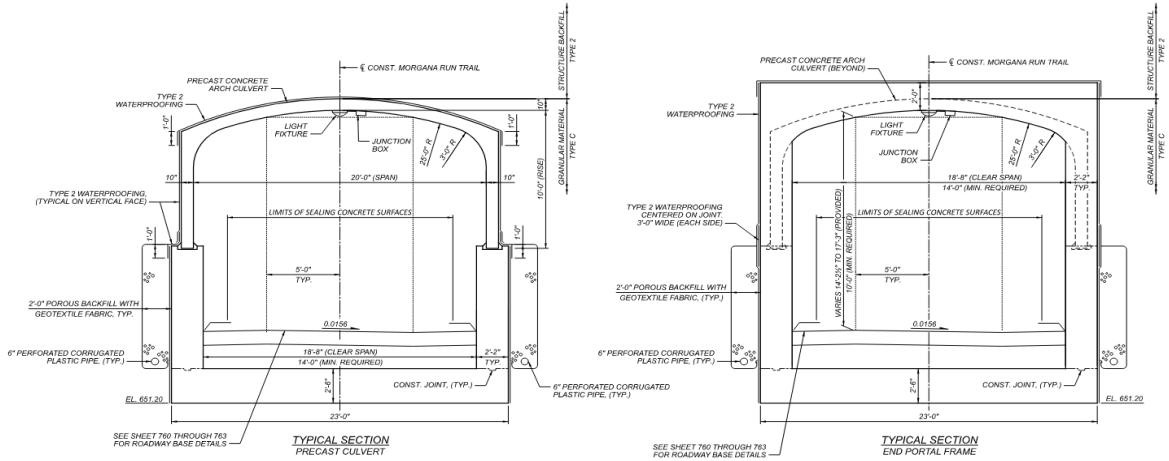
Designer: DA Date 6/10/2026

Checker: RLM Date 6/11//2026

Morgana Trail Replacement Bridge - Culvert Mat Foundation- Geotechnical Design

GEOMETRY OF THE CULVERT

Length of culvert (L), ft	112.7
Width of culvert (B), ft=	23.0
Thickness of mat foundation (t), ft	2.5
Depth from road surface to the top of mat foundation, ft	27.0
Embedment Depth (Df), ft = (Conservative embedment value)	5.0



MATERIAL PROPERTIES

Retained Fill

Unit Wt, γf =	120	pcf
Friction Angle-ϕ=	32	DEG

Boring: **B-071-0-20** Depth (ft)

Soil	From	To	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg
M. dense fine sand, little silt	0.00	2.80	125.00	62.60	0.00	0.00	34.00
M. dense gravel and stone	2.80	5.30	125.00	62.60	0.00	0.00	32.00
Lo to dense silt	5.30	17.80	125.00	62.60	0.00	0.00	33.00
V. stiff silt, some clay	17.80	37.80	125.00	62.60	2500.00	200.00	30.00
Stiff to very stiff silt and clay	37.80	106.80	120.00	57.60	2000.00	160.00	30.00

Boring: **M. dense gra** Depth (ft)

Soil	From	To	γ, pcf	γ', pcf	Cu, psf	c', psf*	ϕ', deg
Dense gravel and stone	0.00	2.90	125.00	62.60	0.00	0.00	36
Soft- V. stiff Sandy silt	2.90	7.90	125.00	62.60	0.00	0.00	36
Stiff to very stiff silt, some clay	7.90	82.90	125.00	62.60	0.00	0.00	34

Foundation Based on drilled boring logs

Undrained			Drained		
γ_{soil}=	125	pcf	γ_{soil}=	125	pcf
ϕ =	0	deg	ϕf=	32	deg
c'=	2500	psf	c'=	0	psf

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Morgana Trail Culvert Mat Foundation Bearing**

Designer: DA Date 6/10/2026

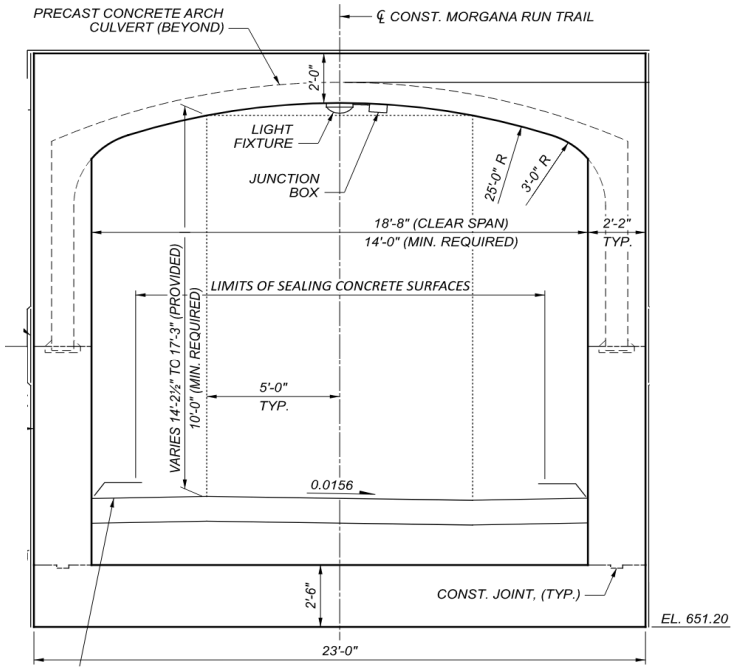
Checker: RLM Date 6/11//2026

Morgana Trail Replacement Bridge - Culvert Mat Foundation- Geotechnical Design

Pressure Calculations: Checked by: **CEJ**

	Load Factor		Pressure, ksf			
Item	Service	Strength I	Calculated	Service	Strength	
Concrete	1	1.25	1.268	1.268	1.586	Conc. Vol. = 194.5 ft^3/ft
Fill Inside (2.7 ft)	1	1.30	0.263	0.263	0.342	2.7 ft thick, 18.67 ft wide
Fill above (6 ft)	1	1.30	0.720	0.720	0.936	6.0 ft thick, 23 ft wide
LL (Traffic)*	1	1.75	0.174	0.174	0.304	1.2*50^k/(23*15)
LL (Ped)	1	1.75	0.075	0.075	0.131	side Underpass
			Sum =	**2.50**	**3.30**	

* The axle load distribution width through 6 feet of fill is approximately 15 feet.



TYPICAL SECTION
END PORTAL FRAME

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Morgana Trail Culvert Mat Foundation Bearing**

Designer: DA Date 6/10/2026

Checker: RLM Date 6/11//2026

Morgana Trail Replacement Bridge - Culvert Mat Foundation- Geotechnical Design

Calculation of Nominal bearing resistance

Undrained: The footing is essentially very long (B/L = **0.00**)

Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	1.00
Nc	5.14
Ny	0.00

$for\ \phi_f = 0$

$N_c = 5.14$

$for\ \phi_f > 0$

$N_c = (N_q - 1)\cot\phi_f$

$N_q = e^{(\pi \tan(\phi_f))} \tan^2\left(\frac{\pi}{4} + \frac{\phi_f}{2}\right)$

$N_\gamma = 2(N_q + 1)\tan\phi_f$

AASHTO Table 10.6.3.1.2a-1

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1 + \left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$

$for\ \phi_f > 0$

$s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1 - 0.4\left(\frac{B}{L}\right),\ s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

q_n =	**109**	**ksf**

Bearing Resistance

$$q_R = \phi_b\ q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R =	**54.4**	**ksf**

Given the underpass cross section and foundation embedment/confinement, the calculated bearing resistance is estimated to be significantly larger than the factored stresses under the mat foundation.

Project: **CUY-77-11.41: Reconstruction of I-77**

Subject: **Morgana Trail Culvert Mat Foundation Bearing**

Designer: DA Date 6/10/2026

Checker: RLM Date 6/11//2026

Morgana Trail Replacement Bridge - Culvert Mat Foundation- Geotechnical Design

Drained: The footing is essentially very long (B/L = **0.00**)

Bearing Capacity Factors (AASHTO Table 10.6.3.1.2a-1)

Nq	32.200
Nc	35.500
Ny	30.200

$for\ \phi_f = 0$

$N_c = 5.14$

$for\ \phi_f > 0$

$N_c = (N_q - 1)\cot\phi_f$

$N_q = e^{(\pi\tan(\phi_f))}\tan^2\left(\frac{\pi}{4}+\frac{\phi_f}{2}\right)$

$N_\gamma = 2(N_q+1)\tan\phi_f$

AASHTO Table 10.6.3.1.2a-1

Shape Factors (AASHTO 10.6.6.1.2a-3):

sc	1.000
sq	1.000
sy	1.000

$for\ \phi_f = 0$

$s_c = 1+\left(\frac{B}{5L}\right),\ s_\gamma = 1,\ s_q = 1$

$for\ \phi_f > 0$

$s_c = 1+\left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right),\ s_\gamma = 1-0.4\left(\frac{B}{L}\right),\ s_q = 1+\left(\frac{B}{L}\tan\phi_f\right)$

Depth Factors (AASHTO 10.6.6.1.2a-3): Ignored due to Small D/B <1.0

dq= 1.000

Coefficient C_{wq} and $C_{w\gamma}$

C_{wq}	1
$C_{w\gamma}$	0.5

Table 10.6.3.1.2a-2

D_w	C_{wq}	$C_{w\gamma}$
0	0.5	0.5
D_f	1	0.5
>1.5B+D_f	1	1

Dw (ft)= **Df**

(Assumed at Df)

Nominal Bearing Capacity

q_n = 42 ksf

AASHTO 10.6.3.1.2a-1

$$q_n = CNcSc + \gamma DfNqSq\ d_q Cwq + 0.5\gamma B' N_\gamma S_\gamma Cw\gamma$$

Bearing Resistance

$$q_R = \phi_b\ q_n$$

ϕ_b 0.5 AASHTO Table 10.5.5.2.2-1

q_R = 20.9 ksf

Safe > Max. factored pressure of 3.3 ksf